Rail Central, Milton Malsor

Northamptonshire

Main Strategic Rail Freight Interchange

Desk Study Report

Report for

ASHFIELD LAND

April 2015, updated February 2018

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007	7th September 2017	Updated with regards to the Trading Estate and Transport Yard being external to site boundary
008	07th February 2018	Updated following EIA review – minor changes.

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Contents

1.0 INTRODUCTION 1
2.0 PRELIMINARY INVESTIGATION (PHASE 1 STUDY) 3
3.0 PRELIMINARY CONCEPTUAL SITE MODEL 18
4.0 DESK STUDY CONCLUSIONS 27
5.0 UNRESOLVED ISSUES, UNCERTAINTIES AND LIMITATIONS 28
6.0 RECOMMENDATIONS FOR FURTHER WORK 29
7.0 REFERENCES 30

Appendices

Appendix A Drawings
Appendix B Site Walkover Photographs
Appendix C Historical Ordnance Survey Maps
Appendix D Desk Study Research Information
Appendix E Hydrock Methodology

Executive Summary and Conceptual Site Model

SITE INFORMATION AND SETTING	
Report Purpose	Phase 1 desk study and preliminary geo-environmental and geotechnical risk assessment.
Client	Ashfield Land.
Site Name and Location	Rail Central, Milton Malsor, Northamptonshire. The site covers an area of approximately 260 ha immediately south of the village of Milton Malsor and approximately 450m north of the village of Blisworth, in Northamptonshire. The scheme is known as Rail Central. The National Grid Reference for the approximate centre of the site is 473077, 254830.
Proposed Development	Preliminary development proposals are for a number of commercial/warehouse structures with associated access and infrastructure, which is to include a rail freight terminal. It is anticipated the development will involve extensive reprofiling of the site and will include retaining structures.
PHASE 1 (DESK STUDY + WALKOVER)	
Current Land Use and Description	The site comprises fields, with two farm yards together with an active transport yard and a derelict filling station. The central section of the site is a shallow valley with higher ground to the west and east.
Site History	The site has remained mainly as farmland since the earliest map edition of the late 19th Century, with development essentially limited to: • a filling station and transport yard adjacent to the A43; • a disused service station in the western area of the site, beside the A43; • Lodge and Manor Farms in the central east of the site; and • two former sand and gravel pits in the north and northwest of the site, which are assumed to have been subsequently infilled. In addition, numerous small farm buildings have been constructed across the site and demolished later in the 20th Century. Off site to the northwest is a transport yard. Offsite in the central south of the site is a trading estate including a food recycling facility, garage and factory. The Grand Union Canal crosses the southwestern part of the site and runs adjacent to the site boundary along the western part of the site. The transport yard in the northwest is not shown on any of the historical maps and is assumed to be modern. The surrounding area has remained as farmland since the earliest map edition with the exception of a number of sand and gravel pits to the north, and brick pits to the west. Earthworks are present in: • the northwest of the site (Rathvilly Farm), where ground levels are unnaturally raised; • the southwest of the site in the form of embankments for the Grand Union Canal and former Great Central Railway; and • in the southeast of the site, understood to be arisings deposited following excavation of Roade Cutting which is located to the southeast of the site along the West Coast Main Line.
Unexploded Ordnance	A non-specialist Unexploded Ordinance (UXO) screening exercise has been undertaken which indicates a low bomb risk.
Geology	The stratigraphic sequence at the site as indicated by BGS mapping is: • Alluvium; • Oadby Member (Glacial Till); • Glaciofluvial Deposits; • Wellingborough Limestone Member; • Rutland Formation;

	• Stamford Member; • Northampton Sand Formation; • Whitby Mudstone Formation; • Marlstone Rock Formation; and • Dyrham Formation. Made Ground may be present associated with areas of former or current development and landfilling.
Mineral Extraction	The Glaciofluvial Deposits in this area are locally known as the Milton Sand, and appear to have been worked in the northwest and north of the site. Anecdotal information suggests that a sand pit in the northeast corner of Area C was subsequently infilled with arisings from the construction of the M1 motorway. The northern part of the site is designated as a Mineral Safeguarding Area (MSA) under the Northamptonshire Minerals and Waste Local Plan (MWLP) (adopted May 2017). The safeguarding area relates to Glaciofluvial sand known locally as Milton Sand. The northeastern corner of the site is within the 300m buffer of an allocated sand and gravel extraction site (M1: Milton Malsor), which relates to a 1.2 million tonne reserve at Maple Farm. However, Hydrock do not believe the proposed Strategic Rail Freight Interchange (SRFI) development presents a risk to the future viability of M1: Milton Malsor as the allocated sand and gravel extraction site (M1: Milton Malsor) is located to northeast of the village of Milton Malsor, to the east of the Northampton Loop Rail line and to the north of Collintree Road. As such, the allocated sand and gravel extraction site is separated from the proposed SRFI development site by existing residential development and major pre-existing infrastructure in the form of roads and the Northampton Loop Rail line. On this basis, there is no viable physical link between the proposed SRFI development and M1: Milton Malsor and as such, both operations are able to co-exist without impact on the other.
Ground Stability	Fine-grained soils may be susceptible to compression, excessive settlements and collapse of excavations. Coarse-grained soils may be susceptible to running sand (particularly in the presence of groundwater) and collapse of excavations.
Hydrogeology	The recorded aquifer status of the soils below the site is as follows: • Alluvium (Secondary Undifferentiated Aquifer); • Glaciofluvial Deposits (Secondary A Aquifer); • Glacial Till (Unproductive Strata); • Wellingborough Member (Secondary A Aquifer); • Rutland Formation (undifferentiated) (Secondary B Aquifer); • Stamford Member (Secondary B Aquifer); • Northampton Sand Formation (Secondary A Aquifer); • Whitby Mudstone Formation (Unproductive Strata); • Marlstone Rock Formation (Secondary A Aquifer); and • Dyrham Formation (Secondary Undifferentiated Aquifer).
Hydrology	Surface drainage is from the south to the north, principally by the Milton Malsor Brook, including an eastern arm, which rises in the east of the site and joins the main brook further to the north.
Radon	Basic radon protective measures are necessary for new, non-domestic buildings according to current guidance.
Natural Soil Chemistry	Published concentrations of naturally occurring Contaminants of Concern in the soils below the site are considered unlikely to present a risk to human health.
Waste Management	There is a record of a landfill at the former pit in the northwest of the site. There are additional landfills within the vicinity of the study area. Gayton Landfill, which is located 350m to the west of the site, is designated as 'Contaminated Land' under Part IIA of the Environmental Protection Act (EPA), 1990.

Contemporary Trades	There is an active transport yard offsite adjacent to the northwest corner. There are numerous activities on an industrial estate off site to the west of Northampton Road including a sewage treatment works, a food recycling centre and a workshop.	
Underground Services	A British Pipeline Association (BPA) high pressure aviation fuel main bisects the site. Numerous large, underground field drains were identified draining into ditches around the site.	
Possible Contaminant Linkages of Moderate or Greater Risk Level - From Desk Study	The possible pollutant linkages on an unremediated site, with risk levels of moderate or greater, as determined by the desk study and walkover are summarised below.	
	Sources	◄ potential Impact on ► Receptors
	Landfill (on and off site) – metals, asbestos, inorganics, polyaromatic hydrocarbons, petroleum hydrocarbons, ground gas and leachate.	End users. Neighbours. Surface water. Groundwater.
	Farm yard – above ground fuel storage.	Surface water. Ecology. Groundwater.
	Farm yard – Made Ground from uncontrolled burials.	End users. Groundwater.
	Filling station – hydrocarbon spillages and leakages.	End users. Neighbours. Surface water. Groundwater.
	Transport yard – metals, acetone, PAH, organolead, polyaromatic hydrocarbons, petroleum hydrocarbons, asbestos.	End users. Neighbours. Surface water. Groundwater.
	Ground gas from natural soils (Alluvium).	End users. Neighbours. Buildings.
	Sewage treatment works – metals, pH, hydrocarbons.	Surface water. Groundwater.
	Abattoir – metals, phenols, PAH, pesticides.	Surface water. Groundwater.
	Railway land – metals, defoliants, PAH, PCB.	End users. Surface water. Groundwater.
	Radon.	End users.

ASSESSMENT AND CONCLUSIONS	
Conclusions	Based on historical land uses and its current uses, the overall risk from land contamination at the site is considered to be low. However, where there are local sources of contamination (landfill, filling station etc) the risk are considered moderate to high. However, the source-pathway-receptor linkages developed as part of the Conceptual Site Model would need to be confirmed by appropriate intrusive investigation, testing and assessment of the results of the investigation. It is considered that it is unlikely that the site would be classified as 'Contaminated Land' under Part 2A of the EPA 1990. There are a number of geotechnical risks which require further assessment and design. However, in Hydrock's opinion, with appropriate investigation and design, the risks are manageable using industry standard solutions. Due to the proposed SRFI site being separated from the M1: Milton Malsor allocated mineral site by existing residential development and major pre-existing infrastructure in the form of roads and the Northampton Loop Rail line, Hydrock does not believe the proposed SRFI site would result in sterilisation of the proven mineral resources at M1: Milton Malsor.
FUTURE CONSIDERATIONS	
Further Work	In order to confirm the actual risks to receptors and confirm the ground conditions with respect to potential geotechnical and geo-environmental risks, an appropriate intrusive investigation will need to be undertaken. The initial works will comprise a site wide, wide-spaced ground investigation which will be designed to: • determine, on a site-wide basis, the vertical and lateral distribution of natural lithologies and Made Ground depth, composition and distribution; • provide initial geotechnical soil parameters for outline foundation zonation and general recommendations with regards to excavations, pavements, concrete design, etc; • provide a global assessment with regards to earthworks, reuse of soils and the potential for the use of lime or cement stabilisation or modification to improve the soils; • provide information in the areas of main existing and proposed infrastructure; • provide recommendations for soakaway drainage; • allow ground gas and groundwater monitoring and assessment; and • allow a site-wide overview of the soil chemistry and identify any areas of concern that will need to be targeted as part of future, plot-specific, investigations for remediation of contamination. Future phases of investigation will be required for the various phases of infrastructure, and as plot specific assessments to provide data for funders to assess risks. Based on the current data the following site investigation is proposed: • the excavation of trial pits to allow collection of samples for geotechnical and chemical analysis, to assess trench stability, over-break potential and 'digability', and determine undrained shear strength; • the undertaking of soil infiltration rate testing; • dynamic ('windowless sampling') sampling to allow collection of samples for geotechnical and chemical analysis of shallow soils, to determine the density of the sands and gravel for foundation design and allow the installation of gas and groundwater monitoring wells; • cable percussive boreholes to allow collection of samples for geotechnical and chemical analysis of deeper soils, allow *in situ* testing (SPTs) to be undertaken to assess the density of the sands and gravel for possible pile design, and allow the installation of gas and groundwater monitoring wells; • installation of gas and groundwater monitoring wells; • gas concentration and groundwater level monitoring; • geotechnical laboratory testing of soils and rock; and • laboratory contamination analysis of soil and groundwater.

This Executive Summary forms part of Hydrock Consultants Limited report number R/151171/001 (Issue 8) and should not be used as a separate document.

1.0 INTRODUCTION

1.1 Terms of Reference

Hydrock Consultants Limited (Hydrock) was commissioned by Ashfield Land (the Client) to undertake a desk study for an area of land south of Milton Malsor in Northamptonshire. This was reported in March 2015 and the desk study has been updated as more information has become available. This revision updates the Desk Study, based on initial EIA consultation responses, the final site layout and changes to local planning policy.

The site covers approximately 260 hectares (ha) immediately to the south of the village of Milton Malsor and approximately 450m to the north of the village of Blisworth. It is predominately occupied by fields and farm buildings.

The proposed development is known as Rail Central. Preliminary development proposals are for a number of commercial/warehouse structures with associated access and infrastructure, which is to include a rail freight terminal. It is anticipated the development will involve extensive reprofiling of the site and will include retaining structures.

A Site Location Plan (Hydrock drawing 151171.D001), a Topographic Survey (12605_3D) and a Preliminary Site Masterplan are presented in Appendix A.

1.2 Objectives

The objectives of this investigation are to assess the readily available information on the likely ground conditions at the site and to undertake preliminary geo-environmental and geotechnical risk assessments.

1.3 Scope

The scope of work for this commission comprises a desk study and site walkover to determine the nature of the site and its surroundings including current and former land uses, geology, hydrogeology, hydrology and geo-environmental data and reporting on the findings.

The extent of the Desk Study area is the land within the Potential Development Area and the immediate surrounding area. The immediate area is defined for the purposes of this chapter as land within close proximity to or bordering the relevant part of the site (i.e. less than 250m from the site) that has the potential to be a contaminant source, which may affect the site or be affected by the site.

See Appendix E for detailed reporting methodology.

1.4 Provided Information

The following has been provided to Hydrock by the Client for use in the preparation of this report:

- Reading Agricultural Consultants. October 1999. 'Draft Semi-detailed Agricultural Land Classification'. Reference 2100/2106/ALCREP.
- CgMg Consulting. October 1999. 'Archaeological Desk based Assessment'. Reference PRC/KB/1887.
- Epcad Development Group. October 1999. 'Ecological Assessment (Briefing Note)'. Unreferenced.
- Topographic Survey (12605_3D).

1.5 Approach

The work has been undertaken in general accordance with recognised best practice as detailed in guidance documents such as the CLR 11 M*odel Procedures* (Environment Agency 2004). The technical details of the approach and the methodologies adopted are given in Appendix E.

This Phase 1 desk study and walkover provides a preliminary assessment of the site conditions and the important factors that may require further investigation to reduce uncertainty. Recommendations for further work are listed at the end.

2.0 PRELIMINARY INVESTIGATION (PHASE 1 STUDY)

The following desk study sources have been obtained for the site and are presented in Appendix D:

- British Geological Survey. 27th March 2015. 'Radon Report: England & Wales'. Reference GR210997/1.
- Peter Brett Associates. April 2015. 'Natural Cavities Database search'. Reference 34104/CBH/CNE/AD/CW/TH.
- Zetica. 2015 'Unexploded Ordnance Hazard Map (Northampton)'. Unreferenced.
- Institute of Geological Sciences. Undated. 'Rugby and Northampton Warwickshire and Northamptonshire'. Mineral Assessment Report 107.
- GroundSure. 25th March 2015. 'EnviroInsight'. Reference HYDNOR-1981473.
- GroundSure. 25th March 2015. 'GeoInsight'. Reference HYDNOR-1981474.
- GroundSure. 25th March 2015. 'MapInsight'. Reference HYDNOR-1981475.

The following sources are also used in the desk study assessment:

- Reading Agricultural Consultants. October 1999. 'Draft Semi-detailed Agricultural Land Classification'. Reference 2100/2106/ALCREP.
- CgMg Consulting. October 1999. 'Archaeological Desk based Assessment'. Reference PRC/KB/1887.
- Epcad Development Group. October 1999. 'Ecological Assessment (Briefing Note)'. Unreferenced.

2.1 Site Referencing

The site is referenced in Table 2.1.

Table 2.1: Site Referencing Information

Item	Brief Description
Site name	Rail Central.
Site location and grid reference	The site covers an area of approximately 260 ha immediately south of the village of Milton Malsor and approximately 450m north of the village of Blisworth, in Northamptonshire. The National Grid Reference for the approximate centre of the site is 473077, 254830.

A Site Location Plan (Hydrock drawing 151171.D001) is provided in Appendix A.

2.2 Site Description and Walkover Survey

A red-line boundary of the study area and designation of areas used in the description of the site are presented in the 'Site Extents Plan' (Hydrock drawing 151171.D002) in Appendix A. This plan also divides the site into three areas (Area A, Area B and Area C).

For clarity and given the size of the proposed development, the Desk Study Report considered the site in three areas, denoted as Areas A, B and C.

Area A covered land at Arm Farm to the west of the A43.

Area B covered land between the A43 in the west, and Northampton Road and Towcester Road in the east. This area of the site includes a redundant filling station on the A43 and a former landfill site in the north.

Area C covered land to the east of Northampton Road and Towcester Road, and to the west of the Northampton Loop Railway Line, incorporating Lodge and Manor Farms and the Diocese of Peterborough Land.

A site description as described in the Desk Study Report, is presented in Table 2.2.

Walkover surveys were undertaken initially in March 2015, with further walkovers as land parcels became available to access, to visually assess potential geo-environmental and geotechnical hazards and receptors. A site description is presented in Table 2.3 and selected walkover photographs are presented in Appendix B.

Table 2.3: Site Description

Item	Brief Description
Site area	Approximately 260 ha.
Transport network	Area A and Area B are separated on an approximately north to south line by the A43 dual carriageway. Area B and Area C are bisected on an approximate north to south line by Northampton Road/Towcester Road (single carriage road). Gayton Road forms the northern site boundary of Area B. Barn Lane (unadopted track) bisects the northern part of Area C. Rectory Lane forms part of the northern site boundary of Area C. The Grand Union Canal forms part of the southwest boundary of Area B.
Surface Drainage	There is a brook in Area B (Milton Malsor Brook) which flows from the south to the north. An eastern tributary of the Milton Malsor Brook rises in the north of Area C and flows north, joining the main Milton Malsor Brook further to the north. For the purpose of the report this has been referred to as the Milton Malsor Brook Eastern Arm.
Present land use and vegetation	**Area A** This comprises an area of land between the Grand Union Canal and the A43. It is principally occupied by single storey residential dwellings with associated gardens, in the west, with two fields to the east. Collectively, the area is known as 'Arm Farm'. At the time of the walkover, the southern field was occupied by sheep and the northern field was empty. Field boundaries are defined by mature tree and hedge growth and domestic gardens. Gayton Marina is located on the western side of the canal. **Area B** Area B comprises twenty fields and a wooded area adjacent to the A43. At the time of the walkover, the fields were cropped, except for two fields in the south, which were grassland. Boundaries are defined by mature tree and hedge growth with gaps and/or gates to be used for access. There are no farm buildings in this area.

Item	Brief Description
	There is an above ground storage tank (no bund) adjacent to the northeast site boundary (north of the proposed Unit 10). The tank apparently carries water for an adjacent pheasant enclosure. To the east of this, is a steep sided pit, but dense vegetation made viewing the pit difficult. There is hummocky ground adjacent to a field boundary near the north of the area (associated with a former farm building beneath proposed Unit 12). There is ridge and furrow in the southwest field of the area as well as two distinct raised earthworks: one orientated east to west associated with the Grand Union Canal and another orientated north to south associated with a former railway line (now dismantled and with the bridge over the canal now removed). A derelict filling station was located adjacent to the A43 in the central west site boundary. Access from the A43 was restricted by an approximately 1m high earth bund. A transport yard was present in the northwest field, but it was not possible to enter this area (no permission was available). A field in the southwest of the site had been partially stripped of topsoil and was very soft and damp. It is understood this relates to an ongoing leak of water from the Grand Union Canal. **Area C** Area C comprises nineteen fields, Lodge Farm, Manor Farm and Barn Lane. At the time of the walkover the fields were cropped or grassland. Boundaries were defined by mature tree and hedge growth with gaps and/or access gates. Lodge Farm comprises a square shaped residential building, with several barns and outhouses. There are numerous above ground storage tanks and numerous pieces of machinery across the compound. There is also a chemical storage room (although no chemical storage was noted). Fertiliser was stored in a separate barn. At the southern extent of Barn Lane, there was a stockpile of plasterboard chippings used to lime the fields. Some field entrances have been stoned with brick and concrete fragments. A manure stockpile was noted in a field southeast of the site boundary.
Topography and geomorphological features	In general, the topography of the site is a wide valley centred on Milton Malsor Brook in Area B. However, small topographical changes were observed and are considered to be generally associated with the change in geology and surface water drainage. **Area A** Area A is relatively flat with a gentle downward slope to the east. Given the proximity to the canal, it is considered likely this area may have been raised and is marginally higher than the area around it. **Area B** Area B is characterised by a gently rolling hills with a central valley. The valley is lowest in the approximate centre of the area and is orientated in a north to south direction. This is associated with Milton Malsor Brook, which bisects the site and flows from south to north. The brook is joined by two tributaries, which flow in ditches on the field boundaries from the southwest and southeast. Generally, the valley floor is relatively flat except in the northeast where there is a steeper upwards slope (associated with the local geology in this area). There are some steep slopes associated with earthworks for the Grand Union Canal, which forms part of the boundary of the site. North of this are earthworks associated with a former railway line. Further earthworks associated with the A43 are noted in the southwest of this Area, with the carriageway elevated above the site. **Area C** The west of Area C is relatively flat. However, east of Barn Lane the site slopes upwards to its highest elevation adjacent to the railway line. A spring line (marked by hydrophilic grasses) was noted at the base of a steep slope approximately 50m south of the southeast site boundary. There was evidence of a landslip on

Item	Brief Description
	the railway embankment in this area. The slip appeared to have been toe-loaded and monitoring inclinometers or wells placed along its length. There is evidence of earthworks in the south of Area C. Anecdotal evidence suggests the ground levels have been raised with arisings from Roade Cutting (railway) to the southeast. Earthworks are also present in the northwest of the site (Rathvilly Farm), where ground levels are unnaturally raised.
Vegetation	With the exception of the occasional ploughed field, the filling station, transport yard and farm yards, the site is covered in grass or crop.
Archaeology	Ridge and furrow was noted in some fields.
Surrounding land	The site is in a rural setting and surrounded predominantly by fields. The exception is the village of Milton Malsor, which forms part of the northern boundary of Area C and the northeastern boundary of Area B. The area to the southwest of Area B (central south of the total site) is occupied by a trading estate including a sewage treatment works, food recycling facility, workshop and caravan sales.

2.3 Site History

A study of historical Ordnance Survey maps (Appendix C) has been undertaken to identify former land uses at the site and surrounding areas that may have geotechnical or geo-environmental implications for the proposed development. The results are summarised in Table 2.4.

Table 2.4: Key Features from Historical Mapping

Map Edition and Scale	Key Features on Site	Key Features off Site
1883 -1884: 1:10,560	The site is occupied by a large number of fields and the boundaries of the site are defined by the same fields, roads and railway lines noted during the site walkover. The surface water courses identified in Area B are the same as identified during the site walkover. Structures present on the site include: **Area A** Navigation Inn (Public House). **Area B** Farm building (on area of hummocky ground identified during walkover). **Area C** Lodge Farm (residential area identified during site walkover). There is a small pond in the centre of Area C.	The site is surrounded by fields, with sporadic farm buildings, the Grand Union Canal and railway lines as noted during the site walkover. There are several large quarries located approximately 200m south of the site. The following off site features are present: **Area A** A clay pit with an associated brick works and kilns is shown adjacent to the northern canal bank, north of Area A. There is a larger 'Brick and Tile Works' with pits and kilns located 500m to the west. **Area B** There is a gravel pit adjacent to the northwest site boundary. Blisworth Union sidings and engine sheds are shown immediately to the south of Area B. A spring is shown approximately 650m southwest of the southern site boundary. **Area C** The village of Milton Malsor is located adjacent to the north of Area C. There are 'Limekilns' associated with the railway approximately 750m southeast of the site.

Map Edition and Scale	Key Features on Site	Key Features off Site
1899 – 1900: 1:10,560	No significant change.	**Area B** The gravel pit adjacent to the northwest boundary has been extended. **Area C** There is a 'Sand Pit' and an 'Old Sand Pit' located within 50m of the northeast site boundary.
1950: 1:10,560	There are numerous small farm buildings generally located on field boundaries. There is an area of disturbed ground in the northeast of the site. This may be associated with the former sand pit, which is present adjacent to the northeast site boundary.	**Area A** The pits, kilns and brickworks to the north and west of Area A are more extensive, but appear to be abandoned. **Area B** There are two circular features adjacent to the southeast corner of Area B (filter beds). The gravel pit to the northwest is labelled as 'Disused' but there is an additional 'Sand Pit' located to the north of the road. **Area C** The sand pit to the northeast has been extended but is now labelled as an 'Old Sand Pit'.
1957 – 1958: 1:10,560	No significant change.	**Area B** Buildings have been constructed adjacent to the northwest site boundary.
1964 - 1968: 1:10,560	No significant change.	**Area B** The sand pit to the north of Area B is no longer shown.
1980 - 1981: 1:10,000	**Area C** A small nursery is present in the central east of Area C, west of Barn Lane.	**Area A** The former clay pits near this area are shown to be flooded. **Area B** An abattoir and garage have been constructed in the area between the southeast of Area B and Northampton Road. A sewage works associated with the round filter beds first identified on the 1950 map is present to the south of the abattoir.
1988 - 1992: 1:10,000	**Area C** There is further development along Barn Lane. Many of the farm buildings are no longer shown.	The A43 has been built adjacent to the eastern edge of Area B A factory has been built to the east of the abattoir.
2002: 1:10,000	**Area B** A petrol station has been built adjacent to the western boundary of Area B, adjacent to the A43.	**Area C** A stream issues from the northeast of this area and flows to the north. Rathvilly Farm has been constructed to the east of Barn Lane.
2010 - 2014: 1:10,000	There is additional development at Lodge Farm.	No significant change.

Summary: The site has remained mainly as farmland since the earliest map edition of the late 19th Century, with development essentially limited to:

- a filling station (now disused) and transport yard adjacent to the A43 (Area B);
- Lodge and Manor Farms (Area C) in the central east of the site;
- two former sand and gravel pits in the northwest and north of the site (Area B), which are assumed to have been subsequently infilled; and

In addition, numerous small farm buildings have been constructed across the site and subsequently demolished.

The Grand Union Canal crosses the southwestern part of the site and runs adjacent to the site boundary along the western part of the site. There is evidence that the canal may be leaking in the southwestern corner of Area B, as discussed further in Section 2.10.

The transport yard in the northwest of Area B is not shown on any of the historical maps and is assumed to be modern.

The surrounding area has remained predominantly farmland since the earliest map edition with the exception of a number of sand and gravel pits to the north, brick pits to the west and a trading estate including a food recycling facility, garage, sewage works, factory, and formerly an abattoir, to the southeast of Area B (central south of the total site).

Fly tipping was observed in the centre of the site (Area B) adjacent to the track off Northampton Road / Towcester Road. Fly tipped materials included general household type wastes and notably corrugated cement bound asbestos sheeting.

2.4 Unexploded Ordnance

In general accordance with CIRIA Report C681 (Stone *et al* 2009) a non-specialist Unexploded Ordinance (UXO) screening exercise has been undertaken which indicates:

- no current or former military use of the area;
- no evidence of bombing (on the historical maps); and
- the Zetica regional bomb risk map (Northamptonshire) shows the site to be in an area where the bomb risk is low (a copy of the map is presented in Appendix D).

Since the Zetica assessment of UXO risk is low and no evidence to the contrary is available, no further consideration of UXO is undertaken as part of this assessment.

2.5 Geology

The general geology of the site area is shown on the 1:50,000 geological map of Towcester (Sheet 202) and is summarised in Table 2.5. Maps of the strata described are presented in the GroundSure report in Appendix D.

Table 2.5: Geology

Location	Age	Stratigraphic Name	Description
Central valley	Recent	Alluvium	Normally consolidated sandy clay.
Northeast			
North	Pleistocene	Glaciofluvial Deposits	Sand and gravel.
Locally in the northwest		Glacial Till (Oadby Member)	Over consolidated gravelly clay with associated sand and gravel deposits.
Locally in the east			
Southeast corner	Jurassic	Wellingborough Member	A massive argillaceous, sandy, shelly and shell-detrital limestone associated with rubbly oyster-rich limestone, marl and mudstones.
Southeast corner		Rutland Formation (undifferentiated)	Fluviatile and lacustrine sandstones, passing into grey marine mudstone and non-marine mudstone and siltstone.
Southeast corner		Stamford Member	A pale greenish grey to yellowish and white, generally massive, fine-grained, generally friable, quartzose, unfossiliferous sandstone or siltstone.
Southeast corner		Northampton Sand Formation	Sandy, berthierine-ooidal and sideritic ironstone, greenish grey where fresh, weathering to brown limonitic sandstone, typically displaying a box-stone structure. The basal part is commonly muddy and less ferruginous.
Entire Site		Whitby Mudstone Formation	Dark grey, fossiliferous mudstone and siltstone with fine grained sandstone beds and fossiliferous limestones.
Centre and northwest		Marlstone Rock Formation	Sandy, ooidal, ferruginous limestone with shell fragments.
Centre and northwest of the area		Dyrham Formation	Pale to dark grey, silty, sandy mudstone weathering to a yellow clay.

Not all strata are shown to be present in all areas of the site.

Made Ground is anticipated around the former filling station (Area A) and the farmyards (Area C). Localised Made Ground may also be present around the site due to farming activities although this is unlikely to be laterally or vertically extensive.

Where there has been landfilling (north of Area B and south and possibly north Area C) then the presence of extensive fill materials is anticipated.

2.6 Mineral Extraction

Reference to the Institute of Geosciences Mineral Assessment Report 107 indicates the Glaciofluvial Deposits at National Grid Reference 735,555 (Milton Malsor) are known locally as the Milton Sand and comprise a pale brown, iron stained fine- to medium-grained sand with localised sandstone and ironstone gravels and occasional shelly Whitby Mudstone Formation fragments.

The report conjectures that the Glaciofluvial Deposits may be younger than (and will therefore overlie) the Oadby Member in the Milton Malsor area. There is no indication from the historical boreholes if this is the case and it would require confirmation by intrusive investigation. However, the presence of former pits infers there is not a significant depth of overburden over the Glaciofluvial Deposits.

This report also describes three sand and gravel pits in the areas to the north of Area B and Area C, although detailed grid references are not available. It is considered that the sand and gravel pits identified on the historical maps are the pits referenced in the mineral assessment. An open pit was also noted during the site walkover in the northwest corner of Area C.

Anecdotal information suggests that a further sand pit in the northeast corner of Area C was subsequently infilled with arisings from the construction of the M1 motorway.

The northern part of the site is designated as a Mineral Safeguarding Area (MSA) under the Northamptonshire Minerals and Waste Local Plan (MWLP) (adopted May 2017). The safeguarding area relates to Glaciofluvial sand known locally as Milton Sand.

The northeastern corner of the site is within the 300m buffer of an allocated sand and gravel extraction site (M1: Milton Malsor), which relates to a 1.2 million tonne reserve at Maple Farm. However, Hydrock does not believe the proposed SRFI development presents a risk to the future viability of M1: Milton Malsor, as the allocated sand and gravel extraction site (M1: Milton Malsor) is located to northeast of the village of Milton Malsor, to the east of the Northampton Loop Rail line, and to the north of Collintree Road. As such, the allocated sand and gravel extraction site is separated from the proposed SRFI development site by existing residential development and major pre-existing infrastructure in the form of roads and the Northampton Loop Rail line. Therefore, there is no viable physical link between the proposed SRFI development and M1: Milton Malsor and as such, both operations are able to co-exist without impact on the other.

2.7 BGS Borehole Archive

The following borehole logs are available from the British Geological Society (BGS) archive (Table 2.6).

Table 2.6: On-site Historical Boreholes

Borehole Reference	Location	Description (and Hydrock Stratigraphic Interpretation)
Area A		
SP75NW407	Adjacent to the central eastern site boundary	• Made Ground to 4.00m bgl; over • Topsoil to 4.30m bgl; over • Firm to stiff fossiliferous clay with selenite crystals (Whitby Mudstone Formation).
SP75SW49	Southern boundary	• Topsoil to 0.10m bgl; over • Firm to stiff clay with lithorelicts becoming a mudstone to >20.00m bgl (Whitby Mudstone Formation).

Borehole Reference	Location	Description (and Hydrock Stratigraphic Interpretation)
Area B		
SP75SW88	Earthworks associated with canal/A43	• Topsoil to a depth of 0.10m bgl; over • Made Ground to depths >4.00m bgl.
Area C		
SP75NE546	Northwest site boundary	• Existing well to 6.00m bgl; over • Brown sand and seams of ironstone (Glaciofluvial Deposits) to 7.85m bgl; over • Interbedded blue clay and rock (Whitby Mudstone Formation).
SP75NW179	Central eastern area of the site	• Brown fine sand (locally pebbly) (Glaciofluvial Deposits) to 8.20m bgl; over • Grey silty clay (Whitby Mudstone Formation).

Although the presence of an existing well in SP75NE546 (Area C) infers groundwater within approximately 6m of the ground surface, groundwater is not recorded on any of the other logs.

The following exploratory holes are available from investigations for construction of the A43 between Area A and Area B (Table 2.7). All locations were investigated in 1987 prior to the construction of the carriageway.

Table 2.7: Relevant Off-site Historical Boreholes

Borehole Reference	Location (on A43)	Description (and Hydrock Stratigraphic Interpretation)
SP75NW434	Northwest of former filling station	• Topsoil to a depth of 0.20m bgl; over • Firm to stiff clay with lithorelicts to >4.00m bgl (Whitby Mudstone Formation).
SP75NW433	West of filling station	• Topsoil to a depth of 0.20m bgl; over • Firm to stiff clay with lithorelicts to >3.50m bgl (Whitby Mudstone Formation).
SP75SW91	Southwest of filling station	• Made Ground to 1.00m bgl; over • Firm orange brown sandy clay >4.00m bgl (Whitby Mudstone Formation).
SP75SW90	East of Gayton Marina	• Made Ground >3.50m bgl (earthworks – few man-made materials).
SP75SW89	Southeast of marina	• Made Ground >3.50m bgl (earthworks– few man-made materials).
SP75SW87	South of Gayton Marina	• Topsoil to 0.20m bgl; over • Firm to stiff clay with lithorelicts to >3.50m bgl (Whitby Mudstone Formation).
SP75SW48		• Topsoil to 0.20m bgl; over • Firm to stiff clay with lithorelicts becoming a mudstone to >30.00m bgl (Whitby Mudstone Formation).

Although the coverage of these boreholes across the site area is limited, they are in broad agreement with the findings of the desk study.

2.8 Ground Stability

Fine-grained soils may be susceptible to compression, excessive settlements and collapse of excavations (if of low strength).

Coarse-grained soils may be susceptible to the creation of running sand (particularly in the presence of groundwater) and collapse of excavations.

The Peter Brett Associates (PBA) database search indicates there are no natural cavity or mining cavity locations within 2km of the site. The nearest recorded natural cavity is located 2.6km north of the site and the nearest recorded mining cavity is located 5km to the north of the site. Peter Brett Associates LLP states *'…we would draw your attention to the fact that the absence of existing records for the site should not be considered as conclusive*.' However, Hydrock consider the risk of natural cavities on the site to be low and if present, likely to affect only the Marlstone Rock.

2.9 Hydrogeology

The aquifer designations given in Table 2.8 are based on the Environment Agency interactive aquifer designation map. Additional information on the hydraulic characteristics of the geological units has been abstracted from Allen *et al* (1997) and Jones *et al* (2000).

Table 2.8: Hydraulic Characteristics of Strata

Stratum	Aquifer Designation	Hydraulic Characteristics
Alluvium	Secondary Undifferentiated	May be a source of groundwater but vertical and lateral variability means these aquifers are locally changeable.
Glaciofluvial Deposits	Secondary A Aquifer	May be a localised source of groundwater.
Glacial Till	Unproductive Strata	Maybe a source of localised groundwater but low permeability and porosity make these poor aquifers. Likely to behave as an aquiclude.
Wellingborough Member	Secondary A Aquifer	Likely to be significantly permeable and may be a localised source of groundwater.
Rutland Formation (undifferentiated)	Secondary B Aquifer	Overall likely to be relatively impermeable, however some of the subordinate units (Wellingborough Limestone) are likely to be permeable and may be confined between beds of low permeability. Overall permeability is likely to be greater in the horizontal direction that the vertical.
Stamford Member	Secondary B Aquifer	May include beds of sand and sandstone that are permeable, however limited thickness and variable composition are likely to mean the Stamford Member is of limited potential as an aquifer.
Northampton Sand Formation	Secondary A Aquifer	May be a localised source of groundwater.
Whitby Mudstone Formation	Unproductive Strata	Maybe a source of localised groundwater but low permeability and porosity make these poor aquifers.

Stratum	Aquifer Designation	Hydraulic Characteristics
		Likely to behave as an aquiclude.
Marlstone Rock Formation	Secondary A Aquifer	May be a localised source of groundwater.
Dyrham Formation	Secondary Undifferentiated	May be a source of groundwater but vertical and lateral variability means these aquifers are locally changeable.

The site is not within a Source Protection Zone (SPZ) and there are no SPZs in the vicinity of the site. There are no recorded groundwater abstraction licenses within 2km of the site.

2.10 Hydrology and Flooding

The surface waters present at the site are summarised in Table 2.9 and are marked on the 'Site Features Plan' in Appendix A.

Table 2.9: Surface Water Features

Feature	Location Relative to Site
Area A	
Grand Union Canal	Adjacent to the western boundary.
Area B	
Milton Malsor Brook	Central area of Area B. Flows from the south to the north. Is joined by a tributary that rises in the southwest of Area B. Also joined by a drain that flows from adjacent to the railway line in Area C.
Area C	
Milton Malsor Brook Tributary	Rises adjacent to the railway line in Area C and flows north to join the Milton Malsor Brook in Area B.
Milton Malsor Brook Eastern Arm	Rises in the centre of Area C and flows north to join the Milton Malsor Brook north of the site.
Drain	Forms part of the southeast boundary and flows to the east.

There are serval small ponds located adjacent to field boundaries within Area C, west of Barn Lane.

The Grand Union Canal crosses the southwestern part of the site and runs adjacent to the site boundary along the western part of the site. Water has been observed issuing from the toe of the canal embankment in the field in the southwest corner of Area B. The water is flowing overland, and it appeared that an attempt had been made to direct it to a nearby field drain via temporary drainage. Recent engineering works were in evidence at the canal adjacent to the leak. At this stage, no discussion has been undertaken with the Canal and Rivers Trust in relation to the leak or any proposed engineering works.

There are no recorded surface water abstraction licenses within 1km of the site.

The environmental data report indicates a risk of groundwater flooding. In addition there are areas designated as Flood Zone 2 and Flood Zone 3 associated with a narrow channel around the Milton Malsor Brook. As part of the proposed development is in Flood Zone 3 (with a high/significant probability of flooding) consultation with the Environment Agency is required with a Flood Risk Assessment (FRA) plus Sequential Test Evidence, and where required, confirmation that the Exception Test has been applied. This has been undertaken, and reported separately (Hydrock report reference R/151171/003). No further consideration of flood risk is undertaken in this report.

The surface water discharge consents in the vicinity, considered likely to have an impact on the site are listed in Table 2.10.

Table 2.10: Surface Water Discharge Consents

Name	Location	Details	Receiving Water
Former Garage	At trading estate adjacent to the southeast of Area B.	Surface water discharged into the ground. The consent is no longer active.	n/a
Manhole No.6201	On site (unknown)	Storm water overflow. The consent is no longer active.	Milton Malsor Brook Eastern Arm
Gayton Road	Northern boundary of Area B	Sewage discharge (as observed during the site walkover).	Tributary of Milton Malsor Brook
Roseacre Nursery	Nursery west of Barn Lane	Surface water discharged into the ground. The consent is no longer active.	n/a

2.11 Waste Management and Hazardous Substances

The waste management sites recorded within 250m of the site are summarised in Table 2.11.

Table 2.11: Waste Management Sites

Site Name	Location	Details
Gayton Road, Milton Malsor	On site. Northwest corner of Area B.	Operated by Galliford Roadstone. No details on the waste placed here beyond the designation 'Inert'. Occupies the former gravel pit identified on the historical maps.
Milton Malsor Landfill	Adjacent to Gayton Road north of Area B (10m)	Licensed to receive non-biodegradable wastes. Now closed.
Proposed recycling centre	Old Sewage Works	Planning application for a recycling centre.
Milton Sand Pit	Adjacent to Gayton Road north of Area B (90m)	Licensed to receive inert liquid sludge.
Rothersthorpe	125m north / northwest of Area B.	Licensed to receive inert waste. No further details available.
Gayton Landfill Site	335m northwest of the Area B.	This site is classified as being Contaminated Land under Part IIA of the Environmental Protection Act 1990.

The dangerous substance storage sites in the vicinity, which may have had an impact on the site are summarised in Table 2.12.

Table 2.12: Dangerous Substance Storage

Site Name	Location	Details
Olleco Renewable Energy	Trading estate adjacent to the southeast boundary of Area B.	Substances with extreme pH were licensed to be stored at the site. The license is no longer active.

The environmental enforcements in the vicinity and the activities to which they relate that may have had an impact on the site are summarised in Table 2.13.

Table 2.13: Environmental Enforcements

Site Name	Location	Details
Blisworth Service Station	Filling Station in Area B.	Petrol vapour recovery process. The enforcement is no longer active.
Anglos Beef Processors	Trading estate adjacent to the southeast boundary of Area B.	Food rendering of animals and plants. The enforcement is no longer active.

There are no records of animal burial on the site. However, animal burial on farmland can often be unrecorded and the possibility of such burials can therefore not be discounted.

2.12 Pollution Incidents

At the time of obtaining the Environmental Data Report (April 2015), a single incident of unspecified hydraulic oil pollution was recorded in an area adjacent to the railway line on the southern boundary of Area C, in 2003. This is considered likely to have had only a minor impact on the soils at the site.

On 6th June 2015, a pollution incident occurred at Gayton Marina immediately west of Area A. The incident was caused by the attempted theft of aviation fuel from the BPA fuel pipeline at the point where it crosses the canal, exposing the pipeline. The action resulted in the spilling of a significant quantity of kerosene into the canal. The incident is reported as 'significant' in terms of impact to water, but is recorded as having 'no impact' on land or air quality. However, there is a small risk that contaminated water ran across the surface of the field in the southwest of Area B due to the canal leak and may have had a localised, minor impact.

2.13 Contemporary Trades

Contemporary trade directory entries within 100m of the site boundary, which may have had an impact on the site, are summarised in Table 2.14.

Table 2.14: Contemporary Trade Directory Entries

Trade	Location	Details
Depot	Northwest of Area B.	Transport yard
Sewage Treatment	Adjacent to the southeast boundary of Area B.	Filter Beds
Grand Union Boat Company	West of Area A.	Marine equipment storage and repair
Depot	10m south of Area B boundary.	Transport yard
Tank	60m west of Area A.	Not known
Abattoir	Trading estate adjacent to the southeast boundary of Area B.	Abattoir (no longer operating)
Echo Foods	Trading estate adjacent to the southeast boundary of Area B.	Fish, meat and poultry products.
Olleco Limited	Trading estate adjacent to the southeast boundary of Area B.	Recycling of cooking oils and food waste.

2.14 Historical Trades

Blisworth Service Station is a former filling station, now disused. Enquiries made to the local petroleum officer indicate the following tanks are present at the site:

- 45,361 litres petroleum;
- 27,216 litres petroleum;
- 18,144 litres petroleum;
- 27,216 litres diesel;
- 18,144 litres diesel; and
- 45,361 litres diesel.

Plans of the tank locations are in Appendix D. The tanks are verified as being filled to capacity with RG22 foam.

2.15 Underground Services

A British Pipeline Association (BPA) high-pressure aviation fuel main is located in the south of Area A and Area B.

A foul sewer is present on site in Area B, approximately following the course of the Milton Malsor Brook.

Numerous large, underground field drains were identified draining into ditches around the site, during the site walkover.

2.16 Archaeology

Reference to the archaeological desk based assessment indicates there are no scheduled monuments and no statutory or non-statutory designations for the site. As such, Hydrock understand there are no archaeological constraints on the site.

2.17 Natural Soil Chemistry

Information contained within the environmental data report (Appendix D) gives indicative natural concentration values (estimated) for the natural soils at the site for a selection of Contaminants of Potential Concern (CoPC). These have been reproduced in Table 2.15 below.

Table 2.15: Natural Soil Chemistry

CoPC	Arsenic	Cadmium	Chromium	Lead	Nickel
Concentration (mg/kg)	15 - 35	<1.8	60 - 120	<100	15 - 45

These concentrations are considered unlikely to present a risk to human health.

2.18 Radon

A British Geological Society (BGS) radon risk report (GR210997/1) has been obtained for the site. This report indicates that the site is in a Radon Affected Area where recorded radon concentrations in 1-3% of homes are above the action level and basic radon protection measures are required for new buildings at this location in line with current guidance. The source of radon at this site is considered likely to be the Whitby Mudstone Formation.

Consideration should be given to fitting basic protection measures on the 'as low as reasonably practicable' principle in view of advice given to householders and the legal responsibilities of rental landlords and employers with commercial properties (see Appendix E for further details).

2.19 Anecdotal Evidence

Conversations with local farmers indicate that site levels in a field in the southeast of of Area C may have been raised with material understood to be derived from arisings from the nearby Roade Cutting on the West Coast Main Line. Intrusive investigation would be required to prove this, and the type of materials that have been placed.

Anecdotal evidence suggests a former sand pit in the northeast corner of Area C may have been infilled with arisings from the construction of the M1 motorway.

3.0 PRELIMINARY CONCEPTUAL SITE MODEL

3.1 Physical Setting

The preliminary ground model of the site is the basis of the understanding of the ground conditions that will inform the geo-environmental exposure model and the geotechnical hazard assessment.

Table 3.1: Desk Study Summary

Item	Details
Site area	Approximately 260 ha.
Site location and grid reference	The site is located immediately south of the village of Milton Malsor and approximately 450m north of the village of Blisworth in Northamptonshire. The National Grid Reference for the approximate centre of the site is 473077, 254830.
Present land use	The site is occupied predominantly by fields with development essentially limited to; • a disused service station in the western area of the site, beside the A43; • Farms in the central east of the site; • An off site transport yard to the northwest of the application site; and • an off site trading estate including a food recycling facility, garage and factory.
Site History	The site has remained mainly as farmland since the earliest map edition of the late 19th Century apart from the development noted above. In addition, two former sand and gravel pits are present in the northwest of Area B, which are assumed to have been subsequently infilled. The surrounding area has remained as farmland since the earliest map edition with the exception of a number of sand and gravel pits to the north and northwest (one of which is now a trading estate) and brick pits to the west and the trading estate to the central south.
Geology and Aquifer Designations	The site is underlain by the following strata (with aquifer designations): • Alluvium (Secondary Undifferentiated Aquifer). • Oadby Member (Unproductive Strata). • Glaciofluvial Deposits (Secondary A Aquifer). • Whitby Formation (Unproductive Strata). • Marlstone Rock Formation (Secondary A Aquifer). • Dyrham Formation (Secondary Undifferentiated Aquifer).
Hydrology	The site is principally drained via Milton Malsor Brook and its tributaries, including the Eastern Arm, flowing from the south to the north with additional field drains. The Grand Union Canal crosses the southwestern part of the site and runs adjacent to the site boundary along the western part of the site. There is an ongoing leak from the canal with water issuing from the canal embankment and running across a field in the southwest. Recent engineering work has been undertaken at this section of the canal.
Mineral Extraction and Landfill	There has been historical landfilling in former sand quarries in the northwest and northeast of the site. Anecdotal information indicates a further sand pit in the northeast corner of Area C infilled with arisings from the construction of the M1 motorway. Former pits to the northwest of the site may have been landfilled. An open pit was also noted during the site walkover in the northwest corner of Area C.

Item	Details
Mineral Extraction and Landfill (Cont.)	The northern part of the site is designated as a Mineral Safeguarding Area (MSA) under the Northamptonshire Minerals and Waste Local Plan (MWLP) (adopted May 2017) and the northeastern corner of the site is within the 300m buffer of an allocated sand and gravel extraction site (M1: Milton Malsor), which relates to a 1.2 million tonne reserve at Maple Farm. However, Hydrock does not believe the proposed SRFI development presents a risk to the future viability of M1: Milton Malsor, because of the presence of existing infrastructure between the two.
Contamination	There is a former filling station and transport yard in the east of the site. Some potentially contaminative practises have been undertaken in the vicinity of the site, which may affect it. There has been a significant water pollution incident following leakage of aviation fuel into the Grand Union Canal. There is a slight possibility that contaminated water in turn leaked from the canal and locally impacted land in the southwest of the site.
Radon	Basic radon protection measures are required.

The main details of the site and potential hazards are summarised on the Site Features Plan (Appendix A).

3.2 Geo-environmental Exposure Model

The preliminary exposure model is used for geo-environmental hazard identification and establishing potential contaminant linkages based on the contaminant (source)-pathway-receptor approach.

3.2.1 Potential Contaminants

For the purpose of this assessment the potential contaminants have been separated according to whether they are likely to have originated from on-site or off-site sources.

Potential On-Site Sources of Contamination

The main potential on-site geo-environmental sources and associated contaminants identified by the walkover and desk study are:

- Landfills: including asbestos, polyaromatic hydrocarbons (PAH) petroleum hydrocarbons, polychlorinated biphenols, dioxins and furans, metals and metalloids.
- Landfill and alluvium: permanent ground gases carbon dioxide and methane from organic materials and biodegradation.
- Farms: hydrocarbon fuels, lubricant and chlorinated solvents associated with existing farms, workshops and activities, pesticides and asbestos.
- Farmland: the potential for Made Ground due to uncontrolled filling and poor historical farming practices possibly including metals, metalloids, asbestos, PAH and petroleum hydrocarbons.
- Fly-tipped materials, metals, polyaromatic hydrocarbons, asbestos.
- Farmland: the use of pesticides across agricultural fields.

- Filling station: chromium, copper, nickel, asbestos, phenols, petroleum hydrocarbons, polyaromatic hydrocarbons, polychlorinated biphenols and organolead compounds.
- Transport yard: heavy metals, polyaromatic hydrocarbons and organolead compounds.

Potential Off-Site Sources of Contamination

The main off-site geo-environmental sources and associated contaminants identified by the walkover and desk study are:

- Sewage treatment works: leaching and migration of metals, polyaromatic hydrocarbons, polychlorinated biphenols and extreme pH of the groundwater.
- Landfills: leaching and migration of polyaromatic hydrocarbons (PAH), petroleum hydrocarbons, polychlorinated biphenols, dioxins and furans, metals and metalloids.
- Landfill and alluvium: ground gases (permanent gases carbon dioxide and methane) from organic materials and biodegradation.
- Railway land: heavy metals, defoliants, polyaromatic hydrocarbons and polychlorinated biphenols.
- Canal: kerosene contamination following pollution incident.

3.2.2 Potential Receptors

The main potential receptors identified:

- Humans: (end users, neighbours).
- Development end use: (buildings, utilities and landscaping).
- Groundwater: there are aquifers present beneath the site.
- Surface water: the Milton Malsor Brook (main) and Eastern Arm, and surface drainage ditch are present across the site.
- Ecology: there will be habitats within the surface waters and drainage ditches present on the site.

It should be noted that health and safety risks to site contractors and maintenance workers have not been assessed during these works and will need to be considered separately.

3.2.3 Potential Pathways

The main potential pathways identified are:

- Humans: ingestion, dermal contact, inhalation of dust and indoor air.
- Buildings: direct contact with substances deleterious to building materials, such as elevated sulphates.
- Buildings: ground gas ingress via permeable soils and/or construction gaps.
- Plant life: root uptake.
- Underlying groundwater: migration of contaminant via leachate dispersion through the unsaturated zone of the aquifers.

- Underlying groundwater: migration of contaminants into the underlying aquifers.
- Surface water: overland flow.
- Surface water: drainage discharge.
- Surface water: base flow from groundwater.

3.2.4 Summary of Potential Contaminant Linkages

Table 3.1 lists the plausible contaminant linkages that have been identified. These are considered as potentially unacceptable risks in line with guidelines published in CLR 11 and additional risk assessment is required.

Linkages has been assessed in general accordance with guidance in CIRIA Report C552 (Rudland *et al* 2001) but with the addition of a 'no linkage' category. More details are given in Appendix E including descriptions of typical examples of probability and consequences.

It should be noted that whilst the risk assessment process undertaken in this report may identify potential risks to site demolition and redevelopment workers, consideration of occupational health and safety issues is beyond the scope of this report and need to be considered separately in the Construction Phase Health and Safety Plan.

Table 3.1: Exposure Model – Preliminary Risk Assessment of Source-Pathway-Receptor Contaminant Linkages

Sources	Possible Pathways	Receptors	Probability	Consequence	Risk Level	Comments
On site						
Landfill – asbestos, PAH, petroleum hydrocarbons, PCB, metals	Ingestion Dermal contact Inhalation	Neighbours End users	Likely	Medium	Moderate	As there are landfills on site the likelihood of landfill materials being present beneath any capping is high. These materials are likely to be in various states of decay and may be generating leachate and ground gas.
Landfill – ground gas	Migration Inhalation		Likely	Severe	High	
Landfill - leachate	Leachate	Surface water Groundwater	Likely	Medium	Moderate	It is likely the landfills will be generating leachate. However, it is not known if the landfills have any leachate recovery system.
Farm yard – above ground fuel storage	Ingestion Dermal contact Inhalation	End users	Low	Mild	Low	The storage tanks observed appeared not to have leaked. Leaking storage tanks are likely to have a localised impact only.
	Migration	Groundwater	Low	Medium	Moderate	Lodge Farm is on Oadby Till and Whitby Mudstone Formation, which is likely to prevent any extensive migration of any contaminants. Run-off may lead to surface water impaction.
		Surface water Ecology	Low	Medium	Moderate	
Farm yard – storage of chemicals, accidental spillages etc	Ingestion Dermal contact Inhalation	End users Ecology	Low	Mild	Low	Most chemicals appear to be stored in pellets but may become mobile when wet.
	Migration	Surface water Groundwater	Low	Mild	Low	Lodge Farm is on Oadby Till and Whitby Mudstone Formation, which is likely to prevent any extensive migration of any contaminants. Run-off may lead to surface water impaction.

Sources	Possible Pathways	Receptors	Probability	Consequence	Risk Level	Comments
Farmland – Made Ground from uncontrolled burials, poor practice, fly-tipping	Ingestion Dermal contact Inhalation	End users	Low	Medium	Moderate	Risks are likely to be limited in lateral and vertical extent.
		Livestock	Low	Mild	Low	
	Migration	Groundwater	Low	Medium	Moderate	
Farmland – use of pesticides, muck spreading and manure storage.	Ingestion Dermal contact Inhalation	End users	Low	Mild	Low	As well as a risk to human health, there is a risk to Controlled Waters from nitrates.
	Migration	Surface water Groundwater	Low	Mild	Low	
Filling station – hydrocarbon leakages and spillages.	Ingestion Dermal contact Inhalation	End users Ecology	Likely to low	Medium	Moderate	Any leakages and spillages from the filling station may have occurred over a long period. The filling station is over Whitby Mudstone Formation, which may limit the lateral and vertical extent of any contaminants.
	Migration	Surface water Groundwater	Likely to low	Medium	Moderate	
Filling station – vapours.	Inhalation	Neighbours End users	Low	Medium	Low	
Transport yard – metals, acetone, PAH, organolead	Ingestion Dermal contact Inhalation	End users Ecology	Likely to low	Medium	Moderate	Leakages and spillages are likely to have occurred over the operational life of the transport yard.
	Migration	Surface water Groundwater	Low	Medium	Moderate	There is a low likelihood the transport yard may impact groundwater, but this would need to be confirmed by groundwater sampling.

Sources	Possible Pathways	Receptors	Probability	Consequence	Risk Level	Comments
Ground gas from natural soils (Alluvium)	Migration Inhalation	Neighbours End users Buildings	Low	Severe	Moderate	The potential for ground gas generation in the alluvium is likely to be limited. Alluvium is limited in lateral extent across the site.
Off site						
Sewage treatment works – metals, pH, hydrocarbons	Migration	Surface water Groundwater	Low	Medium	Moderate	The sewage treatment works is only small and leakages are likely to be limited, but this would need to be confirmed by groundwater sampling.
Abattoir / food waste recycling – metals, phenols, PAH.	Migration	Surface water Groundwater	Low	Medium	Moderate	There is a low likelihood the abattoir may impact groundwater flowing beneath the site, but this would need to be confirmed by groundwater sampling.
Railway Land – metals, defoliants, PAH, PCB	Migration	End users Surface water Groundwater	Low	Medium	Moderate	It is unlikely that chemicals used on the railway will impact the site.
Off-site landfill	Migration	Surface Water Groundwater	Low	Medium	Low	Gayton Landfill is designated as 'Contaminated Land' under Part IIA. The landfill is located in a separate valley to the site drained by a northward flowing stream. Therefore, any leachate impacted surface water or groundwater will flow to the north as opposed to eastwards, toward the site.
Off site landfill – ground gas	Migration Inhalation	End users	Likely	Severe	High	As there are landfills off site the likelihood of landfill materials being present beneath any capping is high. These materials are likely to be in various states of decay and may be generating leachate and/or ground gas.
Ground gas from natural soils (Alluvium)	Migration Inhalation	End users	Low	Severe	Moderate	The potential for ground gas generation in the alluvium is likely to be limited. Alluvium is limited in lateral extent across the site.

Sources	Possible Pathways	Receptors	Probability	Consequence	Risk Level	Comments
Naturally occurring radon	Migration Inhalation	End users	Likely	Medium	Moderate	Basic radon protection measures are required.

3.3 Geotechnical Hazard Identification

Potential geotechnical hazards based on the expected ground conditions are listed below:

- The presence of landfills in the north of the site and the potential for highly variable and poorly compacted landfill soils.
- Backfilled pit in the northeast of the site (not necessary landfill) and the potential for variable and poorly compacted soils..
- Made Ground leading to excessive settlement of foundations and infrastructure.
- Seasonal shrinkage and swelling of clay leading to settlement and heave of foundations when located within the influence of trees and vegetation.
- The presence of highly variable soils (silt, clay, sand, clay, gravel) associated with the alluvial channels along the streams.
- Low strength and compressible ground causing excessive settlement of foundations and infrastructure elements.
- Hard strata where the Marlstone Rock Formation outcrops at the surface.
- Differential settlements between areas of loose/soft ground and dense/hard/stiff ground.
- Running sands, loose landfill and/or shallow groundwater, leading to difficulty with excavation.
- Attack of buried concrete by aggressive ground due to potentially sulphate bearing soils.
- Sulphates affecting soil modification by lime addition and potential delays to earthworks programme if the ground conditions are poorly understood.
- Low permeability soils leading to a lack of infiltration for SUDS drainage.
- Made Ground and the impact on SUDS drainage.
- Potential for relict slip surfaces in the Whitby Mudstone Formation and Dyrham Formation (low risk). However, if present, they will need to be taken into account in detailed design.

4.0 DESK STUDY CONCLUSIONS

Table 3.1 is a summary of the geo-environmental risks identified and the overall risk associated with the site has been designated using qualitative judgement according to the risk categories given in Table 4.1.

Based on current and historical land uses, the overall risk from soil contamination at the site is considered to be low. However, where there are local sources of contamination (landfill, filling station etc) the risks are considered moderate to high. However, the site-pathway-receptor linkages developed as part of the Conceptual Site Model will need to be confirmed by appropriate intrusive investigation, testing and assessment of the results of the investigation.

It is considered that it is unlikely that the site would be classified as 'Contaminated Land' under Part 2A of the EPA 1990.

Table 4.1: Assessed Overall Risk Categories for the Site from Land Contamination

Risk Category	Definition
High Risk	A contaminant linkage is identifiable at the site under current and future use conditions. Although likely, there is no obvious actual evidence of significant harm or significant possibility and significant harm under current conditions. Extent of risk is therefore subject to confirmation by investigation and risk assessment and most likely to be deemed significant. Realisation of the risk is likely to present a substantial liability to the site owner or other Responsible Person. Remediation required for redevelopment and may also be required under Part 2A for existing receptors.
Moderate Risk	A contaminant linkage is identifiable at the site under current and future use conditions. However, it is not likely to be a significant linkage under current conditions. It is either relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely, that the harm would be relatively mild. Actual extent of risk subject to confirmation by additional investigation and risk assessment and most likely to lie between no possibility of harm (under current conditions) and significant possibility of significant harm (under conditions created by new use). Remediation may be required for redevelopment.
Low Risk	Potential pathways and receptors exist but history of contaminative use or site conditions indicates that contamination is likely to be of limited extent and below the level of possibility of harm. It is unlikely that the site owner or other Responsible Person would face substantial liabilities from such a risk. Precautionary investigations and risk assessment advisable on change of use. Any subsequent remedial works are likely to be relatively limited.

There are a number of geotechnical risks, which require further assessment and design. However, in Hydrocks opinion, with appropriate investigation and design, the risks are manageable using industry standard solutions.

Due to the proposed SRFI site being separated from the M1: Milton Malsor allocated mineral site by existing residential development and major pre-existing infrastructure in the form of roads and the Northampton Loop Rail line, Hydrock does not believe the proposed SRFI site would result in sterilisation of the proven mineral resources at M1: Milton Malsor.

5.0 UNRESOLVED ISSUES, UNCERTAINTIES AND LIMITATIONS

This report details the findings of work carried out between March 2015 and February 2018 and has been prepared by Hydrock on the basis of available information obtained during the study period. Although every reasonable effort has been made to gather all relevant information, all potential environmental constraints or liabilities associated with the site may not have been revealed.

The report has been prepared for the exclusive benefit of Ashfield Land and those parties designated by them for the purpose of providing geotechnical and geo-environmental recommendations for the site. The report contents should only be used in that context. Furthermore, new information, changed practices or new legislation may necessitate revised interpretation of the report after the date of its submission.

Information provided by third parties has been used in good faith and is taken at face value; however, Hydrock cannot guarantee its accuracy or completeness. It is assumed that previous reports provided have been assigned to the Client and can be relied upon. Should this not be the case Hydrock should be informed immediately as additional work may be required.

The work has been carried out in general accordance with recognised best practice. The various methodologies used are explained in Appendix E. Unless otherwise stated, no assessment has been made for the presence of radioactive substances or unexploded ordnance. Where the phrase 'suitable for use' is used in this report, it is in keeping with the terminology used in planning control and does not imply any specific warranty or guarantee offered by Hydrock.

The preliminary risk assessment process may identify potential risks to site demolition and redevelopment workers. However, consideration of occupational health and safety issues is beyond the scope of this report.

Please note that notwithstanding any site observations concerning the presence or otherwise of archaeological sites, asbestos-containing materials or invasive weeds such as Japanese knotweed, this report does not constitute a formal survey of these potential hazards.

Any site boundary line depicted on plans does not imply legal ownership of land.

6.0 RECOMMENDATIONS FOR FURTHER WORK

In order to confirm the actual risks to receptors and confirm the ground conditions with respect to potential geotechnical and geo-environmental risks, an appropriate intrusive investigation will need to be undertaken. The initial works will comprise a site wide, wide spaced ground investigation, which will be designed to:

- determine, on a site-wide basis, the vertical and lateral distribution of natural lithology and Made Ground depth, composition and distribution;
- provide initial geotechnical soil parameters for outline foundation zonation and general recommendations with regards to excavations, pavements, concrete design, etc.;
- provide a global assessment with regards to earthworks, reuse of soils and the potential for the use of lime or cement stabilisation or modification to improve the soils;
- provide information in the areas of main existing and proposed infrastructure;
- provide recommendations for soakaway drainage;
- allow ground gas and groundwater monitoring and assessment; and
- allow a site-wide overview of the soil chemistry and identify any areas of concern that will need to be targeted as part of future, plot-specific, investigations for remediation of contamination.

Future phases of investigation will be required for the various phases of infrastructure and as plot specific assessments to provide data for funders to assess risks. Based on the current data, this site investigation is proposed to comprise:

- the excavation of trial pits to allow collection of samples for geotechnical and chemical analysis; to assess trench stability, over-break potential and 'digability'; allow determination of the undrained shear strength, and allow soil infiltration rate testing to be undertaken;
- dynamic ('windowless sampling') sampling to allow collection of samples for geotechnical and chemical analysis of shallow soils, allow *in situ* testing (SPTs) to be undertaken to assess the soils for foundation design and allow the installation of gas and groundwater monitoring wells;
- cable percussive boreholes to allow collection of samples for geotechnical and chemical analysis of deeper soils, allow *in situ* testing (SPTs) to be undertaken to assess the soils for possible pile design, and allow the installation of gas and groundwater monitoring wells;
- the undertaking of soil infiltration rate testing;
- installation of gas and groundwater monitoring wells to allow gas concentrations and groundwater levels to be monitored;
- gas concentration and groundwater level monitoring;
- geotechnical laboratory testing of soils and rock; and
- contamination laboratory analysis of soil and groundwater.

7.0 REFERENCES

ALLEN, D. L., BREWERTON, L. J., COLEBY, L. M., GIBBS, B. R., LEWIS, M. A., MACDONALD, A. M., WAGSTAFF, S. J. and WILLIAMS, A.T. 1997. The physical properties of major aquifers in England and Wales. *British Geological Survey Technical Report WD/97/34.* 312pp. Environment Agency R&D Publication 8.

BRITISH STANDARDS INSTITUTION. 1999. Code of practice for Site Investigations. *BS 5930 Incorporating Amendment No.2:2010.* BSI, London.

BRITISH STANDARDS INSTITUTION. 2011. Code of Practice for Investigation of Potentially Contaminated sites. *BS 10175 Incorporating Amendment No.1:2013.* BSI, London.

DCLG. March 2012. National Planning Policy Framework. DCLG, London.

DCLG. March 2012. Technical Guidance top the National Planning Policy Framework. DCLG, London.

ENVIRONMENT AGENCY. 2004. Model procedures for the management of land contamination. *Contaminated Land Report 11.* The Environment Agency.

JONES, H. K., MORRIS, B. L., CHENEY, C. S., BREWERTON, L. J., MERRIN, P. D., LEWIS, M. A., MACDONALD, A. M., COLEBY, L. M., TALBOT, J. C., MCKENZIE, A. A., BIRD, M. J., CUNNINGHAM, J. and ROBINSON, V. K. 2000. The physical properties of minor aquifers in England and Wales. *British Geological Survey Technical Report WD/00/04.* 234pp. Environment Agency R&D Publication 68.

MILES, J. C. H., APPLETON, J. D., REES, D. M., GREEN, B. M. R., ADLAM. K. A. M. and MYRES. A. H. 2007. Indicative Atlas of Radon in England and Wales. Health Protection Agency and British Geological Survey. Report HPA-RPD-033.

RAWLINS, B. G., McGRATH, S. P., SCHEIB, A. J., CAVE, N., LISTER, T. R., INGHAM, M., GOWING, C. and CARTER, S. 2012 .*The advanced geochemical atlas of England and Wales.* British Geological Survey, Keyworth.

RUDLAND, D. J., LANCEFIELD, R. M. and MAYELL, P. N. 2001. Contaminated land risk assessment. A guide to good practice. *CIRIA Report C552*. CIRIA, London. 158 pp.

SCIVYER, C. 2007. Radon: Guidance on protective measures for new buildings, extensions, conversions and refurbishment (2007 edition). Building Research Establishment Report BR 211. BRE, Garston.

STONE, K., MURRAY, A., COOKE, S., FORAN, J. and GOODERHAM, L. 2009. Unexploded ordnance (UXO), a guide to the construction industry. *CIRIA Report C681*. CIRIA, London. 141 pp.

WILSON, S., OLIVER, S., MALLETT, H., HUTCHINGS, H. and CARD, G. 2007. Assessing risks posed by hazardous ground gases to buildings. *CIRIA Report C665*. CIRIA, London. 182pp.

Appendices

Appendix A **Drawings**

Appendix B **Site Walkover Photographs**

Appendix C **Historical Ordnance Survey Maps**

Appendix D **Desk Study Research Information**

Appendix E **Hydrock Methodology**

Appendix A

Drawings

Notes:

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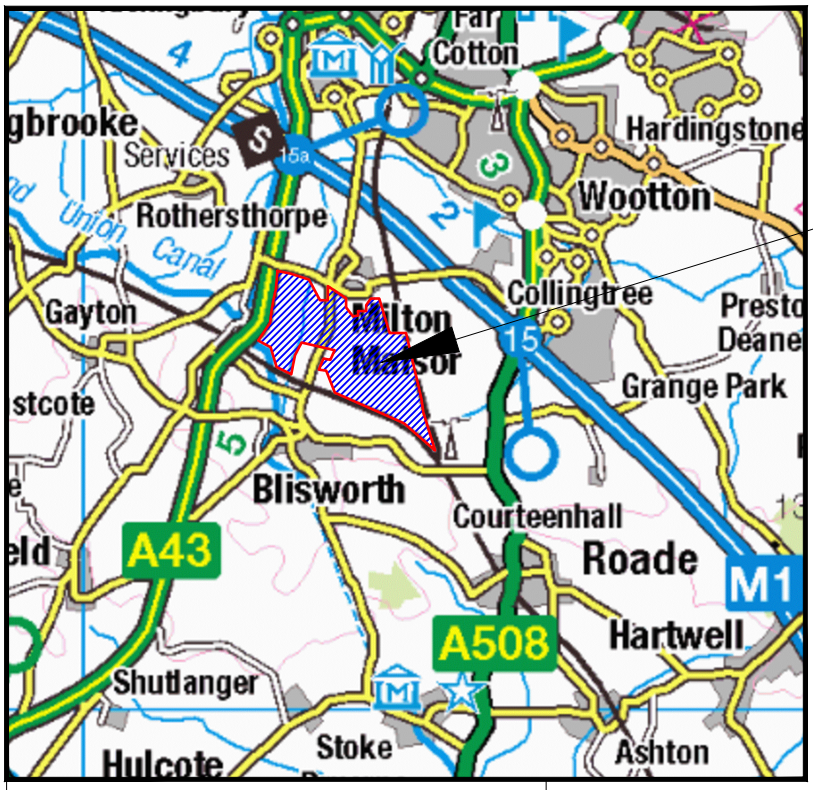

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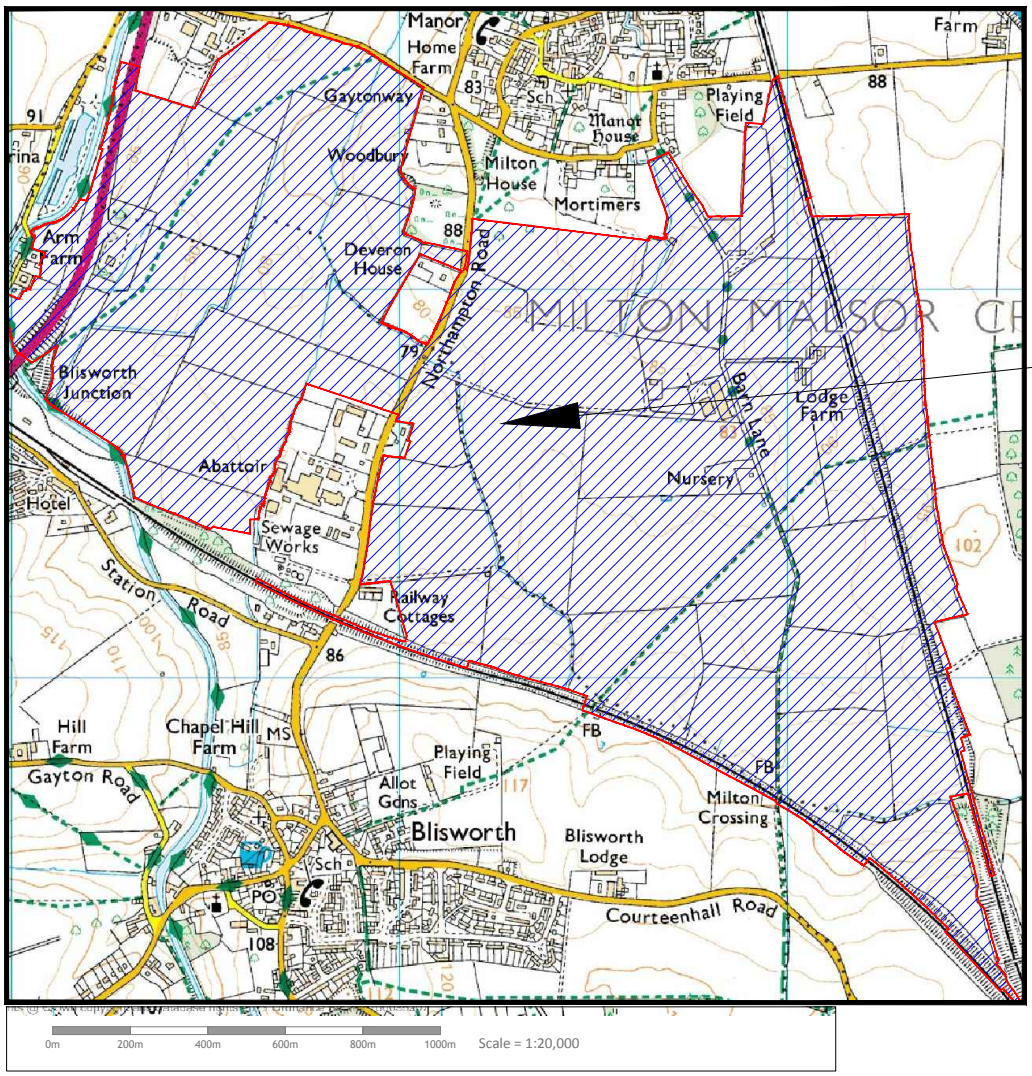

THE SITE

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B	07/06/17	Boundaries revised	RB	AB
A	14/02/17	Boundaries revised	RB	AB

Architect :

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Client :

Ashfield Land

Project Title:

Rail Central, Milton Malsor

Drawing Title:

Site Location Plan

Drawing Status:

FINAL

Hydrock Job No:

C151171

Drawn	Checked	Scale @ A4	Date	Issue Date
NS	AB	See Drawing	09/02/18	09/02/18

Drawing Number:

C151171/D001

Revision:

C

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N

A43

MILTON MALSOR

BLISWORTH

UNIT 10

UNIT 9

UNIT 8

UNIT 13

UNIT 12

UNIT 11

UNIT 1

UNIT 3

UNIT 4

TRUCK PARK
149 HGV SPACES

NORTHAMPTON ROAD

WEST COAST MAIN LINE

GRAND UNION CANAL

LEGEND

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BASED ON MK SURVEYS', TOPOGRAPHICAL SURVEY DRAWING, REF: 2223. DATED JULY 2016. AND ORDNANCE SURVEY INFORMATION.

- ORDER LIMITS
- ILLUSTRATIVE PROPOSED BUILDINGS
- PROPOSED PUBLIC RIGHT OF WAY
- EXISTING LANDSCAPING RETAINED
- PROPOSED LANDSCAPED OPEN SPACE (INCLUDING SCREENING AND BUNDING)
- FLOOD ATTENUATION
- INTERMODAL AREA
- AREA FOR POTENTIAL P.V. PANELS ON ROOFS
- INDICATIVE EXISTING CATENARY POSITIONS
- INDICATIVE PROPOSED CATENARY POSITIONS

REV	DATE	DETAILS OF ISSUE/REVISION	DRW	REV
0	06-02-18	FIRST ISSUE	PF	MS

ASHFIELD LAND

Rail Central
Northamptonshire

THE RAIL CENTRAL STRATEGIC FREIGHT INTERCHANGE ORDER 2018

DRAWING TITLE

ILLUSTRATIVE COLOUR MASTERPLAN - SHEET 1 OF 2

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PAGE SIZE	A0	REVIEWED	MS
REGULATION	5(2)0	DOCUMENT	.

DRAWING STATUS

PLANNING

DRAWING No	REVISION
MSA-30708-PL-DCO-112	0

SHEET 1

SHEET 2

KEY PLAN
1:20,000

MILTON MALSOR

NORTHAMPTON LOOP

M1 MOTORWAY

UNIT 2

UNIT 1

UNIT 3

UNIT 4

UNIT 5

UNIT 6

UNIT 7

TERMINAL CONTROL BUILDING

POTENTIAL EXPRESS FREIGHT CROSS-DOCK PLATFORM

TRAIN MAINTENANCE DEPOT

WEST COAST MAINLINE

BLISWORTH

SHEET 1

SHEET 2

KEY PLAN
1:20,000

0 25 50 100m

LEGEND

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REV	DATE	DETAILS OF ISSUE/REVISION	DRW	REV
0	06-02-18	FIRST ISSUE	PF	MS

ASHFIELD LAND

Rail Central Northamptonshire

THE RAIL CENTRAL STRATEGIC FREIGHT INTERCHANGE ORDER 2018

DRAWING TITLE

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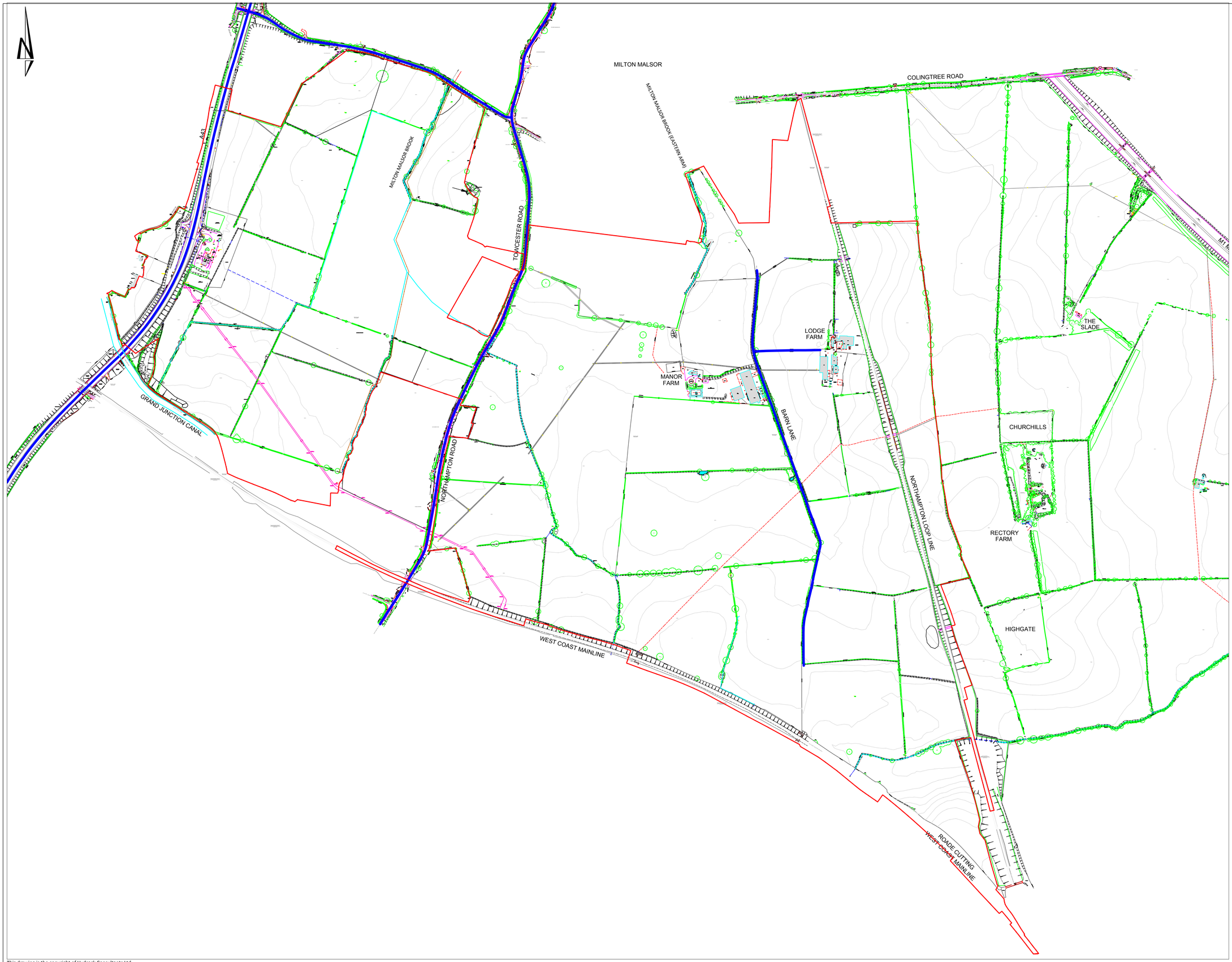

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2. This drawing is to be read in conjunction with all relevant Engineers' and Service Engineers' drawings and specifications.

Key

- Railway line
- Road
- Footpath
- Foul sewer
- BPA Oil Pipeline
- Watercourses
- Trees/Hedges

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C	09/02/18	Updated Site Boundary	NS	AB
B	06/07/17	Updated	RB	AB
A	14/02/17	Updated	RB	AB

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Client :

ASHFIELD LAND

Project Title:

MILTON MALSOR, NORTHAMPTONSHIRE

Drawing Title:

Site Extents Plan

Drawing Status:

FINAL

Hydrock Job No:

C151171

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Drawing Number: 151171/D002

Revision: C

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Transport Yard
Waterlogged ground
Former sand pit (open)
MILTON MALSOR
COLINGTREE ROAD
A43
Landfill (with perimeter monitoring boreholes)
Hummocky ground (former farm buildings)
Pit
Woodland
Anecdotal information - Spoil arisings from M1 construction placed in former sand pit
Tank
Manure stockpile
Milton Malsor Brook
TOWCESTER ROAD
Demolition rubble stockpile
M1 MOTO
Gayton Marina (off site)
Filling station
Farm Farm
Overgrown
LODGE FARM
THE SLADE
Fuel storage above ground
2015 pollution incident (aviation fuel)
Fly tipping (domestic waste)
Soft ground, overland flow of water from canal.
Very soft ground
MANOR FARM
Ridge and Furrow
Canal leak
GRAND JUNCTION CANAL
BARN LANE
CHURCHILLS
Trading estate (not part of site) Including:
- Food recycling facility
- Automotive supplies
- Caravan sales
- And others

NORTHAMPTON ROAD
Ponds
NORTHAMPTON LOOP LINE
RECTORY FARM
Brick fill in entrance
Manure stockpile
HIGHGATE
Plasterboard stockpile (for liming the fields)
WEST COAST MAINLINE
Possible area of Made Ground (anedotal)
ROADE CUTTING
WEST COAST MAINLINE

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2. This drawing is to be read in conjunction with all relevant Engineers' and Service Engineers' drawings and specifications.

Key

- Railway line
- Road
- Footpath
- Foul sewer
- BPA Oil Pipeline
- Watercourses
- Trees/Hedges
- No access during site walkover
- Possible Landfill (extents not defined)
- Raised earthworks

Rev	Date	Description	By	Ckd
C	09/02/18	Site Boundary Updated	NS	AB
B	06/07/17	Updated	RB	AB
A	16/11/16	Updated	RB	AB

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Client :

ASHFIELD LAND

Project Title:

RAIL CENTRAL, MILTON MALSOR, NORTHAMPTONSHIRE

Drawing Title:

Site Features Plan

Drawing Status:

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C151171

Drawn	Checked	Scale @ A1	Date	Issue Date
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Drawing Number: 151171/D003

Revision: C

Appendix B

Site Walkover Photographs



Figure 1: Area A: there were sheep grazing in a field with ridge and furrow.



Figure 2: Area A: the southern boundary of the site was defined by the Grand Junction Canal.



Figure 3: Area B: Stood on the southwest earthworks looking northeast.



Figure 4: Area B: looking north on earthworks.



Figure 5: Area C: southern area looking south.



Figure 6: Area C: Looking southwest along footpath.



Figure 7: Area C: Southern area looking northwest. The site is relatively flat.



Figure 8: Area C: Lodge Farm buidlings.



Figure 9: Area C: Highest part of the site looking southwest (railway line to the right of the picture).



Figure 10: Area C: example of drainage ditch consistent with the entire site.



Figure 11: Area C: demolition materials and farm equipment were stored in the northeast of the site.



Figure 12: Area C: storage of demolition materials to the north of Lodge Farm (distance).



Figure 13: Area C: Pond south of the nursery and west of Barn Lane.



Figure14: Area C: Barn Lane



Figure 15: Area C: anecdotal evidence suggests a field in the southeast of this area has been raised.



Figure 16: Area C: Lodge Farm



Figure 11: Area C: storage of fertiliser, Lodge Farm.



Figure 18: A BPA fuel line crosses all site areas.



Figure 19: Area B: wet and soft ground was found in one field to the southeast of this area.



Figure 20: Area B: fly tipping.



Figure 21: Area B Asbestos cement material amongst fly-tipped deposits



Figure 22: Area B southwest – water issuing from canal embankment



Figure 23: Area B: over-land flow caused by canal leak.



Figure 24: Engineering work adjacent to the Grand Union Canal in the vicinity of the leak



Figure 25: Area B: former filling station in west.



Figure 26: Area B: an area of hummocky ground was identified as the location of a former farm building.



Figure 27: Area B: the desk study identified a former landfill in the northwest noted on site by a slope.



Figure 28: Area B: the area around the former landfill had a number of perimeter boreholes.



Figure 29: Area B: the general topography was of gently rolling hills.



Figure 30: Area B: there was boggy ground in the north of the area adjacent to Gayton Road.



Figure 31: Area B: Milton Malsor Brook, adjacent to Gayton Road.



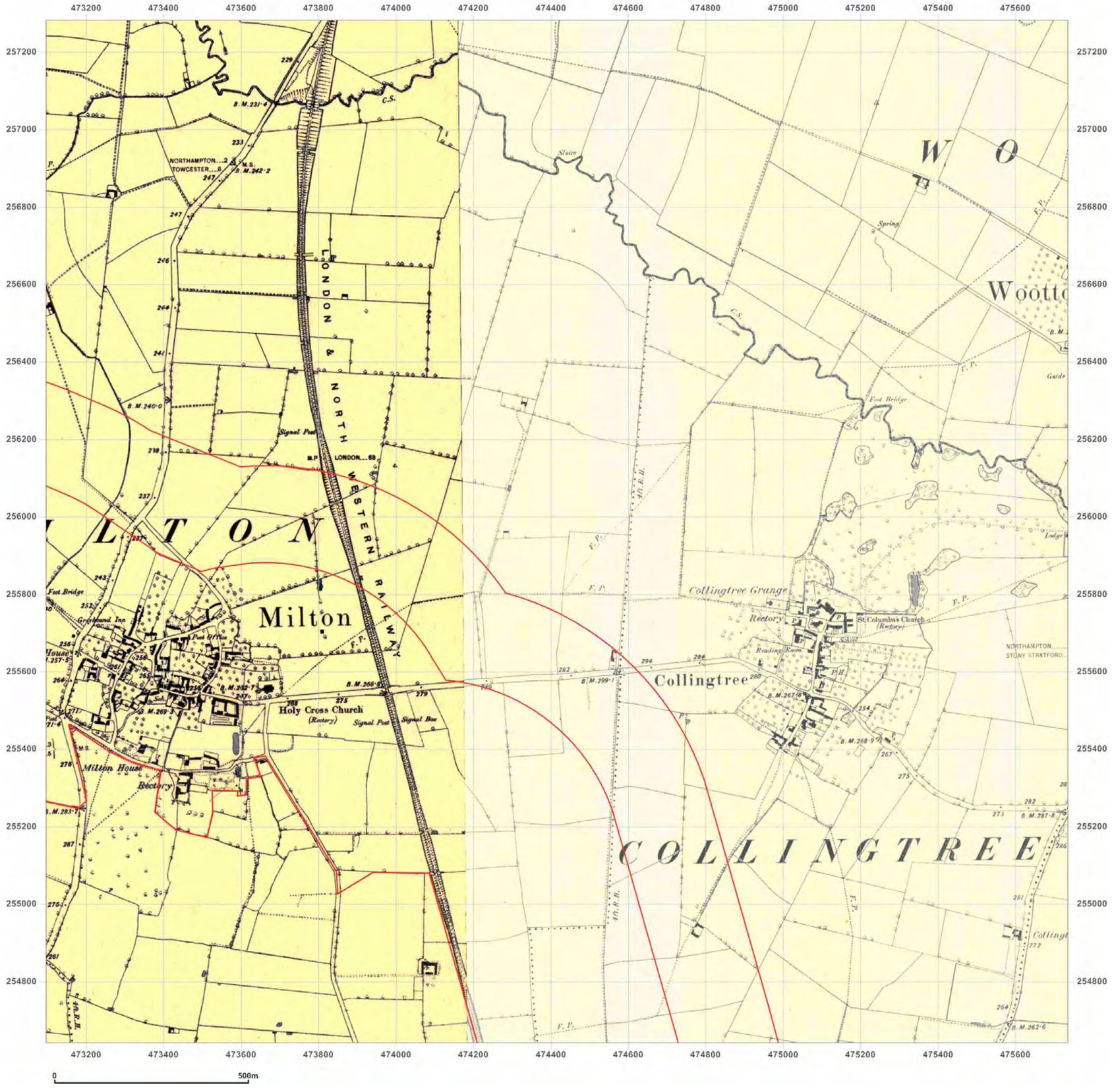
Figure 32: Area B: the view of the northeast of the area (Gayton Road is to the left).



Figure 33: Area B: sand pit in the northwest of the site.

Appendix C

Historical Ordnance Survey Maps



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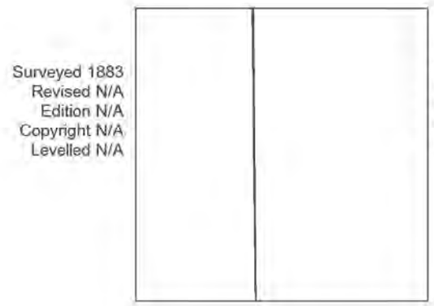

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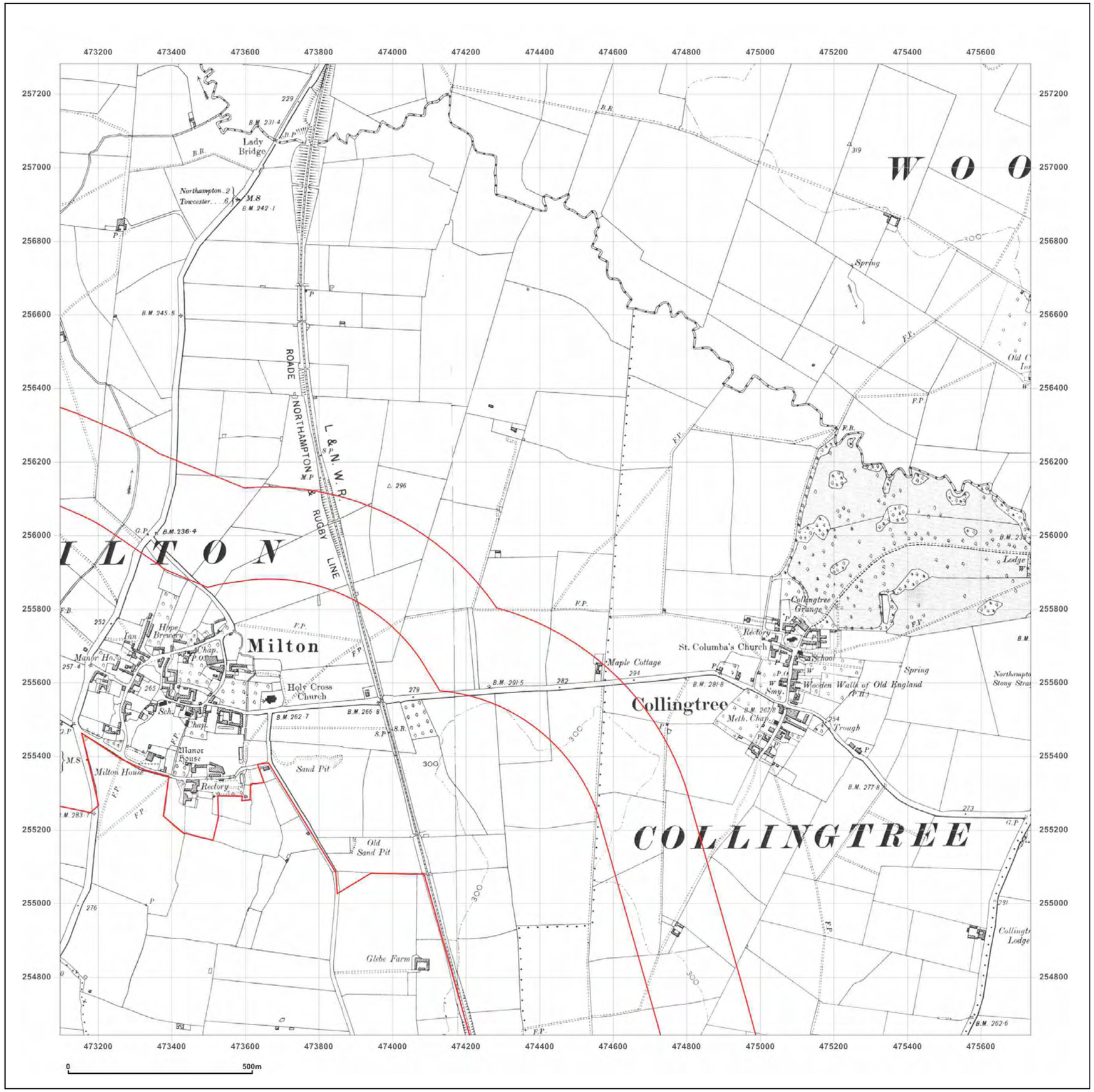

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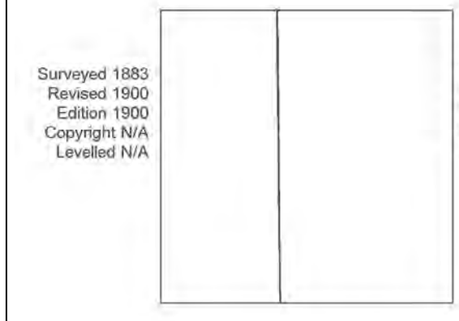

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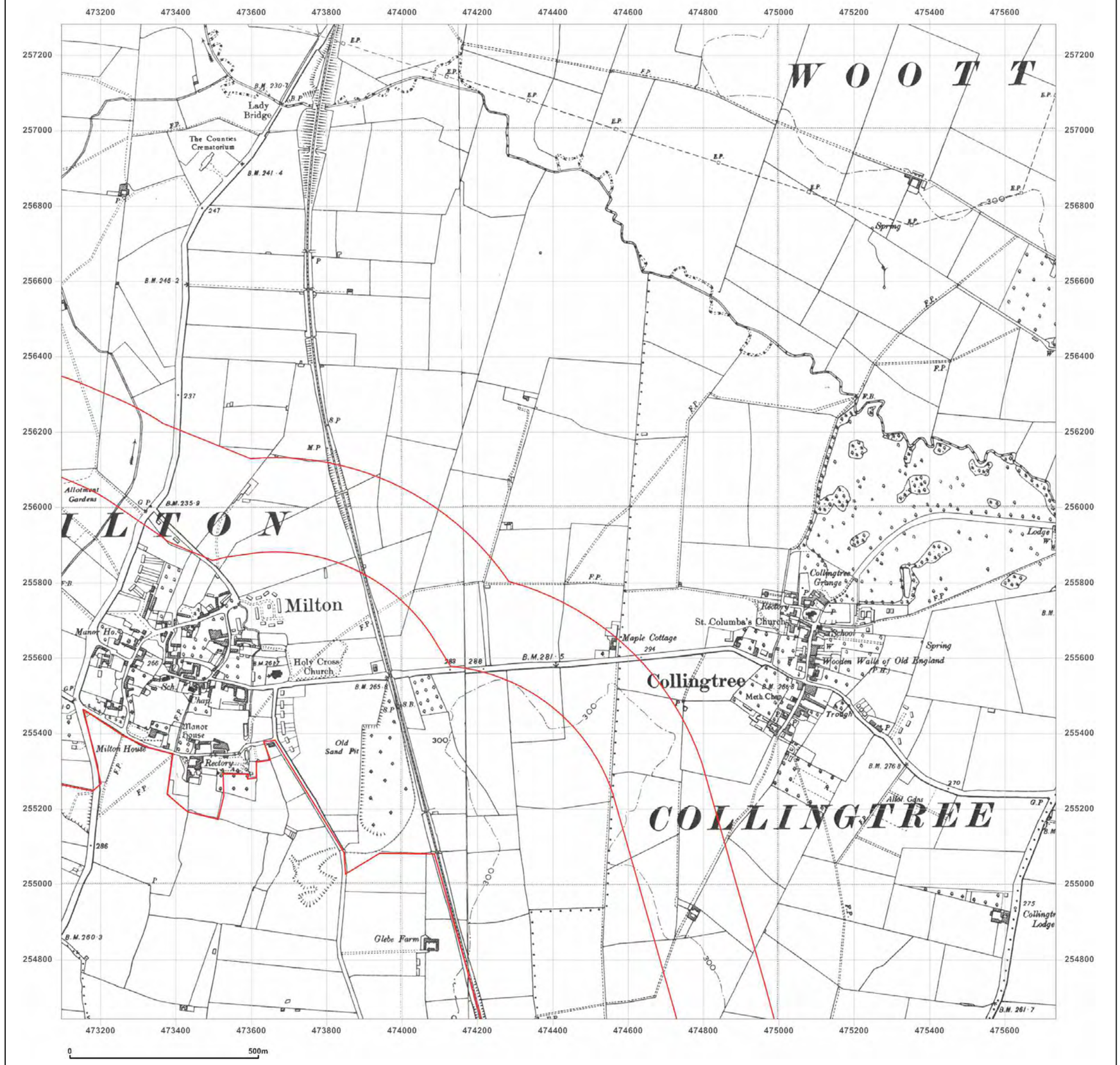

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

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Report Ref: HYDNOR-1981475_SS_2_2
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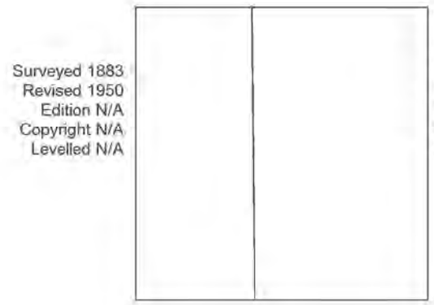

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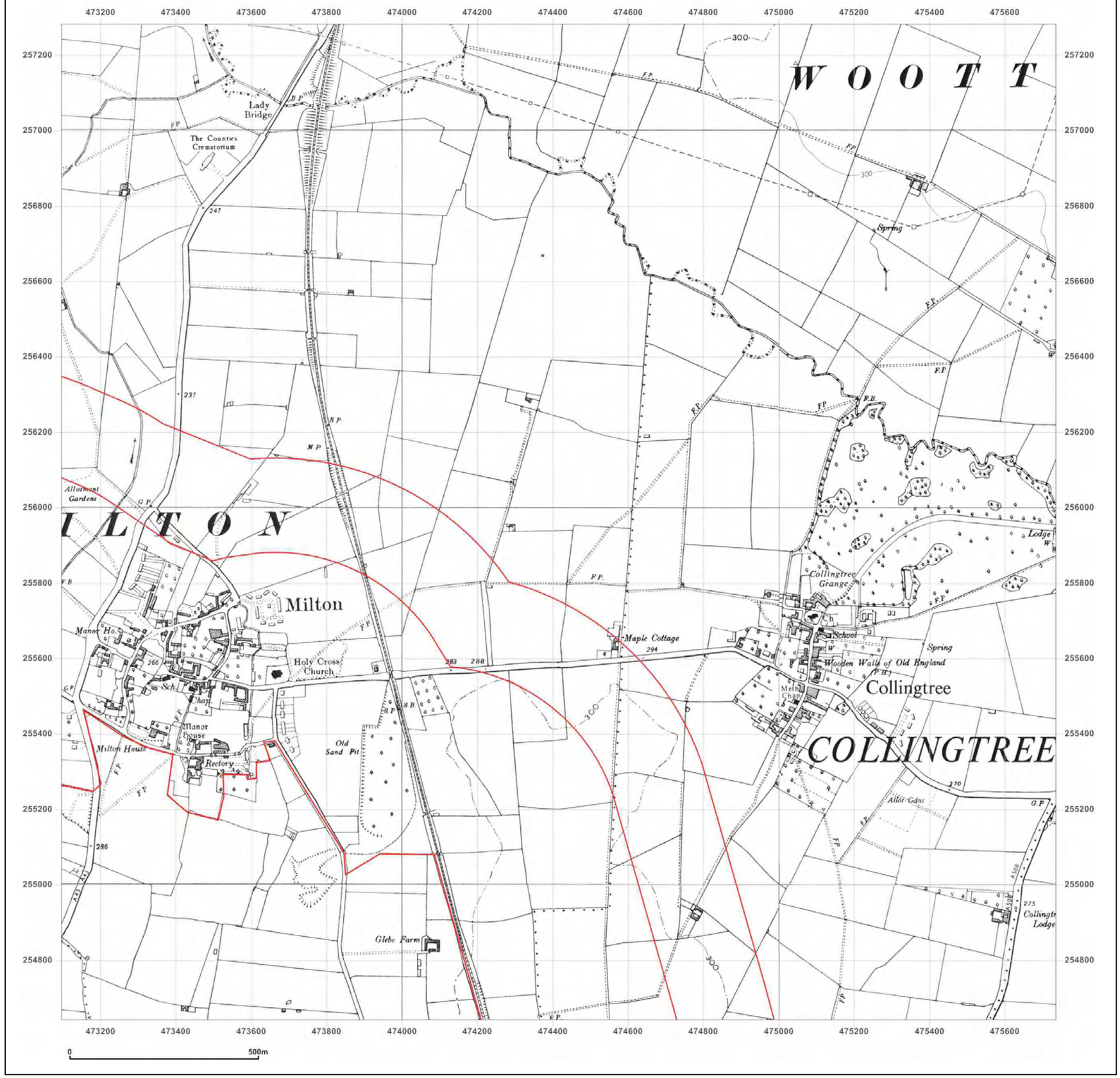
Production date: 25 March 2015

To view map legend click here *Legend*



GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

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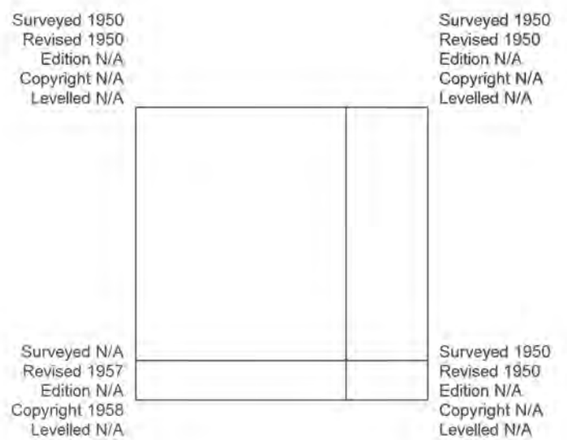

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Production date: 25 March 2015

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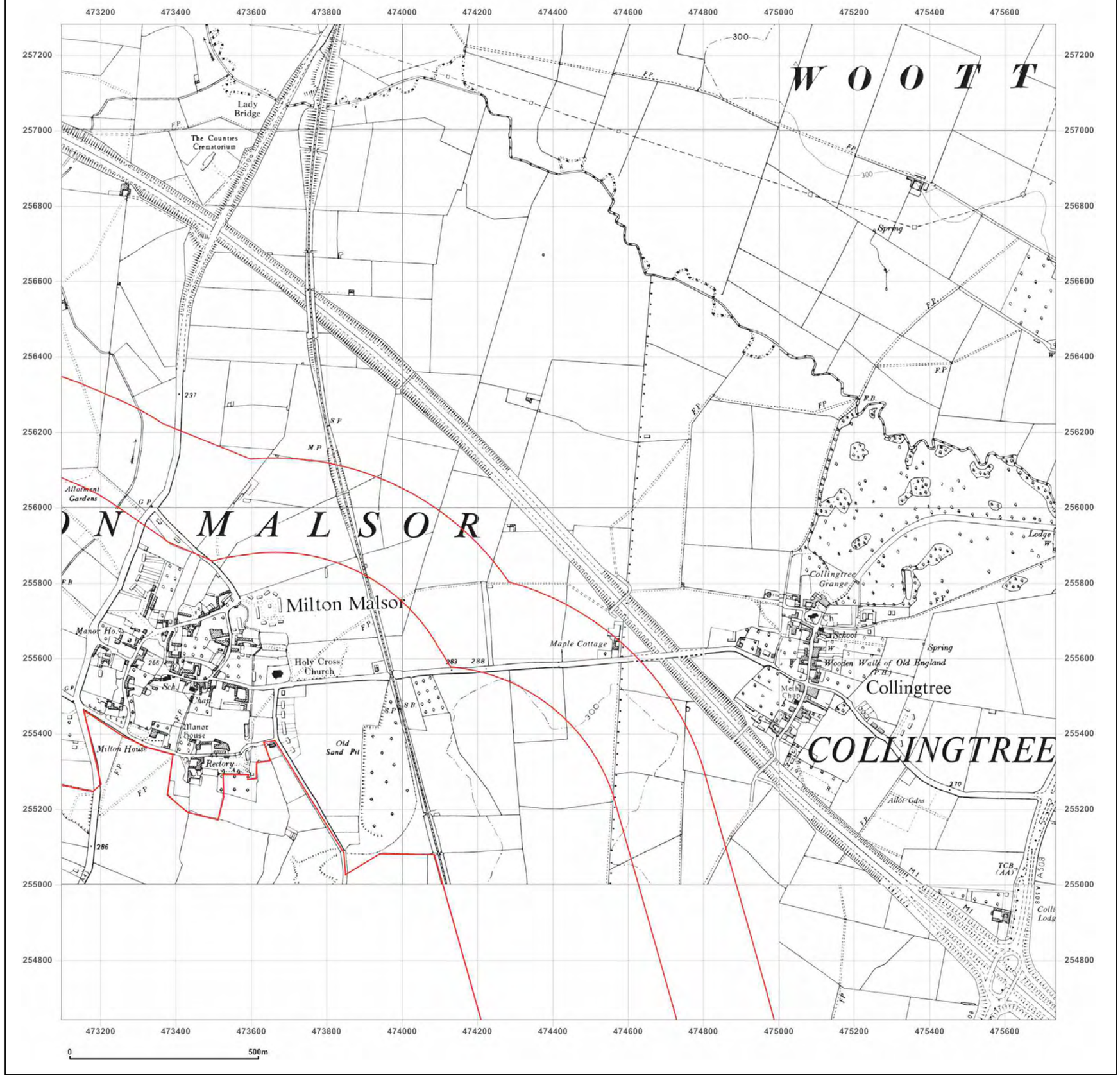

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_2_2
Grid Ref: 474415, 255961

Map Name: Provisional

Map date: **1964-1968**

Scale: 1:10,560

Printed at: 1:10,560

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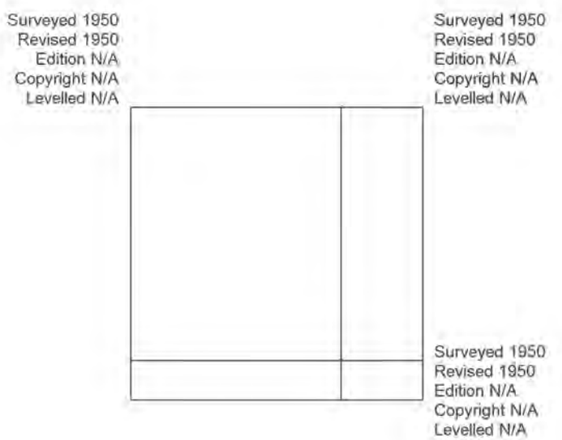

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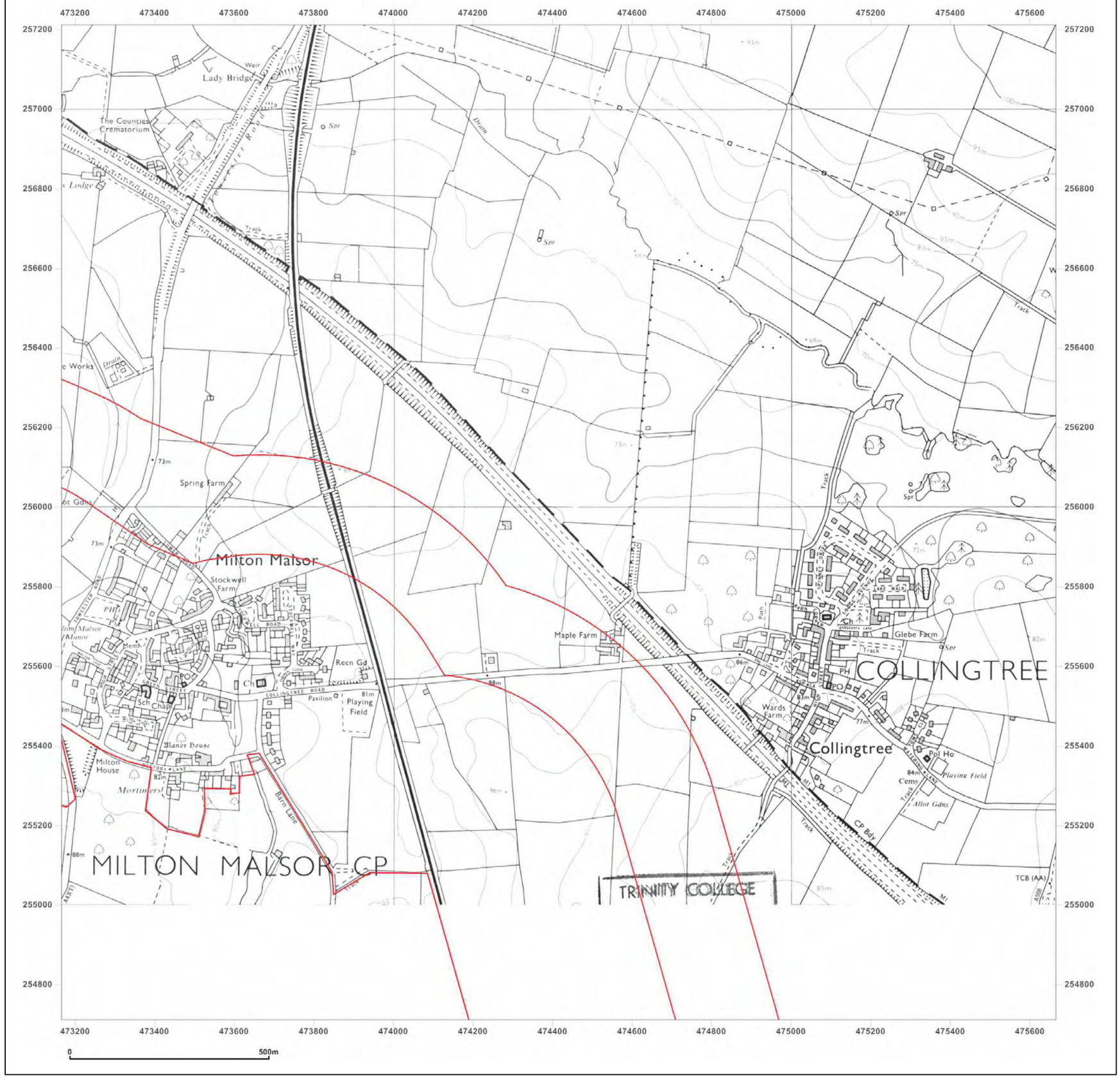

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_2_2
Grid Ref: 474415, 255961

Map Name: National Grid

Map date: **1981**

Scale: 1:10,000

Printed at: 1:10,000

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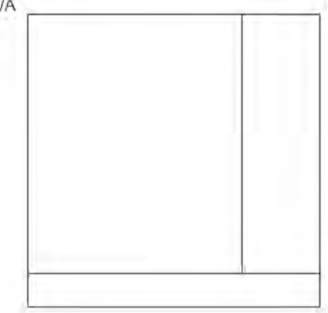
Surveyed 1977
Revised 1981
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1978
Revised 1981
Edition N/A
Copyright N/A
Levelled N/A



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Production date: 25 March 2015

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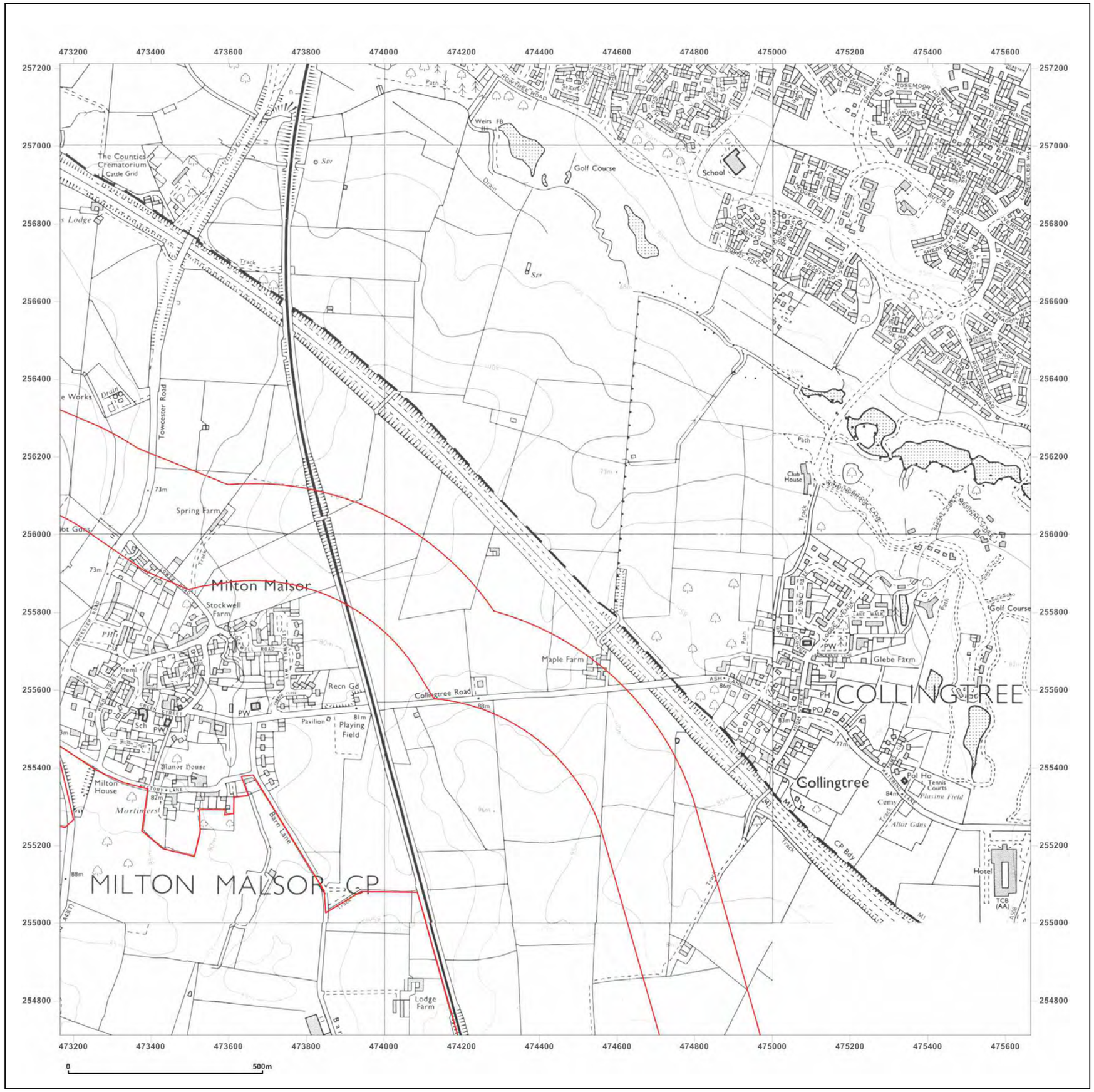

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_2_2
Grid Ref: 474415, 255961

