

**BOLTON HALL
ROTHERHAM**

**PHASE 1 PRELIMINARY
RISK ASSESSMENT**



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CONTENTS

1	INTRODUCTION	1
2	SITE HISTORY	2
3	ENVIRONMENTAL SETTING	4
4	SITE RECONNAISSANCE	6
5	PRELIMINARY CONCEPTUAL MODEL	7
6	PRELIMINARY GEOTECHNICAL RISK ASSESSMENT	12
7	SUMMARY CONCLUSIONS AND RECOMMENDATIONS	13

FIGURES

Figure 1: Site Location Plan

Figure 2: Site Boundary Plan

Figure 3: Proposed Site Use

APPENDICES

- Appendix A: Historical Maps**
- Appendix B: Envirocheck Report**
- Appendix C: Historical BGS Borehole Logs**
- Appendix D: Coal Authority Report**
- Appendix E: Site Reconnaissance**
- Appendix F: Risk Evaluation**

1 INTRODUCTION

1.1 Background

LK Consult Ltd (LKC) has been commissioned by HC Development Co 3 Limited to carry out a Phase 1 Preliminary Risk Assessment (PRA) for Bolton Hall, Rotherham. The report was undertaken in support of a future planning application to redevelop the site for a residential end use.

According to guidance set out in CLR11¹, GPLC1-3² and the National Planning Policy Framework (NPPF)³ a PRA with a site reconnaissance is required as a minimum to ascertain if there is a potential contamination risk.

In accordance with current guidance, the PRA will include a site reconnaissance, site history, geology, hydrogeology, hydrology, mineral search and a landfill search. Information gathered from the desk study and site reconnaissance will be used to develop a contamination conceptual model for the site, which will support the identification and assessment of any pollutant linkages.

In addition, the information gathered will be used to identify potential geotechnical constraints associated with the redevelopment of the site.

Based on the findings of this report, an appropriate site investigation can be derived, if required.

1.2 Site Detail

A summary of site details are presented in Table 1-1. Figures 1 and 2 indicate the site location and boundary. Figure 3 indicates the proposed development.

Location	South of Carr Head Lane, Bolton upon Dearne, Rotherham. Centred at approximate National Grid Reference 445050E, 402710N.
Area	1.23 Ha
Topography	40 metres above ordnance datum (AOD). Site is approximately level.
Current Land Use	<u>Site</u> Currently occupied by a nursing home, which is now disused. Hardstood ground along road leading up to and including the southern area of the site. Grassed areas cover the remainder of the site, with trees along the site boundary. <u>Surrounding Area</u> The surrounding area is predominately residential with commercial activity to the north and a Public Open Space (POS) to the south.
Proposed Development	Residential dwellings with associated gardens, soft landscaping and car parking.

Table 1-1: Summary of site details.

¹ EA (2004). "Model Procedures for the Management of Land Contamination." R&D Publication CLR 11.

² EA (2010) "Guiding Principles for Land Contamination." GPLC1-3.

³ DCL (2012). "National Planning Policy Framework." Department of Communities and Local Government. March 2012.

2 SITE HISTORY

2.1 Historical Map Review

In compiling the site history, LKC consulted historical mapping and aerial photographs provided by the Landmark Information Group Ltd. Copies of relevant historical plans and aerial photographs are provided in Appendix A and are summarised Table 2-1. Notable features within 100m of the site boundary have been presented (distances will be approximate). The exception to this will be features within a 250m buffer that could be infilled historically.

Site Features	Location	Map Dates Present	Comments
Buildings (first layout)	N & Centre	1854-1988	- Buildings collectively annotated as 'Bolton Hall' until at least 1906 mapping. - Buildings collectively annotated as 'Dearne Valley Social Club' from 1930 mapping until at least 1950 mapping. - Southern building annotated as 'Bolton Hall' from 1957 mapping until at least 1977 mapping. - Central building annotated as 'Poultry House' from 1965 mapping until at least 1988 mapping. - Additional buildings added along NW boundary from 1961 mapping. - Northern buildings possibly residential. - Buildings in this current layout no longer shown by 1993 mapping.
Bolton Hall (second layout)	S	1993-Present	- Bolton Hall in its current layout was developed by 1993 mapping.
Paths / tracks	Whole site	1892-Present	- Paths and tracks are distributed across much of the site until at least 1906 mapping. - By 1930 mapping and the development of 'Dearne Valley Social Club', paths are limited to the southern and eastern areas of the site. - By 1957 mapping, paths run across eastern and central areas of the site. - The original paths have been removed and are no longer shown by 1993 mapping. - There is one path that runs N-S from Carr Head Lane to Bolton Hall with a car park adjacent to the building.
Landscaping and Woodland	W, Sand E boundaries	1854-Present	- Extensive gardens / landscaping present on W part of the site. Trees present to W, S and E boundaries.
Pump	Centre	1892-1903	- No longer annotated on 1930 mapping although building outline remains.

Table 2-1: Summary of historical features.

Surrounding Area Features	Distance/ Location	Map Dates Present	Comments
Carr Head Lane	Adj. N	1854-Present	- Road runs NW-SE adjacent to the sites' northern boundary.
Quarry	75m SE	1854-1957	- Annotated as a quarry until 1892 mapping. - No longer annotated by 1893 mapping. - Annotated as 'Old Quarry' by 1903 mapping until at least 1906 mapping. - Annotated as 'Quarry' by 1930 mapping. - Annotated as 'Quarry (Disused)' by 1957 mapping. - No longer annotated by 1965 mapping. - No longer shown by 2000 mapping. - Bank End Close and residential housing built over area of quarry by 2006 mapping.
Pump	180m SE	1930-1950	- No longer annotated by 1951 mapping.
Works	10m W	1957-2000	- Marked as 'Works' until 200 mapping. - Site cleared by 2006 mapping. - Area since developed for residential housing.
Tank	Adj. W	1965-2000	- Associated with works. - No longer present on 2006 mapping.
Poultry Houses	Adj. E	1965-1988	- Marked as 'Poultry Houses' until 1988 mapping.
Allotment Gardens	Adj. SE	1961-Present	- Allotment gardens reduced in size to 50m S on 2016 mapping.

Table 2-1 (continued): Summary of historical features.

3 ENVIRONMENTAL SETTING

In compiling this Section, LKC consulted environmental information provided by the Envirocheck Report (Appendix A and B), British Geological Survey (Appendix C), the Coal Authority (Appendix D) and the local authority planning website. A summary is presented in Table 3-1.

Categories (data sources)			Details
Geology	Artificial ¹		- None recorded on site.
	Superficial ¹		- None recorded on site.
	Bedrock ^{1,2}		- Mexborough Rock (sandstone). - 1 fault adjacent to the S of the site striking NW-SE.
	BGS logs ³		- Ref: SE40SE176, 110m NE identified topsoil to 0.91m, sandy clay to 1.27m and weathered sandstone to 1.42m. - Ref: SE40SW442, 443m NW identified topsoil to 0.3m, clay to 0.4m and weathered sandstone to 2.0m. - Ref: SE40SE168, 291m SE identified topsoil to 0.3m, clay to 1.1m and mudstone to 3.1m.
Hydro-geology	Aquifer Designation	Superficial ¹	- Unproductive.
		Bedrock ¹	- Secondary A.
	Source Protection Zone (SPZ)		- Site is not within an SPZ.
	Groundwater Abstractions ¹		- None within 500m. Nearest 1157m NE, operated by Barnsley Metropolitan Borough Council for pond level maintenance.
Hydrology	Nearest Surface Water ¹		- River Dearne 480m SW, flowing E.
	Water Quality Data ¹		- 429m NE, River Dearne – River Quality C.
	Flooding ¹		- No risk from rivers or sea.
	Surface Water Abstractions ¹		- None within 500m. Nearest 793m SE, operated by British Coal for general industrial purposes.
	Discharge Consent ¹		- None within 250m. Nearest 659m SE, held by Yorkshire Water Services discharging surface water effluent into the River Dearne.
	Pollution Incidents ¹		- None within 250m. Nearest 478m SE, Category 2 – significant incident for sewage debris litter entering a watercourse.
Minerals / Mining	Coal Mining Development High Risk Area ⁴		- Not identified on site.
	Coal Report ⁵		- Likely zone of influence from workings in 4 seams of coal at 210-650m depth, last worked 1970. The CA report that any movement in the ground due to coal mining activity should have stopped. - No shafts present within 20m of the site.
	Surface Extractions ¹		- 1 location within 250m. Sandstone extracted from Bolton Hall Quarry 108m E. Extraction has now ceased.
	Cheshire Brine Compensation District ⁵		- Not within site area.

Table 3-1: Summary of environmental setting.