Map Name: National Grid

Map date: **1989-1992**

Scale: 1:10,000

Printed at: 1:10,000

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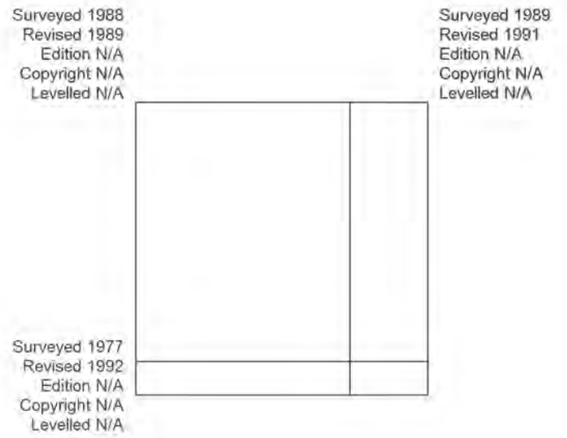

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Production date: 25 March 2015

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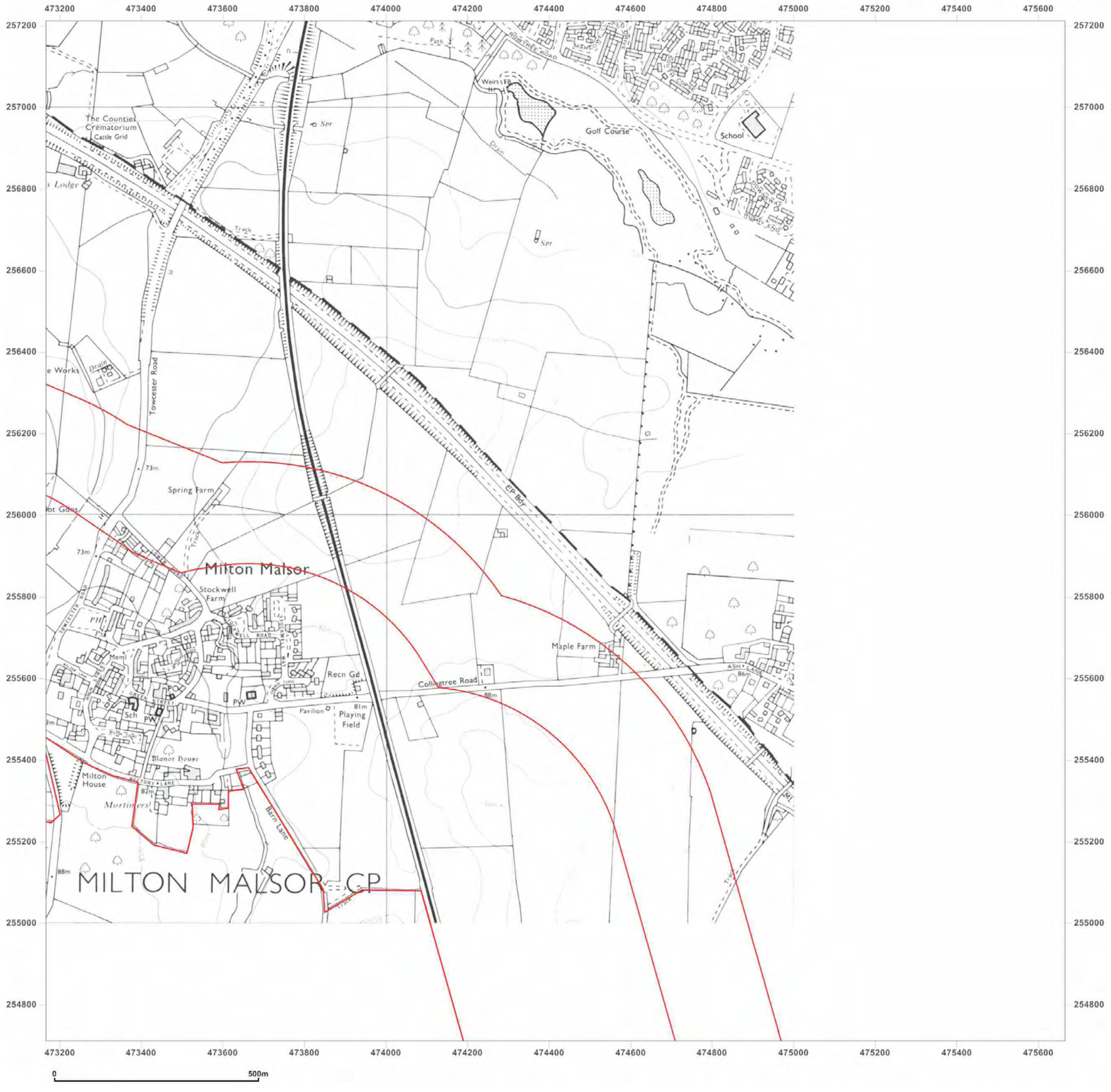

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_2_2
Grid Ref: 474415, 255961

Map Name: National Grid

Map date: **1992**

Scale: 1:10,000

Printed at: 1:10,000

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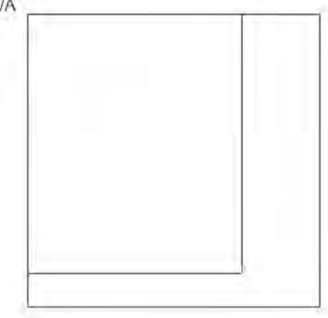
Surveyed 1988
Revised 1992
Edition N/A
Copyright N/A
Levelled N/A



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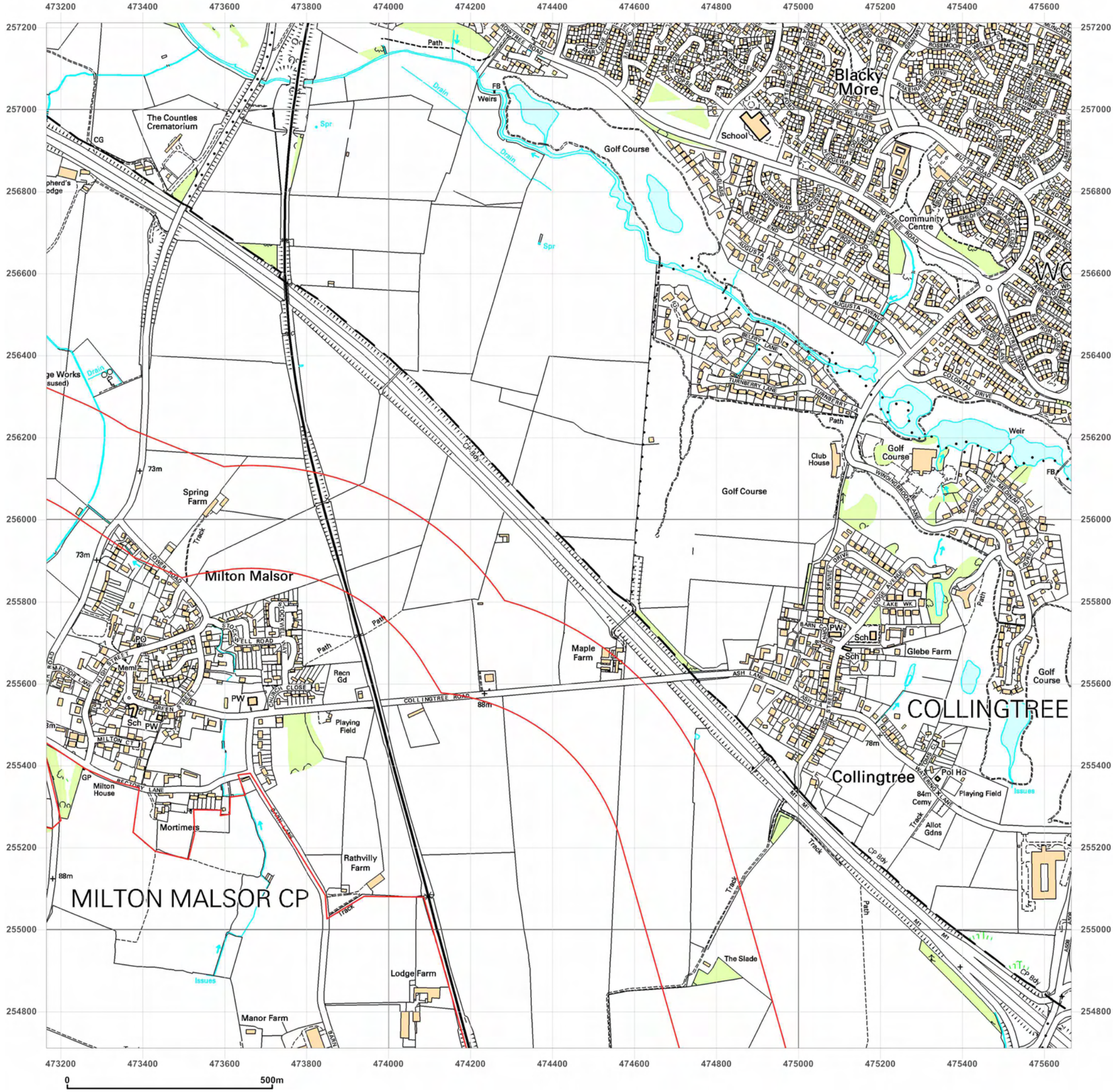

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_2_2
Grid Ref: 474415, 255961

Map Name: 1:10,000 Raster

Map date: **2002**

Scale: 1:10,000

Printed at: 1:10,000

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Production date: 25 March 2015

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_2_2
Grid Ref: 474415, 255961

Map Name: National Grid

Map date: **2010**

Scale: 1:10,000

Printed at: 1:10,000

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Production date: 25 March 2015

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_2_2
Grid Ref: 474415, 255961

Map Name: National Grid

Map date: **2014**

Scale: 1:10,000

Printed at: 1:10,000

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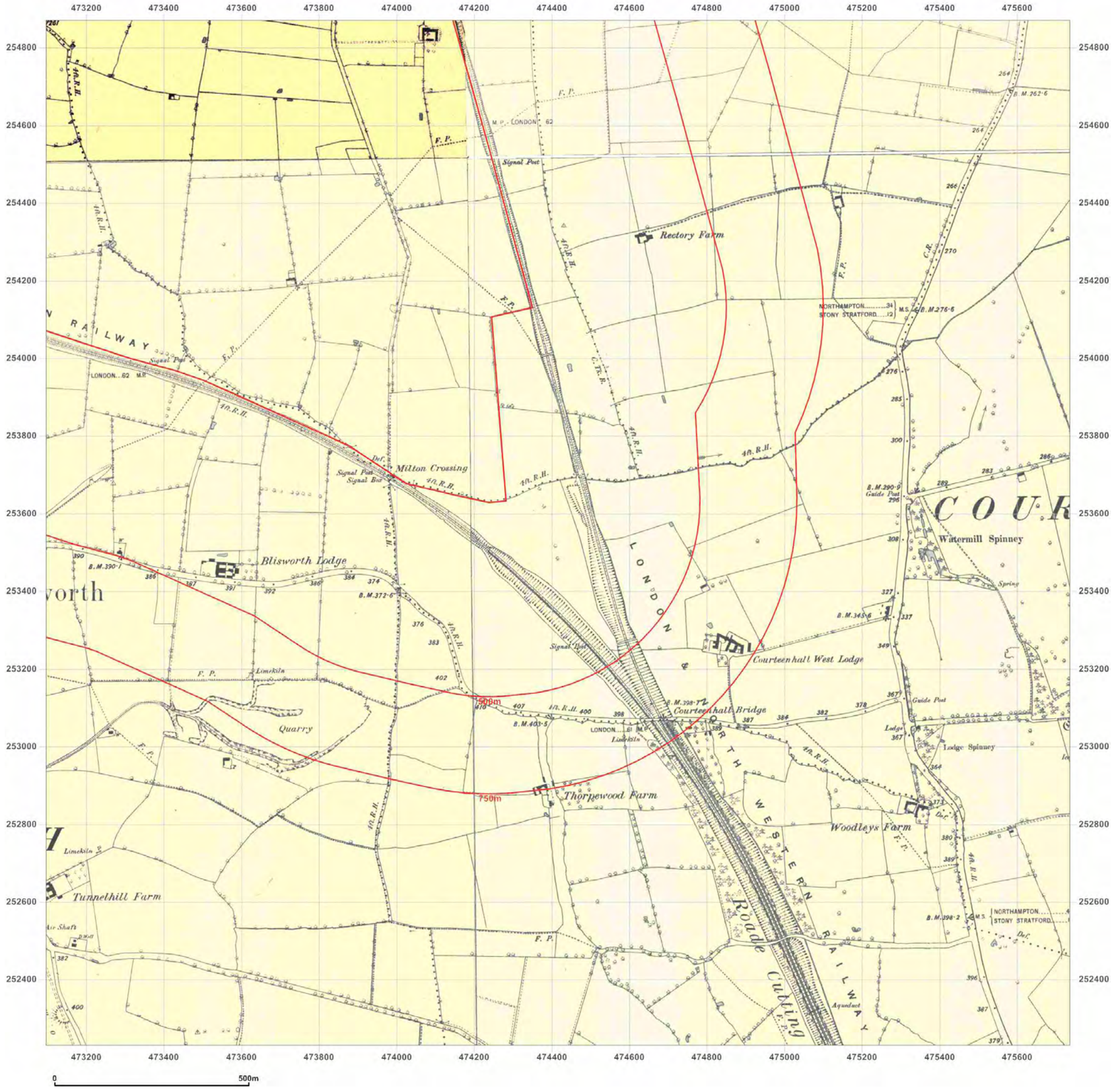

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_2_1
Grid Ref: 474415, 253550

Map Name: County Series

Map date: **1883-1884**

Scale: 1:10,560

Printed at: 1:10,560

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Surveyed 1883
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1883
Revised 1883
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1883
Revised 1883
Edition N/A
Copyright N/A
Levelled N/A

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Edition N/A
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Production date: 25 March 2015

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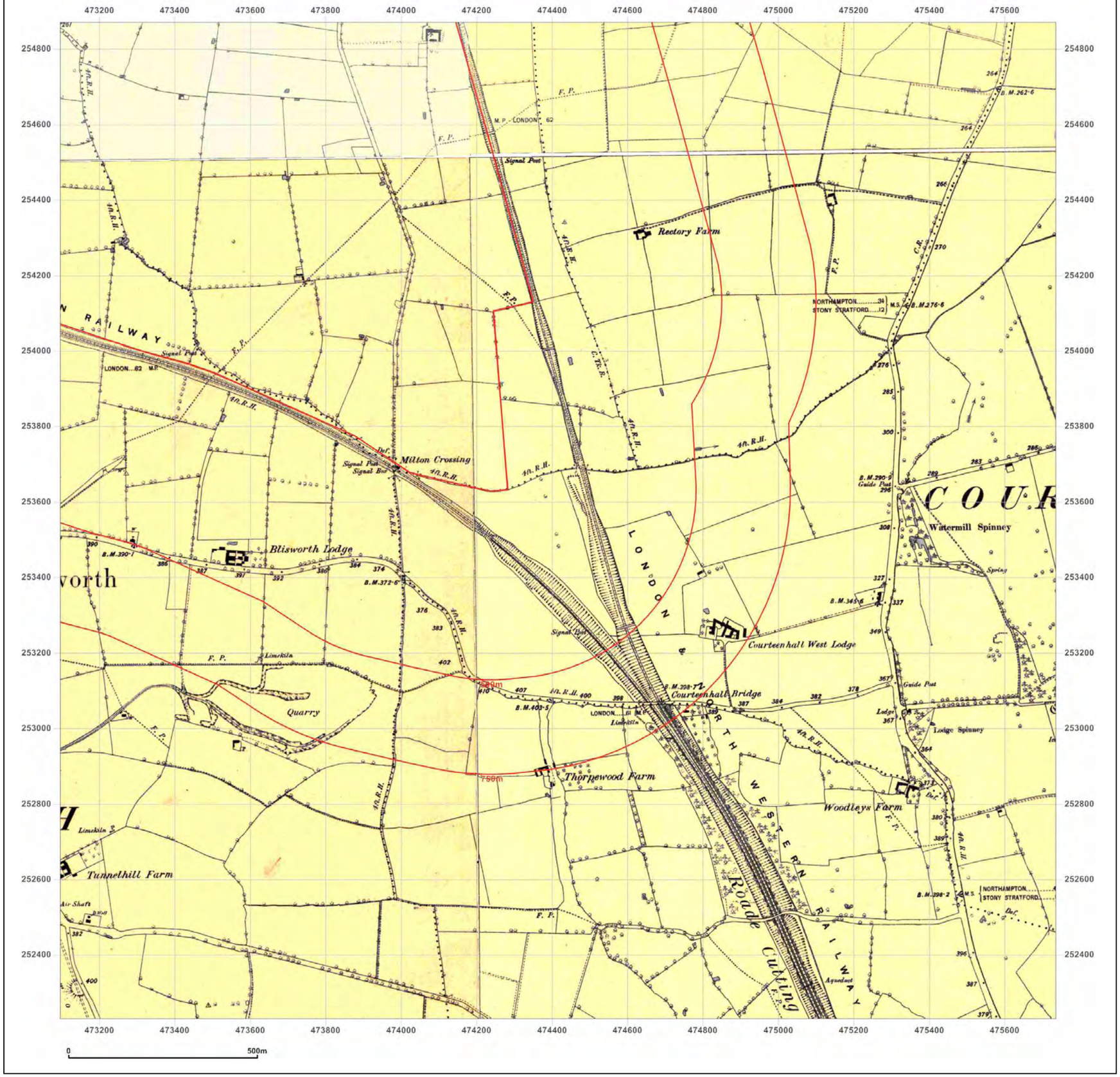

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_2_1
Grid Ref: 474415, 253550

Map Name: County Series

Map date: **1883-1884**

Scale: 1:10,560

Printed at: 1:10,560

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Surveyed 1883
Revised 1883
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1883
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1883
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1883
Revised N/A
Edition N/A
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Production date: 25 March 2015

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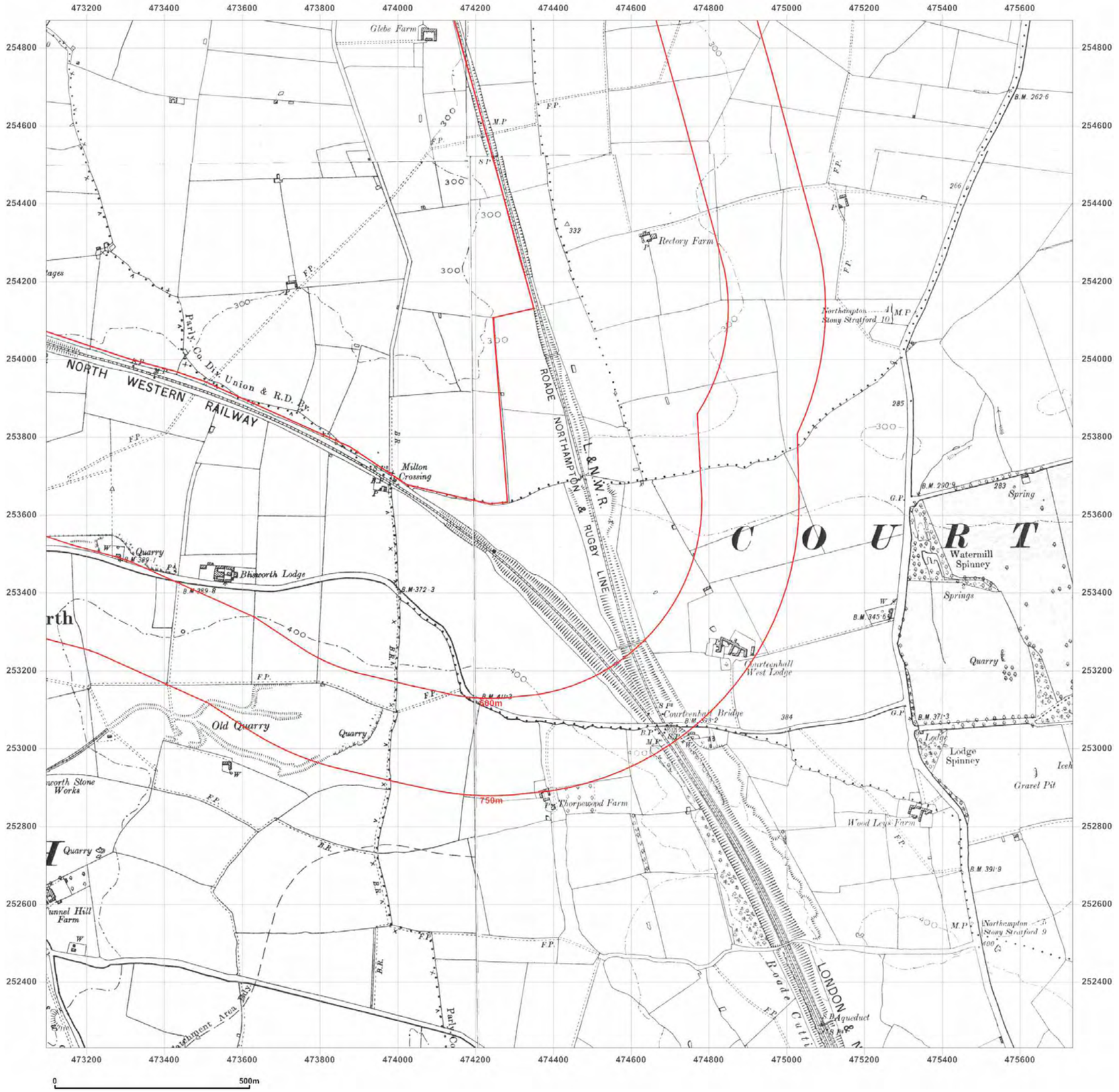

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_2_1
Grid Ref: 474415, 253550

Map Name: County Series

Map date: **1899-1900**

Scale: 1:10,560

Printed at: 1:10,560

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Surveyed 1883
Revised 1900
Edition 1900
Copyright N/A
Levelled N/A

Surveyed 1883
Revised 1899
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1883
Revised 1899
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1883
Revised 1899
Edition N/A
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Production date: 25 March 2015

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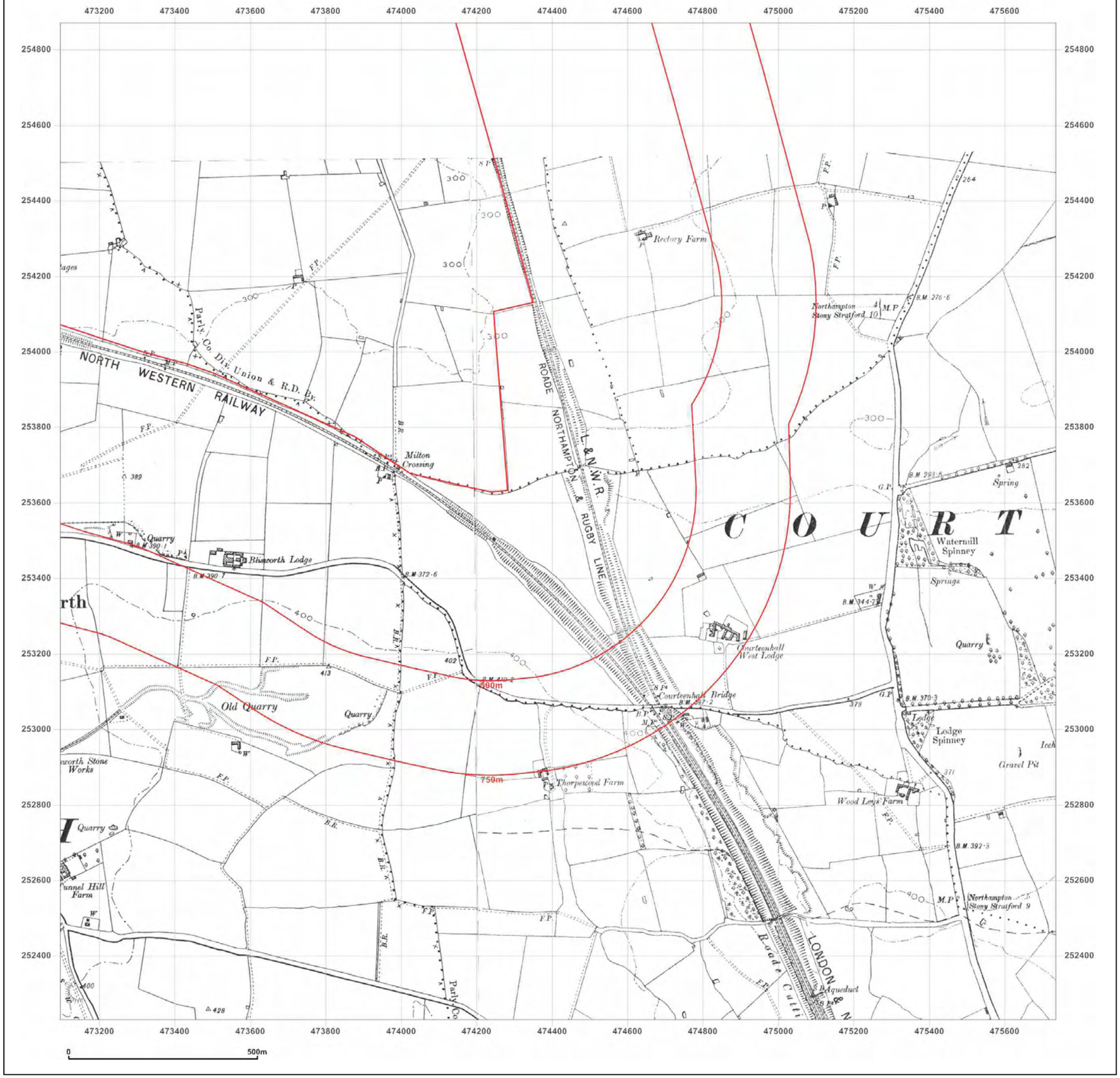

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_2_1
Grid Ref: 474415, 253550

Map Name: County Series

Map date: **1900**

Scale: 1:10,560

Printed at: 1:10,560

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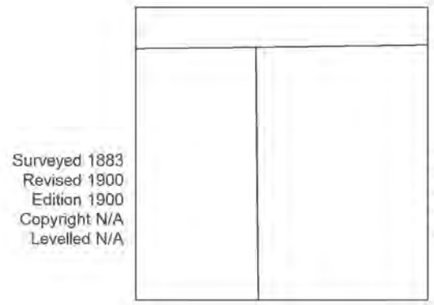

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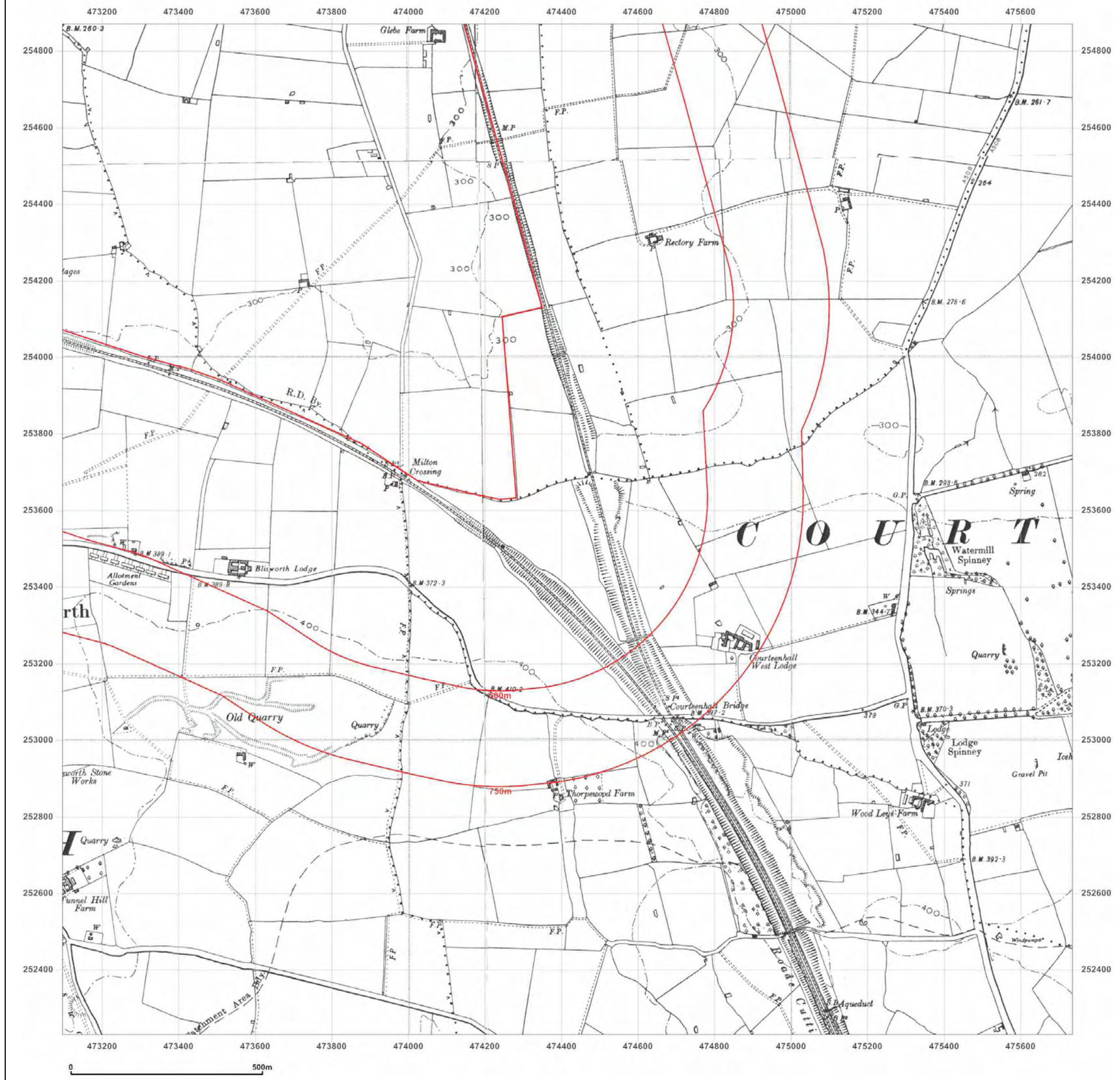

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_2_1
Grid Ref: 474415, 253550

Map Name: County Series

Map date: **1950**

Scale: 1:10,560

Printed at: 1:10,560

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Surveyed 1883
Revised 1950
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1883
Revised 1950
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1883
Revised 1950
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1883
Revised 1950
Edition N/A
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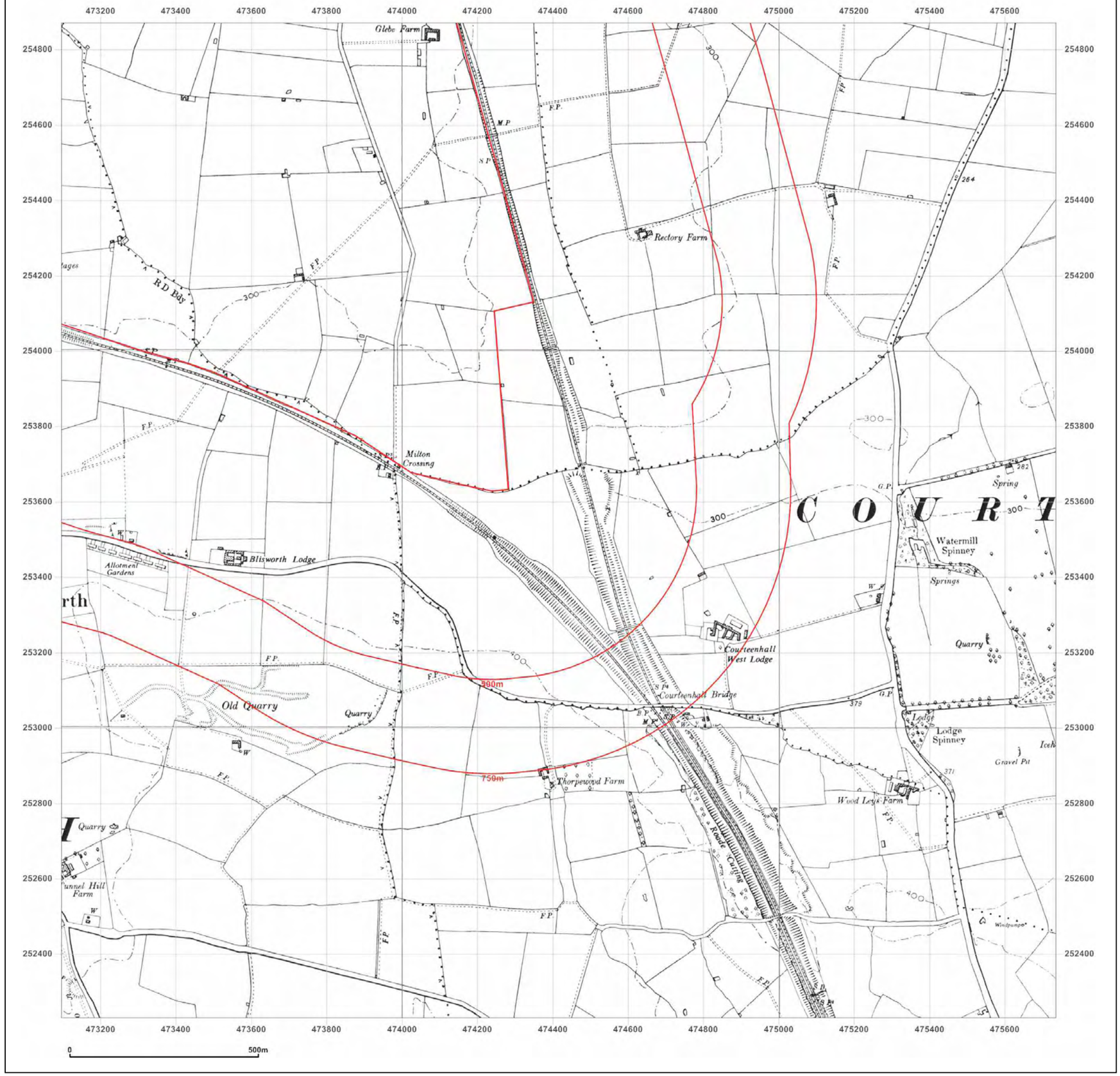

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_2_1
Grid Ref: 474415, 253550

Map Name: Provisional

Map date: **1957-1958**

Scale: 1:10,560

Printed at: 1:10,560

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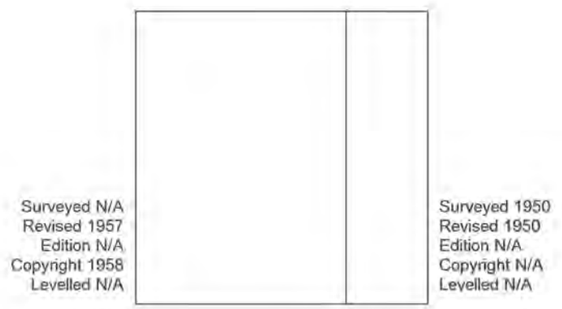

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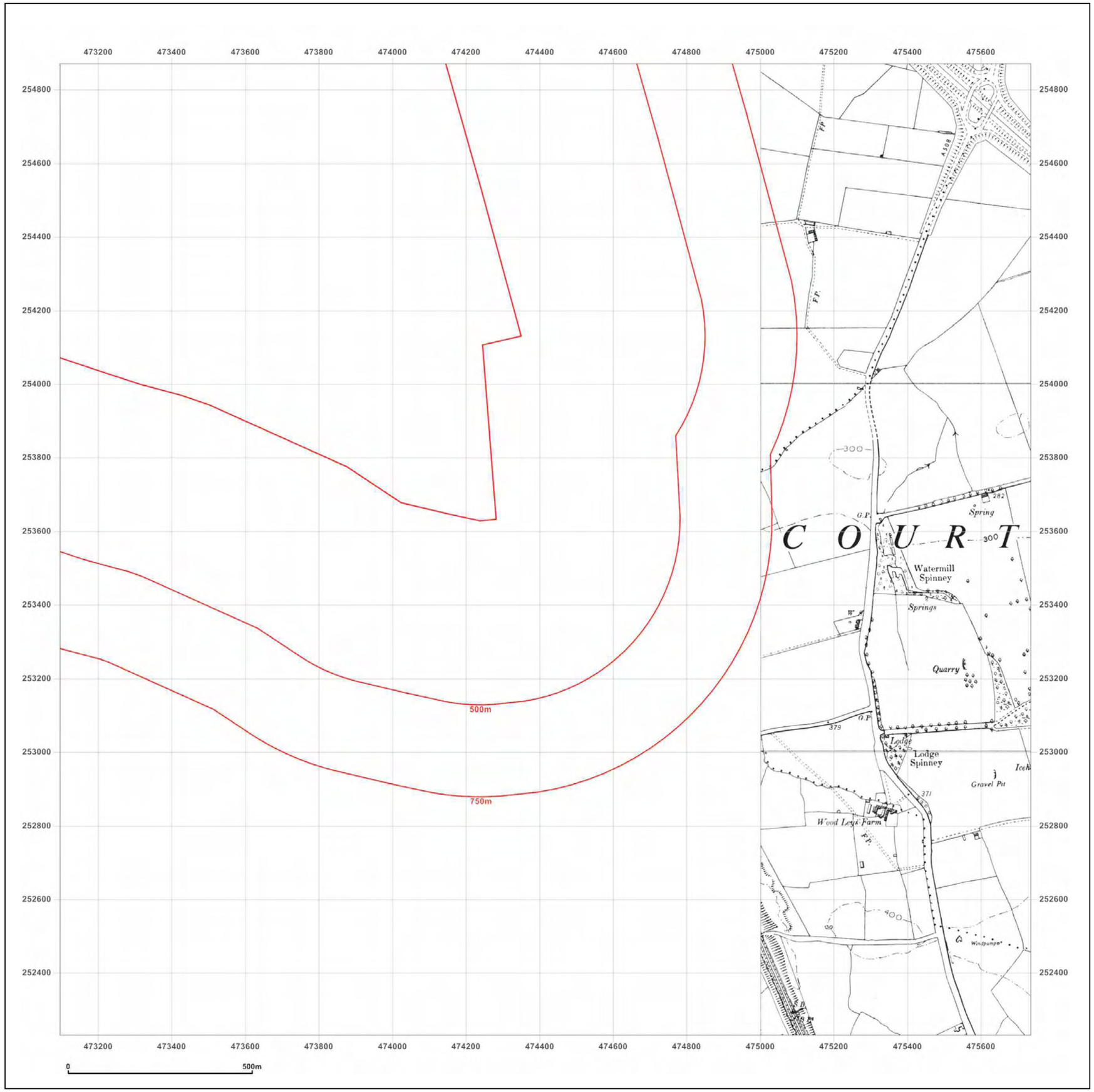

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_2_1
Grid Ref: 474415, 253550

Map Name: Provisional

Map date: **1968**

Scale: 1:10,560

Printed at: 1:10,560

N
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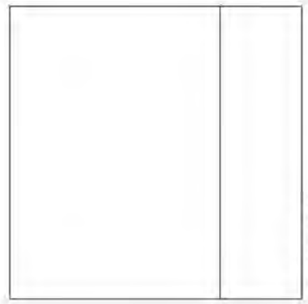

Surveyed 1950
Revised 1950
Edition N/A
Copyright N/A
Levelled N/A

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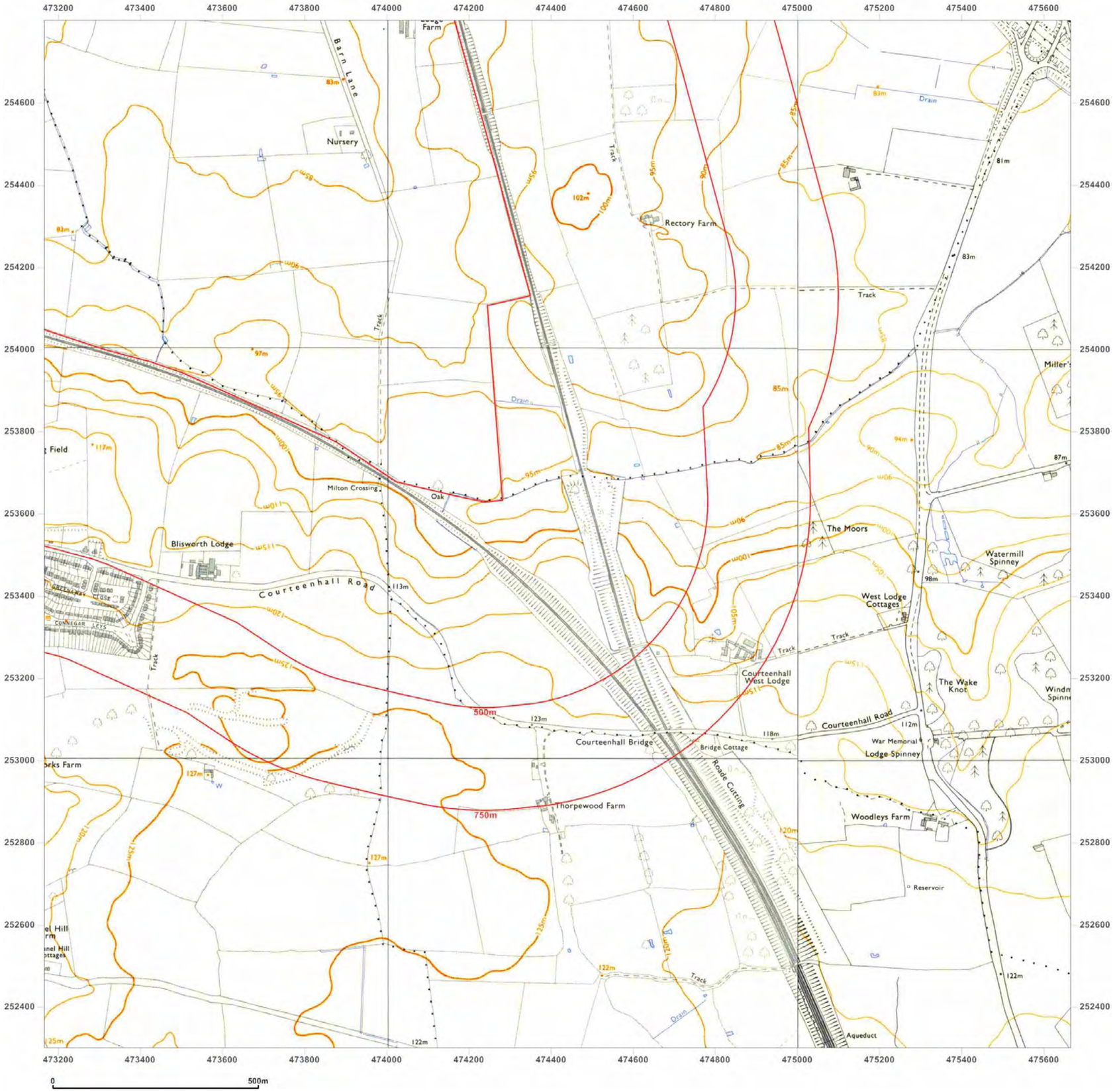

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_2_1
Grid Ref: 474415, 253550

Map Name: National Grid

Map date: **1980-1981**

Scale: 1:10,000

Printed at: 1:10,000

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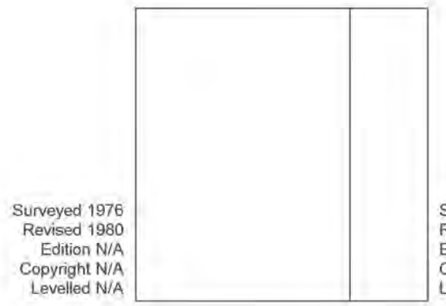

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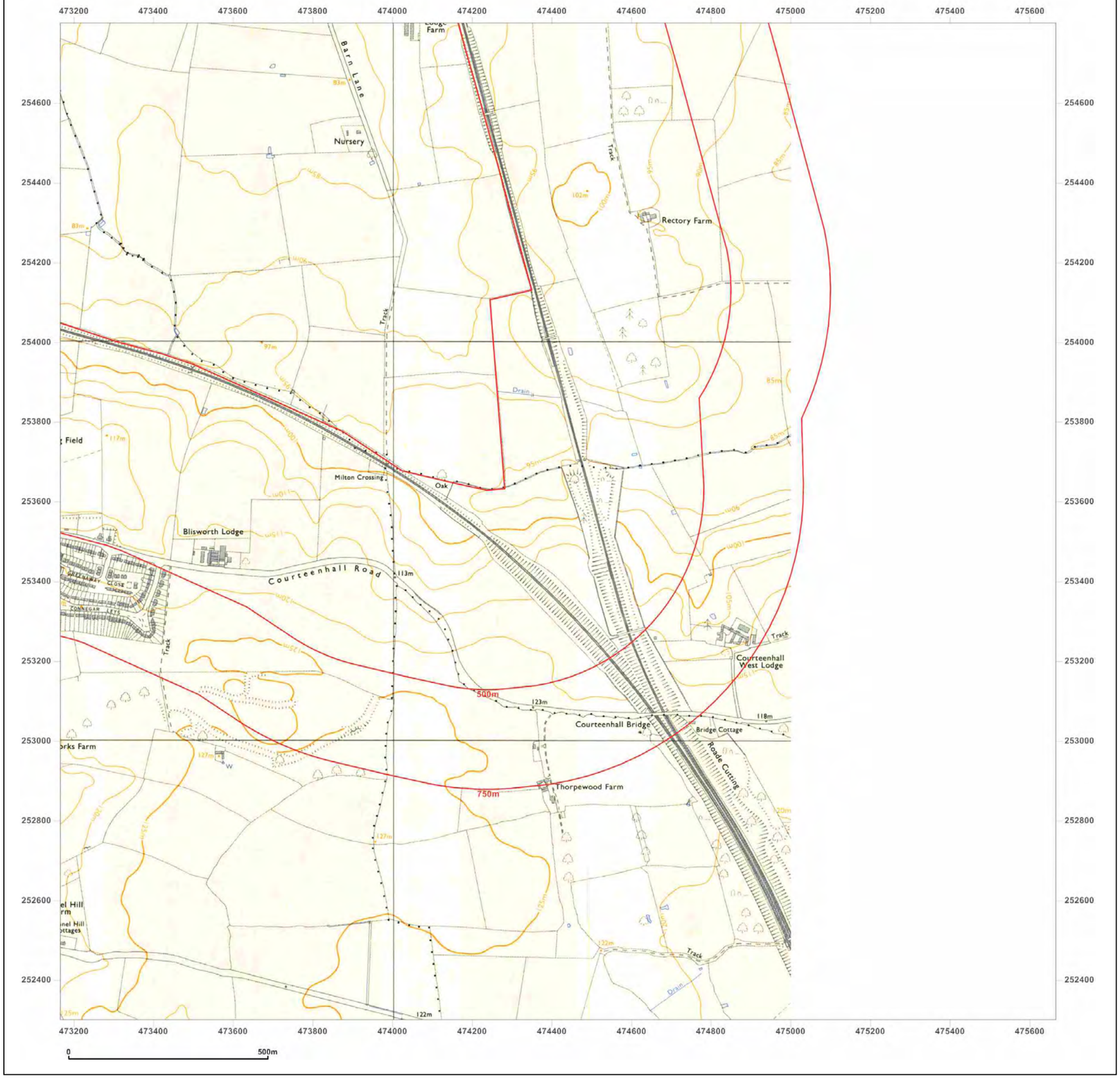

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_2_1
Grid Ref: 474415, 253550

Map Name: National Grid

Map date: **1988**

Scale: 1:10,000

Printed at: 1:10,000

N
W E
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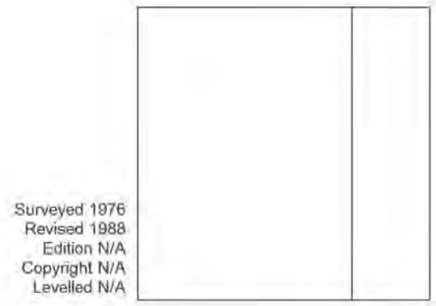

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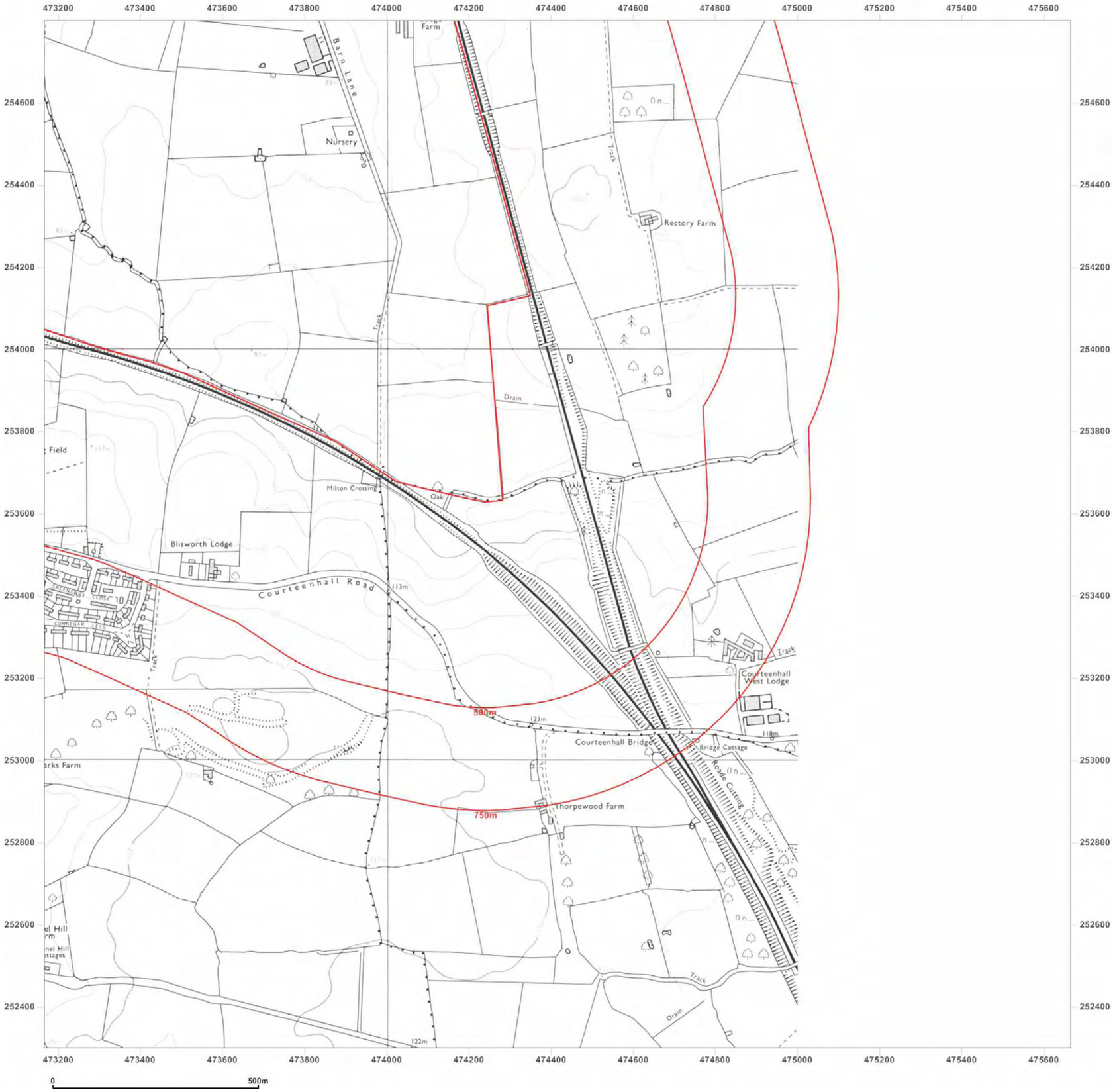

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_2_1
Grid Ref: 474415, 253550

Map Name: National Grid

Map date: **1992**

Scale: 1:10,000

Printed at: 1:10,000

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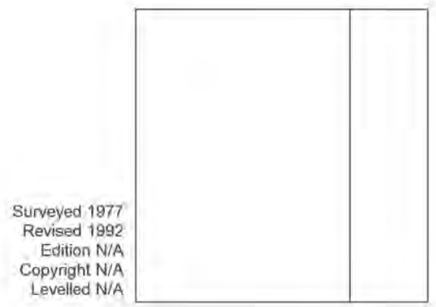

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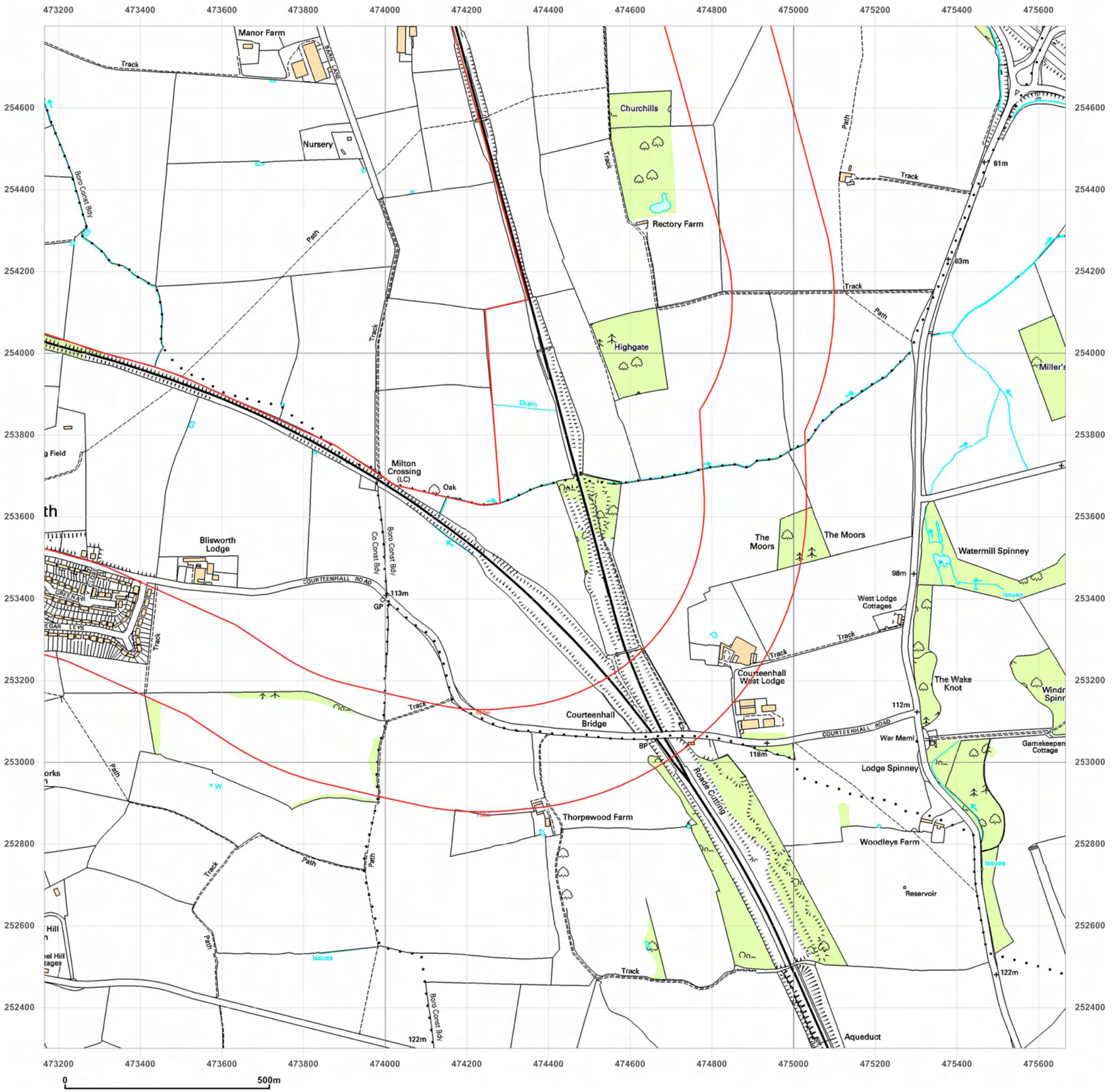

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_2_1
Grid Ref: 474415, 253550

Map Name: 1:10,000 Raster

Map date: **2002**

Scale: 1:10,000

Printed at: 1:10,000

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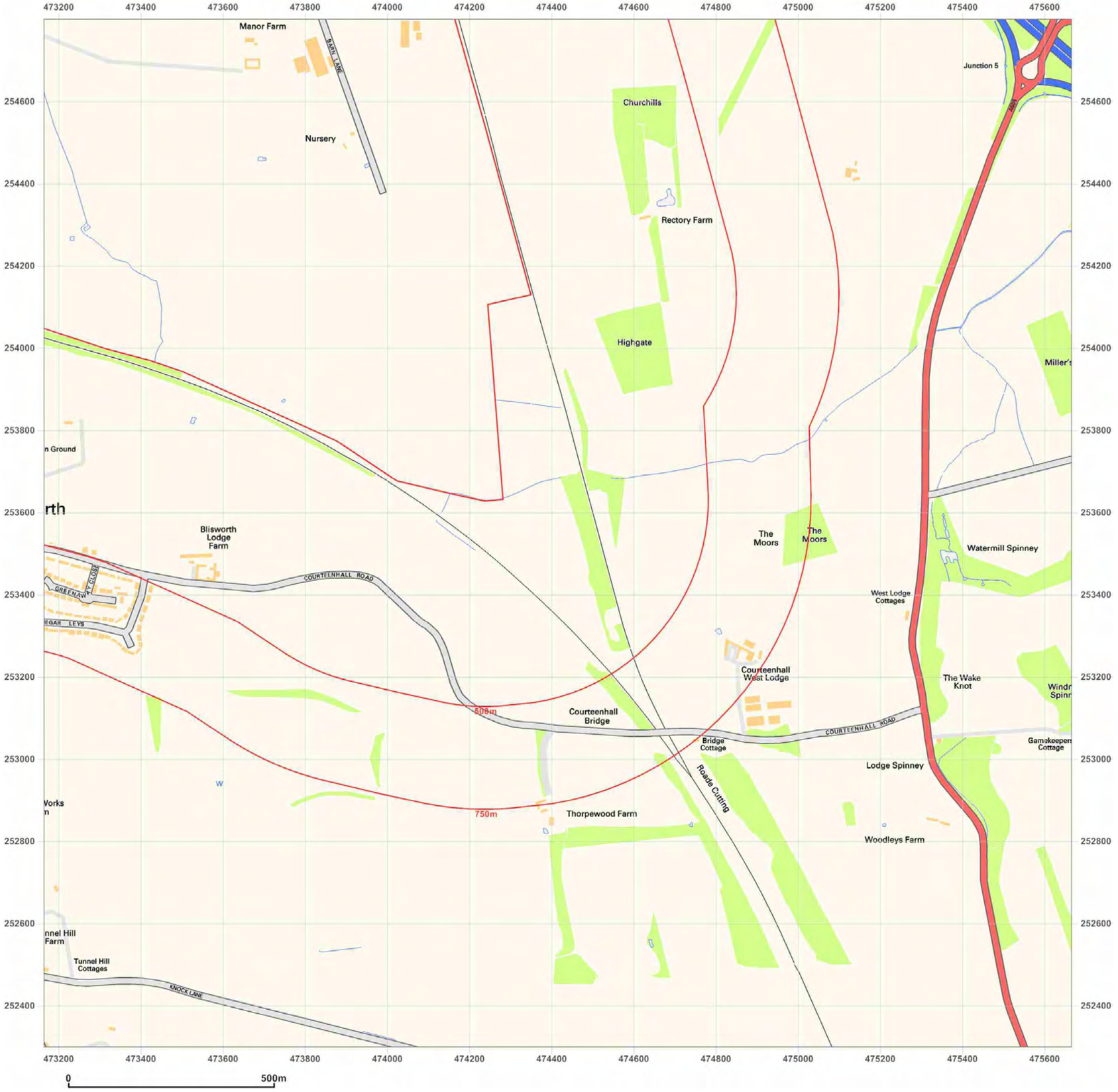
Production date: 25 March 2015

To view map legend click here *Legend*



GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_2_1
Grid Ref: 474415, 253550

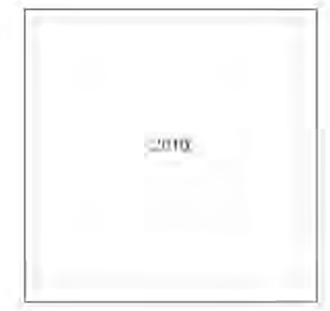
Map Name: National Grid

Map date: **2010**

Scale: 1:10,000

Printed at: 1:10,000

N
W E
S



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Production date: 25 March 2015

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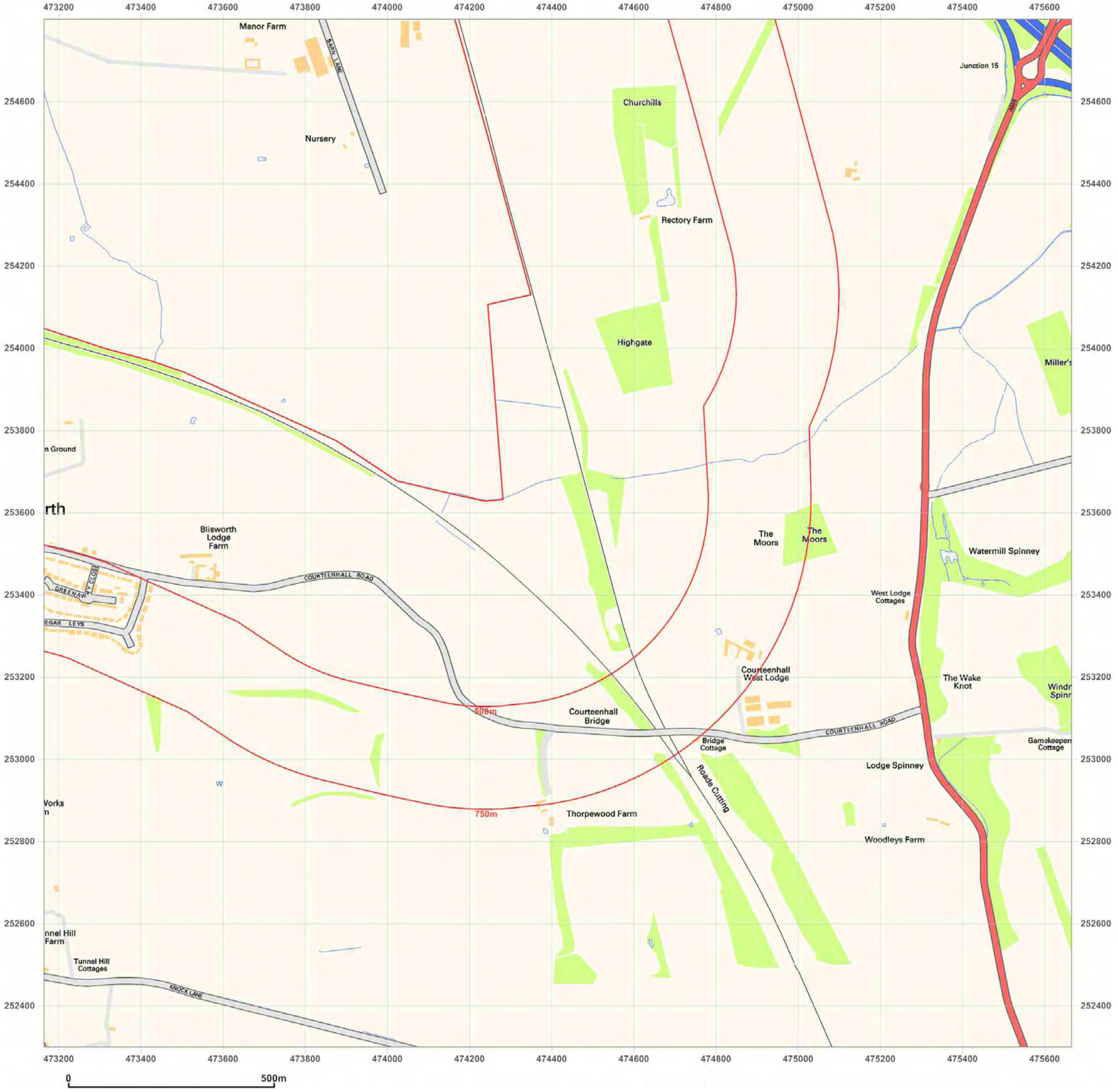

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_2_1
Grid Ref: 474415, 253550

Map Name: National Grid

Map date: **2014**

Scale: 1:10,000

Printed at: 1:10,000

N
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Production date: 25 March 2015

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_1_2
Grid Ref: 471999, 255961

Map Name: County Series

Map date: **1884**

Scale: 1:10,560

Printed at: 1:10,560

N
W E
S

Surveyed 1883
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

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Production date: 25 March 2015

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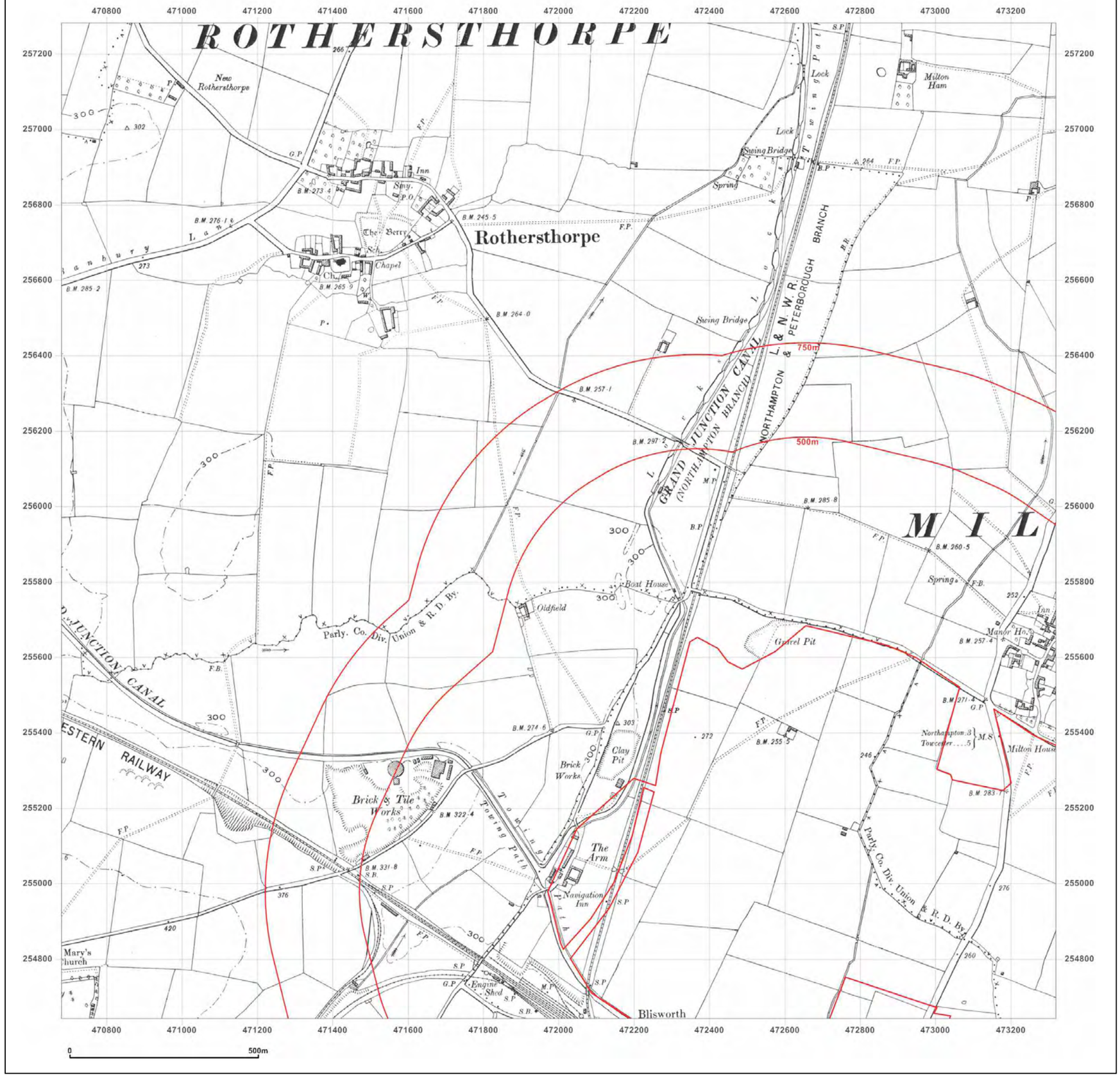

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_1_2
Grid Ref: 471999, 255961

Map Name: County Series

Map date: **1900**

Scale: 1:10,560

Printed at: 1:10,560

N
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Surveyed 1883
Revised 1900
Edition 1900
Copyright N/A
Levelled N/A

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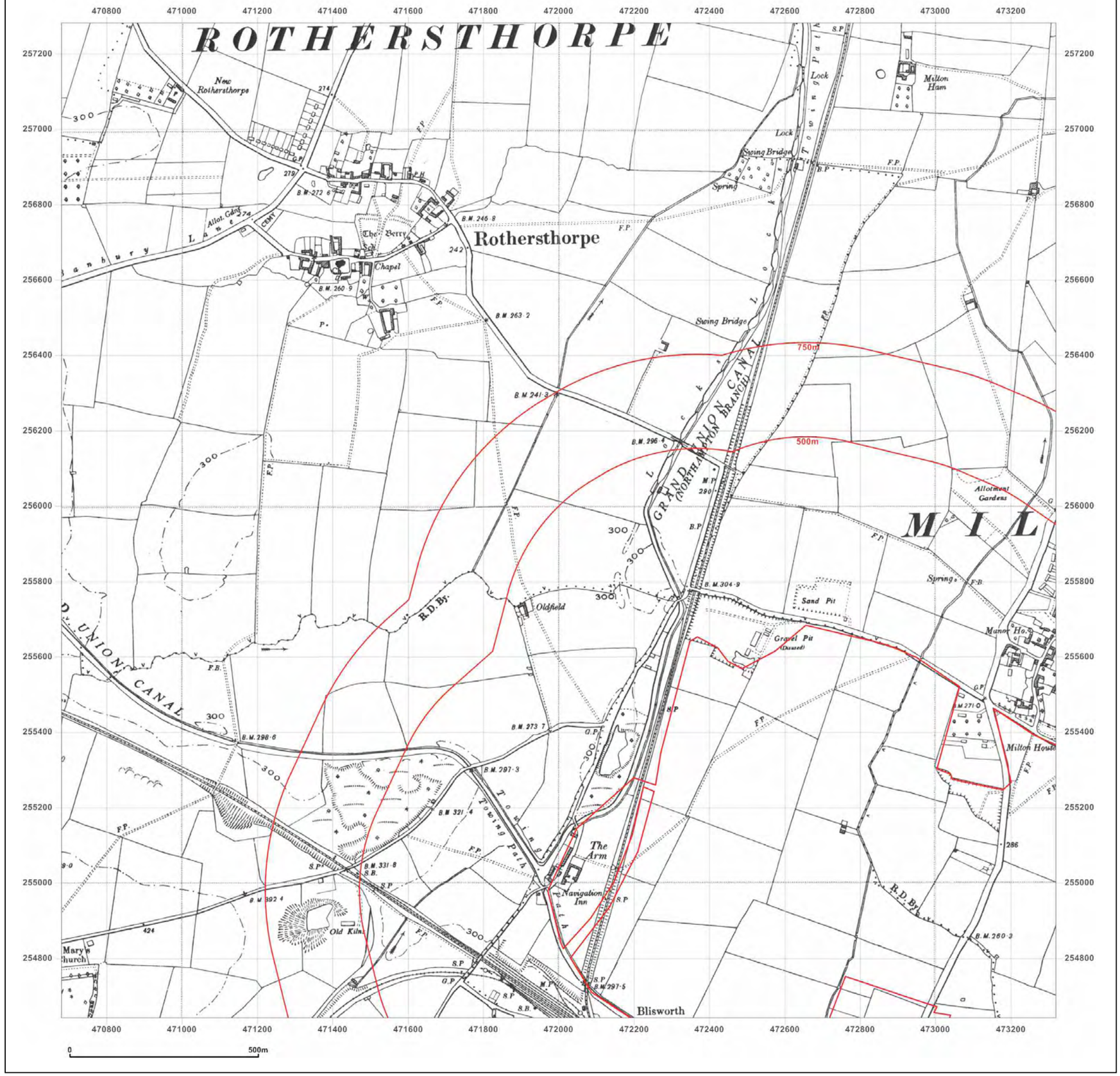

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_1_2
Grid Ref: 471999, 255961

Map Name: County Series

Map date: **1950**

Scale: 1:10,560

Printed at: 1:10,560

N
W E
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Surveyed 1883
Revised 1950
Edition N/A
Copyright N/A
Levelled N/A

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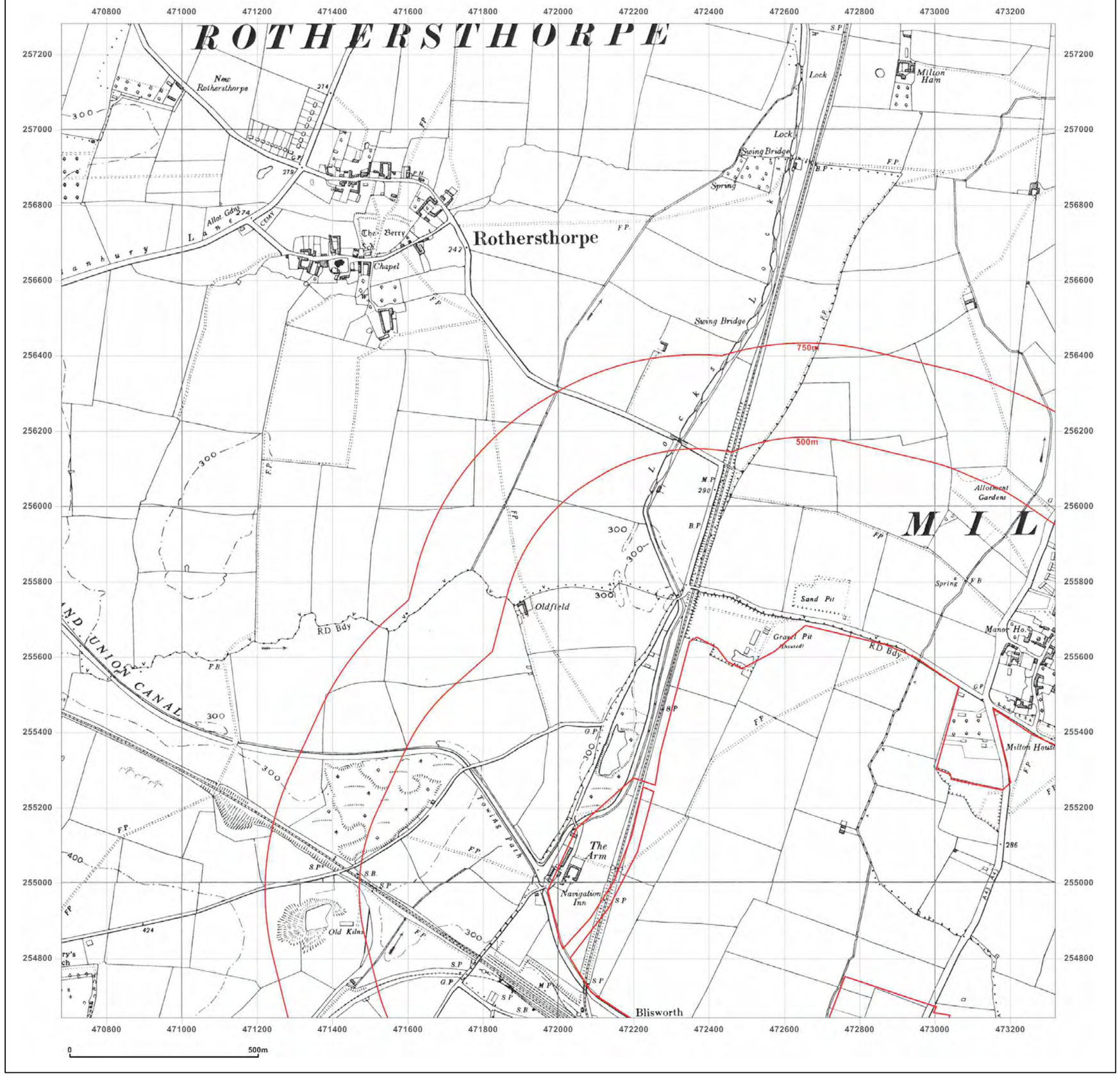

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_1_2
Grid Ref: 471999, 255961

Map Name: Provisional
Map date: **1957-1958**
Scale: 1:10,560
Printed at: 1:10,560

N
W E
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Surveyed 1950
Revised 1950
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised 1957
Edition N/A
Copyright 1958
Levelled N/A

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Production date: 25 March 2015

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_1_2
Grid Ref: 471999, 255961

Map Name: Provisional

Map date: **1964**

Scale: 1:10,560

Printed at: 1:10,560

N
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Surveyed 1950
Revised 1950
Edition N/A
Copyright N/A
Levelled N/A



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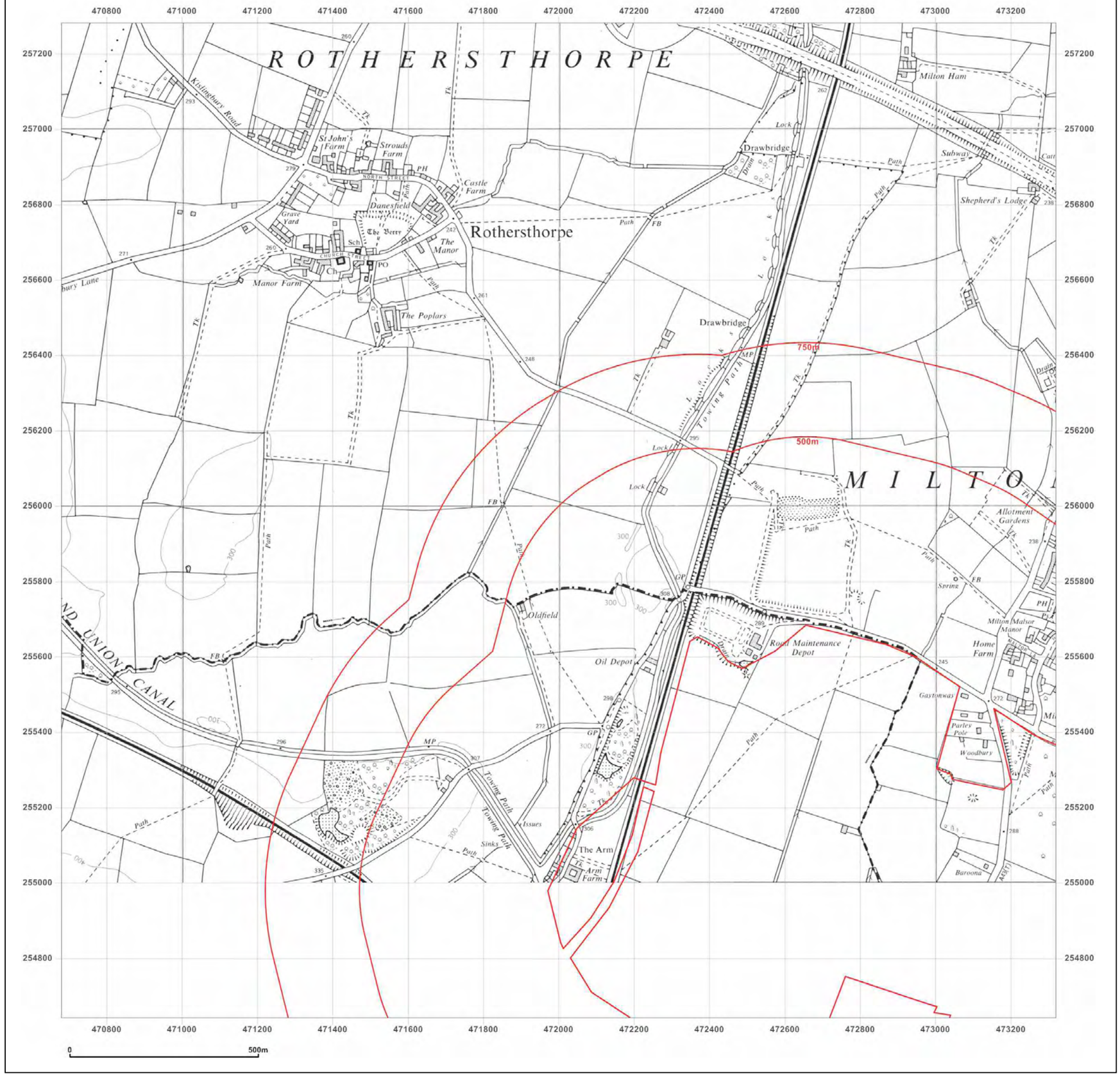

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_1_2
Grid Ref: 471999, 255961

Map Name: Provisional

Map date: **1968**

Scale: 1:10,560

Printed at: 1:10,560

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

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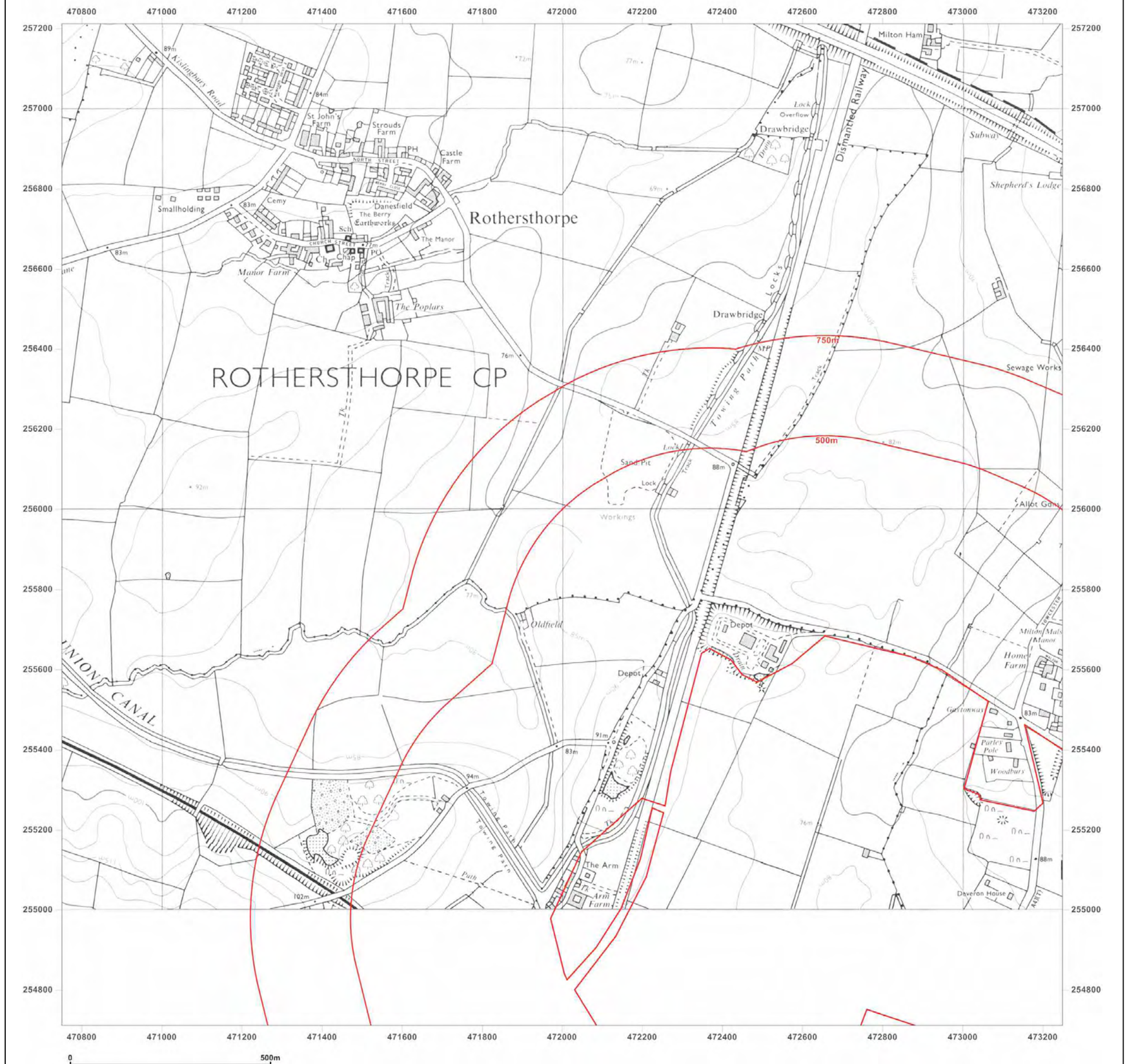

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_1_2
Grid Ref: 471999, 255961

Map Name: National Grid

Map date: **1981**

Scale: 1:10,000

Printed at: 1:10,000

N
W E
S

Surveyed 1977
Revised 1981
Edition N/A
Copyright N/A
Levelled N/A

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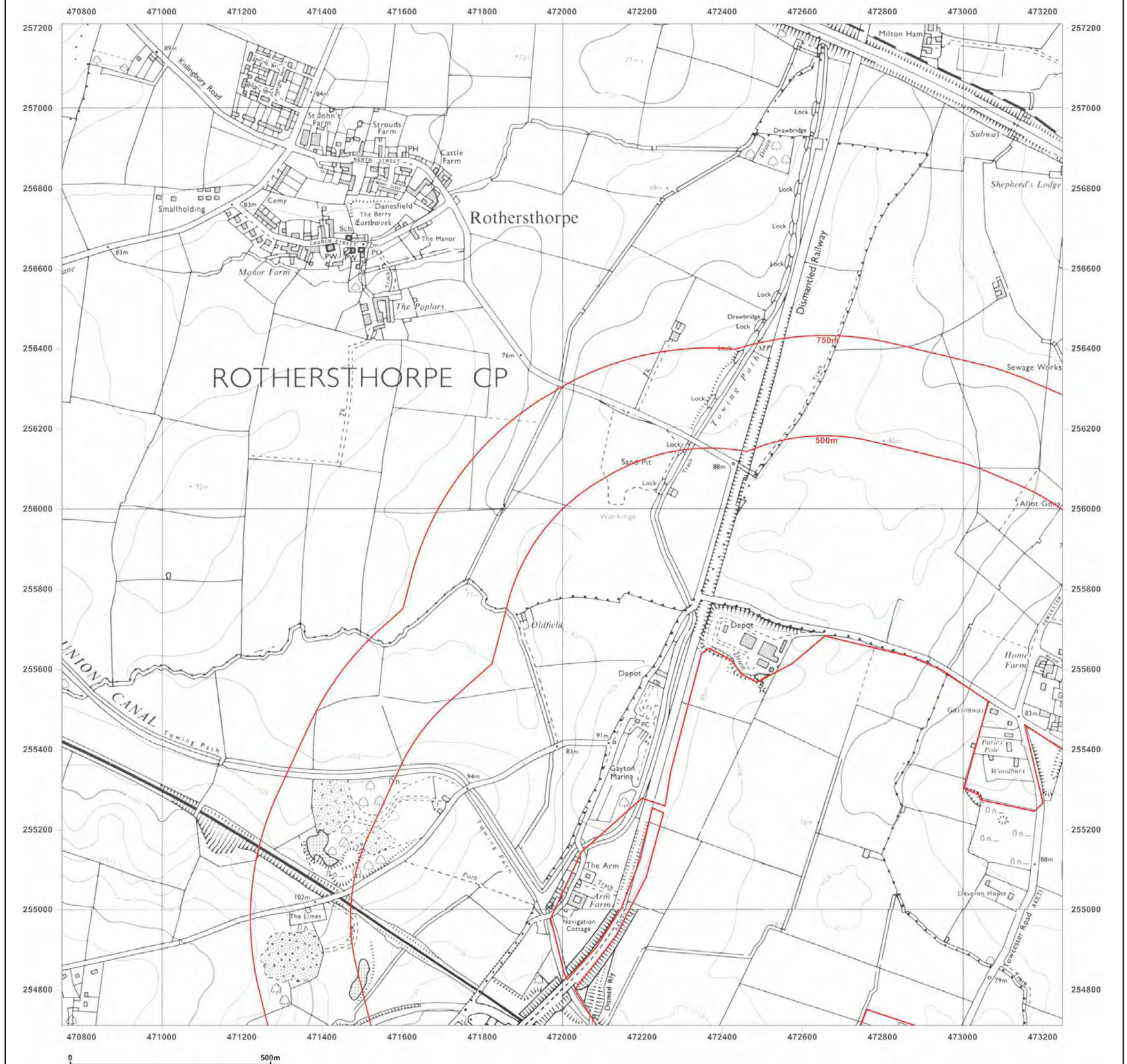

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_1_2
Grid Ref: 471999, 255961

Map Name: National Grid

Map date: **1989-1992**

Scale: 1:10,000

Printed at: 1:10,000

N
W E
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Surveyed 1988
Revised 1989
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1977
Revised 1992
Edition N/A
Copyright N/A
Levelled N/A

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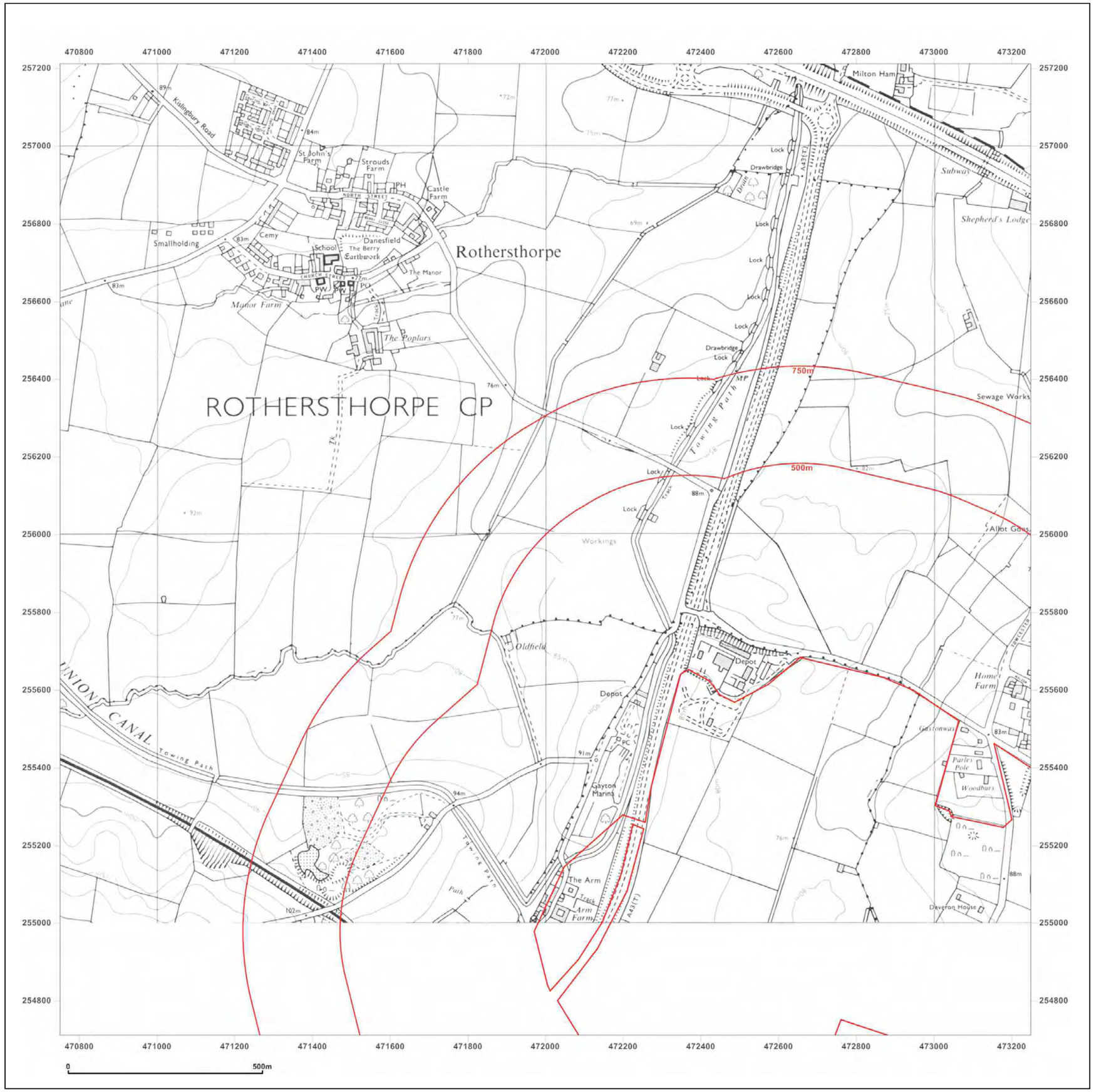

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_1_2
Grid Ref: 471999, 255961

Map Name: National Grid

Map date: **1992**

Scale: 1:10,000

Printed at: 1:10,000

N
W E
S

Surveyed 1988
Revised 1992
Edition N/A
Copyright N/A
Levelled N/A

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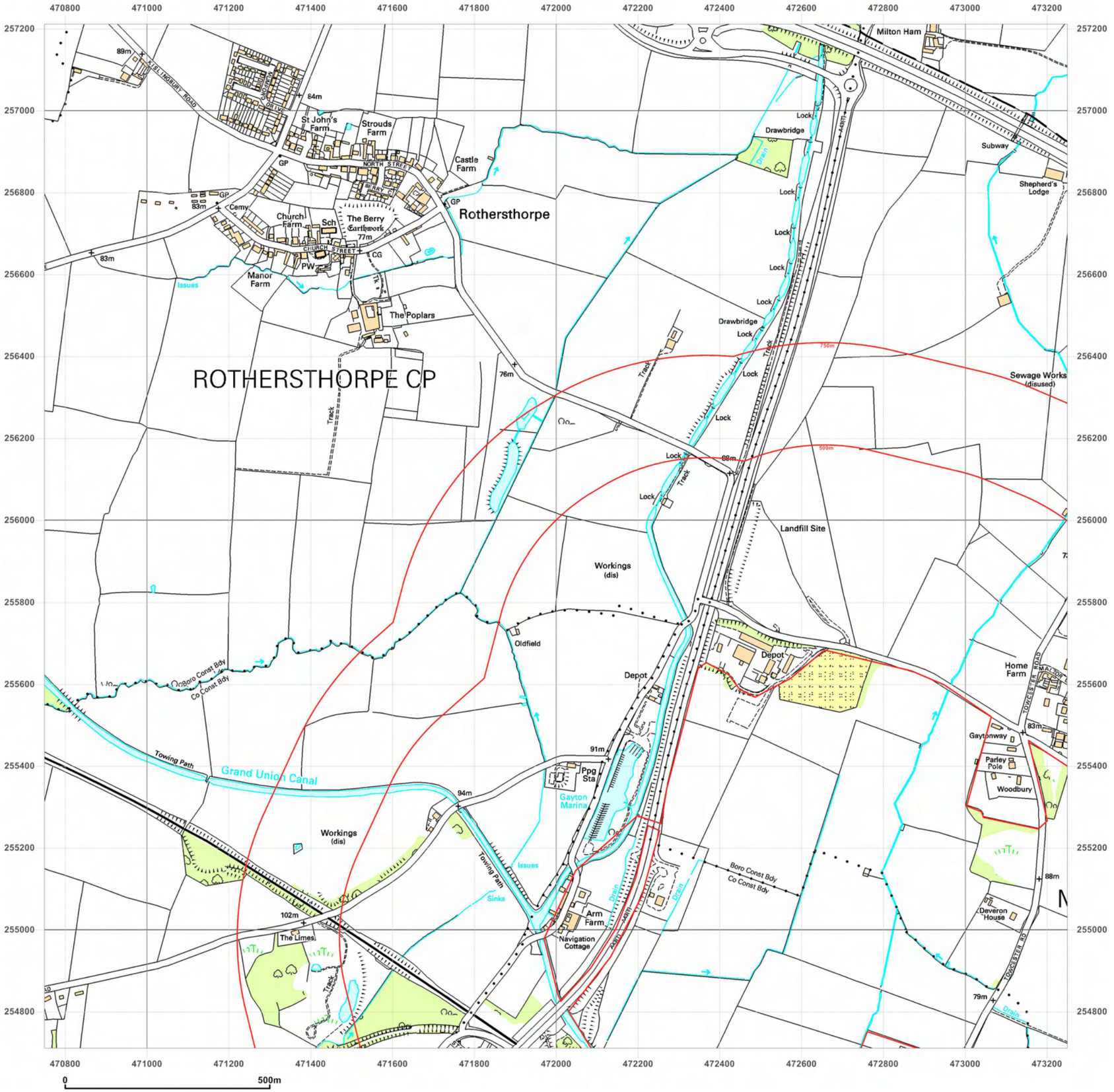

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_1_2
Grid Ref: 471999, 255961

Map Name: 1:10,000 Raster

Map date: **2002**

Scale: 1:10,000

Printed at: 1:10,000

N
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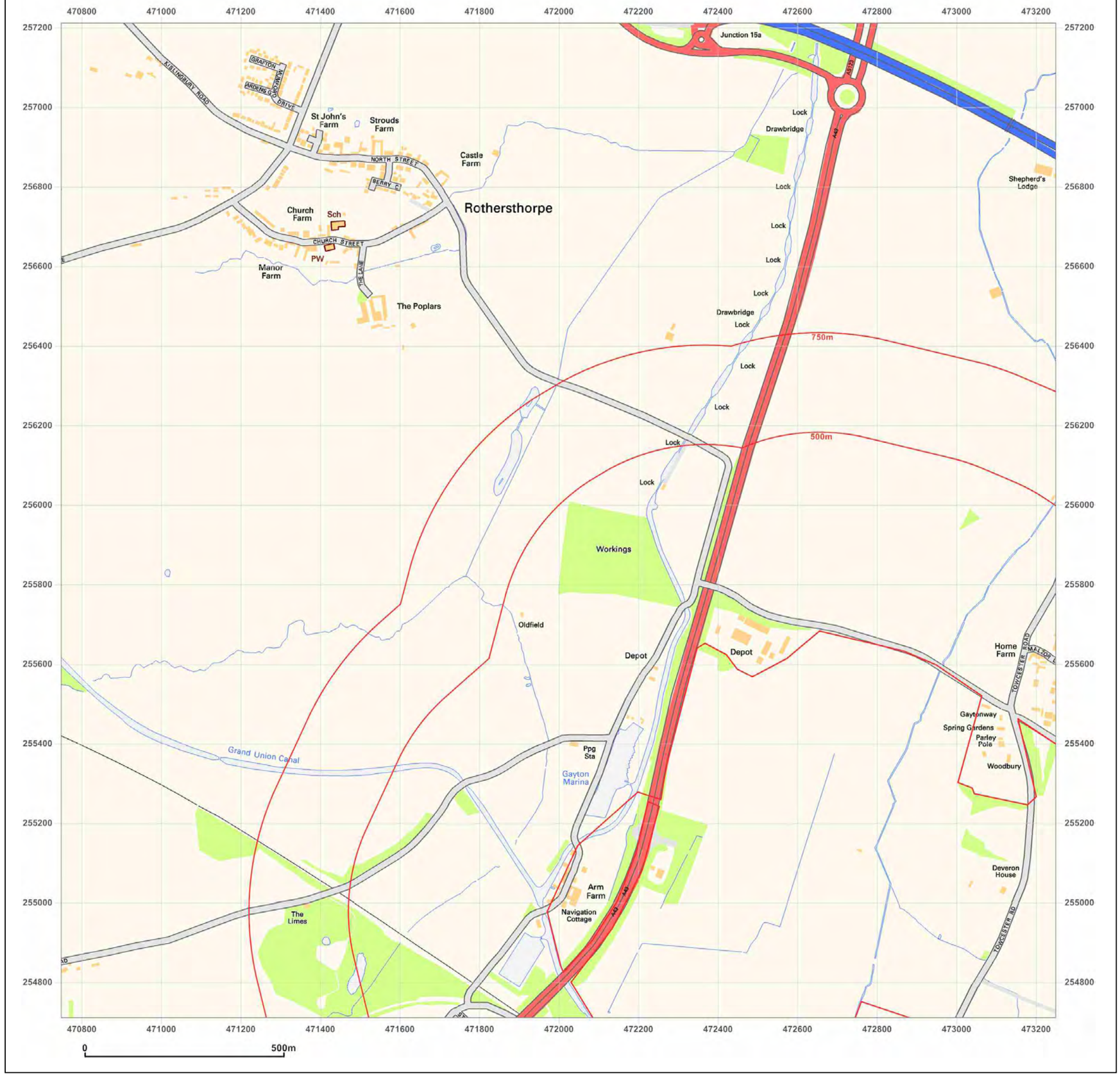

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_1_2
Grid Ref: 471999, 255961

Map Name: National Grid

Map date: **2010**

Scale: 1:10,000

Printed at: 1:10,000

N
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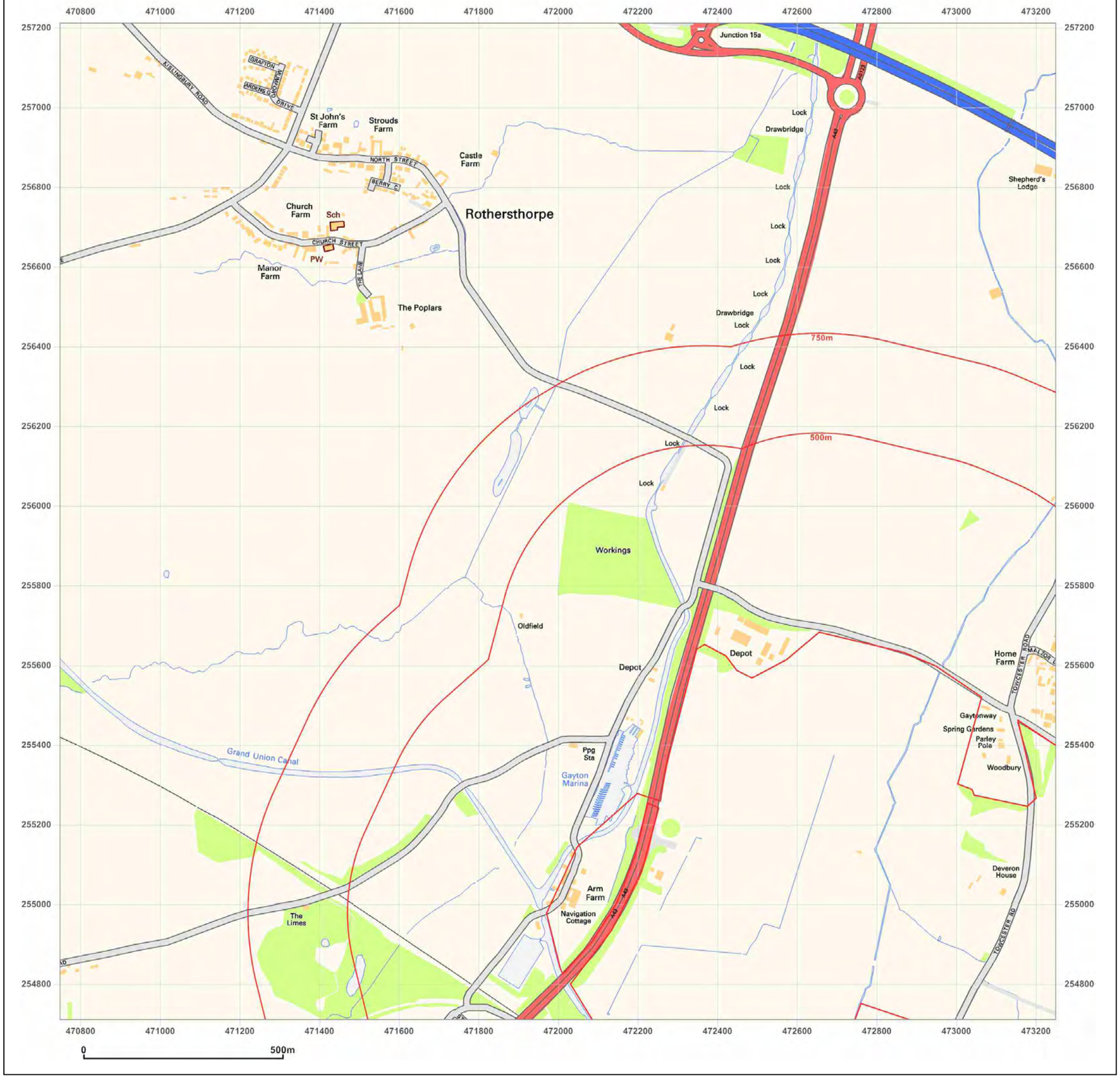

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_1_2
Grid Ref: 471999, 255961

Map Name: National Grid

Map date: **2014**

Scale: 1:10,000

Printed at: 1:10,000

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_1_1
Grid Ref: 471999, 253550

Map Name: County Series

Map date: **1883-1884**

Scale: 1:10,560

Printed at: 1:10,560

N
W E
S

Surveyed 1883
Revised N/A
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1883
Revised 1883
Edition N/A
Copyright N/A
Levelled N/A

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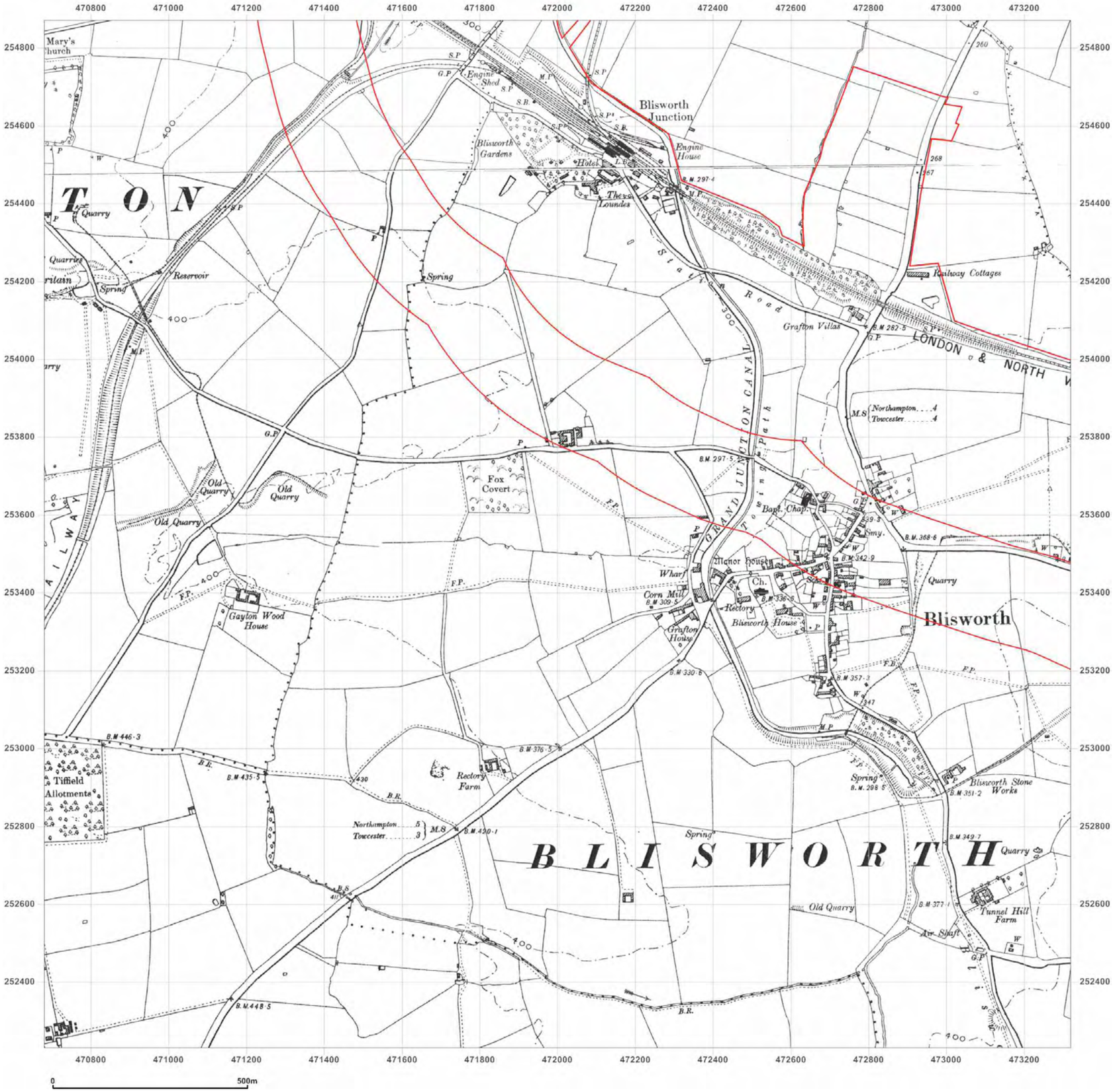

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_1_1
Grid Ref: 471999, 253550

Map Name: County Series

Map date: **1899-1900**

Scale: 1:10,560

Printed at: 1:10,560

N
W E
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Surveyed 1883
Revised 1900
Edition 1900
Copyright N/A
Levelled N/A

Surveyed 1883
Revised 1899
Edition N/A
Copyright N/A
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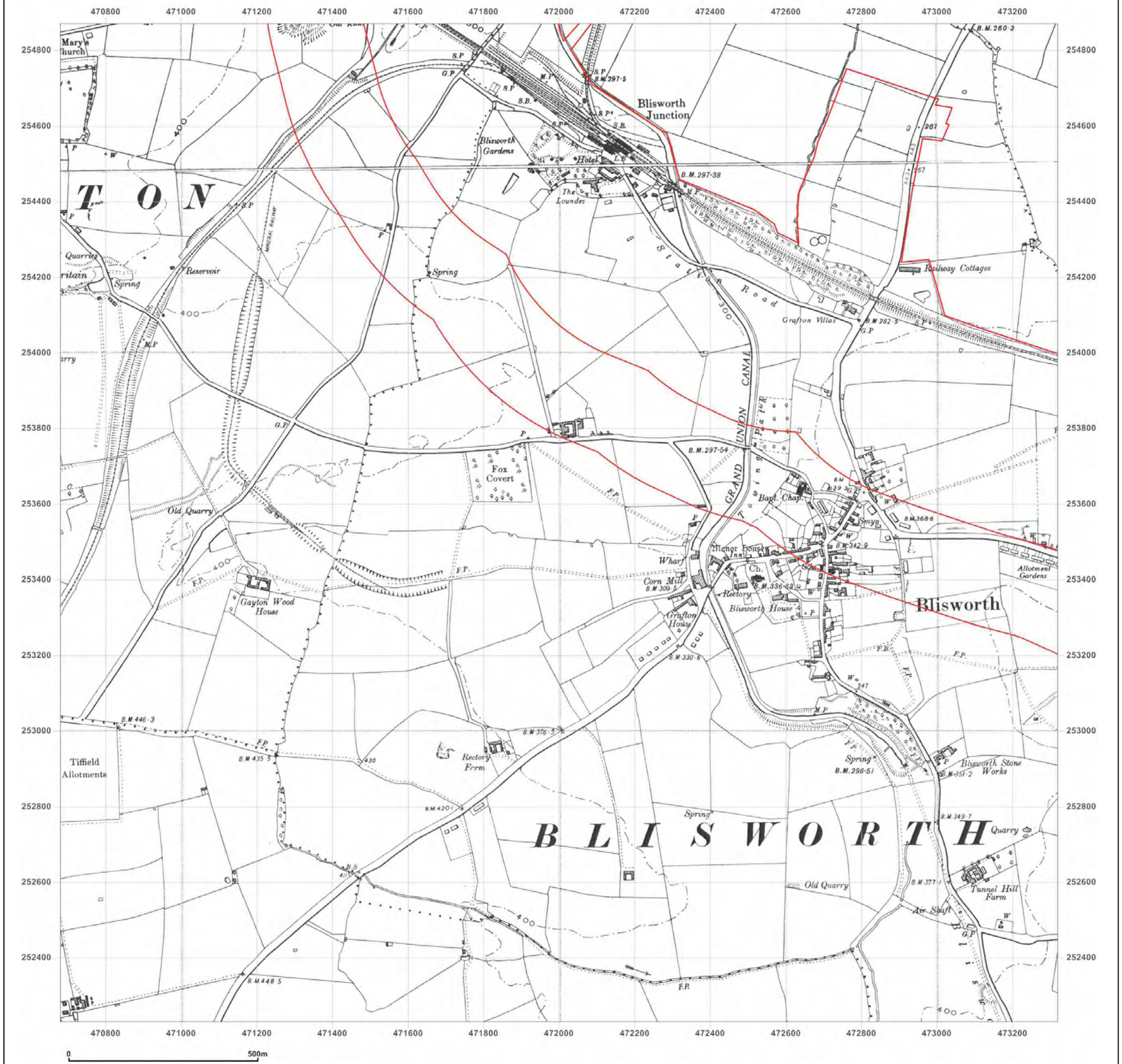

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_1_1
Grid Ref: 471999, 253550

Map Name: County Series

Map date: **1950**

Scale: 1:10,560

Printed at: 1:10,560

N
W E
S

Surveyed 1883
Revised 1950
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1883
Revised 1950
Edition N/A
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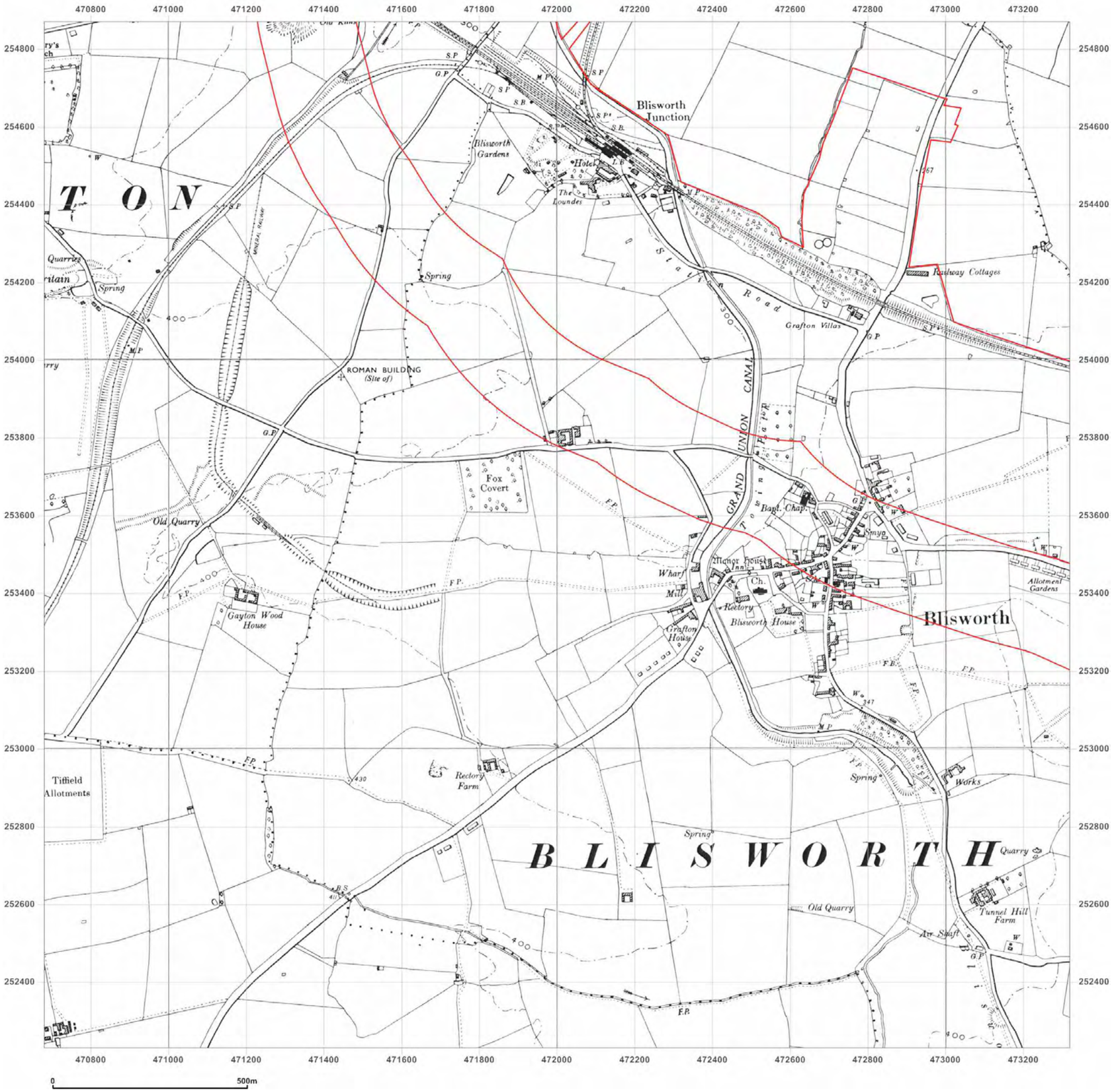