Data Sources: 1 - Envirocheck Report (Appendix A and B); 2 - BGS Sheet 87 1:50,000; 3 - BGS GeoIndex <http://mapapps2.bgs.ac.uk/geoindex/home.html> (Appendix C); 3 - The Coal Authority Web Mapping Services (WMS) and Interactive Map Viewer <http://coal.decc.gov.uk/en/coal/cms/publications/data/map/map.aspx>; 5 - Coal Authority Report (Appendix D).

Categories (data sources)		Details
Ground Stability ¹ (on-site)	Collapsible Ground	- Very low hazard.
	Compressible Ground	- No hazard.
	Landslide	- Very low hazard.
	Running Sand	- No hazard.
	Shrinking / Swelling Clay	- Very low hazard.
	Ground Dissolution	- No hazard.
Landfill sites	Known/Registered ¹	1 within 250m: - 75m E – 'Wath Skip Hire Limited, Station Road.' Inert, industrial and commercial waste types. Operational 1979-1985.
	Potential ¹	- 2 within 250m: - Former pump annotated on site from 1892-1903 mapping. - Former pump 180m SE annotated on 1930-1950 mapping.
Radon ¹		- Probability of between 1-3% of homes above Action Level. No further action required.
Designated Sites ¹		- Nearest Adopted Green Belt 395m NW.
Contemporary Trade Directory ¹		- None within 100m, nearest 116m S (car dealers).
Fuel Station Entries ¹		- None within 100m.
Adjacent Planning Applications ⁶		- Documents submitted to Planning to support the adjacent recent residential development indicate the site was formerly a battery works.
Enforcement and Prohibition Notices ¹		- 3 no. notices to former Battery Works adjacent W. These comprise: - 98m NW, lead material or contaminated lead material located outside process plant - 150m NW, waste handling of lead on site. - 153m NW, failure to label skip as containing lead waste and failure to cover skip.

Table 3-1 (continued): Summary of environmental setting.

Data Sources: **1** - Envirocheck Report (Appendix A and B); **6** – Barnsley Council Planning website <https://www.applications.barnsley.gov.uk/planningexplorermvc>.

4 SITE RECONNAISSANCE

A site reconnaissance was carried out on 29th June 2016.

A total of 6 no. hand dug trial holes were undertaken in accessible areas to confirm the shallow ground conditions.

An annotated plan with photographs, trial holes and pertinent features is provided in Appendix E.

Relevant features identified on site are summarised below:

- Bolton Hall, which is now disused, occupies most of the southern area of the site.
- Hardstanding includes a road that runs N-S across the site from Carr Head Lane to Bolton Hall and a car park connected to Bolton Hall (tarmac, good condition, no visual evidence of spillages).
- The remainder of the site comprises grassed areas, with trees primarily along the site boundaries.
- Fly tipping (wood, plastic, building materials) observed across the site, particularly along the site boundary and surrounding Bolton Hall.
- Made Ground was observed in the trial holes, which contained inclusions of brick, glass, ash and clinker from depths of 0.1m to at least 0.7m.
- Gated entrance and no access restrictions from Carr Head Lane.

The surrounding area comprises residential housing with commercial activity (retail and funeral director) to the north and a Public Open Space (POS) to the south.

5 PRELIMINARY CONCEPTUAL MODEL

5.1 Introduction

The aim of the conceptual model is to provide a preliminary assessment of the likelihood of a pollutant linkage for each potential combination of contaminant, pathway and receptor. A conceptual model can be used to make an informed decision on the contamination risks associated with the site and whether further site investigation work is required.

The Sections below are therefore divided into potential contaminant, potential pathway and potential receptor as described in CLR11⁴. The final Section provides an assessment of the potential pollutant linkages that may still be present on the site if redevelopment were to occur.

5.2 Potential Contaminants

The following contamination sources have been identified:

Former Buildings, Paths and Tracks and Made Ground on Site

Made ground including ash and clinker was often used for drainage and as a sub base to paths and buildings and as a result could be present on site. Such materials have been identified in the shallow hand auger holes. Contamination associated with ash and clinker could include heavy metals (such as arsenic and lead), sulphates and PAHs⁵.

The former building structures may also have contained Asbestos Containing Materials (ACMs) and could be present within the made ground.

The former pump (which may be an abstraction well) may contain localised made ground materials.

Adjacent Former Battery Works and Tank

The former Battery Works and Tank area has recently been redeveloped for residential development; therefore, LKC would anticipate that the site has been suitably remediated. However, there may be hydrocarbons or acids on site which may have migrated from the former tank or heavy metals such as lead and zinc which may have leached onto or been tipped on site.

Landfills / Potentially infilled ground off site

A known landfill site has been identified within 250m of the site. This may generate hazardous gas (principally carbon dioxide and methane).

The potential for migration of hazardous gas can depend upon the age of the feature, volume of material, type of infill material, size of feature distance from the site and intervening geology. The landfill site is a former quarry which has since been redeveloped for residential use between 2000 and 2006. Therefore LKC anticipate that the site has been suitably remediated and is not a significant source of gas to the site.

⁴ Defra (2004). "Model Procedures for the Management of Land Contamination." R&D Publication CLR 11.

⁵ Defra (2002). "Potential Contaminants for the Assessment of Land." R&D Publication CLR 8.

Other Industries in Surrounding Area

The immediate surrounding areas have been developed for both residential and industrial usage. Several potentially contaminative land-uses have been identified within influencing distance of the site, other than the former battery works and tank outlined above. However, contamination is unlikely to be more significant than the contamination sources already identified.

5.3 Potential Pathways

The pathways are split into the migration of soil, water and gas.

Soil

This also includes soil-derived dust / fibres, vapours from the soil and the uptake of contaminants from the soil into flora / vegetables.

Principal potential pathways associated with human health from soil contamination are ingestion, dermal and inhalation. The current UK technical report document⁶ recognises ten such pathways comprising four ingestion, two dermal and four inhalation. These are listed as follows:

- Ingestion of soil
- Ingestion of soil-derived indoor dust
- Ingestion of contaminated vegetables
- Ingestion of soil attached to vegetables
- Dermal contact with soil
- Dermal contact with soil-derived indoor dust
- Inhalation of soil-derived outdoor dust
- Inhalation of soil-derived indoor dust
- Inhalation of vapours outside
- Inhalation of vapours inside

The proposed end-use follows a standard conceptual model of 'residential'. For this land use scenario all ten of the pathways will have to be considered, as vegetable growth cannot be discounted.

The proposed development comprises residential housing with associated gardens, soft landscaping and car parking. Soils may be within direct contact with receptors (e.g. building foundations, services). Soils can also generate dust / fibres which could migrate via windblow to adjacent receptors.

Water

Surface water and groundwater are principal mechanisms for the migration of contaminants. The following pathways are considered in the assessment:

- Surface run-off over impermeable surface.
- Infiltration into the ground, through potentially contaminated material (contamination possibly going into solution).
- Migration through potentially permeable strata and preferential pathways, such as drains, sewers, culverts, faults and mine workings.

The anticipated sandstone bedrock is likely to be relatively permeable and could act as a pathway to the migration of potential contaminated waters.

A fault runs adjacent to the south of the site which could act as a preferential pathway.

⁶ EA (2008). "Updated Technical Background to the CLEA Model." Science Report – SC050021/SR3.

Gas

Gas can migrate via the following potential pathways:

- Migration through potentially permeable strata and preferential pathways, such as drains, sewers, culverts, faults and mine workings.
- Migration into buildings (e.g. via services) and accumulation of gases in confined spaces (potentially causing explosion if methane is present).

5.4 Potential Receptors

Potential receptors include:

- Human Health: future site residents, future site users, offsite land users.
- Controlled Waters: Underlying Secondary A Aquifer.
- Buildings and structures.
- Potable water pipes.
- Flora within future gardens/landscaping.

Surface water is not considered to be a significant receptor given the distance from the site (River Dearne 480m to the SW).

As the proposed development is for residential use, it is likely there will be adults and children (the most sensitive receptor) present on site over a long period of time.

5.5 Preliminary Contamination Conceptual Model

The preliminary contamination conceptual model for Bolton Hall, Rotherham, is illustrated in Table 5-1 below and has identified seven generic potential pollutant linkages.

Each linkage is described along with an assessment of the risk based upon guidance on probabilities and consequences outlined in CIRIA C552⁷.

In order to assess the potential risk for each pollutant linkage, an assessment of the magnitude of the potential consequence (severity) of the risk occurring and the magnitude of the probability (likelihood) of the risk occurring has been considered and classified. This is based on the guidance provided in CIRIA C552 and further details including a risk matrix is provided in Appendix F.

Where LKC identified a low to very low risk, either limited intrusive investigation work, a watching brief (during construction work) or no investigation work will be recommended. This will be dependent on the nature of the site and the proposed development.

Where the risk falls into the moderate/low risk, LKC will undertake an assessment to establish what category the pollutant linkage will fall into (i.e. moderate or low risk will be chosen).

Where LKC identifies a moderate or higher risk, intrusive work or precautionary remedial measures will be recommended.

It should be noted that there may be risk from short term exposure from contaminated soil to site workers. The Preliminary Contamination Conceptual Model deals with long term

⁷ CIRIA (2001). "Contaminated land risk assessment: A guide to good practice". C552.

exposure to key receptors. Acute risks can be easily mitigated by good environmental management of the site during site works. Standard health and safety precautions (as per HSE guidance⁸) should be adopted by all workers involved with site enabling and construction works. Therefore, this receptor is not considered in the contamination conceptual model.

⁸ HSE (1991). "Protection of Workers and the General Public During Development of Contaminated Land" London HMSO.

Receptor	Contaminant (source)	Probability	Consequence	Risk	Assessment
Residents. Future users. Receptors.	-ACM (former buildings, potentially in made ground).	Low	Severe (ACM)	Moderate	- Low probability of ACM due to age of buildings and date of demolition. - Likely probability of heavy metals and PAHs as ash and clinker identified in the site soils and possibly adjacent to former battery works. - Low probability and moderate risk of hydrocarbons assumed adjacent to the former tank. Unlikely probability elsewhere as no significant historical source identified. - Recommendation: Intrusive investigation required.
	- Heavy metals and PAHs (ashy made ground and adjacent to former works).	Likely	Medium	Moderate	
	- Hydrocarbons (former tank adj. W).	Low (adj. to tank)	Medium	Moderate / Low	
		Unlikely (remainder)	Medium	Low	
Residents. Future users.	Volatile Contaminants (former tank adj. W)	Low (adj. to tank)	Medium	Moderate / Low	- Low probability and moderate risk of hydrocarbons assumed adjacent to the former tank. Unlikely probability elsewhere as no significant historical source identified. - Recommendation: Targeted intrusive investigation required adjacent to former tank.
		Unlikely (remainder)	Medium	Low	
Residents. Future users.	- Methane, carbon dioxide. (potentially infilled features 250m of the site).	Unlikely	Severe	Moderate / Low	- Unlikely probability as on site former pump is very small and notified landfill site 75m E has been redeveloped for residential use. Therefore no viable source identified. - Recommendation: No intrusive investigation required.
Future battery A	- Mobile contaminants (ashy made ground, hydrocarbons from adj. former tank).	Low	Medium	Moderate / Low	- Low likelihood across the site but moderate risk assumed due to nature of historical sources. - Recommendation: Intrusive investigation required.
Structure.	- Sulphate (potentially ashy made ground).	Likely	Mild	Moderate / Low	- Ashy made ground identified. Moderate risk assumed due to nature of proposed development. - Recommendation: Intrusive investigation required.
Residents. Future users.	- Organic Contaminants (ashy made ground and hydrocarbons for adj. former tank).	Likely	Medium	Moderate	- Likely probability as made ground anticipated at pipeline depth (0.75-1.35m) and possible contamination from former tank. - Recommendation: Intrusive investigation required.
	- Phytotoxic Contaminants (made ground).	Low	Minor	Very Low	- Low probability as contamination considered possible, which may be taken up by flora in soft landscaping / gardens. - Recommendation: Confirmatory investigation work as part of PL1.

Model.

6 PRELIMINARY GEOTECHNICAL RISK ASSESSMENT

Superficial deposits are indicated as being absent from the site, however a thin layer of clay is noted on BGS boreholes in the site vicinity.

The bedrock geology is mapped as sandstone. Given the history of the site, significant made ground is anticipated.

The Envirocheck Report identified a very low hazard of collapsible ground, landslides and shrinking / swelling clay; and no hazard of compressible ground, running sand and ground dissolution.

The Coal Authority report indicates the site is within a surface area that could be affected by past underground mining.

The following need to be considered and investigated before any construction work commences:

- Deep made ground and / or relic in-ground structures (from current and former buildings and former pump) may be present on site which could affect groundworks (e.g. grubbing out of structures) and type of foundations required (e.g. deepening of foundations/ pilling).
- The strength and variability of any superficial deposits need to be confirmed. Clay may be present which is likely to be at least medium strength however softer ground / organic ground / granular pockets may reduce this strength. An allowable bearing pressure of the soils and weathered bedrock should be confirmed to allow the design of suitable foundations.
- The depth of groundwater and variability of the water table should be confirmed as shallow / fluctuating groundwater can affect the strength of the soil, particularly in granular ground.
- Plasticity of any superficial clay deposits should be confirmed, particularly where trees are present or proposed, to identify the shrinkability risk. This could be an issue around the site boundaries where trees are present.
- The CBR value of the ground for footpath and road design should be calculated. There is a potential for low / poor CBR values from underlying clay and made ground, therefore site roads may require the import of suitable granular material or modification of existing soils.

7 SUMMARY CONCLUSIONS AND RECOMMENDATIONS

7.1 Summary Conclusions

The proposed development is for the construction of residential housing with soft landscaping and associated gardens.

The site was historically used as the location for several buildings, including 'Bolton Hall', a social club, a poultry house and possible residential dwellings, all of which have since been demolished.

The site currently comprises an existing building formerly used as a nursing home. Hardstanding is present along the road leading up to and including the southern area of the site. Grassed areas cover the remainder of the site.

Potential contamination sources affecting the site were identified as asbestos, heavy metals, PAHs, sulphate and hydrocarbons.

These contaminants may pose a risk to site users (via ingestion/dermal contact/inhalation pathways and explosion), controlled waters (via migration through permeable strata / preferential pathways), buildings and structures (direct contact and explosion), water pipes (direct contact) and flora (root uptake).

A contamination conceptual model has been produced by LKC. This has identified the following risks summarised in Table 7-1. Where a moderate / low risk was identified, the assumed risk at this stage has been shown.

Pollutant Linkage		Risk	Further Action Required
1	Contaminants posing a risk to future residents and site users via dermal contact, ingestion and inhalation (of soil, dust, fibres and vegetables).	Moderate (ACMs, PAHs, metals) (Hydrocarbons adj. to former tank)	Intrusive investigation required.
		Low (hydrocarbons – remainder of the site)	
2	Volatile contaminants posing a risk to future site residents and site users via the inhalation of vapours.	Moderate (adj. to former tank)	Targeted intrusive investigation adj. to former tank.
		Low (remainder)	
3	Gas posing a risk to buildings and future site residents and site users via the migration of gas into building causing explosion and asphyxiation.	Low	No intrusive investigation required.
4	Mobile contamination posing a risk to controlled waters via the migration through permeable strata.	Moderate	Intrusive investigation required.
5	Sulphate posing a risk to building via direct contact (sulphate attack).	Low	Intrusive investigation required.
6	Organic contaminants posing a risk to water pipes.	Moderate	Intrusive investigation required.
7	Phytotoxic Metals posing a risk to flora via root uptake.	Very Low	Confirmatory intrusive investigation as part of PL1.

Table 7-1: Risk table.

Based on the above work LKC recommend that intrusive works are undertaken, which are briefly detailed in Section 7.2.

The preliminary geotechnical assessment has also identified the following potential risks which will need to be investigated:

- Unknown strength of soils for foundation design.
- Possible deep made ground with in-ground structures (current and former buildings and pump).
- Plasticity of any superficial clay deposits to identify the shrinkability risk near trees.
- CBR values of any shallow clay deposits and made ground deposits for footpaths and roads.

7.2 Recommendations

It is recommended that a Phase 2 intrusive survey should be carried out across the site to investigate the identified potential pollutant linkages further.

The site investigation should be carried in accordance with relevant guidance documents (including BS10175⁹ and BS5930¹⁰).

The investigation should include trial pits and / or boreholes at a sampling density of 1 sample per 25-50m square centres for an exploratory investigation and 1 sample per 10-25m square centres for a main investigation. In addition targeted sampling locations should be undertaken in areas of concern, particularly in the areas of former buildings, adjacent to the former tank and battery works and the former pump.

Soil samples should be collected from the trial pits / boreholes and tested for contaminants of concern based on the preliminary conceptual model and field observations (PID tests and visual / olfactory evidence).

It should be noted that boreholes and / or trial pits may also be utilised to provide appropriate geotechnical information on sub-surface conditions.

In order to address pollutant linkage 4, groundwater samples should be collected from boreholes (monitoring wells). If no groundwater is present, soils can be subjected to leachability tests. Samples should be tested for contaminants of concern based on the preliminary risk assessment, field observations and results of the soil analysis.