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_1_1
Grid Ref: 471999, 253550

Map Name: Provisional

Map date: **1958**

Scale: 1:10,560

Printed at: 1:10,560

N
W E
S

Surveyed N/A
Revised 1957
Edition N/A
Copyright 1958
Levelled N/A

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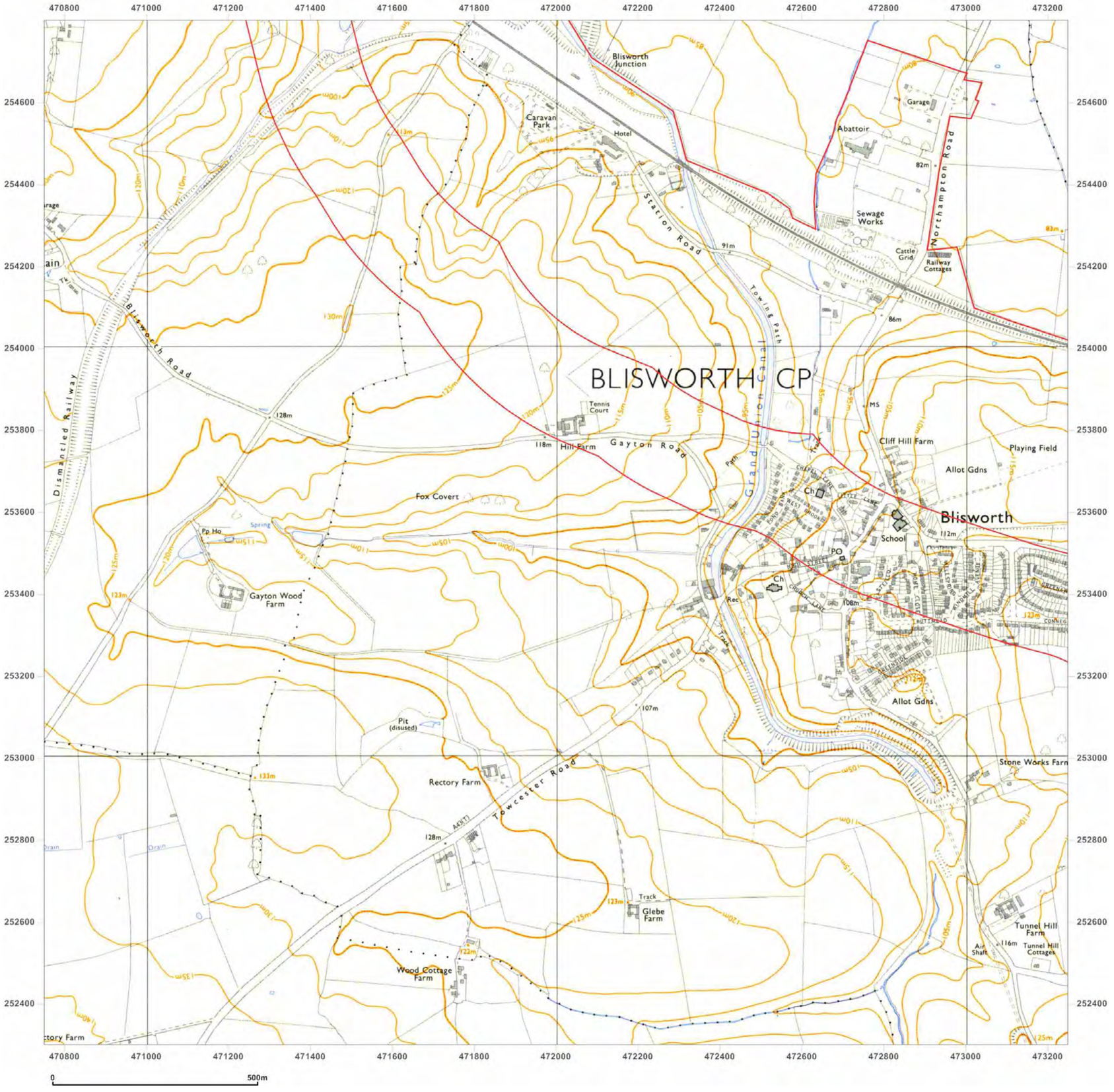

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_1_1
Grid Ref: 471999, 253550

Map Name: National Grid

Map date: **1980**

Scale: 1:10,000

Printed at: 1:10,000

N
W E
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Surveyed 1976
Revised 1980
Edition N/A
Copyright N/A
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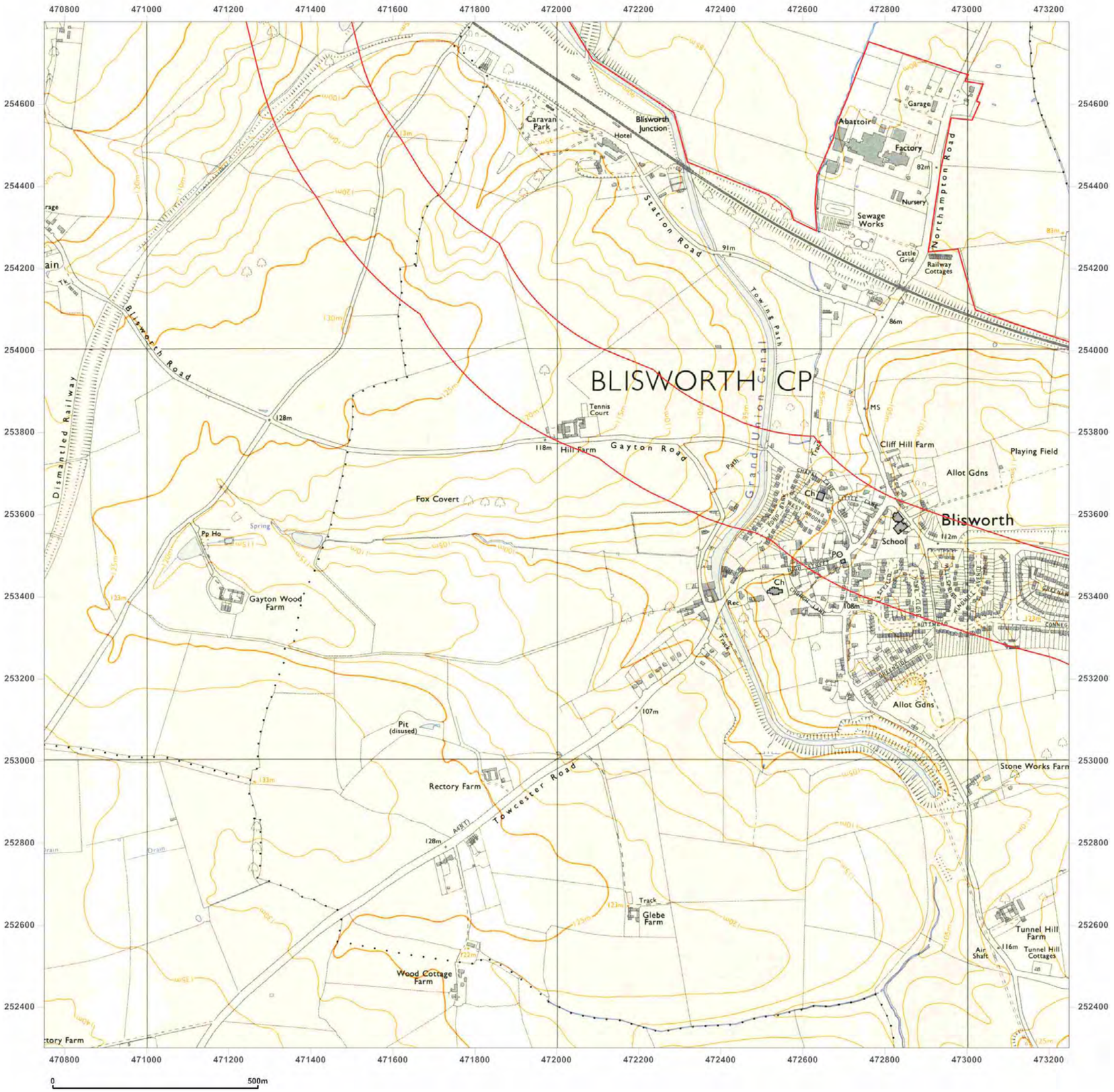

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_1_1
Grid Ref: 471999, 253550

Map Name: National Grid

Map date: **1988**

Scale: 1:10,000

Printed at: 1:10,000

N
W E
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Surveyed 1975
Revised 1988
Edition N/A
Copyright N/A
Levelled N/A

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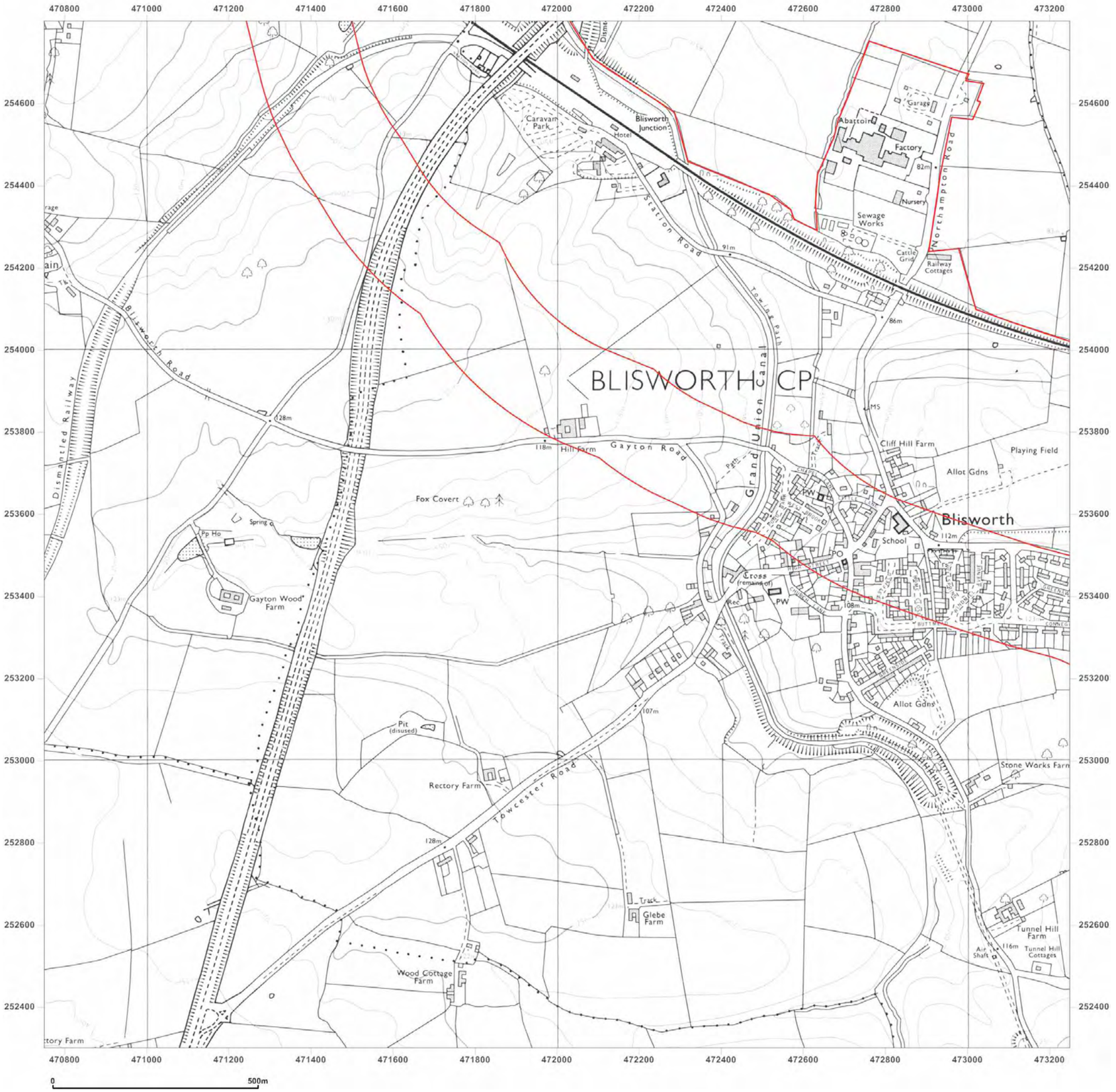

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_1_1
Grid Ref: 471999, 253550

Map Name: National Grid

Map date: **1992**

Scale: 1:10,000

Printed at: 1:10,000

N
W E
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Surveyed 1977
Revised 1992
Edition N/A
Copyright N/A
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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_1_1
Grid Ref: 471999, 253550

Map Name: 1:10,000 Raster

Map date: **2002**

Scale: 1:10,000

Printed at: 1:10,000

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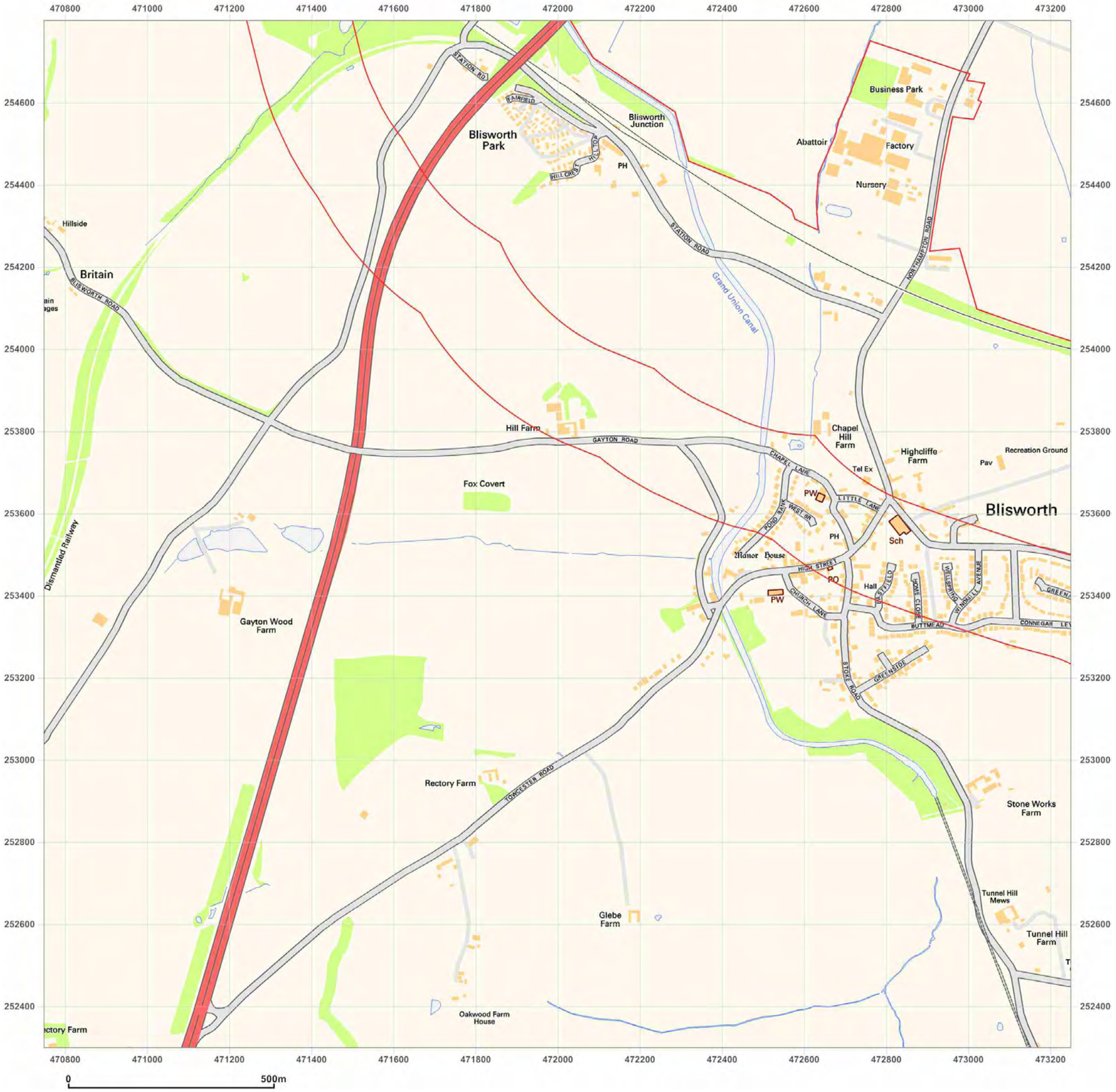

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_1_1
Grid Ref: 471999, 253550

Map Name: National Grid

Map date: **2010**

Scale: 1:10,000

Printed at: 1:10,000

N
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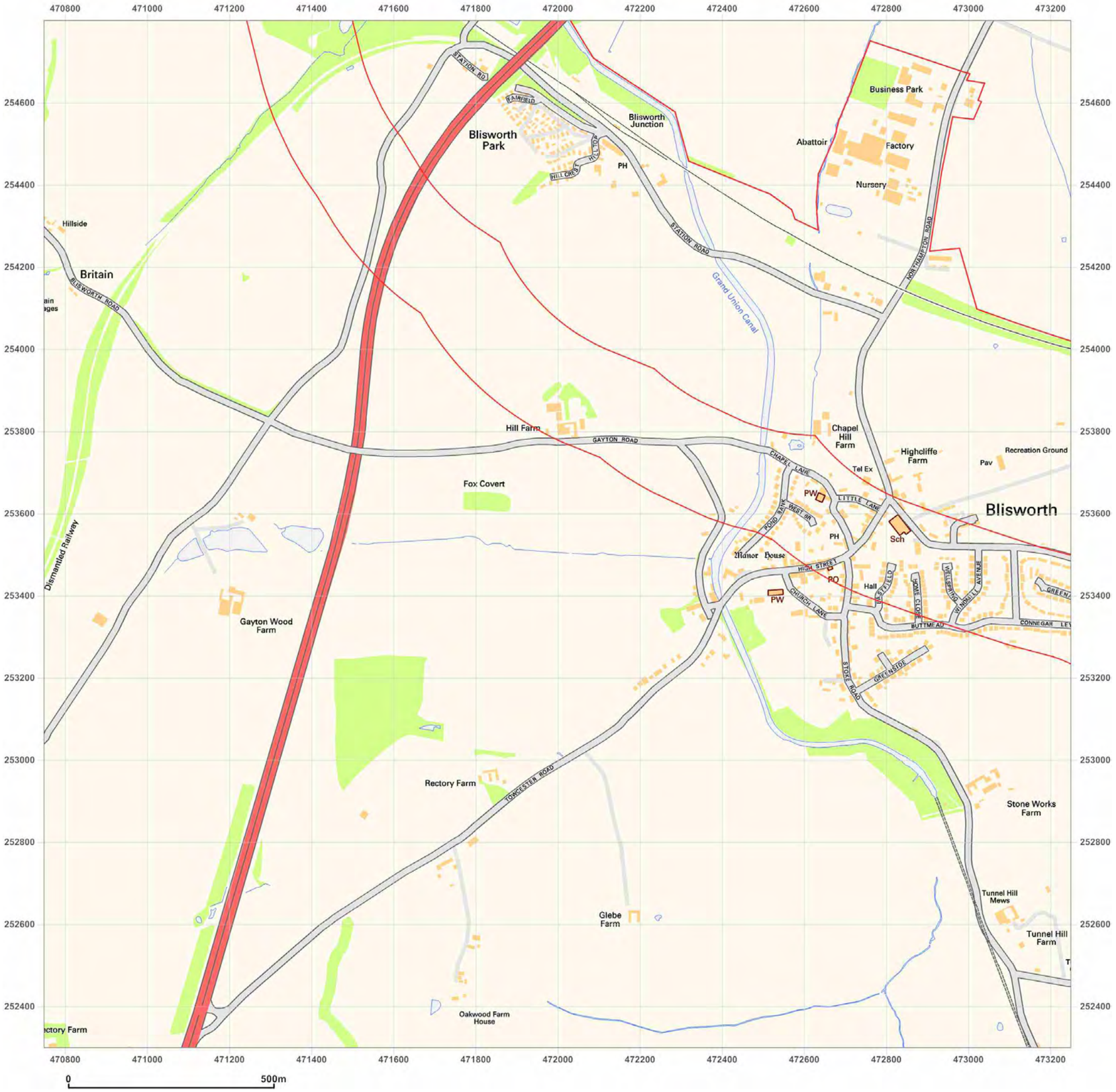

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_SS_1_1
Grid Ref: 471999, 253550

Map Name: National Grid

Map date: **2014**

Scale: 1:10,000

Printed at: 1:10,000

N
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Production date: 25 March 2015

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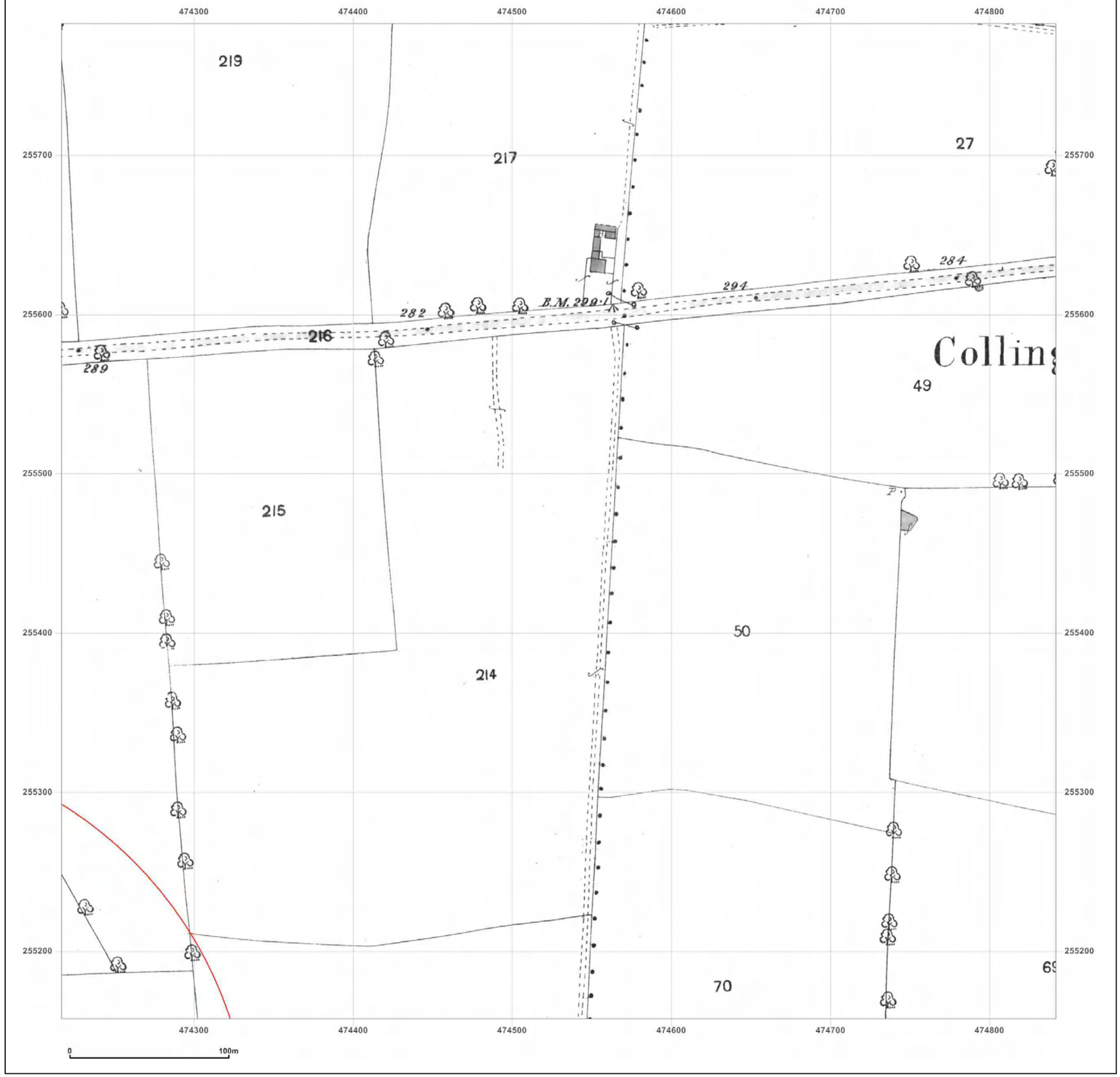

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_6_5
Grid Ref: 474529, 255470

Map Name: County Series

Map date: **1885**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1885
Revised 1885
Edition N/A
Copyright N/A
Levelled N/A

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Production date: 25 March 2015

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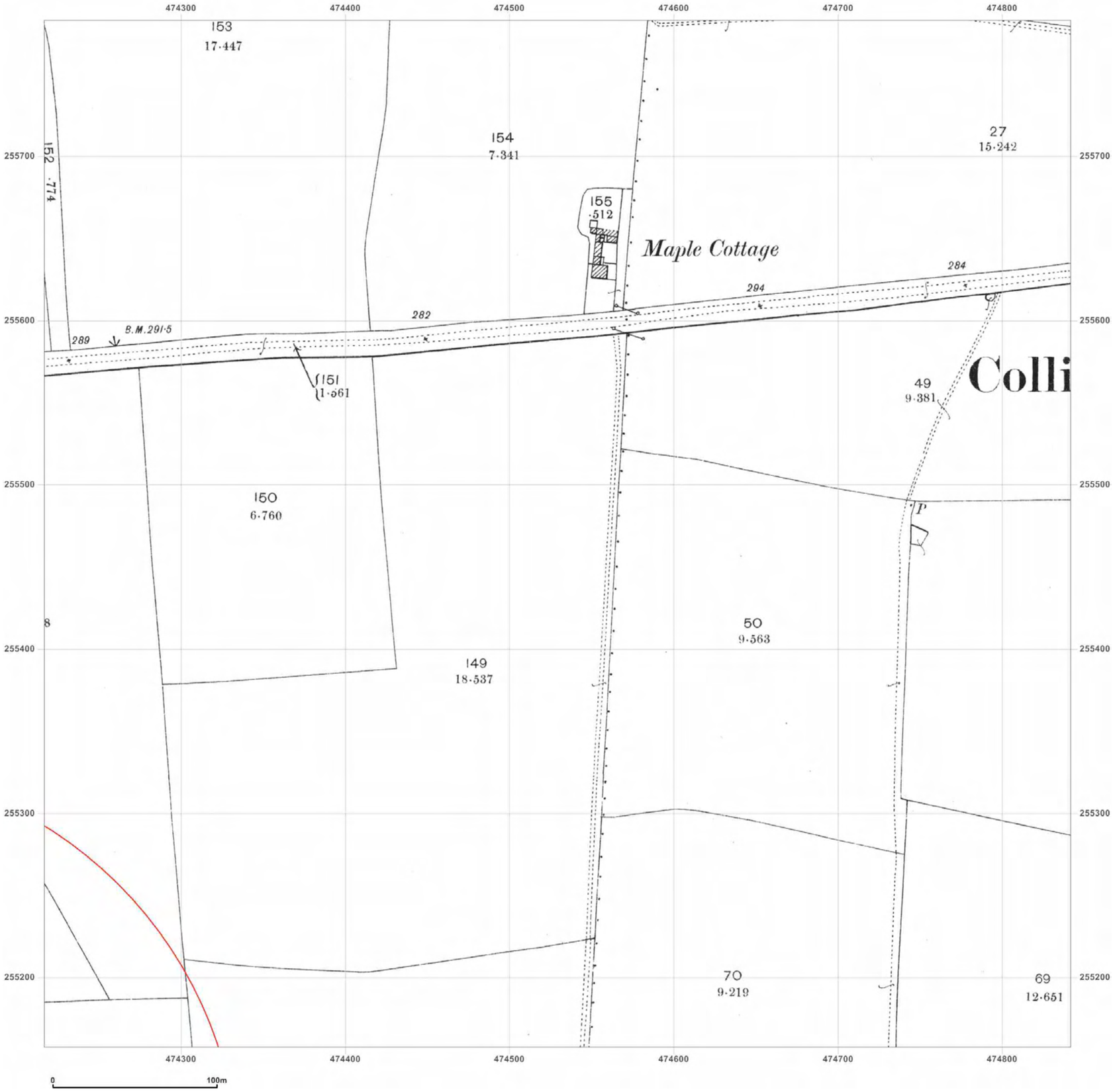

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_6_5
Grid Ref: 474529, 255470

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1900
Revised 1900
Edition N/A
Copyright N/A
Levelled N/A

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Production date: 25 March 2015

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_6_5
Grid Ref: 474529, 255470

Map Name: National Grid

Map date: **1964**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1964
Revised 1964
Edition N/A
Copyright 1965
Levelled 1961

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Production date: 25 March 2015

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Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_6_5
Grid Ref: 474529, 255470

Map Name: National Grid

Map date: **1975**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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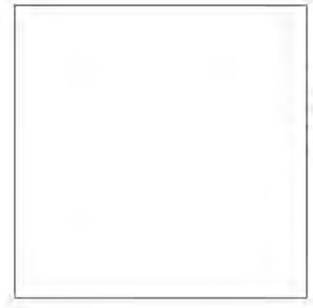

Surveyed 1975
Revised 1975
Edition N/A.
Copyright 1977
Levelled 1961

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Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_6_5
Grid Ref: 474529, 255470

Map Name: National Grid

Map date: **1993**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1993
Revised 1993
Edition N/A
Copyright N/A
Levelled N/A

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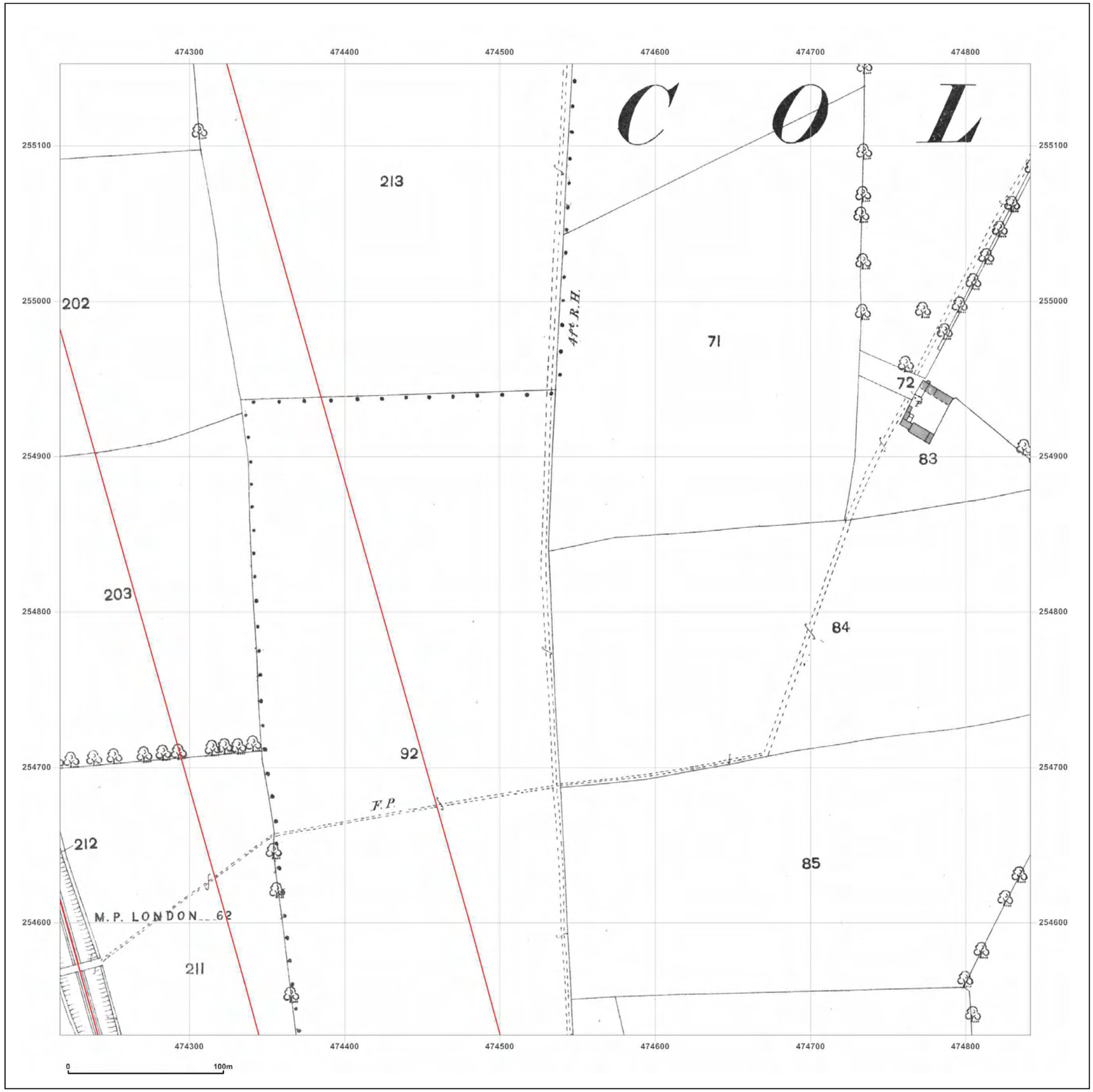

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_6_4
Grid Ref: 474529, 254840

Map Name: County Series

Map date: **1885**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1885
Revised 1885
Edition N/A
Copyright N/A
Levelled N/A

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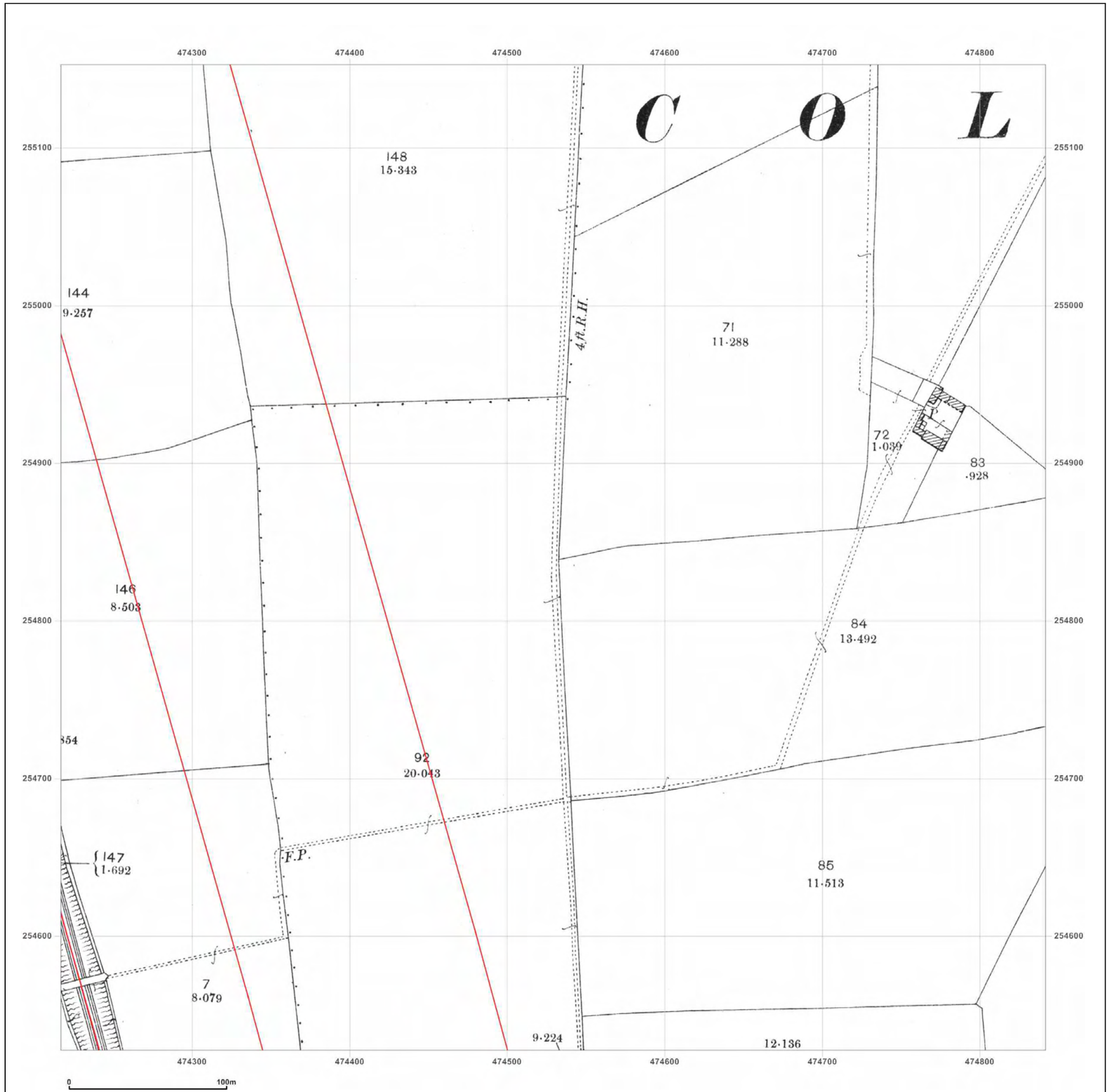

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_6_4
Grid Ref: 474529, 254840

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1900
Revised 1900
Edition N/A
Copyright N/A
Levelled N/A

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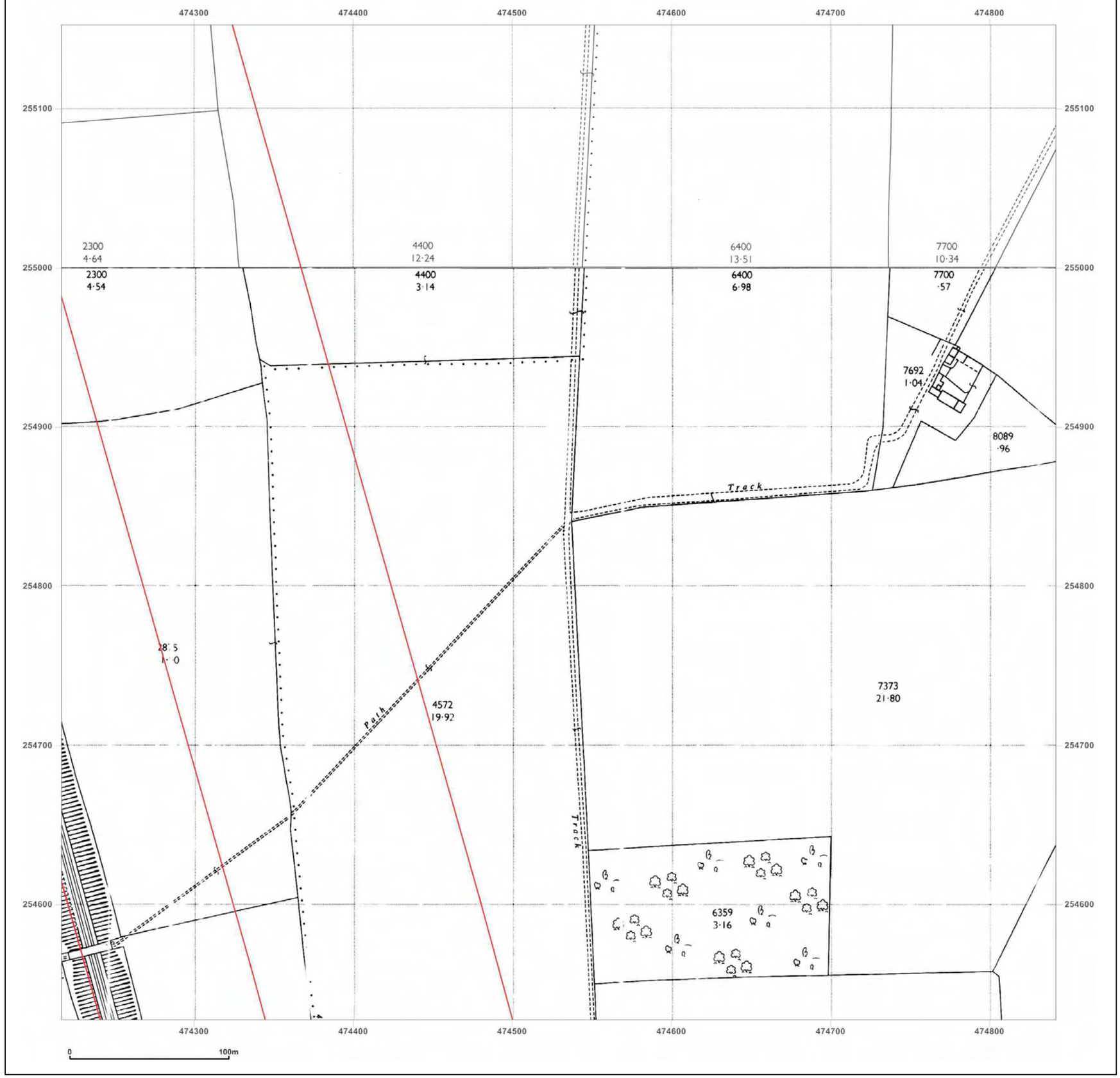

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_6_4
Grid Ref: 474529, 254840

Map Name: National Grid

Map date: **1964-1966**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1964
Revised 1964
Edition N/A
Copyright 1965
Levelled 1961

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

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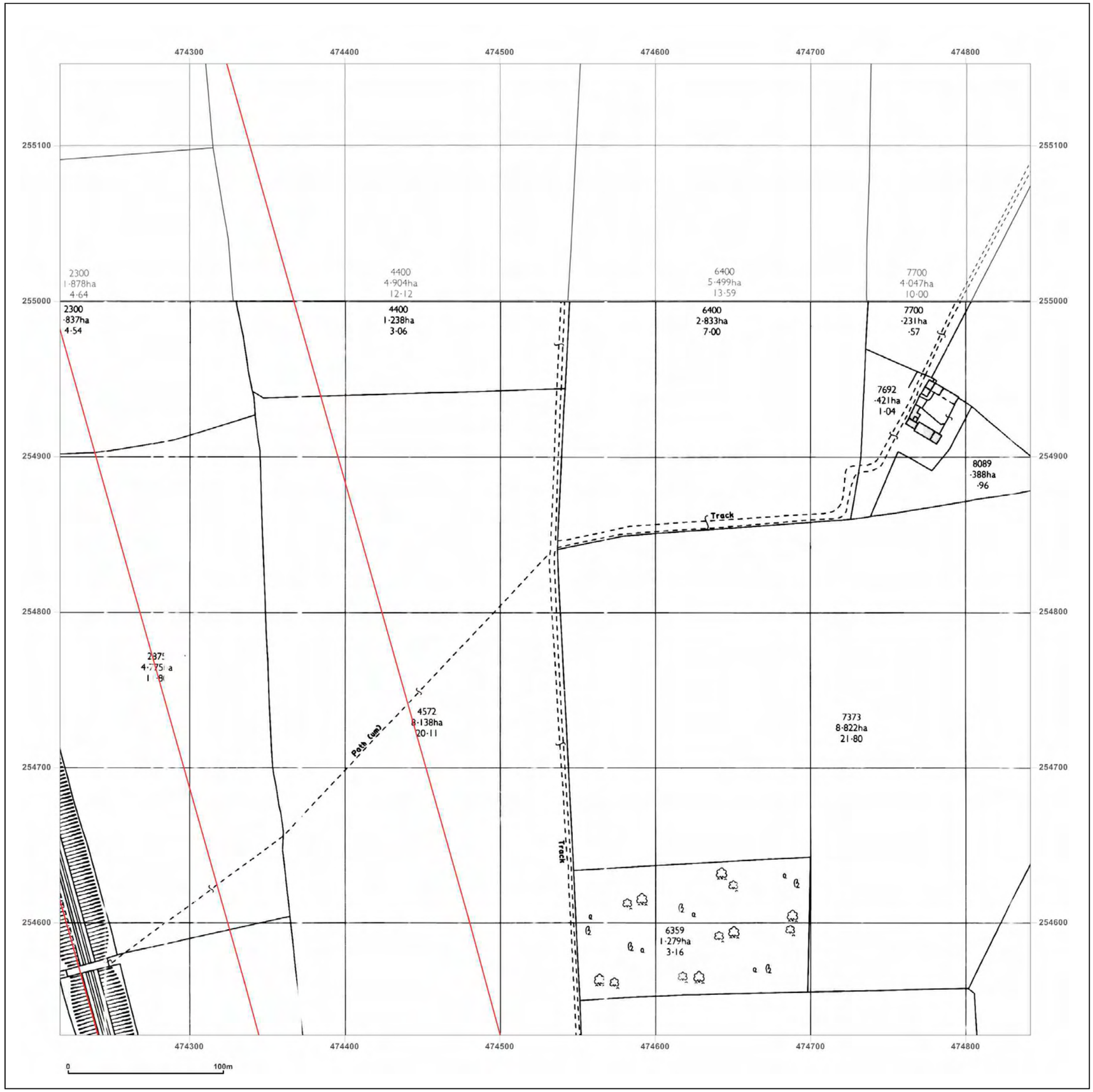

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_6_4
Grid Ref: 474529, 254840

Map Name: National Grid

Map date: **1975-1978**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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Surveyed 1975
Revised 1975
Edition N/A
Copyright 1977
Levelled 1961

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

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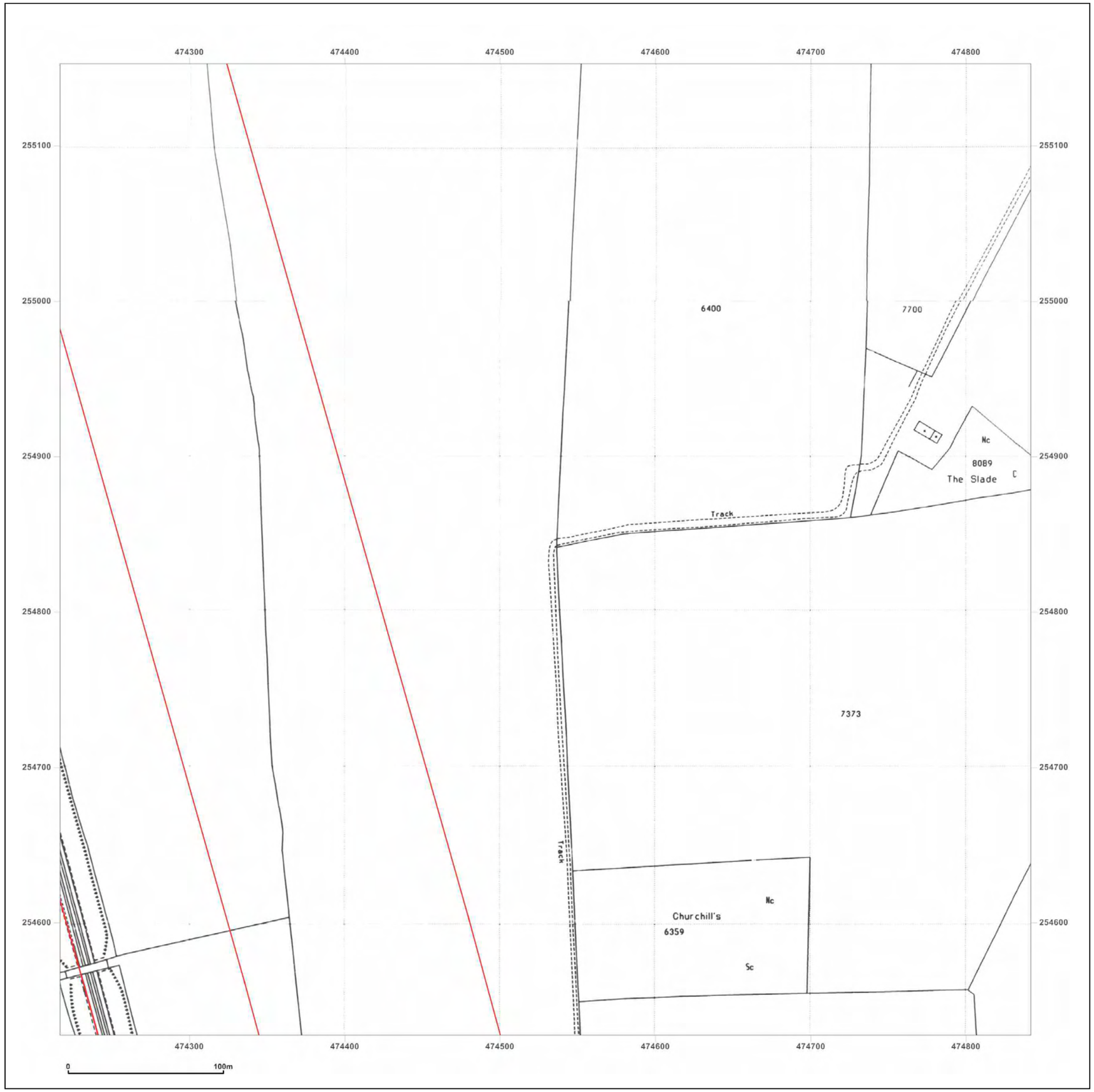

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_6_4
Grid Ref: 474529, 254840

Map Name: National Grid

Map date: **1993**

Scale: 1:2,500

Printed at: 1:2,500

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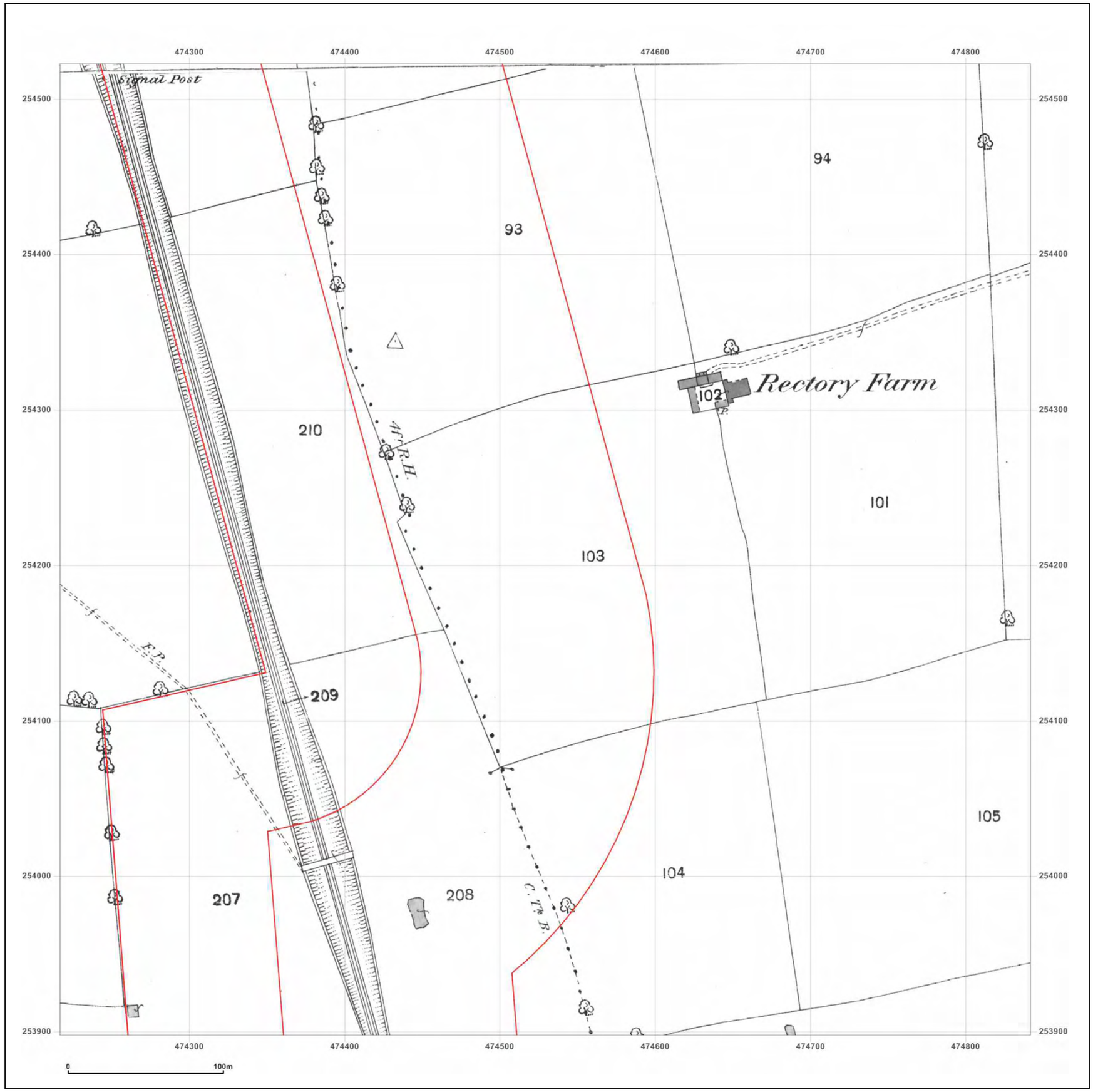

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_6_3
Grid Ref: 474529, 254210

Map Name: County Series

Map date: **1885**

Scale: 1:2,500

Printed at: 1:2,500

N
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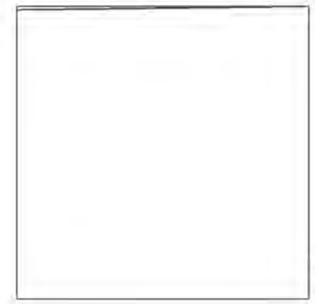
Surveyed 1885
Revised 1885
Edition N/A
Copyright N/A
Levelled N/A



Surveyed 1885
Revised 1885
Edition N/A
Copyright N/A
Levelled N/A

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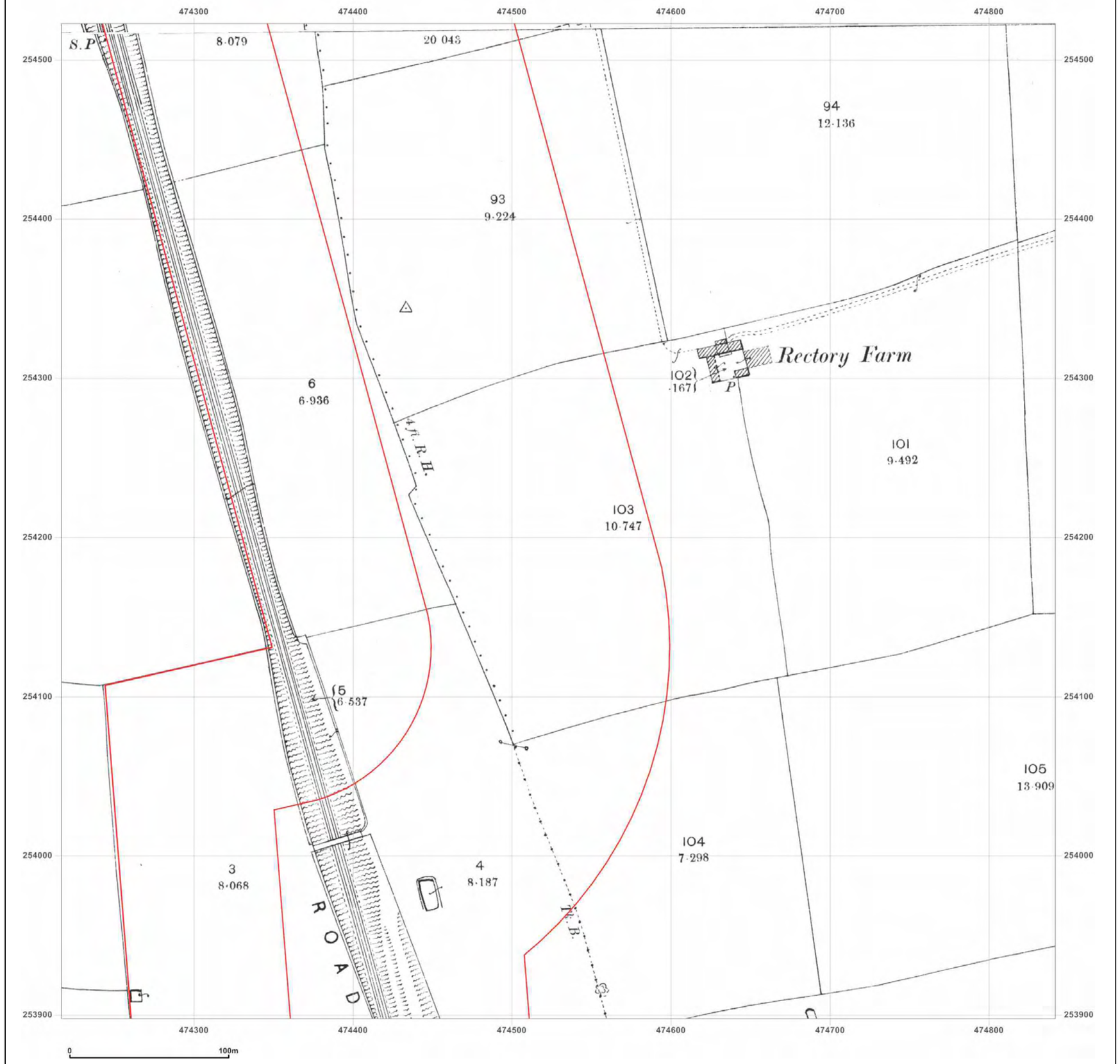

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_6_3
Grid Ref: 474529, 254210

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

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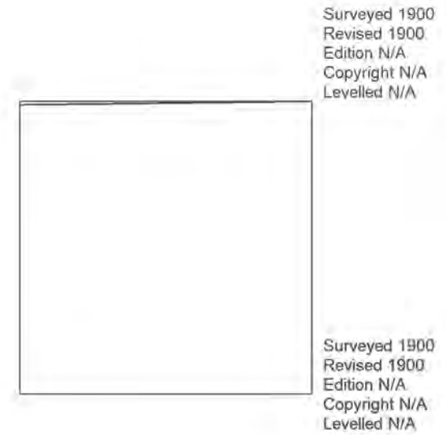

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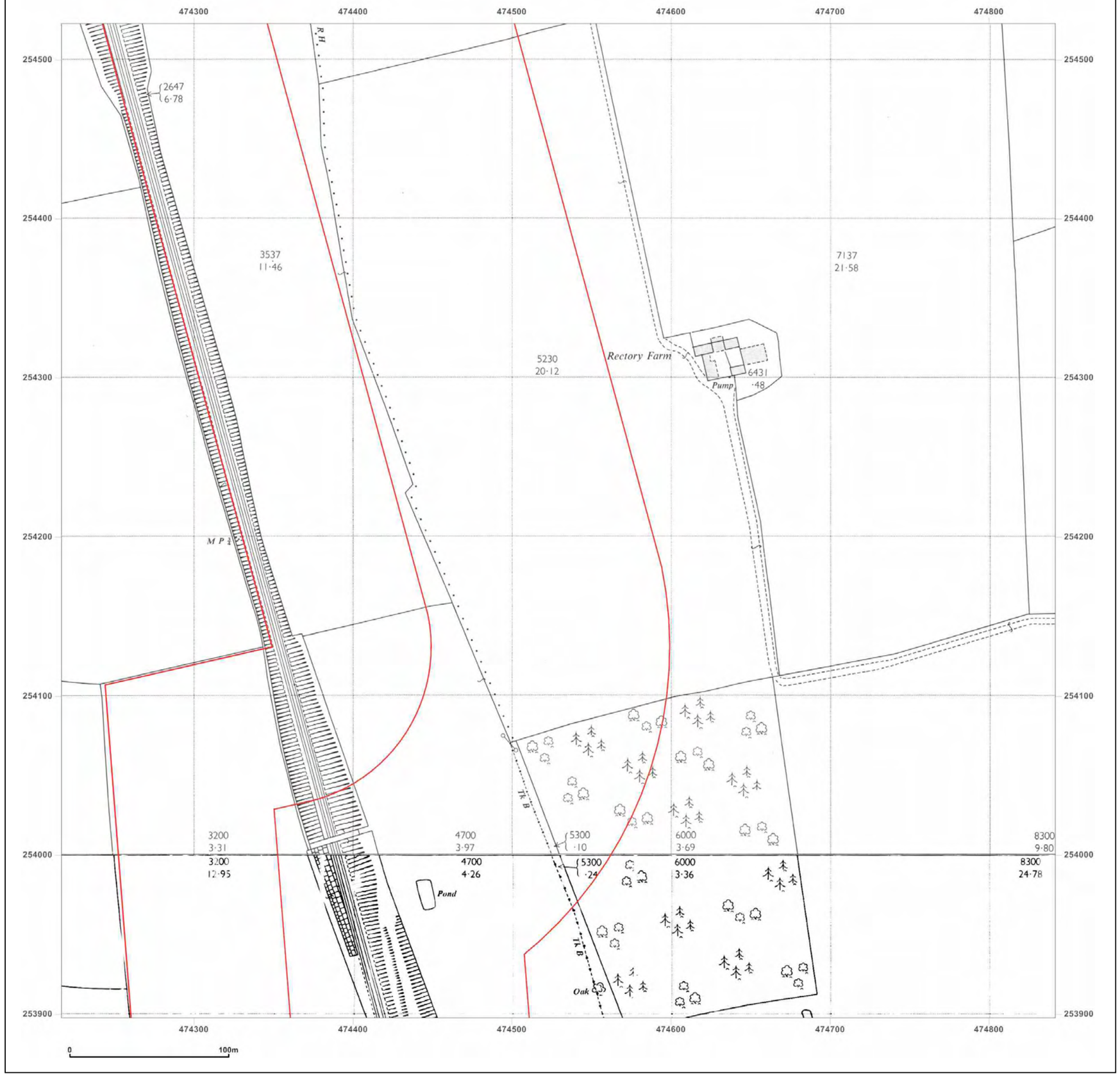

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_6_3
Grid Ref: 474529, 254210

Map Name: National Grid

Map date: **1966-1967**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1968
Revised 1966
Edition N/A
Copyright 1966
Levelled 1961

~~Surveyed N/A~~
Revised N/A
Edition N/A
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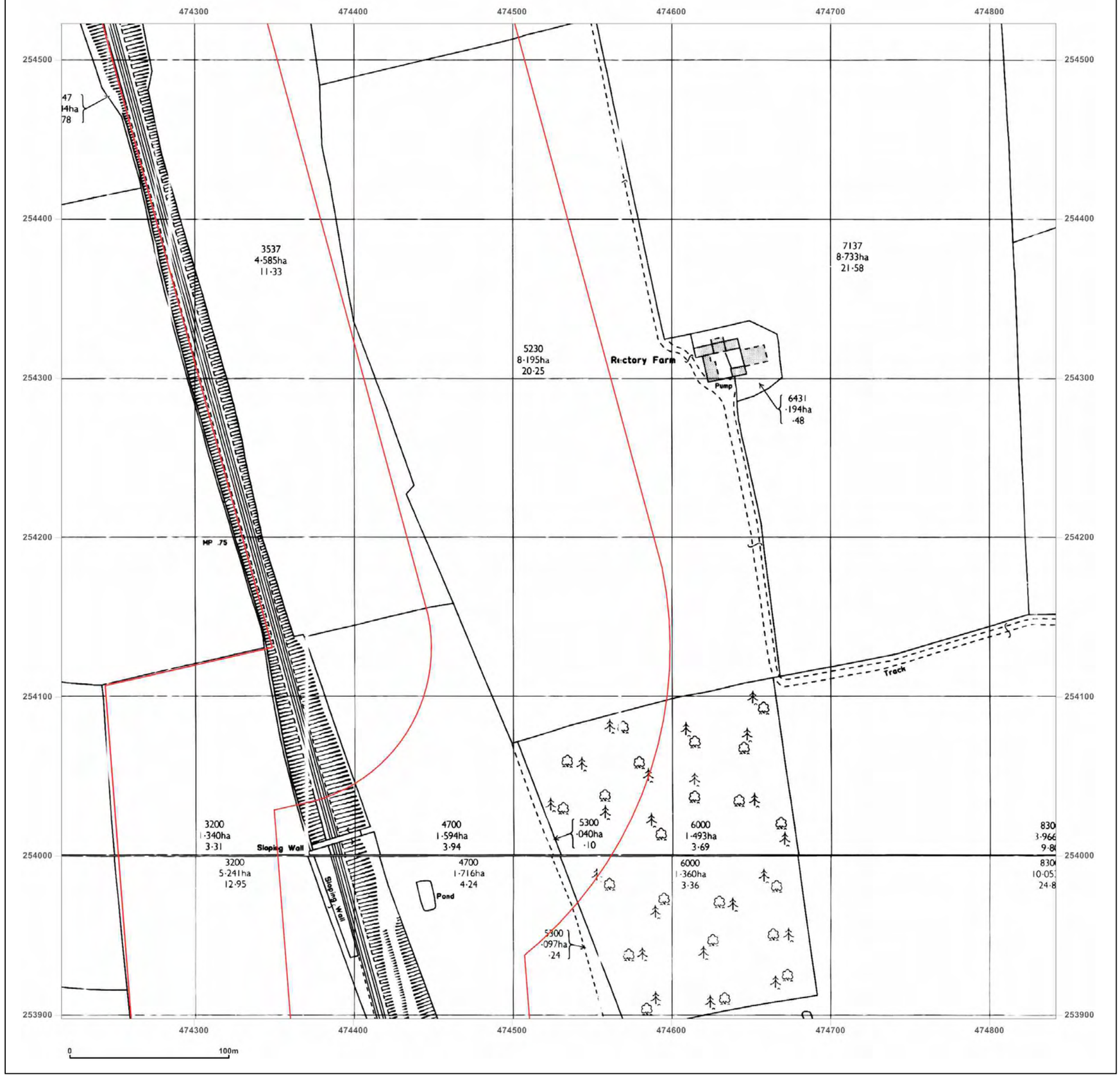

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_6_3
Grid Ref: 474529, 254210

Map Name: National Grid

Map date: **1978**

Scale: 1:2,500

Printed at: 1:2,500

N
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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 N/A
Levelled N/A

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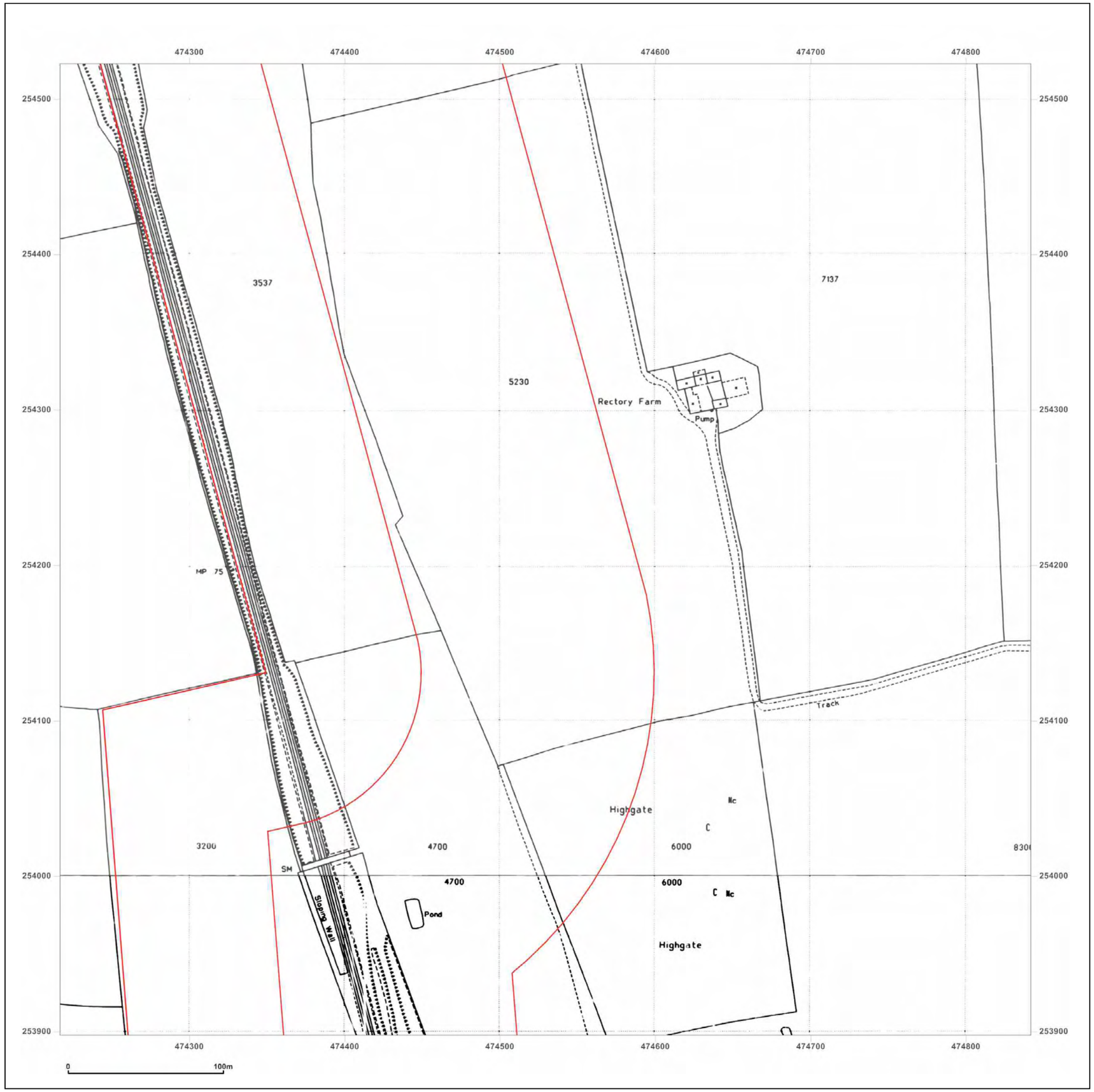

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_6_3
Grid Ref: 474529, 254210

Map Name: National Grid

Map date: **1993**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1993
Revised 1993
Edition N/A
~~Copyright N/A~~
Levelled N/A

~~Surveyed N/A~~
Revised N/A
Edition N/A
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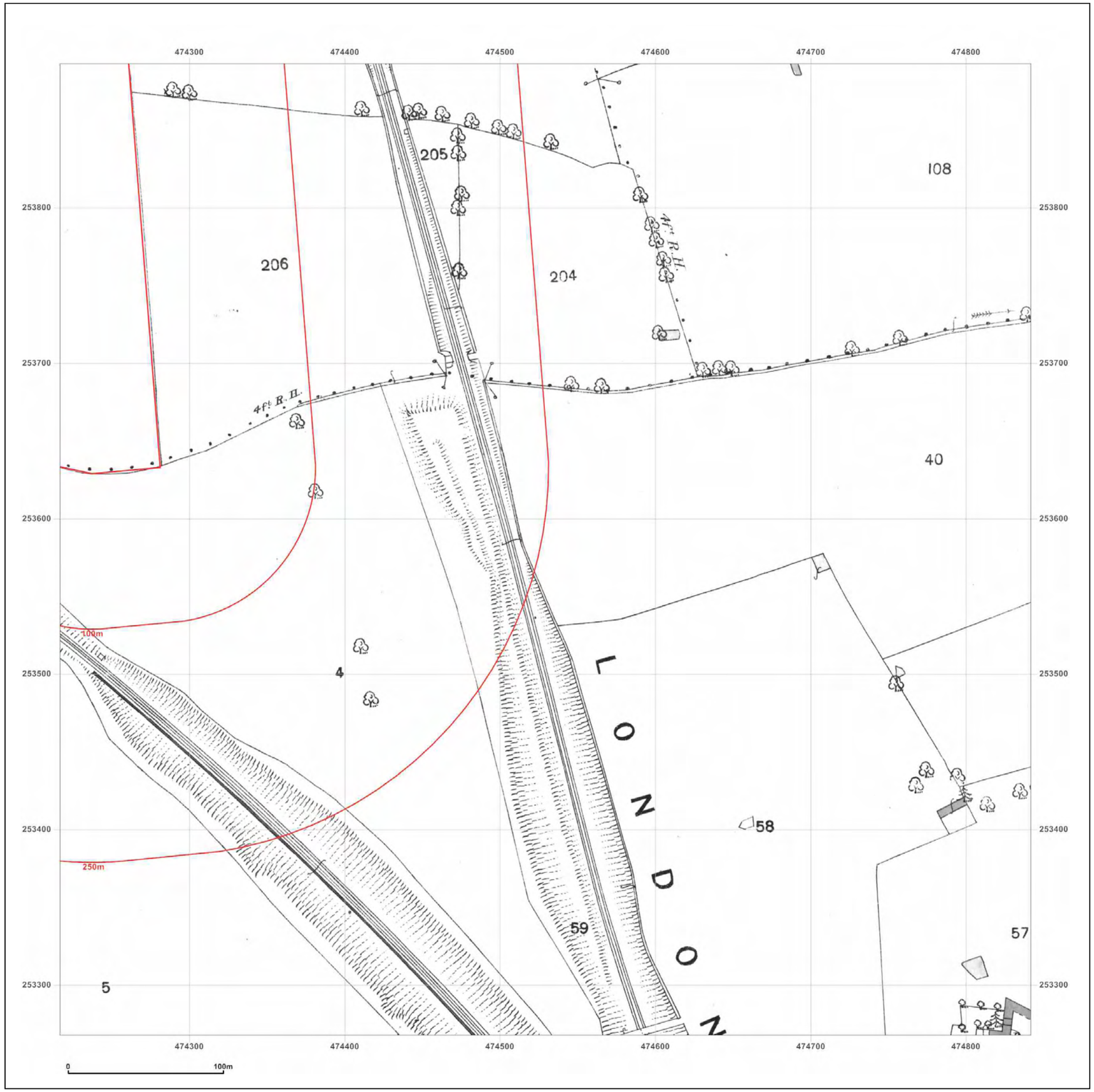

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_6_2
Grid Ref: 474529, 253580

Map Name: County Series

Map date: **1885**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1885
Revised 1885
Edition N/A
Copyright N/A
Levelled N/A

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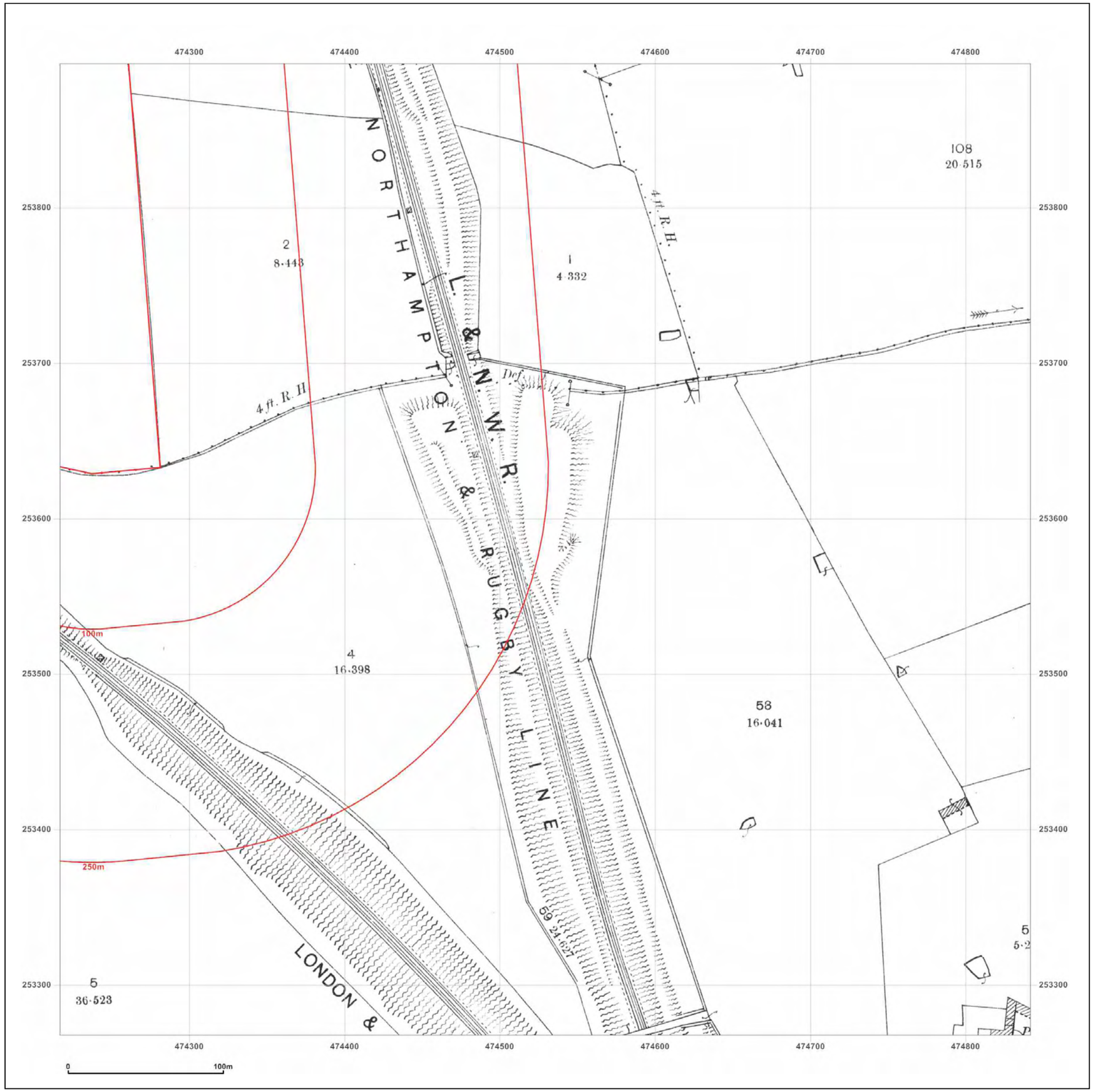

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_6_2
Grid Ref: 474529, 253580

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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Surveyed 1900
Revised 1900
Edition N/A
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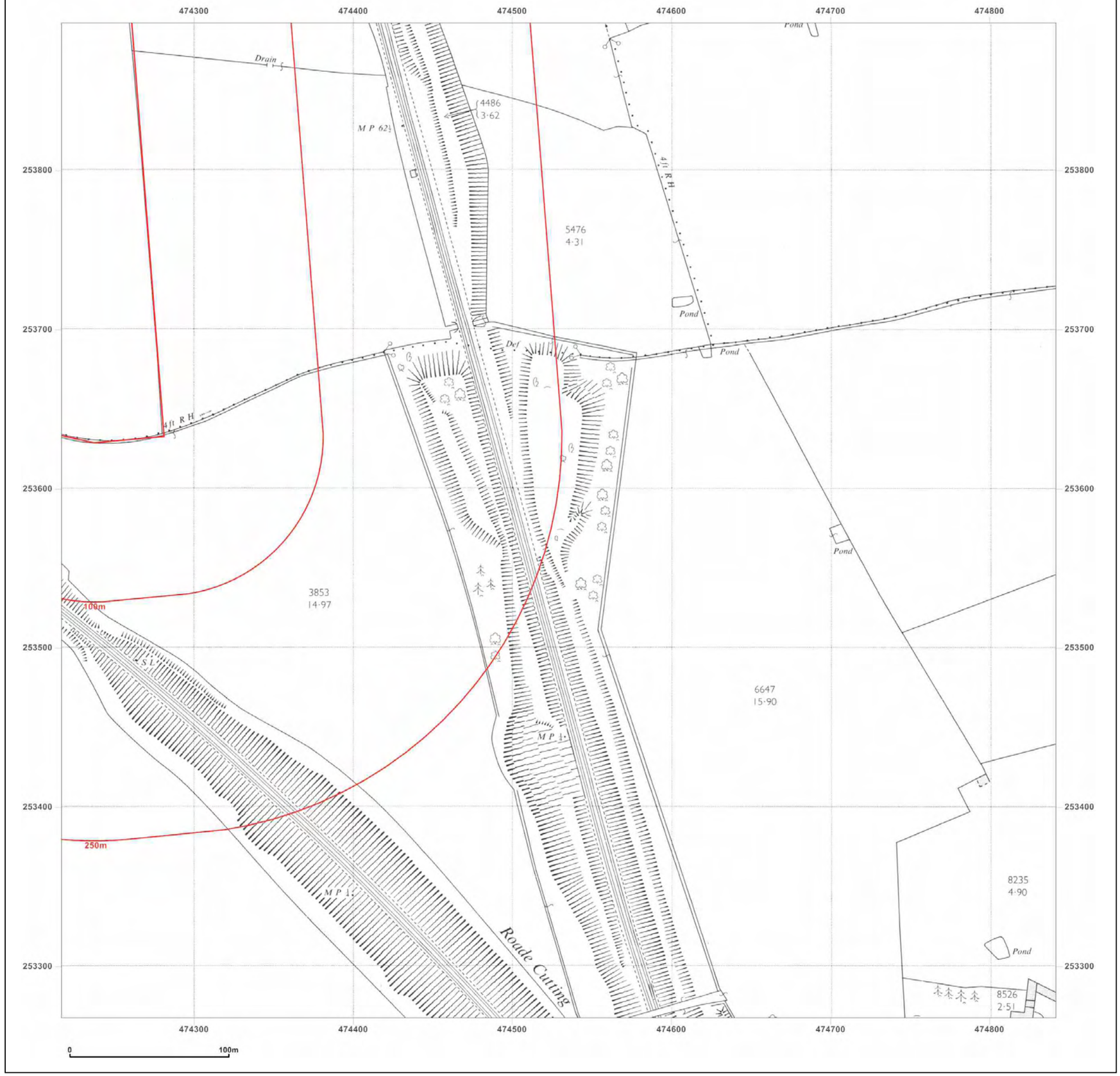

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_6_2
Grid Ref: 474529, 253580

Map Name: National Grid

Map date: **1966**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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Surveyed 1966
Revised 1966
Edition N/A
Copyright 1967
Levelled 1961

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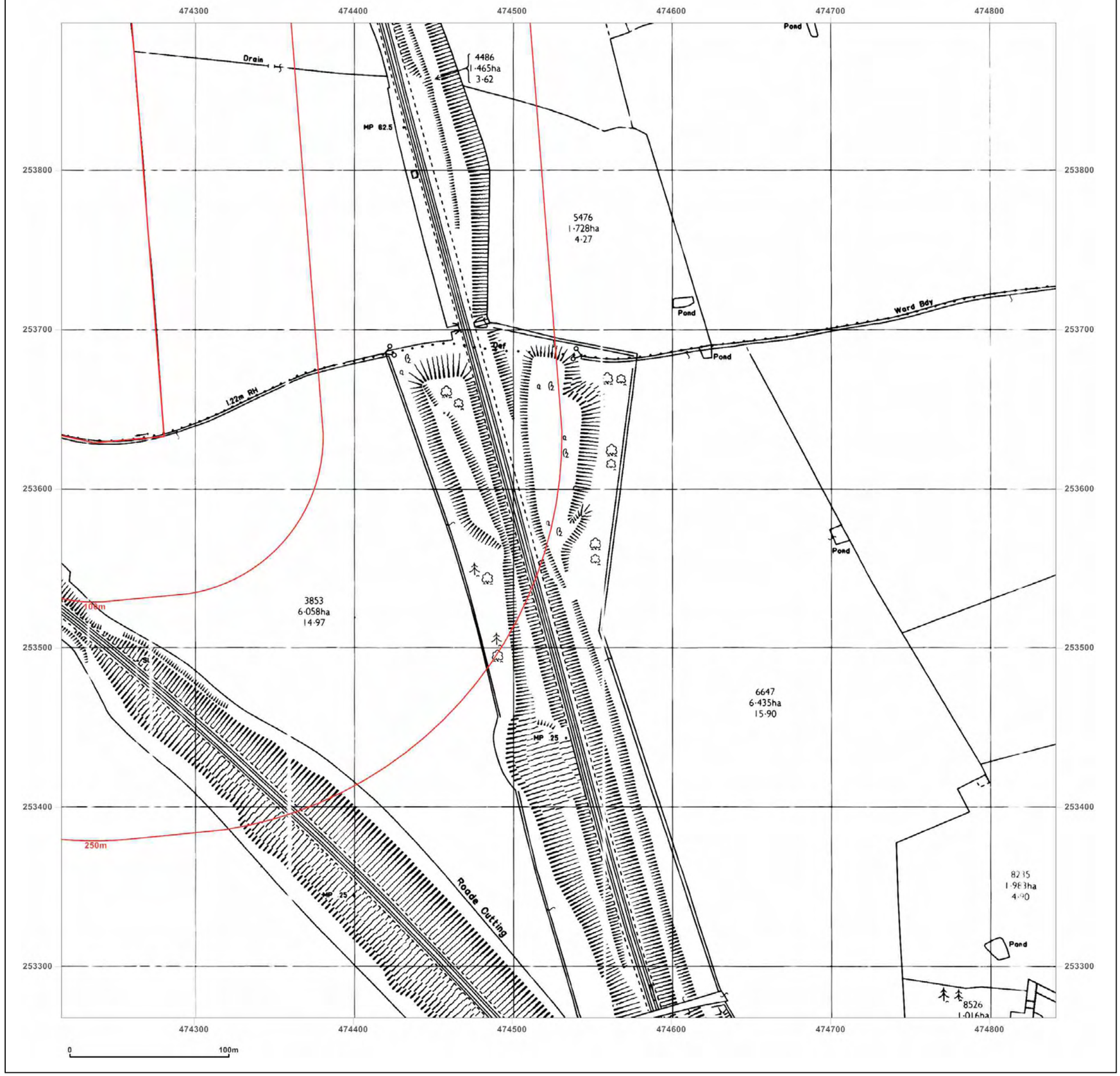

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_6_2
Grid Ref: 474529, 253580

Map Name: National Grid

Map date: **1978**

Scale: 1:2,500

Printed at: 1:2,500

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

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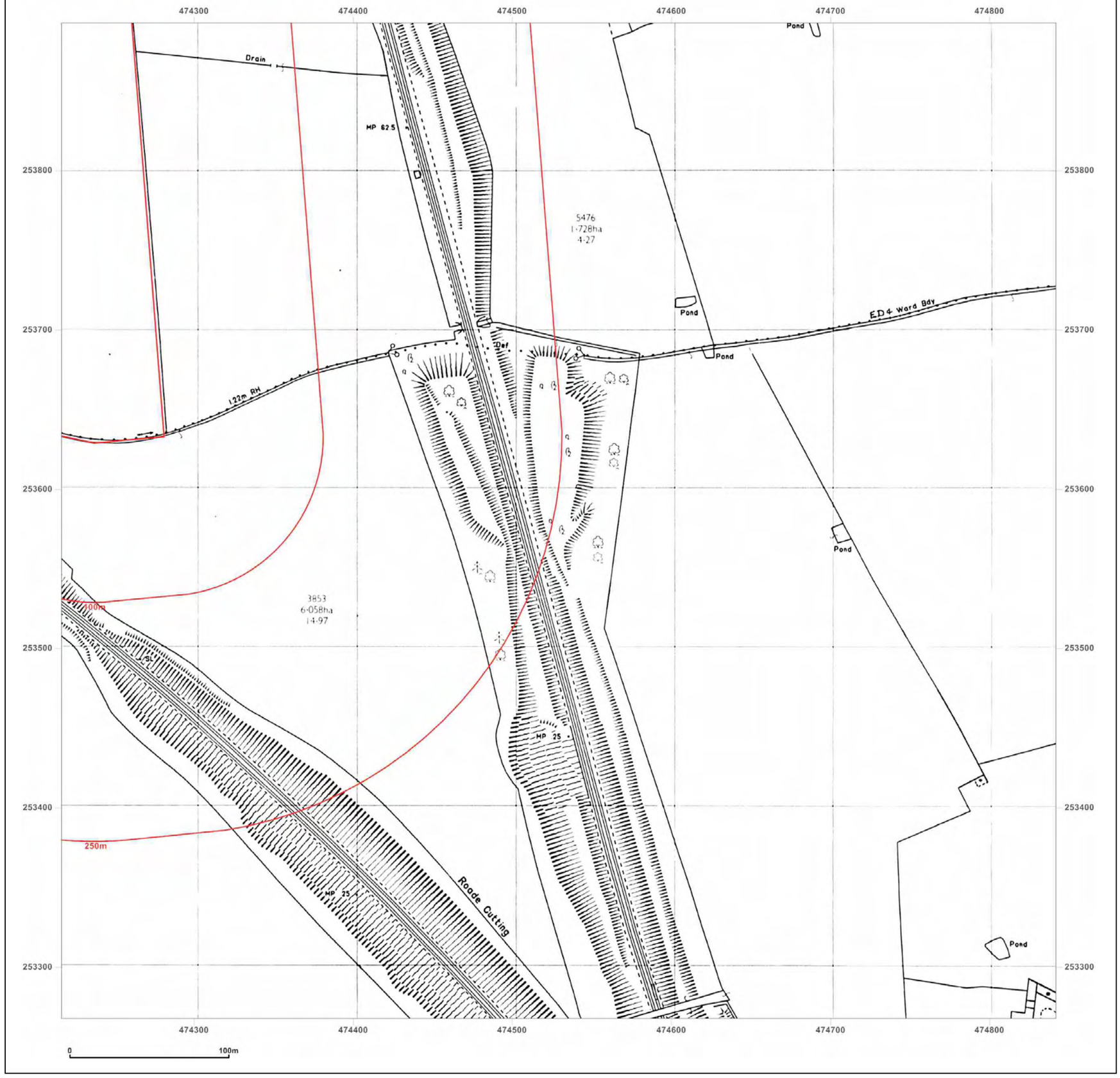

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_6_2
Grid Ref: 474529, 253580

Map Name: National Grid

Map date: **1986**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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Surveyed 1961
Revised 1986
Edition N/A
Copyright 1986
Levelled 1961

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Production date: 25 March 2015

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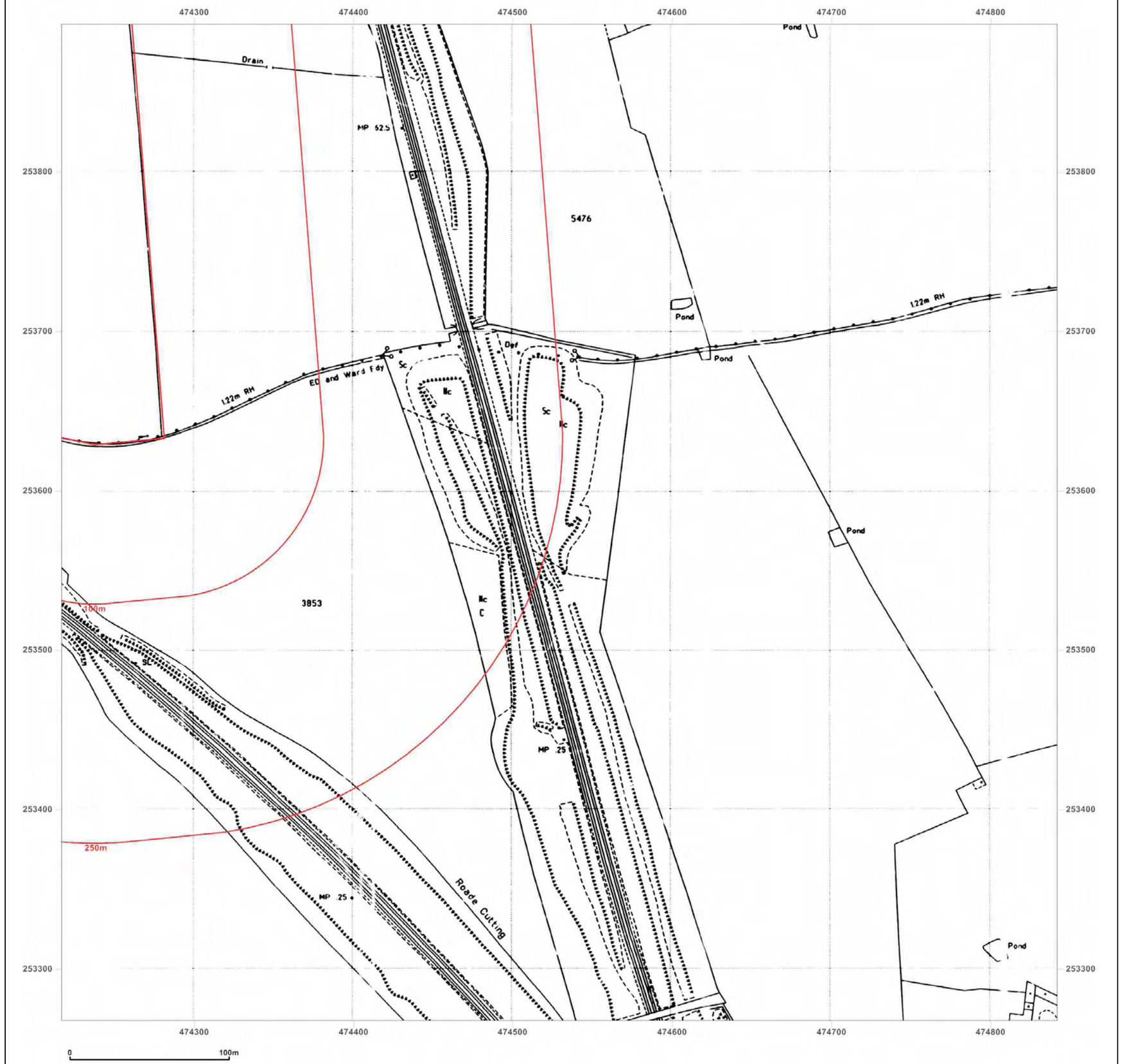

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_6_2
Grid Ref: 474529, 253580

Map Name: National Grid

Map date: **1993**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1993
Levelled N/A

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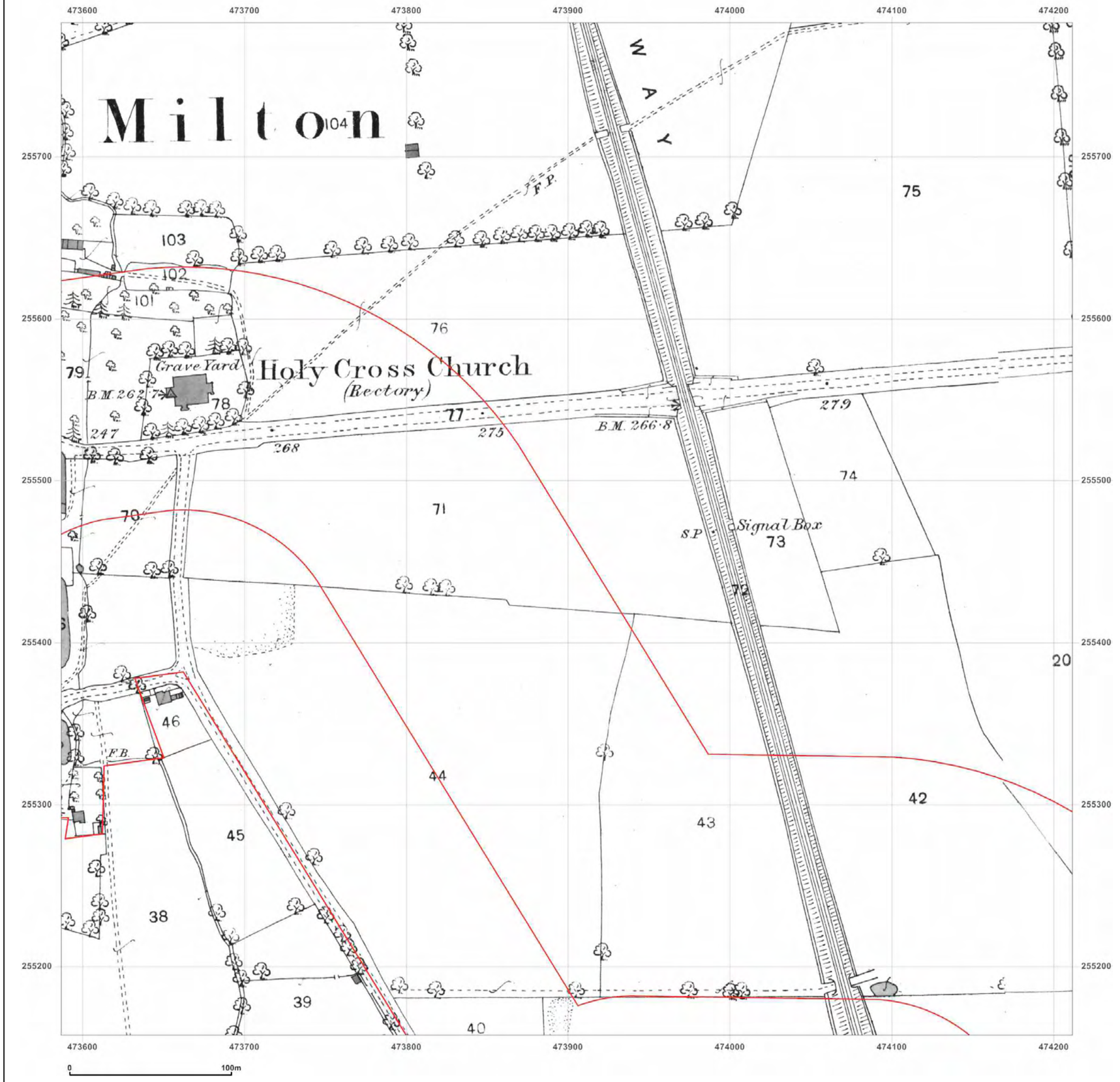
Production date: 25 March 2015

To view map legend click here *Legend*



GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_5
Grid Ref: 473899, 255470

Map Name: County Series

Map date: **1885**

Scale: 1:2,500

Printed at: 1:2,500

N
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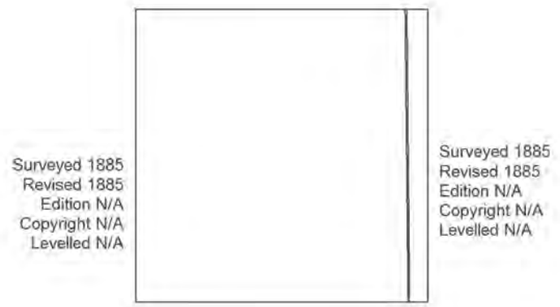

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Production date: 25 March 2015

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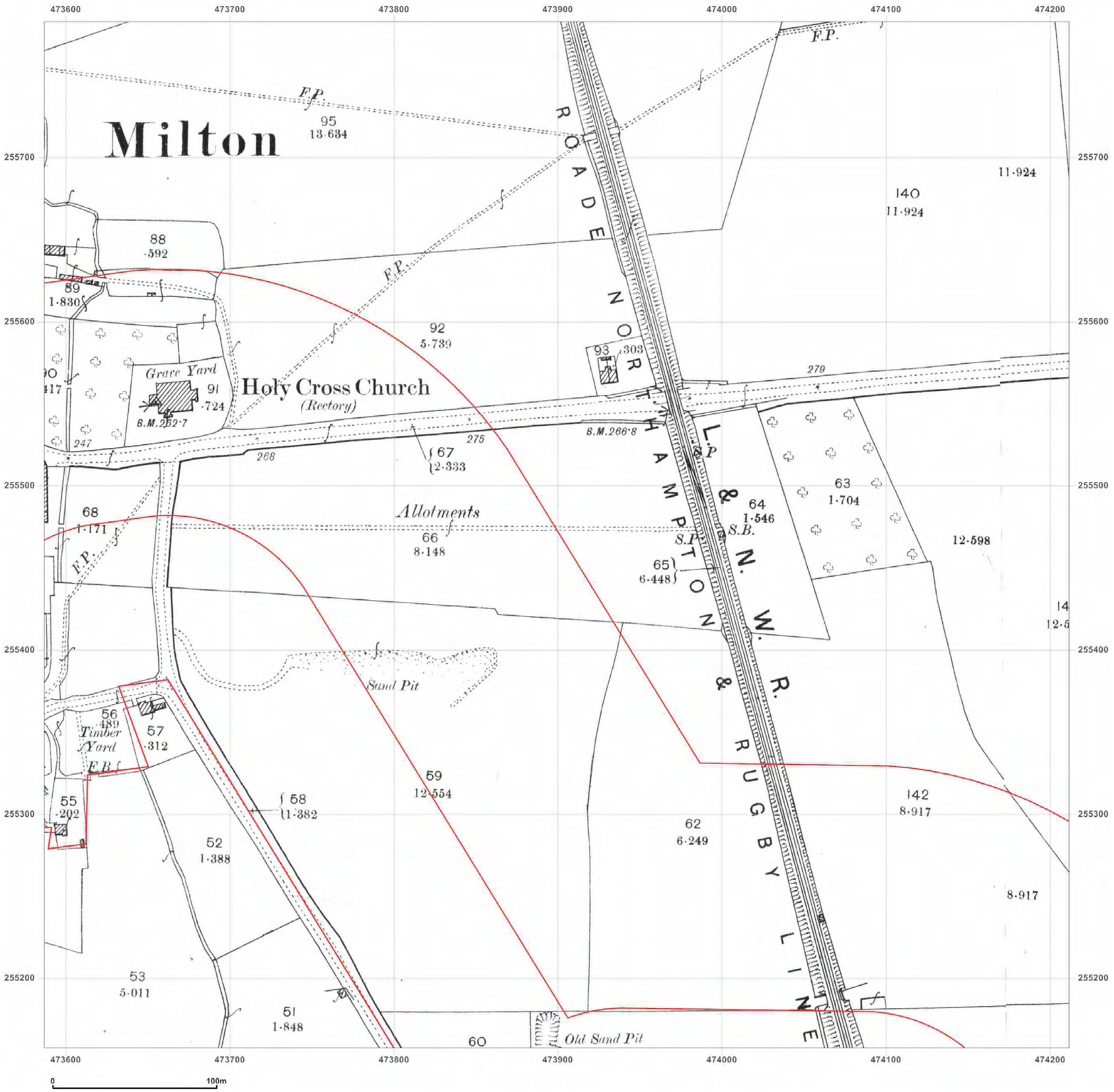

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_5
Grid Ref: 473899, 255470

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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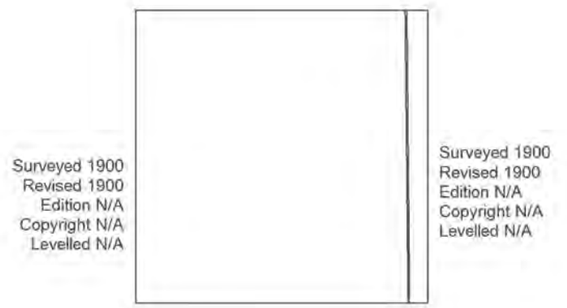

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Production date: 25 March 2015

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_5
Grid Ref: 473899, 255470

Map Name: National Grid

Map date: **1964**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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Surveyed 1964
Revised 1964
Edition N/A
Copyright 1965
Levelled 1961

Surveyed 1964
Revised 1964
Edition N/A
Copyright 1965
Levelled 1961

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Production date: 25 March 2015

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_5
Grid Ref: 473899, 255470

Map Name: National Grid

Map date: **1975-1976**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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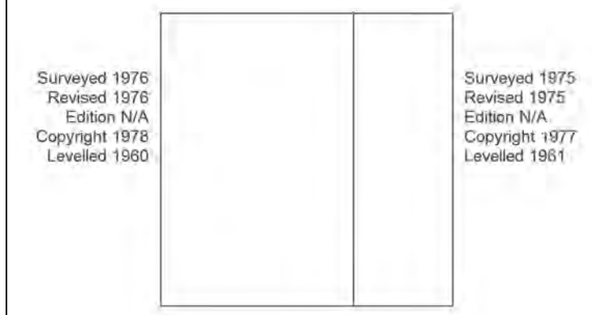

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Production date: 25 March 2015

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_5
Grid Ref: 473899, 255470

Map Name: National Grid

Map date: **1993**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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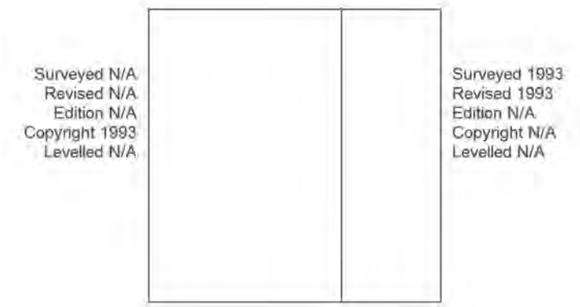

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Production date: 25 March 2015

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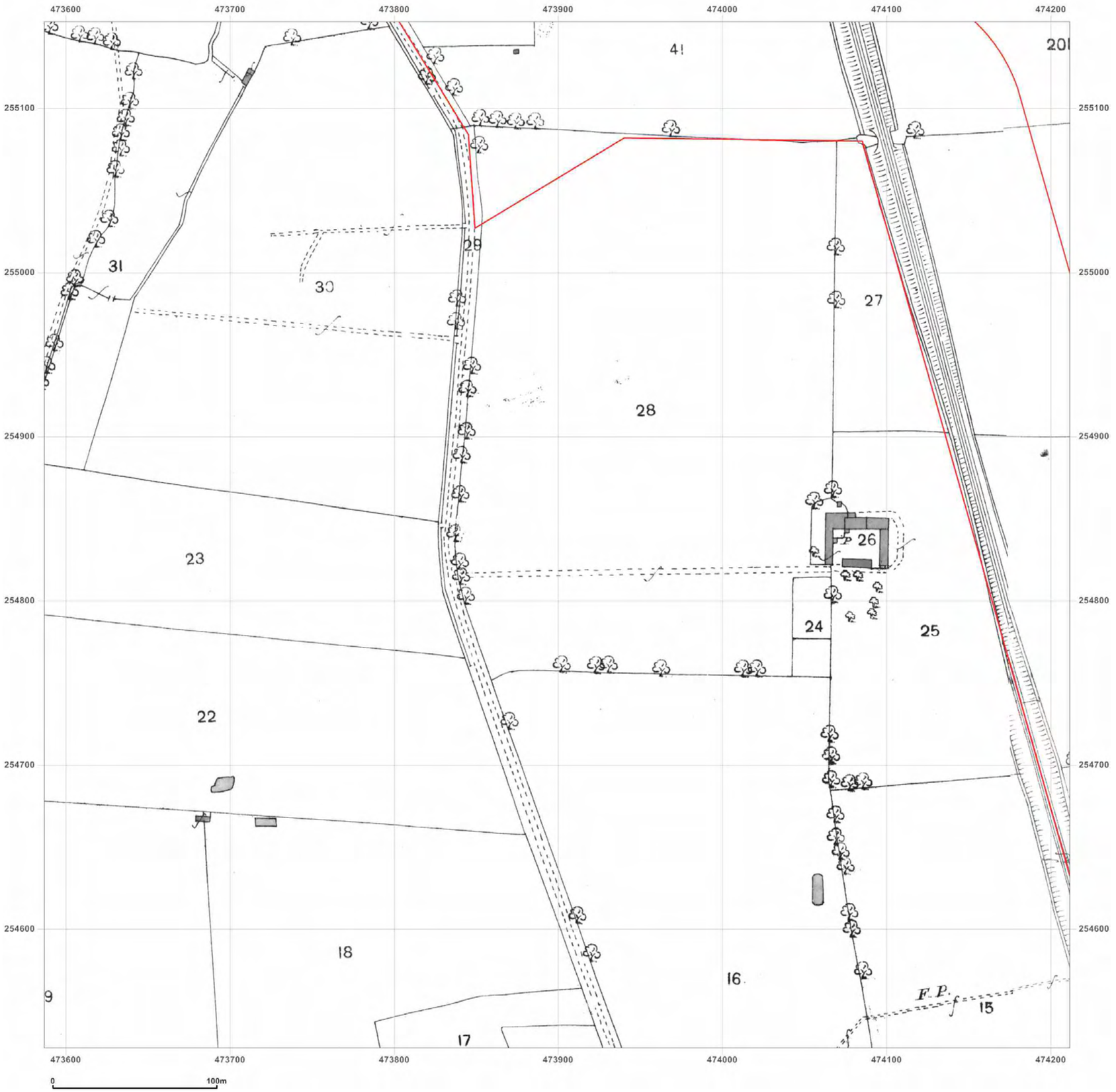

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_4
Grid Ref: 473899, 254840

Map Name: County Series

Map date: **1885**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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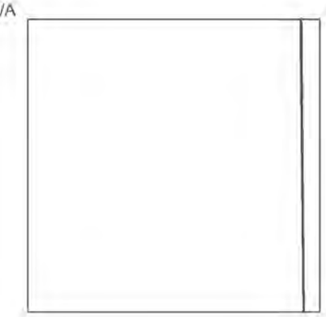
Surveyed 1885
Revised 1885
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1885
Revised 1885
Edition N/A
Copyright N/A
Levelled N/A



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Production date: 25 March 2015

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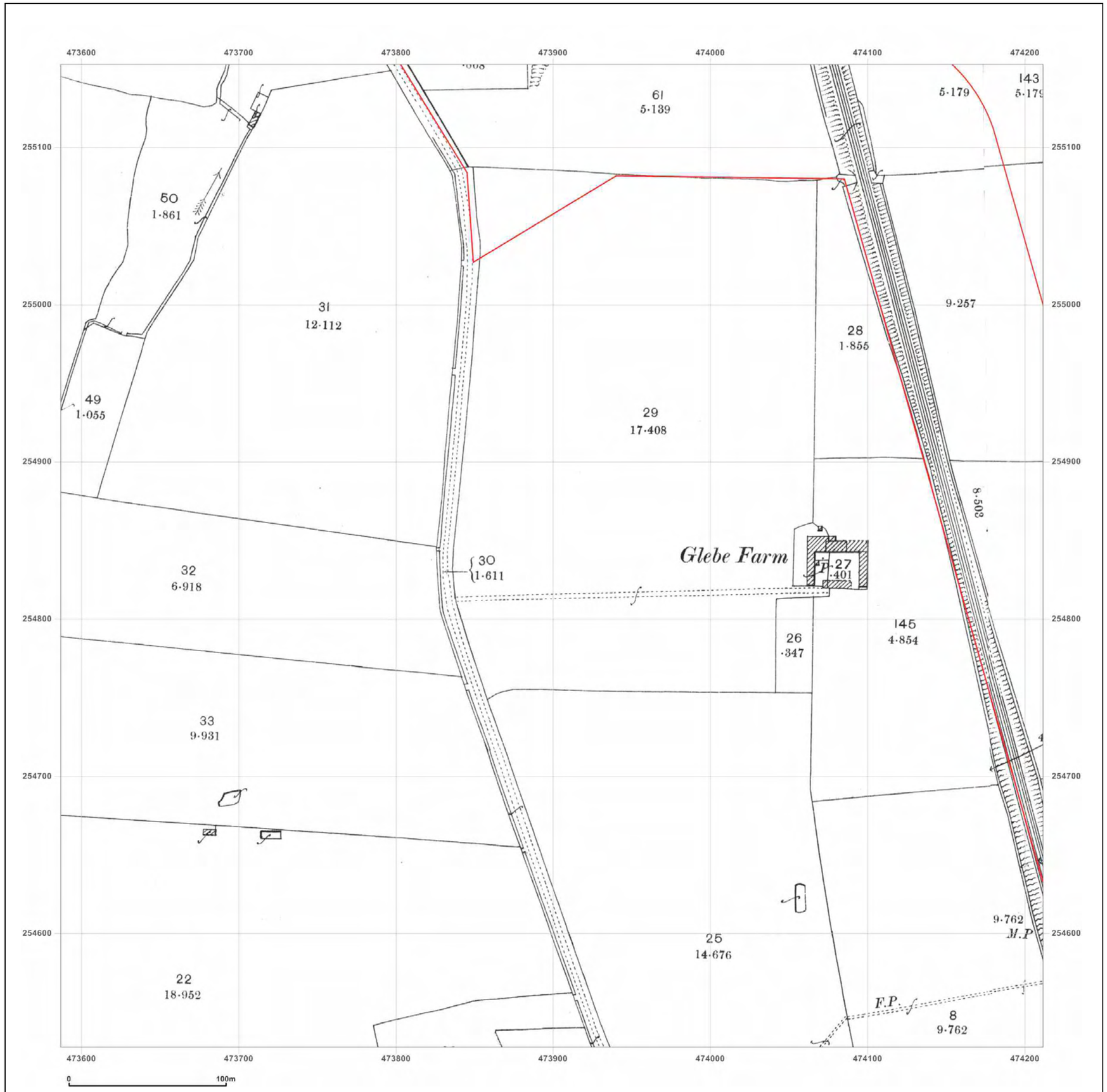

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_4
Grid Ref: 473899, 254840

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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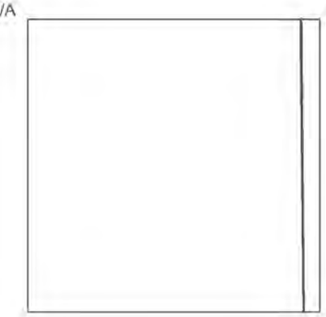
Surveyed 1900
Revised 1900
Edition N/A
Copyright N/A
Levelled N/A