This investigation, in conjunction with appropriate geotechnical testing, will identify and characterise any contaminants encountered. Information from this investigation can then be used to provide a more detailed assessment of the identified pollutant linkages, provide appropriate foundation solutions and, if necessary, identify appropriate remedial measures to ensure that the site is made suitable for its proposed end use.

LKC would recommend that a copy of this report is forwarded to local authority for the approval of the above recommendations before the commencement of any works on the site

⁹ British Standard (2011). "Investigation of Potentially Contaminated Sites – Code of Practice." BS10175:2011.

¹⁰ British Standard (2015). "Code of Practice for Ground Investigations." BS5930:2015.

FIGURES

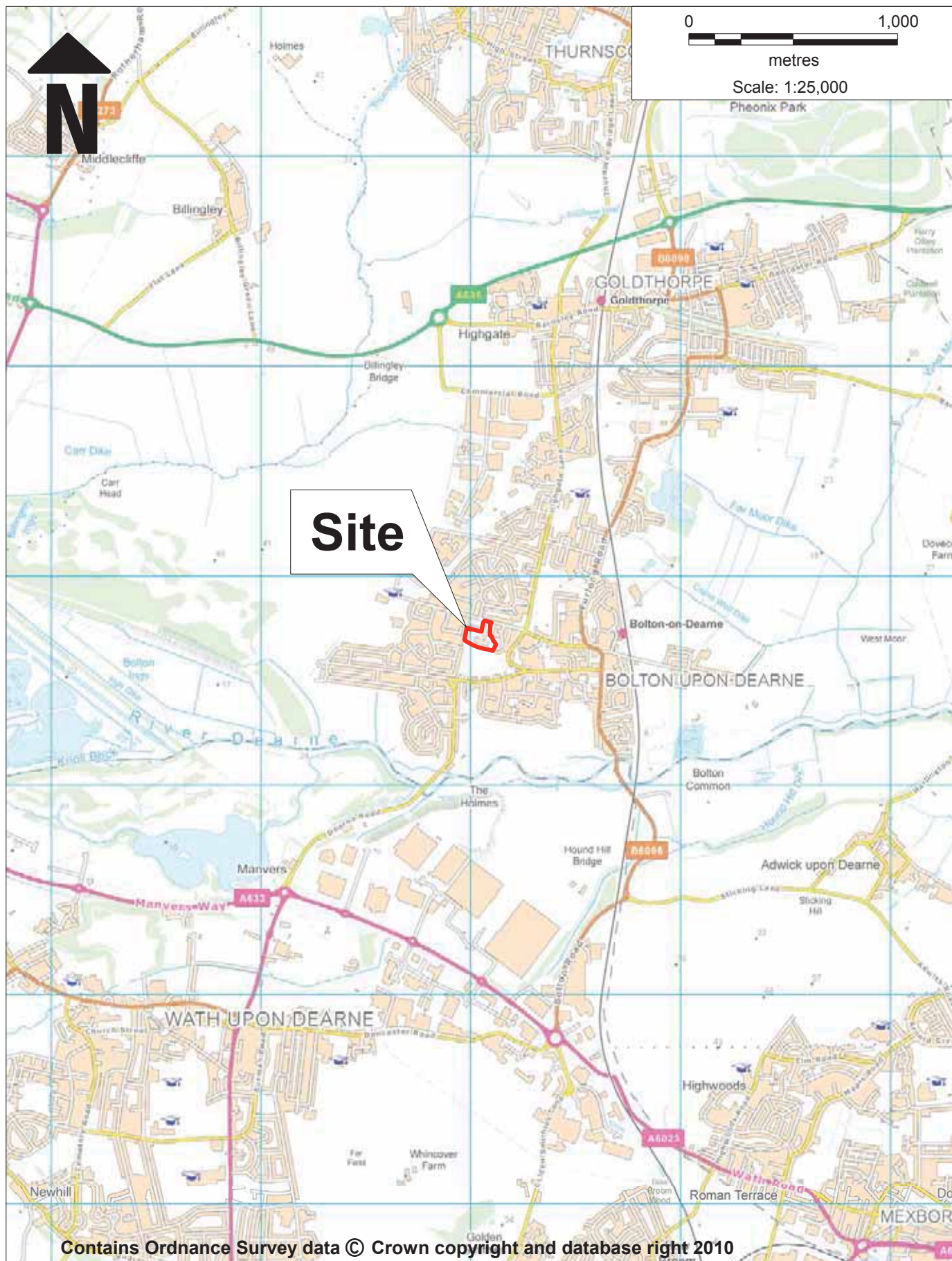
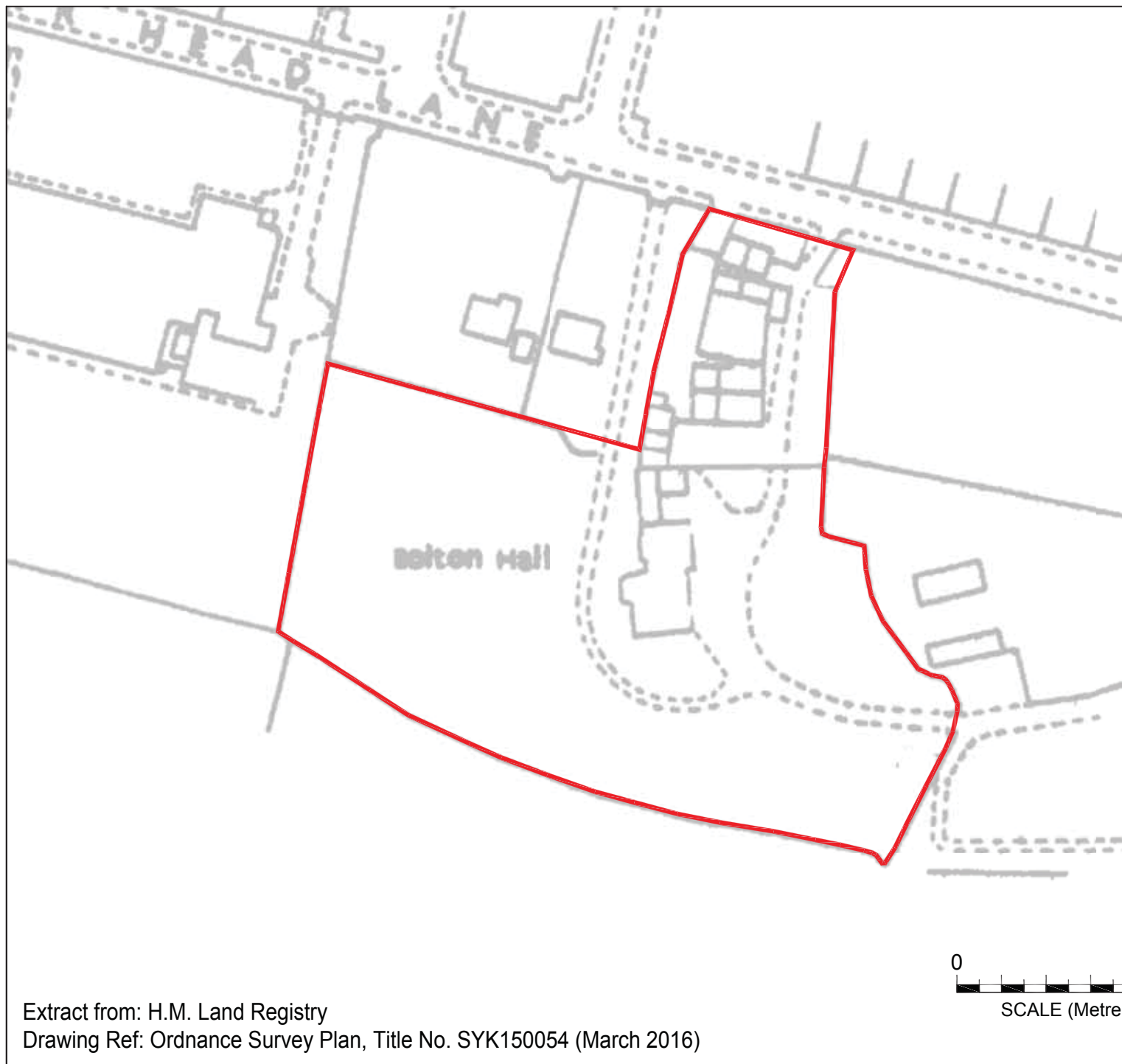
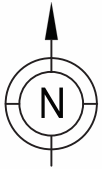


Figure 1: Site Location Plan, Bolton Hall, Rotherham

Drawn: June 2016 Scale: 1:25,000 @ A4 (see scale bar)