Surveyed 1900
Revised 1900
Edition N/A
Copyright N/A
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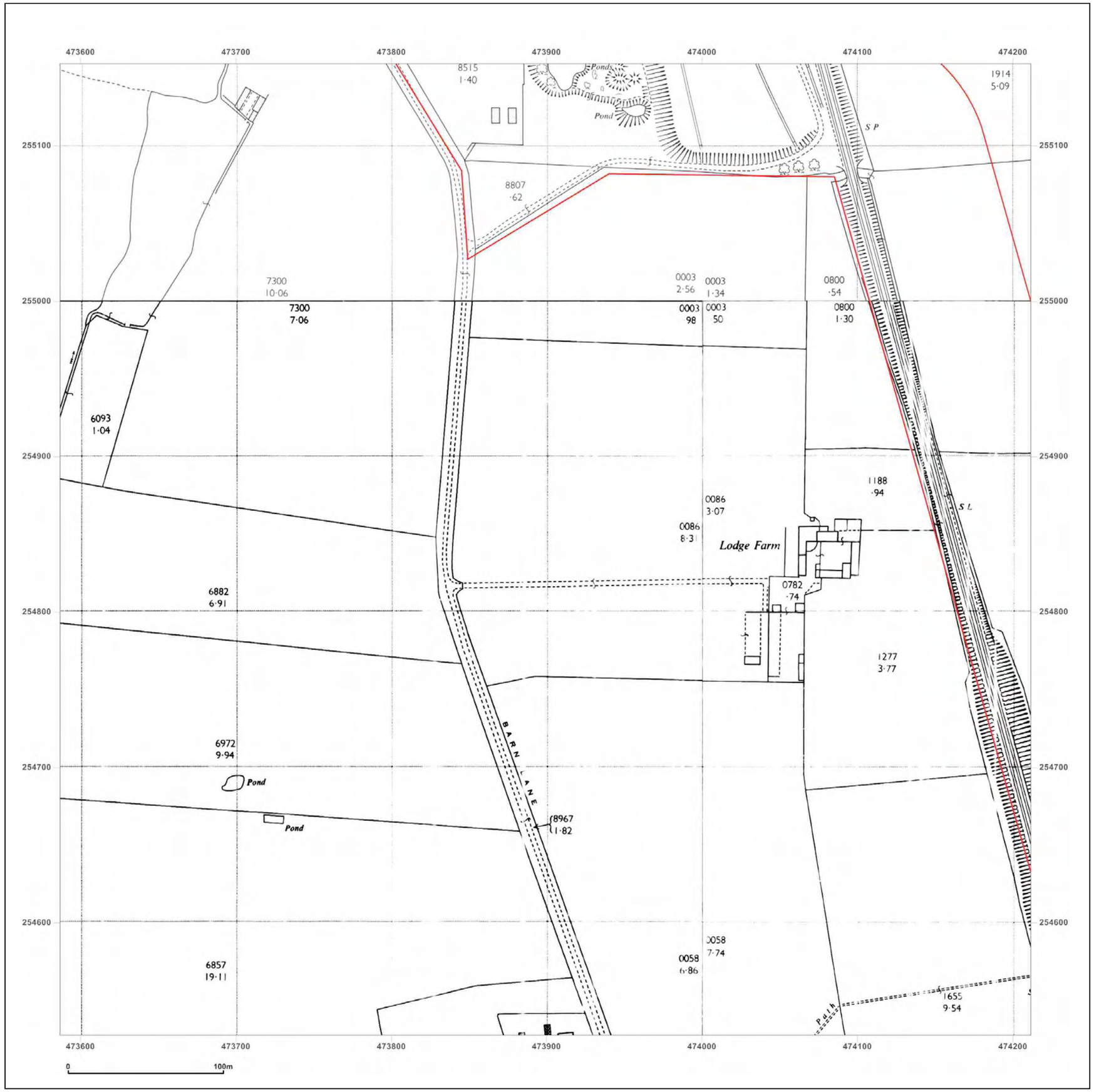

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_4
Grid Ref: 473899, 254840

Map Name: National Grid

Map date: **1964-1966**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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Surveyed 1964
Revised 1964
Edition N/A
Copyright 1965
Levelled 1961

Surveyed 1964
Revised 1964
Edition N/A
Copyright 1965
Levelled 1961

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

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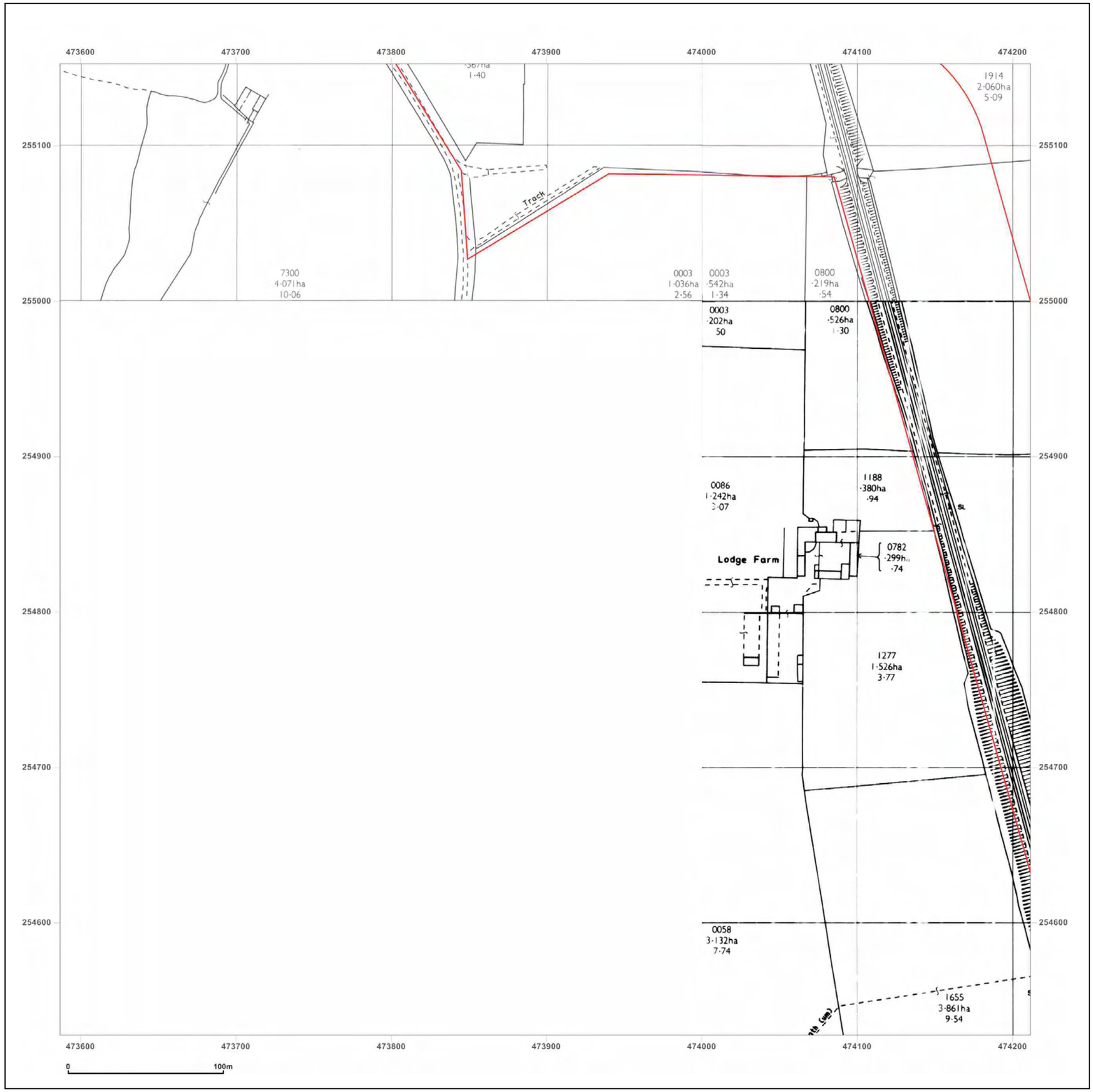

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_4
Grid Ref: 473899, 254840

Map Name: National Grid

Map date: **1975-1978**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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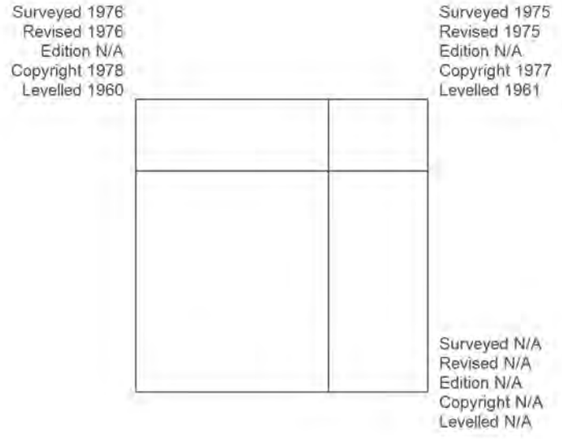

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_4
Grid Ref: 473899, 254840

Map Name: National Grid

Map date: **1993**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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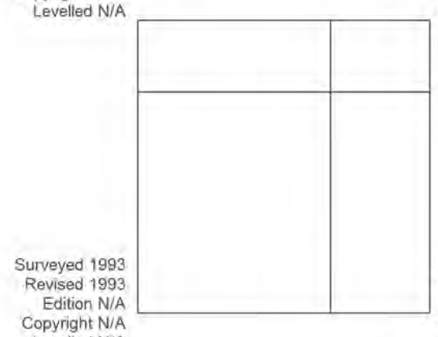
Surveyed N/A
Revised N/A
Edition N/A
Copyright 1993
Levelled N/A

Surveyed 1993
Revised 1993
Edition N/A
Copyright N/A
Levelled N/A



Surveyed 1993
Revised 1993
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1993
Revised 1993
Edition N/A
Copyright N/A
Levelled N/A

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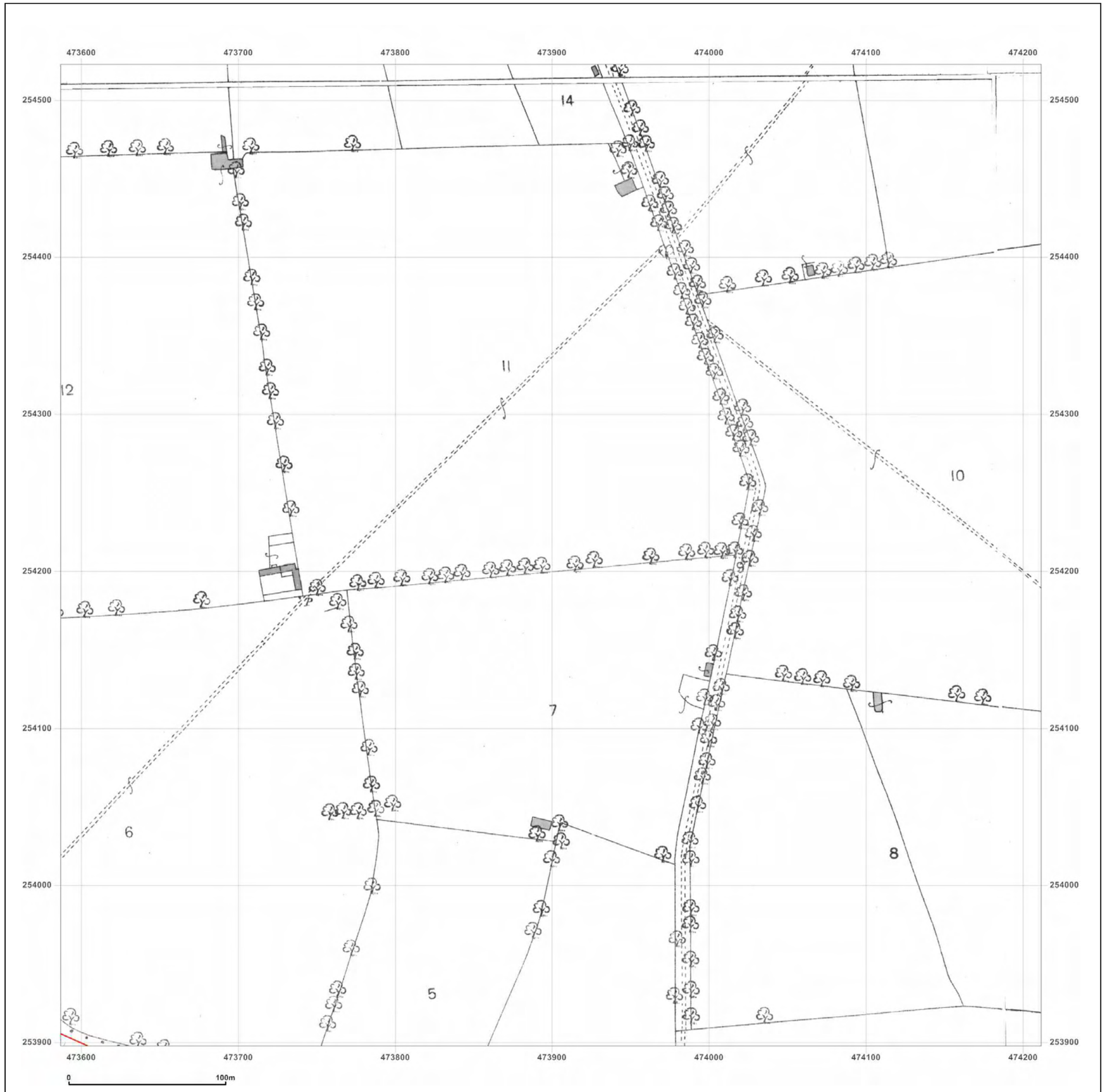

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_3
Grid Ref: 473899, 254210

Map Name: County Series

Map date: **1885**

Scale: 1:2,500

Printed at: 1:2,500

N
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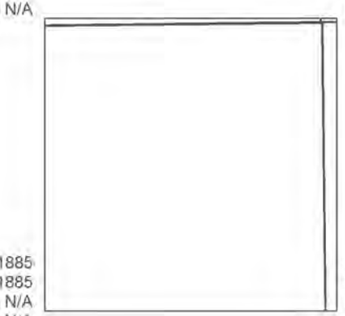
Surveyed 1885
Revised 1885
Edition N/A
Copyright N/A
Levelled N/A



Surveyed 1885
Revised 1885
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1885
Revised 1885
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1885
Revised 1885
Edition N/A
Copyright N/A
Levelled N/A

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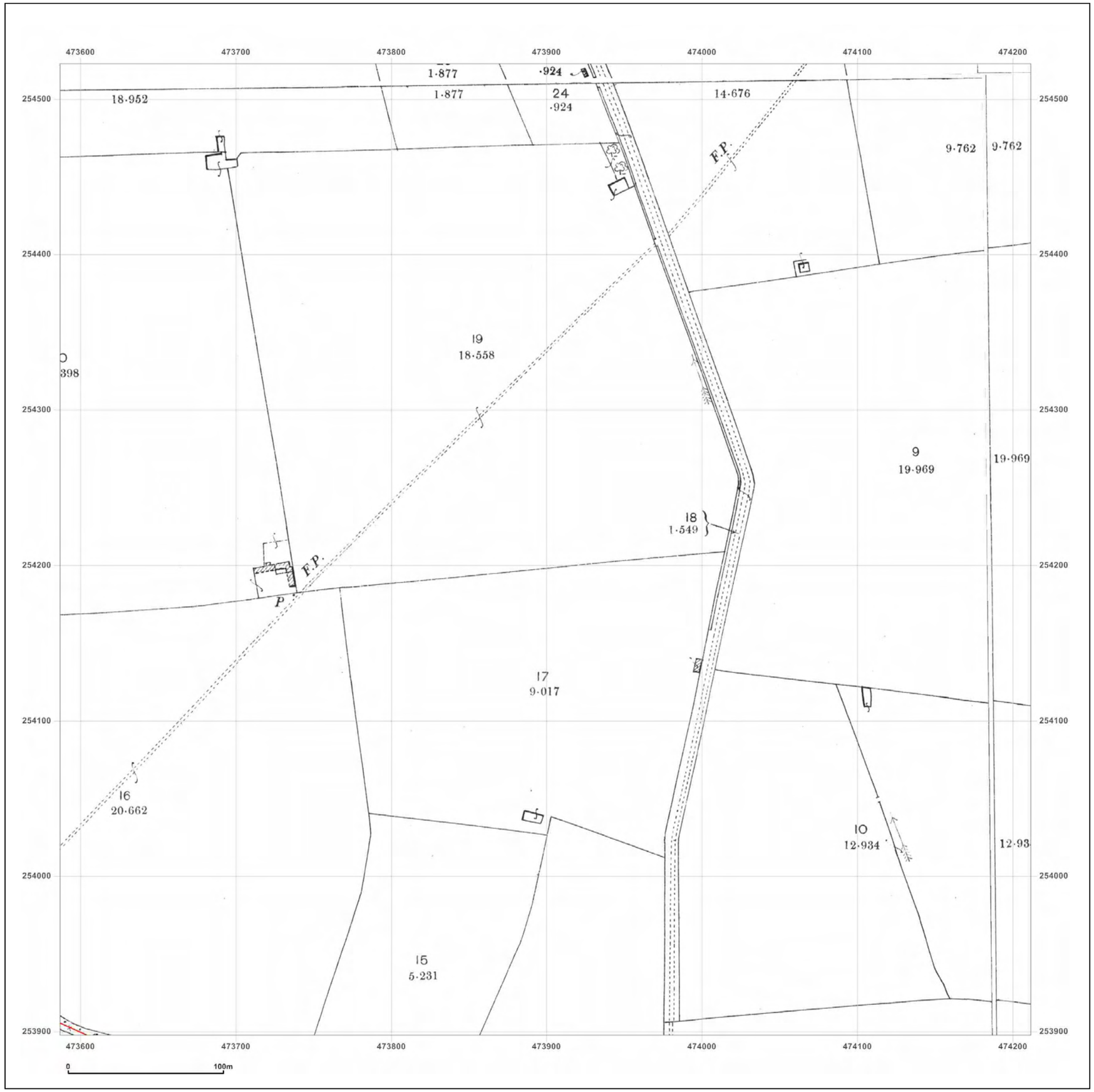

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_3
Grid Ref: 473899, 254210

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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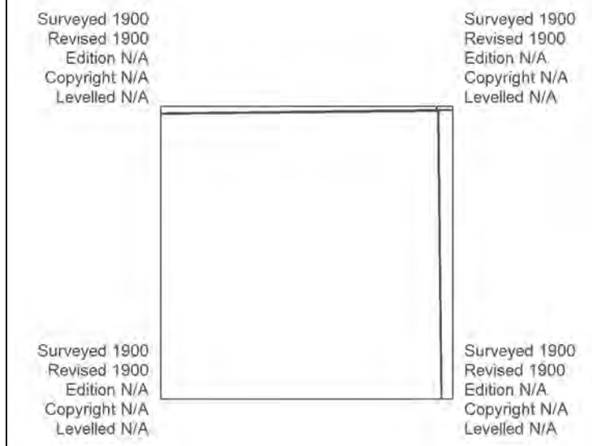

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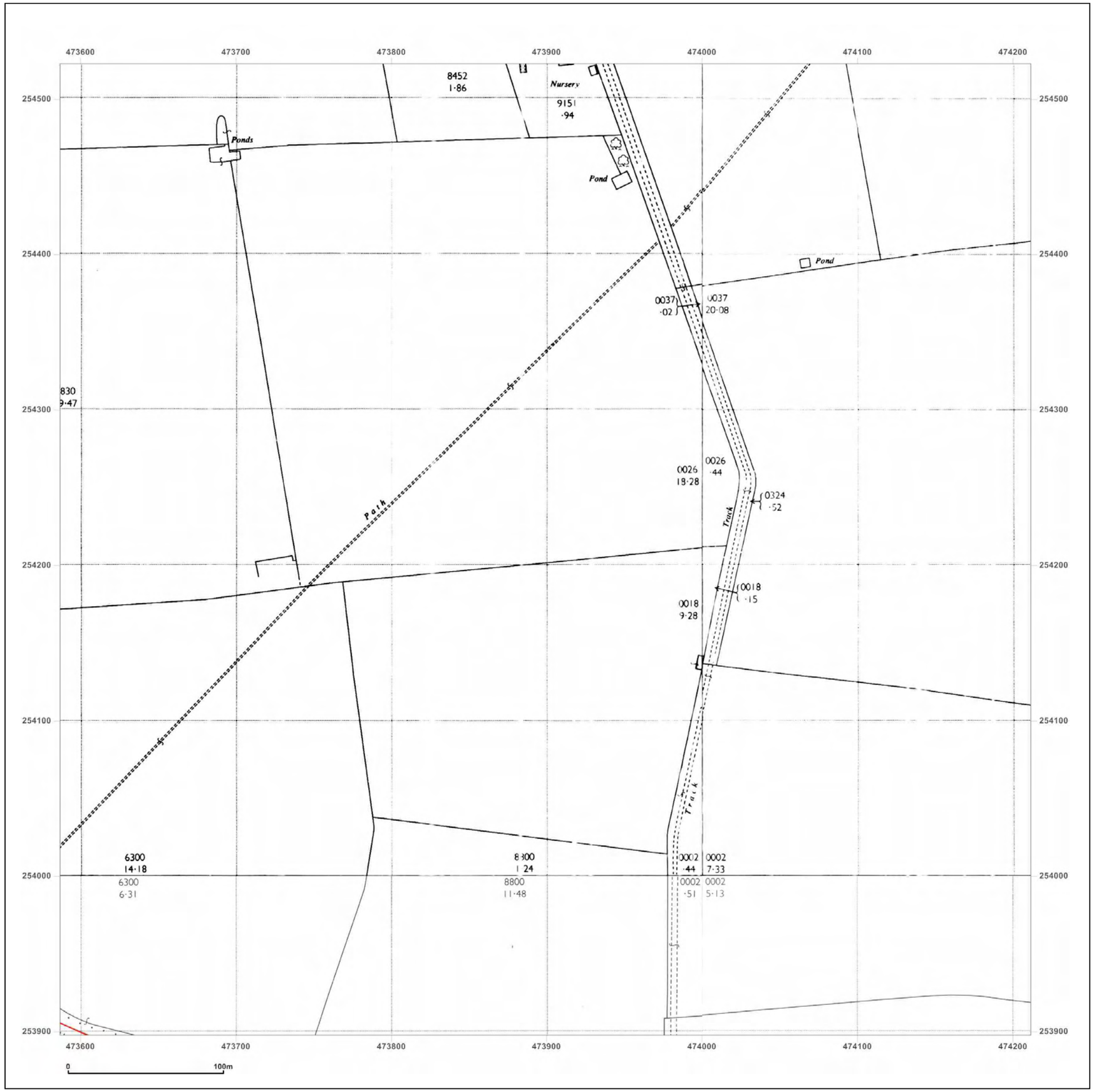

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_3
Grid Ref: 473899, 254210

Map Name: National Grid

Map date: **1966**

Scale: 1:2,500

Printed at: 1:2,500

N
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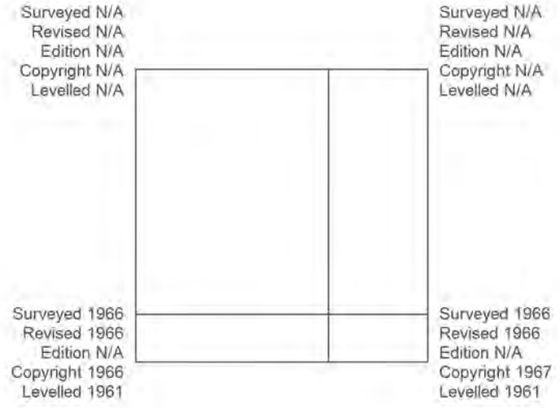

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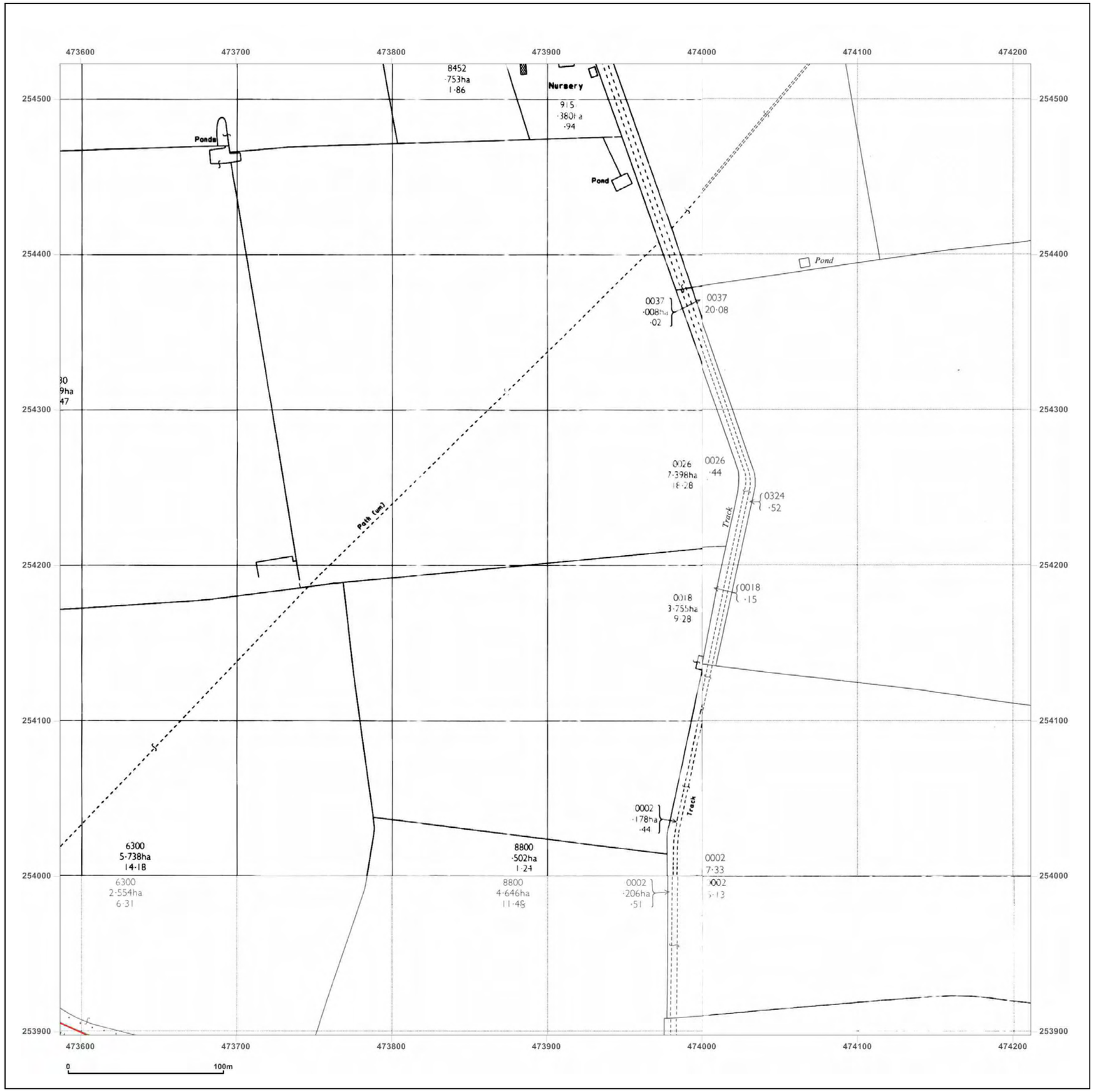

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_3
Grid Ref: 473899, 254210

Map Name: National Grid

Map date: **1966-1970**

Scale: 1:2,500

Printed at: 1:2,500

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

Surveyed 1966
Revised 1966
Edition N/A
Copyright 1966
Levelled 1961

Surveyed 1970
Revised 1970
Edition N/A
Copyright 1971
Levelled 1961

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

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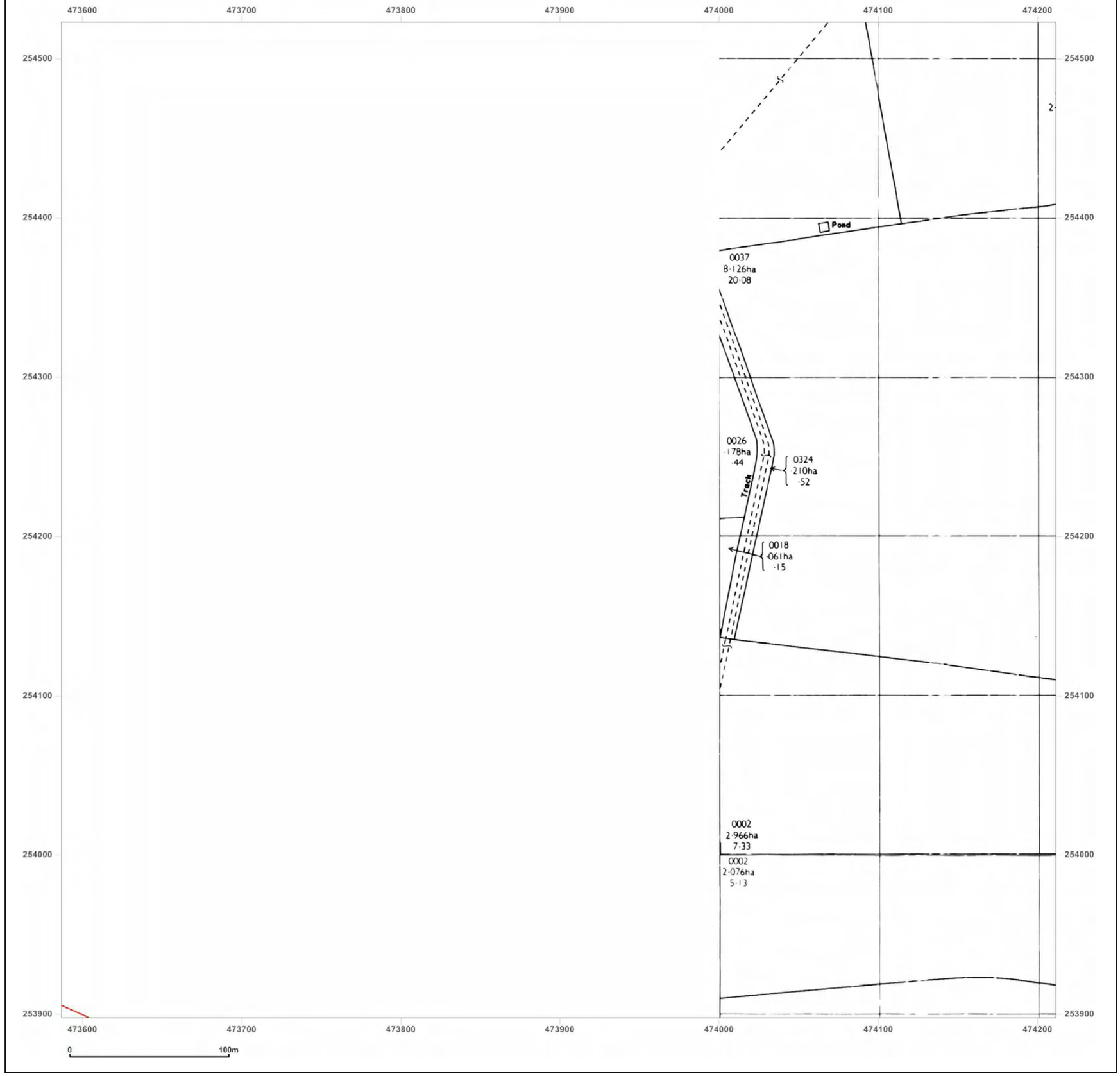

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_3
Grid Ref: 473899, 254210

Map Name: National Grid

Map date: **1978**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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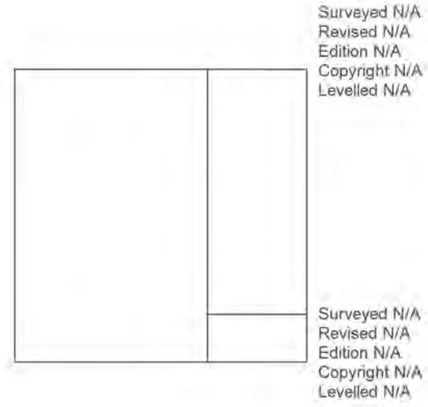

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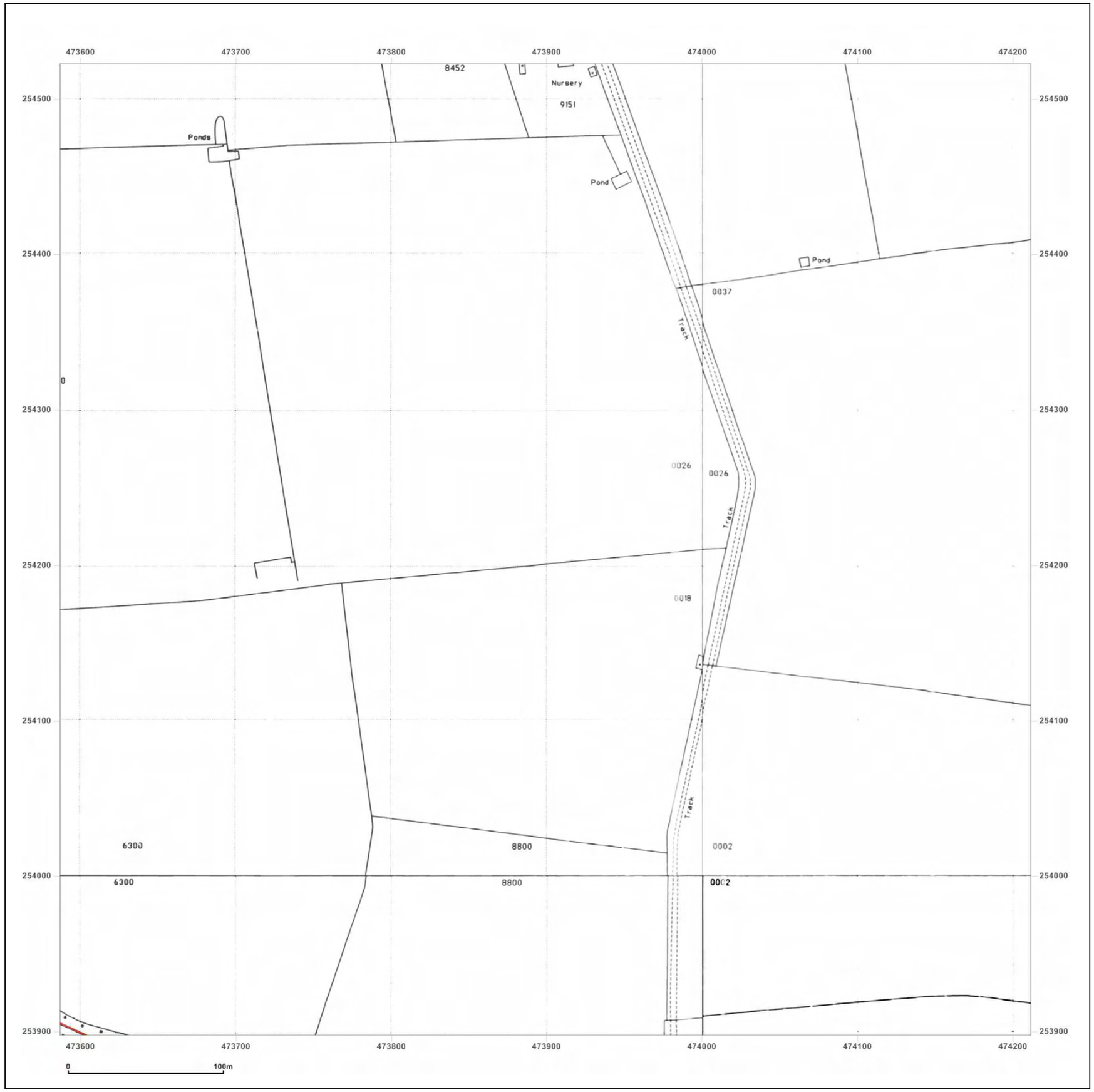

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_3
Grid Ref: 473899, 254210

Map Name: National Grid

Map date: **1993**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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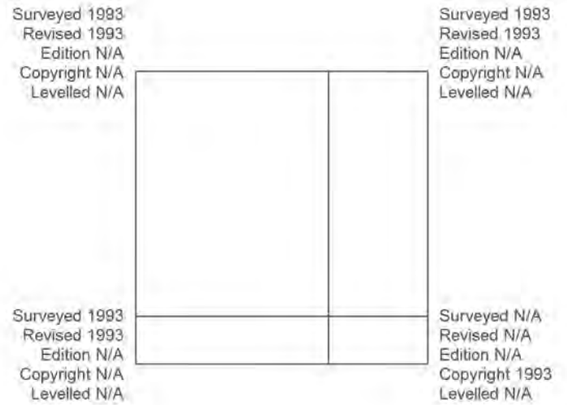

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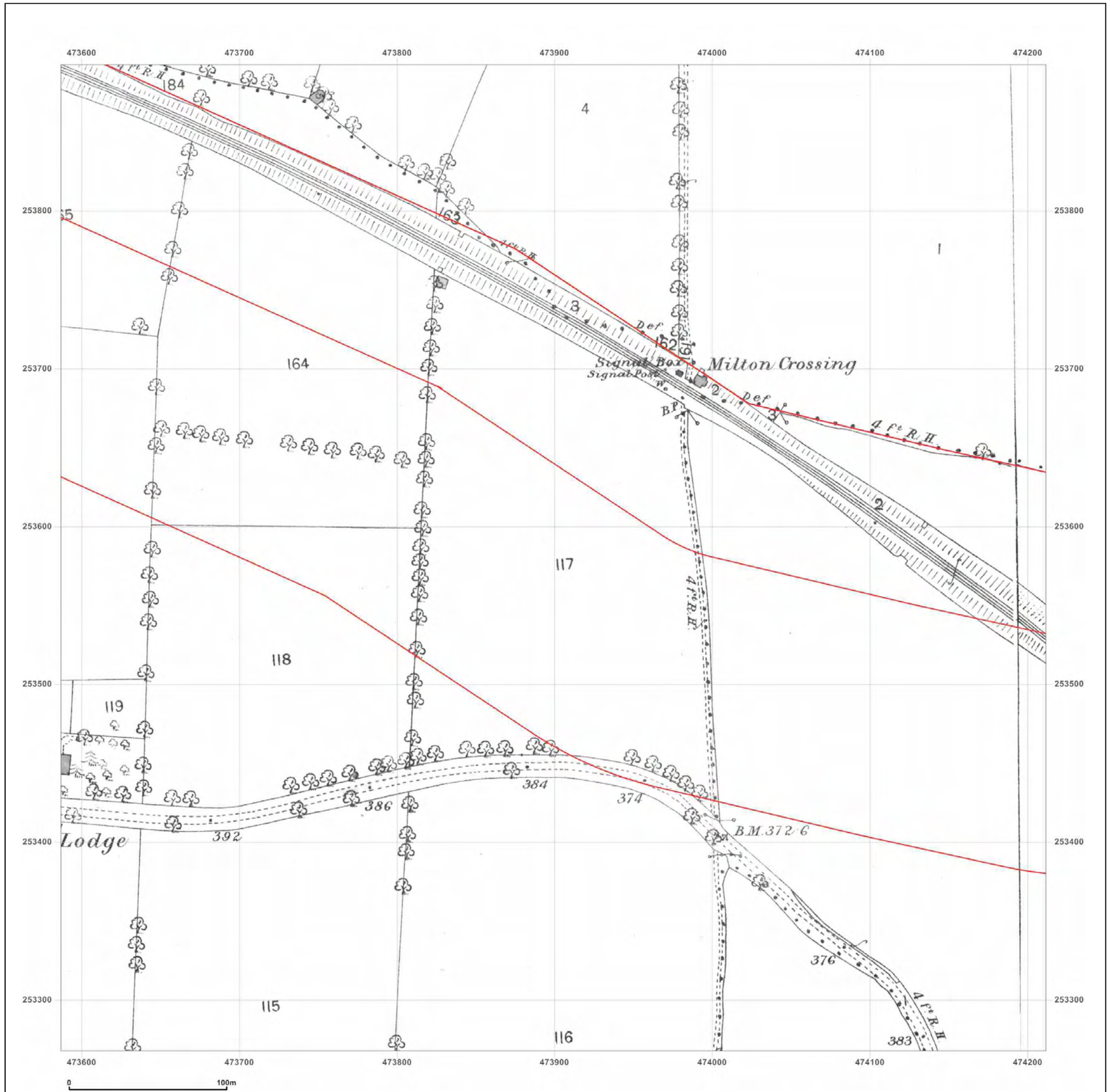

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_2
Grid Ref: 473899, 253580

Map Name: County Series

Map date: **1885**

Scale: 1:2,500

Printed at: 1:2,500

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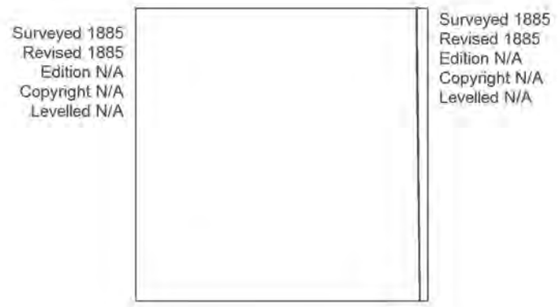

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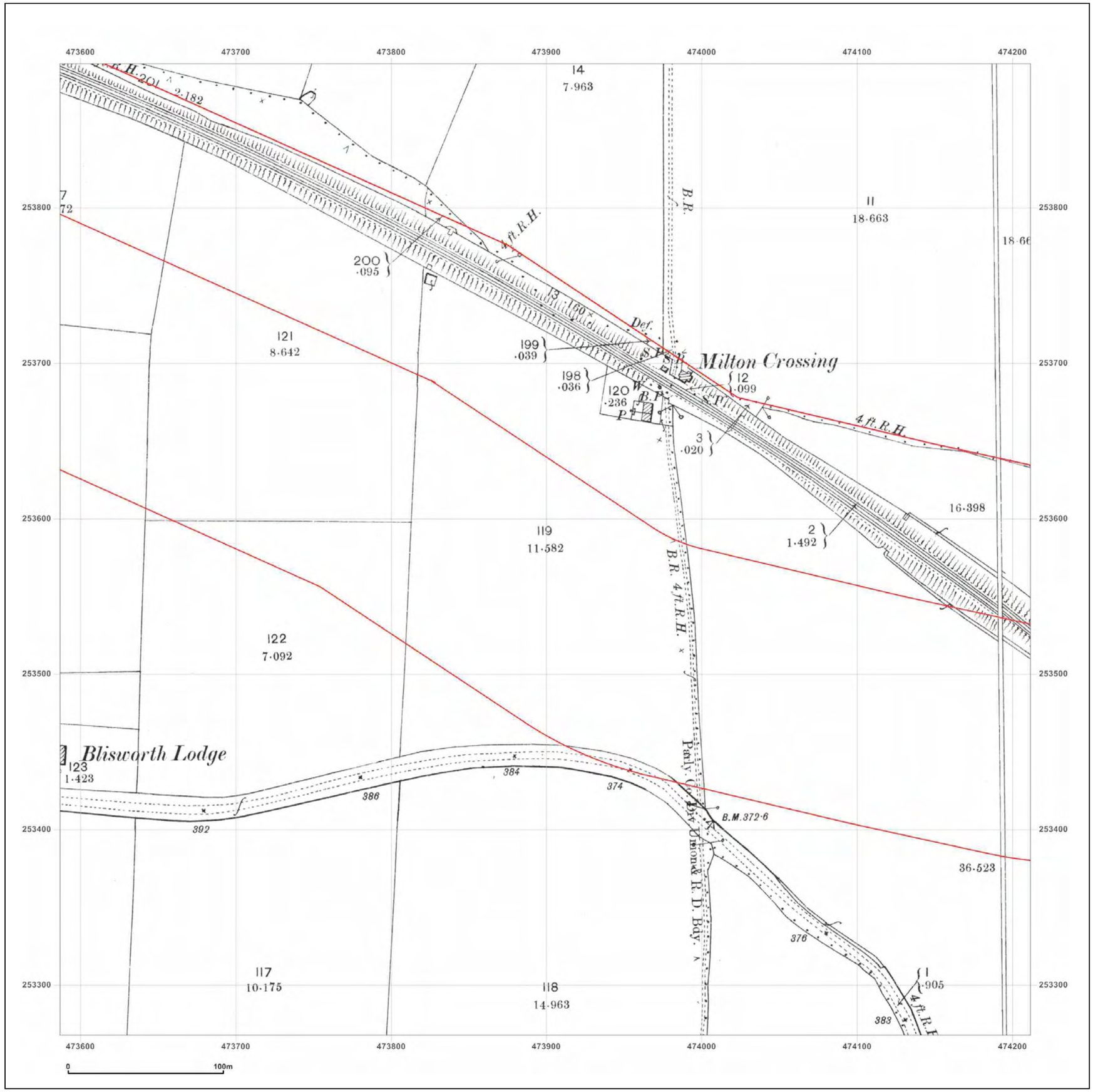

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_2
Grid Ref: 473899, 253580

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

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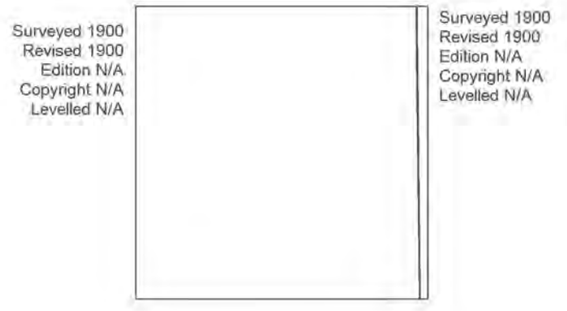

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Production date: 25 March 2015

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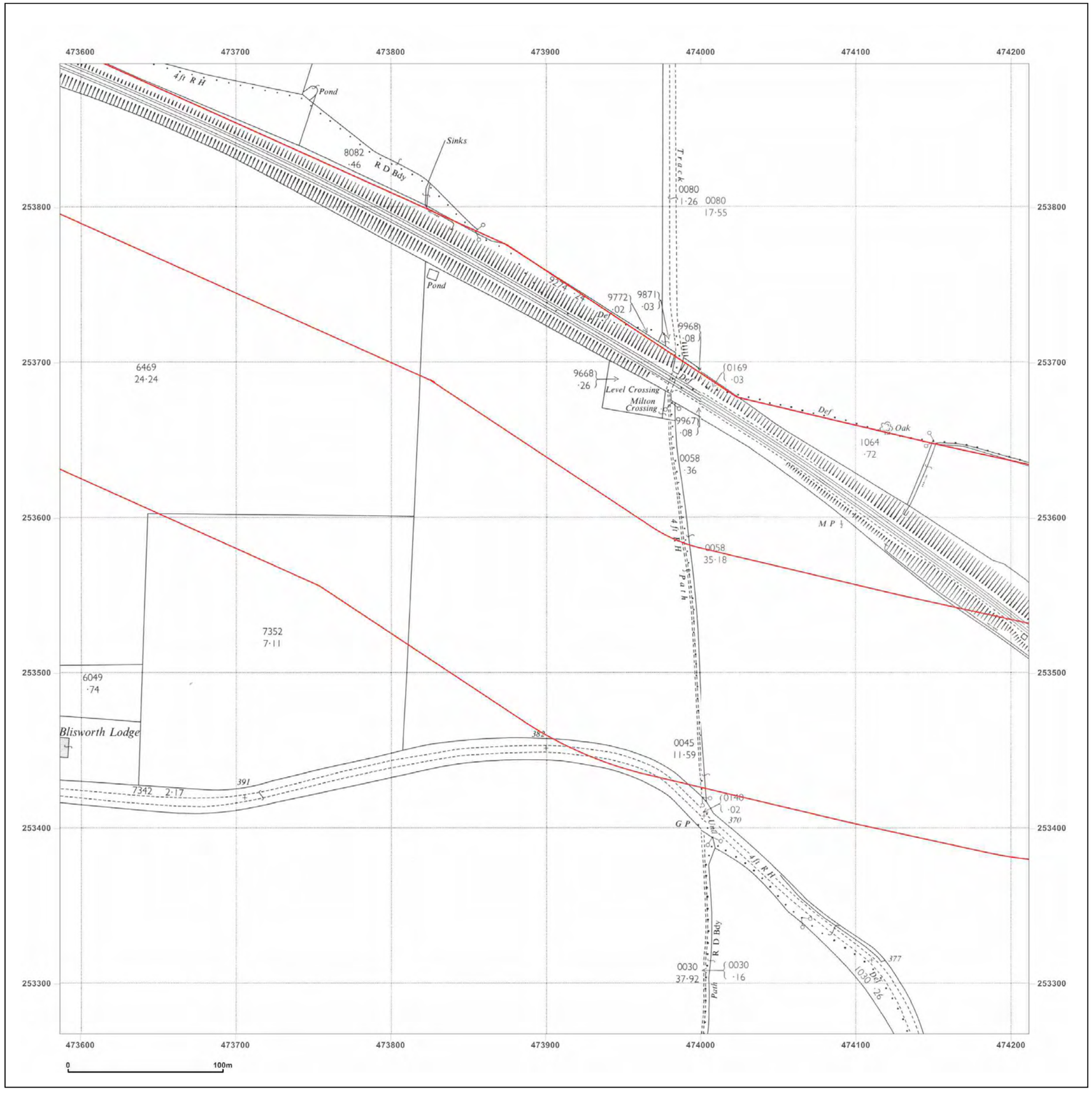

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_2
Grid Ref: 473899, 253580

Map Name: National Grid

Map date: **1966**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1966
Revised 1966
Edition N/A
Copyright 1966
Levelled 1961

Surveyed 1966
Revised 1966
Edition N/A
Copyright 1967
Levelled 1961

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Production date: 25 March 2015

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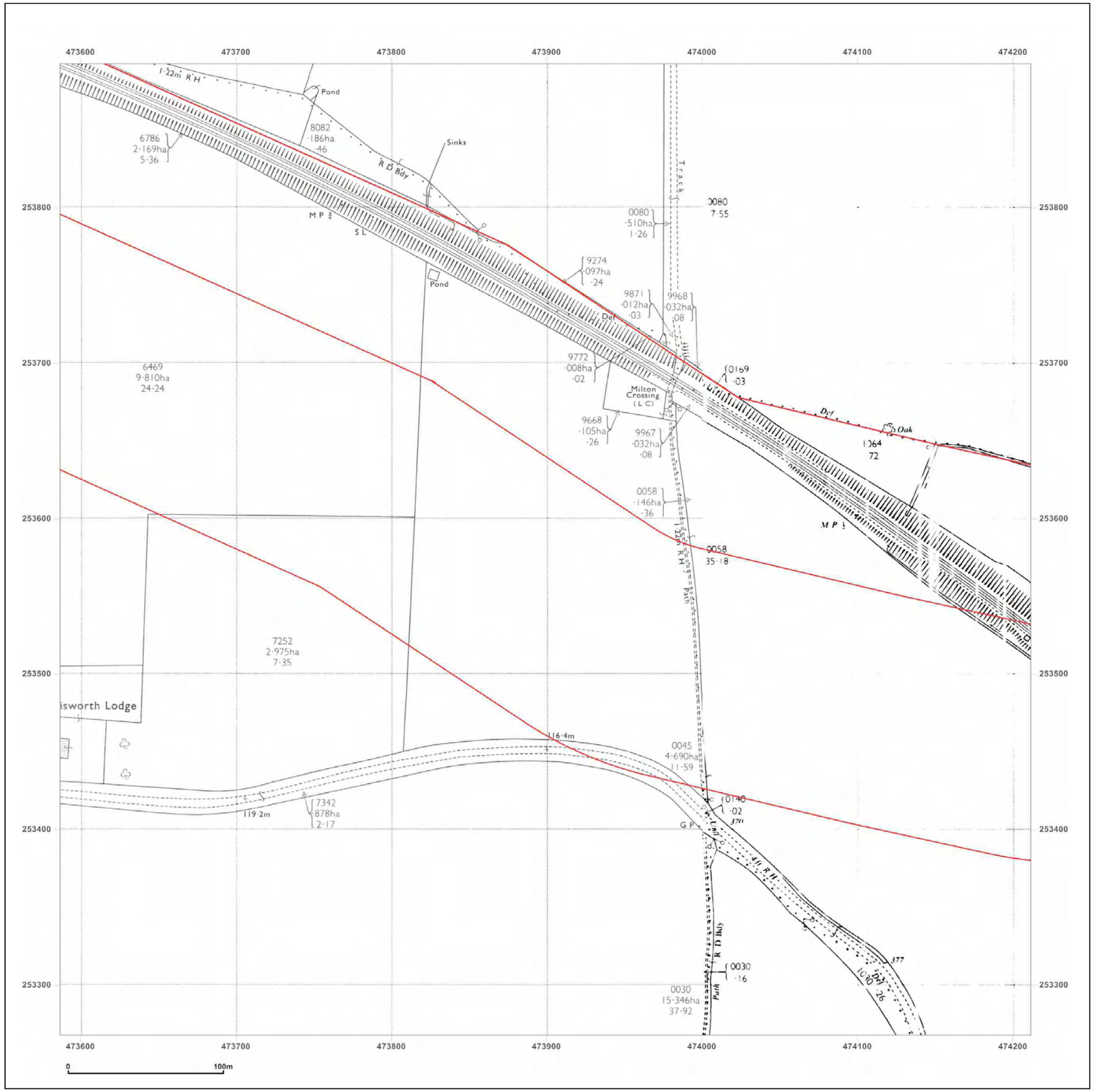

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_2
Grid Ref: 473899, 253580

Map Name: National Grid

Map date: **1967-1970**

Scale: 1:2,500

Printed at: 1:2,500

N
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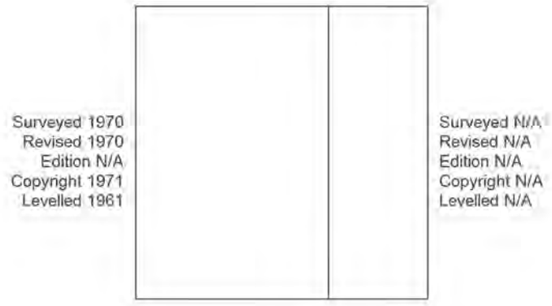

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Production date: 25 March 2015

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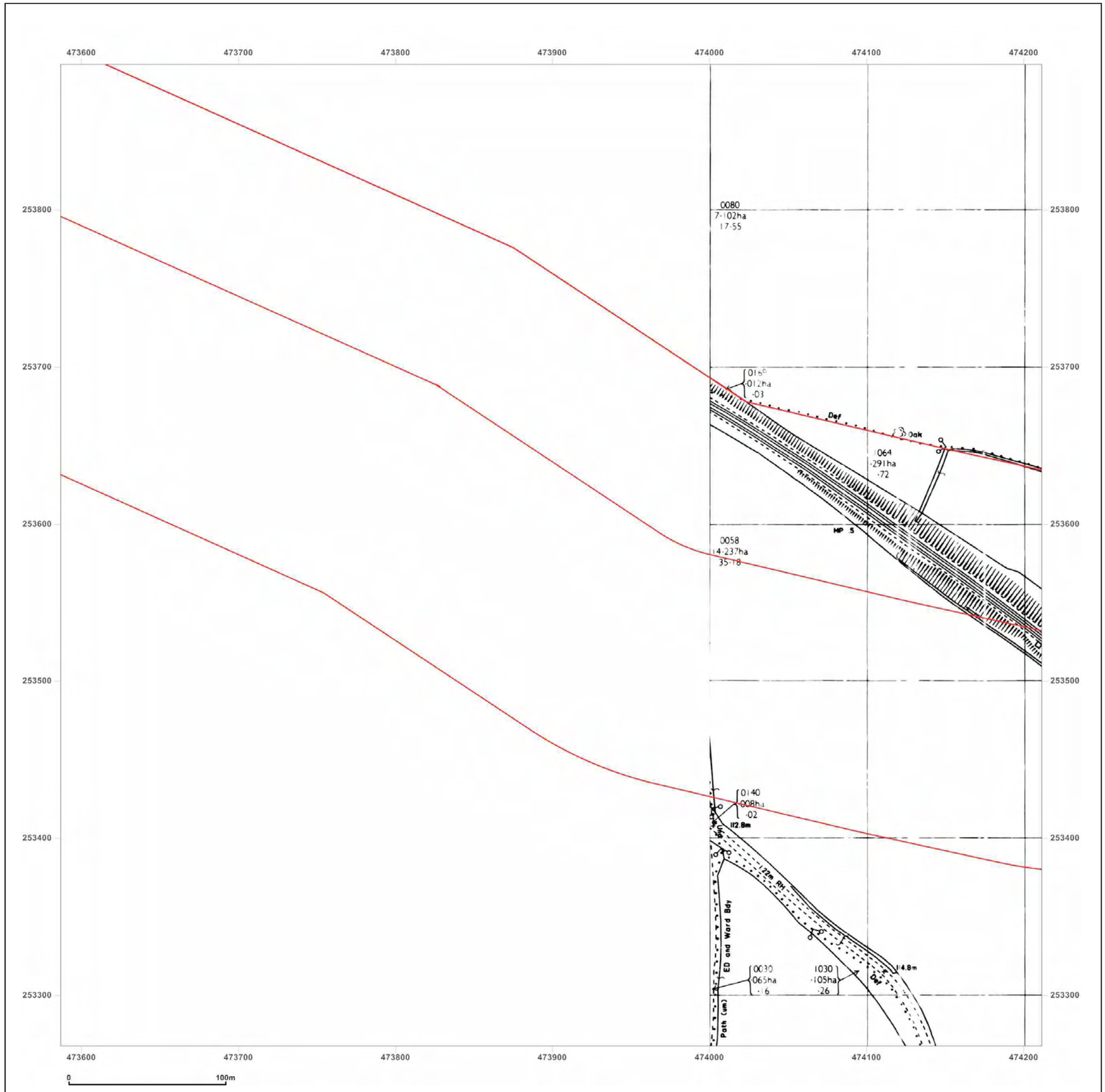

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_2
Grid Ref: 473899, 253580

Map Name: National Grid

Map date: **1978**

Scale: 1:2,500

Printed at: 1:2,500

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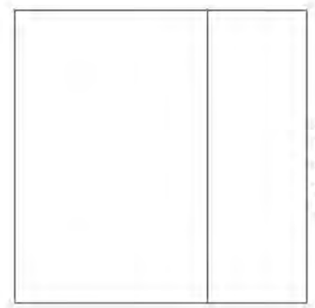

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Production date: 25 March 2015

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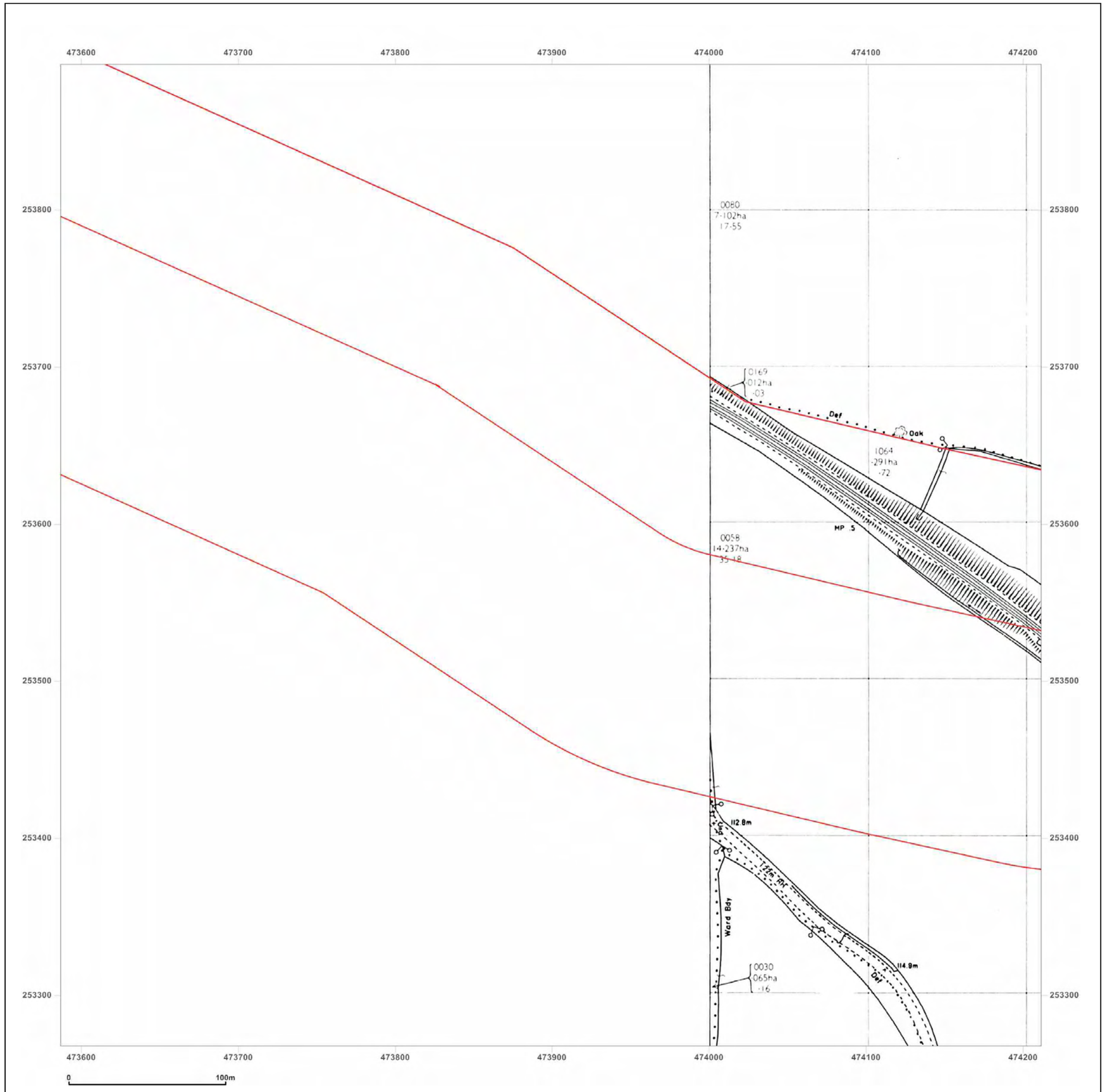

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_2
Grid Ref: 473899, 253580

Map Name: National Grid

Map date: **1986**

Scale: 1:2,500

Printed at: 1:2,500

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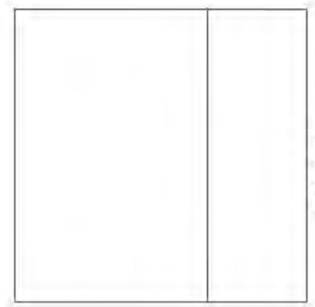

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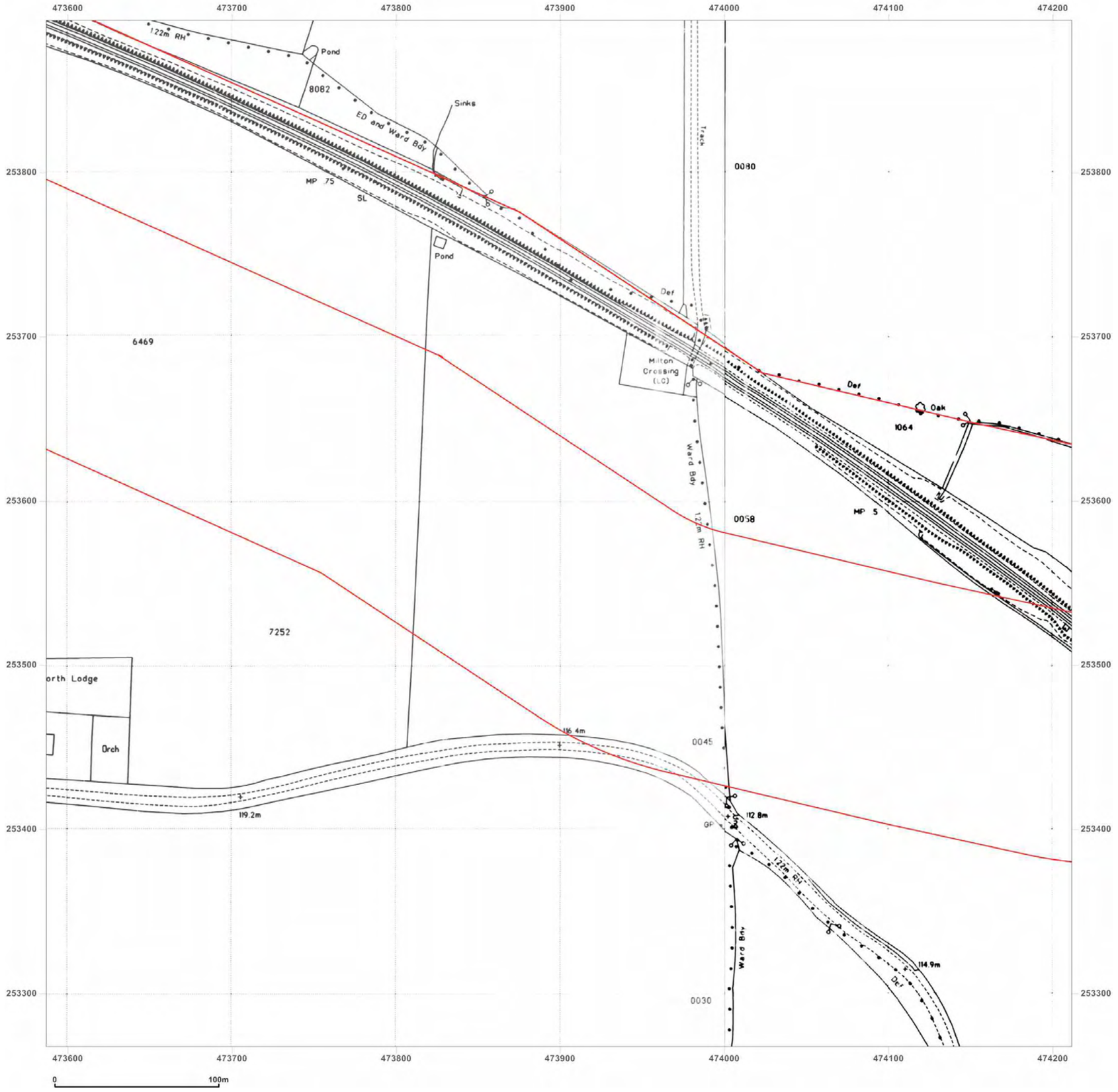

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_5_2
Grid Ref: 473899, 253580

Map Name: National Grid

Map date: **1993**

Scale: 1:2,500

Printed at: 1:2,500

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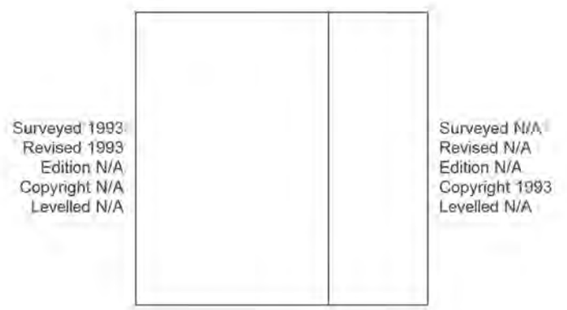

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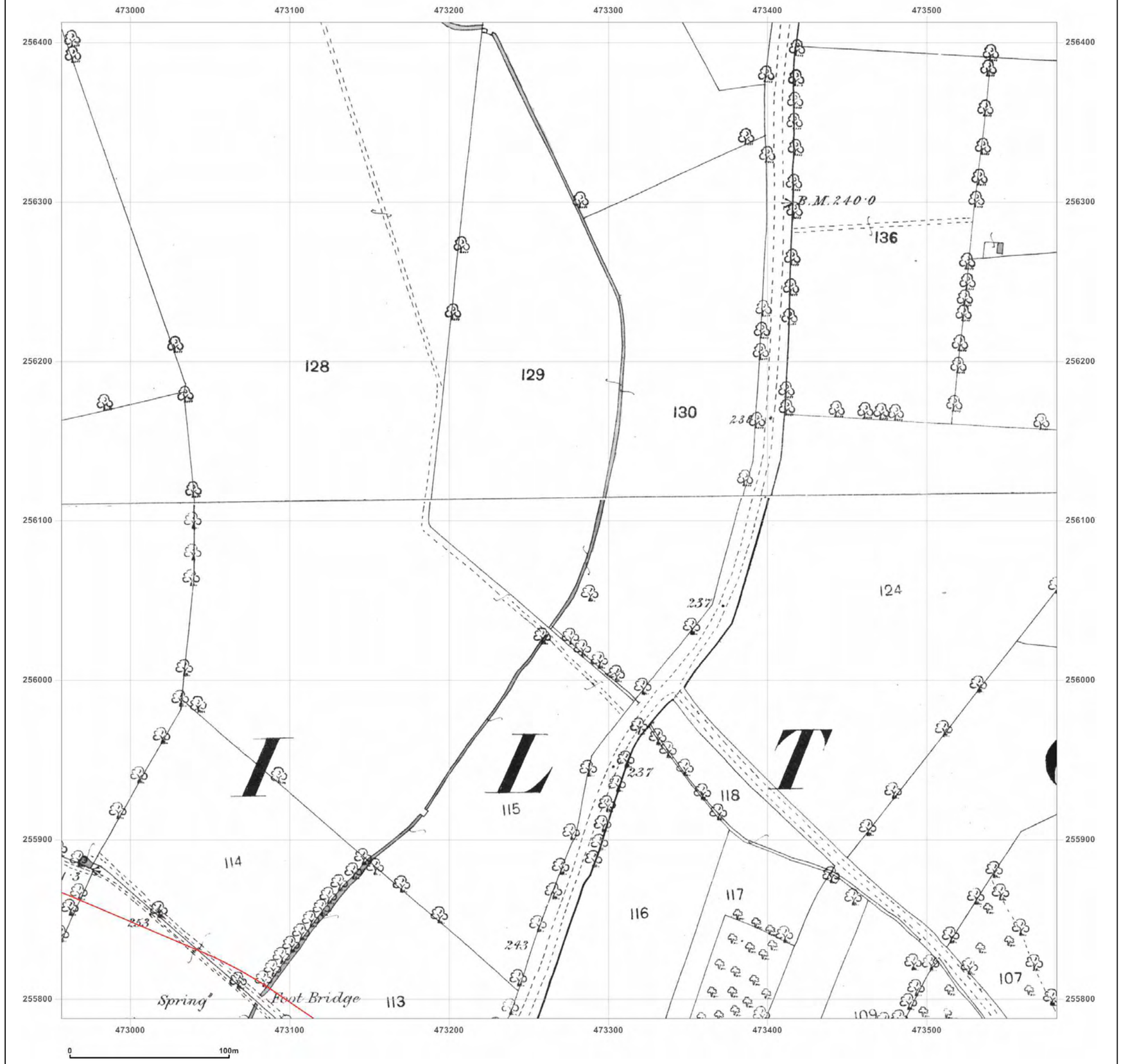

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_6
Grid Ref: 473269, 256100

Map Name: County Series

Map date: **1885**

Scale: 1:2,500

Printed at: 1:2,500

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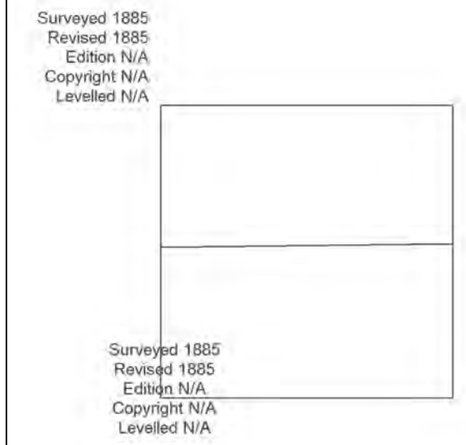

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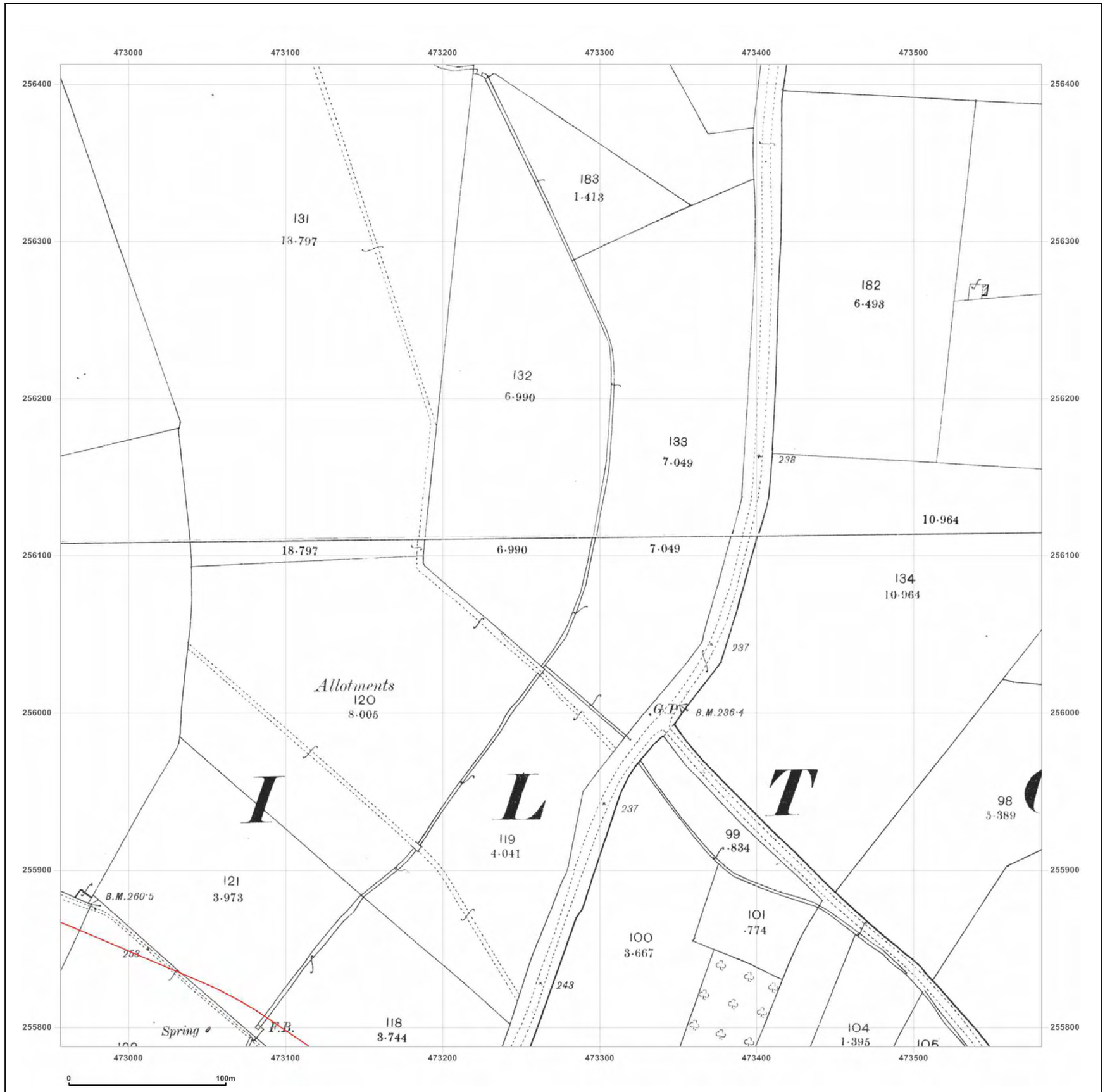

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_6
Grid Ref: 473269, 256100

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

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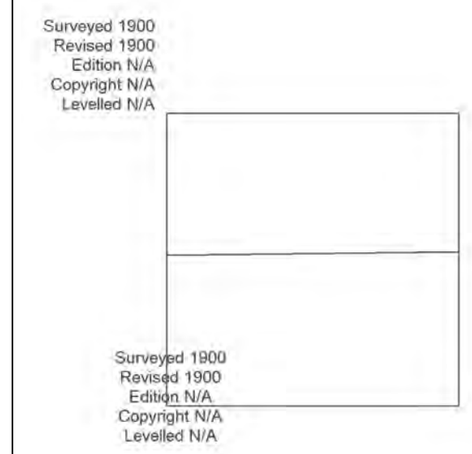

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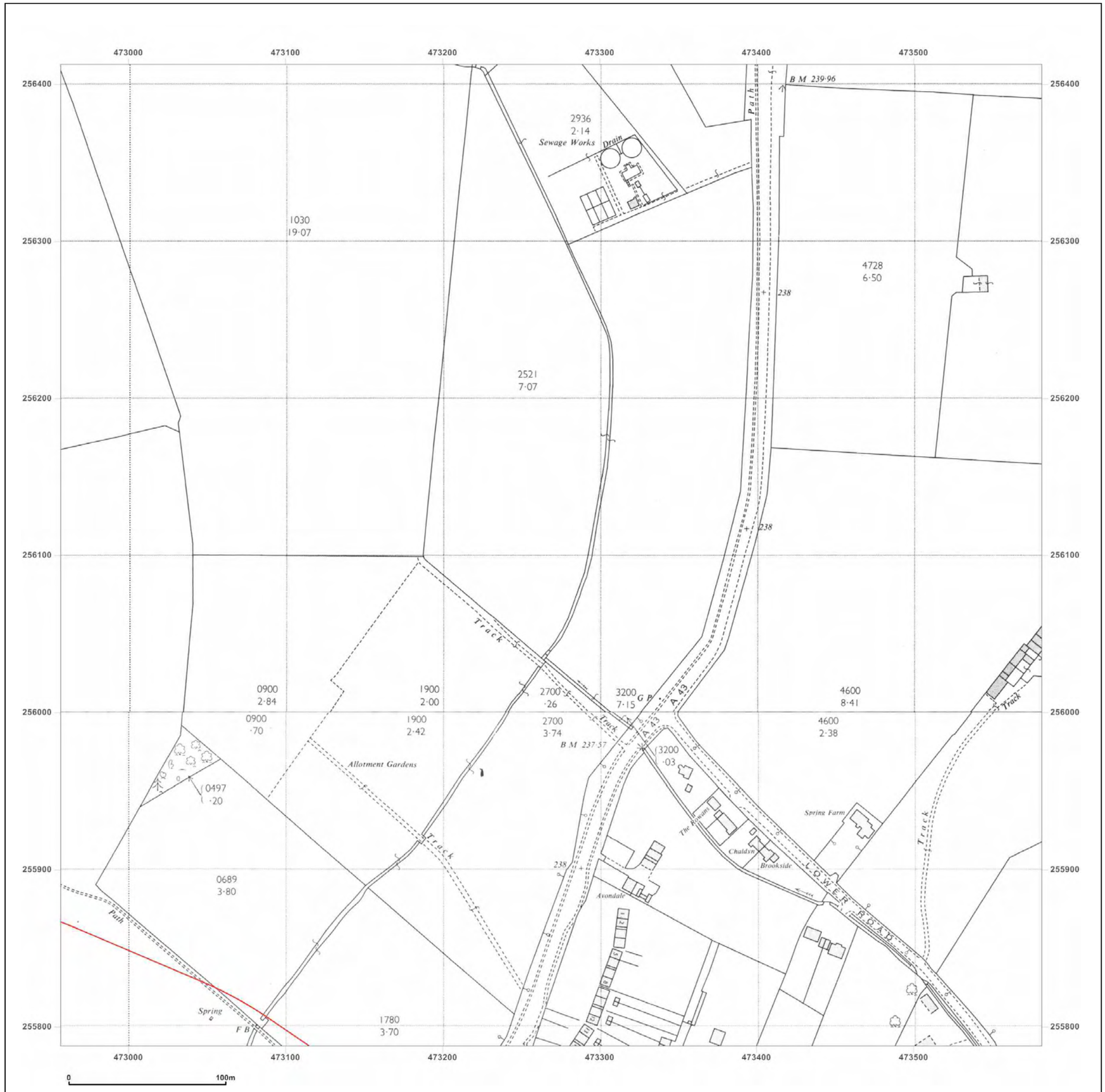

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_6
Grid Ref: 473269, 256100

Map Name: National Grid

Map date: **1964**

Scale: 1:2,500

Printed at: 1:2,500

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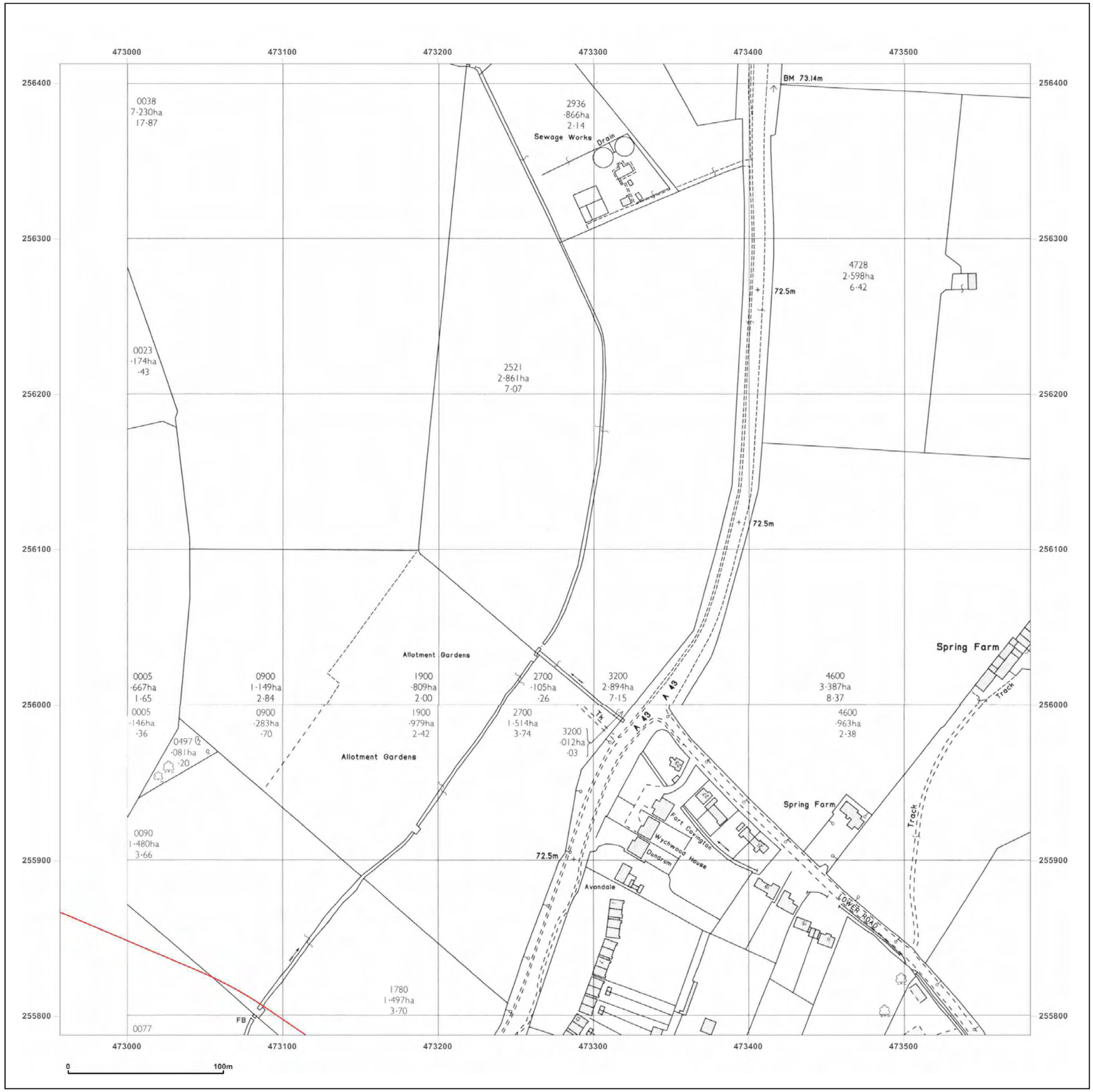

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_6
Grid Ref: 473269, 256100

Map Name: National Grid

Map date: **1976-1977**

Scale: 1:2,500

Printed at: 1:2,500

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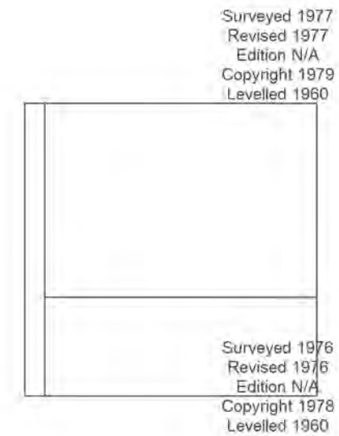

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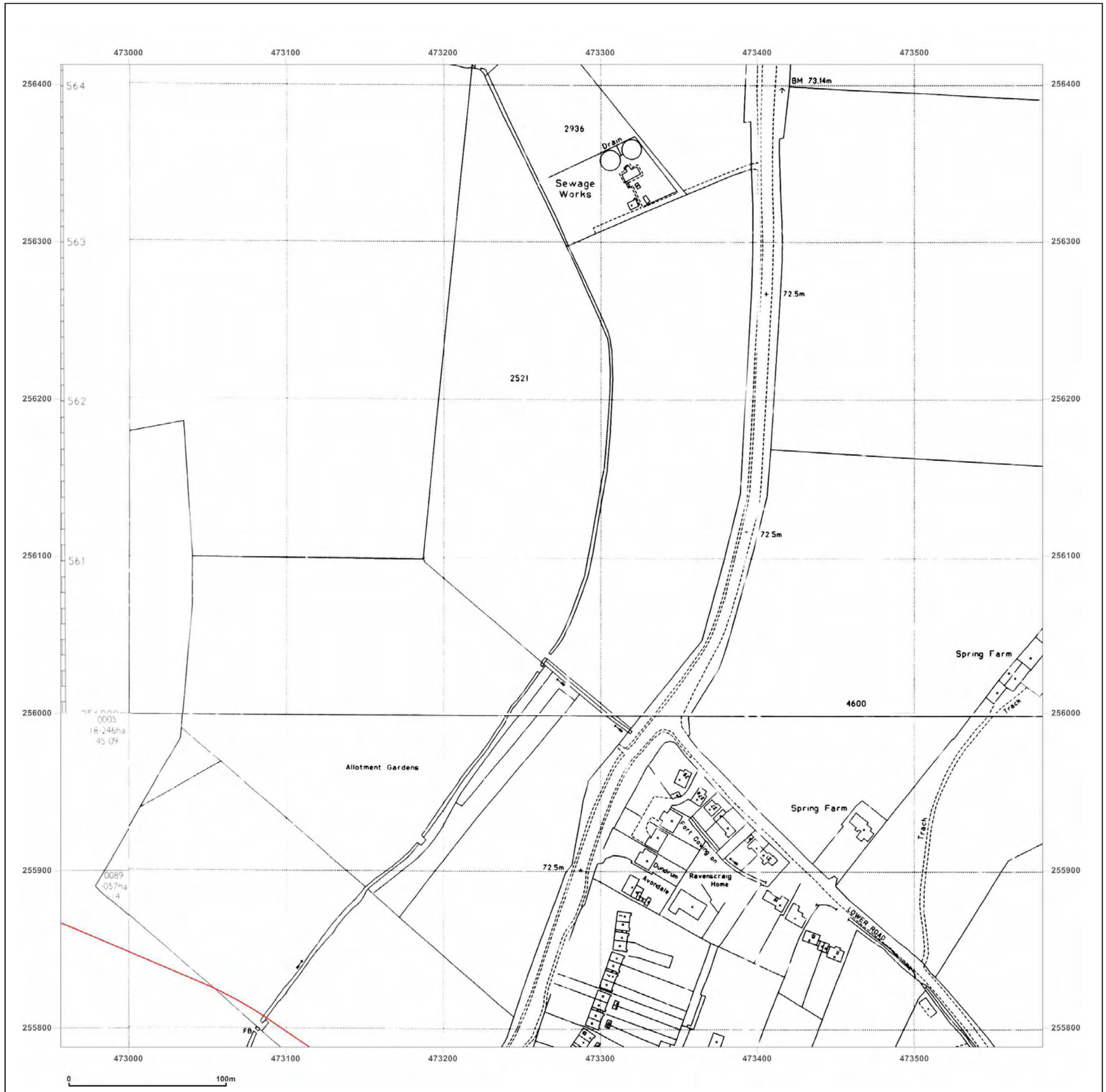

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_6
Grid Ref: 473269, 256100

Map Name: National Grid

Map date: **1989-1993**

Scale: 1:2,500

Printed at: 1:2,500

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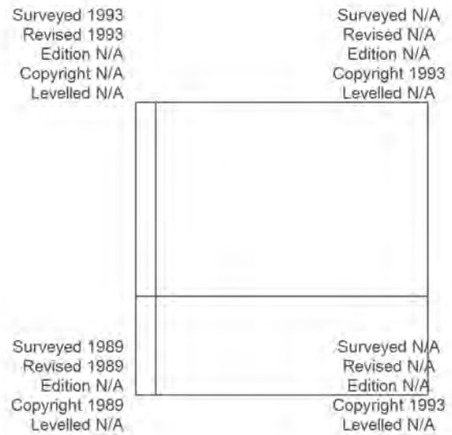

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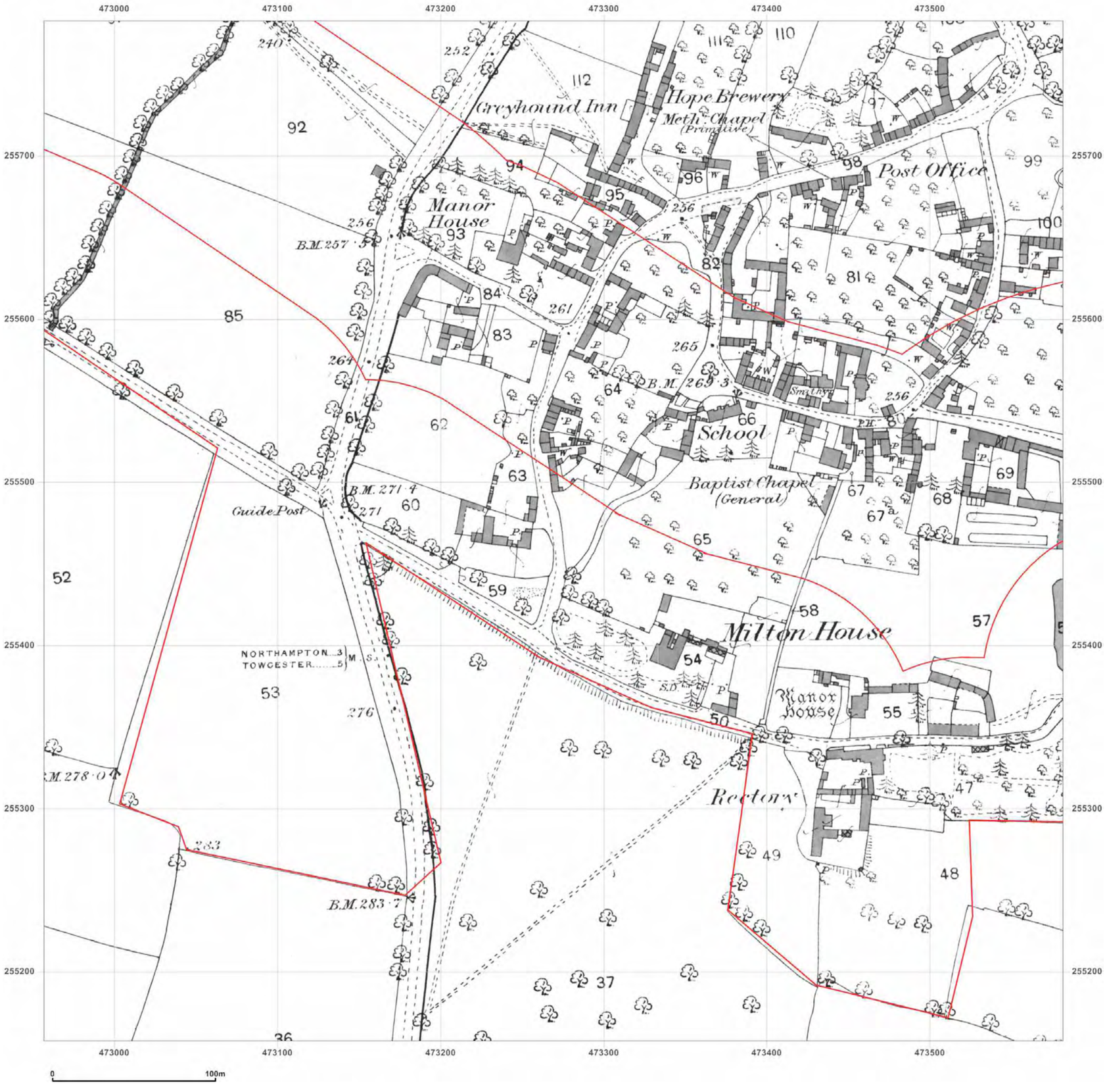

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_5
Grid Ref: 473269, 255470

Map Name: County Series

Map date: **1885**

Scale: 1:2,500

Printed at: 1:2,500

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Surveyed 1885
Revised 1885
Edition N/A
Copyright N/A
Levelled N/A

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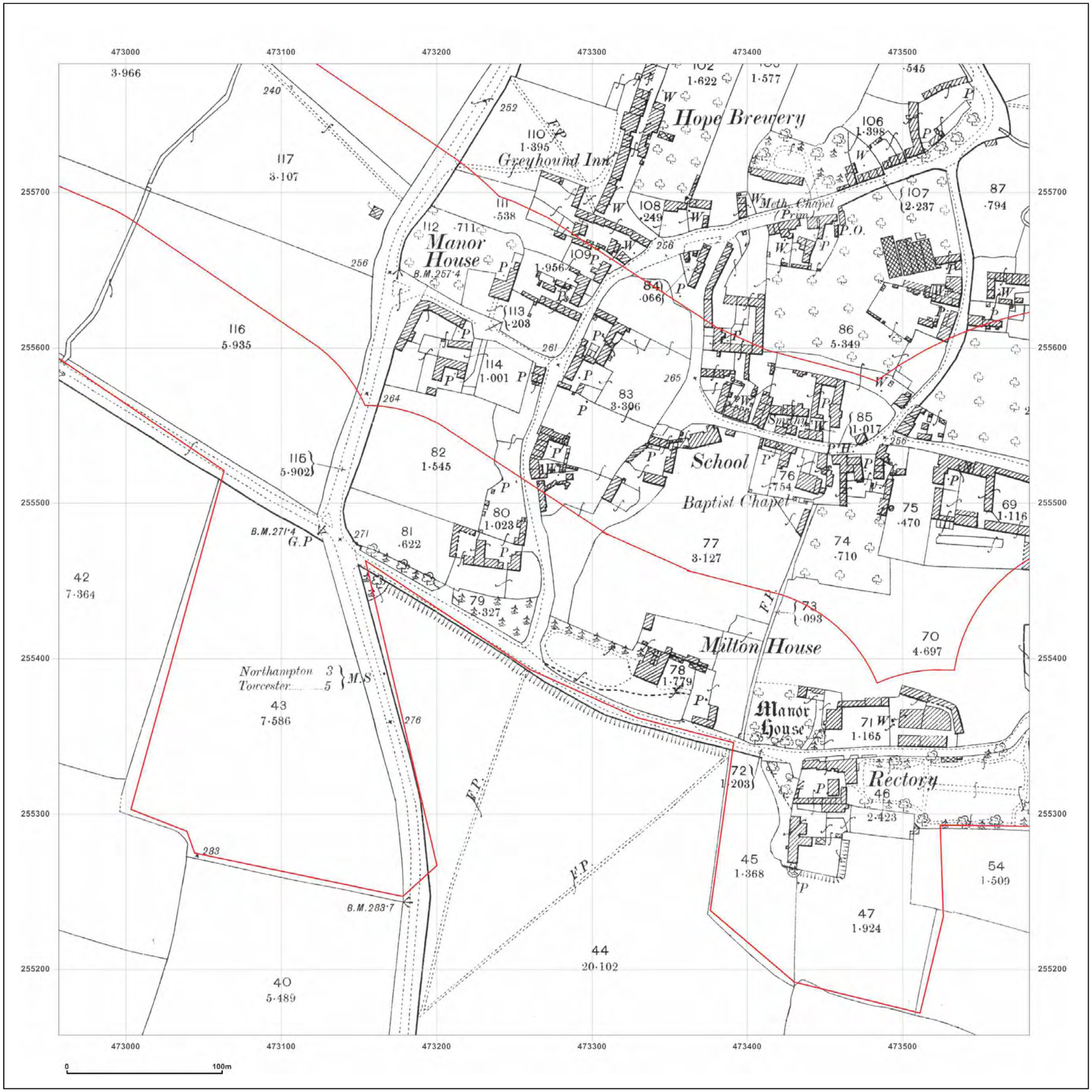
Production date: 25 March 2015

To view map legend click here *Legend*



GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_5
Grid Ref: 473269, 255470

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1900
Revised 1900
Edition N/A
Copyright N/A
Levelled N/A

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Production date: 25 March 2015

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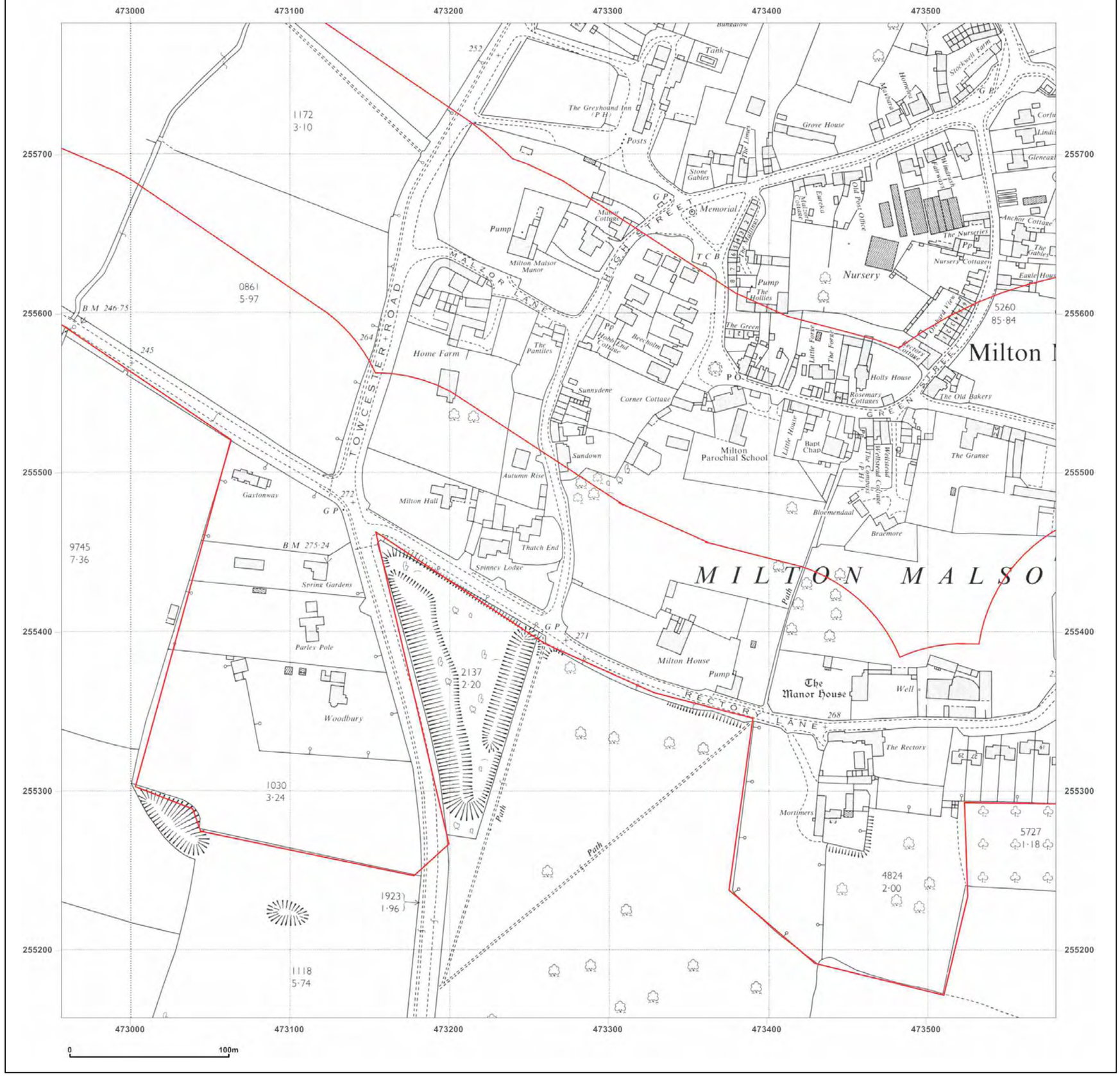

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_5
Grid Ref: 473269, 255470

Map Name: National Grid

Map date: **1964**

Scale: 1:2,500

Printed at: 1:2,500

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Surveyed 1964
Revised 1964
Edition N/A
Copyright 1965
Levelled 1961

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Production date: 25 March 2015

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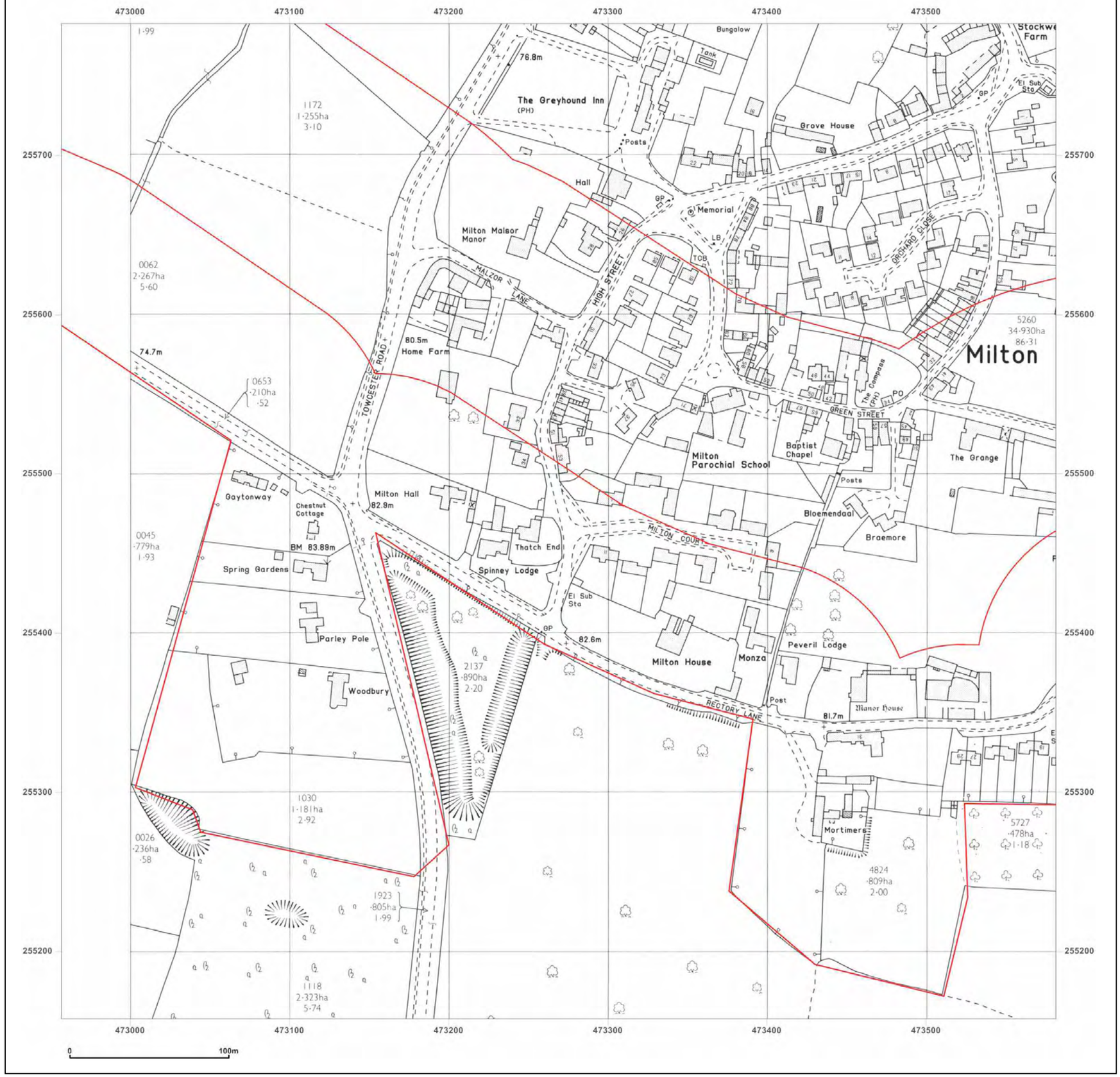

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_5
Grid Ref: 473269, 255470

Map Name: National Grid

Map date: **1976**

Scale: 1:2,500

Printed at: 1:2,500

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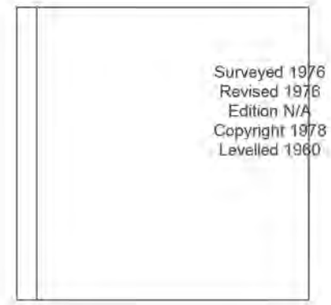

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_5
Grid Ref: 473269, 255470

Map Name: National Grid

Map date: **1989-1993**

Scale: 1:2,500

Printed at: 1:2,500

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

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1993
Levelled N/A

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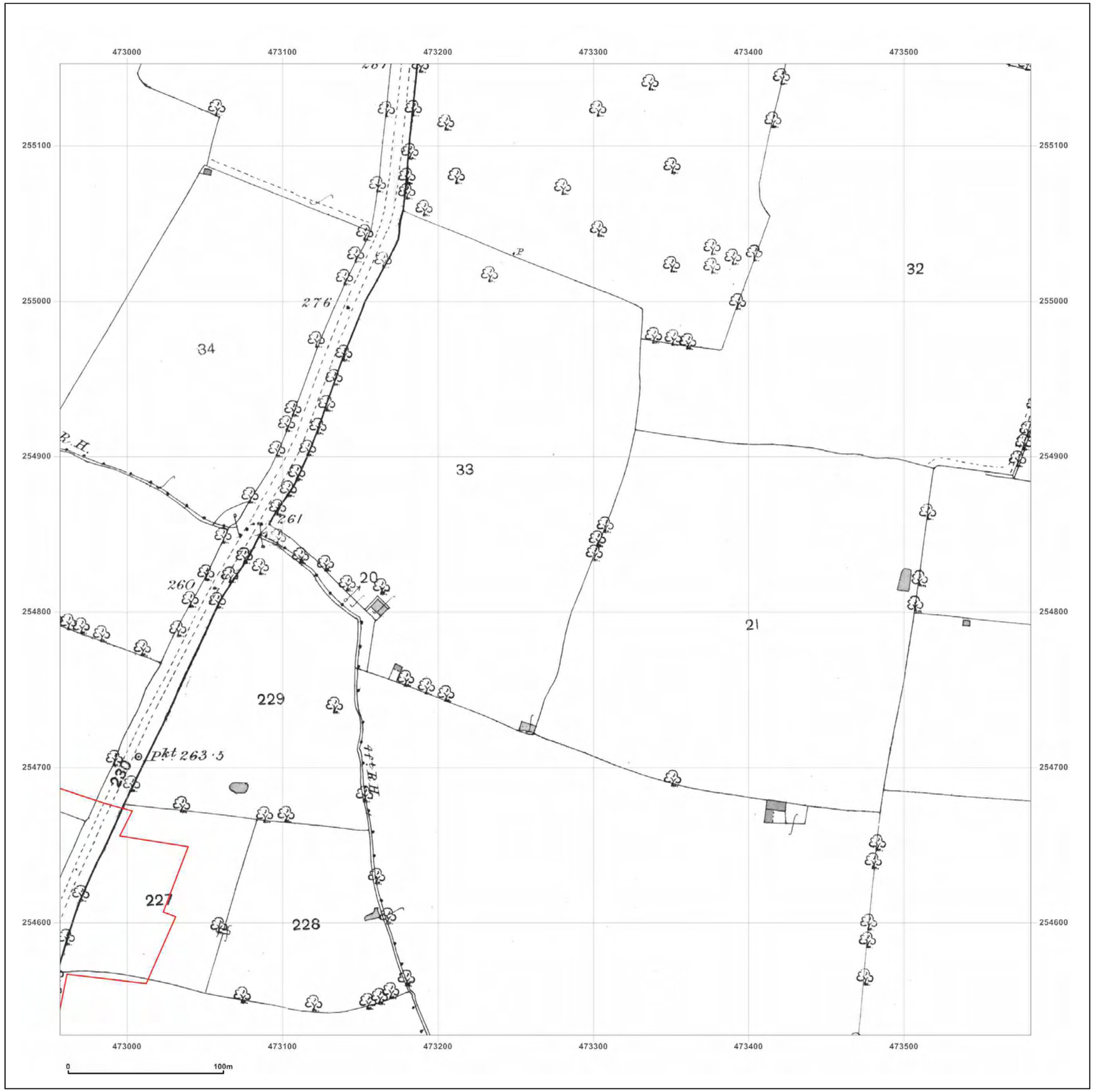

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_4
Grid Ref: 473269, 254840

Map Name: County Series

Map date: **1885**

Scale: 1:2,500

Printed at: 1:2,500

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W E
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Surveyed 1885
Revised 1885
Edition N/A
Copyright N/A
Levelled N/A



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Production date: 25 March 2015

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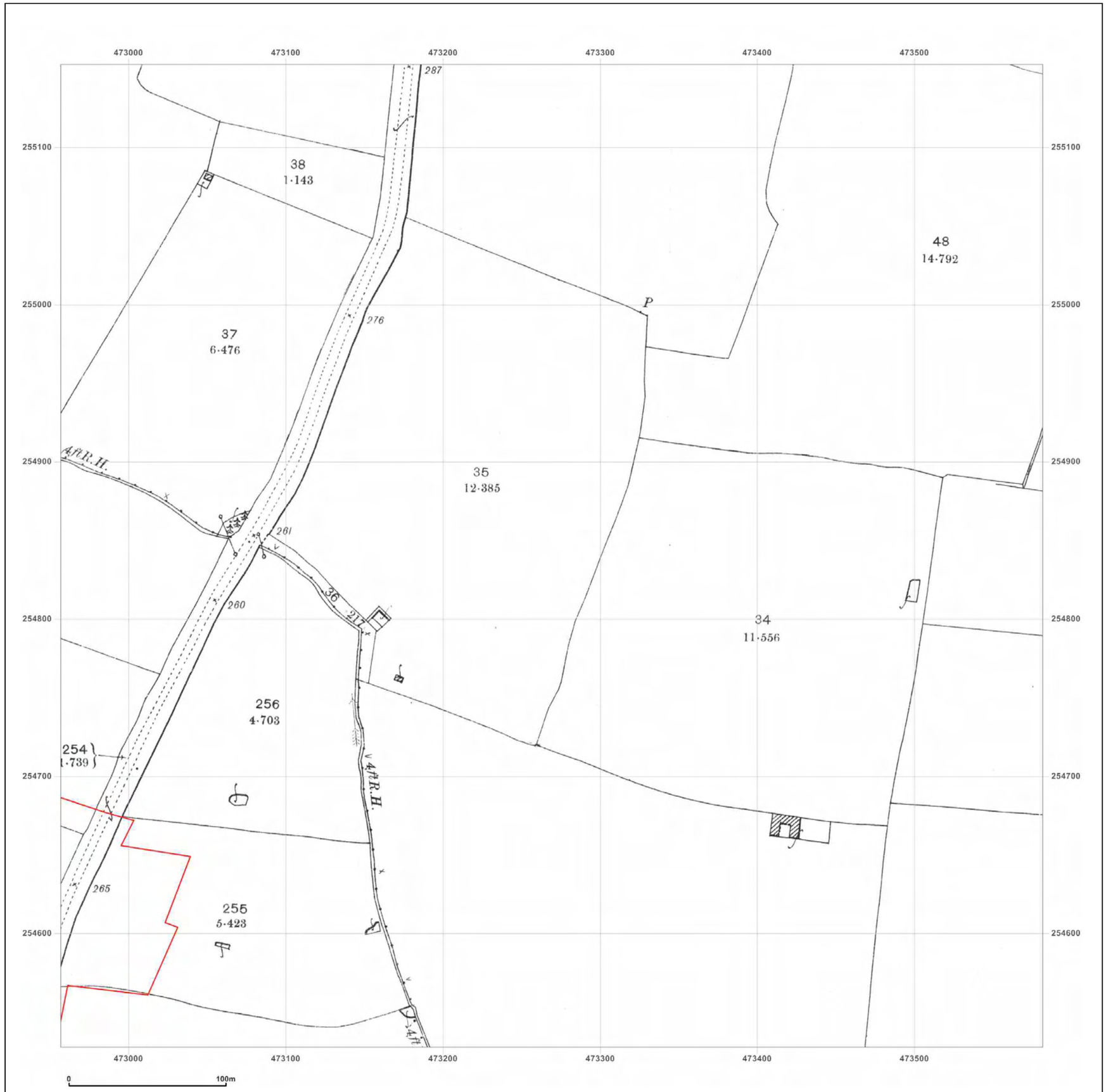

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_4
Grid Ref: 473269, 254840

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

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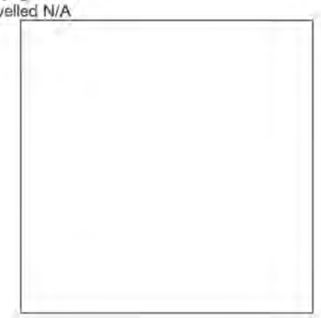
Surveyed 1900
Revised 1900
Edition N/A
Copyright N/A
Levelled N/A



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Production date: 25 March 2015

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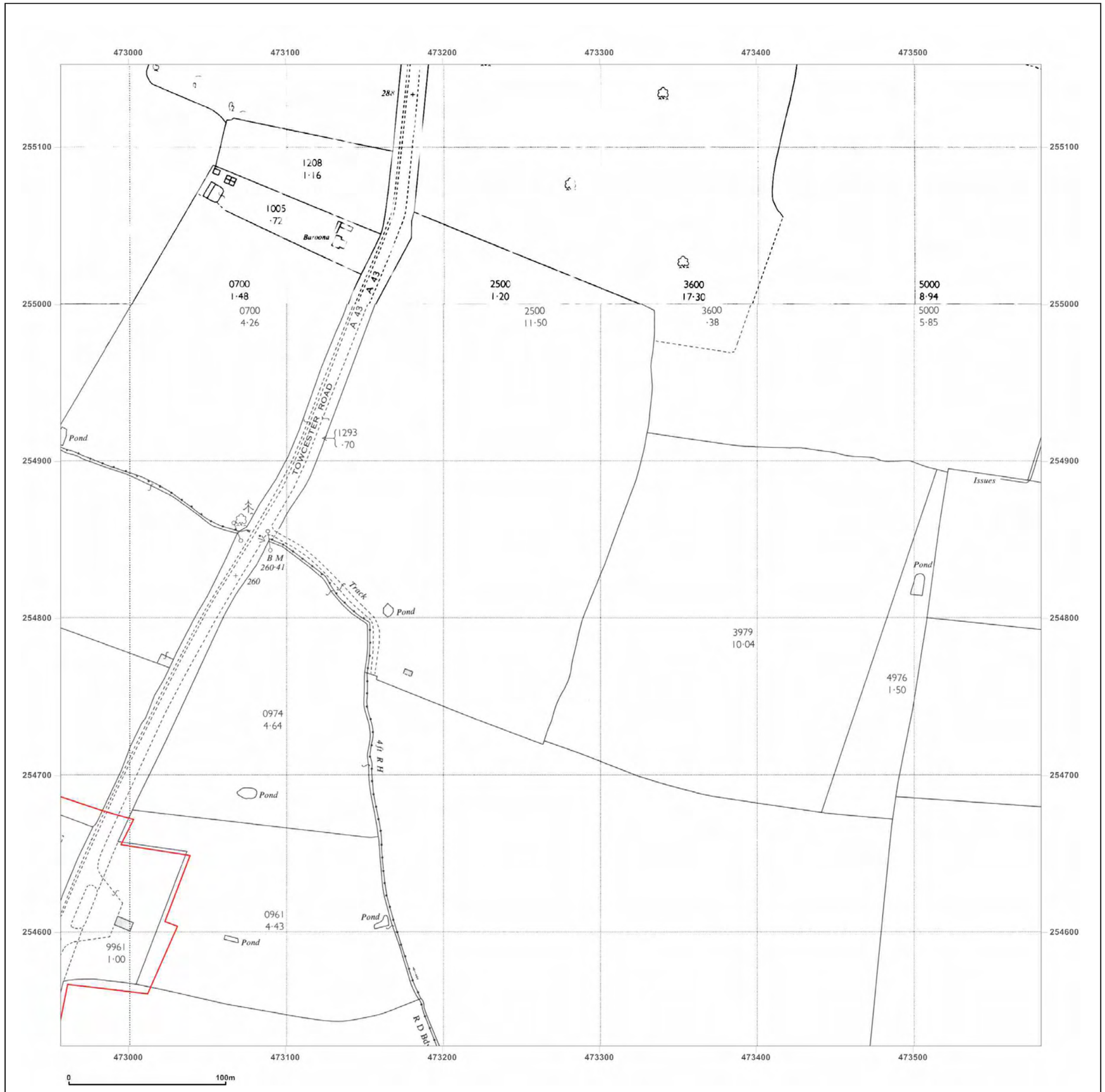