Extract from: H.M. Land Registry
Drawing Ref: Ordnance Survey Plan, Title No. SYK150054 (March 2016)



0

SCALE (Metres)

Extract from: Howard and Seddon Architects Preliminary Proposed Site Plan
Drawing Ref: 12387 201 Rev. C

APPENDIX A

HISTORICAL MAPS

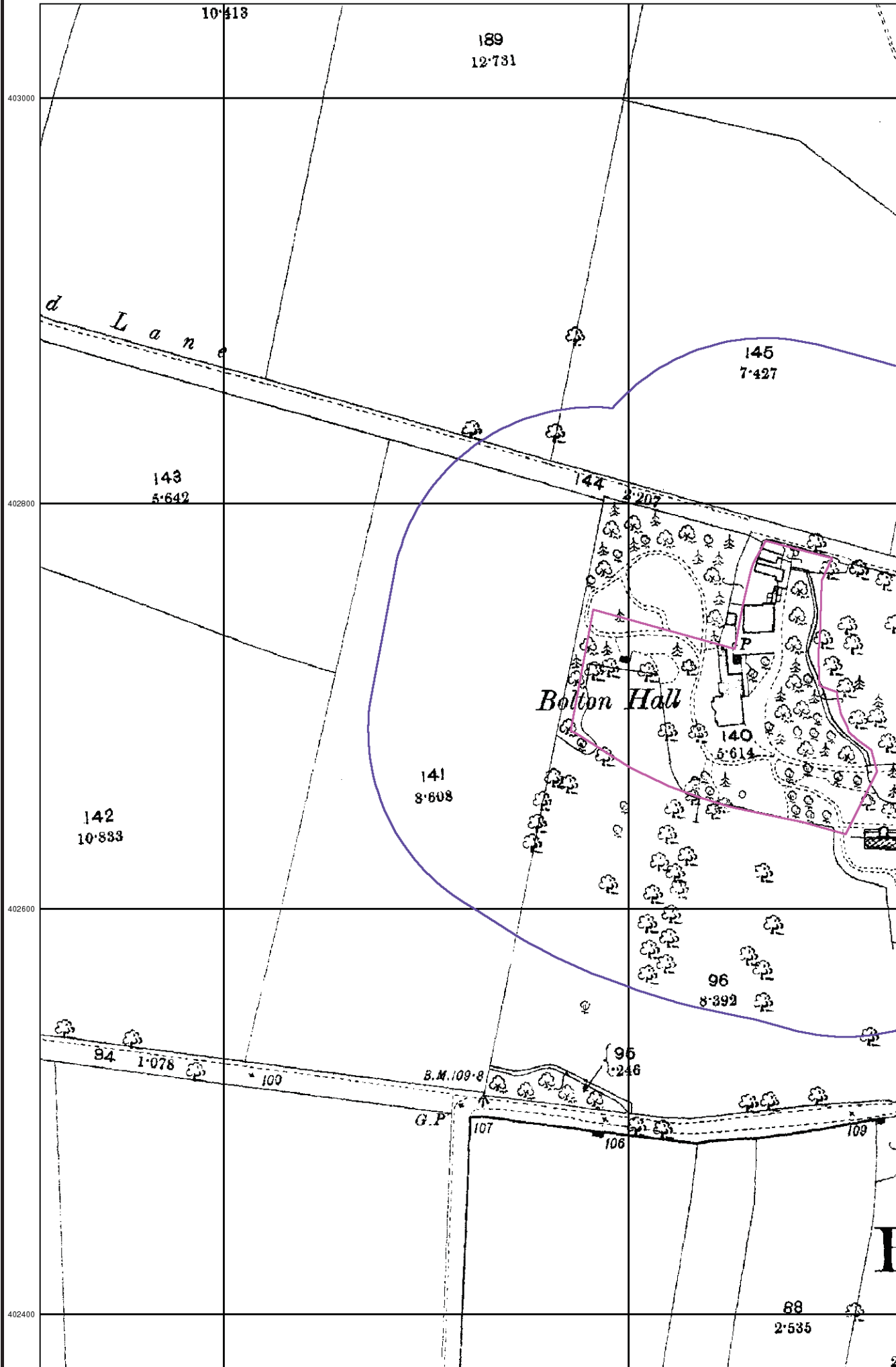
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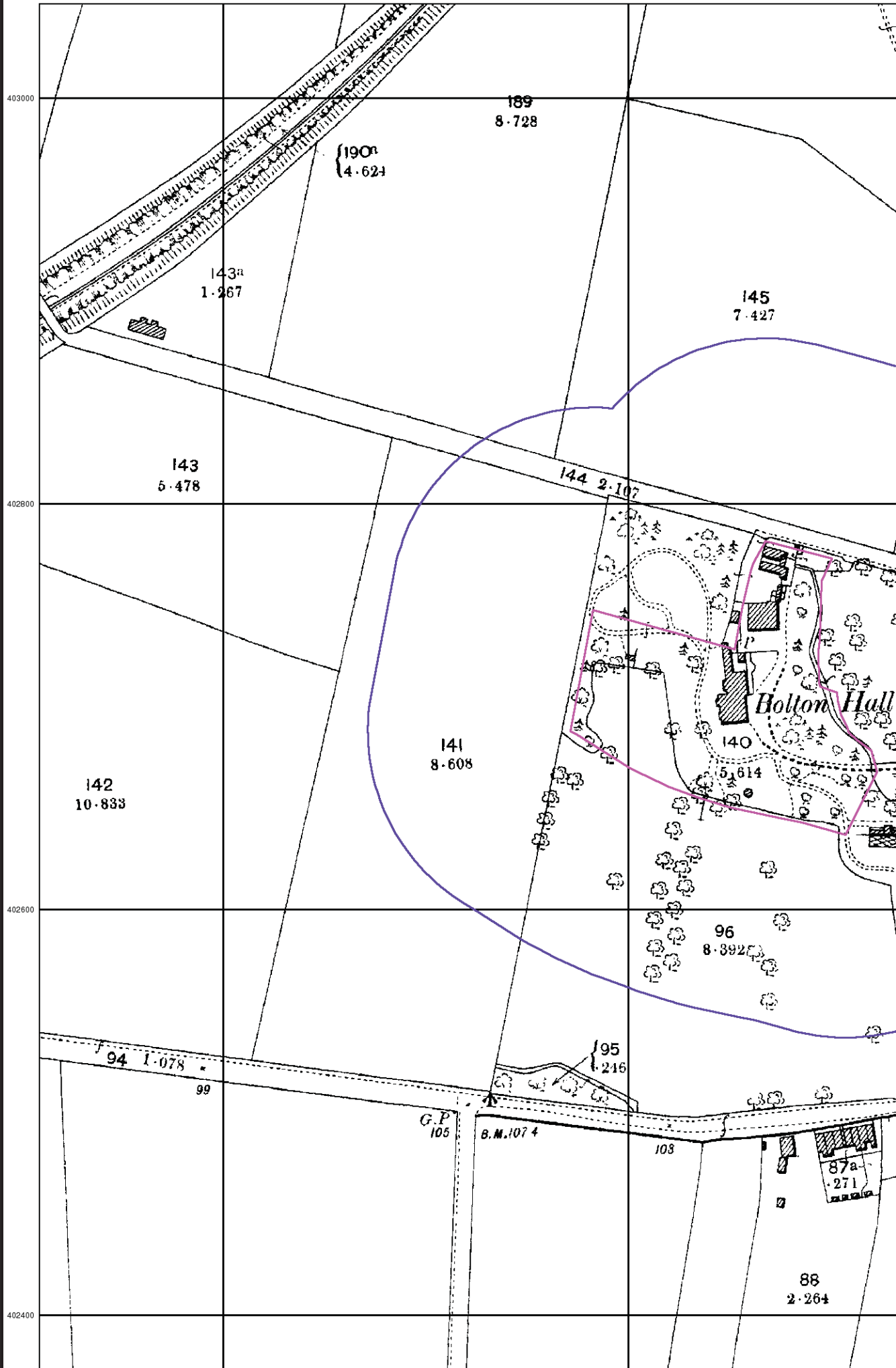
Ordnance Survey County Series and Ordnance Survey Plan 1:2,500