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_4
Grid Ref: 473269, 254840

Map Name: National Grid

Map date: **1965-1966**

Scale: 1:2,500

Printed at: 1:2,500

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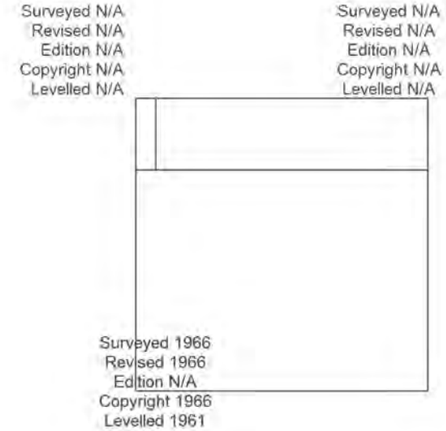

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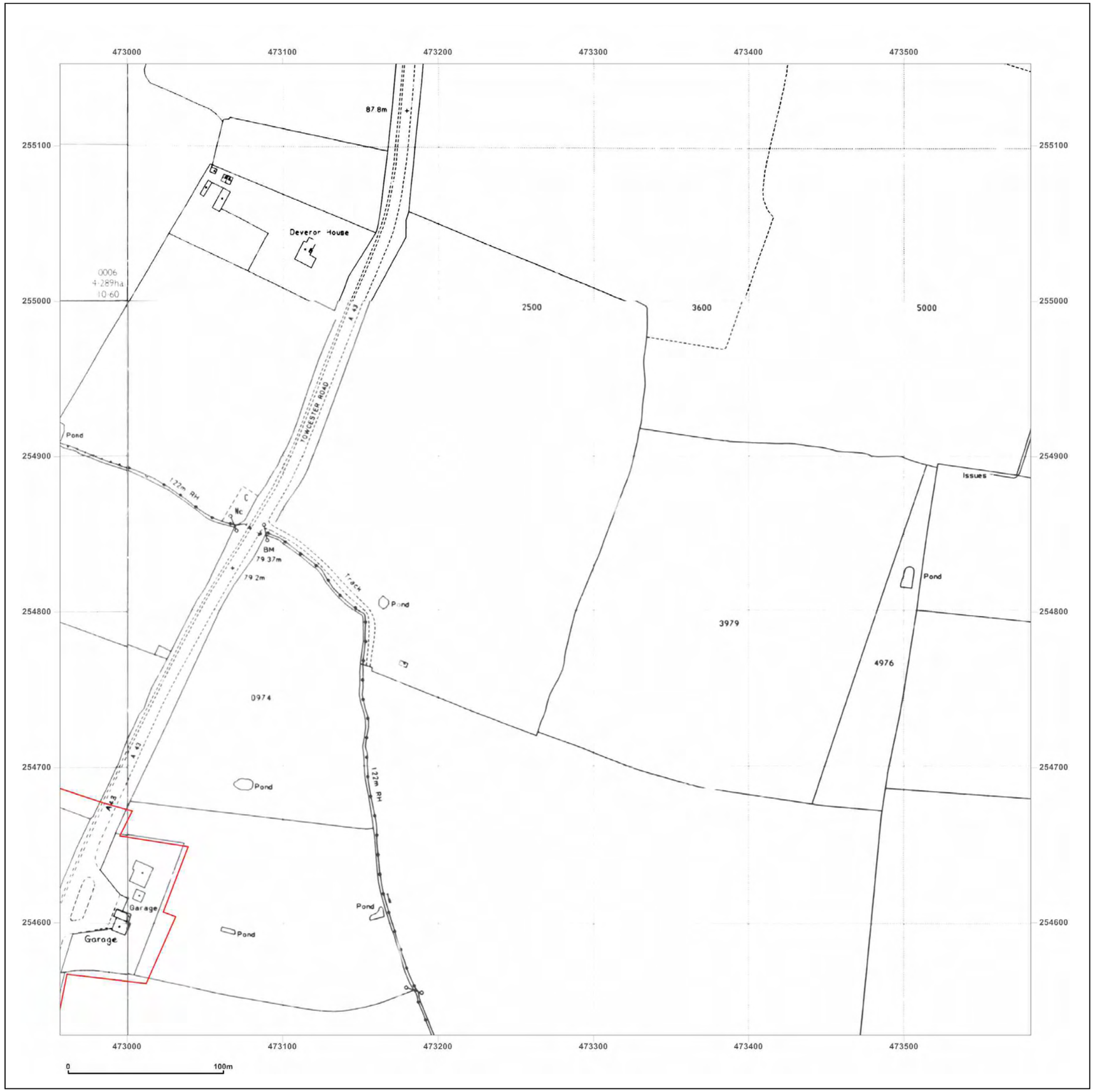

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_4
Grid Ref: 473269, 254840

Map Name: National Grid

Map date: **1989-1993**

Scale: 1:2,500

Printed at: 1:2,500

N
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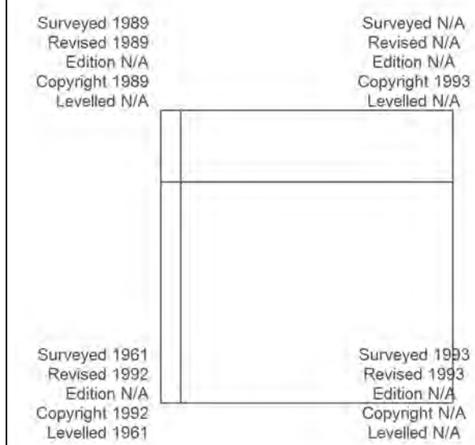

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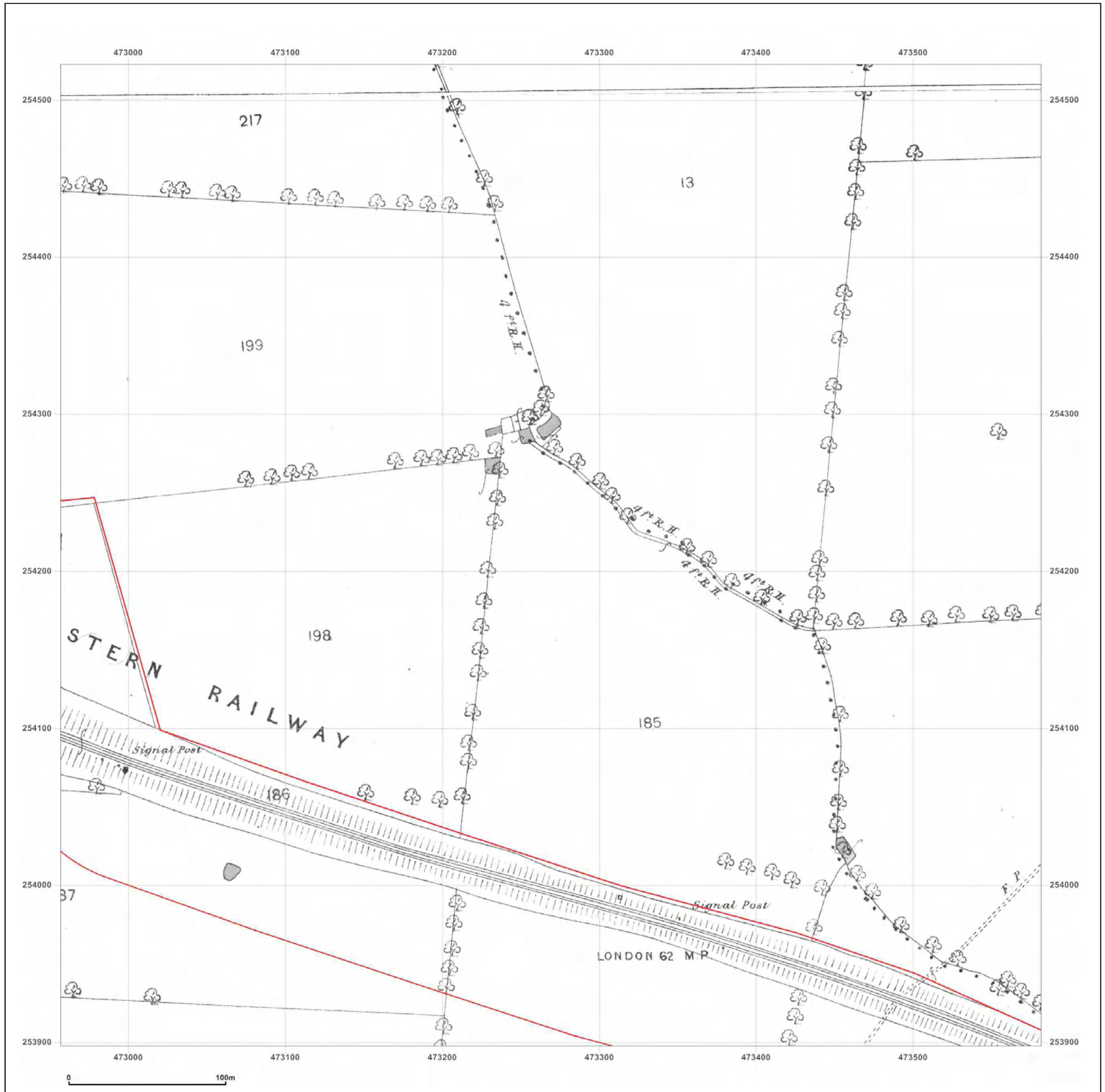

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_3
Grid Ref: 473269, 254210

Map Name: County Series

Map date: **1885**

Scale: 1:2,500

Printed at: 1:2,500

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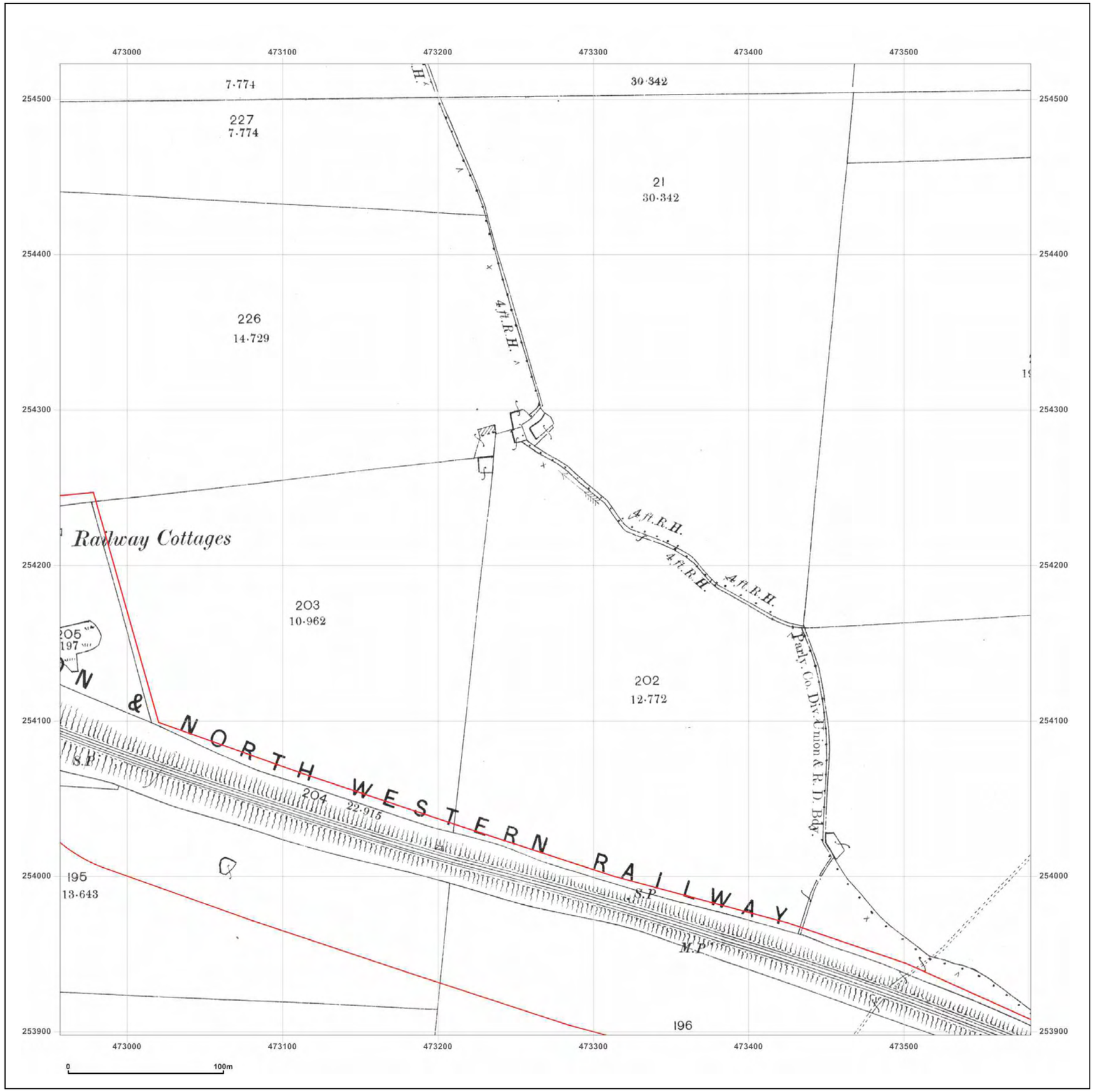

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_3
Grid Ref: 473269, 254210

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

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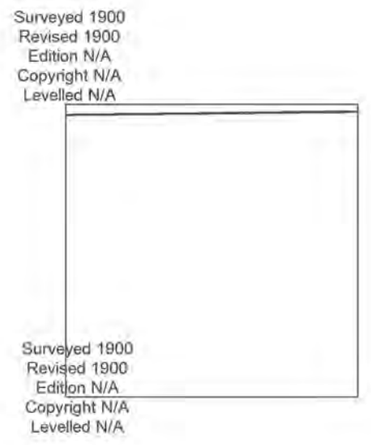

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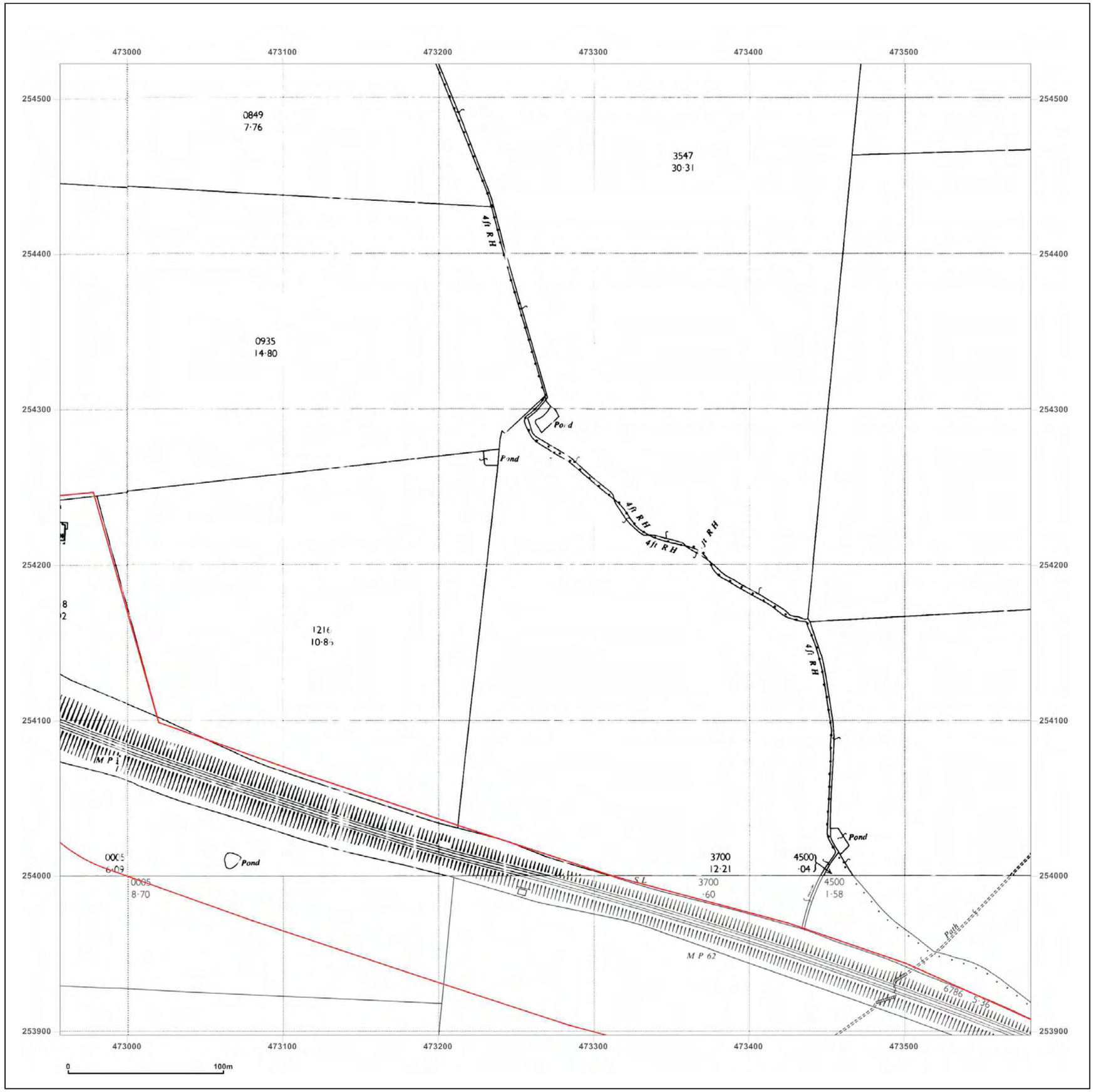

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_3
Grid Ref: 473269, 254210

Map Name: National Grid

Map date: **1966**

Scale: 1:2,500

Printed at: 1:2,500

N
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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 N/A
Levelled N/A

Surveyed 1966
Revised 1966
Edition N/A
Copyright 1966
Levelled 1961

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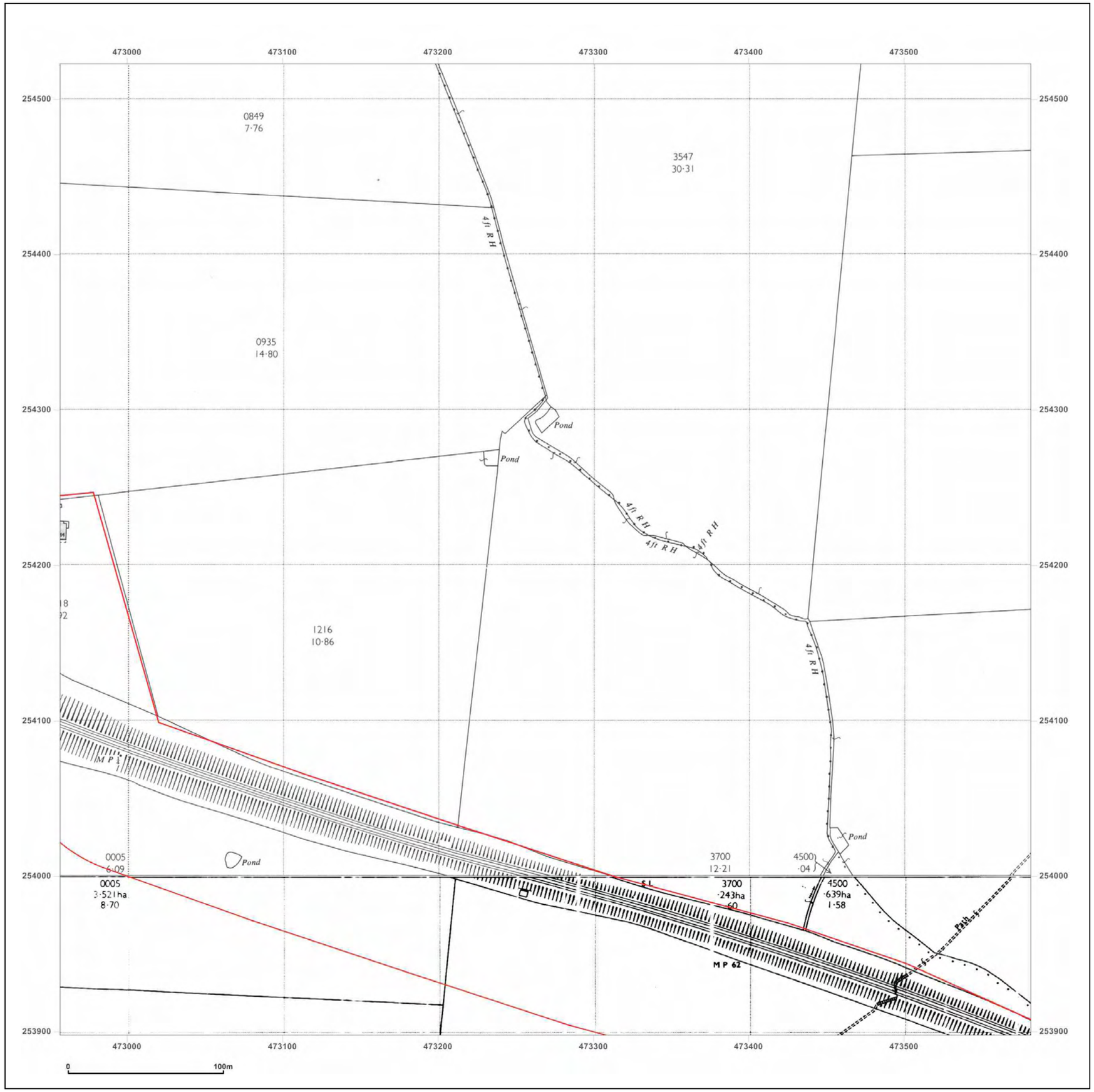

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_3
Grid Ref: 473269, 254210

Map Name: National Grid

Map date: **1966-1971**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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Surveyed 1966
Revised 1966
Edition N/A
Copyright 1966
Levelled 1961

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

Surveyed N/A
Revised N/A
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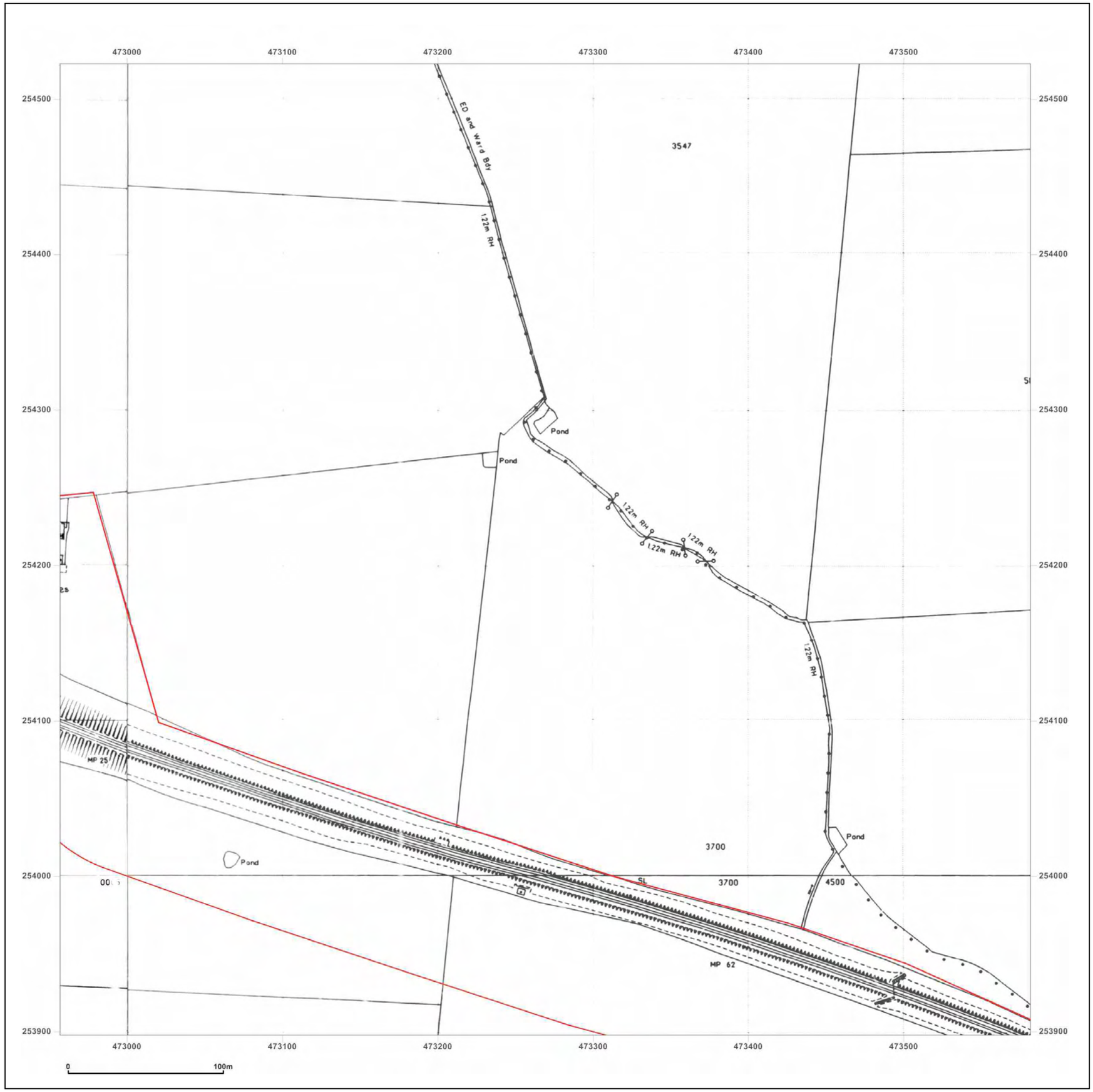

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_3
Grid Ref: 473269, 254210

Map Name: National Grid

Map date: **1992-1993**

Scale: 1:2,500

Printed at: 1:2,500

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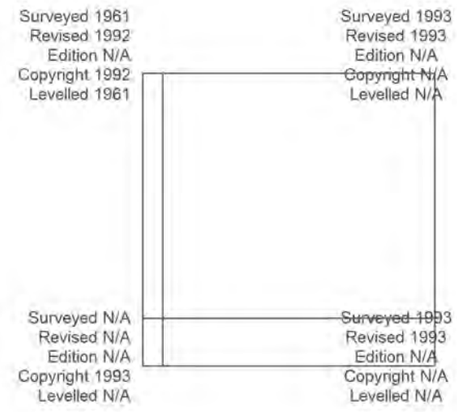

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Production date: 25 March 2015

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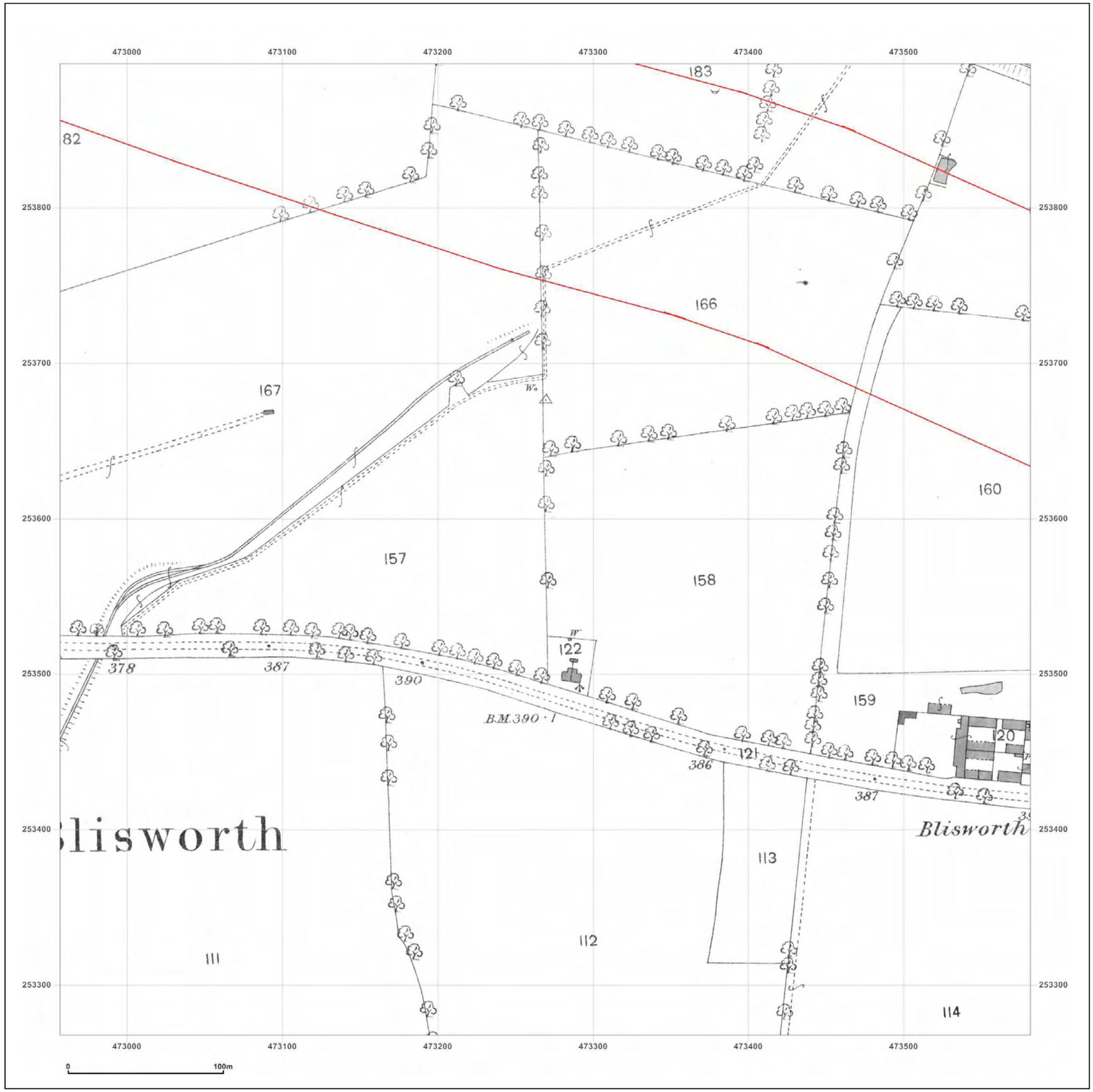

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_2
Grid Ref: 473269, 253580

Map Name: County Series

Map date: **1885**

Scale: 1:2,500

Printed at: 1:2,500

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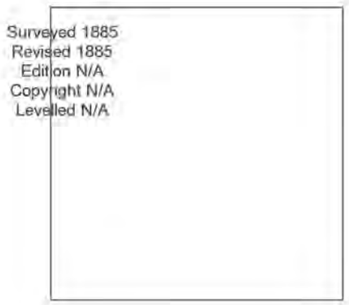

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Production date: 25 March 2015

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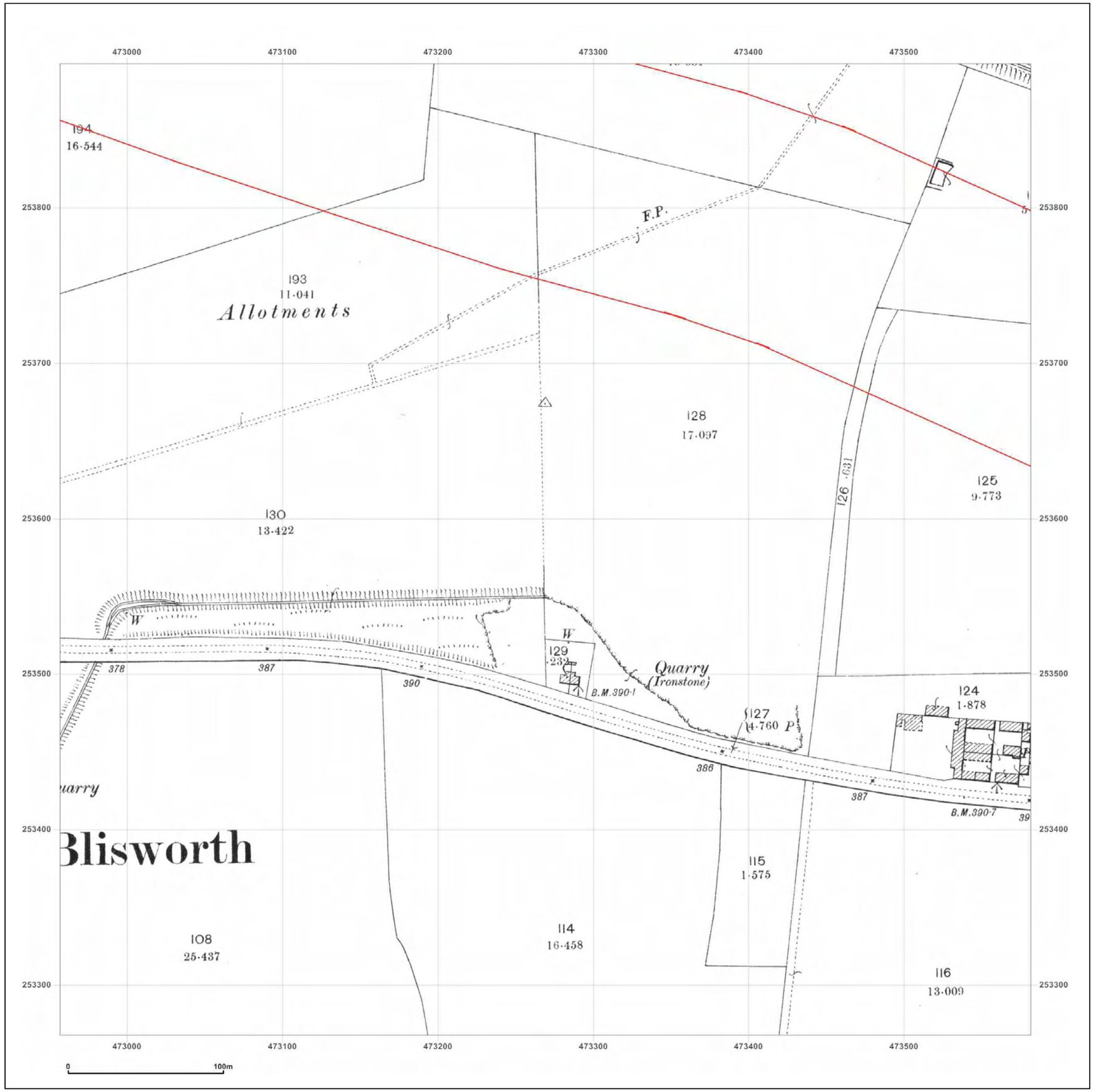

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_2
Grid Ref: 473269, 253580

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

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Surveyed 1900
Revised 1900
Edition N/A
Copyright N/A
Levelled N/A

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Production date: 25 March 2015

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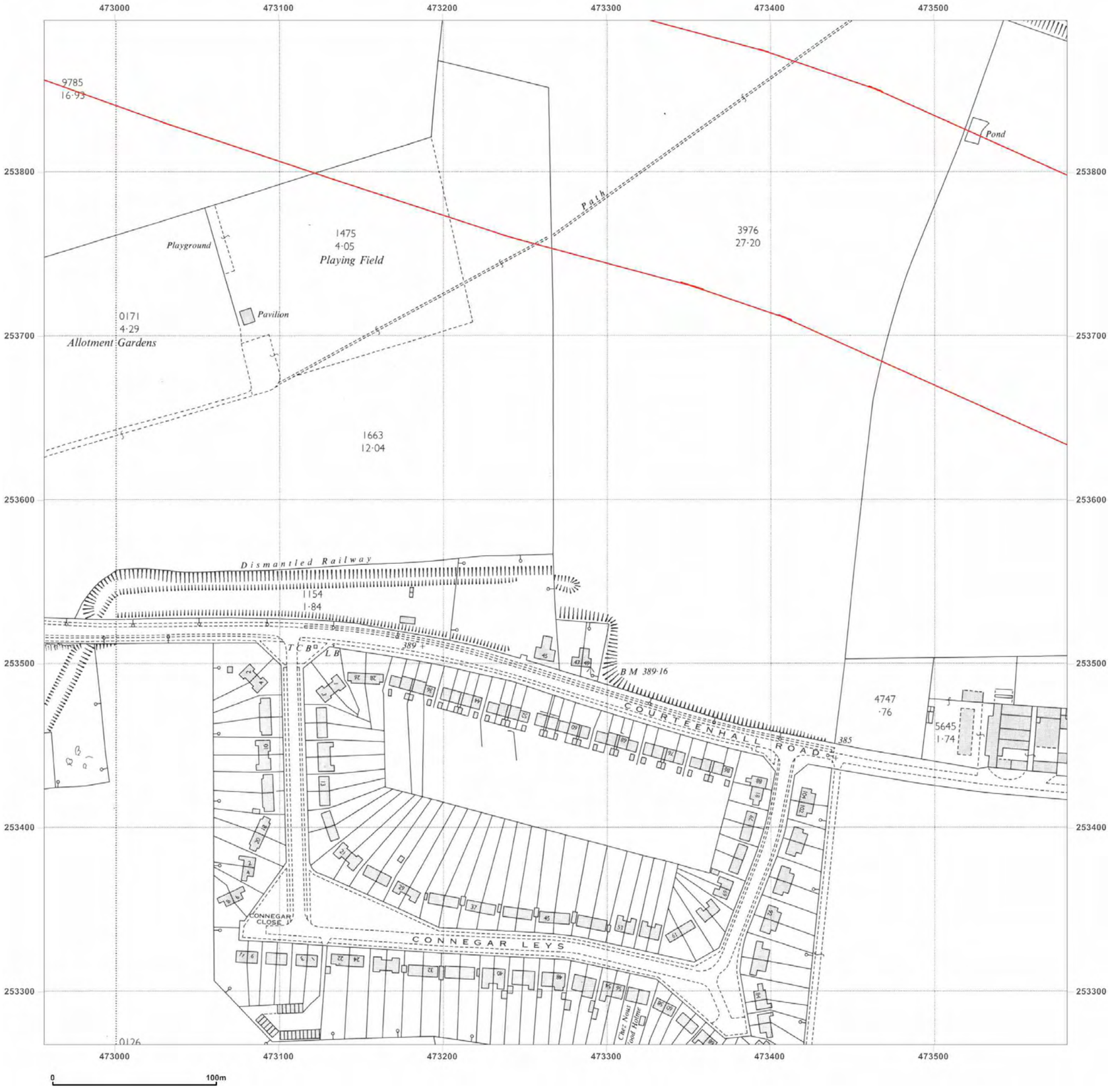

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_2
Grid Ref: 473269, 253580

Map Name: National Grid

Map date: **1966**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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Surveyed 1966
Revised 1966
Edition N/A
Copyright 1966
Levelled 1961

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_2
Grid Ref: 473269, 253580

Map Name: National Grid

Map date: **1970**

Scale: 1:2,500

Printed at: 1:2,500

N
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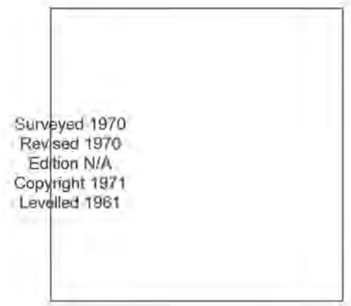

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Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_4_2
Grid Ref: 473269, 253580

Map Name: National Grid

Map date: **1993**

Scale: 1:2,500

Printed at: 1:2,500

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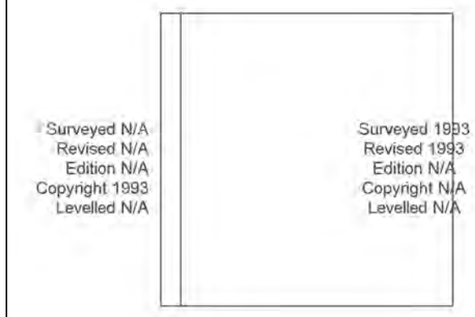

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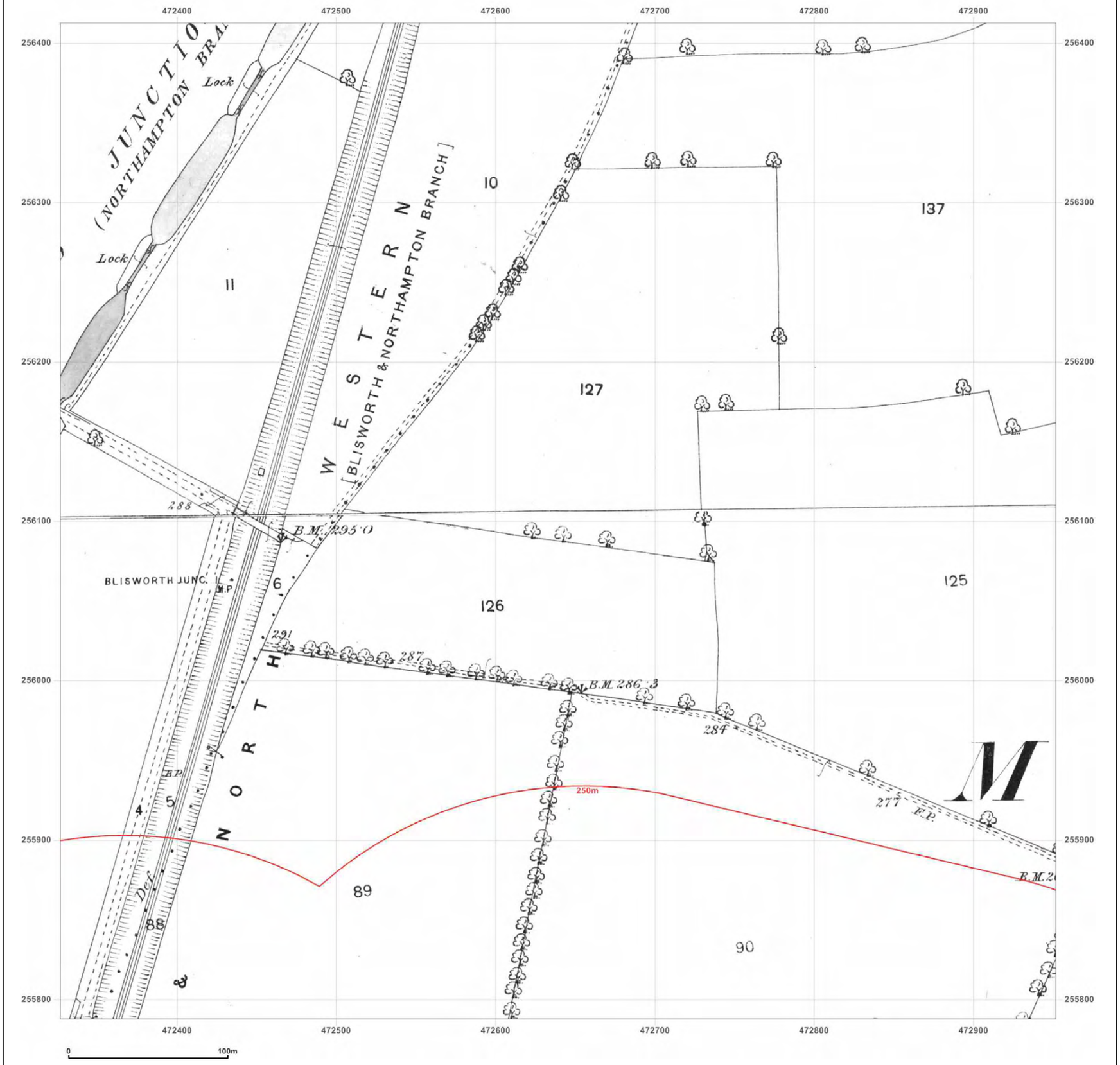

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_6
Grid Ref: 472639, 256100

Map Name: County Series

Map date: **1885**

Scale: 1:2,500

Printed at: 1:2,500

N
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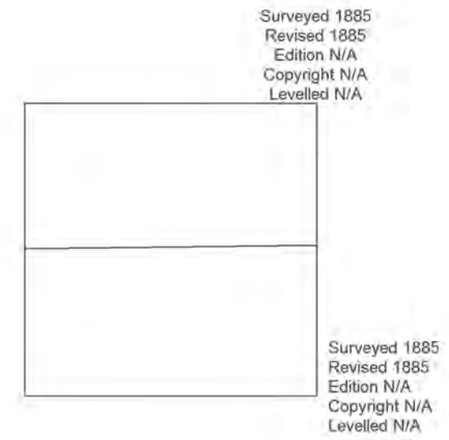

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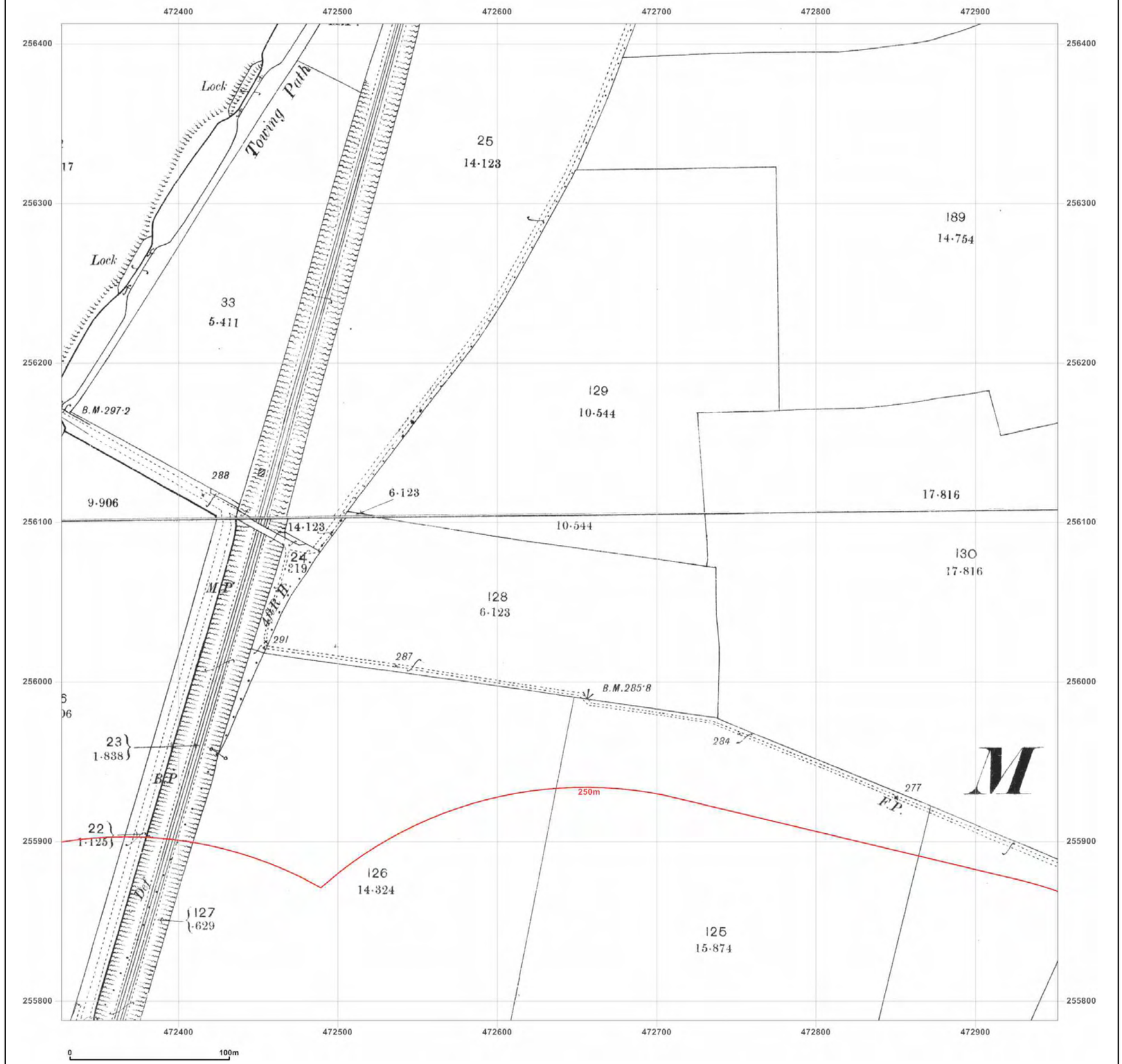

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_6
Grid Ref: 472639, 256100

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

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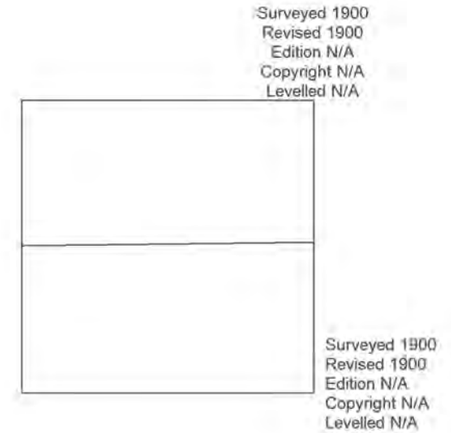

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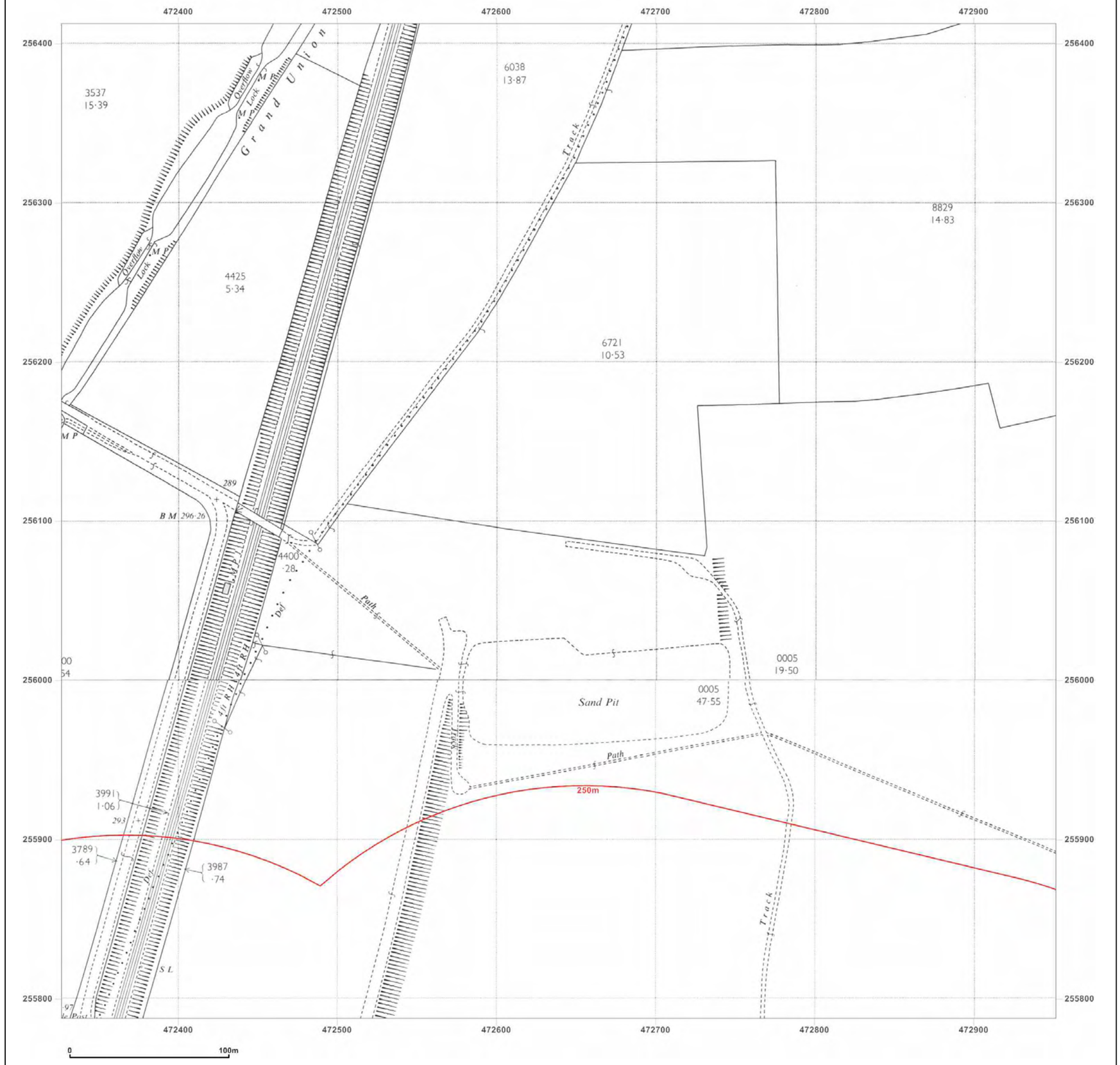

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_6
Grid Ref: 472639, 256100

Map Name: National Grid

Map date: **1964**

Scale: 1:2,500

Printed at: 1:2,500

N
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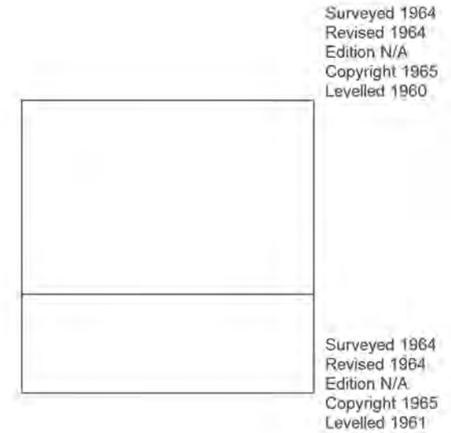

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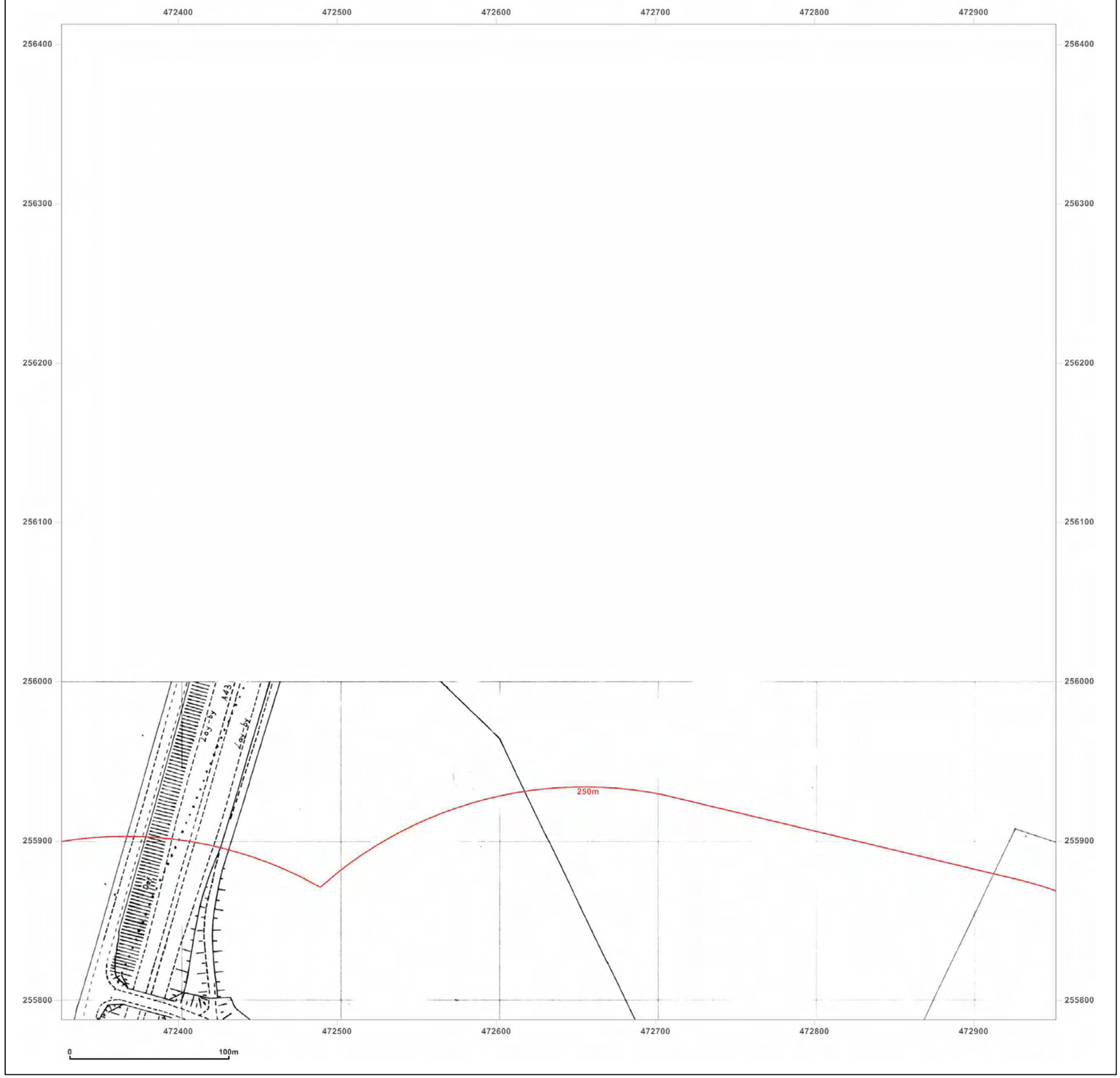

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_6
Grid Ref: 472639, 256100

Map Name: National Grid

Map date: **1992**

Scale: 1:2,500

Printed at: 1:2,500

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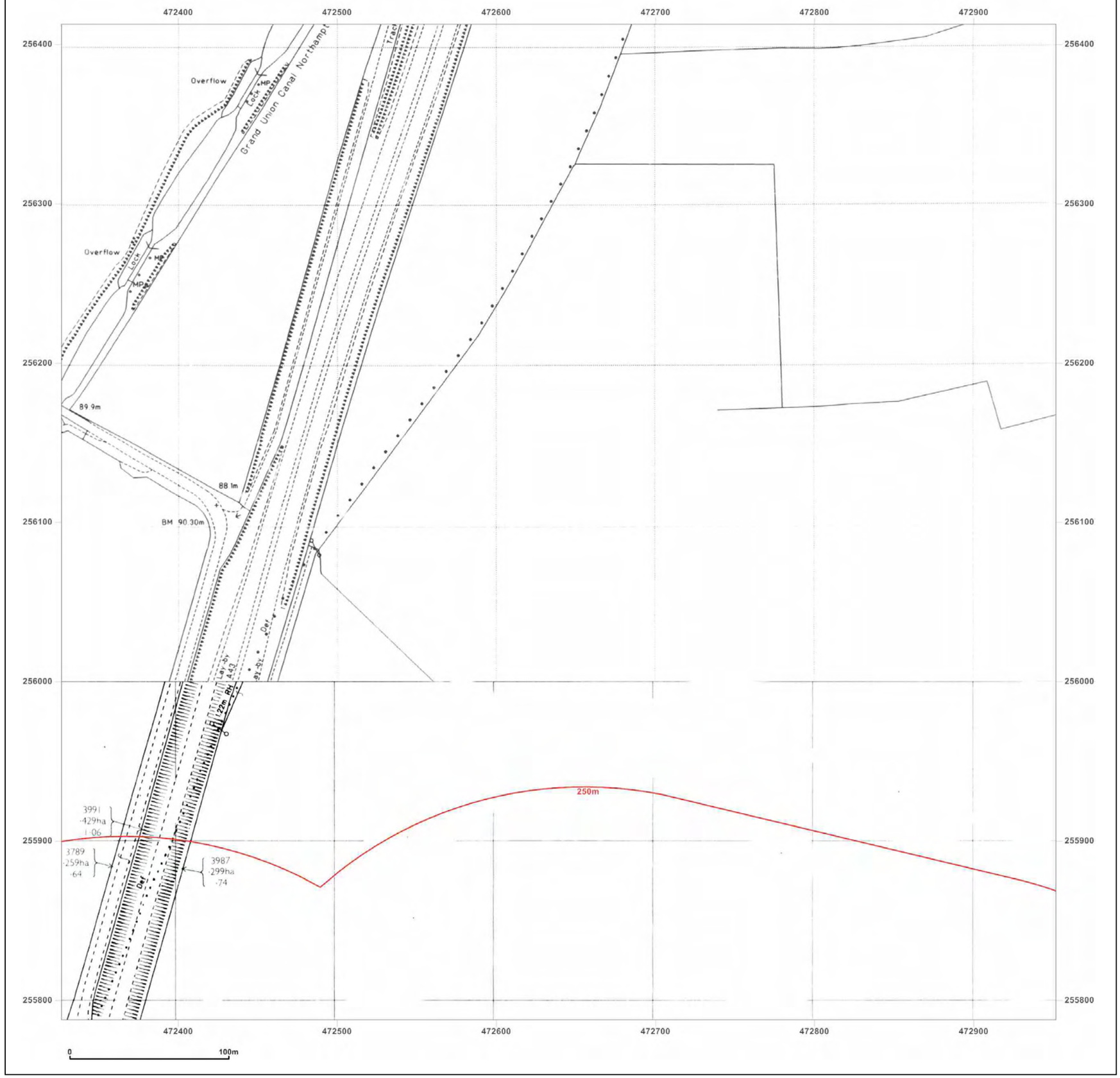

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_6
Grid Ref: 472639, 256100

Map Name: National Grid

Map date: **1989-1993**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1993
Revised 1993
Edition N/A
Copyright N/A
Levelled N/A

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

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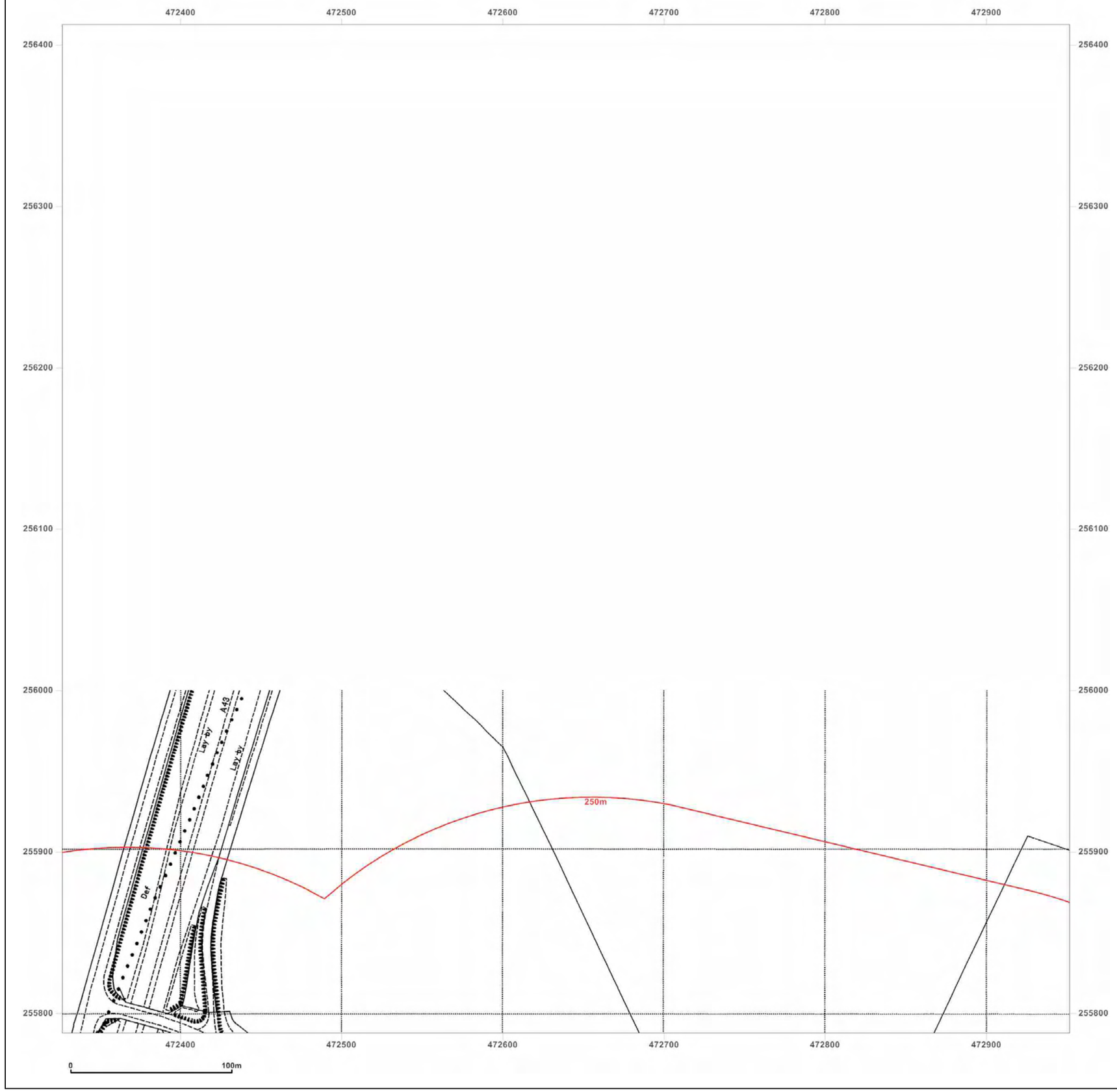


GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_6
Grid Ref: 472639, 256100

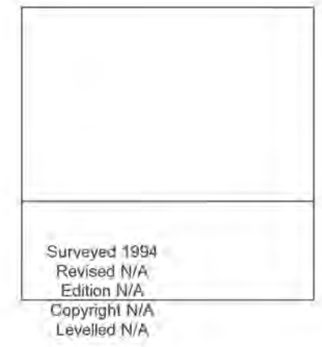
Map Name: National Grid

Map date: **1994**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
S



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Production date: 25 March 2015

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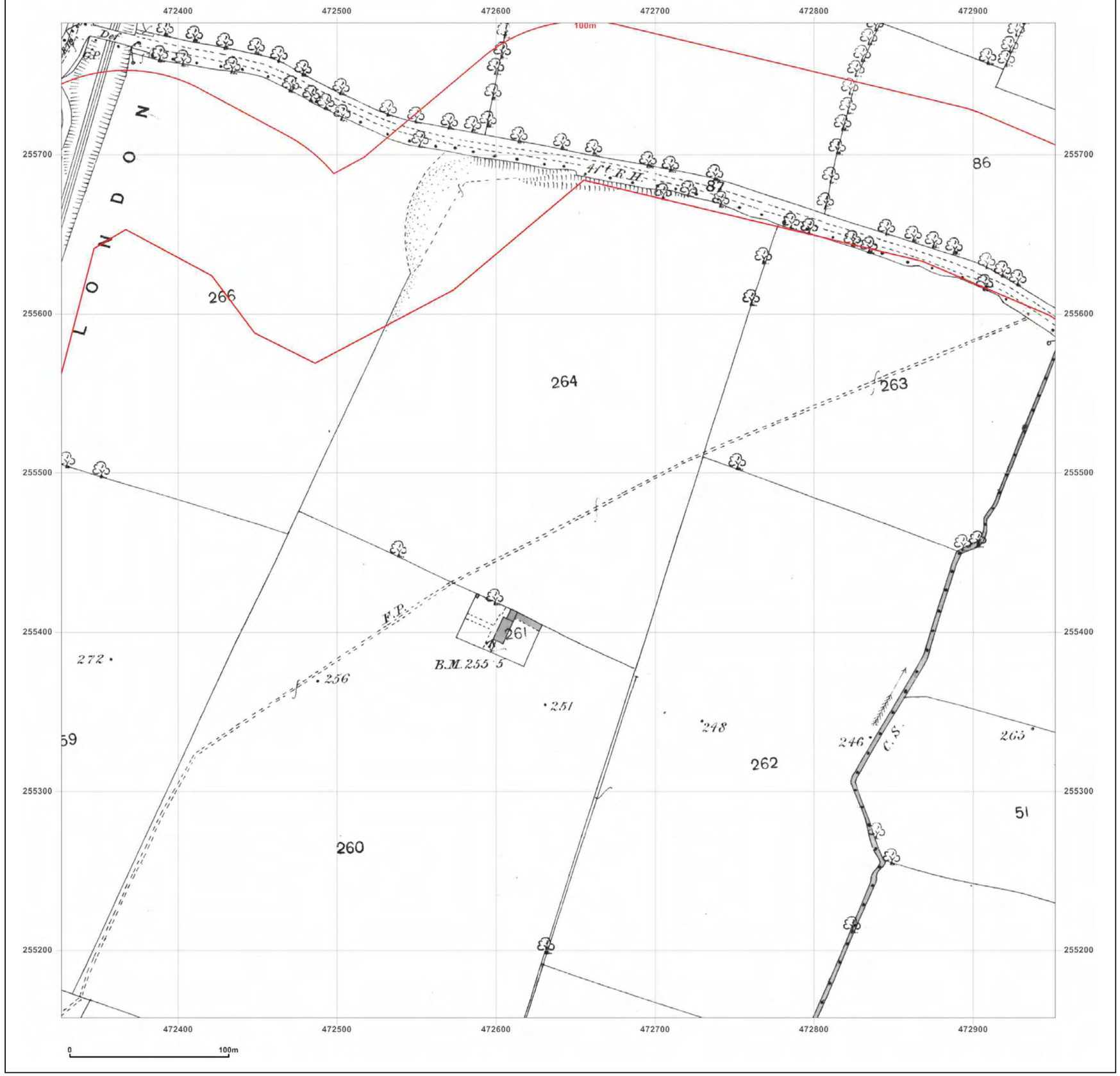

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_5
Grid Ref: 472639, 255470

Map Name: County Series

Map date: **1885**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1885
Revised 1885
Edition N/A
Copyright N/A
Levelled N/A

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Production date: 25 March 2015

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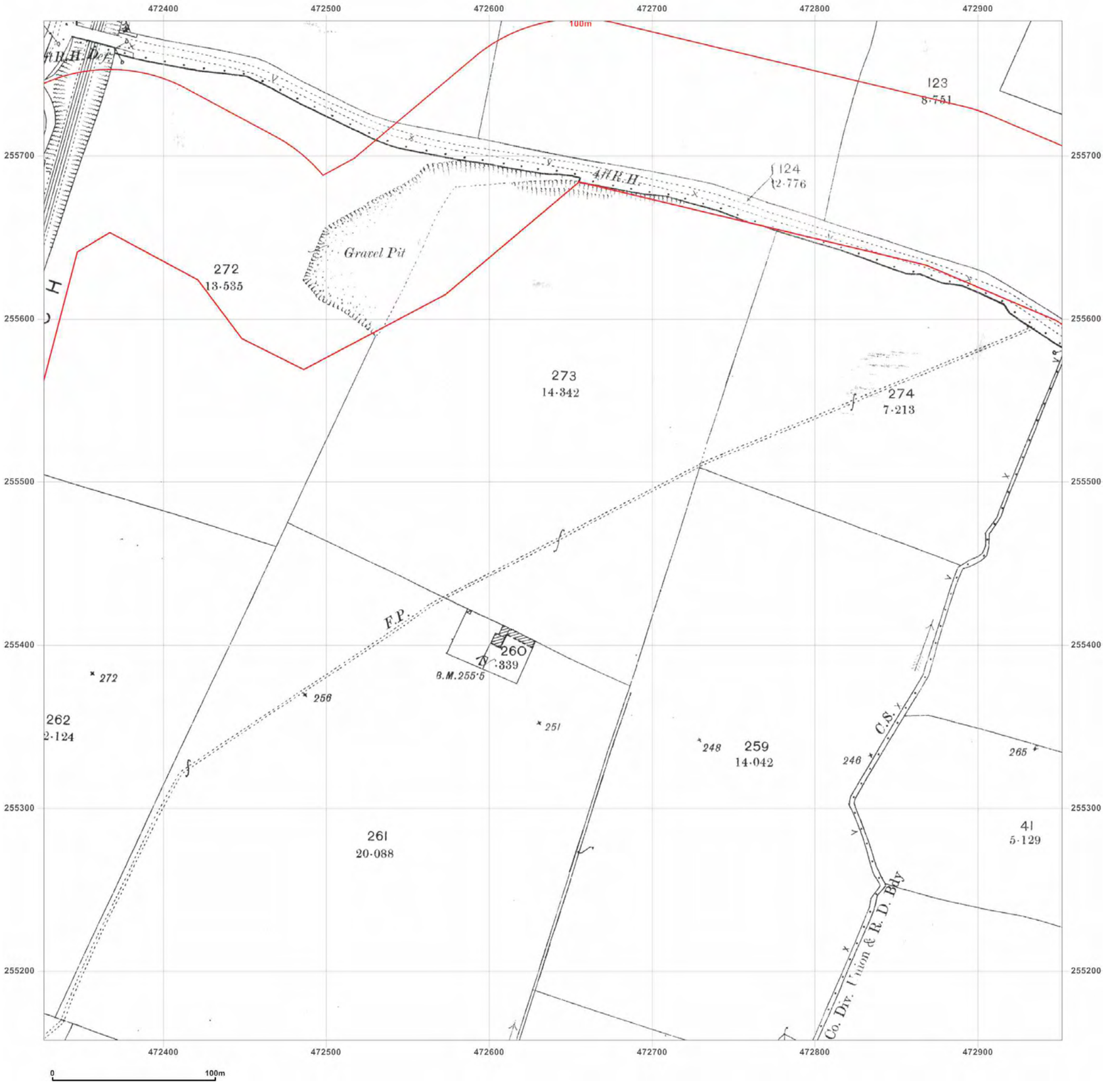

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_5
Grid Ref: 472639, 255470

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

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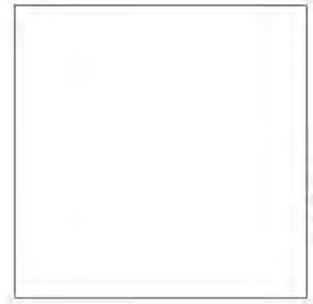

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Production date: 25 March 2015

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GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_5
Grid Ref: 472639, 255470

Map Name: National Grid

Map date: **1964**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1964
Revised 1964
Edition N/A
Copyright 1965
Levelled 1961

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Production date: 25 March 2015

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GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_5
Grid Ref: 472639, 255470

Map Name: National Grid

Map date: **1989**

Scale: 1:2,500

Printed at: 1:2,500

N
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Revised 1989
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Production date: 25 March 2015

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GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_5
Grid Ref: 472639, 255470

Map Name: National Grid

Map date: **1992**

Scale: 1:2,500

Printed at: 1:2,500

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

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GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_5
Grid Ref: 472639, 255470

Map Name: National Grid

Map date: **1993**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed N/A
Revised N/A
Edition N/A
Copyright 1993
Levelled N/A

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GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_5
Grid Ref: 472639, 255470

Map Name: National Grid

Map date: **1994**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1994
Revised N/A
Edition N/A
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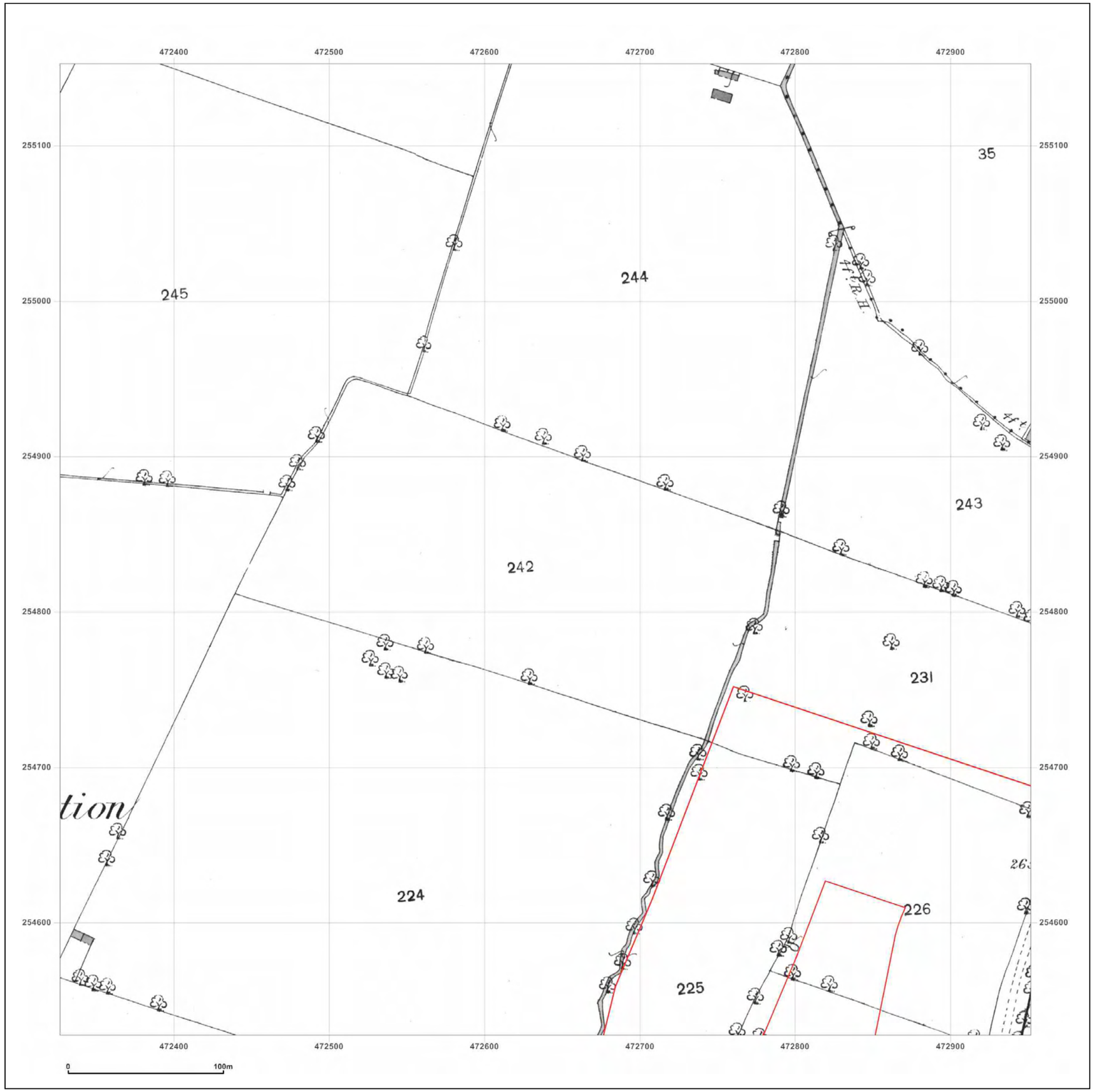

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_4
Grid Ref: 472639, 254840

Map Name: County Series

Map date: **1885**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1885
Revised 1885
Edition N/A
Copyright N/A
Levelled N/A

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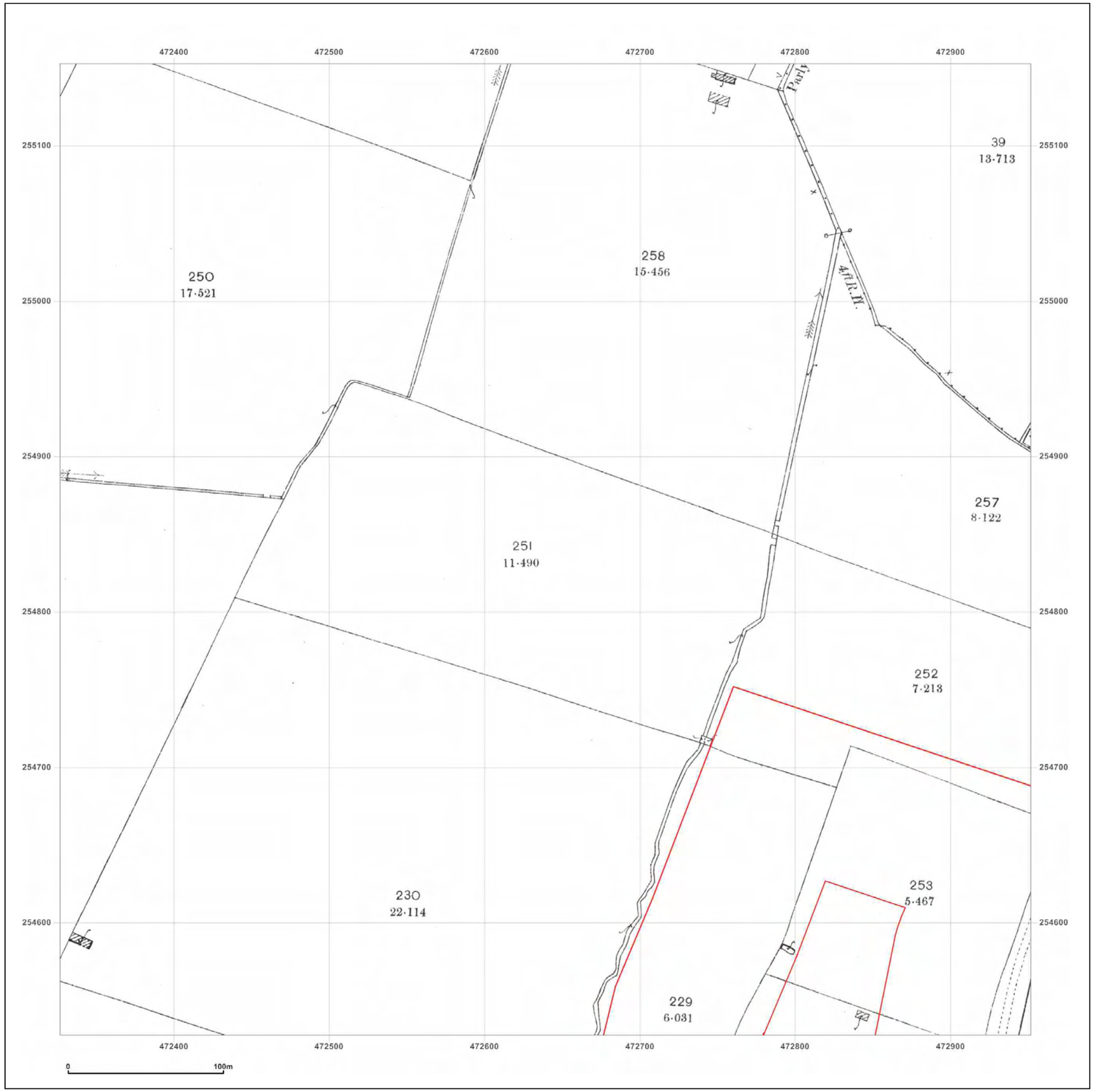

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_4
Grid Ref: 472639, 254840

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

N
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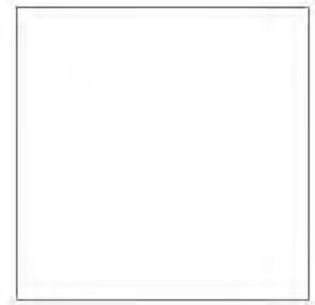
Surveyed 1900
Revised 1900
Edition N/A
Copyright N/A
Levelled N/A



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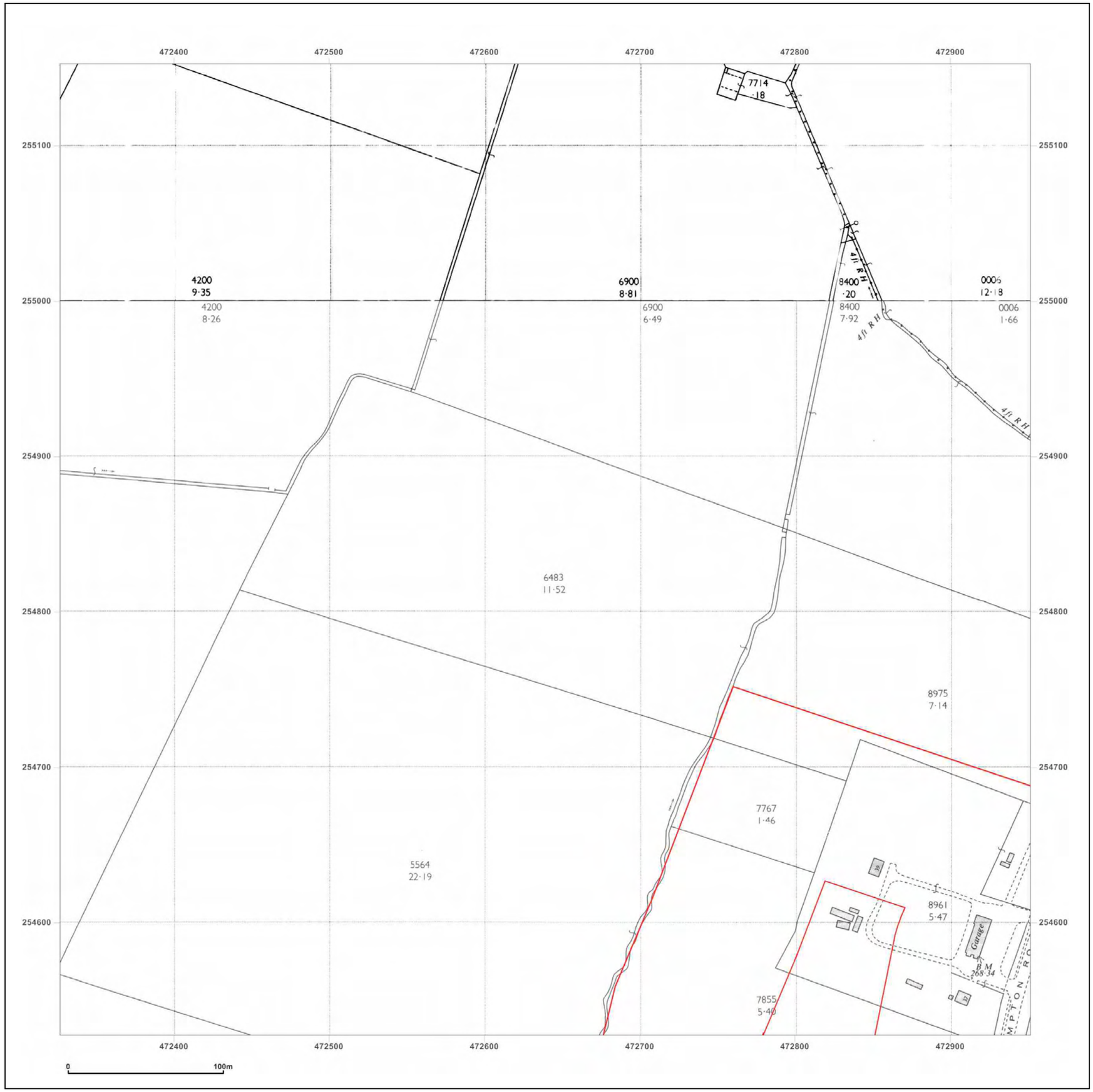

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_4
Grid Ref: 472639, 254840

Map Name: National Grid

Map date: **1965-1966**

Scale: 1:2,500

Printed at: 1:2,500

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

Surveyed 1966
Revised 1966
Edition N/A
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Levelled 1961

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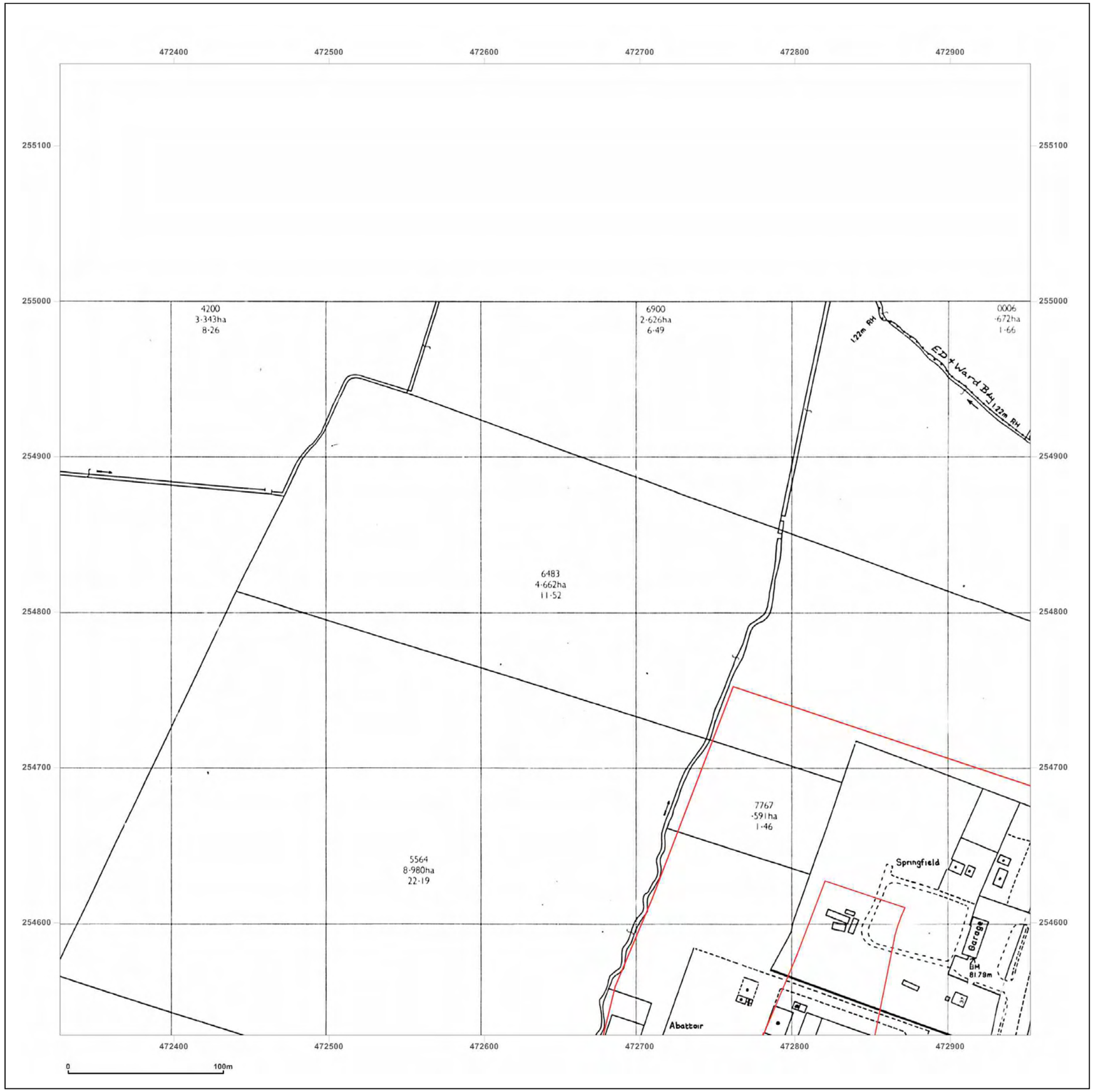

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_4
Grid Ref: 472639, 254840

Map Name: National Grid

Map date: **1986**

Scale: 1:2,500

Printed at: 1:2,500

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_4
Grid Ref: 472639, 254840

Map Name: National Grid

Map date: **1989-1992**

Scale: 1:2,500

Printed at: 1:2,500

N
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Revised 1989
Edition N/A
Copyright 1989
Levelled N/A

Surveyed 1981
Revised 1992
Edition N/A
Copyright 1992
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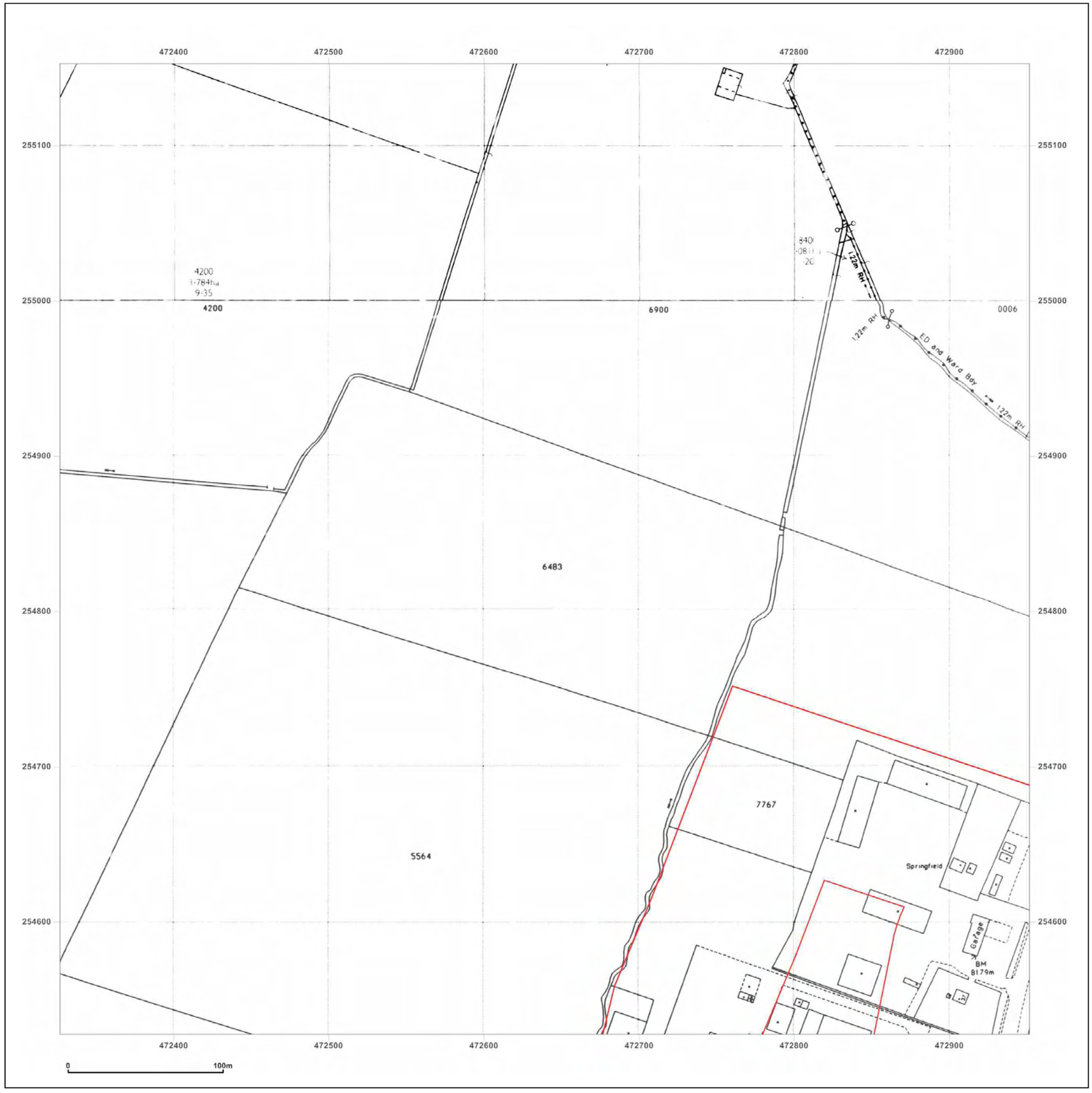

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_4
Grid Ref: 472639, 254840

Map Name: National Grid

Map date: **1992-1993**

Scale: 1:2,500

Printed at: 1:2,500

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

Surveyed 1993
Revised 1993
Edition N/A
Copyright N/A
Levelled N/A

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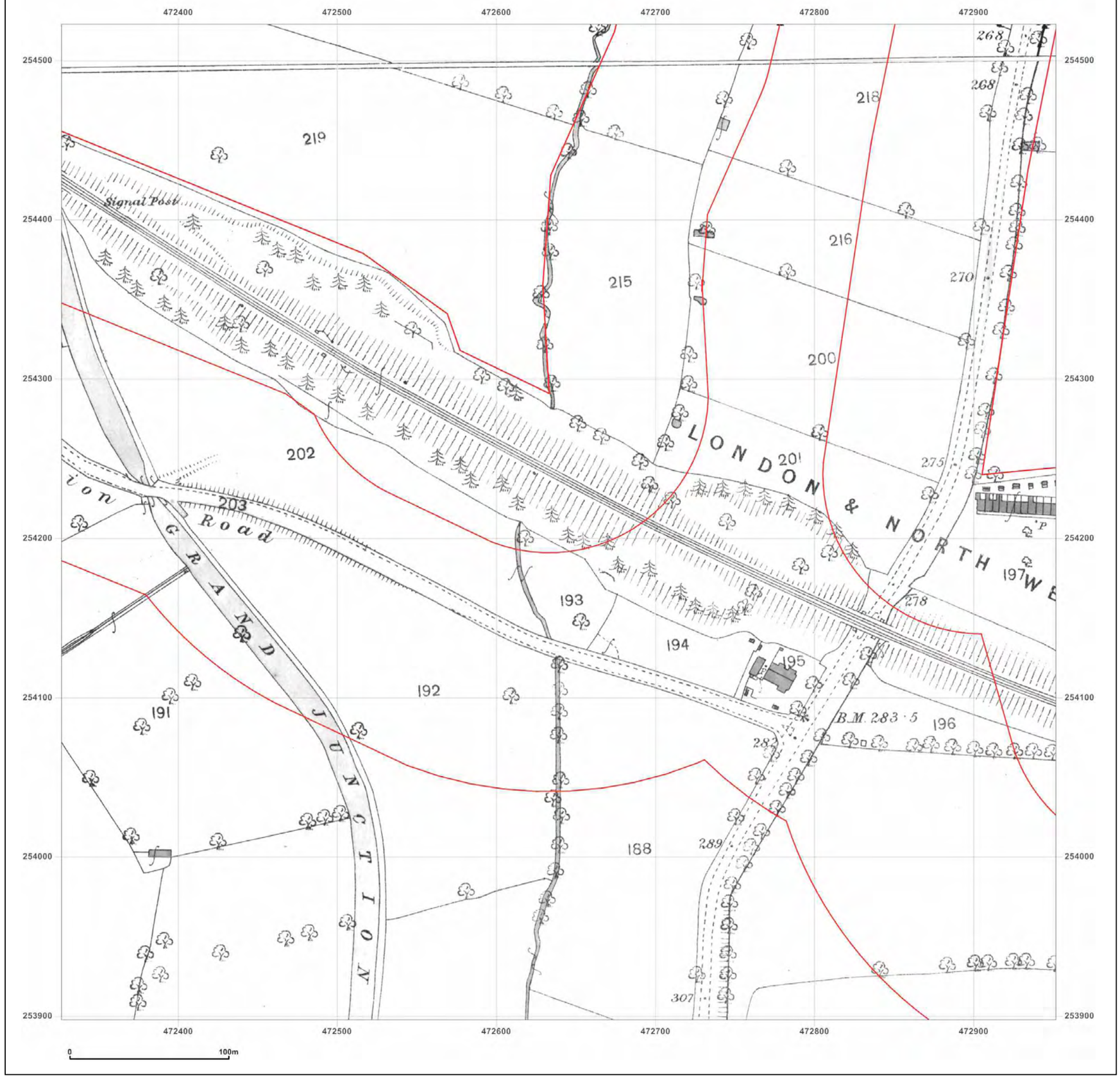

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_3
Grid Ref: 472639, 254210

Map Name: County Series

Map date: **1885**

Scale: 1:2,500

Printed at: 1:2,500

N
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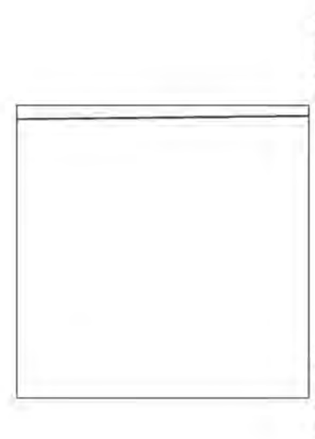

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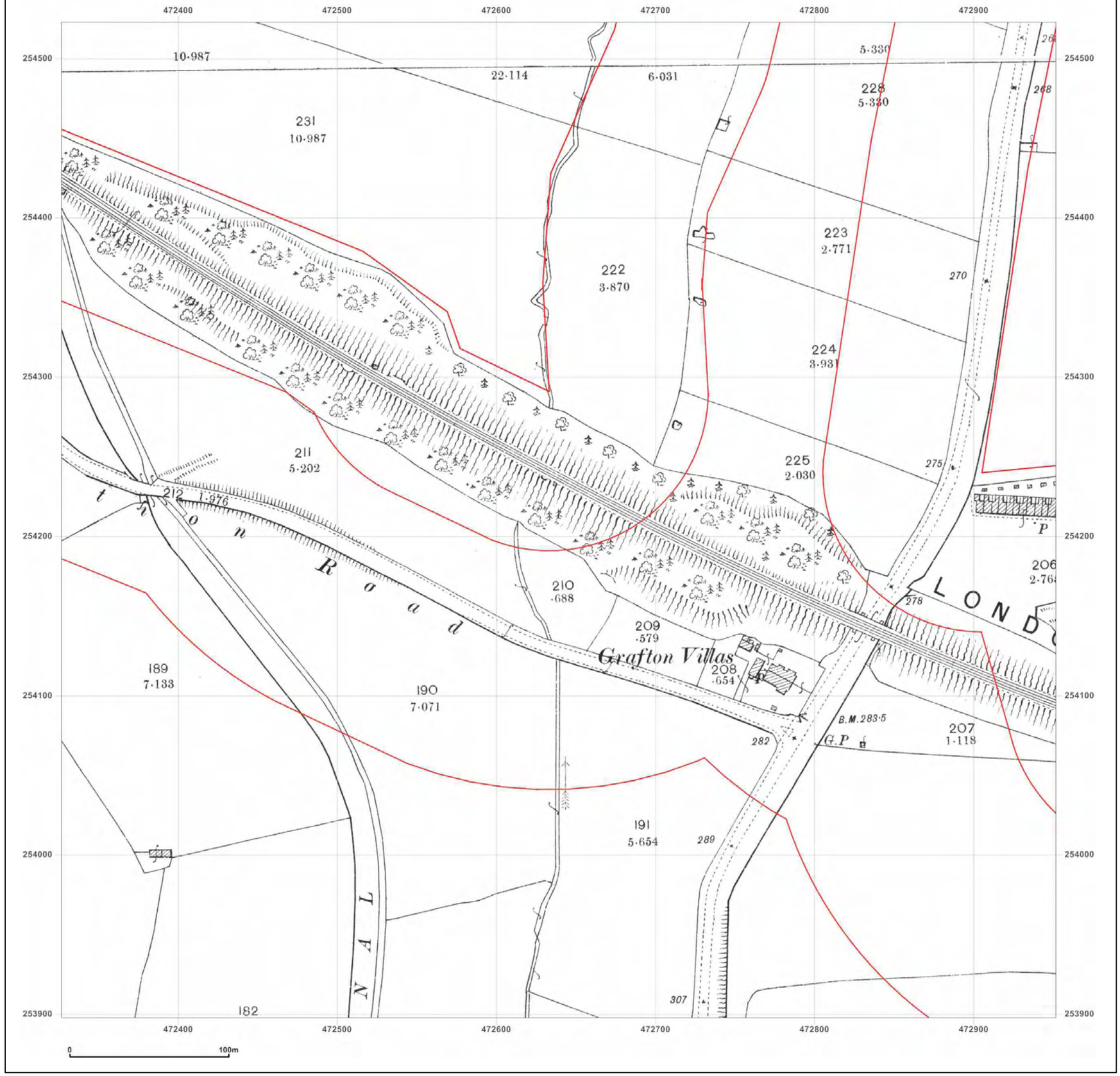

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_3
Grid Ref: 472639, 254210

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

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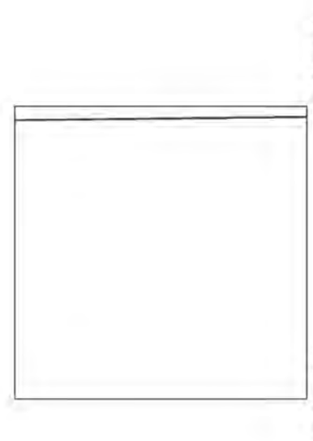

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_3
Grid Ref: 472639, 254210

Map Name: National Grid

Map date: **1966**

Scale: 1:2,500

Printed at: 1:2,500

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

Surveyed 1966
Revised 1966
Edition N/A
Copyright 1966
Levelled 1961

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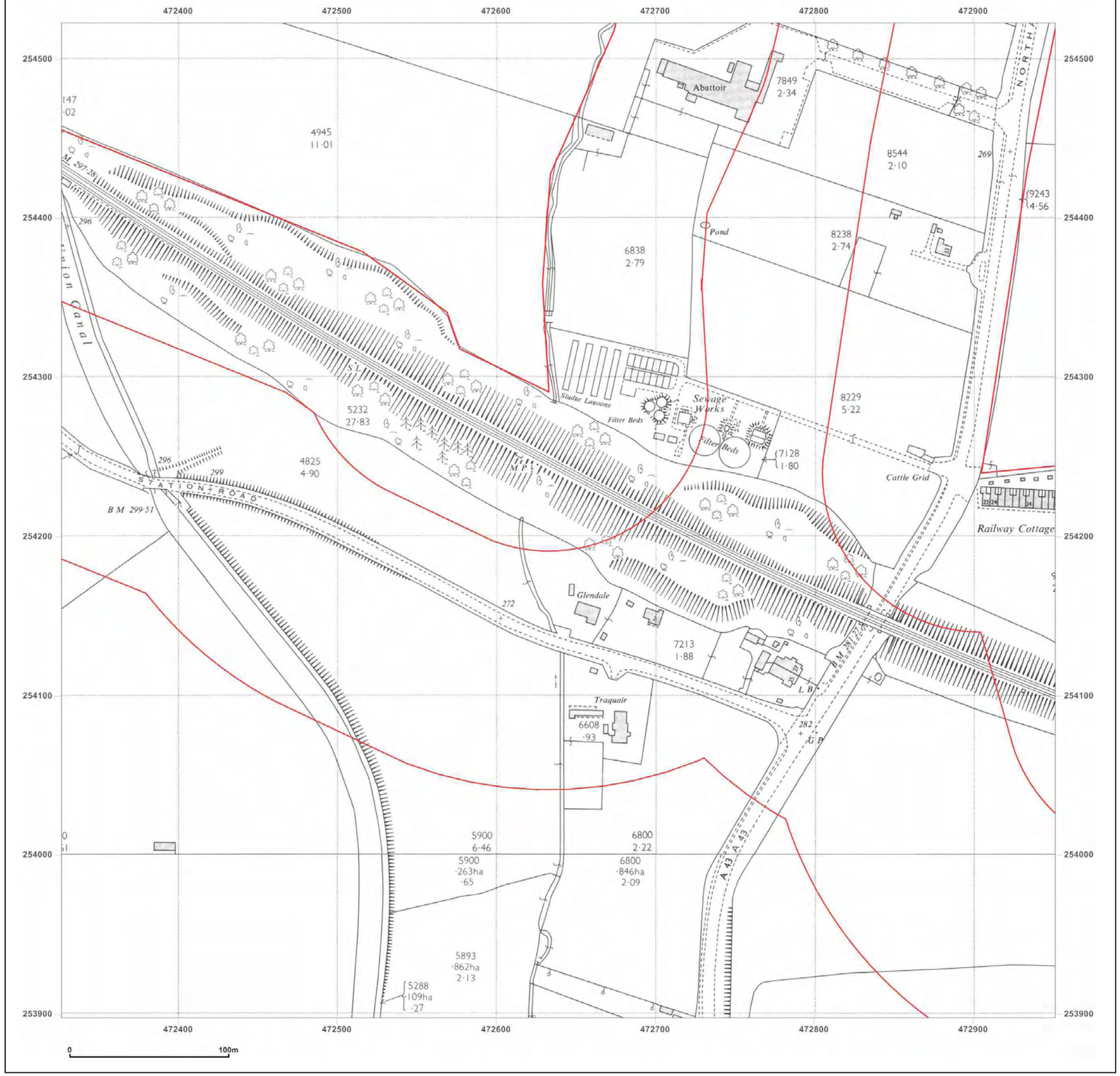

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_3
Grid Ref: 472639, 254210

Map Name: National Grid

Map date: **1966-1970**

Scale: 1:2,500

Printed at: 1:2,500

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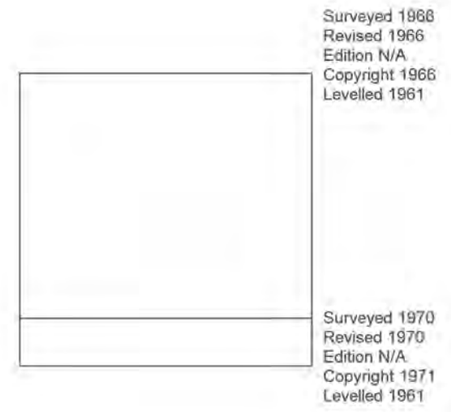

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_3
Grid Ref: 472639, 254210

Map Name: National Grid

Map date: **1986**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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Surveyed 1961
Revised 1986
Edition N/A
Copyright 1966
Levelled 1961

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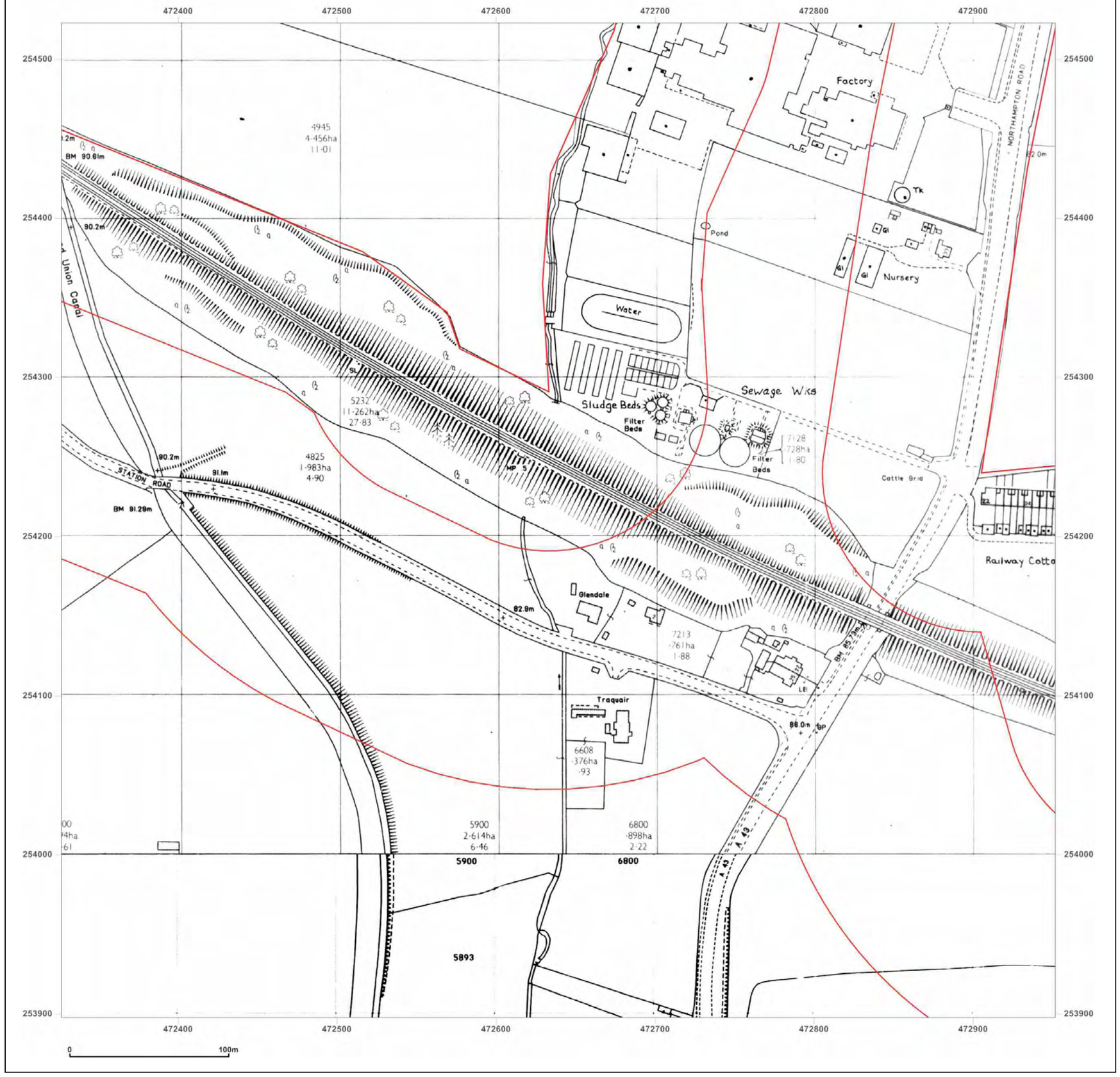

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_3
Grid Ref: 472639, 254210

Map Name: National Grid

Map date: **1992-1993**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed 1961
Revised 1992
Edition N/A
Copyright 1992
Levelled 1961

~~Surveyed N/A~~
~~Revised N/A~~
Edition N/A
Copyright 1993
Levelled N/A

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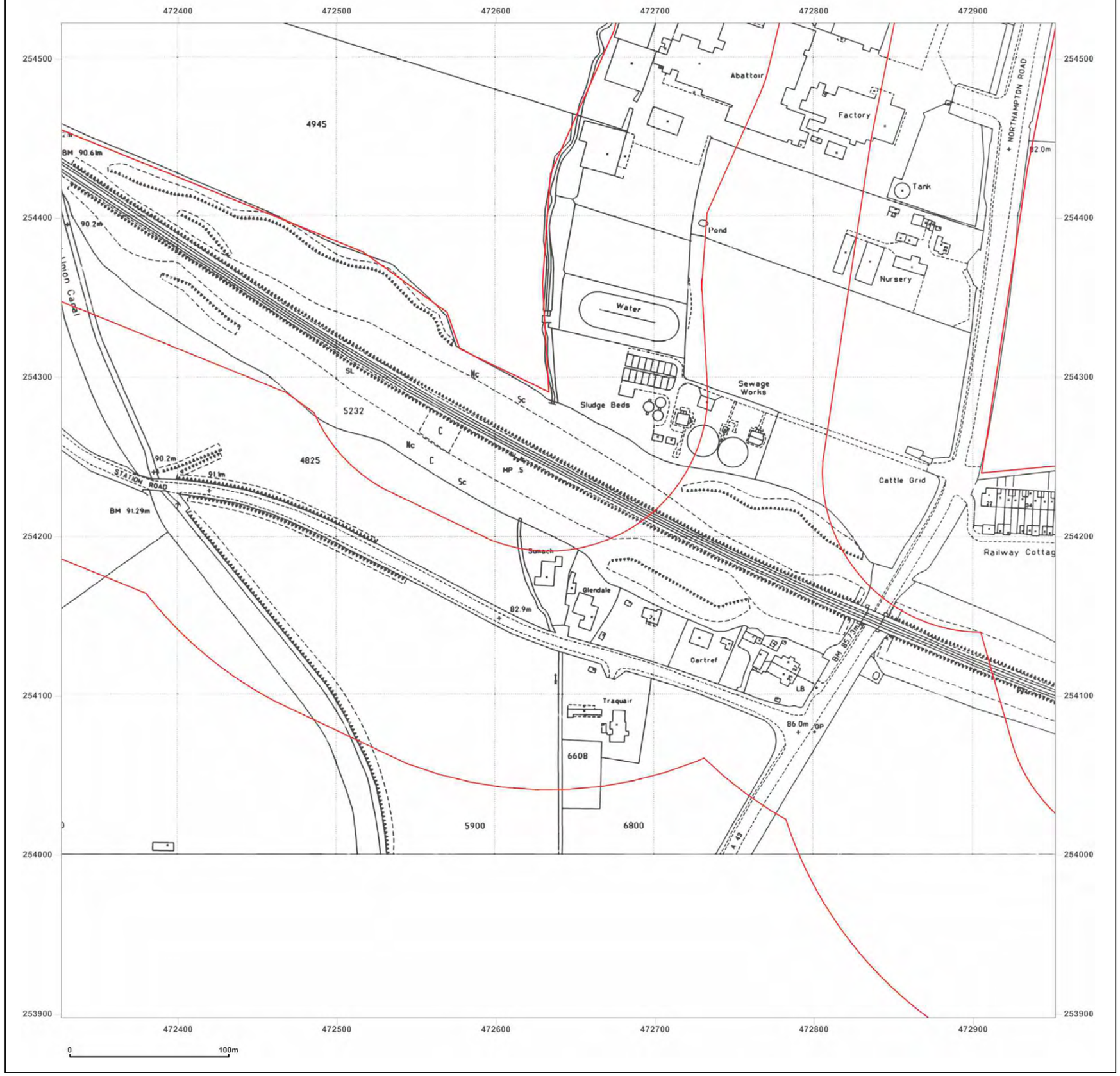

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_3
Grid Ref: 472639, 254210

Map Name: National Grid

Map date: **1993**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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Surveyed 1993
Revised 1993
Edition N/A
Copyright N/A
Levelled N/A

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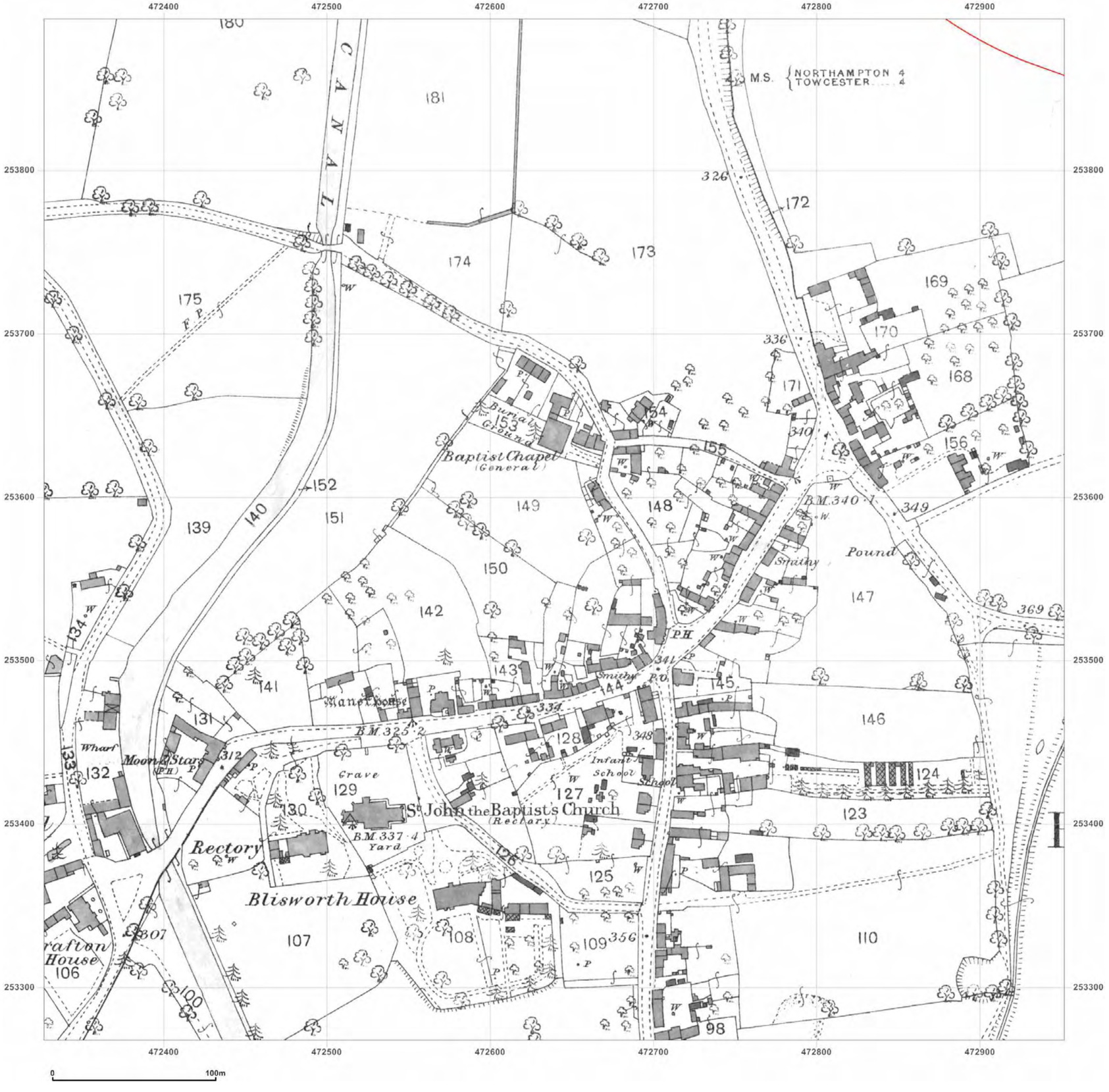

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_2
Grid Ref: 472639, 253580

Map Name: County Series

Map date: **1885**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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Surveyed 1885
Revised 1885
Edition N/A
Copyright N/A
Levelled N/A

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_2
Grid Ref: 472639, 253580

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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Surveyed 1900
Revised 1900
Edition N/A
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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_2
Grid Ref: 472639, 253580

Map Name: National Grid

Map date: **1966**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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Surveyed 1966
Revised 1966
Edition N/A
Copyright 1966
Levelled 1961

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ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_2
Grid Ref: 472639, 253580

Map Name: National Grid

Map date: **1970**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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Surveyed 1970
Revised 1970
Edition N/A
Copyright 1971
Levelled 1981

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GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_3_2
Grid Ref: 472639, 253580

Map Name: National Grid

Map date: **1993**

Scale: 1:2,500

Printed at: 1:2,500

N
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Surveyed N/A
Revised N/A
Edition N/A
Copyright 1993
Levelled N/A

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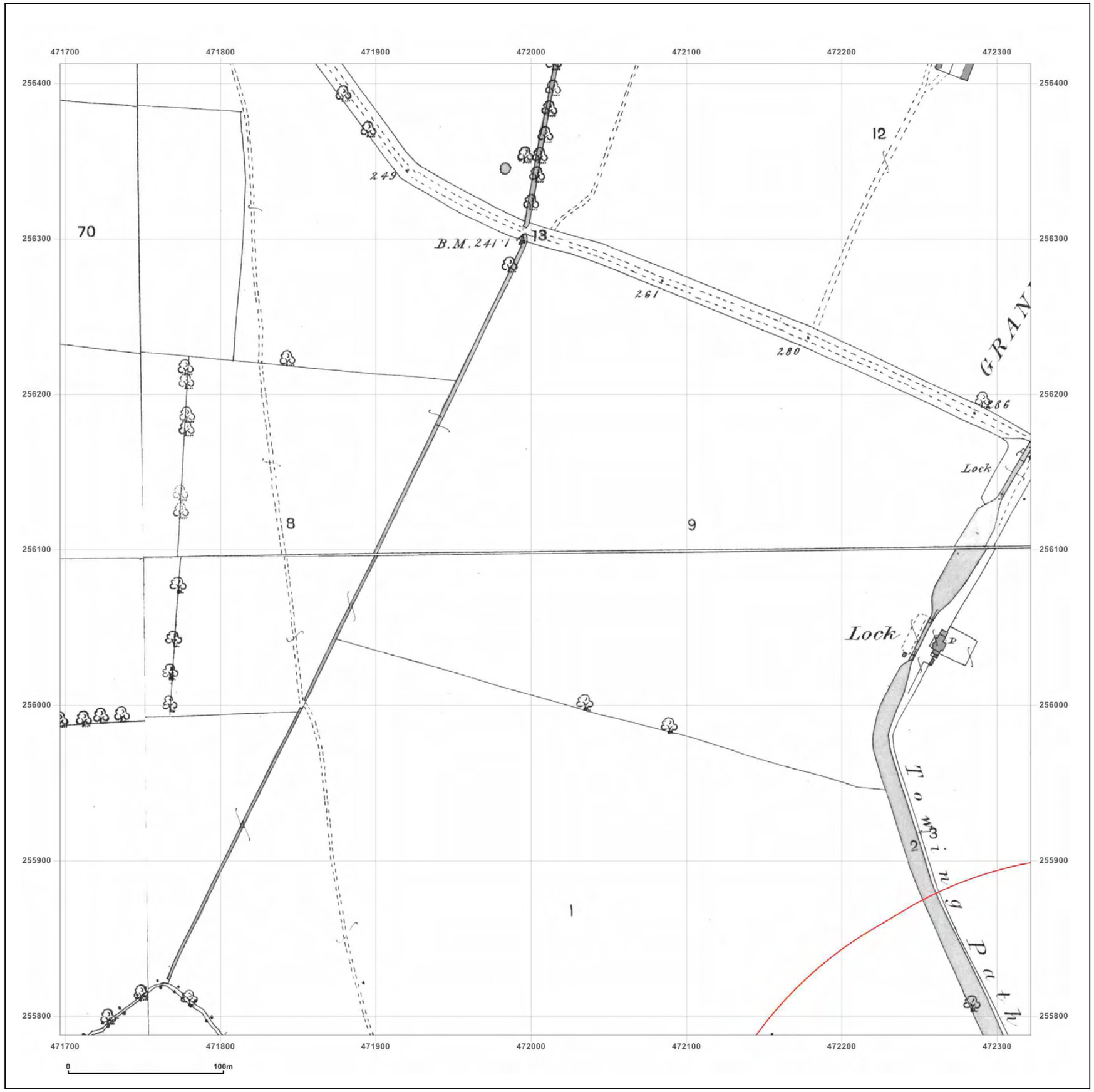

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_6
Grid Ref: 472009, 256100

Map Name: County Series

Map date: **1885**

Scale: 1:2,500

Printed at: 1:2,500

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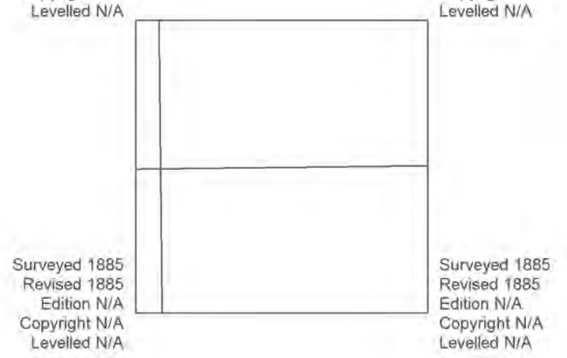

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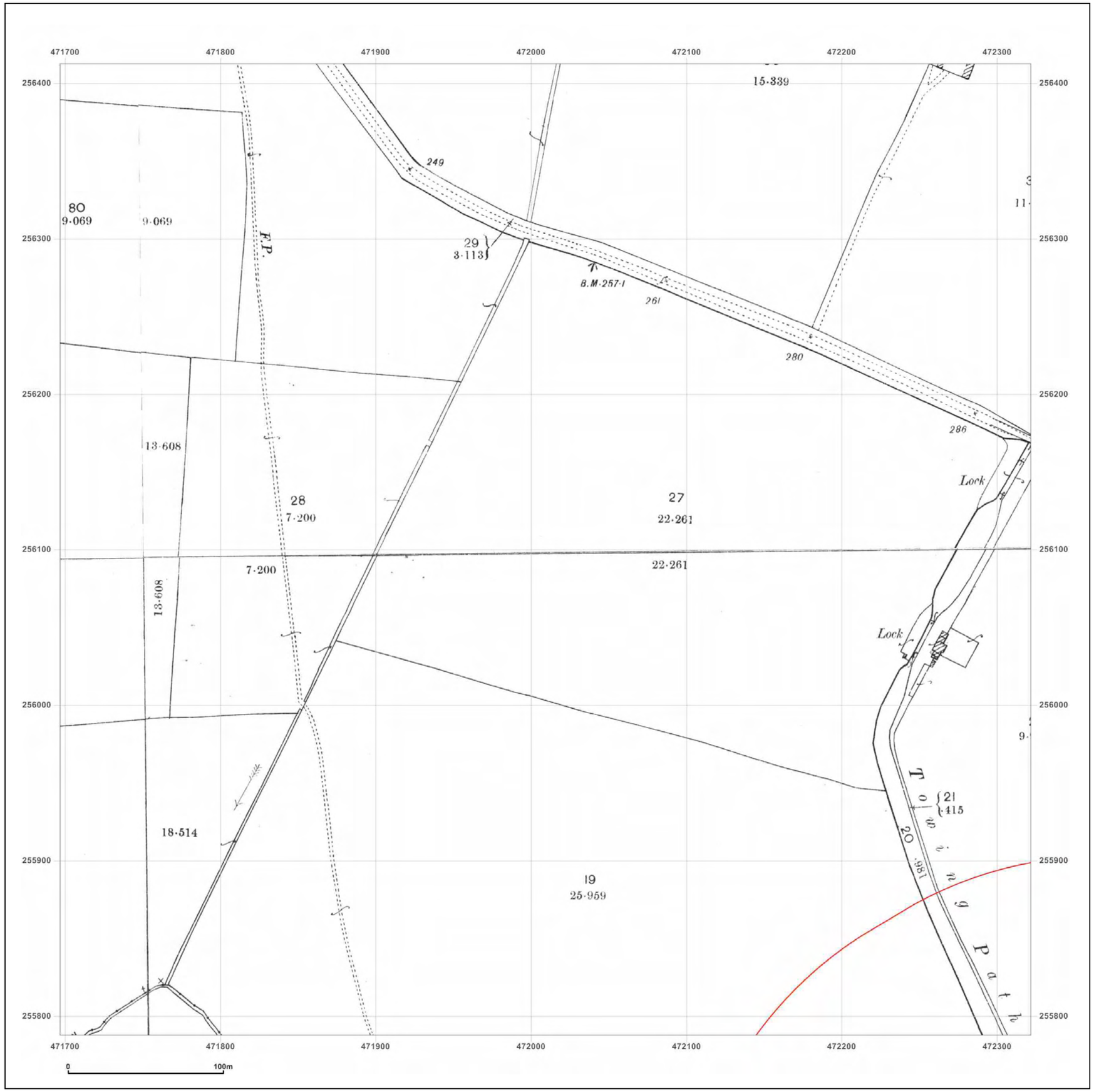

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_6
Grid Ref: 472009, 256100

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

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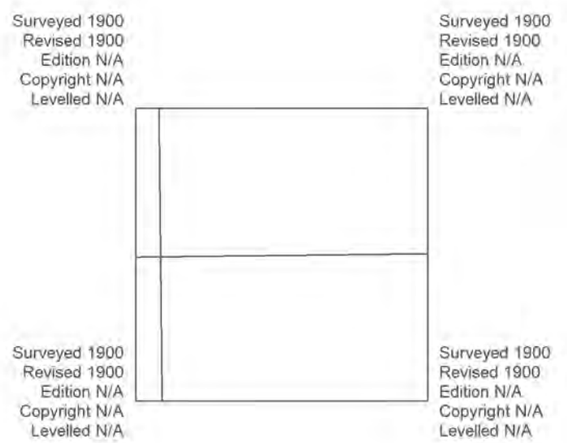

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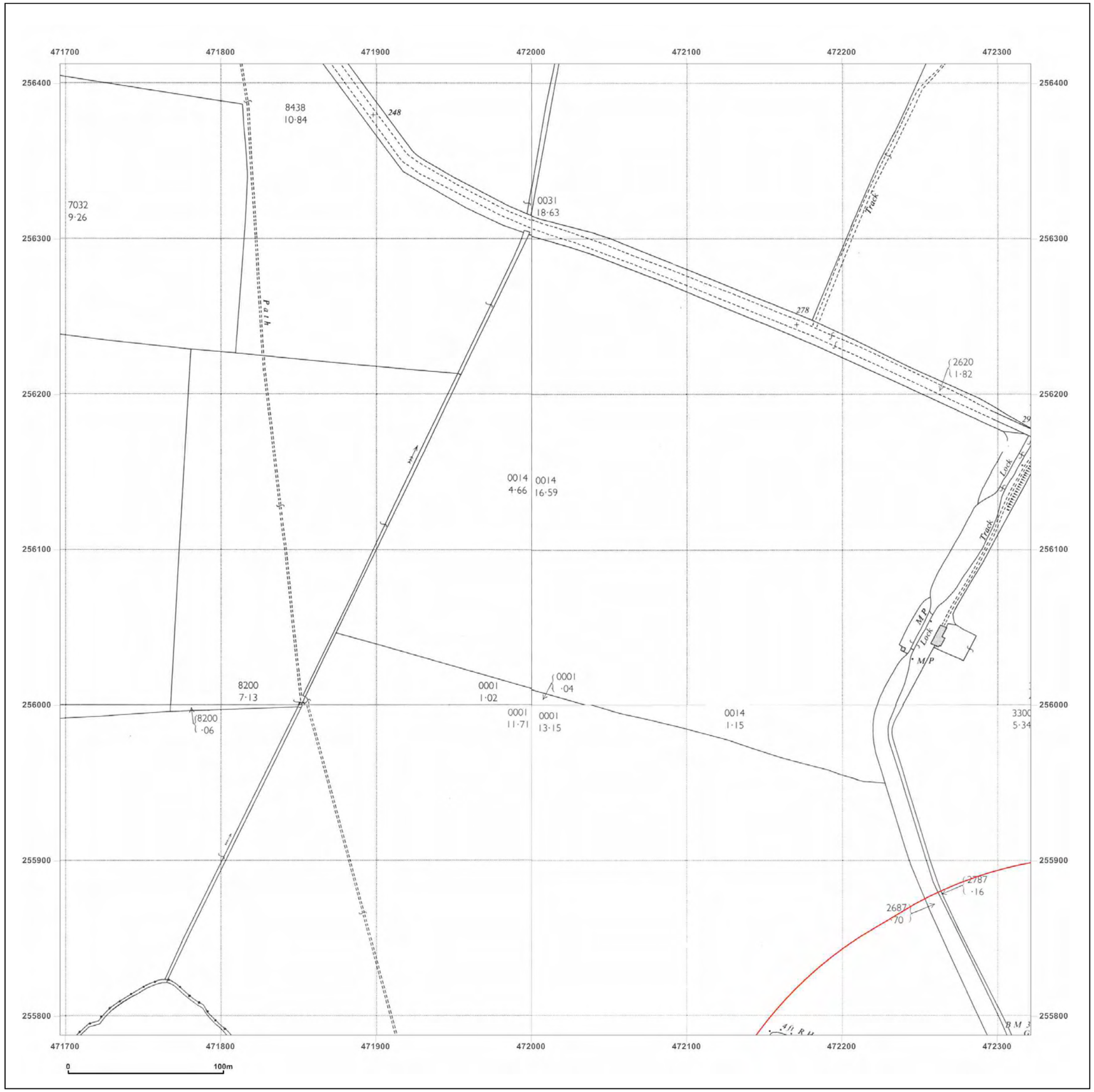

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_6
Grid Ref: 472009, 256100

Map Name: National Grid

Map date: **1964**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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Surveyed 1964
Revised 1964
Edition N/A
Copyright 1965
Levelled 1961

Surveyed 1964
Revised 1964
Edition N/A
Copyright 1965
Levelled 1960

Surveyed 1964
Revised 1964
Edition N/A
Copyright 1965
Levelled 1961

Surveyed 1964
Revised 1964
Edition N/A
Copyright 1965
Levelled 1961

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Production date: 25 March 2015

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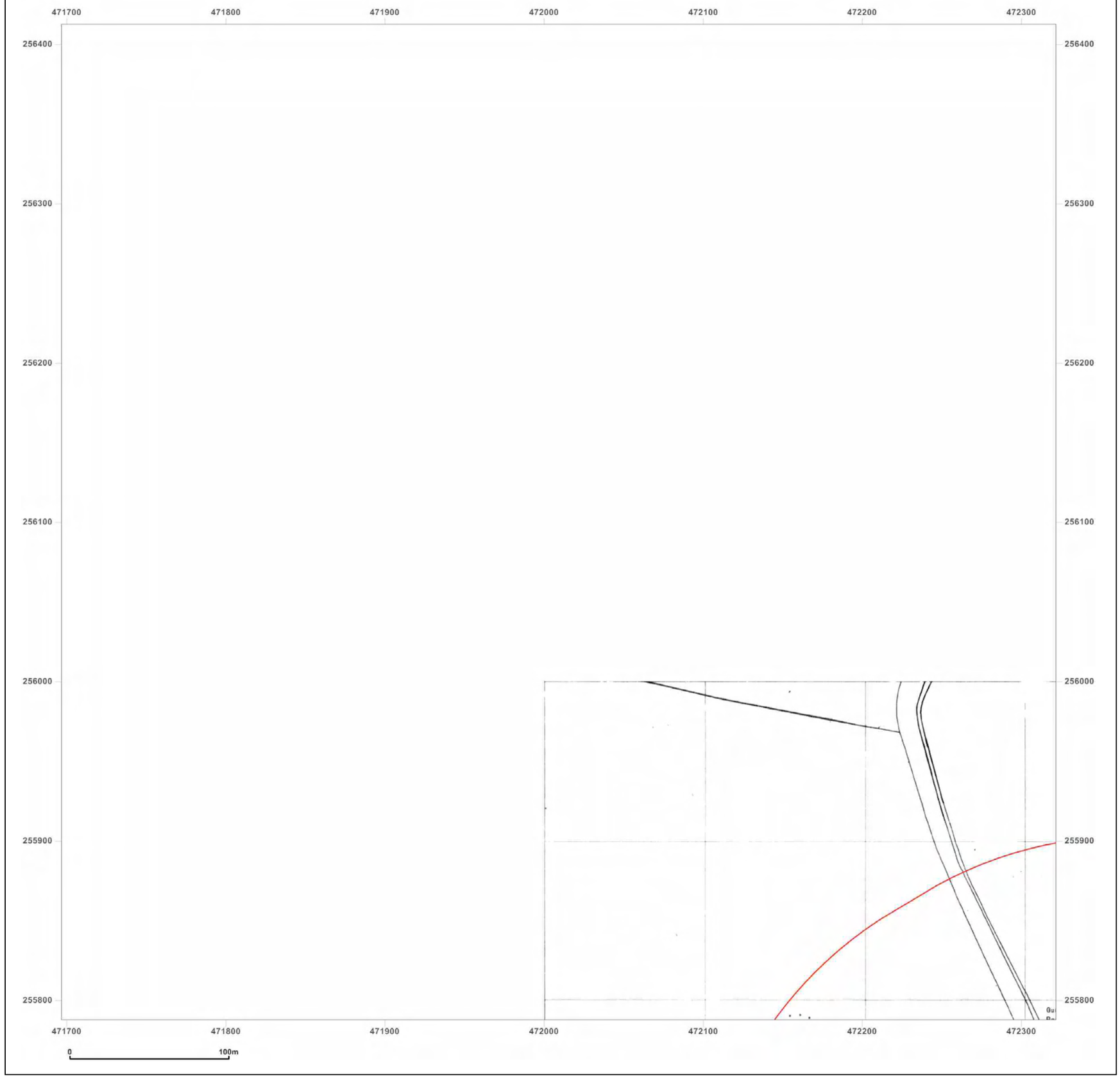

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_6
Grid Ref: 472009, 256100

Map Name: National Grid

Map date: **1992**

Scale: 1:2,500

Printed at: 1:2,500

N
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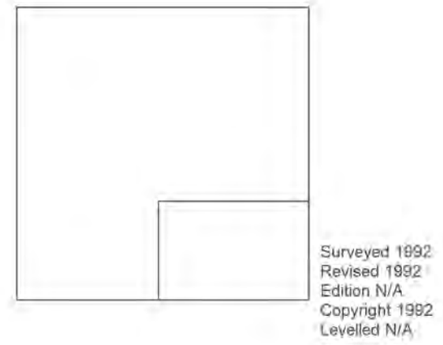

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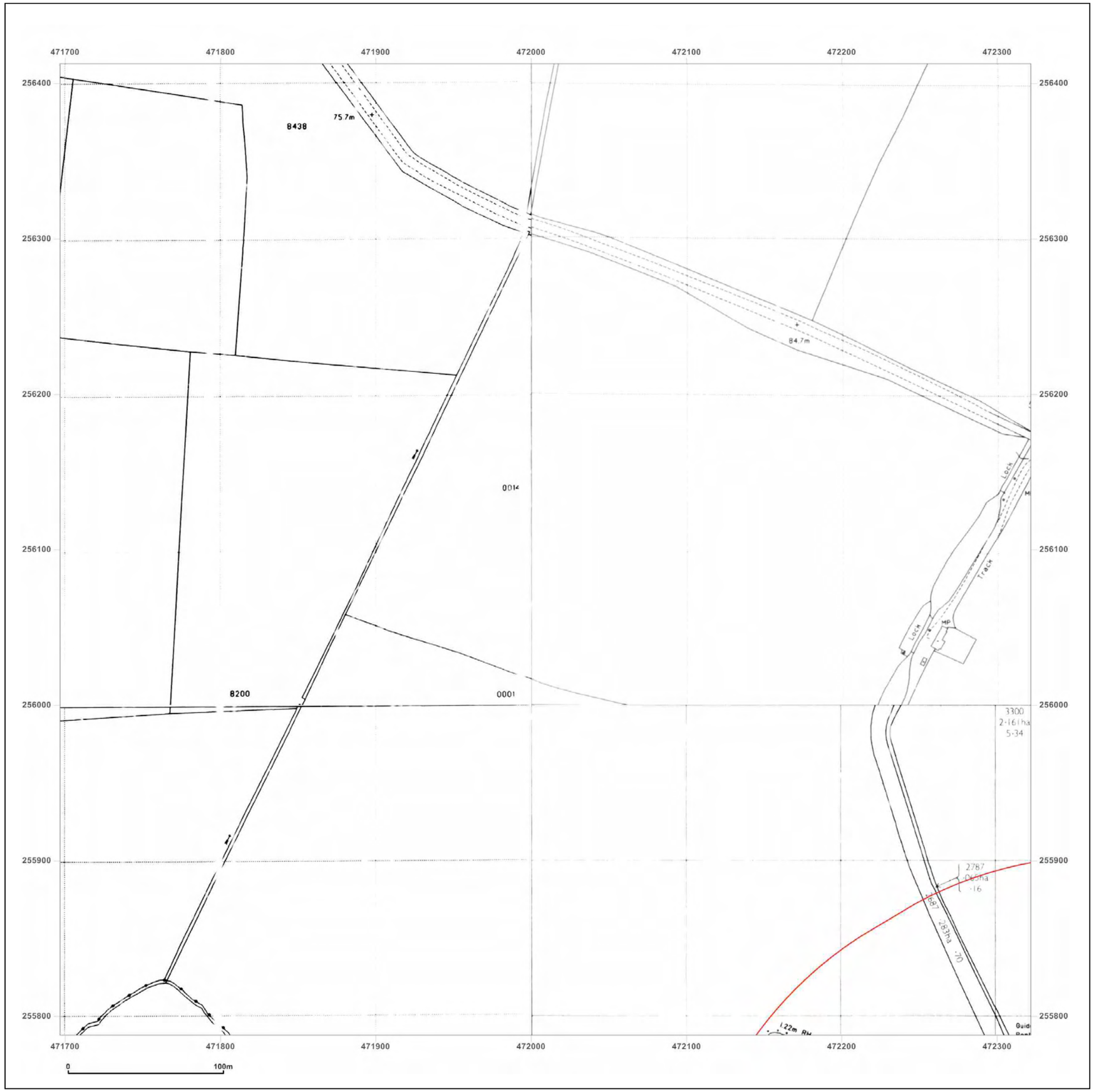

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_6
Grid Ref: 472009, 256100

Map Name: National Grid

Map date: **1989-1993**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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Surveyed N/A
Revised N/A
Edition N/A
Copyright 1993
Levelled N/A

Surveyed 1993
Revised 1993
Edition N/A
Copyright N/A
Levelled N/A

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1993
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Surveyed 1989
Revised 1989
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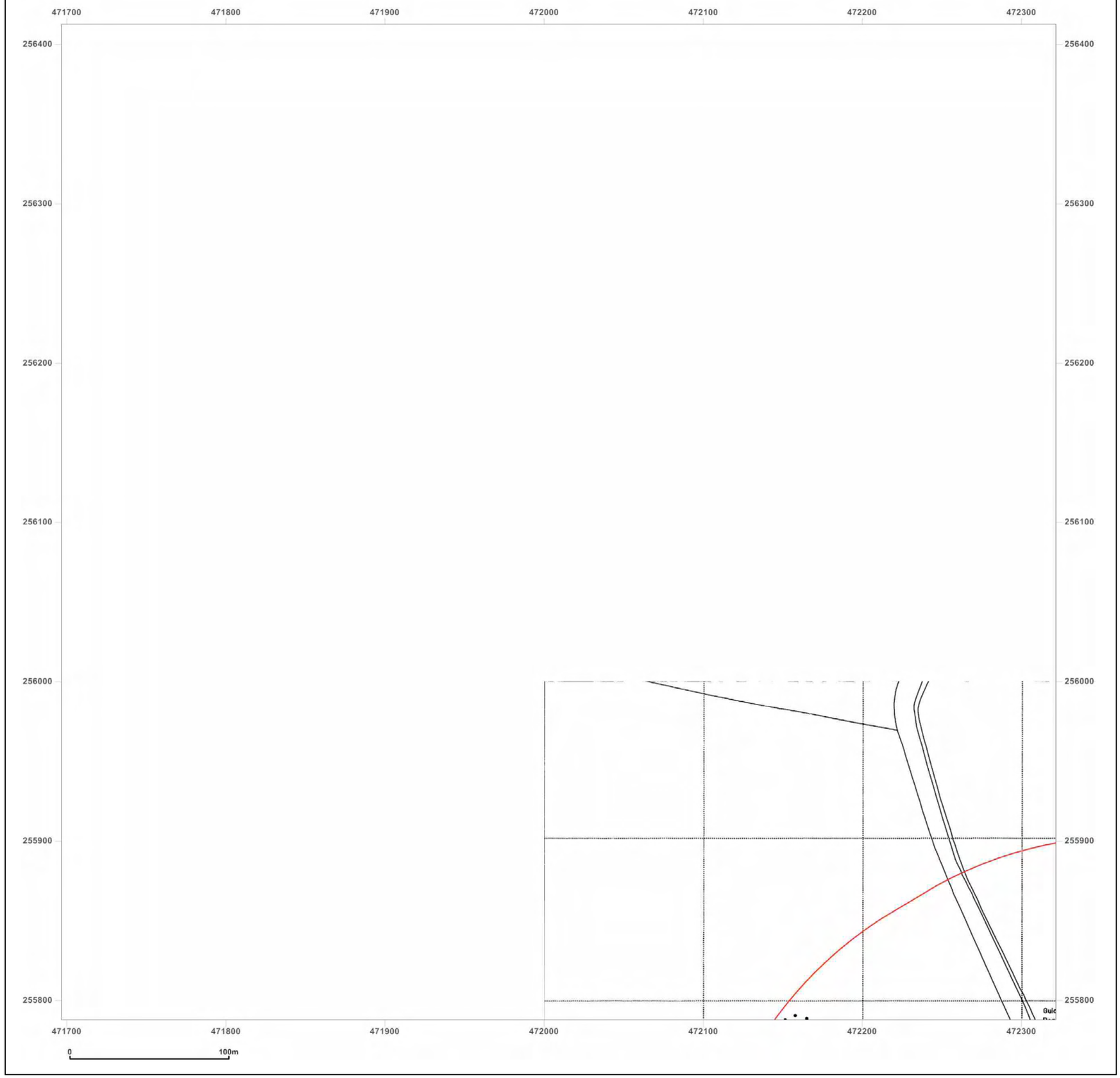

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_6
Grid Ref: 472009, 256100

Map Name: National Grid

Map date: **1994**

Scale: 1:2,500

Printed at: 1:2,500

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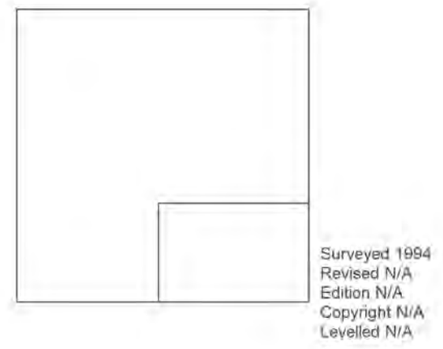

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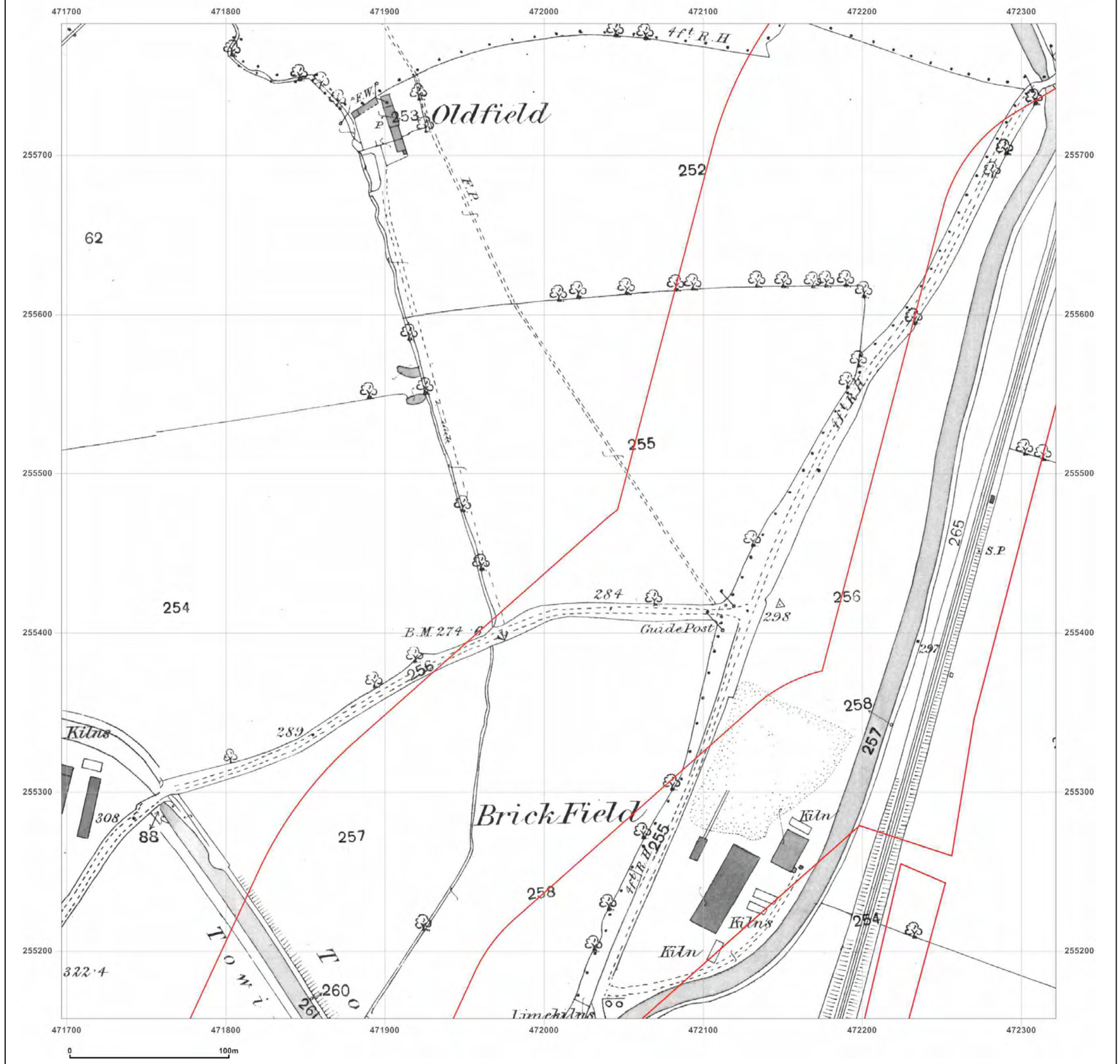

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_5
Grid Ref: 472009, 255470

Map Name: County Series

Map date: **1885**

Scale: 1:2,500

Printed at: 1:2,500

N
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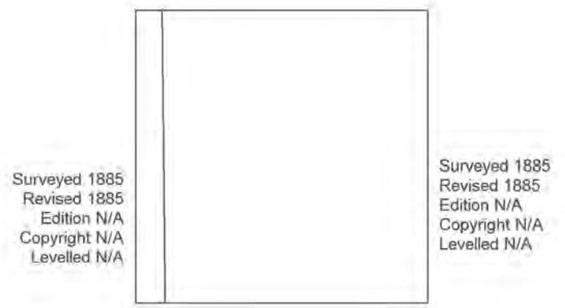

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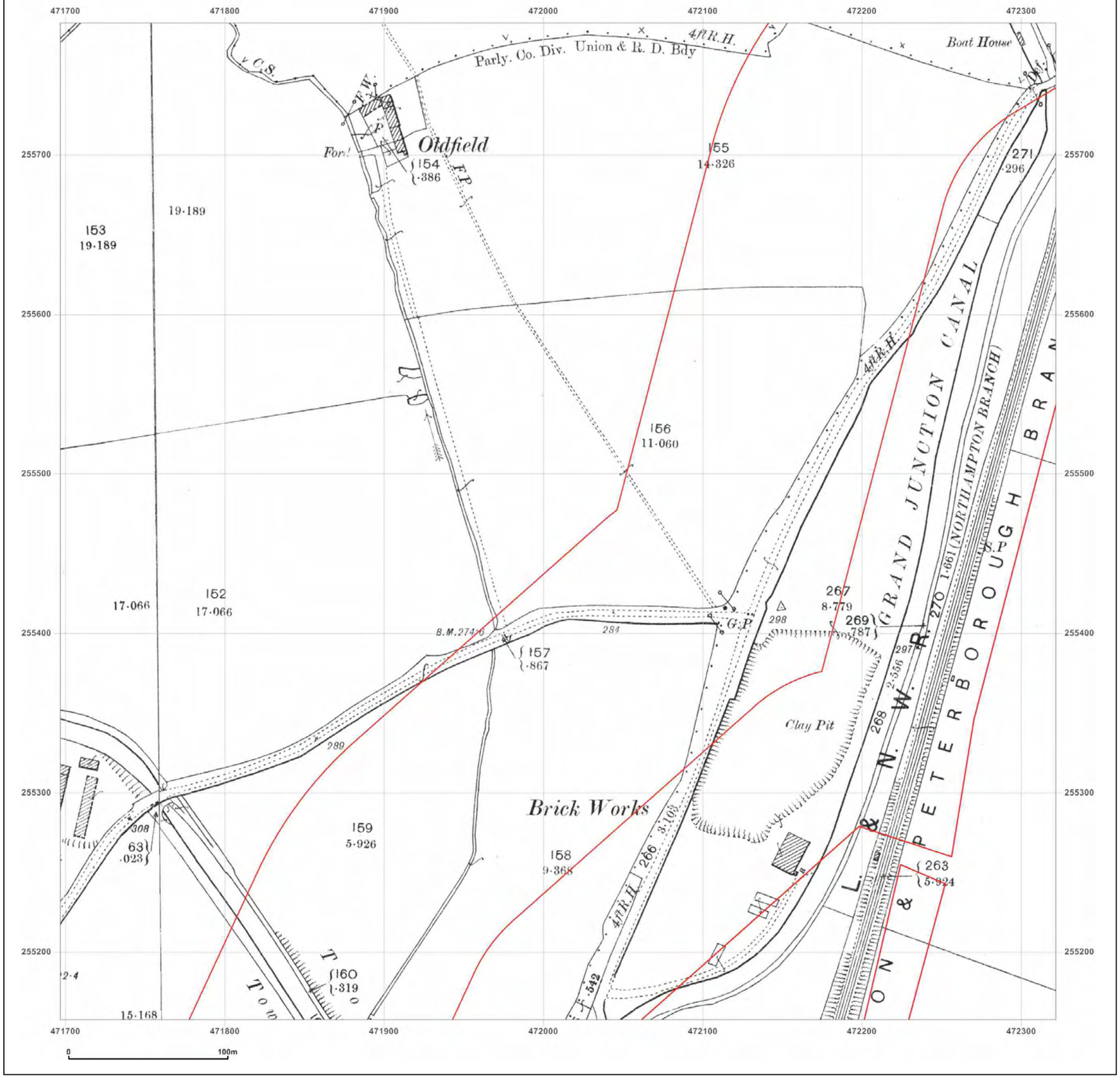

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_5
Grid Ref: 472009, 255470

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

N
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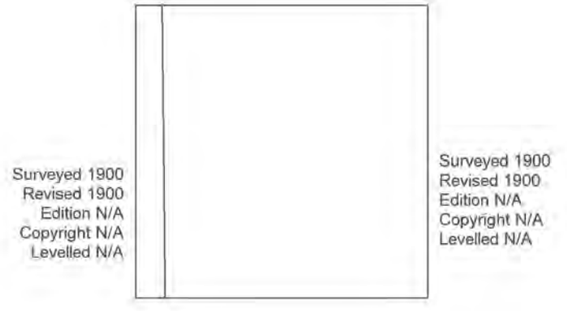

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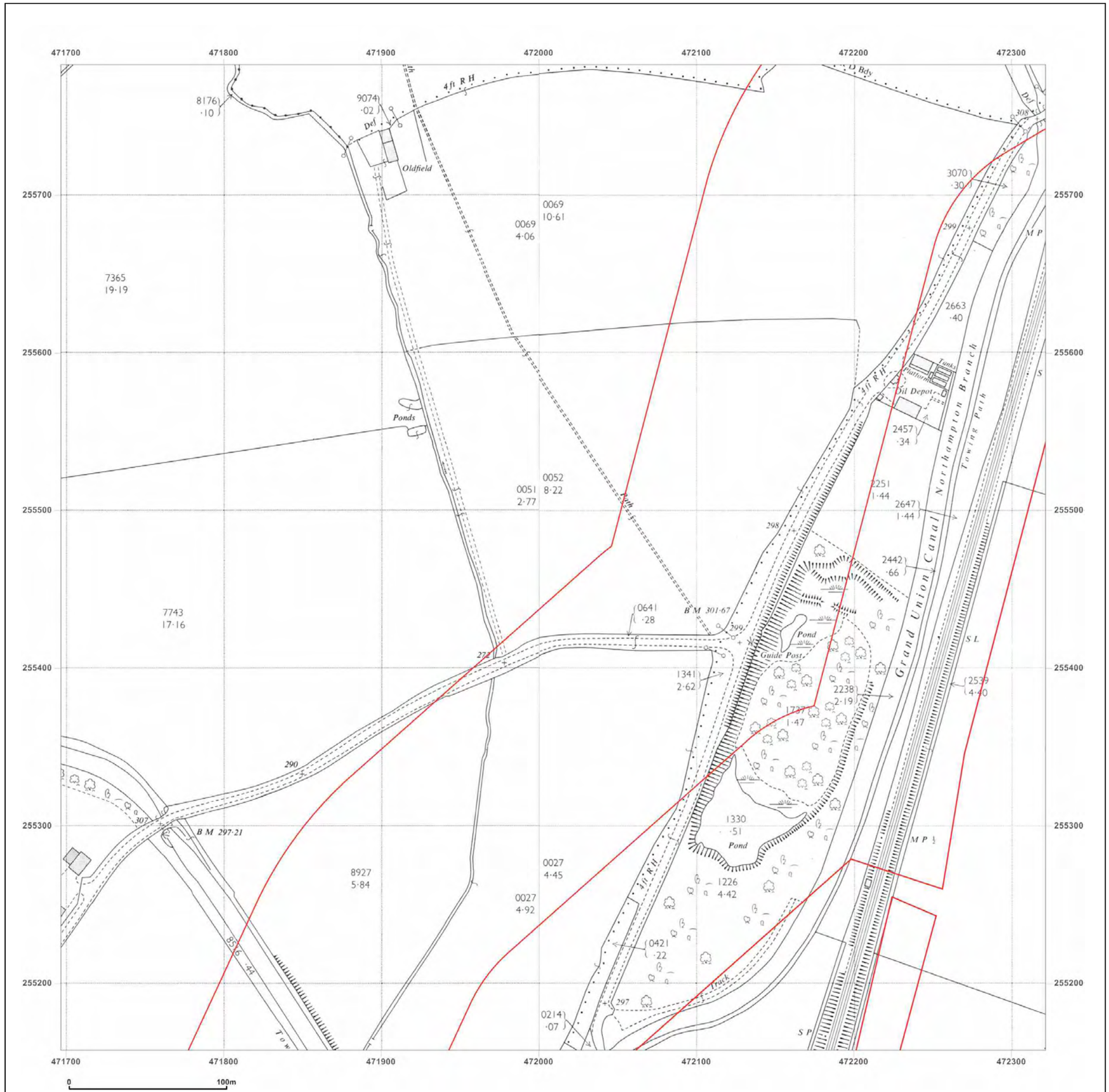

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_5
Grid Ref: 472009, 255470

Map Name: National Grid

Map date: **1964**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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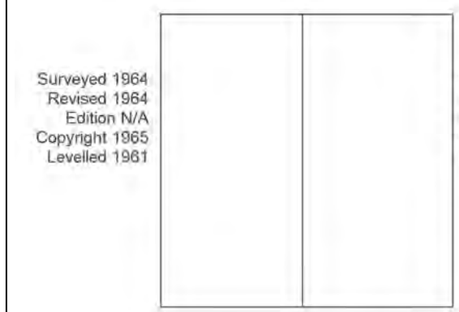

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Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_5
Grid Ref: 472009, 255470

Map Name: National Grid

Map date: **1992**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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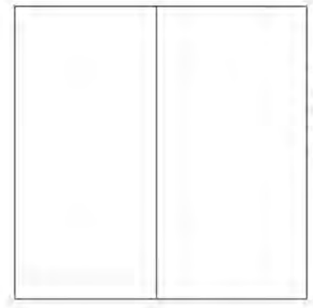

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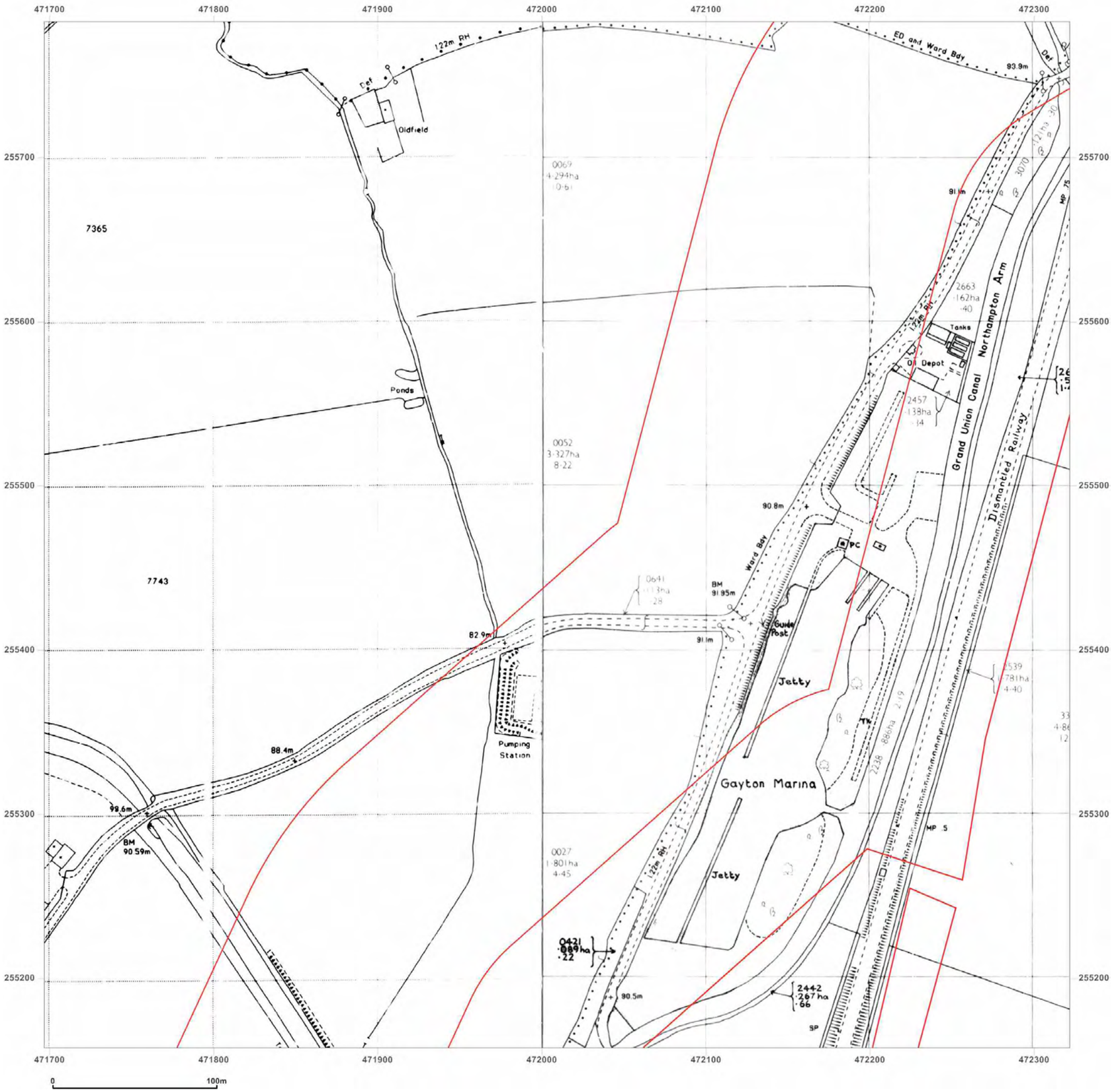

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_5
Grid Ref: 472009, 255470

Map Name: National Grid

Map date: **1989-1993**

Scale: 1:2,500

Printed at: 1:2,500

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W E
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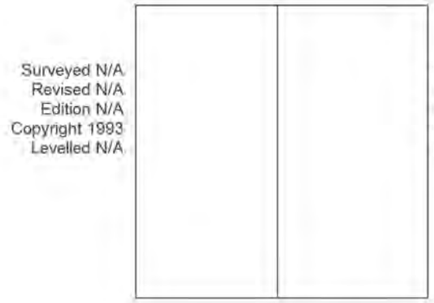

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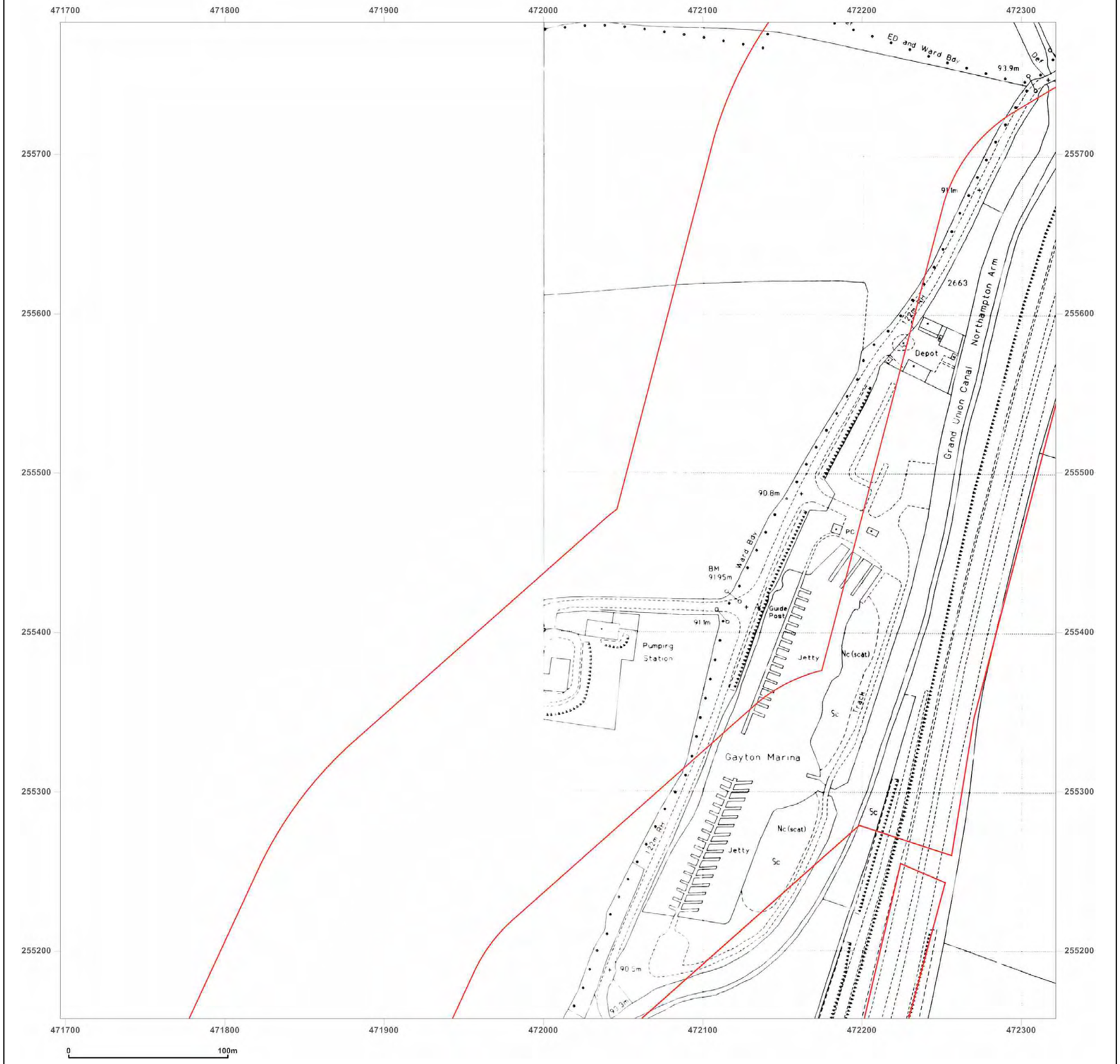

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_5
Grid Ref: 472009, 255470

Map Name: National Grid

Map date: **1993**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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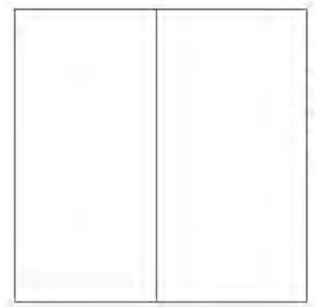

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Revised N/A
Edition N/A
Copyright 1993
Levelled N/A

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Site Details:

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Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_5
Grid Ref: 472009, 255470

Map Name: National Grid

Map date: **1994**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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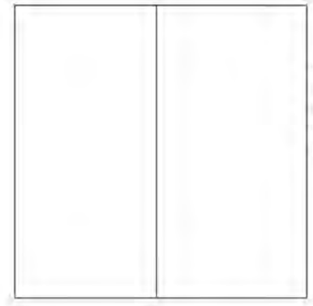

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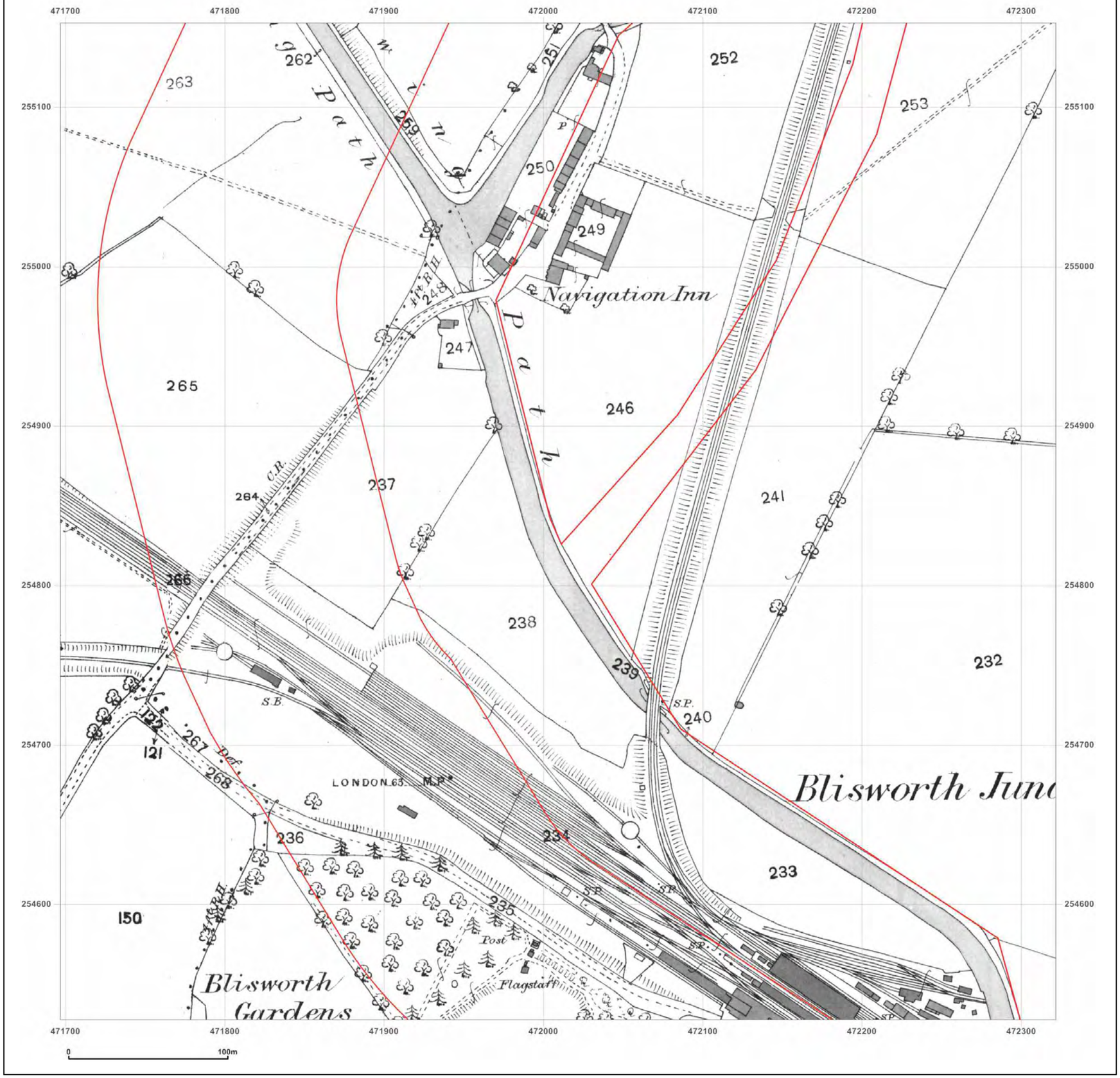

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_4
Grid Ref: 472009, 254840

Map Name: County Series

Map date: **1885**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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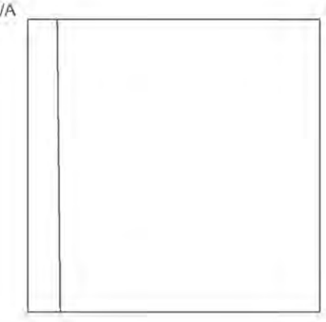
Surveyed 1885
Revised 1885
Edition N/A
Copyright N/A
Levelled N/A



Surveyed 1885
Revised 1885
Edition N/A
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Levelled N/A

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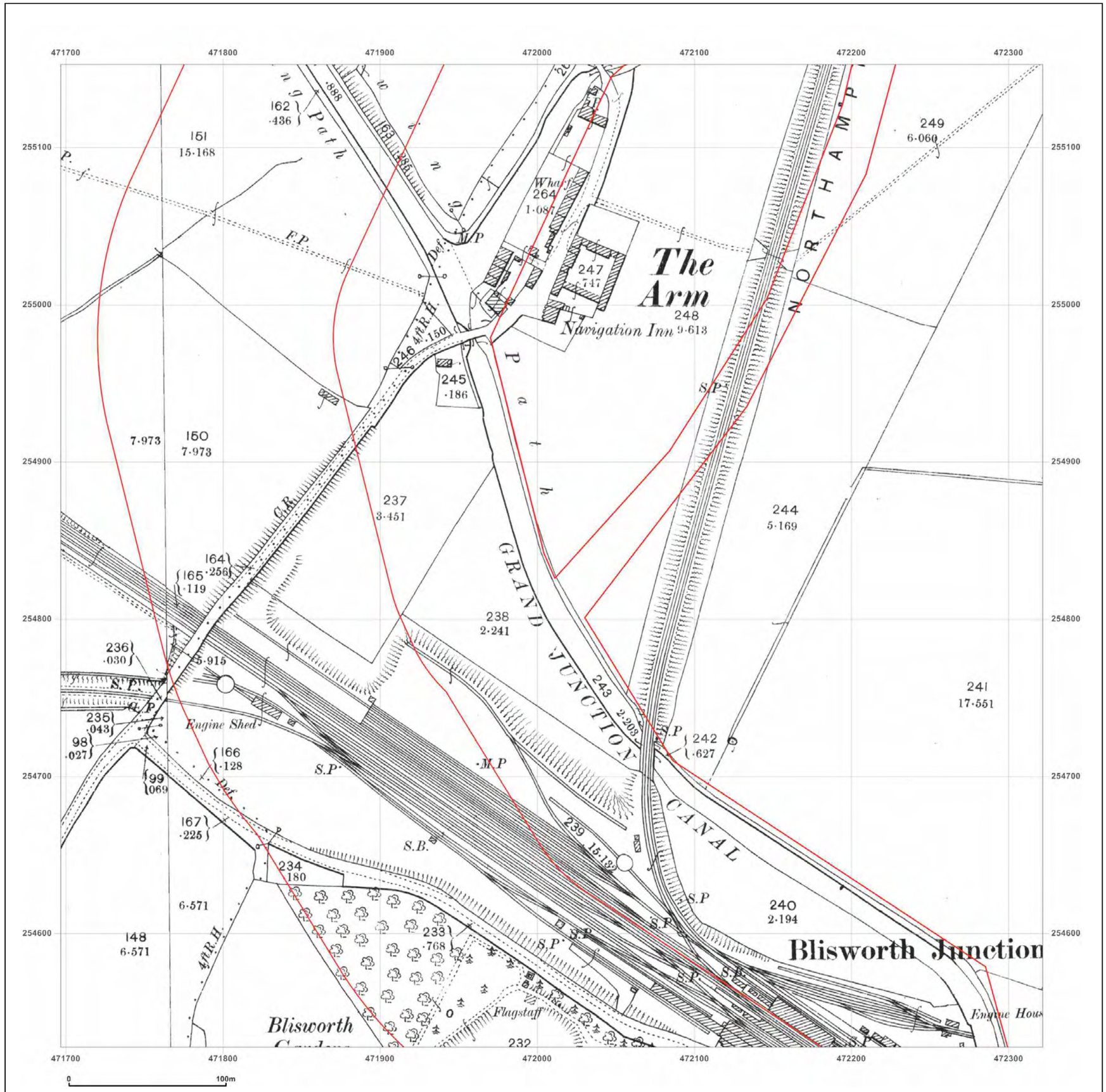

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_4
Grid Ref: 472009, 254840

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

N
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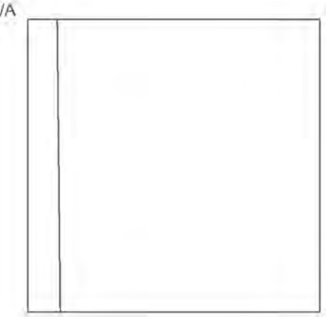
Surveyed 1900
Revised 1900
Edition N/A
Copyright N/A
Levelled N/A



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Revised 1900
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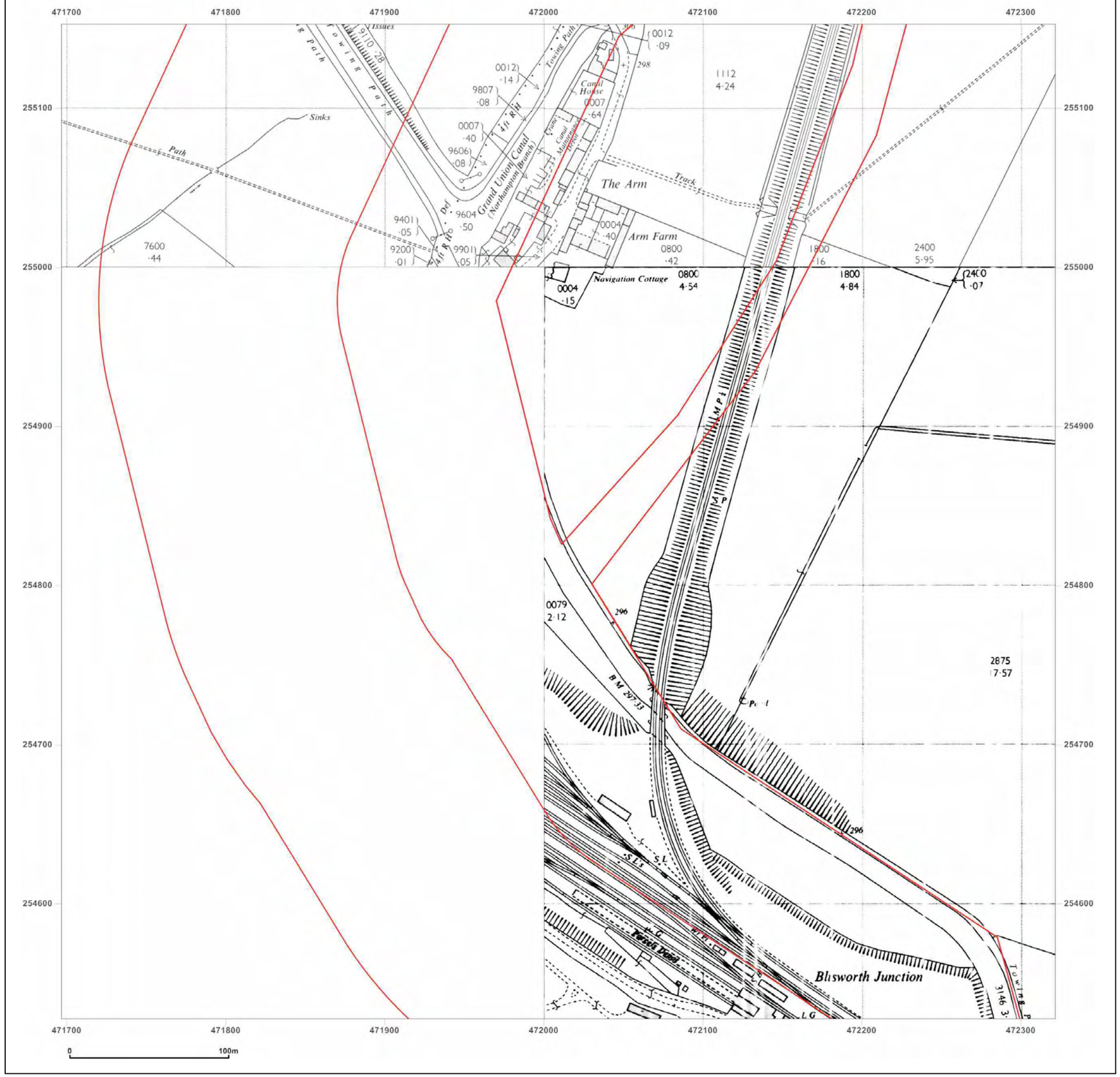

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_4
Grid Ref: 472009, 254840

Map Name: National Grid

Map date: **1964-1966**

Scale: 1:2,500

Printed at: 1:2,500

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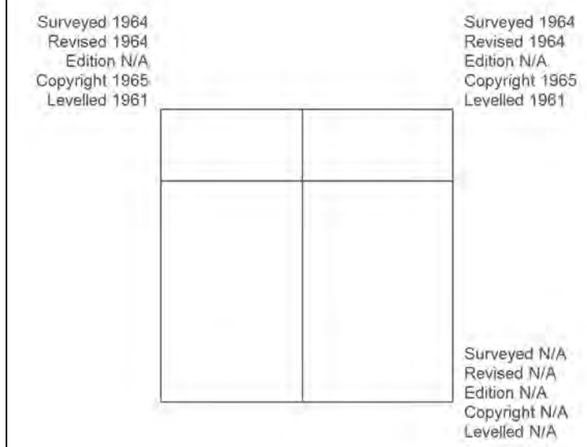

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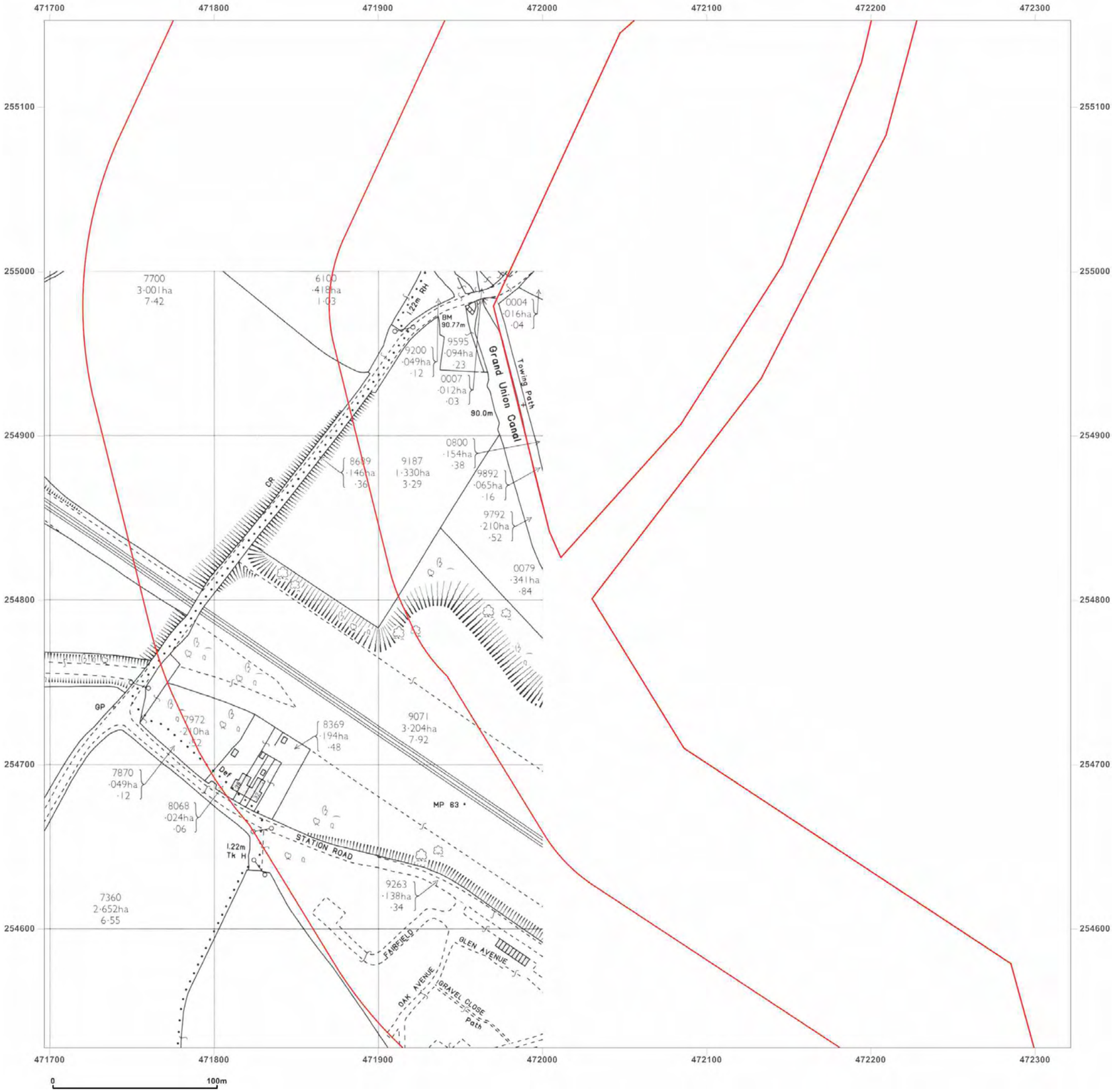

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_4
Grid Ref: 472009, 254840

Map Name: National Grid

Map date: **1973**

Scale: 1:2,500

Printed at: 1:2,500

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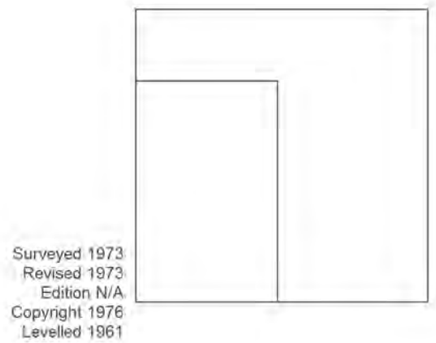

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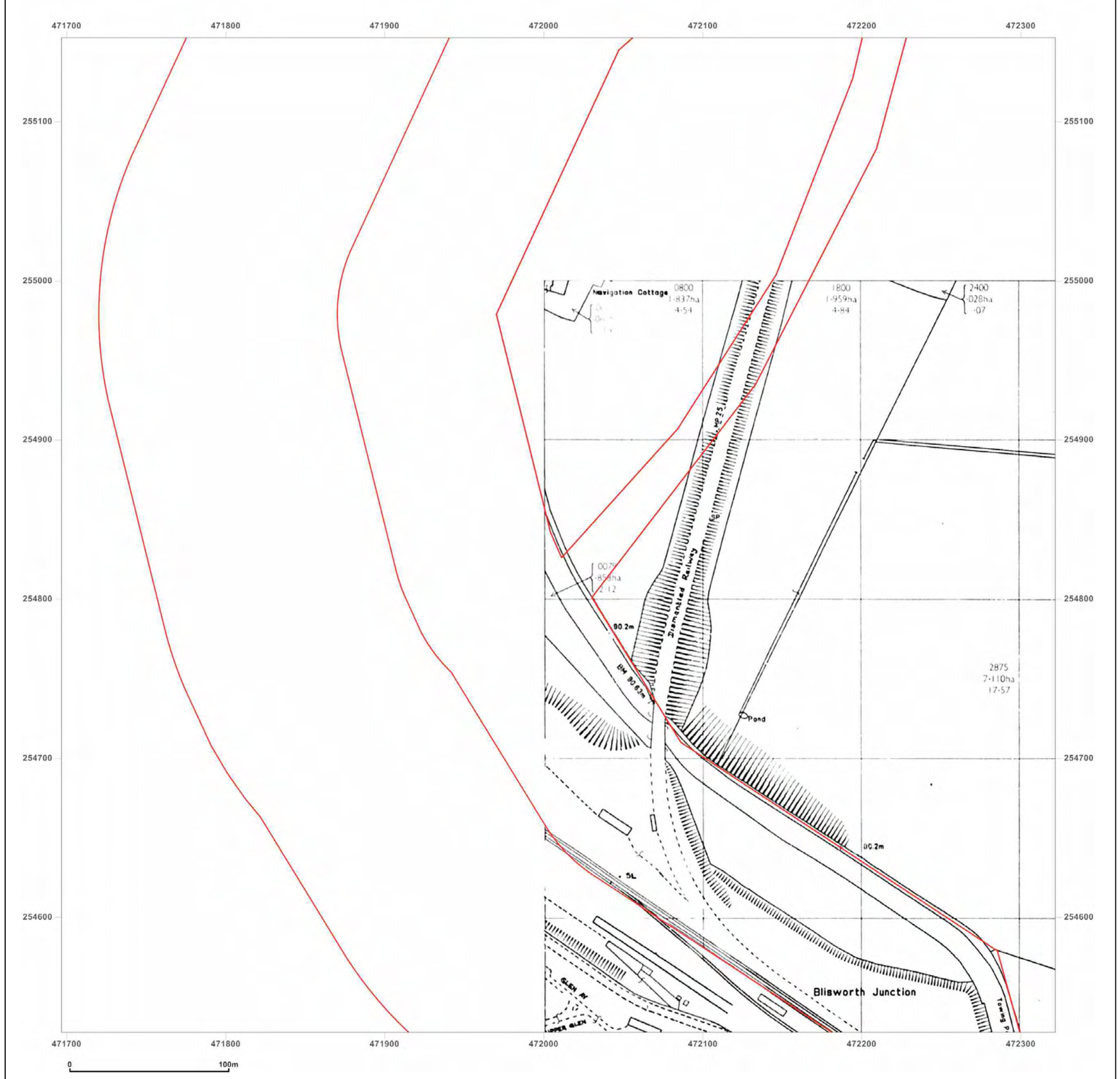

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_4
Grid Ref: 472009, 254840

Map Name: National Grid

Map date: **1986**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
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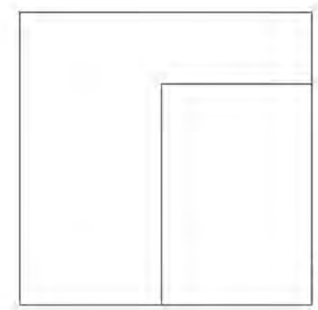

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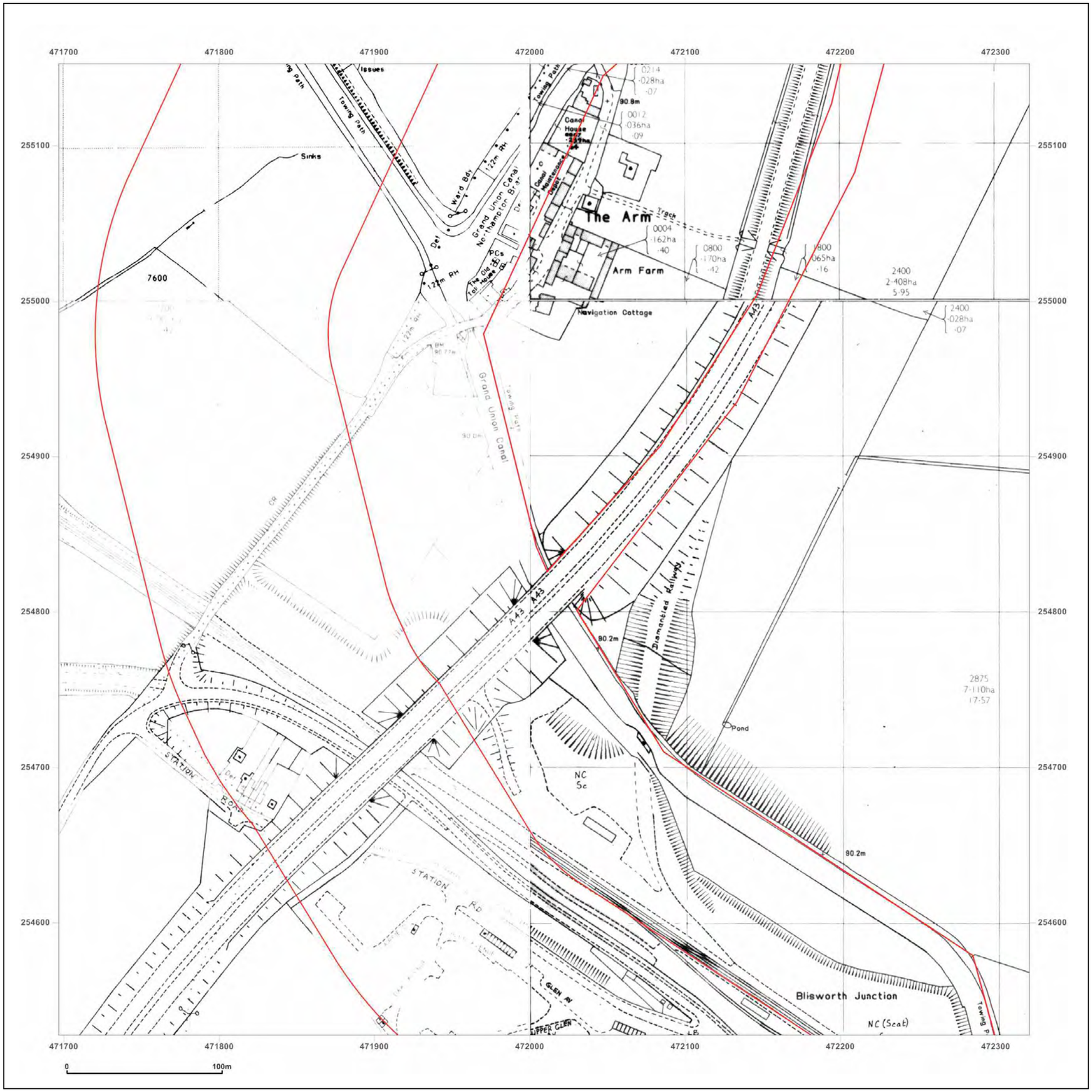

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_4
Grid Ref: 472009, 254840

Map Name: National Grid

Map date: **1989-1993**

Scale: 1:2,500

Printed at: 1:2,500

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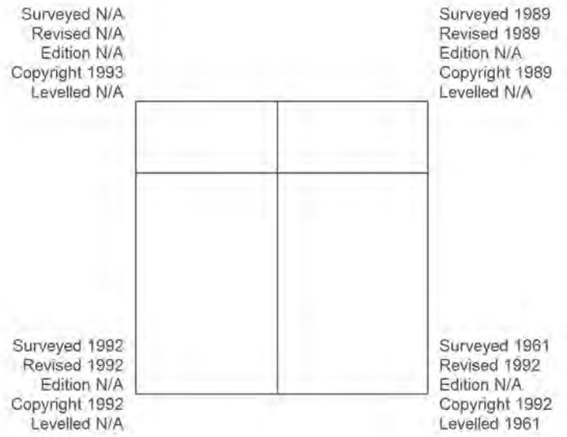

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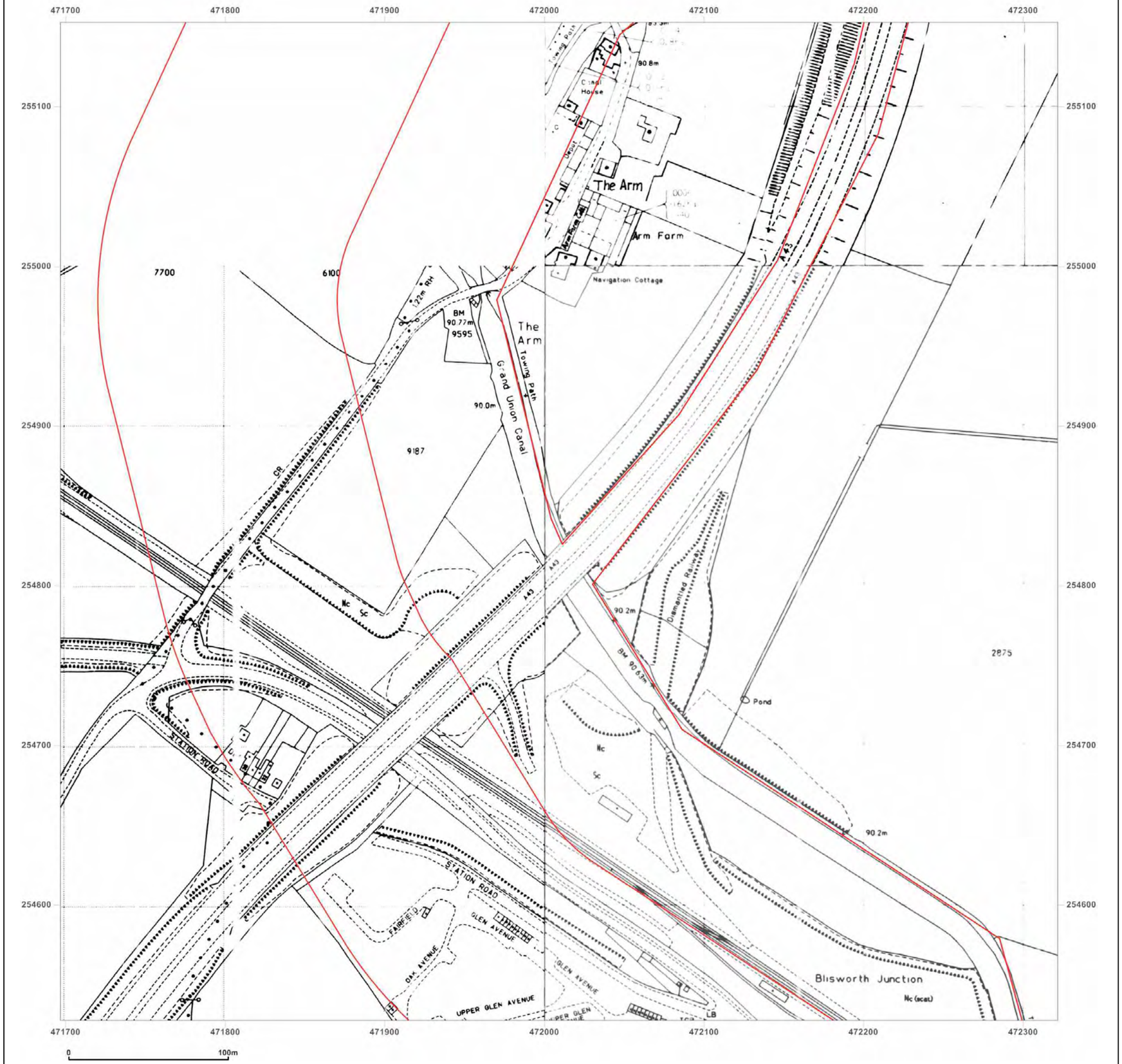

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_4
Grid Ref: 472009, 254840

Map Name: National Grid

Map date: **1992-1993**

Scale: 1:2,500

Printed at: 1:2,500

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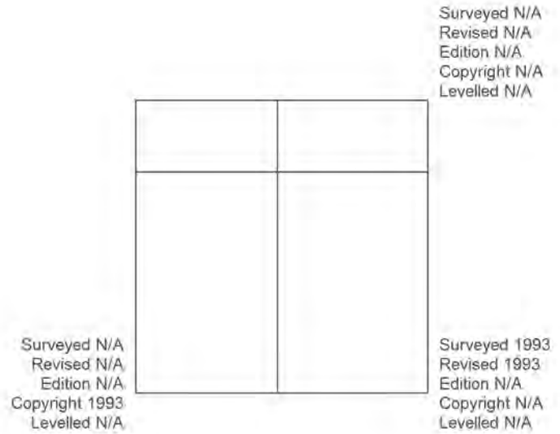

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Production date: 25 March 2015

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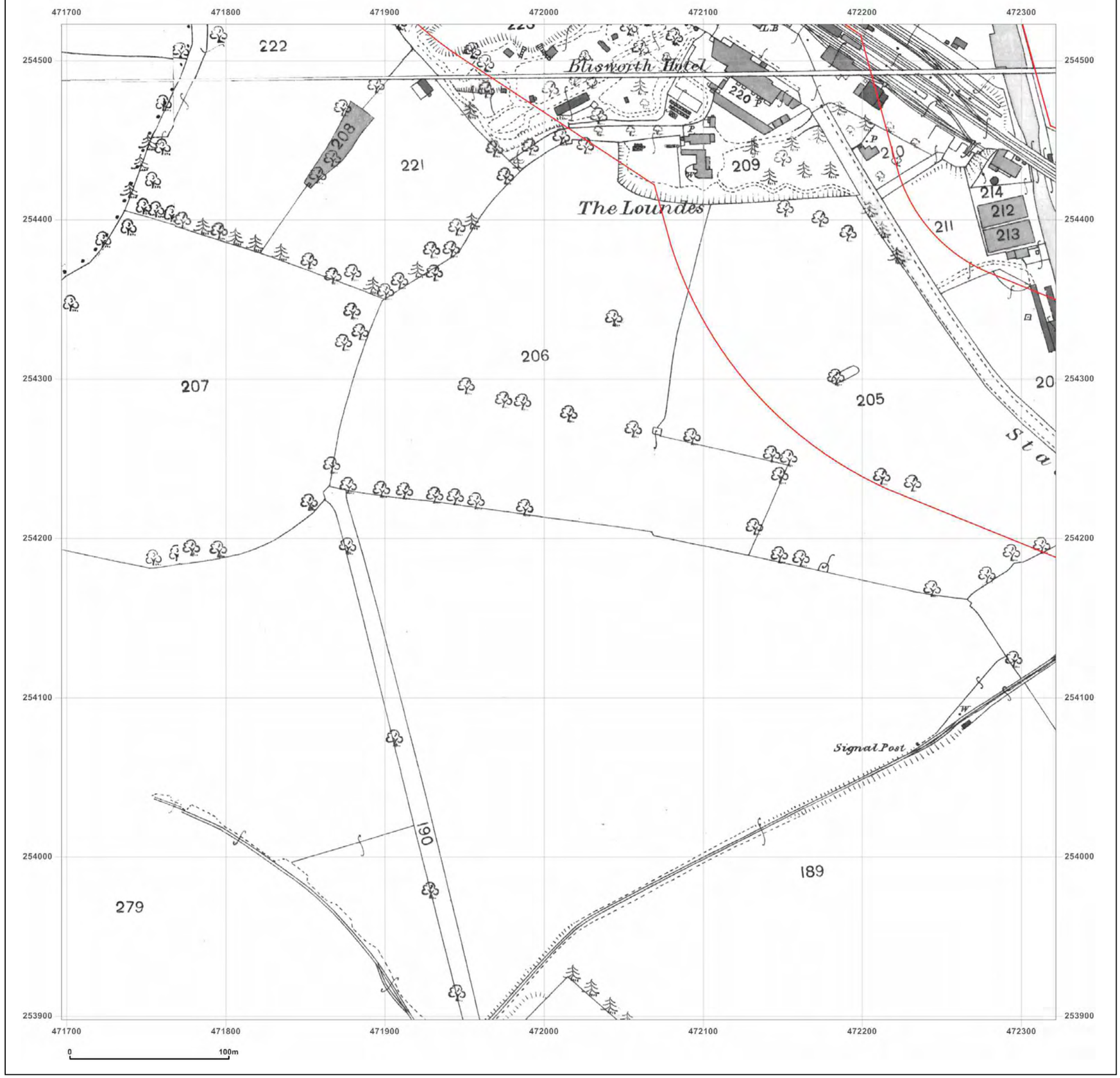

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_3
Grid Ref: 472009, 254210

Map Name: County Series

Map date: **1885**

Scale: 1:2,500

Printed at: 1:2,500

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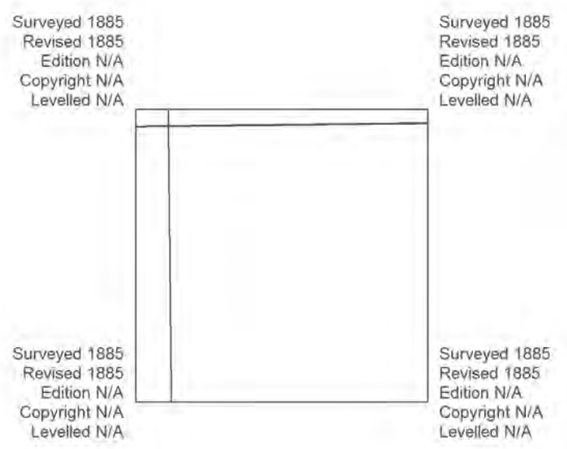

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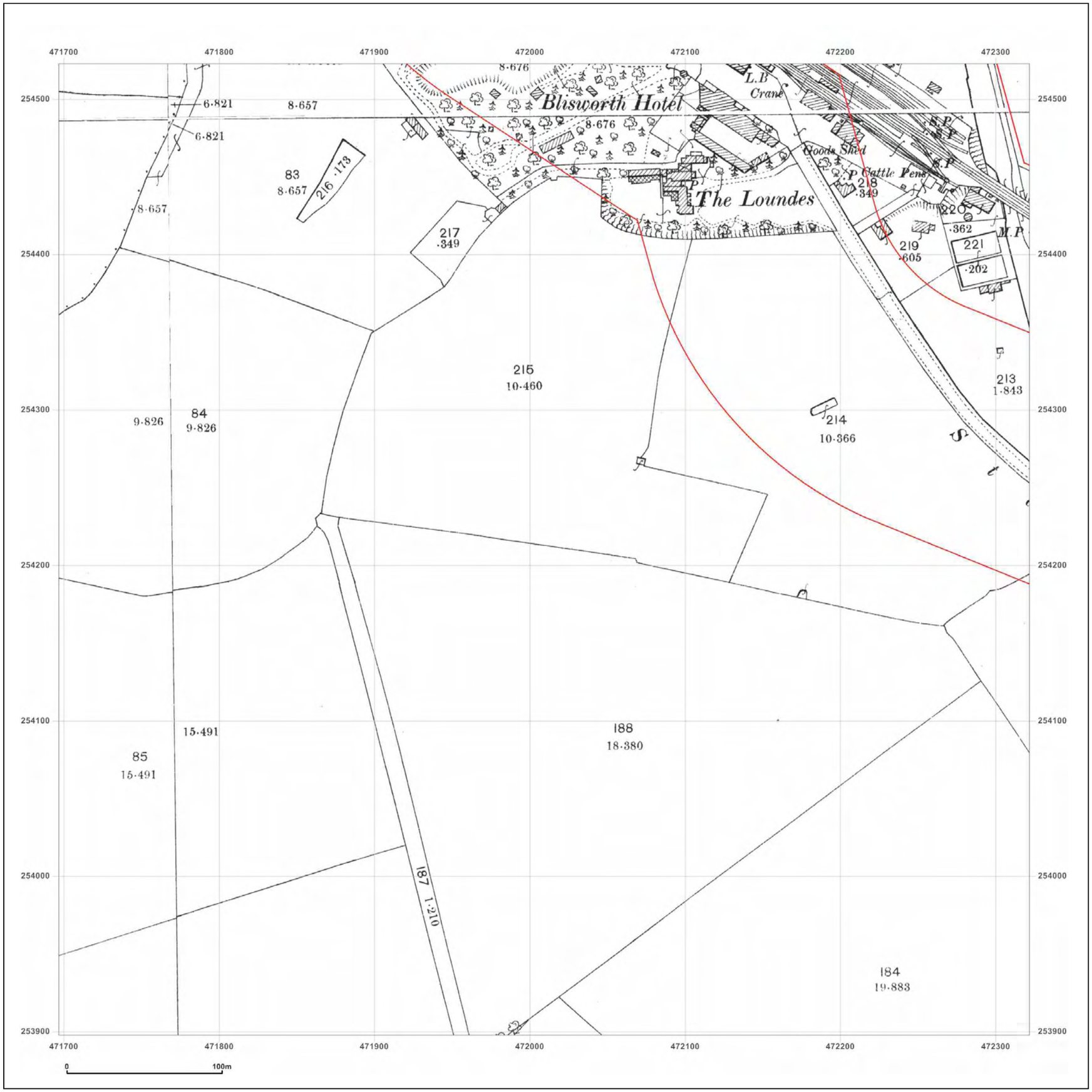

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_3
Grid Ref: 472009, 254210

Map Name: County Series

Map date: **1900**

Scale: 1:2,500

Printed at: 1:2,500

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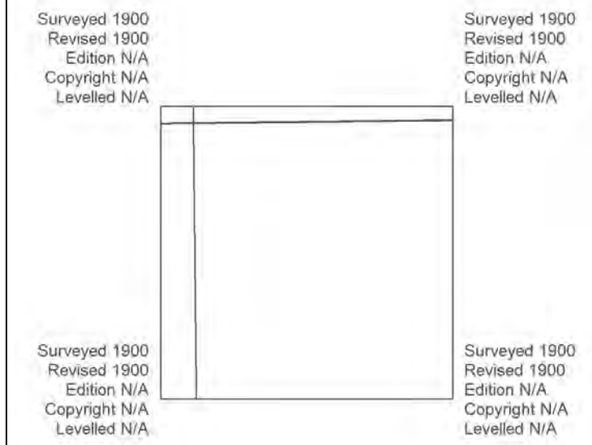

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Production date: 25 March 2015

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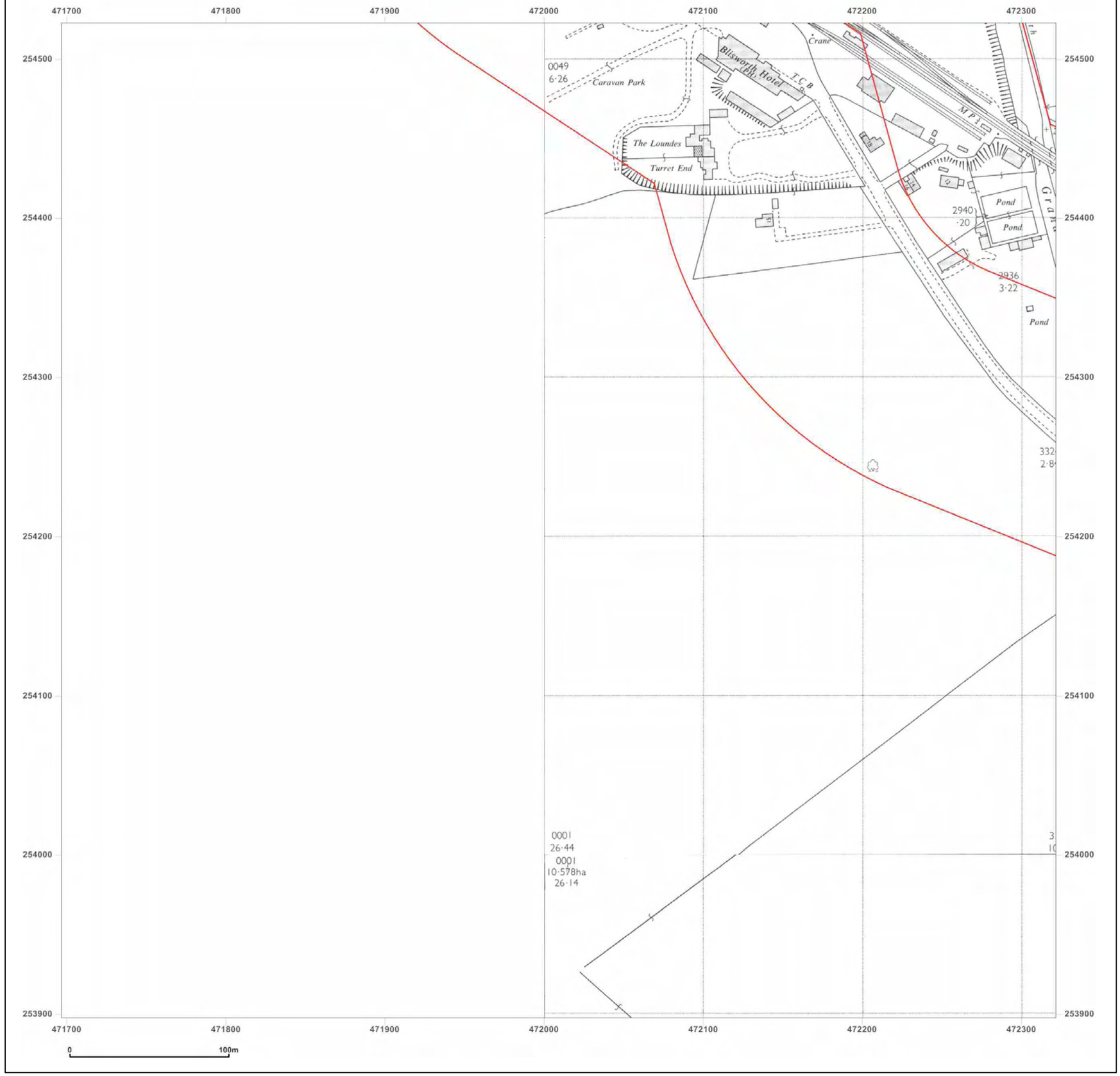

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_3
Grid Ref: 472009, 254210

Map Name: National Grid

Map date: **1966-1970**

Scale: 1:2,500

Printed at: 1:2,500

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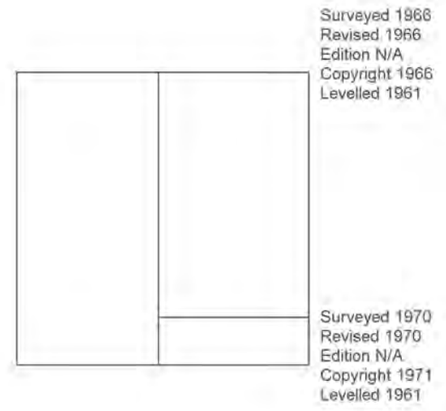

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Production date: 25 March 2015

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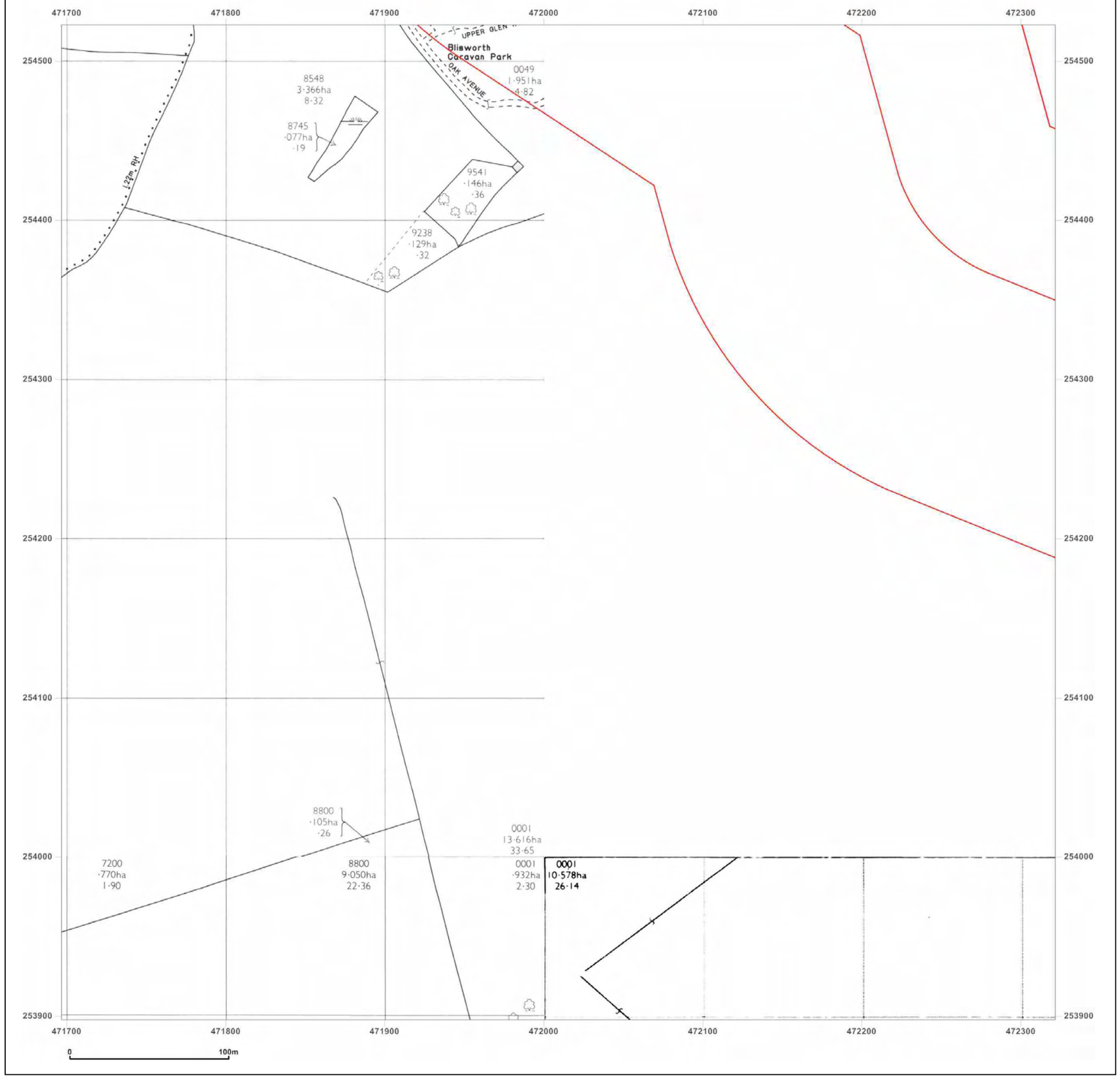

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_3
Grid Ref: 472009, 254210

Map Name: National Grid

Map date: **1971-1973**

Scale: 1:2,500

Printed at: 1:2,500

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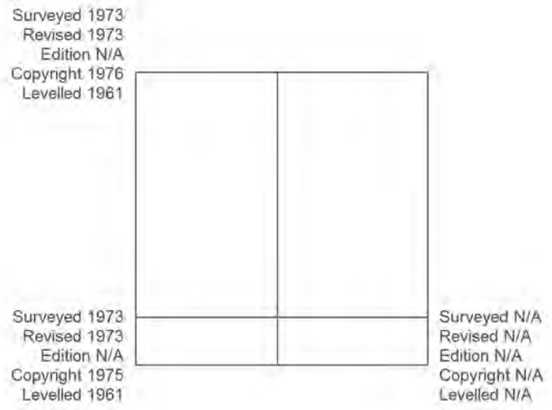

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Production date: 25 March 2015

To view map legend click here *Legend*



GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_3
Grid Ref: 472009, 254210

Map Name: National Grid

Map date: **1986**

Scale: 1:2,500

Printed at: 1:2,500

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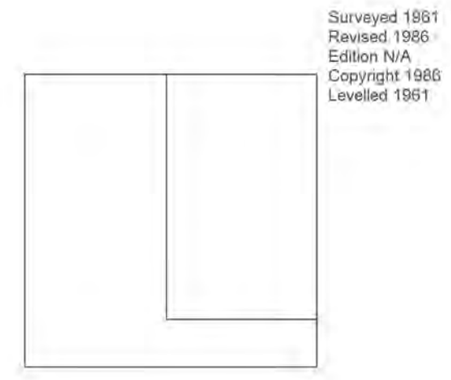

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Production date: 25 March 2015

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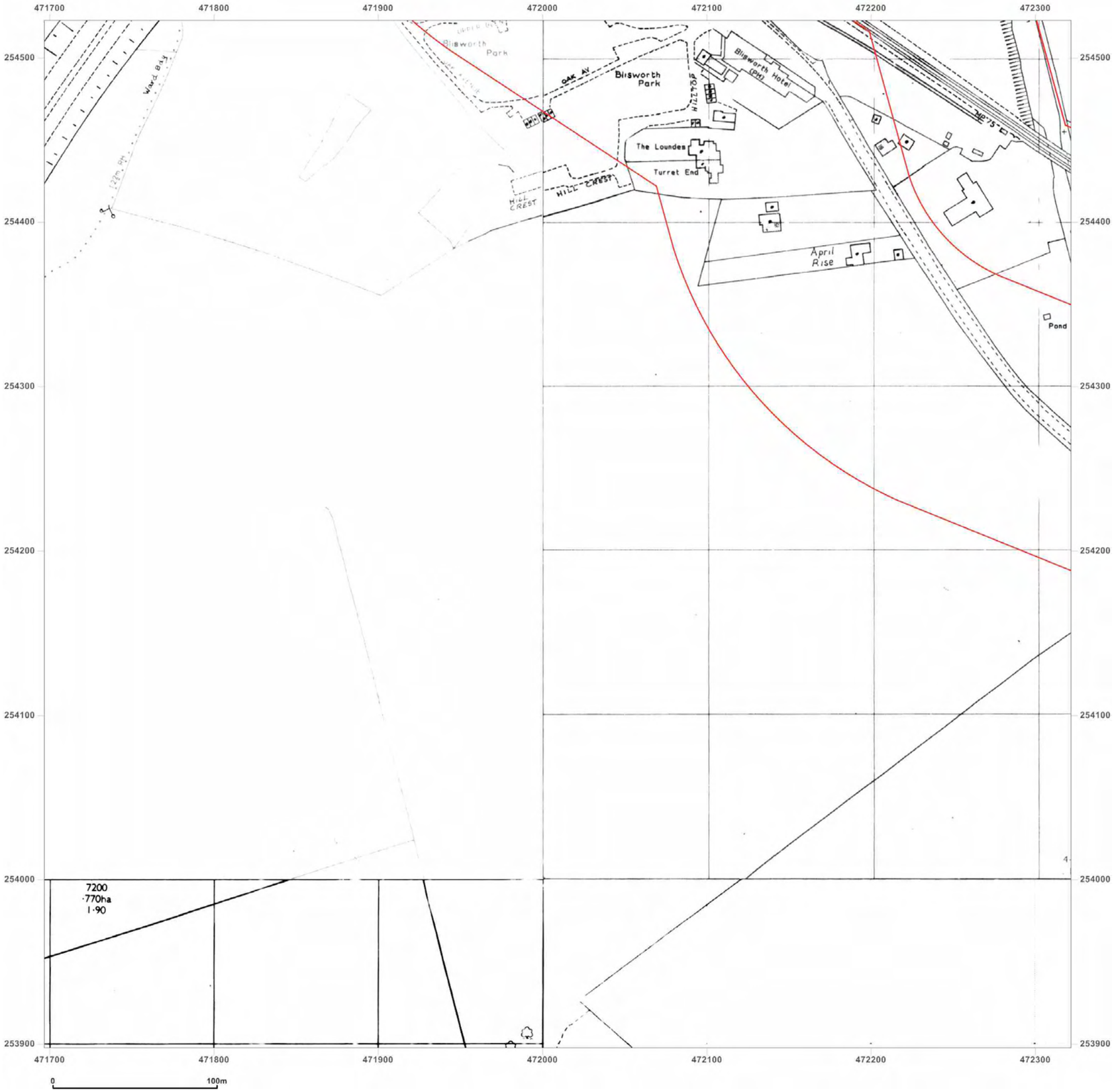

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_3
Grid Ref: 472009, 254210

Map Name: National Grid

Map date: **1992-1993**

Scale: 1:2,500

Printed at: 1:2,500

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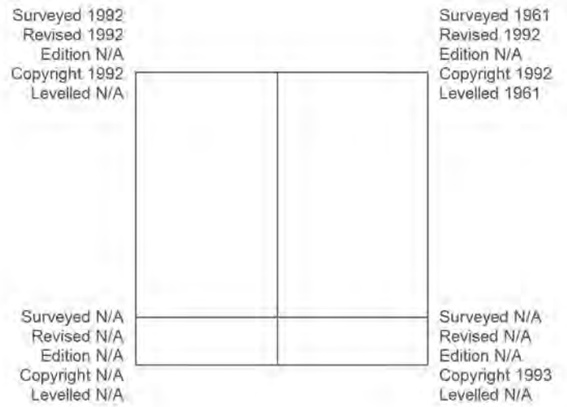

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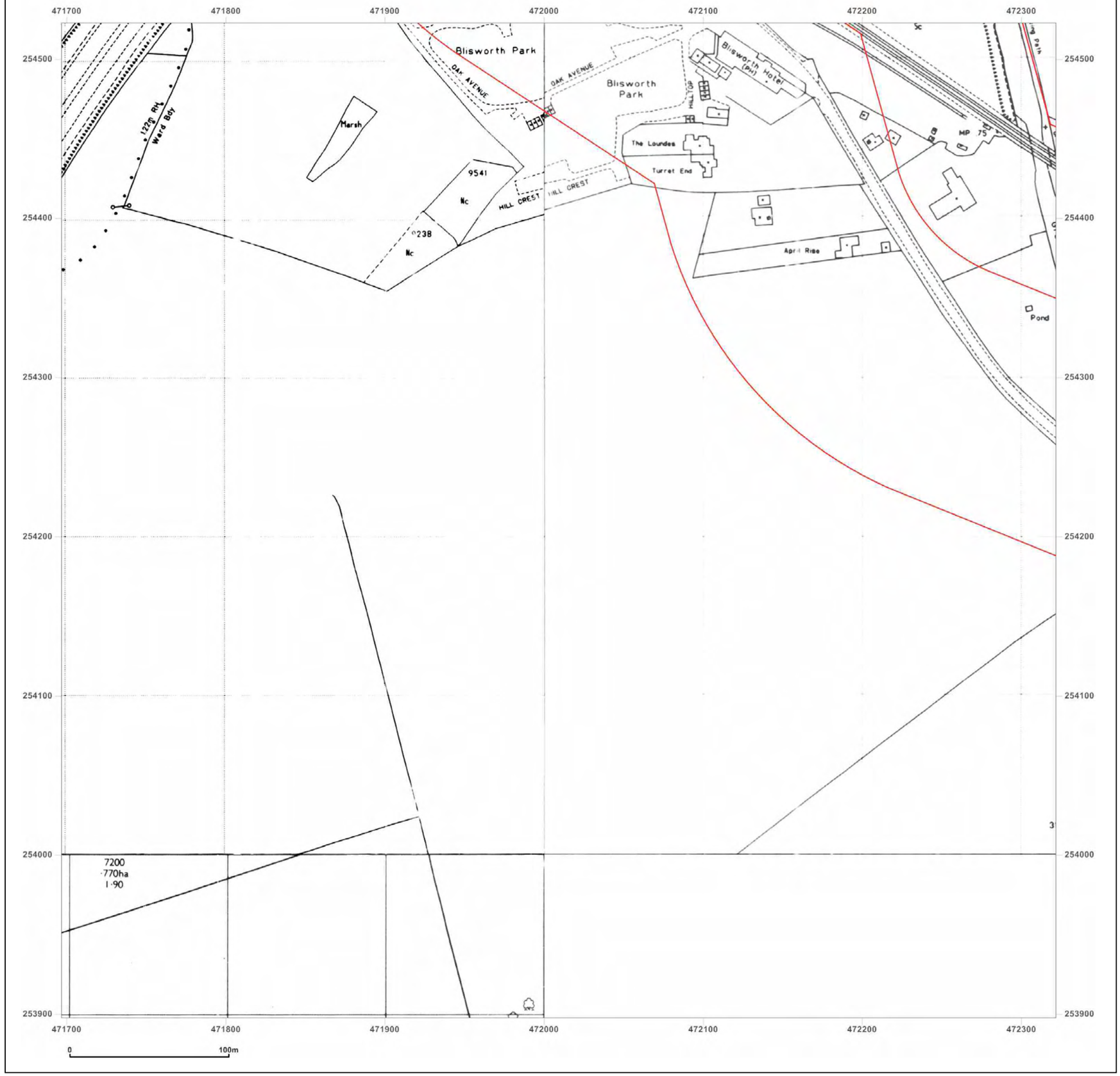

GroundSure
ENVIRONMENTAL INSIGHT

Site Details:

473662, 254753

Client Ref: N7425C151171
Report Ref: HYDNOR-1981475_LS_2_3
Grid Ref: 472009, 254210

Map Name: National Grid

Map date: **1992-1993**

Scale: 1:2,500

Printed at: 1:2,500

N
W E
S

Surveyed N/A
Revised N/A
Edition N/A
Copyright 1993
Levelled N/A

Surveyed 1993
Revised 1993
Edition N/A
Copyright N/A
Levelled N/A

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

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Production date: 25 March 2015

To view map legend click here *Legend*

Appendix D

Desk Study Research Information

REGIONAL UNEXPLODED BOMB RISK

NORTHAMPTONSHIRE

DENSITY OF BOMBS PER BOROUGH

Borough	High explosive	Anti-personnel	Incendiary
Brackley	159	0	2
Daventry	209	0	2
Northampton	206	0	0
Desborough	26	0	0
Brixworth	111	0	3
Oundle & Thrapston	132	0	5
Kettering	116	0	2

BOMB RISK MAP



OTHER WWII TARGETS
- military
- transport
- utilities
- industry
- docks
- other

BOMB TONNAGE
- >1000
- >500
- >100
- > 0
- unverified

BOMB RISK
- high
- moderate
- low

The information in this regional UXB risk map is derived from a number of sources and should be read in conjunction with the "Users' Guide" (printed overleaf). Zetica cannot guarantee the accuracy or completeness of the information or data.