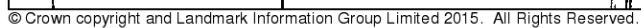
	Quarry		Gravel Pit		Sand Pit
	Clay Pit		Shingle		Refuse Heap
	Sloping Masonry		Flat Rock		
	Marsh		Reeds		Osiers
	Rough Pasture		Furze		Wood
	Mixed Wood		Brushwood		Orchard
	Fir		Ford		Stepping Stones
	Ferry		Waterfall		Lock
	Trig. Station	507	Altitude at Trig. Station		
B.M. 325.9	Bench Mark	342	Surface Level		
	Arrow denotes flow of water		Antiquities (site of)		
	Cutting		Embankment		
	Railway crossing Road		Level Crossing		Road crossing Railway
	Railway crossing River or Canal		Road over single stream		Road over River or Canal
-----	County Boundary (Geographical)				
- . - . - .	County & Civil Parish Boundary				
+ + + + +	Administrative County & Civil Parish Boundary				
-----	County Borough Boundary (England)				
Co. Boro. Bdy.	County Borough Boundary (Scotland)				
B.P. B.S.	Boundary Post or Stone	P.C.B.	Police Call Box		
B.R.	Bridle Road	P	Pump		
E.P.	Electricity Pylon	S.P.	Signal Post		
F.B.	Foot Bridge	Sl.	Sluice		
F.P.	Foot Path	Sp.	Spring		
G.P.	Guide Post or Board	T.C.B.	Telephone Call Box		
M.S.	Mile Stone	Tr.	Trough		
M.P. M.R.	Mooring Post or Ring	W	Well		

Ordnance Survey Plan, Additional SIM Supply of Unpublished Survey Inform 1:2,500 and 1:1,250

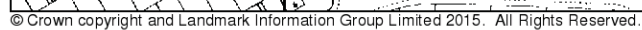
	Inactive Quarry, Chalk Pit or Clay Pit		Active Chalk Pit or Clay Pit
	Rock		Boulder
	Cliff		Slopes
	Roofed Building		Glazed Building
	Sloping Masonry		Archway
	Non-Coniferous Tree (surveyed)		Coniferous (surveyed)
	Non-Coniferous Trees (not surveyed)		Coniferous (not surveyed)
	Orchard Tree		Scrub
	Coppice, Osier		Reeds
	Rough Grassland		Heath
	Direction of water flow		Bench Mark
	Cave Entrance		Triangulation Station
	Electricity Transmission Line		
-----	County Boundary (Geographical)		
- . - . - .	County & Civil Parish Boundary		
.....	Civil Parish Boundary		
-----	Admin. County or County Bor. Boundary		
L B Bdy	London Borough Boundary		
	Symbol marking point where boundary changes		
BH	Beer House	P	Pillar, Pole or Post
BP, BS	Boundary Post or Stone	PO	Post Office
Cn, C	Capstan, Crane	PC	Public Conveniences
Chy	Chimney	PH	Public House
D Fn	Drinking Fountain	Pp	Pump
El P	Electricity Pillar or Post	SB, S Br	Signal Box or Post
FAP	Fire Alarm Pillar	SP, SL	Signal Post or Light
FB	Foot Bridge	Spr	Spring
GP	Guide Post	Tk	Tank or Truck
H	Hydrant or Hydraulic	TCB	Telephone Call Box
LC	Level Crossing	TCP	Telephone Call Post
MH	Manhole	Tr	Trough
MP	Mile Post or Mooring Post	W Pt, Wr T	Water Point, Well or Trough
MS	Mile Stone	W	Well
NTL	Normal Tidal Limit	Wd Pp	Wind Pump





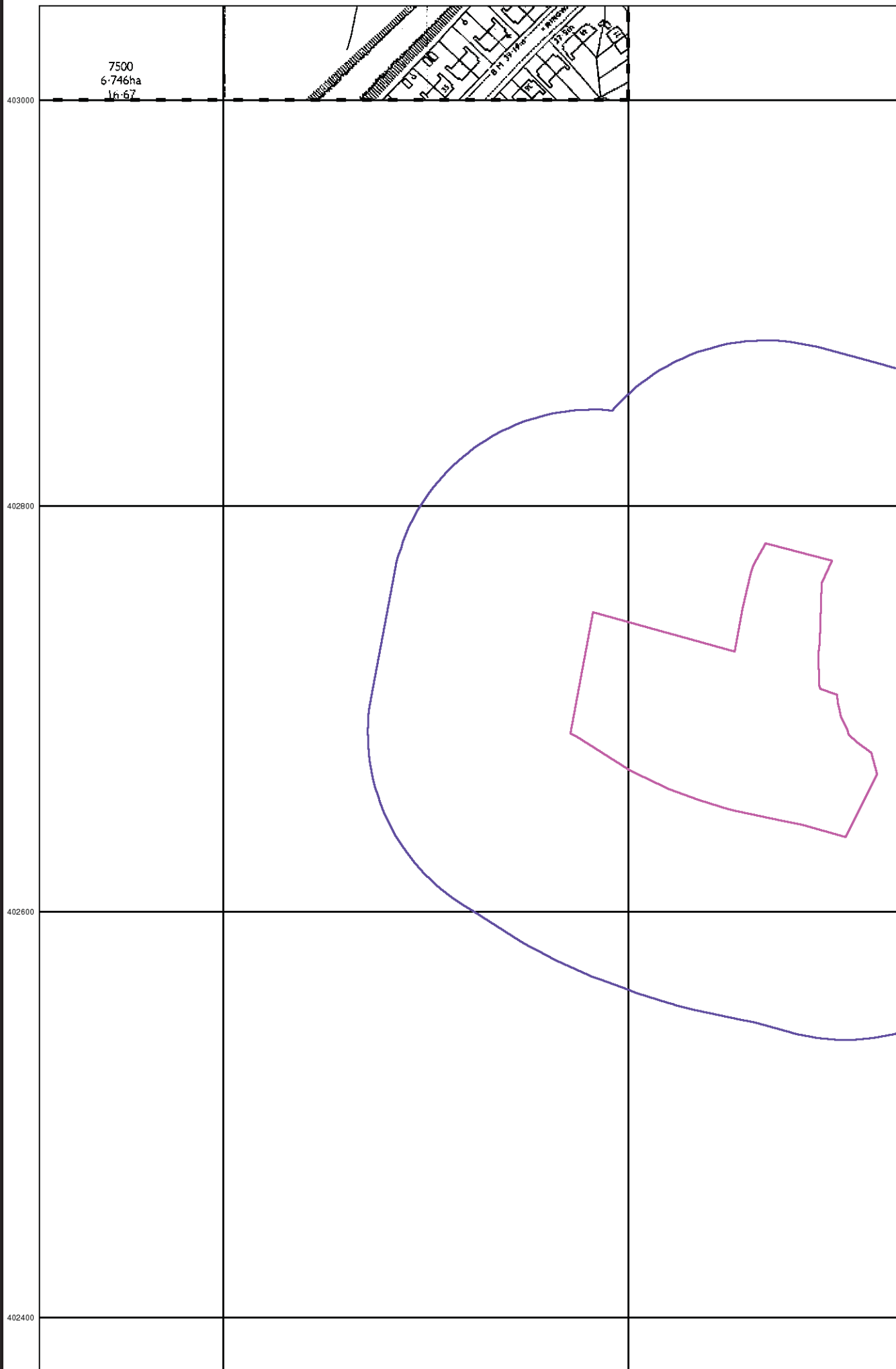


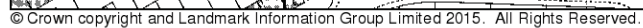




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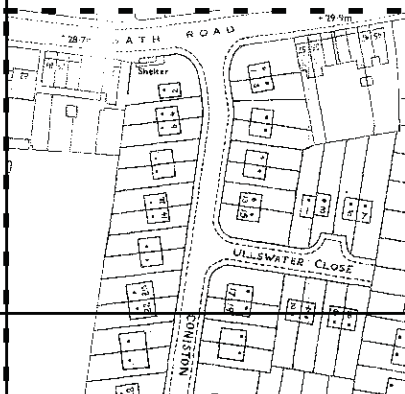
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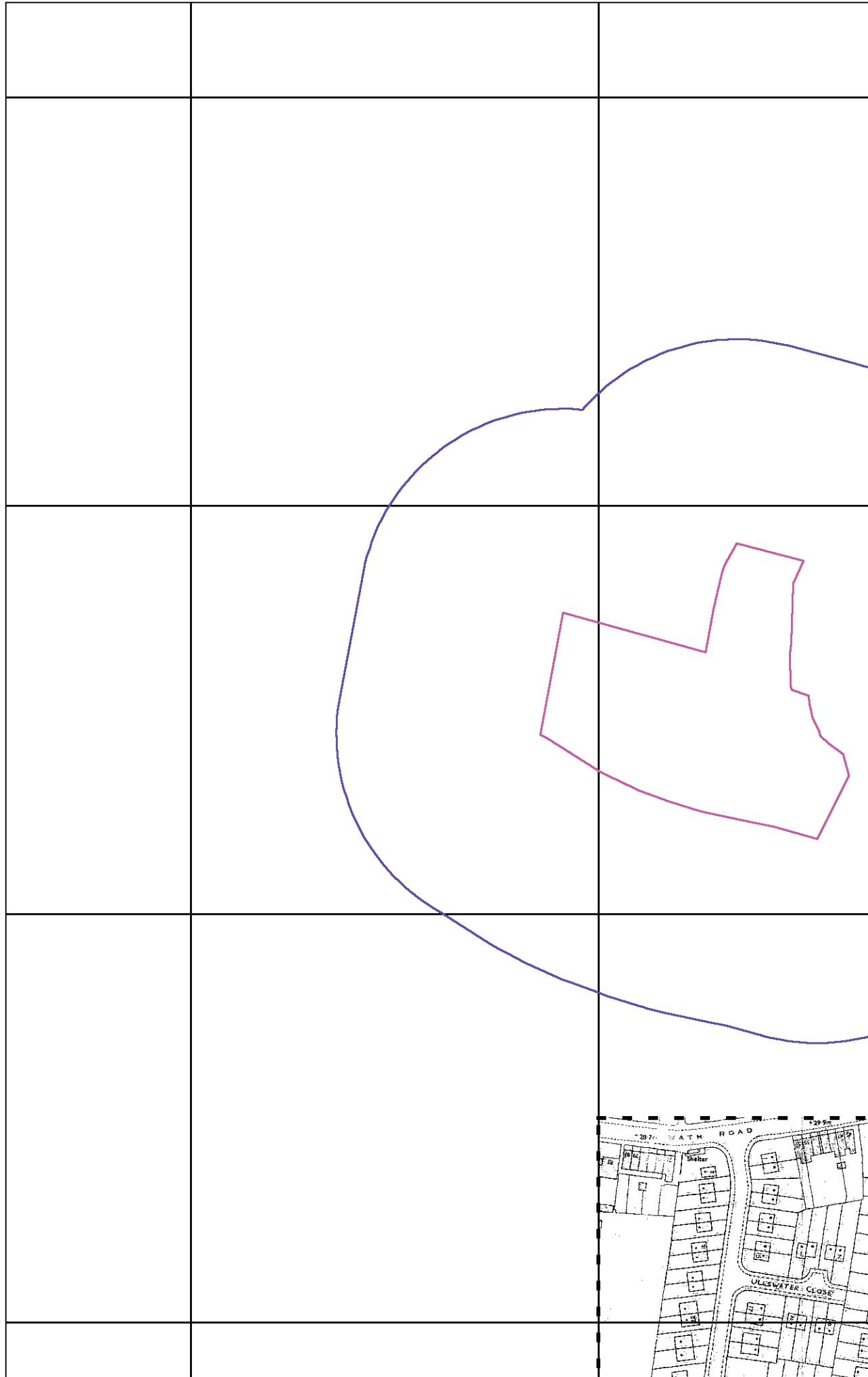
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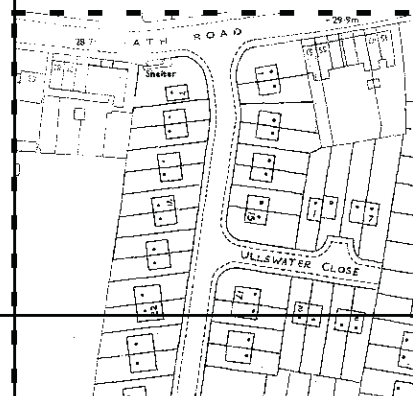
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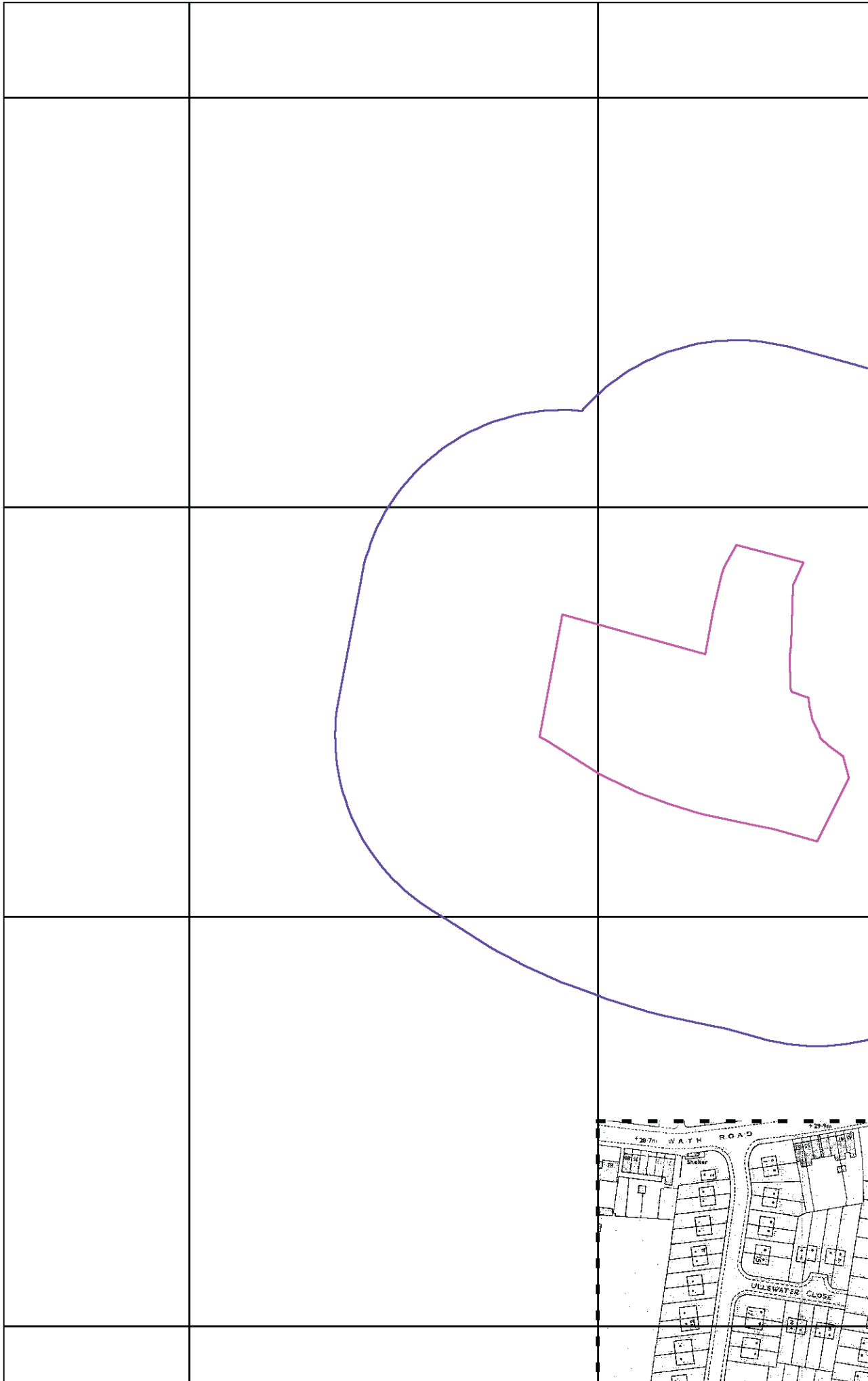
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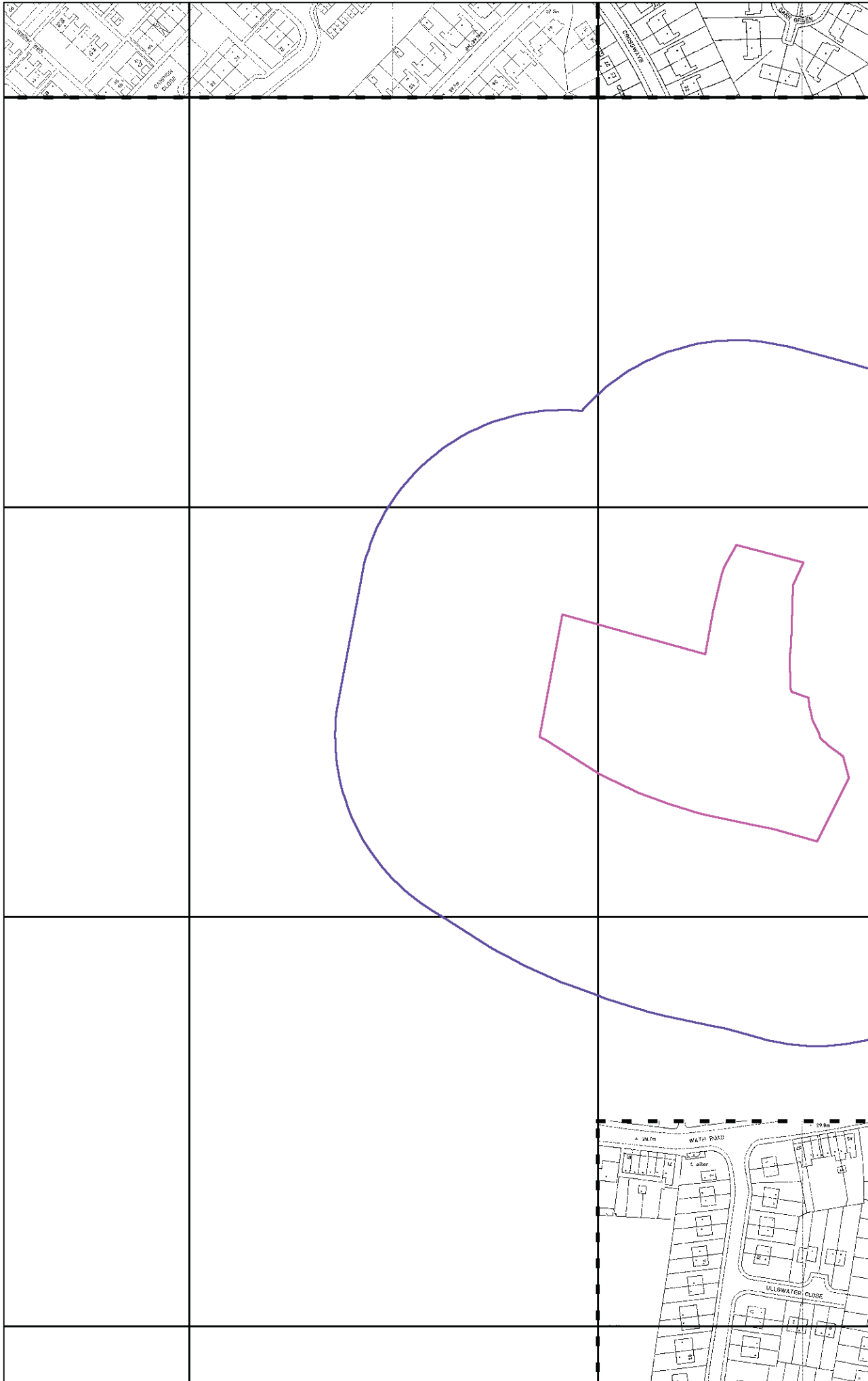
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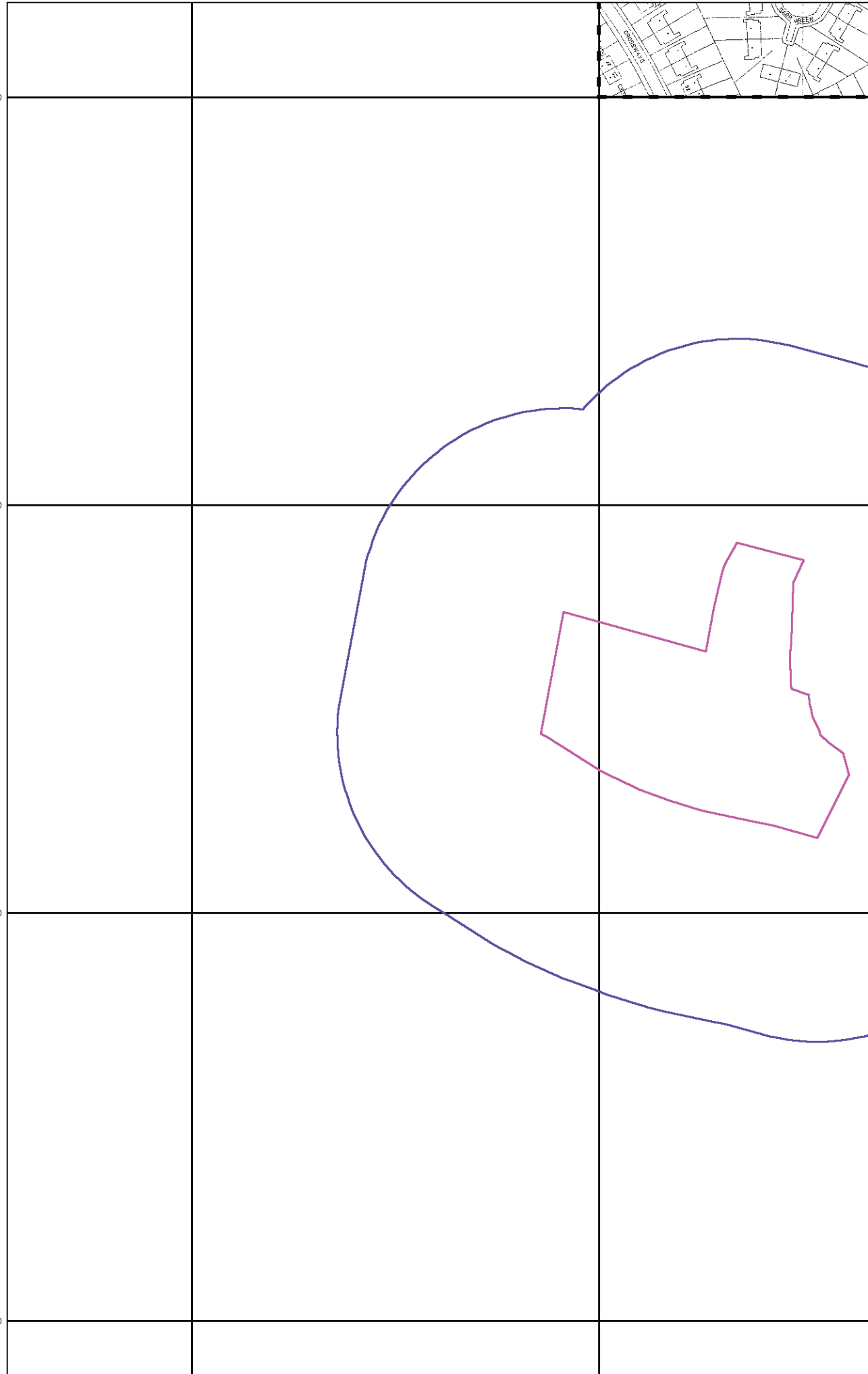
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Historical Mapping Legend