This map covers regions of coast with beaches, estuaries and alike. Further consideration of the bomb risk is required in these areas. The often inaccessible nature and changing ground conditions (e.g. movement of silt that may contain ordnance) means that historical bombing records for these areas are often poor or inaccurate and further assessment of the bomb risk may be required as part of a site specific study.

A FOUR-STEP PROCESS

Risk assessment and method statement from a qualified explosive ordnance clearance (EOC) operative.

Surface geophysical survey to allow shallow groundwork.

MAGCONE detects UXBs and obstructions on piling layout to the no-risk depth.

Detected UXBs can be dealt with by our EOC engineers and a Clearance Certificate issued for the site.

zetica

For more details on this and related services, telephone: +44 (0) 1993 886682 or visit our website: www.zetica.com

BOMB MAP USERS' GUIDE

Sources of information and explanation of bomb risk

Why?

Unexploded bombs (UXB) still present a risk to construction projects long after the end of the Second World War (WWII). UXBs often entered the ground unnoticed at high velocity and penetrated to a depth of several metres. Here they remain – vulnerable to disturbances from construction work. Beyond the depth of shallow excavation work, the greatest risk is to piling, drilling and probing crews. A piling rig could repeatedly hit a UXBs with considerable force before the crew realises an obstruction has been impacted. It could then be up to 72 hours before the detonator activates.

Who?

The responsibility for avoiding UXB risk usually lies with construction companies or house builders particularly those who are redeveloping urban sites. In addition, project engineering or environmental consultants are expected to advise their clients of a site's history. Other interested parties include those organisations whose employees are physically at most risk from intrusive works, normally piling companies, drillers or probing operators.

How?

UXB risk should be assessed for every site, but especially those in known heavily bombed areas or those situated near war-time strategic installations that were priority targets for enemy aircraft, for example, airfields. Zetica's regional bomb risk map is therefore a first point of reference from which the relative, potential abundance of UXBs can be judged. Consultants then advise their clients that an ordnance-risk desk study is required, which they may obtain from external sources. Construction companies or house builders who assess their own risk could choose to come direct to Zetica.

When?

Do not wait for the piling or drilling company to be on site before thinking about UXB risk – it will inevitably cause delays and higher costs. Request the regional bomb risk map from Zetica as soon as a site is being considered, and then use it to help you or your clients to decide if an ordnance-risk desk study is required.

Where?

Maps can be obtained for any county in England, Scotland, Wales or Northern Ireland – or for any London borough. They can help determine the areas that were most heavily bombed – but no part of the country should be considered 100% safe from UXB risk. Even remote rural areas can have a high risk if, for example, they were locations for decoy airfields or beacons that were lit to fool enemy pilots into thinking they had located a burning city that had been successfully hit by others in the raid.

How to use this regional map

This map is designed to give you an indication of the potential risk from UXBs in your area. If you are conducting work that involves excavation, piling or other disturbance of the ground, then you should use the map to identify the category of risk for your site.

The risk boundaries are a guide, compiled from data based on the political areas for which records are held; being just outside a high-risk area does not mean there is no UXB risk. You should use the map to assist in your decision of whether to investigate the UXB risk further.

Information on the regional risk remaining from UXBs in the UK

Zetica has built the largest UXB database of its kind in the UK. It includes a unique digital library of bomb census data, and maps showing key strategic points and bombing densities from the First and Second World Wars. The main sources of information include records from central government (Public Records Office), the Ministry of Defence, and the German Luftwaffe.

Using information from this database, Zetica has published maps of UXB risk on a regional, county and borough scale. The maps indicate relative degrees of UXB risk based on available records for bombing densities and known targeted areas for regions within the UK. The risk is broken down into individual boroughs, towns or cities. The data are based on the historical boroughs and are then overlaid onto the modern map. It is important to note that more-detailed research may be required for individual sites, particularly where proximity to a potential WWII target means the local risk may be higher.

High risk

Areas designated as high risk are those that show a high density of bombing hits (50+ bombs per 1000 acres) and abundant potential WWII targets. In high-risk regions, further action to mitigate UXB risk is considered essential.

Moderate risk

Moderate-risk regions are those that show a bomb density of between 11 and 50 bombs per 1000 acres and that may contain potential WWII targets. Action to mitigate the risk is considered essential, albeit more likely that a reduced scope of work is required compared with that needed for high-risk regions.

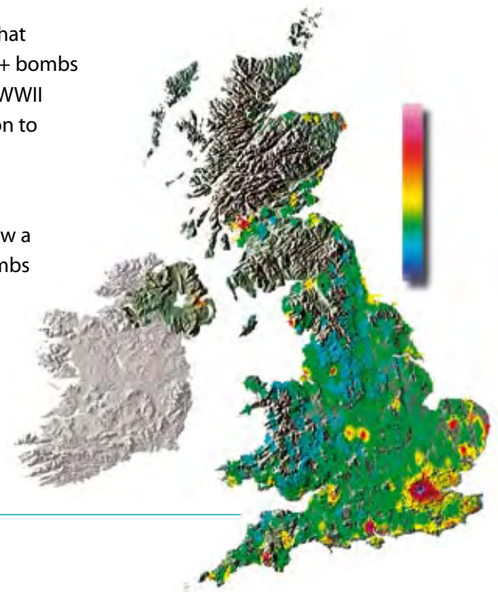
Low risk

Low-risk regions are those with a bombing density of up to 10 bombs per 1000 acres. These areas are considered to have a significant but low UXB risk. In general, further action to mitigate the risk is considered prudent, although not essential. Care is required when assessing the risk for specific sites where the risk may be higher because of local wartime activity.

Other WWII targets

Other regions with the risk of UXBs are key strategic points as defined by the government during WWII as representing potential enemy targets. Where these exist outside areas mapped as high, moderate or low risk, a site-specific assessment of the UXB risk may be required.

Relative UXB risk across UK



What to do if…

…you have a site that has a potential UXB risk

In the absence of current legislation requiring you to address the risk from UXBs, your responsibilities under health and safety legislation and regulations such as construction design and management require that you address all identified risks. The first stage is to request further advice from a professional adviser such as Zetica, or to gain more site-specific information by commissioning an ordnance-risk desk study. Then a strategy to deal with the risk can be established that is tailored to your proposed work.

…you find a suspect item or require advice

If during site works you find a suspect (ordnance-related) item, it is very important that you do not touch or move it (even if it has already been moved by an excavator). If it is clearly ordnance related, then dial 999 and ask for the police. Ensure that the area around the item is kept as clear as possible without placing yourself at risk. If you are unsure and do not wish to cause undue alarm, or you just require some advice, then you can call Zetica. We have experienced qualified UXB specialists on hand who can offer support and advice during any site works.

More-detailed procedures should be established in advance if you are in an area where the risk of finding a UXB is shown to be significant (moderate to high).

Site-specific desktop studies

Zetica is able to provide high-quality, site-specific UXB risk information for any residential, industrial or commercial property in the UK. These desktop studies provide details of the bombing density within an area and for the site itself, in order to indicate the risks of UXBs still being present. A risk assessment is provided to facilitate informed decision making on whether any further risk mitigation measures are required.

Your ref: N7442 / C151171

Our ref: 34104/CBH/CNE/AD/CW/TH

08 April 2015

Peter Brett Associates LLP
Caversham Bridge House
Waterman Place, Reading
Berkshire RG1 8DN
T: +44 (0)118 950 0761
F: +44 (0)118 959 7498
E: reading@peterbrett.com

Hydrock UK
Hawthorn Park
Holdenby Road
Spratton
Northampton
NN6 8LD

Attn: Adam Bennett

Dear Mr Bennett

RE: PBA NATURAL CAVITIES AND MINING CAVITIES DATABASE SEARCHES FOR LAND AT ARM FARM NEAR MILTON MALSOR, NORTHAMPTON

We refer to your email dated 27 March 2015, regarding the above. We thank you for your instructions to carry out natural and mining cavities database for the above named site.

The cavities database searches have been carried out for the site centred at National Grid Reference 473041, 254767, as provided.

NATURAL CAVITY RECORDS

A search of the PBA Natural Cavities Database indicated that there are no recorded natural cavity locations within 2000m of the site centre. The nearest recorded natural cavity is located 3.4km to the north of the site centre.

MINING CAVITY RECORDS

A search of the PBA Mining Cavities Database indicated that there are no recorded mining cavity locations within 2000m of the site centre. The nearest recorded mining cavity is located 5.8km to the north of the site centre.

While there are no records pertaining to natural or mining cavities within your site footprint, we would draw your attention to the fact that the absence of existing records for the site should not be considered as conclusive.

We trust that the information presented will assist you with your project, and thank you for your advanced payment of £270.00 plus VAT received 2nd April 2015 for this report. If you have any queries please do not hesitate to contact Asmi Desai.

Yours sincerely

Claire Walton
Assistant Engineer
For and on behalf of
PETER BRETT ASSOCIATES LLP

Whilst all reasonable efforts are made to check that the information contained in the cavity databases is accurate we do not warranty that the data is complete or error free. The information is based upon our own researches and those collated from a number of external sources and is continually being augmented and updated. IN NO EVENT SHALL PETER BRETT ASSOCIATES LLP BE LIABLE FOR ANY LOSS OR DAMAGE INCLUDING, WITHOUT LIMITATION, INDIRECT OR CONSEQUENTIAL LOSS OR DAMAGE ARISING FROM THE USE OF THIS DATA.

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Registered number: 07765026.

PUMP 1/2

6 HOSE MPD

DIESEL

SUL

4 STAR

UNLEADED

FUTURE STAGE 2

PUMP 3/4

DIESEL

SUL

4 STAR

UNLEADED

6 HOSE MPD

FUTURE STAGE 2

PUMP 5/6

DIESEL

SUL

4 STAR

UNLEADED

FUTURE STAGE 2

6 HOSE MPD

TANK 3
4*

TANK 5
DIESEL

TANK 1
UL

TANK 6
DIESEL

TANK 4
SUL

TANK 2
4*

TANKSAFE® LIMITED
4e Sherwood Road
Aston Fields Industrial Estate
Bromsgrove
Worcs B60 3DR
Tel: 01527 875100
Fax: 01527 876100
Email: info@tanksafe.co.uk

RECEIVED 14 MAR 2003

CERTIFICATE OF TANK FILLING

Certificate No. 03/5344

Customer: TotalFinaElf UK Limited
40 Clarendon Road,
Watford,
Hertfordshire.
WD1 1TQ.

Site Name: Blisworth Service Station,

Address: A43 Blisworth By Pass, Blisworth Arm, Northampton, NN7 3EF

Date Filled: 11/3/03

Tank No.	Product	Tank Capacity (litres)
1	Petrol	45,361
2	Petrol	27,216
3	Petrol	18,144
4	Diesel	27,216
5	Diesel	18,144
6	Diesel	45,361

We declare that the above tanks have been filled to capacity with RG22 hard foam in accordance with the procedures agreed with the local petroleum licensing authority.

Signed..... Dated..13 MAR 2003.....

For and on behalf of TankSafe Limited

TotalFinaElf UK Limited – Paul Towers

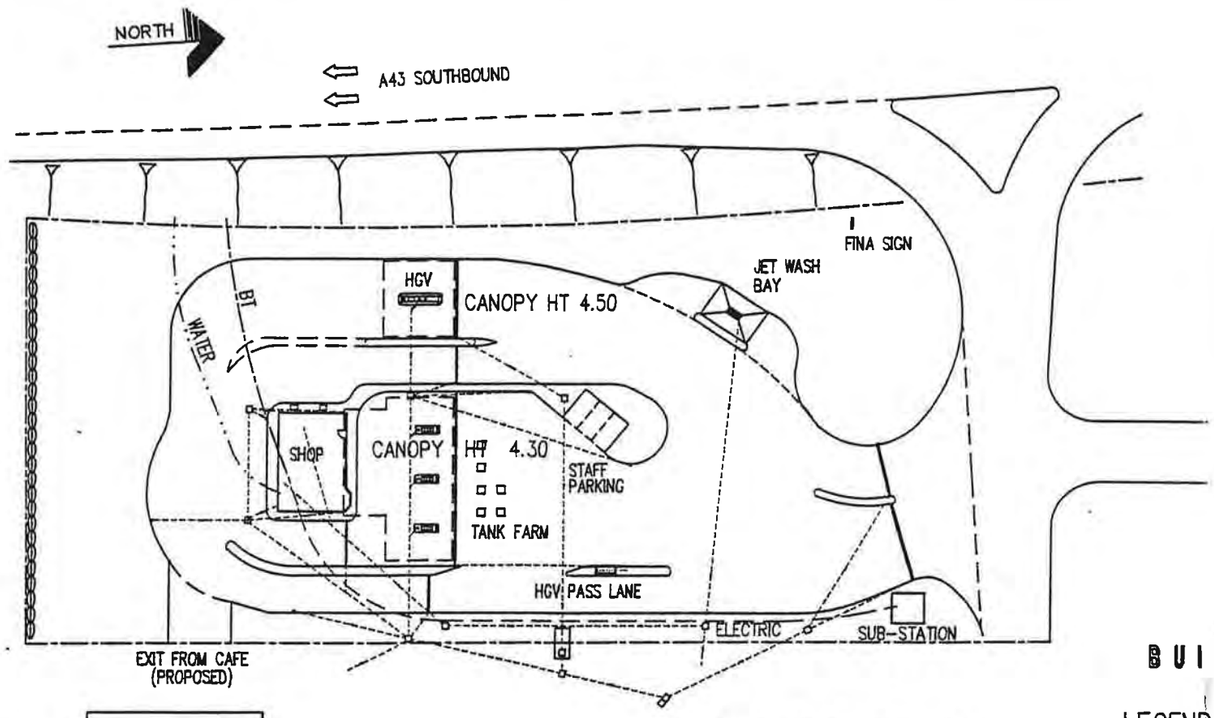
CNC (Supplies) Limited
(client to forward copy to local authority)

SNO 237

No	237 SNO	B4P	2	1
		TASK TYPE		
	STATION			
	TO			
PREM TYPE	PREM STATE			

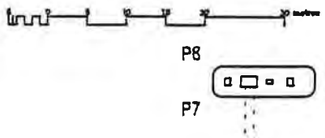
Registered No. 2794139.
Registered Office: The Glassmill, 1 Battersea Bridge, London SW11 3BZ
A member of the Gallic Shipping Group

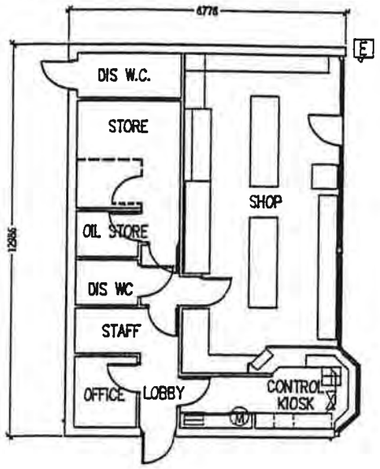
A CORPORATE MEMBER OF THE INSTITUTE OF PETROLEUM



SITE AREA = 7376 SQ.M.
= 0.74 HECTARES
= 1.82 ACRES

SITE LAYOUT





BUILDING PLAN KEY

- FIREMANS SWITCH
- PUMP ISOLATOR
- PUMP CONTROL
- MAIN SWITCHBOARD
- ELECTRIC MAINS

SHOP SHELVING LAYOUT DESIGNED AND FITTED BY G.W.S. SHOPFITTERS 01322 287131

BUILDING PLAN Scale – 1:200

HGV CANOPY SIGNAGE (1:250) VIEWED FROM A43



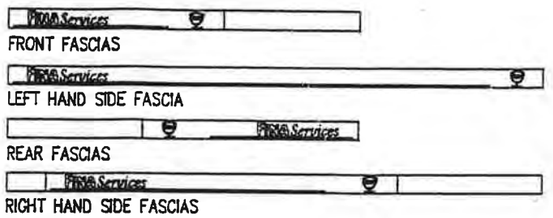
FRONT FASCIA

LEFT HAND SIDE FASCIA

REAR FASCIA

RIGHT HAND SIDE FASCIA

CANOPY SIGNAGE (1:250) VIEWED FROM A43



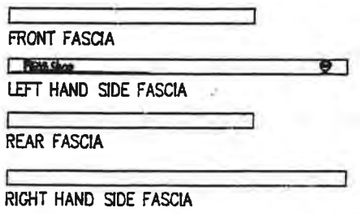
FRONT FASCIAS

LEFT HAND SIDE FASCIA

REAR FASCIAS

RIGHT HAND SIDE FASCIAS

SHOP SIGNAGE (1:250) VIEWED FROM A43



FRONT FASCIA

LEFT HAND SIDE FASCIA

REAR FASCIA

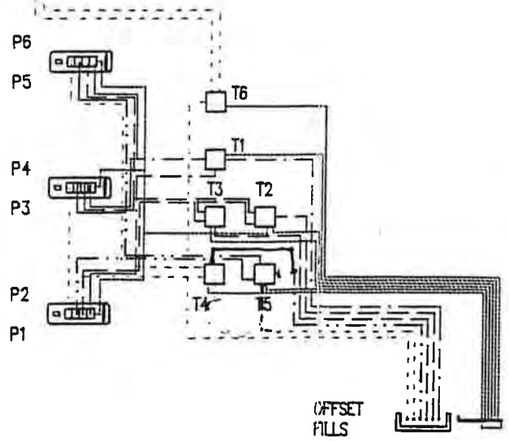
RIGHT HAND SIDE FASCIA

LEGEND

- 4* suction line
- UL suction line
- SUL suction line
- DERV suction line

PUMPS supplied by : SCHLUMBERGER
PUMP CONTROL SYSTEM : FOREMAN

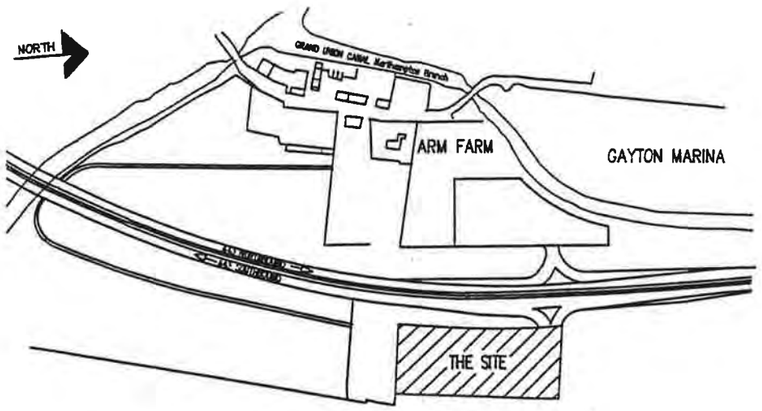
Pump No.	Type	Age	Product
1/2	8 H MPD	1994	UL,4*,SUL,D
3/4	8 H MPD	1994	UL,4*,SUL,D
5/6	8 H MPD	1994	UL,4*,SUL,D
7/8	TWIN HI-SPEED	1994	D



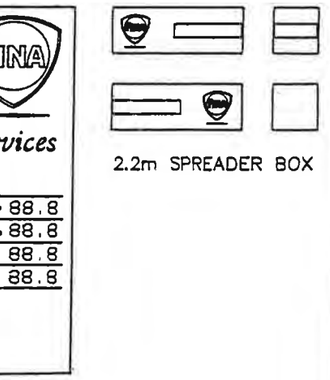
TANKS supplied by :
TANK GAUGES supplied by :

Tank No.	Capacity(97%) Galls/Litres	Product	Pump No.	Type	Material	Age
1	44000 Ltr	UL	1,2,3,4,5,6	SINGLE	STEEL	1994
2	26400 Ltr	4*	1,2,3,4,5,6	"	STEEL	1994
3	17600 Ltr	4*	1,2,3,4,5,6	"	STEEL	1994
4	26400 Ltr	SUL	1,2,3,4,5,6	"	STEEL	1994
5	17600 Ltr	DSL	1->8 incl.	"	STEEL	1994
6	44000 Ltr	DSL	7,8	SINGLE	STEEL	1994

PUMP TO TANK RELATIONSHIP
(DIAGRAMATIC)



LOCATION PLAN
NOT TO SCALE



6m POLE SIGN

2.2m SPREADER BOX

GENERAL FORECOURT SIGNAGE – 1:100

LOCAL AUTHORITY SOUTH NORTHAMPTONSHIRE COUNCIL SPRINGFIELDS TOWCESTER NORTHANTS NN12 6AE Tel: 01327 350211	PETROLEUM LICENSING AUTHORITY N.C.C. FIRE AND RESCUE FIRE PROTECTION DEPT HEADLANDS KETTERING NORTHANTS NN15 6BH Tel: 01536 410222	FIRE PREVENTION SERVICE Tel: 01536 410222 TELEPHONE COMPANY BRITISH TELECOM 5 NEWLANDS WALK GROSVENOR CENTRE NORTHAMPTON NN1 5EW Tel: 01604 28800	ELECTRICITY COMPANY EMEB PLC LODGE WAY HARLESTONE ROAD NORTHAMPTON NN5 7UT Tel: 01604 752345	WATER COMPANY ANGLIAN WATER PLC AMBURY ROAD HUNTINGDON CAMBRIDGESHIRE PE18 6NZ Tel: 01480 443000	CANOPY BY :- CONDER CANOPIES Tel: 01962 863577 CAR WASH BY :- None CAR VAC BY :- VALETMATIC LTD Tel: 01252 373690 AIR TOWER BY :- VALETMATIC LTD Tel: 01252 373690 JET WASH BY :- VALETMATIC LTD Tel: 01252 373690	LOCATION BLISWORTH SERVICE STATION A43 (SOUTHBOUND) BLISWORTH NORTHANTS JAN 1995 / DEC 1994 SPS-111-0	FINA plc RETAIL ENGINEERING DEPARTMENT HEAD OFFICE / LOCAL OIL TERMINAL FINA HOUSE / BUNCEFIELD ASHLEY AVENUE / GREEN LANE EPSOM SURREY / HEMEL HEMPSTEAD KT18 5AD / HERTS HP2 7HZ tel:01372 726226 Tel: 01442 63738

FINA S

HGV

CANOPY HT 4.50

JET WASH BAY

SHOP

CANOPY HT 4.30

PUMPS

1

3 2

4 5

STAFF PARKING

EGRESS

TANK FARM

TANKER OFF LOADING POSITION.

INGRESS

OFFSET FILLS

TANK VENTS

DCD CABINET

HGV PASS LANE

ELECTRIC

SUB-

BLISWORTH SERVICE STATION. FINA Plc.

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

GeoReports

Hydrock Consultants

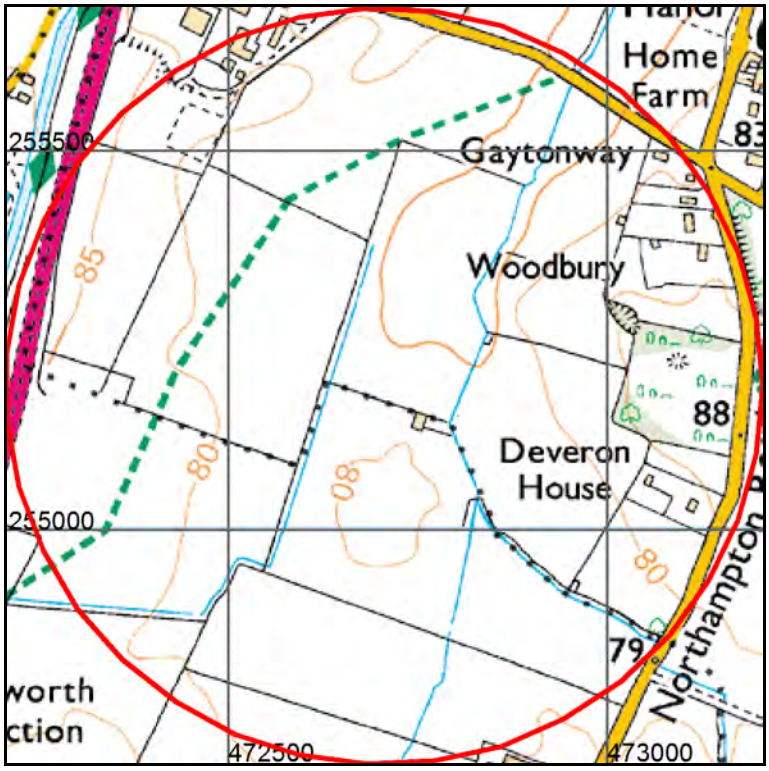
Radon Report: England and Wales

Advisory report on the requirement for radon protective measures in new buildings, conversions and extensions to existing buildings. The report also indicates whether a site is located within a radon Affected Area

Report Id: ***GR_210997/1***

Client reference: C151171

Search location



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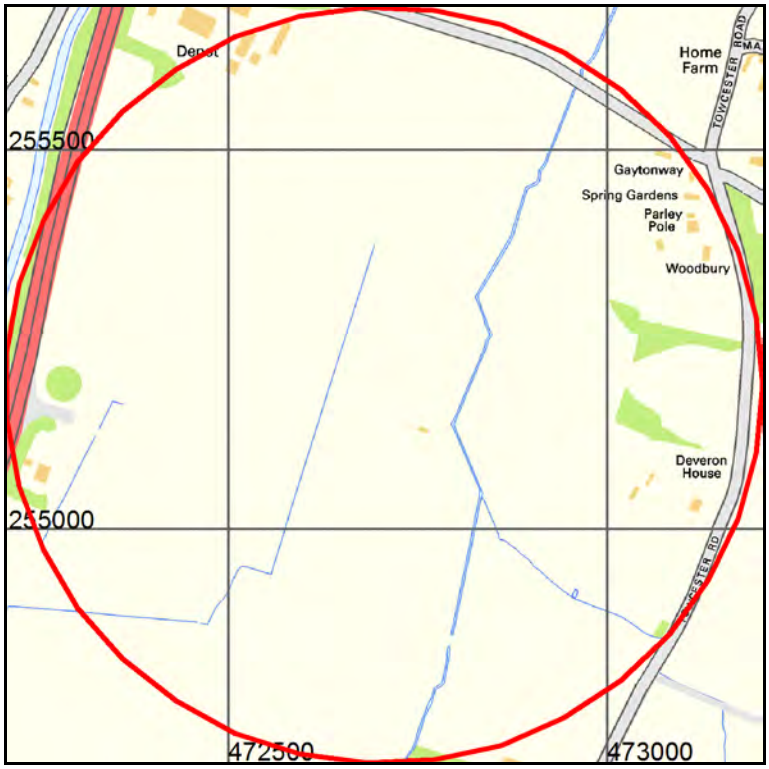
Scale: 1:10 000 (1cm = 100 m)



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OS Street View: Scale: 1:10 000 (1cm = 100 m)

This report describes a site located at National Grid Reference 472706, 255190. Note that for sites of irregular shape, this point may lie outside the site boundary. Where the client has submitted a site plan the assessment will be based on the area given.

Search location indicated in red

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Radon Report: England and Wales

This is an advisory report on the requirement for radon protective measures in new buildings, conversions and extensions. The report also indicates whether a site is located within a radon Affected Area

Requirement for radon protective measures
The determination below follows advice in *BR211 Radon: Guidance on protective measures for new buildings (2007 edition)*, which also provides guidance on what to do if the result indicates that protective measures are required.

BASIC RADON PROTECTIVE MEASURES ARE REQUIRED FOR THE REPORT AREA.

The BGS is not able to provide advice on the technical specifications of 'basic' and 'full' radon protective measures. This information is detailed in **BRE Report BR211 Radon: guidance on protective measures for new buildings** which may be purchased from **brebookshop.com.** This report offers guidance on the technical solutions that are required to satisfy Building Regulations requirements.

Technical solutions to radon protection in new build and existing dwellings in radon affected areas are available on the BRE web site at:
http://www.bre.co.uk/page.jsp?id=1626 and http://www.bre.co.uk/radon/ and in a range of technical reports available from **brebookshop.com;** Tel: 01923 664262, email: bookshop@bre.co.uk.
Summary guidance is available on the web at:
http://www.bre.co.uk/radon/protect.html.

If you require further information or guidance, you should contact your local authority building control officer or approved inspector.

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Radon in existing buildings

Is this property in a radon affected area – YES

The answer to the standard enquiry on house purchase known as **CON29 Standard Enquiry of Local Authority 3.13 Radon Gas: Location of the Property in a radon Affected Area is YES** this property is in a Radon Affected Area as defined by Public Health England (PHE).

The estimated probability of the property being above the Action Level for radon is: 3-5% (INTERMEDIATE PROBABILITY).

The result informs you of the estimated probability that this particular property is above the Action Level for radon. This does not necessarily mean there is a radon problem in the property. The only way to determine whether it is above or below the Action Level is to carry out a radon measurement within the existing property.

Radon Affected Areas are designated by Public Health England. They advise that radon gas should be measured in all properties within Radon Affected Areas.

If you are buying a new build property in a Radon Affected Area, you should ask the builder whether radon protective measures were incorporated in the construction of the property.

If you are buying a currently occupied property in a Radon Affected Area you should ask the present owner whether radon levels have been measured in the property. If they have, ask whether the results were above the Radon Action Level and if so whether remedial measures were installed, radon levels were retested, and the that the results of re-testing confirmed the effectiveness of the measures.

In radon affected homes, the problem of radon can usually be tackled with simple, effective and relatively inexpensive measures. These measures are comparable in cost to work such as damp-proofing and timber treatment. You can get practical advice about construction work to reduce radon levels from the Building Control Officer at your local council.

For further information, advice about radon, its health risks and details of how to order the radon test, please contact the PHE Radon Helpline on 01235 822622 or go online at www.ukradon.org or write to Radon Survey, Public Health England, Centre for Radiation, Chemical and Environmental Hazards, Chilton, Didcot, Oxon, OX11 0RQ, email: radon@hpa.org.uk. You can obtain an information pack from the PHE free Radon answerphone on 0800 614529

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What is radon?

Radon is a naturally occurring radioactive gas, which is produced by the radioactive decay of radium which, in turn, is derived from the radioactive decay of uranium. Uranium is found in small quantities in all soils and rocks, although the amount varies from place to place. Radon released from rocks and soils is quickly diluted in the atmosphere. Concentrations in the open air are normally very low and do not present a hazard. Radon that enters enclosed spaces such as some buildings (particularly basements), caves, mines, and tunnels may reach high concentrations in some circumstances. The construction method and degree of ventilation will influence radon levels in individual buildings. A person's exposure to radon will also vary according to how particular buildings and spaces are used.

Inhalation of the radioactive decay products of radon gas increases the chance of developing lung cancer. If individuals are exposed to high concentrations for significant periods of time, there may be cause for concern. In order to limit the risk to individuals, the Government has adopted an Action Level for radon in homes of 200 becquerels per cubic metre (Bq m^{-3}). The Government advises householders that, where the radon level exceeds the Action Level, measures should be taken to reduce the concentration.

Radon in workplaces

The Ionising Radiation Regulations, 1999, require employers to take action when radon is present above a defined level in the workplace. Advice may be obtained from your local Health and Safety Executive Area Office or the Environmental Health Department of your local authority. The BRE publishes a guide (BR293)**: Radon in the workplace.** BRE publications may be obtained from the BRE Bookshop, Tel: 01923 664262, email: bookshop@bre.co.ukwebsite: www.brebookshop.com

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Report issued by
BGS Enquiry Service

SP 75 SW 91

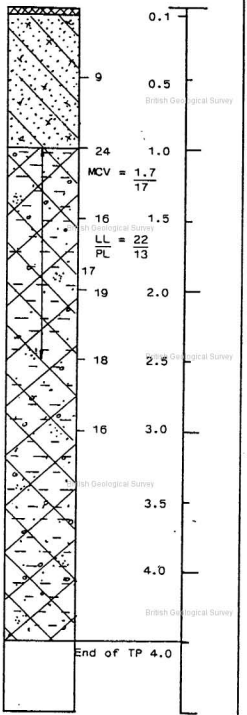
7213 5479

Description:-

Sparse dark brown sandy TOPSOIL and Railway Ballast. (MADE GROUND)

Loose orange brown silty fine to medium SAND. (MADE GROUND)

Firm orange brown very sandy CLAY with occasional to some fine to coarse subangular sandstone gravel and occasional pockets of red brown coarse sand. (MADE GROUND)



Notes

Trial pit complete at 4.5m.
Sides of pit stable throughout excavation.
No groundwater encountered.
Weather:- Rain.

Disturbed Sample → Water Strike | Pocket Penetrometer | Hand Vane | Moisture Content

Northamptonshire
Engineering Services Laboratory
Pondwood Close
Moulton Park
Northampton NN3 1RT
Tel (0604) 42212

TRIAL PIT RECORD

PROJECT: A43 MILTON MALSOR AND BLISWORTH BYPASS

Method of Excavation: JCB 3CXT
TP. No.: 30.
Ground Level: 90.72
Co-ordinates: E. 2135.48, N. 4971.62
Date Completed: 02.06.87.
Figure:

AARQUE T/P1

SP 75SW 90

7212 5494

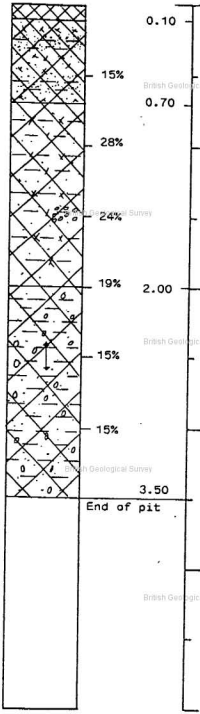
Description:-

Dark brown sandy TOPSOIL and railway ballast.
(MADE GROUND)

Loose orange brown silty fine to medium SAND with occasional pockets of orange brown very sandy clay.
(MADE GROUND)

Mixture of firm grey brown silty CLAY and orange brown very sandy CLAY with occasional pockets of orange brown fine sand and gravel.
(MADE GROUND)

Loose to medium dense orange brown very clayey fine to coarse SAND with occasional to some rounded quartzite gravel and sub-angular sandstone gravel.
(MADE GROUND)



Notes

Trial pit completed at 3.50m.
Trial pit remained stable during excavation.
No groundwater encountered.
Weather:- Raining.

Disturbed Sample → Water Strike | Pocket Penetrometer | Hand Vane | Moisture Content

Northamptonshire
Engineering Services Laboratory
Pondwood Close
Moulton Park
Northampton NN3 1RT
Tel (0604) 42212

TRIAL PIT RECORD

PROJECT: A43 MILTON MALSOR AND BLISWORTH BYPASS

Method of Excavation: JCB 3CXT

TP. No.: 29.

Ground Level: 90.86

Co-ordinates: E 2127.64, N 4942.53

Date Completed: 02.06.87.

Figure:

SP75 SW 89

7210 5488

scription :-

SOIL.

ose orange brown silty fine to medium
).
DE GROUND)

n to stiff brown slightly fine sandy silty
with some fine to coarse angular to
subangular flint, limestone and chalk gravel.
DE GROUND)

xture of firm orange brown very sandy becoming
m to stiff grey brown silty CLAY with many
fine to coarse sandstone gravels.
(MADE GROUND)

rees

Trial pit completed at 3.50m.
al pit remained stable during excavation.
groundwater encountered.
Weather:- Raining.

Depth (m)	Reduced Level (m A.O.D.)
	0.10
8%	
20%	1.05
23%	
	1.80
27%	
29%	
	3.50
End of pit	

Disturbed Sample → Water Strike | Pocket Penetrometer | Hand Vane | Moisture Content

Northamptonshire
Engineering Services Laboratory
Pondwood Close
Moulton Park
Northampton NN3 1RT
Tel (0604) 42212

TRIAL PIT RECORD

PROJECT
A43 MILTON MALSOR AND BLISWORTH BYPASS

Method of Excavation JCB 3CXT

TP No. 28.

Ground Level 91.27

Co-ordinates
E. 2116.37
N. 4898.20

Date Completed
02.06.87.

Figure

SP 75SW 88

Description:-

7209 5481

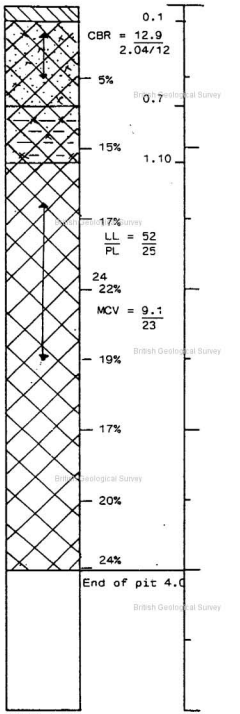
Dark brown sandy TOPSOIL.

Loose to medium dense orange brown silty clayey fine to medium SAND with some gravels.

Firm blue grey and dark orange brown slightly sandy silty CLAY.

Soft to firm orange brown very sandy silty CLAY with some to many fine to coarse rounded to subangular chalk limestone gravels with occasional large pockets (up to 5.00mm in diameter) firm dark blue grey silty clay.

(MADE GROUND)



Notes

Trial pit complete at 4.0m.
Trial pit remained stable during excavation.
No groundwater encountered.
Weather:- Windy/sunny.
At 0.2 - 0.5m Grading.

Disturbed Sample → Water Strike Pocket Penetrometer Hand Vane Moisture Content

Northamptonshire
Engineering Services Laboratory
Pondwood Close
Moulton Park
Northampton NN3 1RT
Tel (0604) 42212

TRIAL PIT RECORD

PROJECT: A43 MILTON MALSOR AND BLISWORTH BYPASS

Method of Excavation: JCB 3CXT

TP. No.: 27.

Ground Level: 92.01

Co-ordinates: E. 2094.99 N. 4824.82

Date Completed: 21.05.87.

Figure:

SP 75 SW 87

7206 5487

Description:-

Depth (m)	Reduced Level (mA.O.D.)
0.20	
0.75	
1.30	
2.00	
3.50	

Dark brown clayey TOPSOIL.

Firm orange brown and blue grey silty CLAY.
(GLACIALLY AFFECTED UPPER LIAS CLAY)

50
40
48
32%

Firm to stiff fissured orange brown and blue grey silty CLAY with occasional fine to coarse orange brown silty mudstone gravels.
(GLACIALLY AFFECTED UPPER LIAS CLAY)

80
90
98
25%

Stiff fissured blue grey occasional brown mottled orange brown silty CLAY with occasional coarse orange brown silty mudstone gravel and abundant fine gravel sized selenite crystals with free water on fissure surfaces.
(GLACIALLY AFFECTED UPPER LIAS CLAY)

98
120
118
26%

120+
155
150
155
slight
25%

Stiff becoming very stiff fissured blue grey occasional brown mottled orange brown silty CLAY with occasional coarse orange brown silty mudstone gravel and abundant fine gravel sized selenite crystals. Free water on fissure surface.
(GLACIALLY AFFECTED UPPER LIAS CLAY)

24%

24%

End of pit

Notes

Trial pit completed at 3.50m.
Trial pit remained stable during excavation.
Slight groundwater encountered at 2.00m.
Weather:- Overcast.
At 1.3 - 1.5m total sulphate content of soil sample = 0.47%,
pH 7.7 Water soluble sulphate = 1.53g/l

Disturbed Sample — Water Strike — Pocket Penetrometer — Hand Vane — Moisture Content

Northamptonshire
Engineering Services Laboratory
Pondwood Close
Moulton Park
Northampton NN3 1RT
Tel (0604) 42212

TRIAL PIT RECORD

PROJECT: A43 MILTON MALSOR AND BLISWORTH BYPASS

Method of Excavation: JCB 3CXT

TP. No. 26.

Ground Level: 87.24

Coordinates: E. 2065.91 N 4848.61

Date Completed: 06.03.87.

Figure

ENGINEER: DIRECTOR OF PLANNING & TRANSP.

PROJECT A43 HELTON WALSOR AND BLISWORTH BYPASS

GROUND LEVEL 80.10 m O.D.

HOLE NO. 229

LOGGED BY:
FIELDWORK BY:
LAB. TESTING BY: ENGINEERING SERVICES LABORATORY

EXCAVATION METHODS
CABLE TOOL AND PERCUSSION RIG (150mm DIAMETER TOOLS)

COORDINATES 2081.0 E 4781.7 N

DATES 21.05.87.

SHEET 1. OF 2.

FIGURE A

Date/Time at Depth	Depth of Casing	Depth to Water	Field	Description of Strata	Strata: Leg.	Reduced Level	Depth	Graphical Representation: Field vane/SPT Cohesion (kN/m²) 10 20 30 40	Sampling/In situ testing: Depths	Type	No.	Blows	V (kN/m²)	Lab. Testing: -425 %	W %	PL %	LL %	γ Mg/m³	C_u kN/m²	Additional Tests and Notes
				TOPSOIL			0.0	SPT N values: 0												
				Soft/firm green brown silty CLAY, topsoil and occasional rootlets and silt pockets.			0.1														
				Firm to stiff closely fissured becoming very stiff extremely closely fissured silty CLAY with occasional pockets of silt, gypsum crystals and occasionally interbedded with weak weathered mudstone. (GLACIALLY AFFECTED UPPER LIAS CLAY)			1.0		1.0	U	1	(32)		28				1.89	28	U100's driven by total jarring weight of 180Kgs. θ = 6°
										B	3			28	21	42				
										U	4	(54)		28				1.83	32	θ = 4°
										B	6									
									2.0	U	7	(78)		24				1.85	62	θ = 4°
							2.0			B	9									At 2.2 - 2.5m total sulphate content = 1.32%, water soluble sulphate = 3.77 gr/ltr
										U	10	(90)		20				1.88	100	θ = 8°
							3.0		3.0	B	12									
										U	13	(110)		24				1.91	80	θ = 7°
										B	15									
							4.0		4.0	U	16	(112)		22				1.87	50	θ = 11°
										B	18									Unable to test U100 at 5.5m due to overmeasing.
										U	19	(120)		22						
							5.0		5.0	B	21									
										U	22	(140)		21						
				Stiff/very stiff extremely closely fissured grey silty CLAY with lenses of silt and occasional fine to medium mudstone gravels. (UPPER LIAS CLAY)			6.0		6.0	B	24									
										U	25	(78)		19						
							7.0		7.0	B	27									
										U	28	(86)		19				2.09	136	θ = 3°
										B	30									
										U	31	(110)		17				2.11	168	θ = 2°
							8.0		8.0	B	33									
										U	34	(100)		21				2.11	168	θ = 2°
										B	36									
							9.0		9.0	U	37	(140)		20						
										B	39									
							10.0		10.0									2.12	237	θ = 0°

WATER: 1. Final water strike 2. Subsequent water strikes. Flow and depth in water at depth of casing shown. Flow 18.00 2.50

PIEZOMETER: Upper seal / Response length / Lower seal

SAMPLE AND TEST: D Small disturbed sample; B Bulk disturbed sample; W Water sample; U Undisturbed sample; P Piston sample; Rotary core recovery in strata; V Vane test; S Standard penetration test; C Core penetration test; K Permeability test; I Insitu density test

Blows: N = 10 blows (N/150, blows for 150mm drive after seating (N*, blows for part or whole of seating drive only (25) Undisturbed sample blow count

V Vane strength kN/m² Natural Remould

C, Core recovery % RQD Rock quality designation -425 Sample % passing 425µm sieve

DEPTH m = depths, levels and thicknesses in metres

Engineering Services Laboratory
Frost Wood Close,
Aviation Park East Entrance,
Birmingham. NEC 3PT.
Tel. (0564) 3292.

Sheet 1 of 2. Hole No. 229

British Geological Survey

ENGINEER: DIRECTOR OF PLANNING & TRANSP.	PROJECT A43 WELTON WALSOR AND BLISWORTH BYPASS	GROUND LEVEL 88.28 m O.D.	HOLE NO. 228.
LOGGED BY: FIELDWORK BY: LAB. TESTING BY: ENGINEERING SERVICES LABORATORY	EXCAVATION METHODS G.L. – 12.0m CABLE TOOL PERCUSSION RIG (150mm DIAMETER TOOLS) 12.0 – 30.0m ROTARY CORE RIG (WATER FLUSH)	COORDINATES 2115.6 E 4778.4 N	SHEET 3. OF 3.
		DATES 22.05.87.	FIGURE A

Date/Time at Depth	Depth of Casing	Depth to Water	Plot	Description of Strata	Strata Log	Strata Reduced Level	Strata Depth	Graphical Representation (FIELD MOISTURE CONTENT – % 10 20 30 40)	Sampling/in situ testing Depths	Type	No.	Blows	V/RQD	Lab. Testing +425 %	M %	PL %	LL %	γ Mg/m³	C_u kN/m²	Additional Tests and Notes
				Very stiff dark grey occasionally fissured and laminated very silty CLAY/clayey SILT with some becoming occasional fossil remains and many sand grade crystals, occasionally very thinly interbedded with moderately strong dark grey calcareous MUDSTONE below 28.5m. (UPPER LIAS CLAY)			20.0	SPT N HAMMER 0	20.0		Run 4		100/0		21			2.19	101	θ = 4°
															15			2.24	545	θ = 0°
							21.0		21.0		Run 5		80/0		13			2.36	798	Uniaxial compressive strength at 21.3m-7.4 mPa. θ = 1°
															13			2.17	1200	θ = 0°
							22.0		22.0											
							23.0		23.0		Run 6		73/0		16			2.30	177	θ = 5°
							24.0		24.0						14			2.32	825	θ = 0°
															15			2.31	345	θ = 0°
							25.0		25.0											
							26.0		26.0		Run 7		96/0		16			2.24	95	θ = 7°
															17			2.21	140	θ = 21°
																		2.08	357	θ = 4° At 26.2m pocket penetrometer result <450 KPa.
							27.0		27.0		Run 8		100/0							
															14			2.51	1480	θ = 0°
							28.0		28.0		Run 9		75/0							
							29.0		29.0						16			2.21	126	θ = 4°
03.06.87	30.0			END OF BOREHOLE 30.0m.			30.0		30.0											

WATER: 1. First water strike 2. Subsequent water strikes. Time and depth to water at depth of boring shown thus 10.00 / 2.00

DEPTH: All depths, levels and thicknesses in metres

PIEZOMETER: Upper seal; Response length; Lower seal

SAMPLE AND TEST KEY: D Small disturbed sample; B Bulk disturbed sample; W Water sample; U Undisturbed sample; P Piston sample; R Rotary core recovery in mm; V Insitu vane test; S Standard penetration test; C Cone penetration test; K Permeability test; I Insitu density test

Blows: N = N value 26/100, blows for 150mm drive after seating 26", blows for part or whole of seating drive only (20) Undisturbed sample blow count

V Vane strength kN/m² Natural / Remould; Cr Core recovery %; RQD Rock quality designation; +425 Sample % passing 425μm sieve

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Northampton. NN3 1RT.
Tel. (0604) 42212.

FIG. A | SHEET 3. OF 3. | HOLE NO. 228.

SK45 8W 48

ENGINEER: DIRECTOR OF PLANNING & TRANSP.	PROJECT A43 HELTON MALBOR AND BLISWORTH BYPASS	GROUND LEVEL 88.28 m O.D.	HOLE NO. 228.
LOGGED BY: / FIELDWORK BY: / LAB. TESTING BY: ENGINEERING SERVICES LABORATORY	EXCAVATION METHODS G.L. - 12.0m CABLE TOOL PERCUSSION RIG (150mm DIAMETER TOOLS) 12.0 - 30.0m ROTARY CORE RIG (WATER FLUSH)	COORDINATES 2115.6 E 4778.4 N	SHEET 2. OF 3.
		DATES 22.05.87. - 03.06.87.	FIGURE A

Date/Time of Depth	Depth of Casing	Depth to Water	Description of Strata	Depth	Sampling/In situ testing: Type	No.	Blows	V	Lab. Testing: U %	PL %	LL %	γ Mg/m³	C_u kN/m²	Additional Tests and Notes
				10.0	U	38	(110)		20 18			2.11	170	θ = 0°
					B	40								
				11.0	U	41	(130)		18			2.13	255	θ = 0°
					B	43								
22.05.87	9.0	DRY			U	44	(140)		15 11			2.07	197	θ = 4°
01.06.87	9.0	3.2	Moderately strong medium bedded grey slightly shelly calcareous MUDSTONE.	12.0								2.11	70	Rotary core drilling below 12.0m.
			Very stiff dark grey silty CLAY with occasional shells with moderately strong thinly bedded grey slightly shelly calcareous MUDSTONE between 13.4 - 13.5m. (UPPER LIAS CLAY)			Run 1		100/20				2.18	104	θ = 4°
				13.0					20			2.12	50	θ = 6°
			Very stiff dark grey fissured and laminated very silty CLAY with occasional shells. (UPPER LIAS CLAY)	13.5										
				14.0		Run 2		92/15						Uniaxial compressive strength:- 12.1m = 8.4 mPa 12.2m = 42.6 mPa 14.5m = 30.1 mPa 14.7m = 23.8 mPa 15.9m = 49.4 mPa 18.5m = 25.4 mPa
			Moderately strong thinly to medium bedded grey calcareous MUDSTONE becoming moderately strong thinly bedded very shelly calcareous MUDSTONE. (UPPER LIAS CLAY)	14.5										
				15.0										
				16.0										
			Very stiff dark grey fissured and laminated very silty CLAY with some sand grade crystals.	16.2										
			Very stiff dark grey silty CLAY/clayey SILT with many sand grade crystals and some fossil remains. (UPPER LIAS CLAY)	16.5								2.24	258	θ = 4°
				17.0								2.17	271	θ = 4°
												2.40	210	θ = 9°
						Run 3		88/5	15			2.32	355	θ = 1°
				18.0					17			2.02	146	θ = 1°
			Moderately strong very thinly to thinly bedded dark grey very shelly calcareous MUDSTONE. (UPPER LIAS CLAY)	18.2										
01.06.87	12.00	2.7	Very stiff dark grey silty CLAY/ clayey SILT with occasional fossil remains. (UPPER LIAS CLAY)	19.0										
				20.0		Run 4								

Graphical Representation: FIELD MOISTURE CONTENT - % 10 20 30 40

WATER: 1. First water strike; 2. Subsequent water strikes. Time and depth to water at depth of boring shown thus 18.00 / 2.50

PIEZOMETER: Upper seal; Response length; Lower seal

SAMPLE AND TEST KEY: D Small disturbed sample; B Bulk disturbed sample; W Water sample; U Undisturbed sample; P Piston sample; R Rotary core; T recovery to scale; V Inside vane test; S Standard penetration test; C Cone penetration test; K Permeability test; I Inside density test

Blows: N = N value 25/150, blows for 150mm drive after seating; 25°, blows for part or whole of seating drive only; (20) Undisturbed sample blow count

V Vane strength kN/m² Natural / Remoulded; Cr Core recovery %; RQD Rock quality designation; -425 Sample % passing 425μm sieve

DEPTH All depths, levels and thicknesses in metres

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HOLE NO. 228. SHEET 2. OF 3. FIG. A

British Geological Survey

ENGINEER: DIRECTOR OF PLANNING & TRANSP.

PROJECT A43 MELTON MALSOR AND BLISWORTH BYPASS

GROUND LEVEL 88.28 m O.D.

HOLE NO. 328.

LOGGED BY:
FIELDWORK BY:
LAB. TESTING BY: ENGINEERING SERVICES LABORATORY

EXCAVATION METHODS
0.0m - 12.0m CABLE TOOL PERCUSSION DRILLING (150mm DIAMETER TOOLS)
12.0m - 30.0m ROTARY CORE DRILLING (WATER FLUSH)

COORDINATES 2115.6 E 4778.4 N

DATES 22.05.87.

SHEET 1. OF 3.

FIGURE A

Date/Time at Depth	Depth of Casing	Depth to Water	Piezo.	Description of Strata	Strata: Leg.	Strata: Reduced Level	Strata: Depth	Graphical Representation: Field undrained Content % (10 20 30 40)	Sampling/In situ testing: Depths	Type	No.	Blows	V	Lab. Testing: +425 %	Lab. Testing: SF %	Lab. Testing: PL %	Lab. Testing: LL %	Lab. Testing: E MN/m²	Lab. Testing: C_u kN/m²	Additional Tests and Notes
22.05.87				TOPSOIL Soft to firm light grey mottled orange brown silty CLAY with occasional pockets of silt becoming stiff/very stiff dark green grey extremely closely fissured silty CLAY with many becoming occasional weathered mudstone gravels and occasional many fine to coarse gypsum crystals and occasional pockets of silt. (GLACIALLY AFFECTED UPPER LIAS CLAY)			0.0	SPT N Value O	0.0	U	1	(50)						1.70	30	U100's driven by total jarring weight of 180Kgs. θ = 0°
										B	2									
									1.0	U	4	(38)						1.65	51	θ = 3°
										B	6									
									2.0	U		(58)								No recovery from U100 sample at 1.7 - 2.15m.
										B	7									
									3.0	U	8	(84)								
										B	10									At 2.50m unable to test U100 sample due to overcasing.
										U	11	(120)								
										B	13							1.89	80	θ = 2°
									4.0	U	14	(120)						1.83	75	θ = 3° At 4.0 - 4.5m one dimensional consolidation test.
										B	16									
									5.0	U	17	(140)						1.80	110	θ = 6°
										B	19									
							5.8			U	20	(140)								
				Very stiff extremely closely fissured silty CLAY with grey silts along fissure faces and occasional mudstone gravels, fossils and gypsum. Occasional slip planes of 45° below 10.20m. Below 11.50m occasionally interbedded with very weathered limestone. (UPPER LIAS CLAY)			6.0		6.0	B	22								
										U	23	(86)						2.08	120	At 6.7 - 7.0m total sulphate content of sample = 0.33%,
									7.0	B	25									θ = 5° pH = 8
										U	26	(112)								
										B	28									
							8.0		8.0	U	29	(110)						2.11	112	θ = 4°
										B	31									
										U	32	(110)								
									9.0	B	34									
										U	35	(110)								
							9.8			B	37									
									10.0											

British Geological Survey

WATER 1. First water strike
2. Subsequent water strikes
Time and depth to water at depth of boring (Date) 15.00 ⊥W

PIEDOMETER Upper seal / Response tamp / Lower seal

SAMPLE AMD B TEST KEY
D Small disturbed sample
B Bulk disturbed sample
W Water sample
U Undisturbed sample
P Piston sample
R Rotary core recovery to scale
V Insitu vane test
S Standard penetration test
C Cone penetration test
K Permeability test
I Insitu density test

Blows N in N value (SPT/CP), blows for 150mm drive after seating 25*, blows for part or whole of seating drive only (CP) Undisturbed sample blow count

V Vane strength kN/m² Remoulded

(C) Core recovery %
RQD Rock quality designation
+425 Sample % passing 425µm sieve

DEPTH All depths, levels and thicknesses in metres

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TRIAL

SHEET 1. OF 3.

HOLE NO. 328.

SW/PSM/JJ 4.8

RECORD of WELL or BORING

SP75/4
Survey No. 2021

at (house or farm) E.M. Alexander Esq., Mortimer House.
Town, Village, &c. Milton. County Northants.
Exact site (unless tracing from a map is supplied, give distance and direction from parish church, cross-roads, or other object shown on maps). Mortimer House, ? formerly Milton Rectory.* S. of Village.
Popular Edition, Sheet No. 53 S.E. of one-inch map. (Sheet 141)
Surface level of ground 270 ft. above Ordnance Datum. Well or Bore commenced at 20 ft. below surface level of ground.
Sunk – ft., diameter – ft. Bored 30' ft.; diameter of boring: at top 5" in., at bottom 4" in.
Details of lining tubes (internal diameters preferred) 36'0" x 5" top 6" B.S.:
10'9½" x 4" top 39'2½" B.S. (on bottom.)
Water struck at depths of (feet) ?
Rest-level of water below above top of well or bore 28'11" Pumping level – ft. Time of recovery – hours.
Suction at – ft. depth. Yield: (i) on test 1,126 galls. per hour (ii) normal – galls. per –
Quality (attach copy of analysis if available) –
Made by – for Mr. – Date of boring 1931
Information from LeGrand, Sutcliff & Gell, Ltd., Southall, Middx. SB 4/415

(For Survey use only.) GEOLOGICAL CLASSIFICATION.	NATURE OF STRATA. (and any additional remarks)	THICKNESS. Feet.	THICKNESS. Inches.	DEPTH. Feet.	DEPTH. Inches.
	[Drift in Marl] ← Existing Well	20	-	20	-
	Brown Sand & seams of Ironstone	6	-	26	-
	Blue Clay	4	-	30	-
	Rock	1	-	31	-
	Blue Clay	3	-	34	-
	Rock	1	-	35	-
	Blue Clay	1	6	36	6
	Rock	4	-	40	6
	Blue Sandy Clay	8	6	49	-
	Rock	1	-	50	-
		50	-	50	-

* The Rectory is on (old) 6" map, ½ S. of the village, + 350 yds S.W. of the (ruined) parish church. O.S. map shows old village as on lower slope of Upper Lias, at its Mid.-Lias outcrop, in lower ground to N.W. of [illegible] near common called "Drift Land" + "Drift Ground", so wild brambles may be wrong.]
The "existing well 20'" is doubtless that already published for Milton Rectory (WS Mem. p. 118)

Original
Received. 9.4.34.
(Copy in 6341 file) C.H.D.

For LeGrand, Sutcliff & Gell, Ltd.

[signature]

GEOLOGICAL SURVEY AND MUSEUM, SOUTH KENSINGTON, LONDON, S.W.7.

For Survey use only.

Date received.	G.S.M.	M. of H. notified.	Sheet Marked on 1" map.
9.VII.37	6341		C.H.D.

(24738C) Wt 26930/295 5,000 11/36 H, J, K & L, Ltd Gp 616

SP 18 SW 434

7222 5520

Description :-

TOPSOIL

Firm to stiff fissured orange brown and grey mottled red brown silty CLAY.
(GLACIALLY AFFECTED UPPER LIAS CLAY)

Stiff fissured blue grey and brown silty CLAY with occasional orange brown coarse mudstone gravels.
(GLACIALLY AFFECTED UPPER LIAS CLAY)

Stiff fissured highly weathered blue and orange brown silty CLAY with occasional to some medium to coarse sub-angular weak mudstone gravels.
(GLACIALLY AFFECTED UPPER LIAS CLAY)

Depth (m)	Reduced Level (mA.O.D.)
0.2	
0.5	
0.8	
1.0	
1.5	
2.0	
2.5	
3.0	

62, 61, 68

110, 90, 91

120+

145, 130, 140

120, 130, 115

28 LL/PL = 46/25

33

MCV = 10/28

25

24

26

26

27

23

End of TP 3.5

Notes

Trial pit complete at 3.5m.
Sides of pit stable throughout excavation.
Slight seepage of groundwater at 2.0m.
Weather:- Rain.
At 1.1 - 1.3m total sulphate content of soil sample = 0.06%, pH 7.9

Disturbed Sample — Water Strike — Pocket Penetrometer — Hand Vane — Moisture Content

Northamptonshire
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Pondwood Close
Moulton Park
Northampton NN3 1RT
Tel (0604) 42212

TRIAL PIT RECORD	PROJECT: A43 MILTON MALSOR AND BLISWORTH BYPASS
Method of Excavation: JCB 3CXT	TP. No. 32.
Ground Level: 84.95	
Co-ordinates: E. 2223.67 N. 5195.59	Date Completed: 02.06.87. Figure

AARQUE T/P1

British Geological Survey

SP 75 NW 433

Description:- 7219 5308

Depth (m) | Reduced Level (mA.O.D.)

Dark brown clayey TOPSOIL. 0.20

Soft to firm orange brown mottled light grey brown silty CLAY with occasional medium to coarse rounded quartzite gravel. (GLACIALLY AFFECTED UPPER LIAS CLAY)

70
52
62
31
CBR = 2.6 / 1.94/27
28
78
86
87
26
0.90

Firm to stiff becoming stiff with depth fissured brown and dark blue grey silty CLAY. (UPPER LIAS CLAY)

110
120+
100
100
27

120+
120
130
130
26

25

26

3.50 End of pit

Notes

Trial pit completed at 3.50m.
Trial pit remained stable during excavation.
No groundwater encountered.
Weather:- Overcast.
At 1.0 - 1.5m total sulphate content of soil sample = 0.16%, pH 8.0

Disturbed Sample → Water Strike | Pocket Penetrometer | Hand Vane | Moisture Content

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Tel (0604) 42212

TRIAL PIT RECORD

PROJECT: A43 MILTON MALSOR AND BLISWORTH BYPASS

Method of Excavation: JCB 3CXT
TP No.: 31.
Ground Level: 84.93
Co-ordinates: E. 2187.65 N. 5078.36
Date Completed: 11.06.87.
Figure:

ENGINEER: COUNTY SURVEYOR.	PROJECT A43 HILTON AND BLISWORTH BYPASS.	GROUND LEVEL m O.D.	HOLE NO. BH.220
LOGGED BY: / FIELDWORK BY: / LAB. TESTING BY: ENGINEERING SERVICES LABORATORY	EXCAVATION METHODS: CABLE TOOL PERCUSSION RIG (150mm Diameter Tools)	COORDINATES E N	SHEET 2 OF 2
		DATES 4/8,7.85.	FIGURE A

Date/Time at Depth	Depth of Casing	Depth to Water	Flush	Description of Strata	Strata: Legend	Strata: Reduced Level	Strata: Depth	Graphical Representation: FIELD MOISTURE CONDITION (10 20 30 40)	Sampling/In situ testing: Depths	Type	No.	Blows	V (kN/m²)	Lab. Testing: -425 %	W %	PL %	LL %	γ Mg/m³	C_u kN/m²	Additional Tests and Notes
				(UPPER LIAS CLAY)				30 40 50 60 Wt. in Hundreds: A C F	10.0	C		N=63			21				
8.7.85	5.80	DRY								B	24									
				End of Borehole. 11.0m.		11.0			11.0											U4 at 11.0m broke in borehole. Used chisel to move the cutter and made no progress in 1 hour borehole consequently abandoned.

WATER ∑ Final water strike; ∑ Subsequent water strikes. Time and depth to water at depth of boring shown (Dash) 10.00 / 5.80

PIEDOMETER: Upper seal; Response length; Lower seal

SAMPLE AND TEST KEY: D Small disturbed sample; B Bulk disturbed sample; W Water sample; U Undisturbed sample; P Piston sample; C Recovery core; V Shear vane test; S Standard penetration test; K Core penetration test; I Insitu density test

Blows: N = N value (SPT) blows for 100mm drive after seating; 25*, blows per part or single of seating drive only; (20) Undisturbed sample blow count

V: Vane strength kN/m²; Remarks; Cr Core recovery %; RQD Rock quality designation; -425 Sample % passing 425um sieve

DEPTH All depths, levels and dimensions in metres

Engineering Services Laboratory
Reed Wood Close,
Moulton Park Ind Estate,
Northampton. NN3 1PL.
Tel: (0604) 670551.

British Geological Survey

SP 75 NW 179 7333 5500 South of Milton Block A

Surface level +88.6 m (+291 ft)
Water not struck
October 1974

Ovderburden 0.1 m
Mineral 8.1 m
Bedrock 0.6 m+

British Geological Survey

LOG

Geological classification	Lithology	Thickness m	Depth m
	Soil	0.1	0.1
Milton Sand	a 'Clayey' pebbly sand Gravel: fine, angular platy ironstone Sand: mainly fine	3.0	3.1
	b 'Clayey' sand, fine with some ironstone pebbles	5.1	8.2
Upper Lias	Silty clay, grey	0.6+	8.8

GRADING

	Mean for deposit percentages			Depth below surface (m)	percentages						
	Fines	Sand	Gravel		Fines	Sand			Gravel		
					-¼	+¼ -¼	+¼ -1	+1 -4	+4 -16	+16 -64	+64 mm
a	15	69	16	0.1-1.1	15	42	23	4	10	6	0
				1.1-2.1	14	43	19	7	13	4	0
				2.1-3.1	15	43	19	8	12	3	0
				Mean	15	42	20	7	12	4	0
b	12	85	3	3.1-4.1	7	70	20	1	1	1	0
				4.1-5.1	14	65	17	2	1	1	0
				5.1-5.9	14	66	18	1	1	0	0
				5.9-6.9	12	67	15	2	4	0	0
				6.9-8.2	14	67	14	1	3	1	0
				Mean	12	67	17	1	2	1	0
a+b	13	79	8	Mean	13	58	18	3	6	2	0



Hydrock Consultants Ltd

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Northampton, NN6 8LD

Report Reference: HYDNOR-1981474

Your Reference: N7425C151171

Report Date 25 Mar 2015

Report Delivery Method: Email - pdf

GroundSure Geoinsight

Address: 473662, 254753,

Dear Sir/ Madam,

Thank you for placing your order with GroundSure. Please find enclosed the **GroundSure GeoInsight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 01604 842 888 quoting the above report reference number.

Yours faithfully,

Hydrock

Enc.
GroundSure GeoInsight

GroundSure GeoInsight

Address:	**473662, 254753,**
Date:	**25 Mar 2015**
Reference:	**HYDNOR-1981474**
Client:	**Hydrock Consultants Ltd**

NW N NE

W E



SW S SE

Aerial Photograph Capture date:	24-Jul-2012
Grid Reference:	472974,255025
Site Size:	260.07ha

Contents Page

Overview of Findings....5
1 Geology....8
1.1 Artificial Ground Map....8
1 Geology....9
1.1 Artificial Ground....9
1.1.1Artificial/ Made Ground....9
1.1.2 Permeability of Artificial Ground....9
1.2 Superficial Deposits and Landslips Map....10
1.2 Superficial Deposits and Landslips....11
1.2.1 Superficial Deposits/ Drift Geology....11
1.2.2 Permeability of Superficial Ground....11
1.2.3 Landslip....11
1.2.4 Landslip Permeability....12
1.3 Bedrock and Faults Map....13
1.3 Bedrock, Solid Geology & Faults....14
1.3.1 Bedrock/ Solid Geology....14
1.3.2 Permeability of Bedrock Ground....14
1.3.3 Faults....15
1.4 Radon Data....16
1.4.1 Radon Affected Areas....16
1.4.2 Radon Protection....16
2 Ground Workings Map....17
2 Ground Workings....18
2.1 Historical Surface Ground Working Features derived from Historical Mapping....18
2.2 Historical Underground Working Features derived from Historical Mapping....22
2.3 Current Ground Workings....22
3 Mining, Extraction & Natural Cavities Map....24
3 Mining, Extraction & Natural Cavities....25
3.1 Historical Mining....25
3.2 Coal Mining....25
3.3 Johnson Poole and Bloomer....25
3.4 Non-Coal Mining....25
3.5 Non-Coal Mining Cavities....26
3.6 Natural Cavities....26
3.7 Brine Extraction....26
3.8 Gypsum Extraction....26
3.9 Tin Mining....26
3.10 Clay Mining....27
4 Natural Ground Subsidence....28
4.1 Shrink-Swell Clay Map....28
4.2 Landslides Map....29
4.3 Ground Dissolution Soluble Rocks Map....30
4.4 Compressible Deposits Map....31
4.5 Collapsible Deposits Map....32
4.6 Running Sand Map....33
4 Natural Ground Subsidence....34
4.1 Shrink-Swell Clays....34
4.2 Landslides....35
4.3 Ground Dissolution of Soluble Rocks....37
4.4 Compressible Deposits....37
4.5 Collapsible Deposits....38
4.6 Running Sands....38
5 Borehole Records Map....40
5 Borehole Records....41

6 Estimated Background Soil Chemistry....46
7 Railways and Tunnels Map....50
7 Railways and Tunnels....51
7.1 Tunnels....51
7.2 Historical Railway and Tunnel Features....51
7.3 Historical Railways....52
7.4 Active Railways....52
7.5 Railway Projects....53

Overview of Findings

The GroundSure GeoInsight provides high quality geo-environmental information that allows geo-environmental professionals and their clients to make informed decisions and be forewarned of potential ground instability problems that may affect the ground investigation, foundation design and possibly remediation options that could lead to possible additional costs.

The report is based on the BGS 1:50,000 Digital Geological Map of Great Britain, BGS Geosure data; BRITPITS database; Shallow Mining data and Borehole Records, Coal Authority data including brine extraction areas, PBA non-coal mining and natural cavities database, Johnson Poole and Bloomer mining data and GroundSure's unique database including historical surface ground and underground workings.

For further details on each dataset, please refer to each individual section in the report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Section 1: Geology		
1.1 Artificial Ground	1.1.1 Is there any Artificial Ground/ Made Ground present beneath the study site?	No
	1.1.2 Are there any records relating to permeability of artificial ground within the study site* boundary?	No
1.2 Superficial Geology and Landslips	1.2.1 Is there any Superficial Ground/Drift Geology present beneath the study site?	Yes
	1.2.2 Are there any records relating to permeability of superficial geology within the study site boundary?	Yes
	1.2.3 Are there any records of landslip within 500m of the study site boundary?	No
	1.2.4 Are there any records relating to permeability of landslips within the study site boundary?	No
1.3 Bedrock, Solid Geology & Faults	1.3.1 For records of Bedrock and Solid Geology beneath the study site* see the detailed findings section.	
	1.3.2 Are there any records relating to permeability of bedrock within the study site boundary?	Yes
	1.3.3 Are there any records of faults within 500m of the study site boundary?	No
1.4 Radon data	1.4.1 Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?	The property is in a Radon Affected Area, as between 3 and 5% of properties are above the Action Level
	1.4.2 Is the property in an area where Radon Protection Measures are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment?	Basic radon protective measures are necessary

Section 2: Ground Workings	On-site	0-50m	51-250	251-500	501-1000
2.1 Historical Surface Ground Working Features from Small Scale Mapping	50	33	21	Not Searched	Not Searched
2.2 Historical Underground Workings from Small Scale Mapping	0	0	0	0	0
2.3 Current Ground Workings	2	0	3	4	14

Section 3: Mining, Extraction & Natural Cavities	On-site	0-50m	51-250	251-500	501-1000
3.1 Historical Mining	0	0	0	0	0

Section 3: Mining, Extraction & Natural Cavities	On-site	0-50m	51-250	251-500	501-1000
3.2 Coal Mining	0	0	0	0	0
3.3 Johnson Poole and Bloomer Mining Area	0	0	0	0	0
3.4 Non-Coal Mining	0	0	0	0	0
3.5 Non-Coal Mining Cavities	0	0	0	0	0
3.6 Natural Cavities	0	0	0	0	0
3.7 Brine Extraction	0	0	0	0	0
3.8 Gypsum Extraction	0	0	0	0	0
3.9 Tin Mining	0	0	0	0	0
3.10 Clay Mining	0	0	0	0	0

Section 4: Natural Ground Subsidence	On-site
4.1 Shrink Swell Clay	Low
4.2 Landslides	Moderate
4.3 Ground Dissolution of Soluble Rocks	Very Low
4.4 Compressible Deposits	Moderate
4.5 Collapsible Deposits	Very Low
4.6 Running Sand	Low

Section 5: Borehole Records	On-site	0-50m	51-250
5 BGS Recorded Boreholes	7	27	51

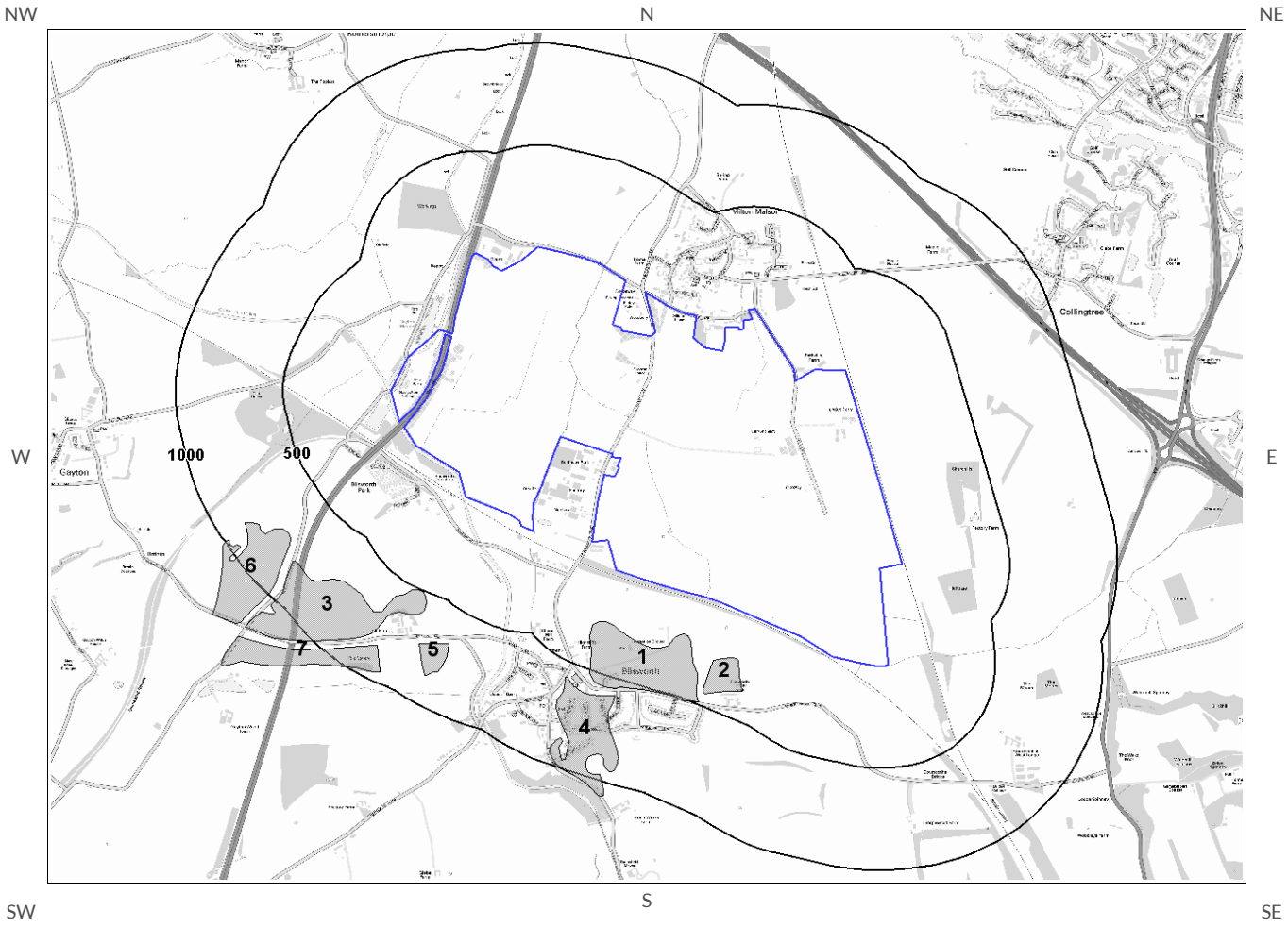
Section 6: Estimated Background Soil Chemistry	On-site	0-50m	51-250
6 Records of Background Soil Chemistry	97	9	44

Section 7: Railways and Tunnels	On-site	0-50m	51-250	251-500
7.1 Tunnels	0	0	0	Not Searched
7.2 Historical Railway and Tunnel Features	3	14	2	Not Searched
7.3 Historical Railways	2	0	1	Not Searched
7.4 Active Railways	0	10	7	Not Searched

Section 7:Railways and Tunnels	On-site	0-50m	51-250	251-500
7.5 Railway Projects	0	0	0	0

1 Geology

1.1 Artificial Ground Map



Artificial Ground Legend

Mapping sourced from Ordnance Survey

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Site Outline

500
1000
Search Buffers (m)

Made Ground (undivided)

Disturbed Ground (undivided)

Worked Ground (undivided)

Landscaped Ground (undivided)

Infilled Ground

Reclaimed Ground

1 Geology

1.1 Artificial Ground

1.1.1Artificial/ Made Ground

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No:202

Are there any records of Artificial/Made Ground within 500m of the study site boundary? Yes

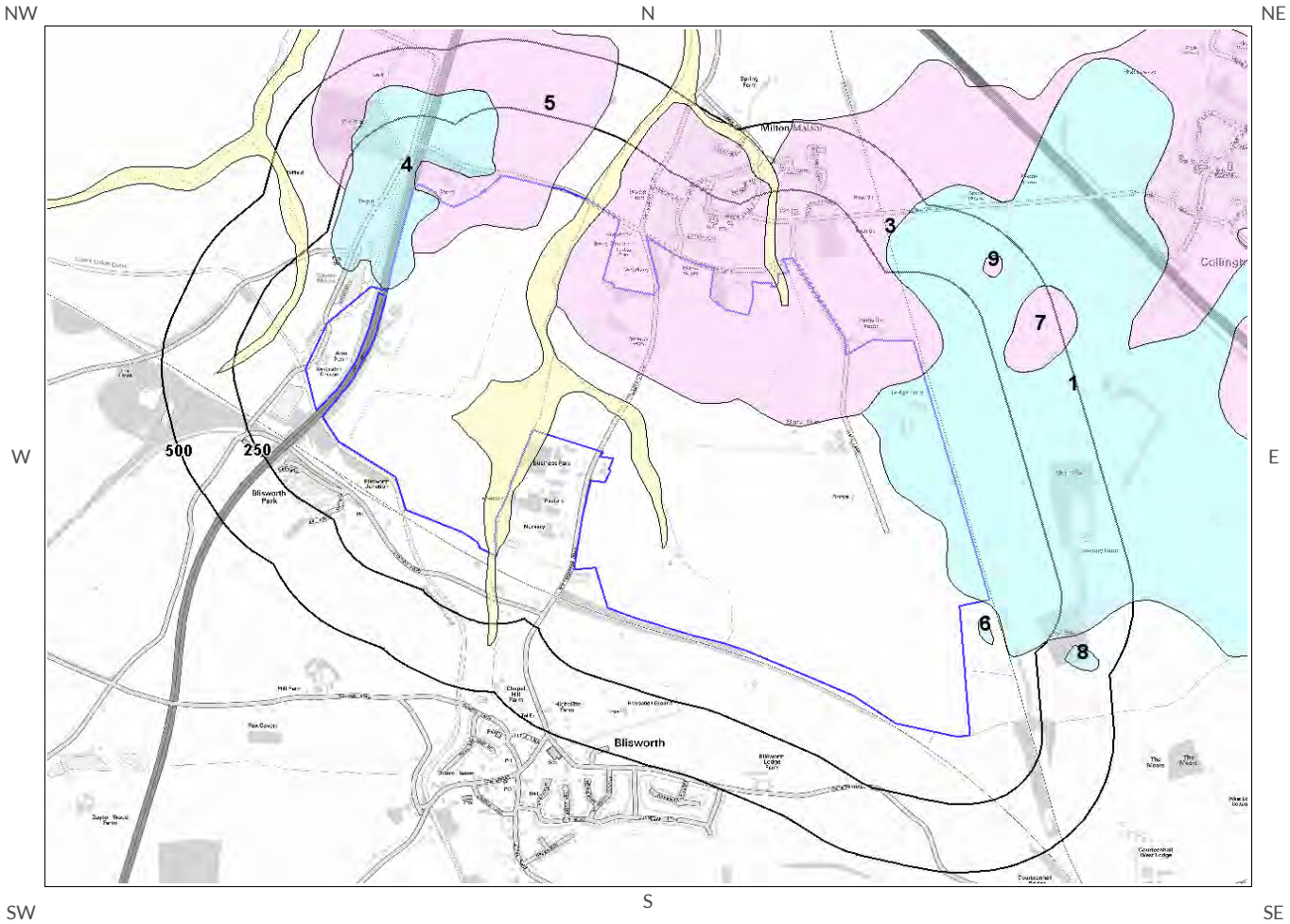
ID	Distance (m)	Direction	LEX Code	Description	Rock Description
1	201.0	S	WGR-OPEN	WORKED GROUND (UNDIVIDED)	VOID
2	222.0	SW	WGR-OPEN	WORKED GROUND (UNDIVIDED)	VOID

1.1.2 Permeability of Artificial Ground

Are there any records relating to permeability of artificial ground within the study site boundary? No

Database searched and no data found.

1.2 Superficial Deposits and Landslips Map



Superficial Deposits and Landslips Legend

Mapping sourced from Ordnance Survey

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Site Outline

500
1000
Search Buffers (m)

1.2 Superficial Deposits and Landslips

1.2.1 Superficial Deposits/ Drift Geology

Are there any records of Superficial Deposits/ Drift Geology within 500m of the study site boundary? Yes

ID	Distance (m)	Direction	LEX Code	Description	Rock Description
1	0.0	On Site	ODT	OADBY MEMBER	DIAMICTON
2	0.0	On Site	ALV	ALLUVIUM	CLAY, SILT, SAND AND GRAVEL [UNLITHIFIED DEPOSITS CODING SCHEME]
3	0.0	On Site	GFDMP	GLACIOFLUVIAL DEPOSITS, MID PLEISTOCENE	SAND AND GRAVEL [UNLITHIFIED DEPOSITS CODING SCHEME]
4	0.0	On Site	ODT	OADBY MEMBER	DIAMICTON
5	0.0	On Site	GFDMP	GLACIOFLUVIAL DEPOSITS, MID PLEISTOCENE	SAND AND GRAVEL [UNLITHIFIED DEPOSITS CODING SCHEME]
6	56.0	S	ODT	OADBY MEMBER	DIAMICTON
7	284.0	E	GFDMP	GLACIOFLUVIAL DEPOSITS, MID PLEISTOCENE	SAND AND GRAVEL [UNLITHIFIED DEPOSITS CODING SCHEME]
8	334.0	SE	ODT	OADBY MEMBER	DIAMICTON
9	350.0	NE	GFDMP	GLACIOFLUVIAL DEPOSITS, MID PLEISTOCENE	SAND AND GRAVEL [UNLITHIFIED DEPOSITS CODING SCHEME]

1.2.2 Permeability of Superficial Ground

Are there any records relating to permeability of superficial ground within the study site boundary? Yes

Distance (m)	Direction	Flow Type	Maximum Permeability	Minimum Permeability
0.0	On Site	Mixed	High	Low
0.0	On Site	Intergranular	Very High	High
0.0	On Site	Intergranular	Very High	High
0.0	On Site	Mixed	High	Low
0.0	On Site	Intergranular	Very High	High
0.0	On Site	Intergranular	High	Very Low
0.0	On Site	Intergranular	High	Very Low
49.0	E	Mixed	High	Low

1.2.3 Landslip

Are there any records of Landslip within 500m of the study site boundary? No

Database searched and no data found.

This Geology shows the main components as discrete layers, these are: Artificial / Made Ground, Superficial / Drift Geology and Landslips. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

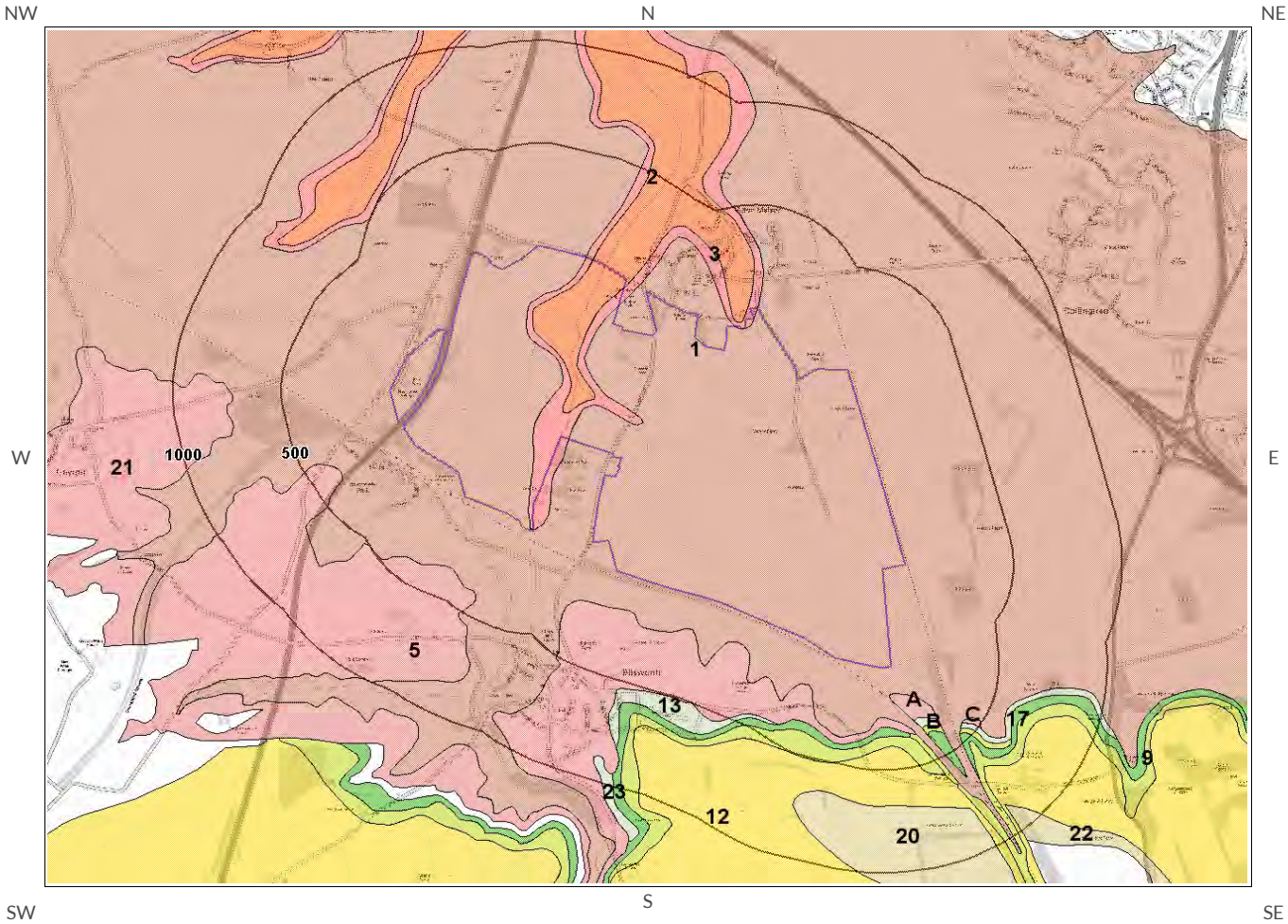
1.2.4 Landslip Permeability

Are there any records relating to permeability of landslips within the study site* boundary? No

Database searched and no data found.

* This includes an automatically generated 50m buffer zone around the site

1.3 Bedrock and Faults Map



Bedrock and Faults Legend

Mapping sourced from Ordnance Survey

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Site Outline

500
1000
Search Buffers (m)

1.3 Bedrock, Solid Geology & Faults

The following geological information represented on the mapping is derived from 1:50,000 scale BGS Geological mapping, Sheet No:202

1.3.1 Bedrock/ Solid Geology

Records of Bedrock/ Solid Geology within 500m of the study site boundary:

ID	Distance (m)	Direction	LEX Code	Description	Rock Age
1	0.0	On Site	WHM-MDST	Whitby Mudstone Formation - Mudstone	Toarcian
2	0.0	On Site	DYS-SIMD	Dyrham Formation - Siltstone And Mudstone, Interbedded	Pliensbachian
3	0.0	On Site	MRB-FLMST	Marlstone Rock Formation - Limestone, Ferruginous	Toarcian / Pliensbachian
4A	131.0	S	NS-FEOOL	Northampton Sand Formation - Ironstone, Ooidal	Aalenian
5	145.0	SW	NS-FEOOL	Northampton Sand Formation - Ironstone, Ooidal	Aalenian
6A	277.0	SE	STAM-SDSL	Stamford Member - Sandstone And Siltstone, Interbedded	Bathonian / Bajocian
7	290.0	S	WBRO-LMST	Wellingborough Limestone Member - Limestone	Bathonian
8B	328.0	SE	RLD-MDST	Rutland Formation - Mudstone	Bathonian / Bajocian
9	335.0	S	RLD-MDST	Rutland Formation - Mudstone	Bathonian / Bajocian
10	336.0	S	RLD-MDST	Rutland Formation - Mudstone	Bathonian / Bajocian
11B	366.0	SE	WBRO-LMST	Wellingborough Limestone Member - Limestone	Bathonian
12	384.0	S	BWL-LMST	Blisworth Limestone Formation - Limestone	Bathonian
13	416.0	SW	STAM-SDSL	Stamford Member - Sandstone And Siltstone, Interbedded	Bathonian / Bajocian
14C	424.0	SE	NS-FEOOL	Northampton Sand Formation - Ironstone, Ooidal	Aalenian
15	425.0	SE	STAM-SDSL	Stamford Member - Sandstone And Siltstone, Interbedded	Bathonian / Bajocian
16C	438.0	SE	RLD-MDST	Rutland Formation - Mudstone	Bathonian / Bajocian
17	459.0	SE	WBRO-LMST	Wellingborough Limestone Member - Limestone	Bathonian

1.3.2 Permeability of Bedrock Ground

Are there any records relating to permeability of bedrock ground within the study site* boundary? Yes

Distance (m)	Direction	Flow Type	Maximum Permeability	Minimum Permeability
0.0	On Site	Fracture	Very High	High
0.0	On Site	Mixed	Moderate	Low
0.0	On Site	Fracture	Low	Low
0.0	On Site	Fracture	Very High	High
0.0	On Site	Mixed	Moderate	Low
0.0	On Site	Fracture	Very High	High
0.0	On Site	Fracture	Low	Low

* This includes an automatically generated 50m buffer zone around the site

Distance (m)	Direction	Flow Type	Maximum Permeability	Minimum Permeability
0.0	On Site	Fracture	Low	Low

1.3.3 Faults

Are there any records of Faults within 500m of the study site boundary? No

Database searched and no data found.

The geology map for the site and surrounding area are extracted from the BGS Digital Geological Map of Great Britain at 1:50,000 scale.

This Geology shows the main components as discrete layers, these are: Bedrock/ Solid Geology and linear features such as Faults. These are all displayed with the BGS Lexicon code for the rock unit and BGS sheet number. Not all of the main geological components have nationwide coverage.

1.4 Radon Data

1.4.1 Radon Affected Areas

Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level? The property is in a Radon Affected Area, as between 3 and 5% of properties are above the Action Level

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1.4.2 Radon Protection

Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment? Basic radon protective measures are necessary

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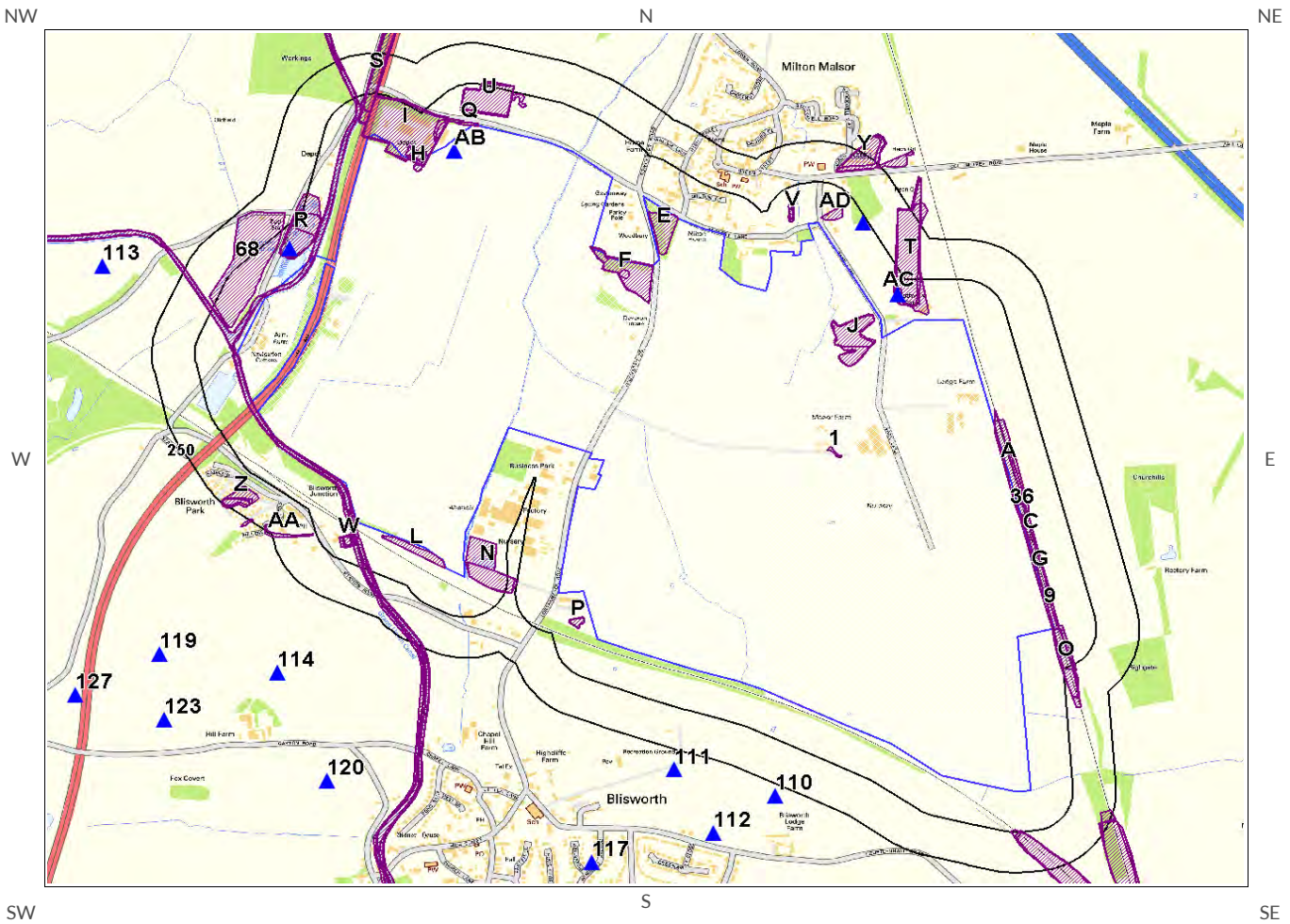
2 Ground Workings Map



Ground Workings Legend

Mapping sourced from Ordnance Survey

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Site Outline

125
250
Search Buffers (m)

Historic Surface Ground Workings

Historic Underground Workings

Current Ground Workings



2 Ground Workings

2.1 Historical Surface Ground Working Features derived from Historical Mapping

This dataset is based on GroundSure's unique Historical Land Use Database derived from 1:10,560 and 1:10,000 scale historical mapping.

Are there any Historical Surface Ground Working Features within 250m of the study site boundary? Yes

The following Historical Surface Ground Working Features are provided by GroundSure:

ID	Distance (m)	Direction	NGR	Use	Date
1	0.0	On Site	473710 254675	Ponds	1883
2B	0.0	On Site	472286 256107	Canal	1883
3A	0.0	On Site	474219 254660	Cuttings	1883
4A	0.0	On Site	474219 254660	Cuttings	1899
5B	0.0	On Site	472286 256107	Canal	1950
6C	0.0	On Site	474296 254389	Cuttings	1992
7C	0.0	On Site	474296 254389	Cuttings	1988
8G	0.0	On Site	474308 254307	Cuttings	1950
9	0.0	On Site	474332 254202	Cuttings	1883
10D	0.0	On Site	473076 252500	Canal	1992
11D	0.0	On Site	473076 252500	Canal	1988
12	0.0	On Site	472511 253952	Canal	1950
13E	0.0	On Site	473211 255348	Unspecified Pits	1992
14E	0.0	On Site	473211 255348	Unspecified Pits	1981
15E	0.0	On Site	473211 255348	Unspecified Pits	1989
16E	0.0	On Site	473211 255348	Unspecified Pits	1968
17F	0.0	On Site	473098 255224	Unspecified Pit	1968
18F	0.0	On Site	473098 255224	Unspecified Pit	1989
19F	0.0	On Site	473098 255224	Unspecified Pit	1992
20F	0.0	On Site	473098 255224	Unspecified Pit	1981
21F	0.0	On Site	473090 255219	Unspecified Pit	1950

ID	Distance (m)	Direction	NGR	Use	Date
22F	0.0	On Site	473089 255220	Unspecified Pit	1950
23F	0.0	On Site	473024 255280	Unspecified Pit	1968
24F	0.0	On Site	473024 255280	Unspecified Pit	1992
25F	0.0	On Site	473024 255280	Unspecified Pit	1989
26F	0.0	On Site	473024 255280	Unspecified Pit	1981
27Q	0.0	On Site	472642 255684	Unspecified Pit	1883
28A	0.0	On Site	474233 254583	Cuttings	1950
29G	0.0	On Site	474307 254312	Cuttings	1950
30H	0.0	On Site	472496 255552	Unspecified Heap	1989
31H	0.0	On Site	472496 255552	Unspecified Heap	1981
32H	0.0	On Site	472496 255552	Unspecified Heap	1968
33H	0.0	On Site	472489 255592	Pond	1950
34A	0.0	On Site	474219 254660	Cuttings	1950
35I	0.0	On Site	472481 255661	Disused Gravel Pit	1950
36	0.0	On Site	474255 254493	Cuttings	1950
37J	0.0	On Site	473764 255019	Unspecified Pit	1950
38D	0.0	On Site	473076 252500	Canal	1980
39I	0.0	On Site	472458 255665	Disused Gravel Pit	1950
40H	0.0	On Site	472490 255596	Pond	1950
41C	0.0	On Site	474296 254389	Cuttings	1980
42J	0.0	On Site	473765 255047	Unspecified Pit	1950
43J	0.0	On Site	473769 254970	Unspecified Pit	1950
44K	0.0	On Site	472640 257349	Canal	1981
45K	0.0	On Site	472640 257349	Canal	1968
46K	0.0	On Site	472640 257349	Canal	1950
47L	0.0	On Site	472483 254368	Unspecified Heap	1883
48L	0.0	On Site	472483 254368	Unspecified Heap	1950
49K	0.0	On Site	472640 257349	Canal	1992
50K	0.0	On Site	472640 257349	Canal	1989
51O	1.0	S	474386 254028	Cuttings	1950

ID	Distance (m)	Direction	NGR	Use	Date
52M	3.0	W	472498 253702	Canal	1883
53M	3.0	W	472498 253702	Canal	1950
54N	4.0	E	472710 254327	Sewage Works	1992
55N	4.0	E	472710 254327	Sewage Works	1988
56O	5.0	S	474386 254023	Cuttings	1950
57N	10.0	E	472710 254287	Sewage Works	1980
58AD	16.0	NE	473702 255412	Unspecified Pit	1883
59T	17.0	N	473935 255269	Unspecified Ground Workings	1968
60P	22.0	W	472959 254150	Pond	1950
61P	22.0	W	472959 254149	Pond	1950
62Q	22.0	NW	472548 255665	Unspecified Ground Workings	1883
63R	34.0	NW	472155 255349	Pond	1950
64R	34.0	NW	472150 255369	Pond	1981
65R	34.0	NW	472150 255369	Pond	1968
66R	35.0	NW	472154 255349	Pond	1950
67R	35.0	NW	472143 255323	Gravel Pit	1883
68	36.0	NW	471998 255236	Brick Field	1883
69U	38.0	N	472698 255758	Sand Pit	1950
70S	38.0	NW	472434 256032	Cuttings	1883
71W	39.0	S	472294 254405	Ponds	1980
72S	39.0	NW	472432 256034	Cuttings	1968
73S	39.0	NW	472432 256034	Cuttings	1989
74S	39.0	NW	472432 256034	Cuttings	1981
75T	41.0	N	473925 255318	Old Sand Pit	1950
76U	42.0	N	472698 255763	Sand Pit	1950
77V	42.0	W	473584 255412	Pond	1883
78V	43.0	W	473585 255404	Pond	1968
79W	44.0	S	472293 254399	Ponds	1950
80W	44.0	S	472293 254399	Ponds	1883
81W	46.0	SW	472284 254401	Ponds	1950

ID	Distance (m)	Direction	NGR	Use	Date
82T	47.0	N	473925 255335	Old Sand Pit	1950
83V	48.0	W	473583 255409	Pond	1950
84S	67.0	N	472422 255996	Cuttings	1950
85S	69.0	N	472423 255998	Cuttings	1950
86AC	72.0	NE	473897 255162	Unspecified Pit	1883
87	85.0	N	472795 255757	Unspecified Ground Workings	1968
88	116.0	S	474578 253323	Cuttings	1883
89X	120.0	S	474730 252988	Cuttings	1992
90X	120.0	S	474730 252988	Cuttings	1988
91X	120.0	S	474730 252988	Cuttings	1980
92X	123.0	S	474730 252988	Cuttings	1950
93	127.0	S	474456 253303	Cuttings	1950
94AA	134.0	W	472054 254432	Unspecified Pit	1883
95Y	164.0	N	473785 255594	Gravel Pit	1950
96Y	165.0	N	473838 255596	Refuse Heap	1950
97Z	171.0	SW	471976 254535	Unspecified Pit	1883
98Z	191.0	SW	471968 254519	Unspecified Pit	1950
99Z	202.0	SW	471967 254520	Unspecified Pit	1950
100AA	241.0	SW	471998 254456	Unspecified Pit	1883
101Y	243.0	NE	473917 255576	Unspecified Pit	1968
102Y	243.0	NE	473917 255576	Unspecified Pit	1989
103Y	243.0	NE	473917 255576	Unspecified Pit	1981
104Y	243.0	NE	473917 255576	Unspecified Pit	1992

2.2 Historical Underground Working Features derived from Historical Mapping

This data is derived from the GroundSure unique Historical Land Use Database. It contains data derived from 1:10,000 and 1:10,560 historical Ordnance Survey Mapping and includes some natural topographical features (Shake Holes for example) as well as manmade features that may have implications for ground stability. Underground and mining features have been identified from surface features such as shafts. The distance that these extend underground is not shown.

Are there any Historical Underground Working Features within 1000m of the study site boundary? No

Database searched and no data found.

2.3 Current Ground Workings

This dataset is derived from the BGS BRITPITS database covering active; inactive mines; quarries; oil wells; gas wells and mineral wharves; and rail deposits throughout the British Isles.

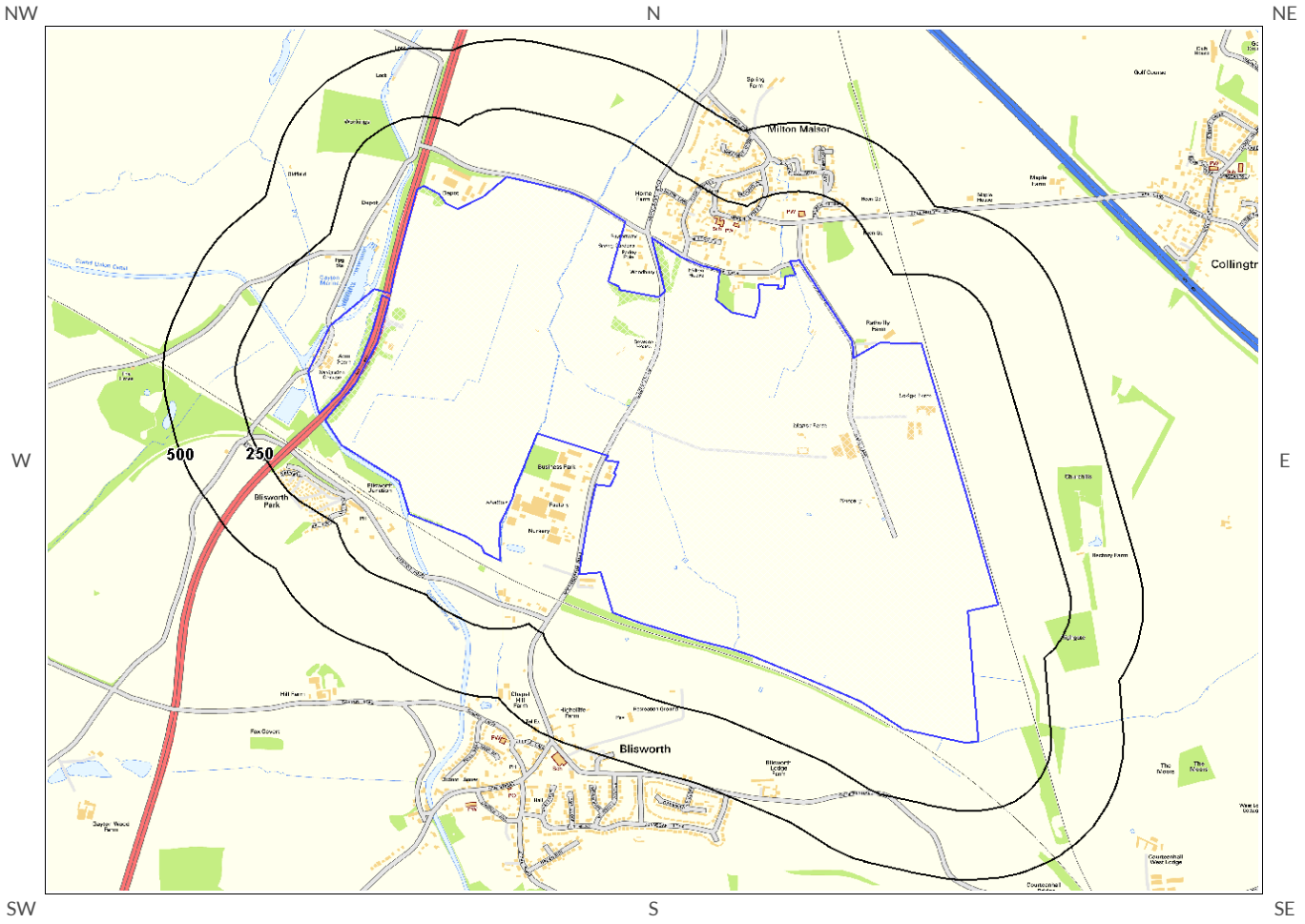
Are there any BGS Current Ground Workings within 1000m of the study site boundary? Yes

The following Current Ground Workings information is provided by British Geological Survey:

ID	Distance (m)	Direction	NGR	Commodity Produced	Pit Name	Type of working	Status
105AB	0.0	On Site	472600 255600	Clay & Shale	Milton Malsor	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
106AB	0.0	On Site	472600 255600	Sand & Gravel	Milton Malsor	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
107R	67.0	NW	472120 255300	Clay & Shale	Blisworth Brickworks	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
108AC	81.0	NE	473894 255159	Sand & Gravel	Milton Sand Pit	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
109AD	111.0	NE	473793 255380	Sand & Gravel	Milton Sand Pit	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
110	286.0	SW	473535 253615	Ironstone	Blisworth Lodge Pit	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
111	314.0	S	473240 253695	Ironstone	Blisworth No 2 Ironstone Pit	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
112	465.0	SW	473355 253500	Ironstone	Blisworth	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
113	470.0	NW	471575 255245	Clay & Shale	Gayton Brickworks	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
114	519.0	SW	472085 253995	Ironstone	Blisworth Quarries	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
Not shown	625.0	SW	473650 253175	Limestone	Blisworth	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
Not shown	642.0	S	473916 253044	Limestone	Blisworth Stone Works	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased

ID	Distance (m)	Direction	NGR	Commodity Produced	Pit Name	Type of working	Status
117	658.0	S	473000 253410	Ironstone	Blisworth No 1 Ironstone Pit	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
Not shown	659.0	SW	473735 253085	Limestone	Blisworth	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
119	708.0	SW	471740 254050	Ironstone	Blisworth Quarries	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
120	744.0	SW	472230 253660	Ironstone	Fox Covert Pits	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
Not shown	788.0	S	472890 253310	Ironstone	Blisworth Ironstone	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
Not shown	816.0	SW	473345 253120	Limestone	Blisworth	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
123	829.0	SW	471755 253850	Ironstone	Blisworth Quarries	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
Not shown	880.0	S	472780 253250	Ironstone	Blisworth Ironstone	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
Not shown	931.0	SW	473420 252960	Limestone	Blisworth	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
Not shown	952.0	S	472880 253140	Ironstone	Blisworth Ironstone	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased
127	981.0	SW	471495 253925	Ironstone	Blisworth Quarries	A surface mineral working. It may be termed Quarry, Sand Pit, Clay Pit or Opencast Coal Site	Ceased

3 Mining, Extraction & Natural Cavities Map



Mining, Extraction and Natural Cavities Legend

Mapping sourced from Ordnance Survey

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Site Outline

250
500
Search Buffers (m)

Historical Mining

Non-Coal Mining Cavities

Natural Cavities

Non-Coal Mining

Highly likely

Likely

Unlikely

Highly unlikely

Rare

3 Mining, Extraction & Natural Cavities

3.1 Historical Mining

This dataset is derived from GroundSure unique Historical Land-use Database that are indicative of mining or extraction activities.

Are there any Historical Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

3.2 Coal Mining

This dataset provides information as to whether the study site lies within a known coal mining affected area as defined by the coal authority.

Are there any Coal Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

3.3 Johnson Poole and Bloomer

This dataset provides information as to whether the study site lies within an area where JPB hold information relating to mining.

Are there any JPB Mining areas within 1000m of the study site boundary? No

The following information provided by JPB is not represented on mapping: Database searched and no data found.

3.4 Non-Coal Mining

This dataset provides information as to whether the study site lies within an area which may have been subject to non-coal historic mining.

Are there any Non-Coal Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

3.5 Non-Coal Mining Cavities

This dataset provides information from the Peter Brett Associates (PBA) mining cavities database (compiled for the national study entitled "Review of mining instability in Great Britain, 1990" PBA has also continued adding to this database) on mineral extraction by mining.

Are there any Non-Coal Mining cavities within 1000m of the study site boundary? No

Database searched and no data found.

3.6 Natural Cavities

This dataset provides information based on Peter Brett Associates natural cavities database.

Are there any Natural Cavities within 1000m of the study site boundary? No

Database searched and no data found.

3.7 Brine Extraction

This data provides information from the Coal Authority issued on behalf of the Cheshire Brine Subsidence Compensation Board.

Are there any Brine Extraction areas within 1000m of the study site boundary? No

Database searched and no data found.

3.8 Gypsum Extraction

This dataset provides information on Gypsum extraction from British Gypsum records.

Are there any Gypsum Extraction areas within 1000m of the study site boundary? No

Database searched and no data found.

3.9 Tin Mining

This dataset provides information on tin mining areas and is derived from tin mining records. This search is based upon postcode information to a sector level.

Are there any Tin Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

3.10 Clay Mining

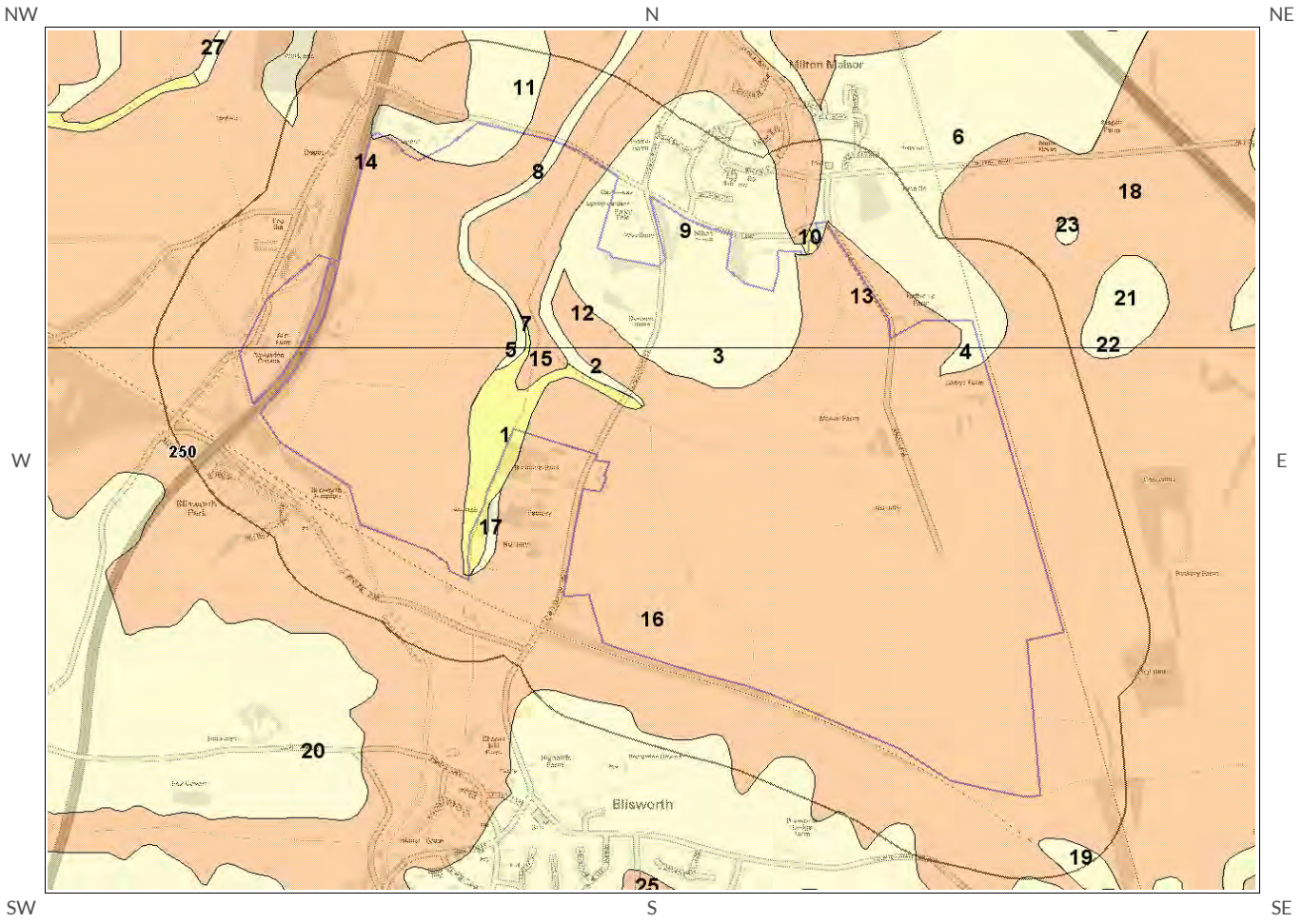
This dataset provides information on Kaolin and Ball Clay mining from relevant mining records.