Ordnance Survey County Series 1:10,560

	Gravel Pit		Sand Pit		Other Pits
	Quarry		Shingle		Orchard
	Osiers		Reeds		Marsh
	Mixed Wood		Deciduous		Brushwood
	Fir		Furze		Rough Pasture
	Arrow denotes flow of water		Trigonometrical Station		
	Site of Antiquities		Bench Mark		
	Pump, Guide Post, Signal Post		Well, Spring, Boundary Post		
	•285 Surface Level				
	Sketched Contour		Instrumental Contour		
	Main Roads		Minor Roads		
	Sunken Road		Raised Road		
	Road over Railway		Railway over River		
	Railway over Road		Level Crossing		
	Road over River or Canal		Road over Stream		
	Road over Stream				
	County Boundary (Geographical)				
	County & Civil Parish Boundary				
	Administrative County & Civil Parish Boundary				
	County Borough Boundary (England)				
	County Burgh Boundary (Scotland)				
	R.D. Bdy.				
	Civil Parish Boundary				

Ordnance Survey Plan 1:10,000

	Chalk Pit, Clay Pit or Quarry		Gravel Pit
	Sand Pit		Disused Quarry
	Refuse or Slag Heap		Lake, Loch or Pond
	Dunes		Boulders
	Coniferous Trees		Non-Coniferous Trees
	Orchard		Scrub
	Bracken		Heath
	Marsh		Reeds
	Building		Glasshouse
	Sloping Masonry		Pylon
			Electric Transmission Line
	Cutting		Embankment
	Road Under		Road Over
	Level Crossing		Foot Bridge
	Standard Gauge Multiple Track		Standard Gauge Single Track
	Siding, Trough or Mineral Line		Narrow Gauge
	Geographical County		
	Administrative County, County Borough or County of City		
	Municipal Borough, Urban or Rural District, Burgh or District Council		
	Borough, Burgh or County Constituency		
	Civil Parish		
	Shown alternately when coincidence of boundaries occurs		
BP, BS	Boundary Post or Stone	Pol Sta	Police Station
Ch	Church	PO	Post Office
CH	Club House	PC	Public Conven
F E Sta	Fire Engine Station	PH	Public House
FB	Foot Bridge	SB	Signal Box
Fn	Fountain	Spr	Spring
GP	Guide Post	TCB	Telephone Cal
MP	Mile Post	TCP	Telephone Cal
MS	Mile Stone	W	Well