Are there any Clay Mining areas within 1000m of the study site boundary? No

Database searched and no data found.

4 Natural Ground Subsidence

4.1 Shrink-Swell Clay Map



Shrink Swell Clay Legend

Mapping sourced from Ordnance Survey®

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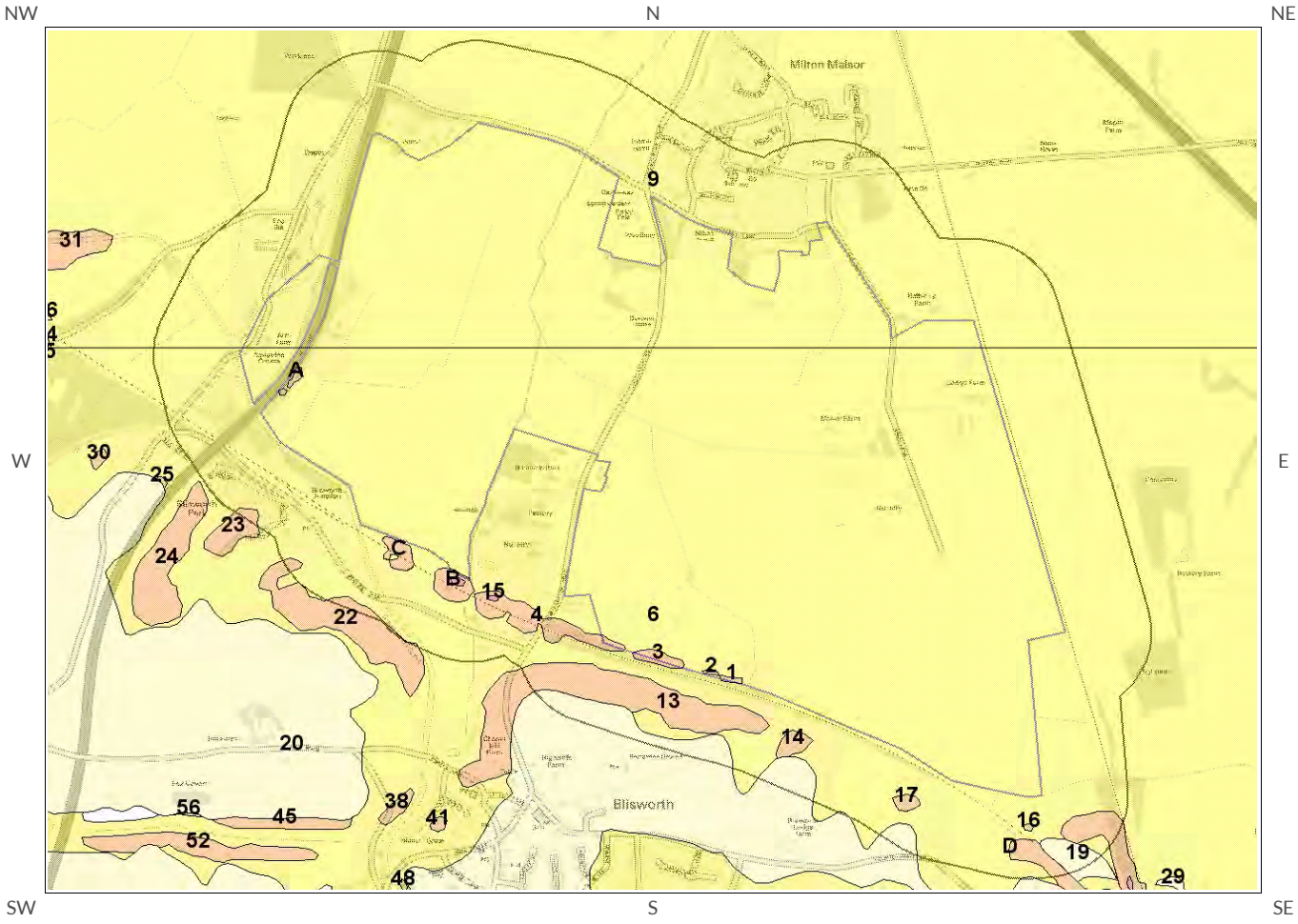
Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

4.2 Landslides Map



Landslides Legend

Mapping sourced from Ordnance Survey

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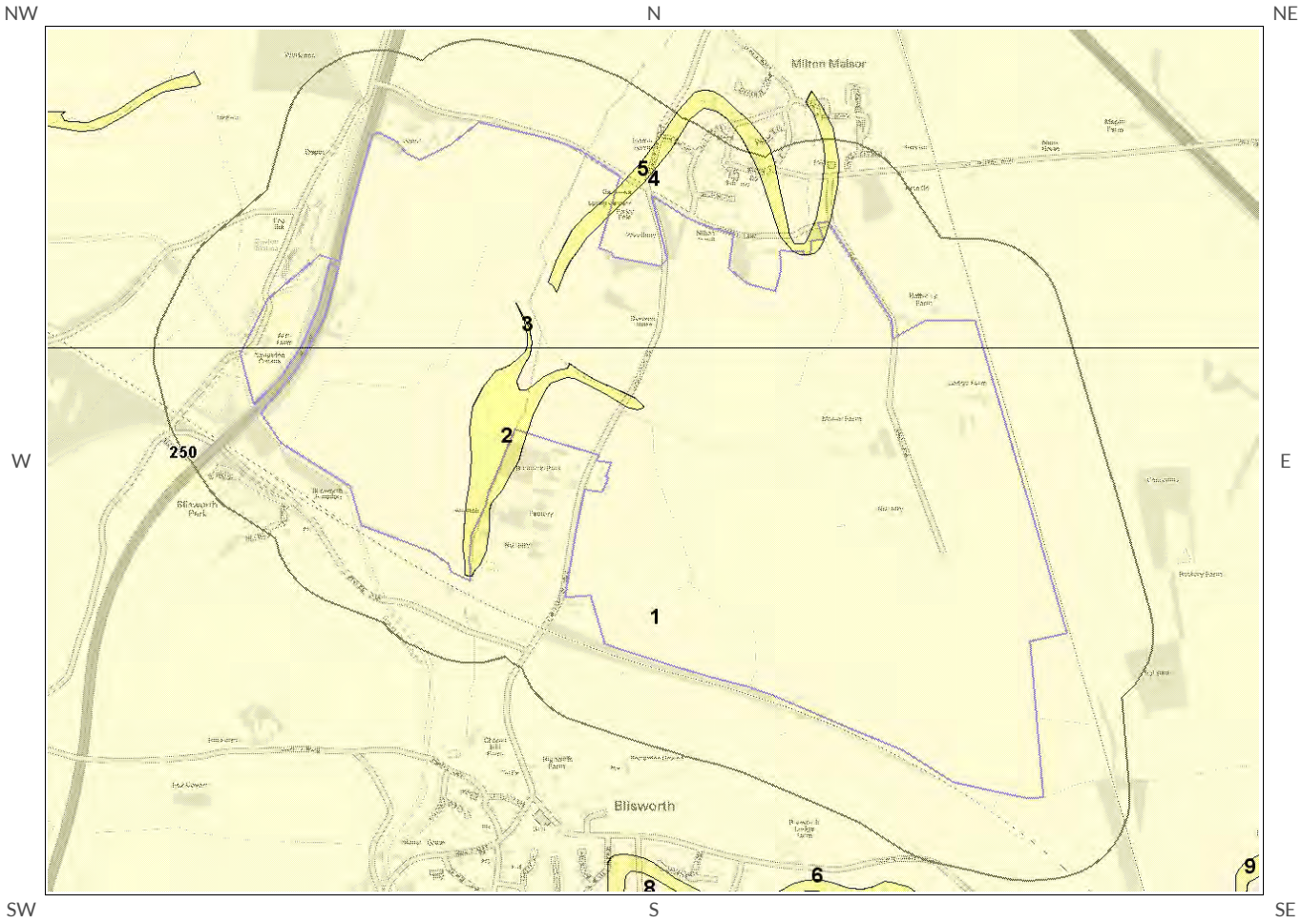
Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

4.3 Ground Dissolution Soluble Rocks Map



Ground Dissolution Soluble Rocks Legend

Mapping sourced from Ordnance Survey

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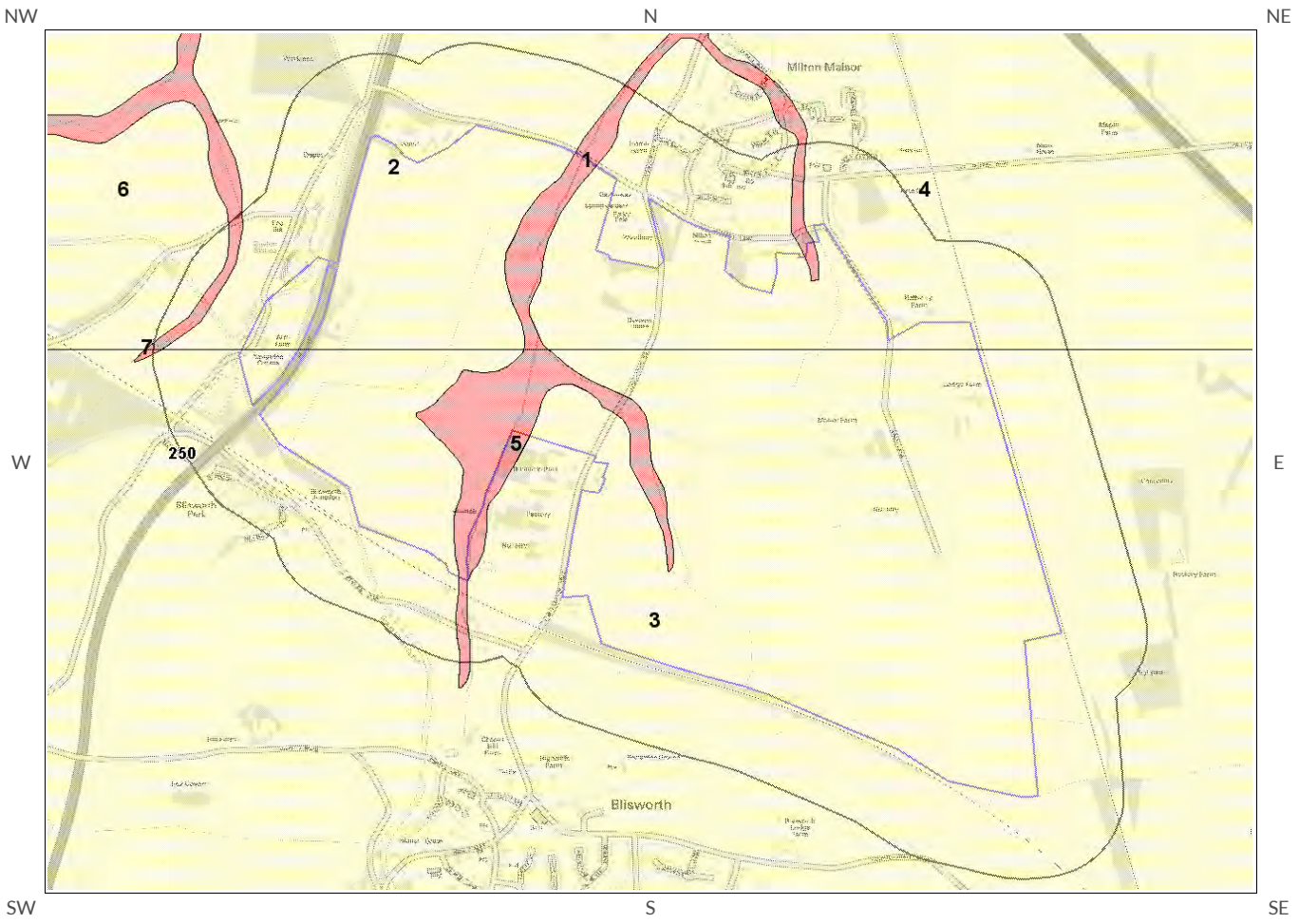
Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

4.4 Compressible Deposits Map



Compressible Deposits Legend

Mapping sourced from Ordnance Survey

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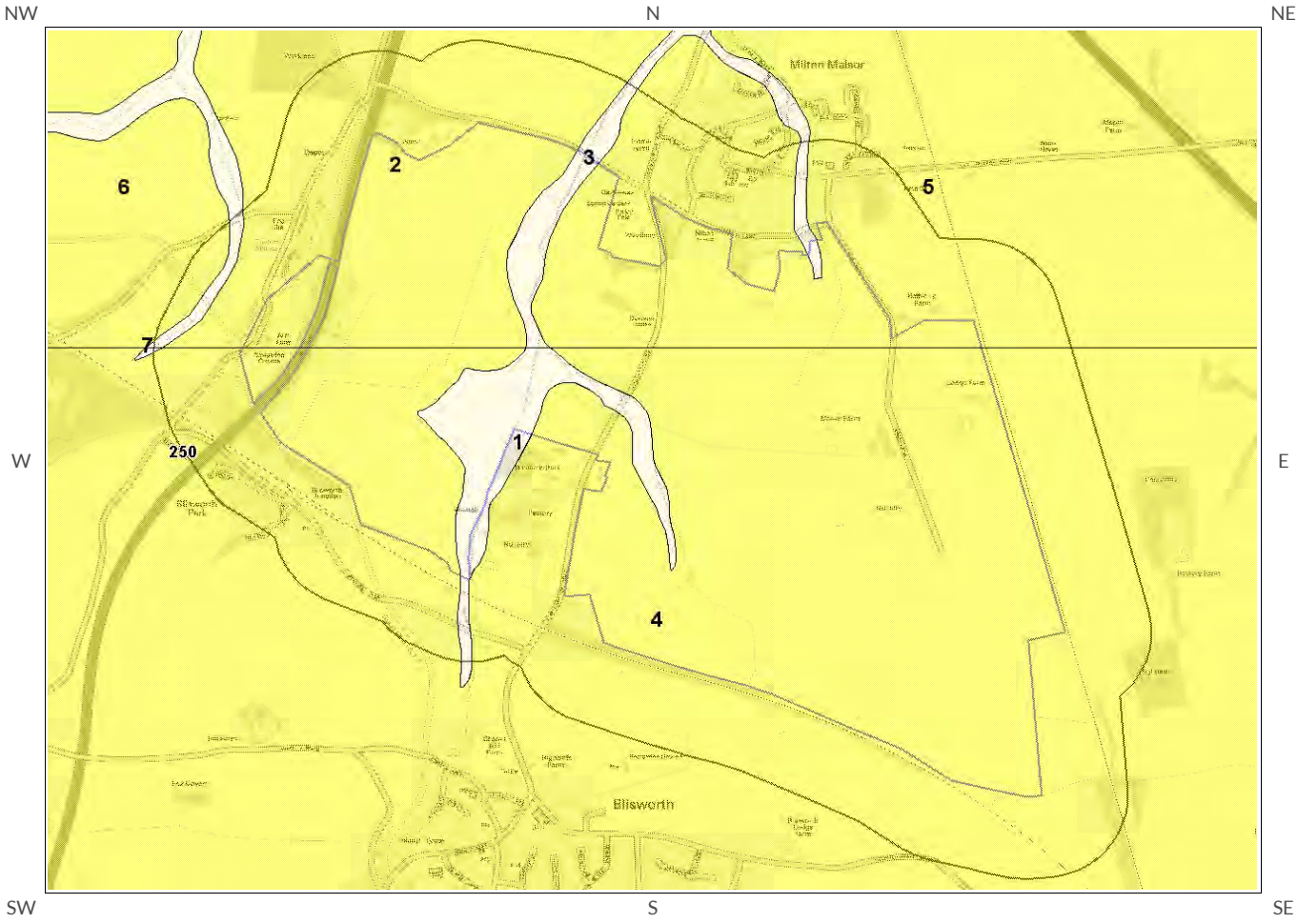
Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

4.5 Collapsible Deposits Map



Collapsible Deposits Legend

Mapping sourced from Ordnance Survey

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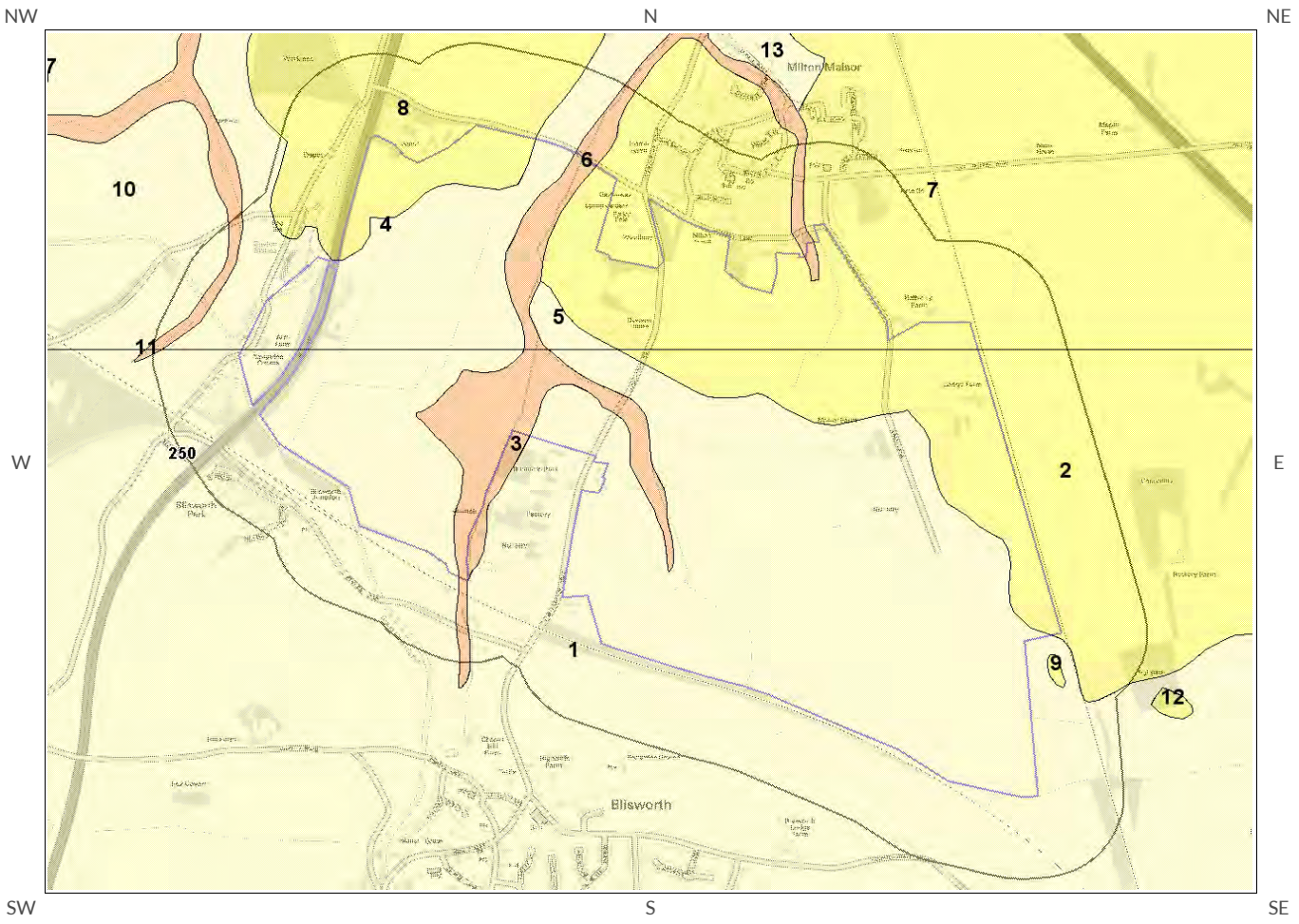
Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High

4.6 Running Sand Map



Running Sand Legend

Mapping sourced from Ordnance Survey

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Site Outline

125
250
Search Buffers (m)

No Data / Null
Negligible
Very Low

Low
Moderate
High



4 Natural Ground Subsidence

The National Ground Subsidence rating is obtained through the 6 natural ground stability hazard datasets, which are supplied by the British Geological Survey (BGS).

The following GeoSure data represented on the mapping is derived from the BGS Digital Geological map of Great Britain at 1:50,000 scale.

What is the maximum hazard rating of natural subsidence within the study site[*] boundary? Moderate

4.1 Shrink-Swell Clays

The following Shrink Swell information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Very Low	Ground conditions predominantly low plasticity. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with shrink-swell clays.
2	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.
3	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.
4	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.
5	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.
6	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.
7	0.0	On Site	Very Low	Ground conditions predominantly low plasticity. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with shrink-swell clays.
8	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.
9	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.
10	0.0	On Site	Very Low	Ground conditions predominantly low plasticity. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with shrink-swell clays.

* This includes an automatically generated 50m buffer zone around the site

ID	Distance (m)	Direction	Hazard Rating	Details
11	0.0	On Site	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.
12	0.0	On Site	Low	Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.
13	0.0	On Site	Low	Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.
14	0.0	On Site	Low	Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.
15	0.0	On Site	Low	Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.
16	0.0	On Site	Low	Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.
17	4.0	E	Negligible	Ground conditions predominantly non-plastic. No special actions required to avoid problems due to shrink-swell clays. No special ground investigation required, and increased construction costs or increased financial risks are unlikely likely due to potential problems with shrink-swell clays.
18	49.0	E	Low	Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.

4.2 Landslides

The following Landslides information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Low	Possibility of slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems. Existing property - no significant increase in insurance risk due to natural slope instability problems.

ID	Distance (m)	Direction	Hazard Rating	Details
2	0.0	On Site	Low	Possibility of slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems. Existing property - no significant increase in insurance risk due to natural slope instability problems.
3	0.0	On Site	Low	Possibility of slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems. Existing property - no significant increase in insurance risk due to natural slope instability problems.
4	0.0	On Site	Low	Possibility of slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems. Existing property - no significant increase in insurance risk due to natural slope instability problems.
5B	0.0	On Site	Low	Possibility of slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems. Existing property - no significant increase in insurance risk due to natural slope instability problems.
6	0.0	On Site	Very Low	Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.
7A	0.0	On Site	Low	Possibility of slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems. Existing property - no significant increase in insurance risk due to natural slope instability problems.
8A	0.0	On Site	Low	Possibility of slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems. Existing property - no significant increase in insurance risk due to natural slope instability problems.
9	0.0	On Site	Very Low	Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.
10C	4.0	S	Low	Possibility of slope instability problems after major changes in ground conditions. Consideration should be given to stability if changes to drainage or excavations take place. Possible increase in construction cost to reduce potential slope stability problems. Existing property - no significant increase in insurance risk due to natural slope instability problems.
11B	8.0	SW	Moderate	Significant potential for slope instability with relatively small changes in ground conditions. Avoid large amounts of water entering the ground through pipe leakage or soak-aways. Do not undercut or place large amounts of material on slopes without technical advice. For new build - consider the potential and consequences of ground movement during excavations, or consequence of changes to loading or drainage. For existing property - probable increase in insurance risk is likely due to potential natural slope instability after changes to ground conditions such as a very long, excessively wet winter.
12C	47.0	S	Very Low	Slope instability problems are unlikely to be present. No special actions required to avoid problems due to landslides. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with landslides.

4.3 Ground Dissolution of Soluble Rocks

The following Ground Dissolution information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.
2	0.0	On Site	Very Low	Significant soluble rocks are present. Problems unlikely except with considerable surface or subsurface water flow. No special actions required to avoid problems due to soluble rocks. No special ground investigation required or increased construction costs are likely. An increase in financial risk due to potential problems with soluble rocks is unlikely.
3	0.0	On Site	Very Low	Significant soluble rocks are present. Problems unlikely except with considerable surface or subsurface water flow. No special actions required to avoid problems due to soluble rocks. No special ground investigation required or increased construction costs are likely. An increase in financial risk due to potential problems with soluble rocks is unlikely.
4	0.0	On Site	Negligible	Soluble rocks are present, but unlikely to cause problems except under exceptional conditions. No special actions required to avoid problems due to soluble rocks. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with soluble rocks.
5	0.0	On Site	Very Low	Significant soluble rocks are present. Problems unlikely except with considerable surface or subsurface water flow. No special actions required to avoid problems due to soluble rocks. No special ground investigation required or increased construction costs are likely. An increase in financial risk due to potential problems with soluble rocks is unlikely.

4.4 Compressible Deposits

The following Compressible Deposits information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Moderate	Significant potential for compressibility problems. Avoid large differential loadings of ground. Do not drain or de-water ground near the property without technical advice. For new build - consider possibility of compressible ground in ground investigation, construction and building design. Consider effects of groundwater changes. Extra construction costs are likely. For existing property - possible increase in insurance risk from compressibility, especially if water conditions or loading of the ground change significantly.
2	0.0	On Site	Negligible	No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.
3	0.0	On Site	Negligible	No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.
4	0.0	On Site	Negligible	No indicators for compressible deposits identified. No special actions required to avoid problems due to compressible deposits. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with compressible deposits.
5	0.0	On Site	Moderate	Significant potential for compressibility problems. Avoid large differential loadings of ground. Do not drain or de-water ground near the property without technical advice. For new build - consider possibility of compressible ground in ground investigation, construction and building design. Consider effects of groundwater changes. Extra construction costs are likely. For existing property - possible increase in insurance risk from compressibility, especially if water conditions or loading of the ground change significantly.

4.5 Collapsible Deposits

The following Collapsible Rocks information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	No indicators for collapsible deposits identified. No actions required to avoid problems due to collapsible deposits. No special ground investigation required, or increased construction costs or increased financial risk due to potential problems with collapsible deposits.
2	0.0	On Site	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.
3	0.0	On Site	Negligible	No indicators for collapsible deposits identified. No actions required to avoid problems due to collapsible deposits. No special ground investigation required, or increased construction costs or increased financial risk due to potential problems with collapsible deposits.
4	0.0	On Site	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.
5	0.0	On Site	Very Low	Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.

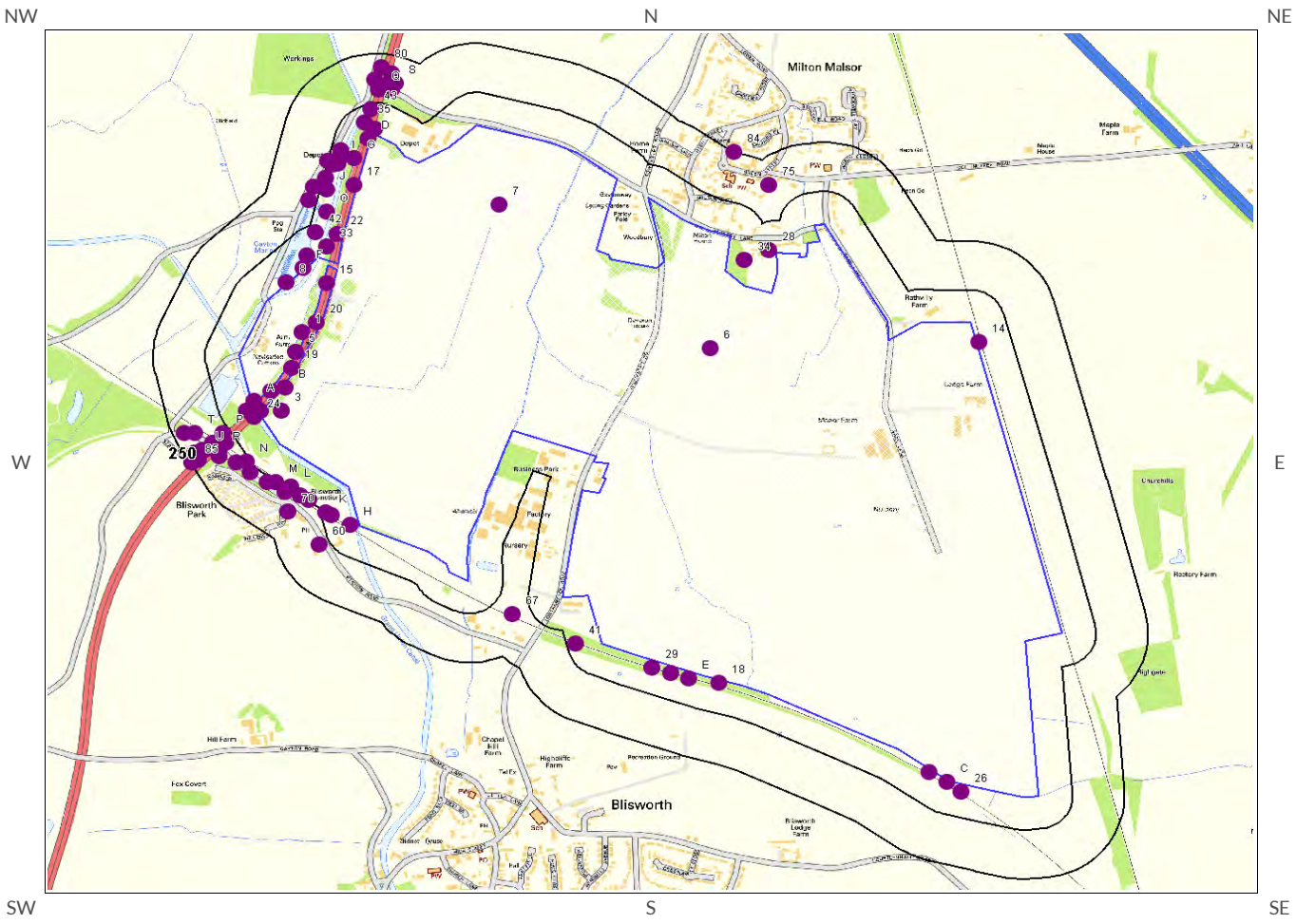
4.6 Running Sands

The following Running Sands information provided by the British Geological Survey:

ID	Distance (m)	Direction	Hazard Rating	Details
1	0.0	On Site	Negligible	No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.
2	0.0	On Site	Very Low	Very low potential for running sand problems if water table rises or if sandy strata are exposed to water. No special actions required, to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.
3	0.0	On Site	Low	Possibility of running sand problems after major changes in ground conditions. Normal maintenance to avoid leakage of water-bearing services or water bodies (ponds, swimming pools) should reduce likelihood of problems due to running sand. For new build - consider possibility of running sand into trenches or excavations if water table is high or sandy strata are exposed to water. Avoid concentrated water inputs to site. Unlikely to be an increase in construction costs due to potential for running sand. For existing property - no significant increase in insurance risk due to running sand problems is likely.
4	0.0	On Site	Negligible	No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.
5	0.0	On Site	Negligible	No indicators for running sand identified. No special actions required to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.

ID	Distance (m)	Direction	Hazard Rating	Details
6	0.0	On Site	Low	Possibility of running sand problems after major changes in ground conditions. Normal maintenance to avoid leakage of water-bearing services or water bodies (ponds, swimming pools) should reduce likelihood of problems due to running sand. For new build - consider possibility of running sand into trenches or excavations if water table is high or sandy strata are exposed to water. Avoid concentrated water inputs to site. Unlikely to be an increase in construction costs due to potential for running sand. For existing property - no significant increase in insurance risk due to running sand problems is likely.
7	0.0	On Site	Very Low	Very low potential for running sand problems if water table rises or if sandy strata are exposed to water. No special actions required, to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.
8	0.0	On Site	Very Low	Very low potential for running sand problems if water table rises or if sandy strata are exposed to water. No special actions required, to avoid problems due to running sand. No special ground investigation required, and increased construction costs or increased financial risks are unlikely due to potential problems with running sand.

5 Borehole Records Map



Borehole Records Legend

Mapping sourced from Ordnance Survey

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Site Outline

Borehole Locations

125
250
Search Buffers (m)



5 Borehole Records

The systematic analysis of data extracted from the BGS Borehole Records database provides the following information.

Records of boreholes within 250m of the study site boundary:	85

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
1	0.0	On Site	472150 255050	SP75NW407	11.0	A43 MILTON BYPASS 230
2A	0.0	On Site	472010 254840	SP75SW49	20.0	A43 MILTON BY PASS 229
3	0.0	On Site	472090 254810	SP75SW88	4.0	A43 MILTON BY PASS TP 27
4B	0.0	On Site	472100 254880	SP75SW89	3.0	A43 MILTON BY PASS TP 28
5	0.0	On Site	472130 254990	SP75SW91	4.0	A43 MILTON BY PASS TP 30
6	0.0	On Site	473330 255000	SP75NW179	8.8	SOUTH OF MILTON
7	0.0	On Site	472720 255439	SP75NW561	-1.0	RUGBY ALLIANCE G6356A
8	4.0	NW	472105 255202	SP75NW1149	-1.0	GAYTON MARINA NORTHANTS TP101
9F	5.0	NW	472154 255246	SP75NW1150	-1.0	GAYTON MARINA NORTHANTS TP102
10A	5.0	NW	472030 254810	SP75SW48	30.0	A43 MILTON BY PASS 228
11D	7.0	W	472340 255640	SP75NW439	3.0	A43 MILTON BYPASS TP 37/A
12B	7.0	SE	472060 254870	SP75SW87	3.0	A43 MILTON BY PASS TP 26
13C	7.0	SW	474016 253674	SP75SW115	-1.0	RUGBY ALLAINCE 2 WSG61/29A
14	8.0	E	474110 255020	SP75NW550	-1.0	RUGBY ALLIANCE SIGNAL BASES WS5297
15	9.0	E	472220 255200	SP75NW434	3.0	A43 MILTON BYPASS TP 32
16C	10.0	SW	473965 253705	SP75SW116	-1.0	RUGBY ALLAINCE 2 WSG61/31A
17	10.0	W	472300 255500	SP75NW438	3.0	A43 MILTON BYPASS TP 36
18	11.0	S	473357 253977	SP75SW117	-1.0	RUGBY ALLIANCE SIGNAL BASES WS3294
19	13.0	SE	472120 254940	SP75SW90	3.0	A43 MILTON BY PASS TP 29
20	13.0	E	472190 255080	SP75NW433	3.0	A43 MILTON BYPASS TP 31
21D	18.0	N	472360 255670	SP75NW440	2.0	A43 MILTON BYPASS TP 38
22	20.0	W	472250 255350	SP75NW436	3.0	A43 MILTON BYPASS TP 34
23E	21.0	S	473269 253992	SP75SW124	-1.0	RUGBY OLE BH62/06A
24	23.0	SW	472010 254790	SP75SW47	13.0	A43 MILTON BY PASS 227
25E	23.0	S	473217 254007	SP75SW125	-1.0	RUGBY OLE BH62/08A
26	24.0	S	474058 253645	SP75SW114	-1.0	RUGBY ALLAINCE 2 WSG61/27A
27F	25.0	NW	472165 255283	SP75NW1142	-1.0	GAYTON MARINA NORTHANTS WS101
28	25.0	W	473500 255300	SP75NW546	15.24	MORTIMER HOUSE MILTON
29	26.0	S	473161 254023	SP75SW126	-1.0	RUGBY OLE BH62/10A
30A	26.0	SW	471990 254810	SP75SW46	14.0	A43 MILTON BY PASS 226

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
31H	27.0	W	472289 254461	SP75SW119	-1.0	RUGBY ALLIANCE SIGNAL BASES WS3296
32G	30.0	W	472300 255580	SP75NW437	3.0	A43 MILTON BYPASS TP 35
33	36.0	N	472220 255310	SP75NW435	4.0	A43 MILTON BYPASS TP 33
34	49.0	E	473430 255270	SP75NW7	15.24	MILTON RECTORY NORTHANTS
35	51.0	NW	472330 255690	SP75NW408	10.0	A43 MILTON BYPASS 232
36O	67.0	W	472220 255418	SP75NW1151	-1.0	GAYTON MARINA NORTHANTS TP103
37G	70.0	W	472255 255566	SP75NW1147	-1.0	GAYTON MARINA NORTHANTS WS106
38H	71.0	W	472236 254491	SP75SW127	-1.0	RUGBY ALLIANCE TP4150
39I	73.0	W	472256 255581	SP75NW1153	-1.0	GAYTON MARINA NORTHANTS TP105
40G	73.0	W	472262 255606	SP75NW1154	-1.0	GAYTON MARINA NORTHANTS TP106
41	76.0	W	472942 254096	SP75SW118	-1.0	RUGBY ALLIANCE SIGNAL BASES WS3295
42	78.0	N	472189 255356	SP75NW1143	-1.0	GAYTON MARINA NORTHANTS WS102
43	79.0	N	472350 255730	SP75NW409	10.3	A43 MILTON BYPASS 233
44J	82.0	W	472222 255485	SP75NW1155	-1.0	GAYTON MARINA NORTHANTS TP107
45I	85.0	W	472239 255563	SP75NW1152	-1.0	GAYTON MARINA NORTHANTS TP104
46K	85.0	W	472219 254498	SP75SW128	-1.0	RUGBY ALLIANCE TP4151
47L	93.0	SW	472118 254578	SP75SW123	-1.0	WEST COAST MAIN LINE BH59R1
48J	94.0	W	472219 255521	SP75NW1145	-1.0	GAYTON MARINA NORTHANTS WS104
49K	99.0	SW	472170 254536	SP75SW129	-1.0	RUGBY ALLIANCE TP4152
50L	102.0	SW	472144 254550	SP75SW130	-1.0	RUGBY ALLIANCE TP4153
51I	103.0	W	472223 255574	SP75NW1146	-1.0	GAYTON MARINA NORTHANTS WS105
52M	105.0	SW	472074 254592	SP75SW131	-1.0	RUGBY ALLIANCE TP4155
53N	111.0	SW	471989 254655	SP75SW132	-1.0	RUGBY ALLIANCE TP4157
54L	118.0	SW	472100 254560	SP75SW93	4.0	A43 MILTON BY PASS TP 80
55M	120.0	SW	472050 254590	SP75SW94	3.0	A43 MILTON BY PASS TP 81
56J	121.0	W	472184 255494	SP75NW1148	-1.0	GAYTON MARINA NORTHANTS WS107
57N	124.0	SW	472000 254620	SP75SW95	3.0	A43 MILTON BY PASS TP 82
58O	125.0	W	472169 255453	SP75NW1144	-1.0	GAYTON MARINA NORTHANTS WS103
59P	125.0	SW	471920 254740	SP75SW44	15.0	A43 MILTON BY PASS 224
60	132.0	SW	472200 254400	SP75SW110	6.19	THE LOUNDES BLISWORTH

ID	Distance (m)	Direction	NGR	BGS Reference	Drilled Length	Borehole Name
61P	133.0	SW	471930 254710	SP75SW45	25.0	A43 MILTON BY PASS 225
62Q	137.0	N	472370 255790	SP75NW413	14.8	A43 MILTON BYPASS 236
63N	139.0	SW	471960 254650	SP75SW96	4.0	A43 MILTON BY PASS TP 83A
64Q	139.0	N	472390 255790	SP75NW411	15.1	A43 MILTON BYPASS 235
65Q	144.0	N	472410 255790	SP75NW445	3.0	A43 MILTON BYPASS TP 39A
66Q	153.0	N	472410 255800	SP75NW446	3.0	A43 MILTON BYPASS TP 39B
67	156.0	W	472758 254188	SP75SW122	-1.0	WEST COAST MAIN LINE BH58R1
68R	160.0	SW	471910 254690	SP75SW42	30.0	A43 MILTON BY PASS 223A
69Q	160.0	N	472400 255810	SP75NW412	14.8	A43 MILTON BYPASS 235A
70	162.0	SW	472110 254500	SP75SW1	30.0	BLISWORTH JUNCTION NORTHANTS
71S	166.0	N	472420 255810	SP75NW447	3.0	A43 MILTON BYPASS TP 39C
72P	167.0	SW	471890 254710	SP75SW41	20.0	A43 MILTON BY PASS 222
73Q	167.0	N	472360 255820	SP75NW410	15.0	A43 MILTON BYPASS 234
74R	171.0	SW	471910 254670	SP75SW43	10.0	A43 MILTON BY PASS 223
75	180.0	NW	473500 255500	SP75NW548	1.83	MILTON
76T	191.0	SW	471840 254740	SP75SW97	3.0	A43 MILTON BY PASS TP 84
77S	192.0	N	472410 255840	SP75NW442	3.0	A43 MILTON BYPASS TP 38B
78R	194.0	SW	471870 254690	SP75SW40	20.0	A43 MILTON BY PASS 221
79U	203.0	SW	471860 254690	SP75SW100	0.0	A43 MILTON BY PASS TP 87
80	207.0	N	472380 255860	SP75NW441	2.0	A43 MILTON BYPASS TP 38A
81T	219.0	SW	471810 254740	SP75SW98	3.0	A43 MILTON BY PASS TP 85
82U	225.0	SW	471840 254680	SP75SW37	8.0	A43 MILTON BY PASS 219
83U	227.0	SW	471850 254660	SP75SW39	3.0	A43 MILTON BY PASS 220A
84	246.0	NE	473400 255600	SP75NW547	3.35	MILTON
85	249.0	SW	471830 254650	SP75SW38	10.0	A43 MILTON BY PASS 220

Additional online information is available for the following boreholes listed above:

#1: scans.bgs.ac.uk/sobi_scans/boreholes/344457
#2A: scans.bgs.ac.uk/sobi_scans/boreholes/344739
#3: scans.bgs.ac.uk/sobi_scans/boreholes/344778
#4B: scans.bgs.ac.uk/sobi_scans/boreholes/344779
#5: scans.bgs.ac.uk/sobi_scans/boreholes/344781
#6: scans.bgs.ac.uk/sobi_scans/boreholes/344229

#10A: scans.bgs.ac.uk/sobi_scans/boreholes/344738
#11D: scans.bgs.ac.uk/sobi_scans/boreholes/344489
#12B: scans.bgs.ac.uk/sobi_scans/boreholes/344777
#15: scans.bgs.ac.uk/sobi_scans/boreholes/344484
#17: scans.bgs.ac.uk/sobi_scans/boreholes/344488
#19: scans.bgs.ac.uk/sobi_scans/boreholes/344780
#20: scans.bgs.ac.uk/sobi_scans/boreholes/344483
#21D: scans.bgs.ac.uk/sobi_scans/boreholes/344490
#22: scans.bgs.ac.uk/sobi_scans/boreholes/344486
#24: scans.bgs.ac.uk/sobi_scans/boreholes/344737
#28: scans.bgs.ac.uk/sobi_scans/boreholes/344596
#30A: scans.bgs.ac.uk/sobi_scans/boreholes/344736
#32G: scans.bgs.ac.uk/sobi_scans/boreholes/344487
#33: scans.bgs.ac.uk/sobi_scans/boreholes/344485
#34: scans.bgs.ac.uk/sobi_scans/boreholes/344057
#35: scans.bgs.ac.uk/sobi_scans/boreholes/344458
#43: scans.bgs.ac.uk/sobi_scans/boreholes/344459
#54L: scans.bgs.ac.uk/sobi_scans/boreholes/344783
#55M: scans.bgs.ac.uk/sobi_scans/boreholes/344784
#57N: scans.bgs.ac.uk/sobi_scans/boreholes/344785
#59P: scans.bgs.ac.uk/sobi_scans/boreholes/344734
#60: scans.bgs.ac.uk/sobi_scans/boreholes/344800
#61P: scans.bgs.ac.uk/sobi_scans/boreholes/344735
#62Q: scans.bgs.ac.uk/sobi_scans/boreholes/344463
#63N: scans.bgs.ac.uk/sobi_scans/boreholes/344786
#64Q: scans.bgs.ac.uk/sobi_scans/boreholes/344461
#65Q: scans.bgs.ac.uk/sobi_scans/boreholes/344495
#66Q: scans.bgs.ac.uk/sobi_scans/boreholes/344496
#68R: scans.bgs.ac.uk/sobi_scans/boreholes/344732
#69Q: scans.bgs.ac.uk/sobi_scans/boreholes/344462
#70: scans.bgs.ac.uk/sobi_scans/boreholes/344691
#71S: scans.bgs.ac.uk/sobi_scans/boreholes/344497
#72P: scans.bgs.ac.uk/sobi_scans/boreholes/344731
#73Q: scans.bgs.ac.uk/sobi_scans/boreholes/344460
#74R: scans.bgs.ac.uk/sobi_scans/boreholes/344733
#75: scans.bgs.ac.uk/sobi_scans/boreholes/344598
#76T: scans.bgs.ac.uk/sobi_scans/boreholes/344787
#77S: scans.bgs.ac.uk/sobi_scans/boreholes/344492
#78R: scans.bgs.ac.uk/sobi_scans/boreholes/344730
#79U: scans.bgs.ac.uk/sobi_scans/boreholes/344790
#80: scans.bgs.ac.uk/sobi_scans/boreholes/344491
#81T: scans.bgs.ac.uk/sobi_scans/boreholes/344788
#82U: scans.bgs.ac.uk/sobi_scans/boreholes/344727
#83U: scans.bgs.ac.uk/sobi_scans/boreholes/344729
#84: scans.bgs.ac.uk/sobi_scans/boreholes/344597
#85: scans.bgs.ac.uk/sobi_scans/boreholes/344728



6 Estimated Background Soil Chemistry

Records of background estimated soil chemistry within 250m of the study site boundary: 150

For further information on how this data is calculated and limitations upon its use, please see the GroundSure GeoInsight User Guide, available on request.

Distance (m)	Direction	Sample Type	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Nickel (Ni)	Lead (Pb)
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
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Distance (m)	Direction	Sample Type	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Nickel (Ni)	Lead (Pb)
0.0	On Site	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
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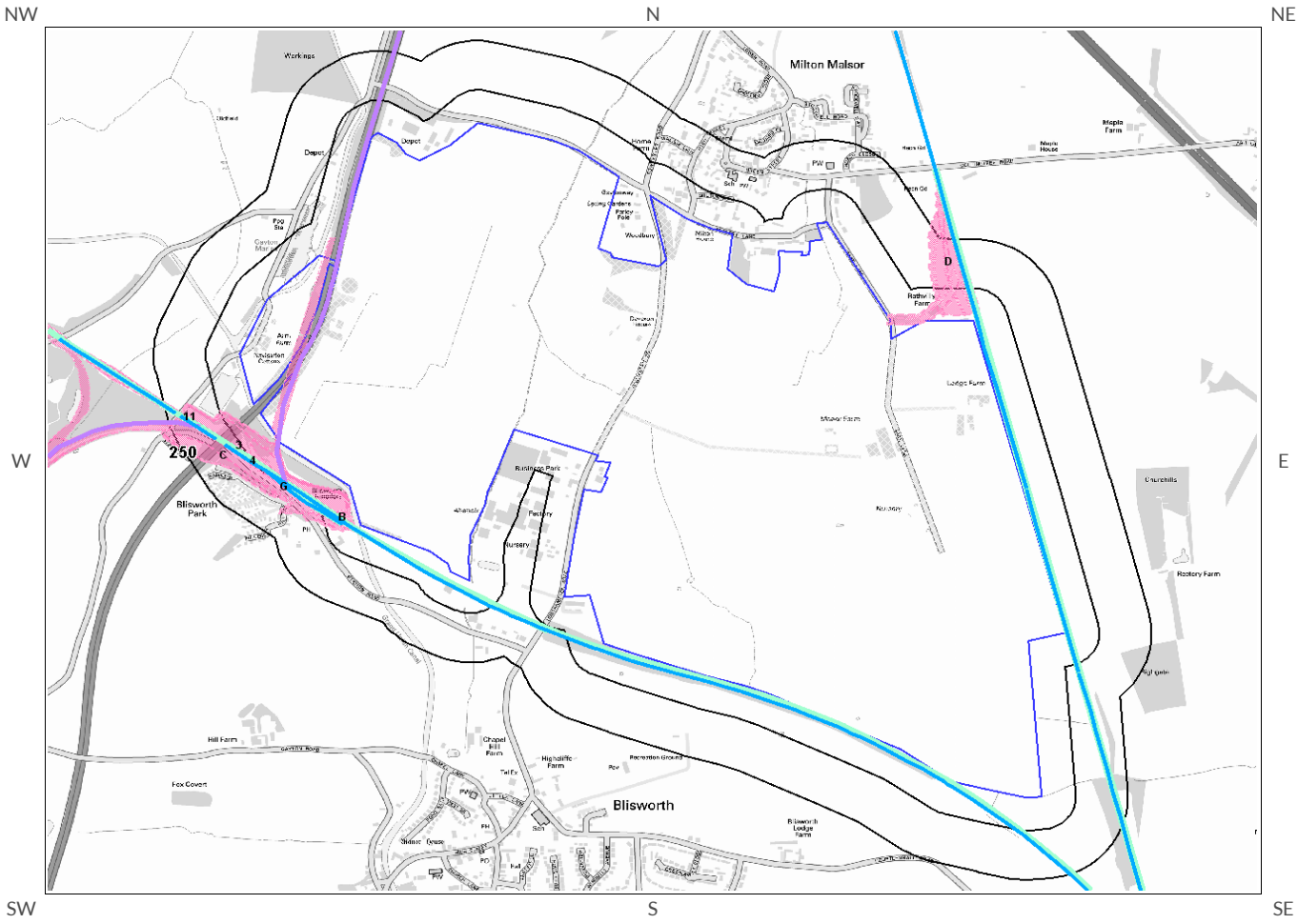
Distance (m)	Direction	Sample Type	Arsenic (As)	Cadmium (Cd)	Chromium (Cr)	Nickel (Ni)	Lead (Pb)
0.0	On Site	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
4.0	E	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
10.0	E	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
11.0	W	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
13.0	NW	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
14.0	E	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
20.0	W	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
30.0	NW	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<100 mg/kg
37.0	N	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
49.0	E	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
56.0	S	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<100 mg/kg
63.0	E	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<100 mg/kg
100.0	S	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
100.0	S	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
105.0	NE	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
105.0	NE	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
118.0	N	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
119.0	N	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
121.0	N	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
125.0	N	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
126.0	N	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
129.0	S	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
130.0	NW	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<100 mg/kg
131.0	S	RuralSoil	35 - 45 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
133.0	S	RuralSoil	35 - 45 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
137.0	NW	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
140.0	S	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<100 mg/kg
145.0	SW	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
150.0	SE	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
151.0	E	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<100 mg/kg
160.0	NW	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
164.0	S	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
167.0	NW	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
175.0	S	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
175.0	S	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
178.0	SW	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
179.0	S	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
179.0	S	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
181.0	NE	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
181.0	NE	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
200.0	SE	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<100 mg/kg
201.0	S	RuralSoil	45 - 60 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
206.0	SW	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
219.0	E	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
222.0	SW	RuralSoil	45 - 60 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
223.0	SW	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
223.0	SW	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
224.0	W	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
225.0	NE	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
225.0	NE	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	15 - 30 mg/kg	<100 mg/kg
225.0	W	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<100 mg/kg
228.0	W	RuralSoil	25 - 35 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg
243.0	E	RuralSoil	15 - 25 mg/kg	<1.8 mg/kg	60 - 90 mg/kg	30 - 45 mg/kg	<100 mg/kg
243.0	S	RuralSoil	35 - 45 mg/kg	<1.8 mg/kg	90 - 120 mg/kg	30 - 45 mg/kg	<100 mg/kg

*As this data is based upon underlying 1:50,000 scale geological information, a 50m buffer has been added to the search radius.

7 Railways and Tunnels Map



Railways and Tunnels Legend

Mapping sourced from Ordnance Survey

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- Site Outline
- 250 / 500 Search Buffers (m)
- Underground or Partially Underground Railway / Subway System
- Railway Tunnel (OS Mapping)
- Abandoned or Dismantled Railway (OpenStreetMap)
- Railway Track (OS Mapping)
- Railway Track (OpenStreetMap)
- High Speed 2
- Crossrail
- Railway and/or Tunnel Feature from Historical Mapping



7 Railways and Tunnels

7.1 Tunnels

This data is derived from OpenStreetMap and provides information on the possible locations of underground railway systems in the UK - the London Underground, the Tyne & Wear Metro and the Glasgow Subway.

Have any underground railway lines been identified within the study site boundary? No

Have any underground railway lines been identified within 250m of the study site boundary? No

Database searched and no data found.

Any records that have been identified are represented on the Railways and Tunnels Map.

This data is derived from Ordnance Survey mapping and provides information on the possible locations of railway tunnels forming part of the UK overground railway network.

Have any other railway tunnels been identified within the site boundary? No

Have any other railway tunnels been identified within 250m of the site boundary? No

Database searched and no data found.

Any records that have been identified are represented on the Railways and Tunnels Map.

7.2 Historical Railway and Tunnel Features

This data is derived from GroundSure's unique Historical Land-use Database and contains features relating to tunnels, railway tracks or associated works that have been identified from historical Ordnance Survey mapping.

Have any historical railway or tunnel features been identified within the study site boundary? Yes

Have any historical railway or tunnel features been identified within 250m of the study site boundary? Yes

ID	Distance (m)	Direction	NGR	Details	Date
1A	0	On Site	474026 255253	Railway Sidings	1950
2A	0	On Site	474043 255230	Railway Sidings	1964
11	0	On Site	n/a	Railway	1883
3	13	SW	471888 254749	Railway Sidings	1900
12	13	N	473976 255316	Railway Sidings	1964
4	14	SW	472018 254638	Railway Sidings	1958
5D	18	N	474028 255287	Railway Sidings	1968
6B	18	W	472255 254470	Railway Sidings	1950
7B	18	W	472255 254470	Railway Sidings	1883

ID	Distance (m)	Direction	NGR	Details	Date
13D	18	N	474039 255256	Railway Sidings	1964
8C	19	W	471404 254657	Railway Sidings	1950
9C	19	W	471404 254657	Railway Sidings	1883
10B	24	W	472246 254466	Railway Sidings	1900
14F	31	W	472110 254590	Railway Sidings	1966
15G	39	W	472087 254569	Railway Sidings	1966
16E	45	W	472141 254541	Railway Sidings	1992
17E	46	W	472149 254536	Railway Sidings	1993
18F	88	SW	472083 254604	Railway Sidings	1966
19G	95	SW	472111 254566	Railway Sidings	1986

Any records that have been identified are represented on the Railways and Tunnels Map.

7.3 Historical Railways

This data is derived from OpenStreetMap and provides information on the possible alignments of abandoned or dismantled railway lines in proximity to the study site.

Have any historical railway lines been identified within the study site boundary? Yes

Have any historical railway lines been identified within 250m of the study site boundary? Yes

Distance (m)	Direction	Status
0	On Site	Abandoned
0	On Site	Dismantled
170	SW	Abandoned

Note: multiple sections of the same track may be listed in the detail above

Any records that have been identified are represented on the Railways and Tunnels Map.

7.4 Active Railways

These datasets are derived from Ordnance Survey mapping and OpenStreetMap and provide information on the possible locations of active railway lines in proximity to the study site.

Have any active railway lines been identified within the study site boundary? No

Have any active railway lines been identified within 250m of the study site boundary? Yes

Distance (m)	Direction	Name	Type
3	SW	West Coast Main Line	Rail
6	E	Not given	Multi Track
8	E	Not given	Rail

Distance (m)	Direction	Name	Type
9	E	Not given	Multi Track
11	E	Northampton Loop Line	Rail
11	SW	Not given	Multi Track
18	SW	West Coast Main Line;48b	Rail
23	S	West Coast Main Line	Rail
26	W	West Coast Main Line	Rail
49	W	Not given	Multi Track
51	W	Blisworth Siding	Rail
90	SW	West Coast Main Line	Rail
94	SW	Not given	Multi Track
107	SW	West Coast Main Line	Rail
112	SW	West Coast Main Line	Rail
129	S	Not given	Multi Track
152	SW	Not given	Multi Track
224	W	Not given	Multi Track

Note: multiple sections of the same track may be listed in the detail above
Any records that have been identified are represented on the Railways and Tunnels Map.

7.5 Railway Projects

These datasets provide information on the location of large scale railway projects High Speed 2 and Crossrail.

Is the study site within 5km of the route of the High Speed 2 rail project? No

Is the study site within 500m of the route of the Crossrail rail project? No

Further information on proximity to these routes, the project construction status and associated works can be obtained through the purchase of a GroundSure HS2 and Crossrail Report.

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DX 716176 Mansfield 5
www.coal.gov.uk

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Acknowledgements: Ordnance Survey © Crown Copyright and/or Database Right. All Rights Reserved. Licence Number [03421028]. This report has been prepared in accordance with the GroundSure Ltd standard Terms and Conditions of business for work of this nature.

Standard Terms and Conditions

1 Definitions

In these terms and conditions unless the context otherwise requires:
"Beneficiary" means the person or entity for whose benefit the Client has obtained the Services.
"Client" means the party or parties entering into a Contract with GroundSure.
"Commercial" means any building or property which is not Residential.
"Confidential Information" means the contents of this Contract and all information received from the Client as a result of, or in connection with, this Contract other than

(i) information which the Client can prove was rightfully in its possession prior to disclosure by GroundSure and

(ii) any information which is in the public domain (other than by virtue of a breach of this Contract).

"Support Services" means Support Services provided by GroundSure including, without limitation, interpreting third party and in-house environmental data, providing environmental support advice, undertaking environmental audits and assessments, Site investigation, Site monitoring and related items.
"Contract" means the contract between GroundSure and the Client for the provision of the Services, and which shall incorporate these terms and conditions, the Order, and the relevant User Guide.
"Third Party Data Provider" means any third party providing Third Party Content to GroundSure.
"Data Reports" means reports comprising factual data with no accompanying interpretation.
"Fees" has the meaning set out in clause 5.1.
"GroundSure" means GroundSure Limited, a company registered in England and Wales under number 03421028.
"GroundSure Materials" means all materials prepared by GroundSure and provided as part of the Services, including but not limited to Third Party Content, Data Reports, Mapping, and Risk Screening Reports.
"Intellectual Property" means any patent, copyright, design rights, trade or service mark, moral rights, data protection rights, know-how or trade mark in each case whether registered or not and including applications for the same or any other rights of a similar nature anywhere in the world.
"Mapping" means a map, map data or a combination of historical maps of various ages, time periods and scales.
"Order" means an electronic, written or other order form submitted by the Client requesting Services from GroundSure in respect of a specified Site.
"Ordnance Survey" means the Secretary of State for Business, Innovation and Skills, acting through Ordnance Survey, Adanac Drive, Southampton, SO16 0AS, UK.
"Order Website" means the online platform through which Orders may be placed by the Client and accepted by GroundSure.
"Report" means a Risk Screening Report or Data Report for Commercial or Residential property.
"Residential" means any building or property used as or intended to be used as a single dwelling.
"Risk Screening Report" means a risk screening report comprising factual data with an accompanying interpretation by GroundSure.
"Services" means any Report, Mapping and/or Support Services which GroundSure has agreed to provide by accepting an Order pursuant to clause 2.6.
"Site" means the area of land in respect of which the Client has requested GroundSure to provide the Services.
"Third Party Content" means data, database information or other information which is provided to GroundSure by a Third Party Data Provider.
"User Guide" means the user guide, as amended from time to time, available upon request from GroundSure and on the website (www.GroundSure.com) and forming part of this Contract.

2 Scope of Services, terms and conditions, requests for insurance and quotations

2.1 GroundSure agrees to provide the Services in accordance with the Contract.
2.2 GroundSure shall exercise reasonable skill and care in the provision of the Services.
2.3 Subject to clause 7.3 the Client acknowledges that it has not relied on any statement or representation made by or on behalf of GroundSure which is not set out and expressly agreed in writing in the Contract and all such statements and representations are hereby excluded to the fullest extent permitted by law.
2.4 The Client acknowledges that terms and conditions appearing on a Client's order form, printed stationery or other communication, or any terms or conditions implied by custom, practice or course of dealing shall be of no effect, and that this Contract shall prevail over all others in relation to the Order.
2.5 If the Client or Beneficiary requests insurance in conjunction with or as a result of the Services, GroundSure shall use reasonable endeavours to recommend such insurance, but makes no warranty that such insurance shall be available from insurers or that it will be offered on reasonable terms. Any insurance purchased by the Client or Beneficiary shall be subject solely to the terms of the policy issued by insurers and GroundSure will have no liability therefor. In addition you acknowledge and agree that GroundSure does not act as an agent or broker for any insurance providers. The Client should take (and ensure that the Beneficiary takes) independent advice to ensure that the insurance policy requested or offered is suitable for its requirements.
2.6 GroundSure's quotations or proposals are valid for a period of 30 days only unless an alternative period of time is explicitly stipulated by GroundSure. GroundSure reserves the right to withdraw any quotation or proposal at any time before an Order is accepted by GroundSure. GroundSure's acceptance of an Order shall be binding only when made in writing and signed by GroundSure's authorised representative or when accepted through the Order Website.

3 The Client's obligations

3.1The Client shall comply with the terms of this Contract and

(i) procure that the Beneficiary or any third party relying on the Services complies with and acts as if it is bound by the Contract and

(ii) be liable to GroundSure for the acts and omissions of the Beneficiary or any third party relying on the Services as if such acts and omissions were those of the Client.

3.2 The Client shall be solely responsible for ensuring that the Services are appropriate and suitable for its and/or the Beneficiary's needs.
3.3 The Client shall supply to GroundSure as soon as practicable and without charge all requisite information (and the Client warrants that such information is accurate, complete and appropriate), including without limitation any environmental information relating to the Site and shall give such assistance as GroundSure shall reasonably require in the provision of the Services including, without limitation, access to the Site, facilities and equipment.
3.4 Where the Client's approval or decision is required to enable GroundSure to carry out work in order to provide the Services, such approval or decision shall be given or procured in reasonable time and so as not to delay or disrupt the performance of the Services.
3.5 Save as expressly permitted by this Contract the Client shall not, and shall procure that the Beneficiary shall not, re-sell, alter, add to, or amend the GroundSure Materials, or use the GroundSure Materials in a manner for which they were not intended. The Client may make the GroundSure Materials available to a third party who is considering acquiring some or all of, or providing funding in relation to, the Site, but such third party cannot rely on the same unless expressly permitted under clause 4.
3.6 The Client is responsible for maintaining the confidentiality of its user name and password if using the Order Website and the Client acknowledges that GroundSure accepts no liability of any kind for any loss or damage suffered by the Client as a consequence of using the Order Website.

4 Reliance

4.1The Client acknowledges that the Services provided by GroundSure consist of the presentation and analysis of Third Party Content and other content and that information obtained from a Third Party Data Provider cannot be guaranteed or warranted by GroundSure to be reliable.
4.2 In respect of Data Reports, Mapping and Risk Screening Reports, the following classes of person and no other are entitled to rely on their contents;

(i) the Beneficiary,

(ii) the Beneficiary's professional advisers, (iii) any person providing funding to the Beneficiary in relation to the Site (whether directly or as part of a lending syndicate),

(iv) the first purchaser or first tenant of the Site, and

(v) the professional advisers and lenders of the first purchaser or tenant of the Site.

4.3 In respect of Support Services, only the Client, Beneficiary and parties expressly named in a Report and no other parties are entitled to rely on its contents.
4.4 Save as set out in clauses 4.2 and 4.3 and unless otherwise expressly agreed in writing, no other person or entity of any kind is entitled to rely on any Services or Report issued or provided by GroundSure. Any party considering such Reports and Services does so at their own risk.

5 Fees and Disbursements

5.1GroundSure shall charge and the Client shall pay fees at the rate and frequency specified in the written proposal, Order Website or Order acknowledgement form, plus (in the case of Support Services) all proper disbursements incurred by GroundSure. The Client shall in addition pay all value added tax or other tax payable on such fees and disbursements in relation to the provision of the Services (together "Fees").
5.2 The Client shall pay all outstanding Fees to GroundSure in full without deduction, counterclaim or set off within 30 days of the date of GroundSure's invoice or such other period as may be agreed in writing between GroundSure and the Client ("Payment Date"). Interest on late payments will accrue on a daily basis from the Payment Date until the date of payment (whether before or after judgment) at the rate of 8% per annum.
5.3 The Client shall be deemed to have agreed the amount of any invoice unless an objection is made in writing within 28 days of the date of the invoice. As soon as reasonably practicable after being notified of an objection, without prejudice to clause 5.2 a member of GroundSure's management team will contact the Client and the parties shall then use all reasonable endeavours to resolve the dispute within 15 days.

6 Intellectual Property and Confidentiality

6.1 Subject to

(i) full payment of all relevant Fees and

(ii) compliance with this Contract, the Client is granted (and is permitted to sub-licence to the Beneficiary) a royalty-free, worldwide, non-assignable and (save to the extent set out in this Contract) non-transferable licence to make use of the GroundSure Materials.

6.2 All Intellectual Property in the GroundSure Materials are and shall remain owned by GroundSure or GroundSure's licensors (including without limitation the Third Party Data Providers) the Client acknowledges, and shall procure acknowledgement by the Beneficiary of, such ownership. Nothing in this Contract purports to transfer or assign any rights to the Client or the Beneficiary in respect of such Intellectual Property.
6.3 Third Party Data Providers may enforce any breach of clauses 6.1 and 6.2 against the Client or Beneficiary.

6.4 The Client shall, and shall procure that any recipients of the GroundSure Materials shall:

(i) not remove, suppress or modify any trade mark, copyright or other proprietary marking belonging to GroundSure or any third party from the Services;

(ii) use the information obtained as part of the Services in respect of the subject Site only, and shall not store or reuse any information obtained as part of the Services provided in respect of adjacent or nearby sites;

(iii) not create any product or report which is derived directly or indirectly from the Services (save that those acting in a professional capacity to the Beneficiary may provide advice based upon the Services);

(iv) not combine the Services with or incorporate such Services into any other information data or service;

(v) not reformat or otherwise change (whether by modification, addition or enhancement), the Services (save that those acting for the Beneficiary in a professional capacity shall not be in breach of this clause 6.4(v) where such reformatting is in the normal course of providing advice based upon the Services);

(vi) where a Report and/or Mapping contains material belonging to Ordnance Survey, acknowledge and agree that such content is protected by Crown Copyright and shall not use such content for any purpose outside of receiving the Services; and

(vii) not copy in whole or in part by any means any map prints or run-on copies containing content belonging to Ordnance Survey (other than that contained within Ordnance Survey's OS Street Map) without first being in possession of a valid Paper Map Copying Licence from Ordnance Survey,

6.5 Notwithstanding clause 6.4, the Client may make reasonable use of the GroundSure Materials in order to advise the Beneficiary in a professional capacity. However, GroundSure shall have no liability in respect of any advice, opinion or report given or provided to Beneficiaries by the Client.

6.6 The Client shall procure that any person to whom the Services are made available shall notify GroundSure of any request or requirement to disclose, publish or disseminate any information contained in the Services in accordance with the Freedom of Information Act 2000, the Environmental Information Regulations 2004 or any associated legislation or regulations in force from time to time.

7.Liability: Particular Attention Should Be Paid To This Clause

7.1 This Clause 7 sets out the entire liability of GroundSure, including any liability for the acts or omissions of its employees, agents, consultants, subcontractors and Third Party Content, in respect of:

(i) any breach of contract, including any deliberate breach of the Contract by GroundSure or its employees, agents or subcontractors;

(ii) any use made of the Reports, Services, Materials or any part of them; and

(iii) any representation, statement or tortious act or omission (including negligence) arising under or in connection with the Contract.

7.2 All warranties, conditions and other terms implied by statute or common law are, to the fullest extent permitted by law, excluded from the Contract.

7.3 Nothing in the Contract limits or excludes the liability of the Supplier for death or personal injury resulting from negligence, or for any damage or liability incurred by the Client or Beneficiary as a result of fraud or fraudulent misrepresentation.

7.4 GroundSure shall not be liable for

(i) loss of profits;

(ii) loss of business;

(iii) depletion of goodwill and/or similar losses;

(iv) loss of anticipated savings;

(v) loss of goods;

(vi) loss of contract;

(vii) loss of use;

(viii) loss or corruption of data or information;

(ix) business interruption;

(x) any kind of special, indirect, consequential or pure economic loss, costs, damages, charges or expenses;

(xi) loss or damage that arise as a result of the use of all or part of the GroundSure Materials in breach of the Contract;

(xii) loss or damage arising as a result of any error, omission or inaccuracy in any part of the GroundSure Materials where such error, omission or inaccuracy is caused by any Third Party Content or any reasonable interpretation of Third Party Content;

(xiii) loss or damage to a computer, software, modem, telephone or other property; and

(xiv) loss or damage caused by a delay or loss of use of GroundSure's internet ordering service.

7.5 GroundSure's total liability in relation to or under the Contract shall be limited to £10 million for any claim or claims.

7.6 GroundSure shall procure that the Beneficiary shall be bound by limitations and exclusions of liability in favour of GroundSure which accord with those detailed in clauses 7.4 and 7.5 (subject to clause 7.3) in respect of all claims which the Beneficiary may bring against GroundSure in relation to the Services or other matters arising pursuant to the Contract.

8 GroundSure's right to suspend or terminate

8.1 If GroundSure reasonably believes that the Client or Beneficiary has not provided the information or assistance required to enable the proper provision of the Services, GroundSure shall be entitled to suspend all further performance of the Services until such time as any such deficiency has been made good.

8.2 GroundSure shall be entitled to terminate the Contract immediately on written notice in the event that:

(i) the Client fails to pay any sum due to GroundSure within 30 days of the Payment Date; or

(ii) the Client (being an individual) has a bankruptcy order made against him or (being a company) shall enter into liquidation whether compulsory or voluntary or have an administration order made against it or if a receiver shall be appointed over the whole or any part of its property assets or undertaking or if the Client is struck off the Register of Companies or dissolved; or

(iii) the Client being a company is unable to pay its debts within the meaning of Section 123 of the Insolvency Act 1986 or being an individual appears unable to pay his debts within the meaning of Section 268 of the Insolvency Act 1986 or if the Client shall enter into a composition or arrangement with the Client's creditors or shall suffer distress or execution to be levied on his goods; or

(iv) the Client or the Beneficiary breaches any term of the Contract (including, but not limited to, the obligations in clause 4) which is incapable of remedy or if remediable, is not remedied within five days of notice of the breach.

9. Client's Right to Terminate and Suspend

9.1 Subject to clause 10.1, the Client may at any time upon written notice terminate or suspend the provision of all or any of the Services.

9.2 In any event, where the Client is a consumer (and not a business) he/she hereby expressly acknowledges and agrees that:

(i) the supply of Services under this Contract (and therefore the performance of this Contract) commences immediately upon GroundSure's acceptance of the Order; and

(ii) the Reports and/or Mapping provided under this Contract are
(a) supplied to the Client's specification(s) and in any event
(b) by their nature cannot be returned.

10 Consequences of Withdrawal, Termination or Suspension

10.1 Upon termination of the Contract:

(i) GroundSure shall take steps to bring to an end the Services in an orderly manner, vacate any Site with all reasonable speed and shall deliver to the Client and/or Beneficiary any property of the Client and/or Beneficiary in GroundSure's possession or control; and

(ii) the Client shall pay to GroundSure all and any Fees payable in respect of the performance of the Services up to the date of termination or suspension. In respect of any Support Services provided, the Client shall also pay GroundSure any additional costs incurred in relation to the termination or suspension of the Contract.

11 Anti-Bribery

11.1 The Client warrants that it shall:

(i) comply with all applicable laws, statutes and regulations relating to anti-bribery and anti-corruption including but not limited to the Bribery Act 2010;

(ii) comply with such of GroundSure's anti-bribery and anti-corruption policies as are notified to the Client from time to time; and

(iii) promptly report to GroundSure any request or demand for any undue financial or other advantage of any kind received by or on behalf of the Client in connection with the performance of this Contract.

11.2 Breach of this Clause 11 shall be deemed a material breach of this Contract.

12 General

12.1 The Mapping contained in the Services is protected by Crown copyright and must not be used for any purpose other than as part of the Services or as specifically provided in the Contract.

12.2 The Client shall be permitted to make one copy only of each Report or Mapping Order. Thereafter the Client shall be entitled to make unlimited copies of the Report or Mapping Order only in accordance with an Ordnance Survey paper map copy license available through GroundSure.

12.3 GroundSure reserves the right to amend or vary this Contract. No amendment or variation to this Contract shall be valid unless signed by an authorised representative of GroundSure.

12.4 No failure on the part of GroundSure to exercise, and no delay in exercising, any right, power or provision under this Contract shall operate as a waiver thereof.

12.5 Save as expressly provided in this Contract, no person other than the persons set out therein shall have any right under the Contract (Rights of Third Parties) Act 1999 to enforce any terms of the Contract.

12.6 The Secretary of State for Business, Innovation and Skills ("BIS") or BIS' successor body, as the case may be, acting through Ordnance Survey may enforce a breach of clause 6.4(vi) and clause 6.4(vii) of these terms and conditions against the Client in accordance with the provisions of the Contracts (Rights of Third Parties) Act 1999.

12.7 GroundSure shall not be liable to the Client if the provision of the Services is delayed or prevented by one or more of the following circumstances:

(i) the Client or Beneficiary's failure to provide facilities, access or information;

(ii) fire, storm, flood, tempest or epidemic;

(iii) Acts of God or the public enemy;

(iv) riot, civil commotion or war;

(v) strikes, labour disputes or industrial action;

(vi) acts or regulations of any governmental or other agency;

(vii) suspension or delay of services at public registries by Third Party Data Providers;

(viii) changes in law; or

(ix) any other reason beyond GroundSure's reasonable control.

In the event that GroundSure is prevented from performing the Services (or any part thereof) in accordance with this clause 12.6 for a period of not less than 30 days then GroundSure shall be entitled to terminate this Contract immediately on written notice to the Client.

12.8 Any notice provided shall be in writing and shall be deemed to be properly

given if delivered by hand or sent by first class post, facsimile or by email to the address, facsimile number or email address of the relevant party as may have been notified by each party to the other for such purpose or in the absence of such notification the last known address.

12.9 Such notice shall be deemed to have been received on the day of delivery if delivered by hand, facsimile or email (save to the extent such day is not a working day where it shall be deemed to have been delivered on the next working day) and on the second working day after the day of posting if sent by first class post.

12.10 The Contract constitutes the entire agreement between the parties and shall supersede all previous arrangements between the parties relating to the subject matter hereof.

12.11 Each of the provisions of the Contract is severable and distinct from the others and if one or more provisions is or should become invalid, illegal or unenforceable, the validity and enforceability of the remaining provisions shall not in any way be tainted or impaired.

12.12 This Contract shall be governed by and construed in accordance with English law and any proceedings arising out of or connected with this Contract shall be subject to the exclusive jurisdiction of the English courts.

12.13 GroundSure is an executive member of the Council of Property Search Organisation (CoPSO) and has signed up to the Search Code administered by the Property Codes Compliance Board (PCCB). All Risk Screening Reports shall be supplied in accordance with the provisions of the Search Code.

12.14 If the Client or Beneficiary has a complaint about the Services, written notice should be given to the Compliance Officer at GroundSure who will respond in a timely manner.

12.15 The Client agrees that it shall, and shall procure that each Beneficiary shall, treat in confidence all Confidential Information and shall not, and shall procure that each Beneficiary shall not (i) disclose any Confidential Information to any third party other than in accordance with the terms of this Contract; and (ii) use Confidential Information for a purpose other than the exercise of its rights and obligations under this Contract. Subject to clause 6.6, nothing shall prevent the Client or any Beneficiary from disclosing Confidential Information to the extent required by law

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Hydrock Consultants Ltd

2-4 Hawthorn Park, Holdenby Road,
Northampton, NN6 8LD

GroundSure Reference:	HYDNOR-1981473
Your Reference:	N7425C151171
Report Date	25 Mar 2015
Report Delivery Method:	Email - pdf

GroundSure EnviroInsight

Address: 473662, 254753,

Dear Sir/ Madam,

Thank you for placing your order with GroundSure. Please find enclosed the **GroundSure Enviroinsight** as requested.

If you need any further assistance, please do not hesitate to contact our helpline on 01604 842 888 quoting the above report reference number.

Yours faithfully,

Hydrock

Enc.
GroundSure EnviroInsight

GroundSure EnviroInsight

Address:	**473662, 254753,**
Date:	**25 Mar 2015**
Reference:	**HYDNOR-1981473**
Client:	**Hydrock Consultants Ltd**

NW N NE



W E

SW S SE

Aerial Photograph Capture date:	24-Jul-2012
Grid Reference:	472974,255025
Site Size:	260.07ha

Contents Page

Contents Page 3
Overview of Findings 5
Using this report 9
1. Environmental Permits, Incidents and Registers Map 10
1. Environmental Permits, Incidents and Registers 11
1.1 Industrial Sites Holding Licences and/or Authorisations 11
1.1.1 Records of historic IPC Authorisations within 500m of the study site: 11
1.1.2 Records of Part A(1) and IPPC Authorised Activities within 500m of the study site: 11
1.1.3 Records of Water Industry Referrals (potentially harmful discharges to the public sewer) within 500m of the study site: 11
1.1.4 Records of Red List Discharge Consents (potentially harmful discharges to controlled waters) within 500m of the study site: 11
1.1.5 Records of List 1 Dangerous Substances Inventory Sites within 500m of the study site: 11
1.1.6 Records of List 2 Dangerous Substance Inventory Sites within 500m of the study site: 12
1.1.7 Records of Part A(2) and Part B Activities and Enforcements within 500m of the study site: 12
1.1.8 Records of Category 3 or 4 Radioactive Substances Authorisations: 12
1.1.9 Records of Licensed Discharge Consents within 500m of the study site: 13
1.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site: 14
1.2 Dangerous or Hazardous Sites 14
1.3 Environment Agency Recorded Pollution Incidents 15
1.3.1 Records of National Incidents Recording System, List 2 within 500m of the study site: 15
1.3.2 Records of National Incidents Recording System, List 1 within 500m of the study site: 15
1.4 Sites Determined as Contaminated Land under Part 2A EPA 1990 15
2. Landfill and Other Waste Sites Map 16
2. Landfill and Other Waste Sites 17
2.1 Landfill Sites 17
2.1.1 Records from Environment Agency landfill data within 1000m of the study site: 17
2.1.2 Records of Environment Agency historic landfill sites within 1500m of the study site: 17
2.1.3 Records of BGS/DoE non-operational landfill sites within 1500m of the study site: 18
2.1.4 Records of Local Authority landfill sites within 1500m of the study site: 19
2.2 Other Waste Sites 19
2.2.1 Records of waste treatment, transfer or disposal sites within 500m of the study site: 19
2.2.2 Records of Environment Agency licensed waste sites within 1500m of the study site: 19
3. Current Land Use Map 21
3. Current Land Uses 22
3.1 Current Industrial Data 22
3.2 Petrol and Fuel Sites 23
3.3 Underground High Pressure Oil and Gas Pipelines 24
4. Geology 25
4.1 Artificial Ground and Made Ground 25
4.2 Superficial Ground and Drift Geology 25
4.3 Bedrock and Solid Geology 25
5. Hydrogeology and Hydrology 26
5a. Aquifer Within Superficial Geology 26
5b. Aquifer Within Bedrock Geology and Abstraction Licenses 27
5c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licenses 28
5d. Hydrology Source Protection Zones within confined aquifer 29
5 e. Hydrology – Detailed River Network and River Quality 30
5. Hydrogeology and Hydrology 31
5.1 Aquifer within Superficial Deposits 31
5.2 Aquifer within Bedrock Deposits 32

5.3 Groundwater Abstraction Licences....33
5.4 Surface Water Abstraction Licences....33
5.5 Potable Water Abstraction Licences....34
5.6 Source Protection Zones....34
5.7 Source Protection Zones within Confined Aquifer....35
5.8 Groundwater Vulnerability and Soil Leaching Potential....36
5.9 River Quality....36
5.9.1 Biological Quality:....36
5.9.2 Chemical Quality:....37
5.10 Detailed River Network....38
5.11 Surface Water Features....41
6. Environment Agency Flood Map for planning (from rivers and the sea)....42
6. Flooding....43
6.1 Zone 2 Flooding....43
6.2 Zone 3 Flooding....43
6.3 Flood Defences....43
6.4 Areas benefiting from Flood Defences....43
6.5 Areas benefiting from Flood Storage....44
6.6 Groundwater Flooding Susceptibility Areas....44
6.6.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site?....44
6.6.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?....44
6.7 Groundwater Flooding Confidence Areas....44
7. Designated Environmentally Sensitive Sites Map....45
7. Designated Environmentally Sensitive Sites....46
7.1 Records of Sites of Special Scientific Interest (SSSI) within 2000m of the study site:....46
7.2 Records of National Nature Reserves (NNR) within 2000m of the study site:....46
7.3 Records of Special Areas of Conservation (SAC) within 2000m of the study site:....46
7.4 Records of Special Protection Areas (SPA) within 2000m of the study site:....46
7.5 Records of Ramsar sites within 2000m of the study site:....46
7.6 Records of Ancient Woodland within 2000m of the study site:....47
7.7 Records of Local Nature Reserves (LNR) within 2000m of the study site:....47
7.8 Records of World Heritage Sites within 2000m of the study site:....47
7.9 Records of Environmentally Sensitive Areas within 2000m of the study site:....47
7.10 Records of Areas of Outstanding Natural Beauty (AONB) within 2000m of the study site:....47
7.11 Records of National Parks (NP) within 2000m of the study site:....47
7.12 Records of Nitrate Sensitive Areas within 2000m of the study site:....47
7.13 Records of Nitrate Vulnerable Zones within 2000m of the study site:....48
7.14 Records of Green Belt land within 2000m of the study site:....48
8. Natural Hazards Findings....49
8.1 Detailed BGS GeoSure Data....49
8.1.1 Shrink Swell....49
8.1.2 Landslides....49
8.1.3 Soluble Rocks....50
8.1.4 Compressible Ground....50
8.1.5 Collapsible Rocks....50
8.1.6 Running Sand....51
9. Mining....52
9.1 Coal Mining....52
9.2 Shallow Mining....52
9.3 Brine Affected Areas....52
Contact Details....53
Standard Terms and Conditions....54

Overview of Findings

For further details on each dataset, please refer to each individual section in the main report as listed. Where the database has been searched a numerical result will be recorded. Where the database has not been searched '-' will be recorded.

Section 1: Environmental Permits, Incidents and Registers	On-site	0-50m	51-250	251-500
1.1 Industrial Sites Holding Environmental Permits and/or Authorisations				
1.1.1 Records of historic IPC Authorisations	0	0	0	0
1.1.2 Records of Part A(1) and IPPC Authorised Activities	0	0	0	0
1.1.3 Records of Water Industry Referrals (potentially harmful discharges to the public sewer)	0	0	0	0
1.1.4 Records of Red List Discharge Consents (potentially harmful discharges to controlled waters)	0	0	0	0
1.1.5 Records of List 1 Dangerous Substances Inventory sites	0	0	0	0
1.1.6 Records of List 2 Dangerous Substances Inventory sites	1	0	0	0
1.1.7 Records of Part A(2) and Part B Activities and Enforcements	0	1	1	0
1.1.8 Records of Category 3 or 4 Radioactive Substances Authorisations	0	0	0	0
1.1.9 Records of Licensed Discharge Consents	5	0	5	4
1.1.10 Records of Planning Hazardous Substance Consents and Enforcements	0	0	0	0
1.2 Records of COMAH and NIHHS sites	0	0	0	0
1.3 Environment Agency Recorded Pollution Incidents				
1.3.1 National Incidents Recording System, List 2	1	0	1	1
1.3.2 National Incidents Recording System, List 1	0	0	0	0
1.4 Sites Determined as Contaminated Land under Part 2A EPA 1990	0	0	0	1

Section 2: Landfill and Other Waste Sites	On-site	0-50m	51-250	251-500	501-1000	1000-5000
2.1 Landfill Sites						
2.1.1 Environment Agency Registered Landfill Sites	0	1	0	0	0	Not searched
2.1.2 Environment Agency Historic Landfill Sites	2	0	2	2	2	1
2.1.3 BGS/DoE Landfill Site Survey	0	0	0	0	1	0
2.1.4 GroundSure Local Authority Landfill Sites Data	0	0	0	0	0	0
2.2 Landfill and Other Waste Sites Findings						
2.2.1 Operational and Non-Operational Waste Treatment, Transfer and Disposal Sites	0	0	1	0	Not searched	Not searched
2.2.2 Environment Agency Licensed Waste Sites	0	0	2	1	0	0

Section 3: Current Land Use

	On-site	0-50m	51-250	251-500
3.1 Current Industrial Sites Data	3	8	19	Not searched
3.2 Records of Petrol and Fuel Sites	2	0	0	0
3.3 Underground High Pressure Oil and Gas Pipelines	2	0	2	0

Section 4: Geology

4.1 Are there any records of Artificial Ground and Made Ground present beneath the study site?	No
4.2 Are there any records of Superficial Ground and Drift Geology present beneath the study site?	Yes
4.3 For records of Bedrock and Solid Geology beneath the study site see the detailed findings section.	

Section 5: Hydrogeology and Hydrology

	0-500m
5.1 Are there any records of Strata Classification in the Superficial Geology within 500m of the study site?	Yes
5.2 Are there any records of Strata Classification in the Bedrock Geology within 500m of the study site?	Yes

	On-site	0-50m	51-250	251-500	501-1000	1000-2000
5.3 Groundwater Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	0
5.4 Surface Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	6
5.5 Potable Water Abstraction Licences (within 2000m of the study site)	0	0	0	0	0	0
5.6 Source Protection Zones (within 500m of the study site)	0	0	0	0	Not searched	Not searched
5.7 Source Protection Zones within Confined Aquifer	0	0	0	0	Not searched	Not searched
5.8 Groundwater Vulnerability and Soil Leaching Potential (within 500m of the study site)	3	0	2	3	Not searched	Not searched

	On-site	0-50m	51-250	251-500	501-1000	1000-1500
5.9 Is there any Environment Agency information on river quality within 1500m of the study site?	No	No	No	No	No	No
5.10 Detailed River Network entries within 500m of the site	11	4	9	3	Not searched	Not searched
5.11 Surface water features within 250m of the study site	Yes	Yes	Yes	Not searched	Not searched	Not searched

Section 6: Flooding

6.1 Are there any Environment Agency Zone 2 floodplains within 250m of the study site?	Yes
6.2 Are there any Environment Agency Zone 3 floodplains within 250m of the study site?	Yes
6.3 Are there any Flood Defences within 250m of the study site?	No
6.4 Are there any areas benefiting from Flood Defences within 250m of the study site?	No
6.5 Are there any areas used for Flood Storage within 250m of the study site?	No
6.6 What is the maximum BGS Groundwater Flooding susceptibility within 50m of the study site?	Potential at Surface
6.7 What is the BGS confidence rating for the Groundwater Flooding susceptibility areas?	High

Section 7: Designated Environmentally Sensitive Sites

	On-site	0-50m	51-250	251-500	501-1000	1000-2000
7.1 Records of Sites of Special Scientific Interest (SSSI)	0	0	0	1	0	1
7.2 Records of National Nature Reserves (NNR)	0	0	0	0	0	0
7.3 Records of Special Areas of Conservation (SAC)	0	0	0	0	0	0
7.4 Records of Special Protection Areas (SPA)	0	0	0	0	0	0
7.5 Records of Ramsar sites	0	0	0	0	0	0
7.6 Records of Ancient Woodlands	0	0	0	0	0	0
7.7 Records of Local Nature Reserves (LNR)	0	0	0	0	0	0
7.8 Records of World Heritage Sites	0	0	0	0	0	0
7.9 Records of Environmentally Sensitive Areas	0	0	0	0	0	0
7.10 Records of Areas of Outstanding Natural Beauty (AONB)	0	0	0	0	0	0
7.11 Records of National Parks	0	0	0	0	0	0
7.12 Records of Nitrate Sensitive Areas	0	0	0	0	0	0
7.13 Records of Nitrate Vulnerable Zones	1	0	0	0	1	1
7.14 Records of Green Belt Data	0	0	0	0	0	0

Section 8: Natural Hazards

8.1 What is the maximum risk of natural ground subsidence?	Moderate
8.1.1 What is the maximum Shrink-Swell hazard rating identified on the study site?	Low
8.1.2 What is the maximum Landslides hazard rating identified on the study site?	Moderate
8.1.3 What is the maximum Soluble Rocks hazard rating identified on the study site?	Very Low
8.1.4 What is the maximum Compressible Ground hazard rating identified on the study site?	Moderate
8.1.5 What is the maximum Collapsible Rocks hazard rating identified on the study site?	Very Low
8.1.6 What is the maximum Running Sand hazard rating identified on the study site?	Low

Section 9: Mining

9.1 Are there any coal mining areas within 75m of the study site?	No
9.2 What is the risk of subsidence relating to shallow mining within 150m of the study site?	Low
9.3 Are there any brine affected areas within 75m of the study site?	No

Using this report

The following report is designed by Environmental Consultants for Environmental Professionals bringing together the most up-to-date market leading environmental data. This report is provided under and subject to the Terms & Conditions agreed between GroundSure and the Client. The document contains the following sections:

1. Environmental Permits, Incidents and Registers

Provides information on Regulated Industrial Activities and Pollution Incidents as recorded by Regulatory Authorities, and sites determined as Contaminated Land. This search is conducted using radii up to 500m.

2. Landfills and Other Waste Sites

Provides information on landfills and other waste sites that may pose a risk to the study site. This search is conducted using radii up to 1500m.

3. Current Land Uses

Provides information on current land uses that may pose a risk to the study site in terms of potential contamination from activities or processes. These searches are conducted using radii of up to 500m. This includes information on potentially contaminative industrial sites, petrol stations and fuel sites as well as high pressure underground oil and gas pipelines.

4. Geology

Provides information on artificial and superficial deposits and bedrock beneath the study site.

5. Hydrogeology and Hydrology

Provides information on productive strata within the bedrock and superficial geological layers, abstraction licenses, Source Protection Zones (SPZs) and river quality. These searches are conducted using radii of up to 2000m.

6. Flooding

Provides information on surface water flooding, flood defences, flood storage areas and groundwater flood areas. This search is conducted using radii of up to 250m.

7. Designated Environmentally Sensitive Sites

Provides information on the Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR), Special Areas of Conservation (SAC), Special Protection Areas (SPA), Ramsar sites, Local Nature Reserves (LNR), Areas of Outstanding Natural Beauty (AONB), National Parks (NP), Environmentally Sensitive Areas, Nitrate Sensitive Areas, Nitrate Vulnerable Zones and World Heritage Sites and Scheduled Ancient Woodland. These searches are conducted using radii of up to 2000m.

8. Natural Hazards

Provides information on a range of natural hazards that may pose a risk to the study site. These factors include natural ground subsidence.

9. Mining

Provides information on areas of coal and shallow mining.

10. Contacts

This section of the report provides contact points for statutory bodies and data providers that may be able to provide further information on issues raised within this report. Alternatively, GroundSure provide a free Technical Helpline (08444 159000) for further information and guidance.

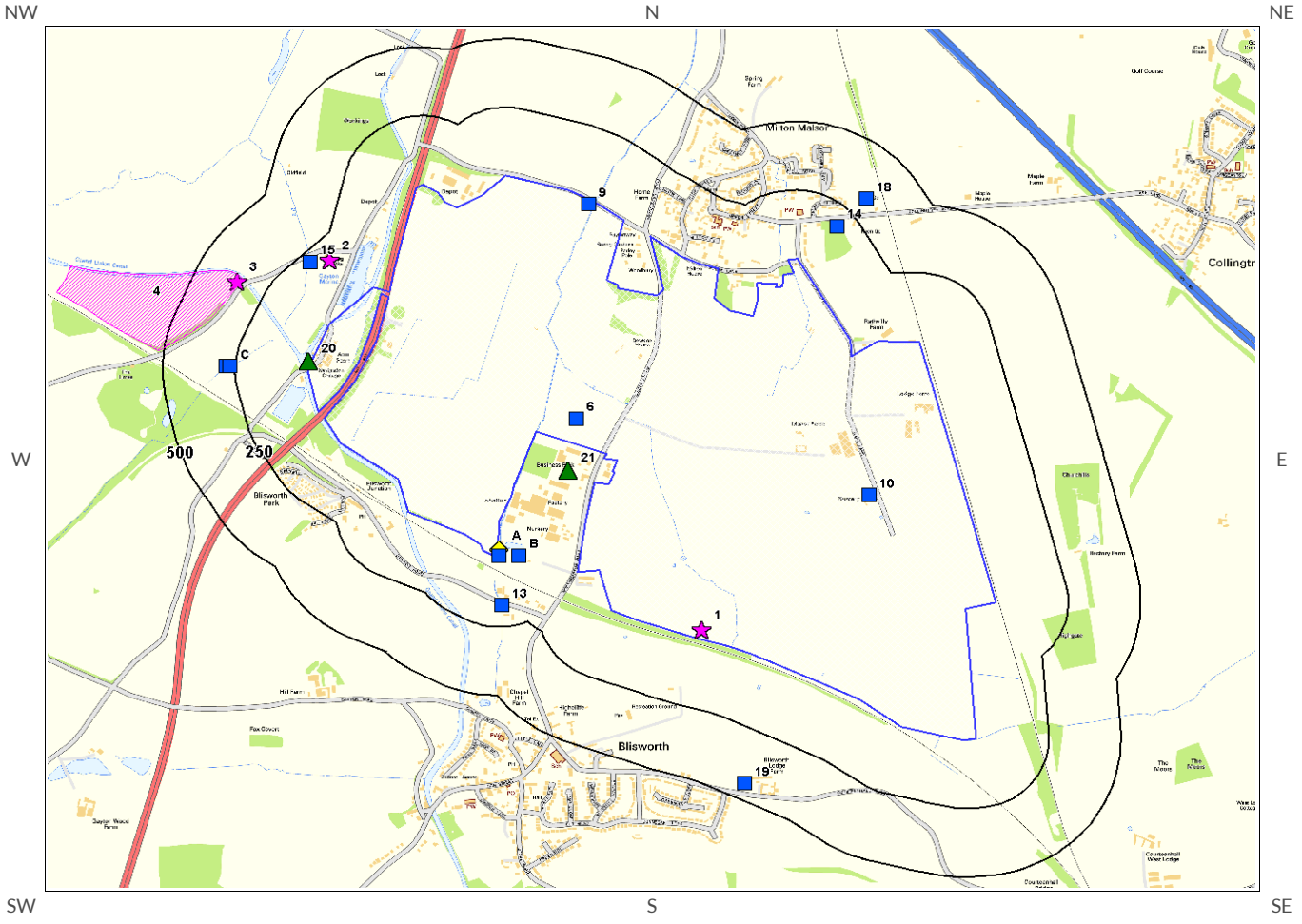
Note: Maps

Only certain features are placed on the maps within the report. All features represented on maps found within this search are given an identification number. This number identifies the feature on the mapping and correlates it to the additional information provided below. This identification number precedes all other information and takes the following format -Id: 1, Id: 2, etc. Where numerous features on the same map are in such close proximity that the numbers would obscure each other a letter identifier is used instead to represent the features. (e.g. Three features which overlap may be given the identifier “A” on the map and would be identified separately as features 1A, 3A, 10A on the data tables provided).

Where a feature is reported in the data tables to a distance greater than the map area, it is noted in the data table as “Not Shown”.

All distances given in this report are in Metres (m). Directions are given as compass headings such as N: North, E: East, NE: North East from the nearest point of the study site boundary.

1. Environmental Permits, Incidents and Registers Map



Environmental Permits, Incidents and Registers Legend

Mapping sourced from Ordnance Survey

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- Site Outline
- Search Buffers (m) 250 500
- Recorded Pollution Incident
- Dangerous Substances (List 1)
- Dangerous Substances (List 2)
- Water Industry Referrals
- Licenced Discharge Consents
- Red List Discharge Consents
- RAS 3 & 4 Authorisations
- Part A(1) Authorised Processes and Historic IPC Authorisations
- Part A(2) and Part B Authorised Processes
- COMAH / NIHHS Sites
- Sites Determined as Contaminated Land
- Hazardous Substance Consents and Enforcements



1. Environmental Permits, Incidents and Registers

1.1 Industrial Sites Holding Licences and/or Authorisations

Searches of information provided by the Environment Agency and Local Authorities reveal the following information:

1.1.1 Records of historic IPC Authorisations within 500m of the study site:

0

Database searched and no data found.

1.1.2 Records of Part A(1) and IPPC Authorised Activities within 500m of the study site:

0

Database searched and no data found.

1.1.3 Records of Water Industry Referrals (potentially harmful discharges to the public sewer) within 500m of the study site:

0

Database searched and no data found.

1.1.4 Records of Red List Discharge Consents (potentially harmful discharges to controlled waters) within 500m of the study site:

0

Database searched and no data found.

1.1.5 Records of List 1 Dangerous Substances Inventory Sites within 500m of the study site:

0

Database searched and no data found.

1.1.6 Records of List 2 Dangerous Substance Inventory Sites within 500m of the study site:

1

The following List 2 Dangerous Substance Inventory Site records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance	Direction	NGR	Details	
5A	0.0	On Site	472630 254320	Name: Agri Energy/fryers Status: Not Active Receiving Water: Na	Authorised Substances: pH

1.1.7 Records of Part A(2) and Part B Activities and Enforcements within 500m of the study site:

2

The following Part A(2) and Part B Activities are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance	Direction	NGR	Details	
20	7.0	NW	471973 255003	Address: Blisworth Service Station, A43 By-pass, Blisworth Arm, Northamptonshire, NN7 3EF Process: Petrol Vapour Recovery Process Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcement Notified Date of Enforcement: No Enforcement Notified Comment: No Enforcement Notified
21	99.0	NW	472870 254605	Address: Anglos Beef Processors Ltd, Northampton Road, Blisworth, Northampton, NN7 3DR Process: Pet Food/rendering/animals/plant Treatment Process Status: Historical Permit Permit Type: Part B	Enforcement: No Enforcement Notified Date of Enforcement: No Enforcement Notified Comment: No Enforcement Notified

1.1.8 Records of Category 3 or 4 Radioactive Substances Authorisations:

0

Database searched and no data found.

1.1.9 Records of Licensed Discharge Consents within 500m of the study site:

14

The following Licensed Discharge Consents records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance	Direction	NGR	Details	
6	0.0	On Site	472900 254800	Address: Filling Station, Northampton Rd, Blisworth, Northants Effluent Type: Trade Discharges - Unspecified Permit Number: PR5LF3880 Permit Version: 1	Receiving Water: Land Status: Pre Nra Legislation Where Issue Date < 01-sep-89 (historic Only) Issue date: 16/2/1983 Effective Date: 16/2/1983 Revocation Date: 1/10/1996
7A	0.0	On Site	472630 254300	Address: Manhole No 6201, Blisworth, Northamptonshire Effluent Type: Sewage Discharges - Stw Storm Overflow/storm Tank - Water Company Permit Number: AWNNF10290 Permit Version: 2	Receiving Water: Blisworth Arm Of Wootton Brook Status: Post Nra Legislation Where Issue Date > 31-aug-89 (historic Only) Issue date: 19/7/1995 Effective Date: 19/7/1995 Revocation Date: -
8A	0.0	On Site	472630 254300	Address: Manhole No 6201, Blisworth, Northamptonshire Effluent Type: Sewage Discharges - Stw Storm Overflow/storm Tank - Water Company Permit Number: AWNNF10290 Permit Version: 1	Receiving Water: Blisworth Arm Of Wootton Brook Status: Post Nra Legislation Where Issue Date > 31-aug-89 (historic Only) Issue date: - Effective Date: - Revocation Date: 18/7/1995
9	0.0	On Site	472940 255580	Address: Gayton Rd, Milton Malsor Effluent Type: Sewage Discharges - Final/treated Effluent - Not Water Company Permit Number: PR5NF692 Permit Version: 1	Receiving Water: Trib Wootton Brook Status: Pre Nra Legislation Where Issue Date < 01-sep-89 (historic Only) Issue date: 6/11/1979 Effective Date: 6/11/1979 Revocation Date: -
10	0.0	On Site	473910 254520	Address: Roseacre Nursery, Barn Lane, Milton Malsor, Northampton, NN7 3AG Effluent Type: Unspecified Permit Number: PR5LF3401 Permit Version: 1	Receiving Water: Land Status: Pre Nra Legislation Where Issue Date < 01-sep-89 (historic Only) Issue date: 28/2/1977 Effective Date: 28/2/1977 Revocation Date: 1/10/1996
11 B	67.0	E	472700 254300	Address: Blisworth Stw, Station Road, Blisworth, Northampton, NN7 3DS Effluent Type: Unspecified Permit Number: AWNNF1019 Permit Version: 1	Receiving Water: Wooton Brook River Nene Nt Status: Post Nra Legislation Where Issue Date > 31-aug-89 (historic Only) Issue date: - Effective Date: - Revocation Date: -
12 B	67.0	E	472700 254300	Address: Blisworth Stw, Station Road, Blisworth, Northampton, NN7 3DS Effluent Type: Sewage Discharges - Sewer Storm Overflow - Water Company Permit Number: AWNNF1019 Permit Version: 1	Receiving Water: Wooton Brook River Nene Nt Status: Post Nra Legislation Where Issue Date > 31-aug-89 (historic Only) Issue date: - Effective Date: - Revocation Date: -
13	171.0	S	472640 254120	Address: Blisworth N'hampton, Blisworth, Northampton, NN7 Effluent Type: Trade Discharges - Process Effluent - Not Water Company Permit Number: PR5NF603 Permit Version: 1	Receiving Water: Trib Wootton Brook Status: Pre Nra Legislation Where Issue Date < 01-sep-89 (historic Only) Issue date: 11/4/1973 Effective Date: 11/4/1973 Revocation Date: 28/5/1993
14	182.0	NE	473800 255500	Address: Milton Football Club, Collingtree Road, Milton Malsor, Northampton Effluent Type: Unspecified Permit Number: PR5LF3756 Permit Version: 1	Receiving Water: Land Status: Pre Nra Legislation Where Issue Date < 01-sep-89 (historic Only) Issue date: 23/1/1981 Effective Date: 23/1/1981 Revocation Date: 1/10/1996

ID	Distance	Direction	NGR	Details	
15	213.0	NW	471980 255370	Address: Blisworth Booster Stn, Blisworth, Northampton, NN7 3ER Effluent Type: Miscellaneous Discharges - Surface Water Permit Number: PR5NF5345 Permit Version: 1	Receiving Water: Unknown Trib. Wootton Brook Status: Pre Nra Legislation Where Issue Date < 01-sep-89 (historic Only) Issue date: 23/5/1987 Effective Date: 23/5/1987 Revocation Date: -
16 C	270.0	W	471700 254990	Address: New Marina, Blisworth Arm, Blisworth, Northamptonshire, NN7 3EF Effluent Type: Sewage Discharges - Final/treated Effluent - Not Water Company Permit Number: PRNNF12924 Permit Version: 1	Receiving Water: Tributary Of Wootton Brook Status: New Consent (wra 91, S88 & Sched 10 As Amended By Env Act 1995) Issue date: 23/4/2003 Effective Date: 9/4/2003 Revocation Date: -
17 C	280.0	W	471690 254990	Address: Blisworth Arm Marina, Blisworth Arm, Blisworth, Northampton, Northamptonshire, NN7 3EF Effluent Type: Sewage Discharges - Final/treated Effluent - Not Water Company Permit Number: PRNNF18760 Permit Version: 1	Receiving Water: Trib Of Grand Union Canal Status: New Consent (wra 91, S88 & Sched 10 As Amended By Env Act 1995) Issue date: 26/6/2007 Effective Date: 26/6/2007 Revocation Date: -
18	323.0	NE	473900 255600	Address: Railway Cottages 1&2, Collingtree Road, Milton Malsor, Northampton, NN7 3AF Effluent Type: Unspecified Permit Number: PR5LF3004 Permit Version: 1	Receiving Water: Land Status: Pre Nra Legislation Where Issue Date < 01-sep-89 (historic Only) Issue date: 22/2/1966 Effective Date: 22/2/1966 Revocation Date: 31/7/1997
19	441.0	SW	473480 253470	Address: Blisworth Lodge Farm, Courteenhall Road, Blisworth Effluent Type: Unspecified Permit Number: PR5LF5187 Permit Version: 1	Receiving Water: Land Status: Pre Nra Legislation Where Issue Date < 01-sep-89 (historic Only) Issue date: 22/9/1986 Effective Date: 22/9/1986 Revocation Date: 17/9/1997

1.1.10 Records of Planning Hazardous Substance Consents and Enforcements within 500m of the study site: 0

Database searched and no data found.

1.2 Dangerous or Hazardous Sites

Records of COMAH & NIHHS sites within 500m of the study site: 0

Database searched and no data found.

1.3 Environment Agency Recorded Pollution Incidents

1.3.1 Records of National Incidents Recording System, List 2 within 500m of the study site: 3

The following NIRS List 2 records are represented as points on the Environmental Permits, Incidents and Registers Map:

ID	Distance	Direction	NGR	Details	
1	0.0	On Site	473330 254030	Incident Date: 03/08/2003 Incident Identification: 178641 Pollutant: Oils and Fuel Pollutant Description: Hydraulic Oils	Water Impact: Category 4 (No Impact) Land Impact: Category 3 (Minor) Air Impact: Category 4 (No Impact)
2	175.0	NW	472045 255377	Incident Date: 18/02/2003 Incident Identification: 137749 Pollutant: Sewage Materials Pollutant Description: Sludge	Water Impact: Category 3 (Minor) Land Impact: Category 3 (Minor) Air Impact: Category 4 (No Impact)
3	356.0	NW	471726 255298	Incident Date: 24/01/2006 Incident Identification: 372874 Pollutant: Specific Waste Materials Pollutant Description: Tyres	Water Impact: Category 4 (No Impact) Land Impact: Category 2 (Significant) Air Impact: Category 4 (No Impact)

1.3.2 Records of National Incidents Recording System, List 1 within 500m of the study site: 0

Database searched and no data found.

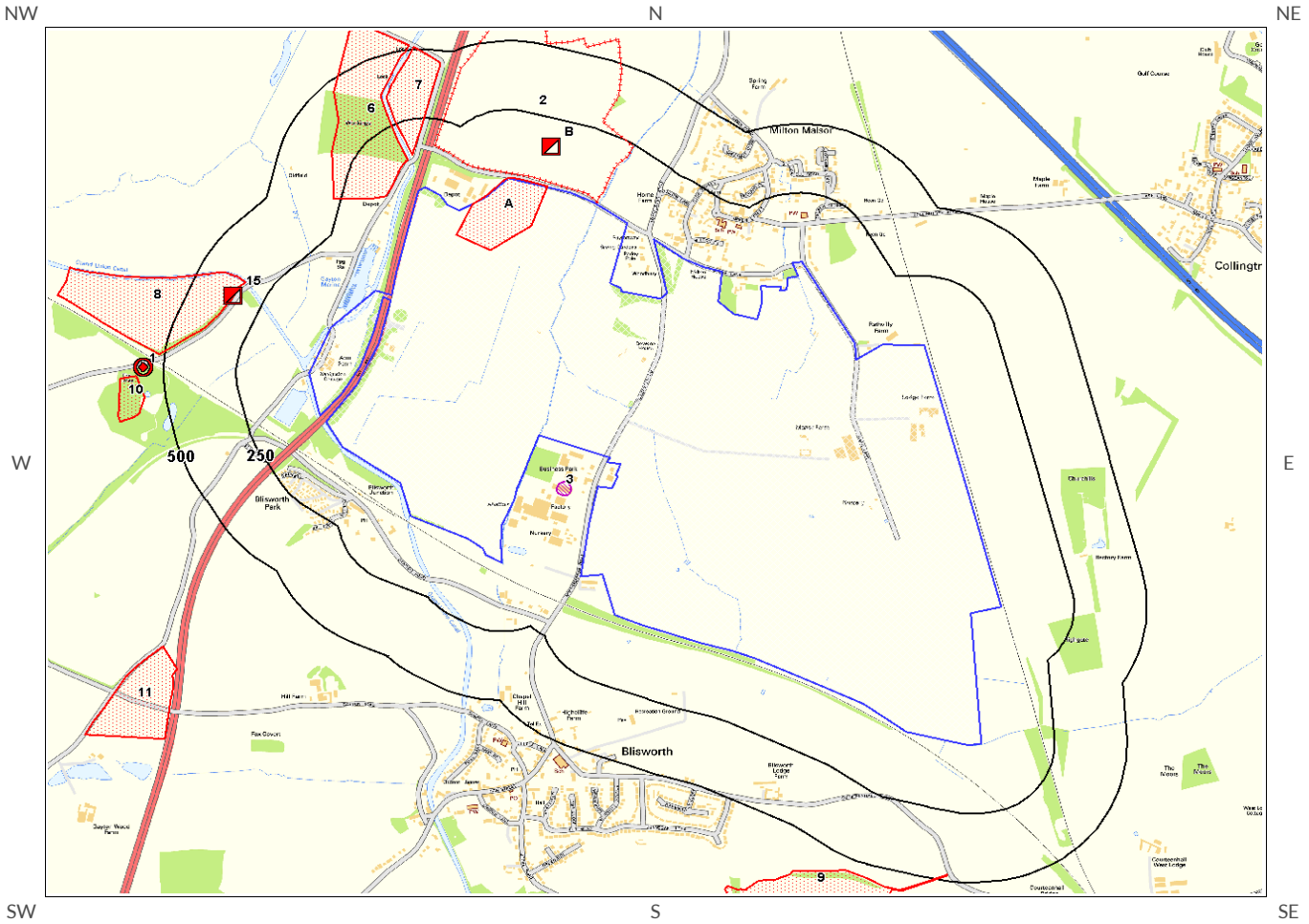
1.4 Sites Determined as Contaminated Land under Part 2A EPA 1990

How many records of sites determined as contaminated land under Section 78R of the Environmental Protection Act 1990 are there within 500m of the study site? 1

The following records are represented as polygons on the Environmental Permits, Incidents and Registers Map:

ID	Distance	Direction	NGR	Description	Location	Category	Year Identified
4	337.0	NW	471427 255203	Old Landfill	Gayton Landfill Site, Milton Road, Gayton	Contaminated Land	2010

2. Landfill and Other Waste Sites Map



Landfill and Other Waste Sites Legend

Mapping sourced from Ordnance Survey

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Site Outline

250
500
Search Buffers (m)

E.A. Active Landfill

E.A. Historic Landfill

Local Authority Landfill

Historic and Planned Waste Sites

E.A. Licensed Waste Site

BGS / DoE Survey Landfill



2. Landfill and Other Waste Sites

2.1 Landfill Sites

2.1.1 Records from Environment Agency landfill data within 1000m of the study site:

1

The following Environment Agency landfill records are represented as polygons on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details	
2	9.0	NE	472800 255800	Address: Weldon Plant Ltd, Milton Malsor, Northants, NN7 3AA Landfill Reference: 70648.0 Environmental Permitting Regulations (Waste) Reference: WEL001 Landfill Type: A5 : Landfill taking Non-Biodegradeable Wastes	Operator: Weldon Plant Ltd Status: Closure IPPC Reference: EPR Reference:

2.1.2 Records of Environment Agency historic landfill sites within 1500m of the study site:

9

The following landfill records are represented as either points or polygons on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details	
4A	0.0	On Site	472600 255500	Site Address: Gayton Road, Milton Malsor Waste Licence: Yes Site Reference: S/107 Waste Type: Inert Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: 24-Aug-1993 Licence Surrendered: 12-Aug-1997 Licence Hold Address: PO Box 33, Gayton Road, Milton Malsor, Northampton Operator: Galliford Roadstone
5A	0.0	On Site	725 557	Site Address: Gayton Road, Milton Malsor, Waste Licence: Yes Site Reference: 2800/0170 Waste Type: Inert Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: 24-Aug-1993 Licence Surrendered: Licence Hold Address: - Operator: GALLYFORD ROADSTONE
6	91.0	NW	472100 255900	Site Address: Milton Sand Pit, Milton Malsor and Gayton Waste Licence: Yes Site Reference: S/015 Waste Type: Inert Liquid sludge, Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: 02-Nov-1979 Licence Surrendered: Licence Hold Address: Little Billing, Northampton, Northamptonshire Operator: Mixconcrete Aggregates Limited

ID	Distance (m)	Direction	NGR	Details	
7	124.0	N	472300 255900	Site Address: Rothersthorpe, Milton Malsor, Northamptonshire Waste Licence: Yes Site Reference: S/022 Waste Type: Inert Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: 06-Aug-1980 Licence Surrendered: Licence Hold Address: Little Billing, Northampton Operator: -
8	335.0	NW	471400 255200	Site Address: Gayton Landfill Site, Milton Malsor Road, Gayton Waste Licence: - Site Reference: S/A, R4701 Waste Type: Inert, Industrial, Commercial, Household Liquid sludge, Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: Licence Surrendered: Licence Hold Address: - Operator: Northamptonshire County Council
9	477.0	S	473700 253000	Site Address: Blisworth Lodge Farm, Courteenhall Road, Blisworth Waste Licence: Yes Site Reference: S/026, 2800/5409 Waste Type: Inert Liquid sludge, Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: 02-Oct-1981 Licence Surrendered: 30-Sep-1991 Licence Hold Address: - Operator: Courteenhall Sand Limited
10	571.0	W	471300 254800	Site Address: Part OS 96, Gayton Waste Licence: - Site Reference: S/F Waste Type: Inert Household Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: Licence Surrendered: Licence Hold Address: - Operator: -
11	952.0	SW	471300 253700	Site Address: Tiffield Road Junctions, Blisworth, Gayton Waste Licence: Yes Site Reference: S/079 Waste Type: Inert Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: 11-Jul-1990 Licence Surrendered: 30-Jun-1992 Licence Hold Address: Lammas Road, Corby Operator: Weldon Plant Limited
Not shown	1181.0	S	472900 252700	Site Address: Tunnel Hill Farm, Stoke Road, Blisworth Waste Licence: Yes Site Reference: S/032, 2800/5408 Waste Type: Inert Environmental Permitting Regulations (Waste) Reference: -	Licence Issue: 01-Jul-1983 Licence Surrendered: 31-Dec-1984 Licence Hold Address: Foundation House, Eastern Road, Bracknell, Berkshire Operator: John Mowlem and Company Plc

2.1.3 Records of BGS/DoE non-operational landfill sites within 1500m of the study site:

1

The following landfill records are represented as points on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details	
1	570.0	W	471400.0 255000.0	Address: Milton Rd, Gayton, Northants BGS Number: 1130.0	Risk: No risk to aquifer Waste Type: N/A

2.1.4 Records of Local Authority landfill sites within 1500m of the study site:

0

Database searched and no data found.

2.2 Other Waste Sites

2.2.1 Records of waste treatment, transfer or disposal sites within 500m of the study site:

1

The following waste treatment, transfer or disposal sites records are represented as points on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details		
3	85.0	W	472846 254558	Type of Site: Recycling Centre Site Address: The Old Sewage Works, Northampton Road, Blisworth, NORTHAMPTON, Northamptonshire, NN7 3D	Planning Application Reference: S/2009/0792/PC Date: 01/05/2010	Further Details: Scheme comprises change of use to storage and transfer of hardcore waste and recycled aggregates. An application (ref: S/2009/0792/PC) for detailed planning permission was submitted to South Northamptonshire D.C. Data Source: Historic Planning Application Data Type: Point

2.2.2 Records of Environment Agency licensed waste sites within 1500m of the study site:

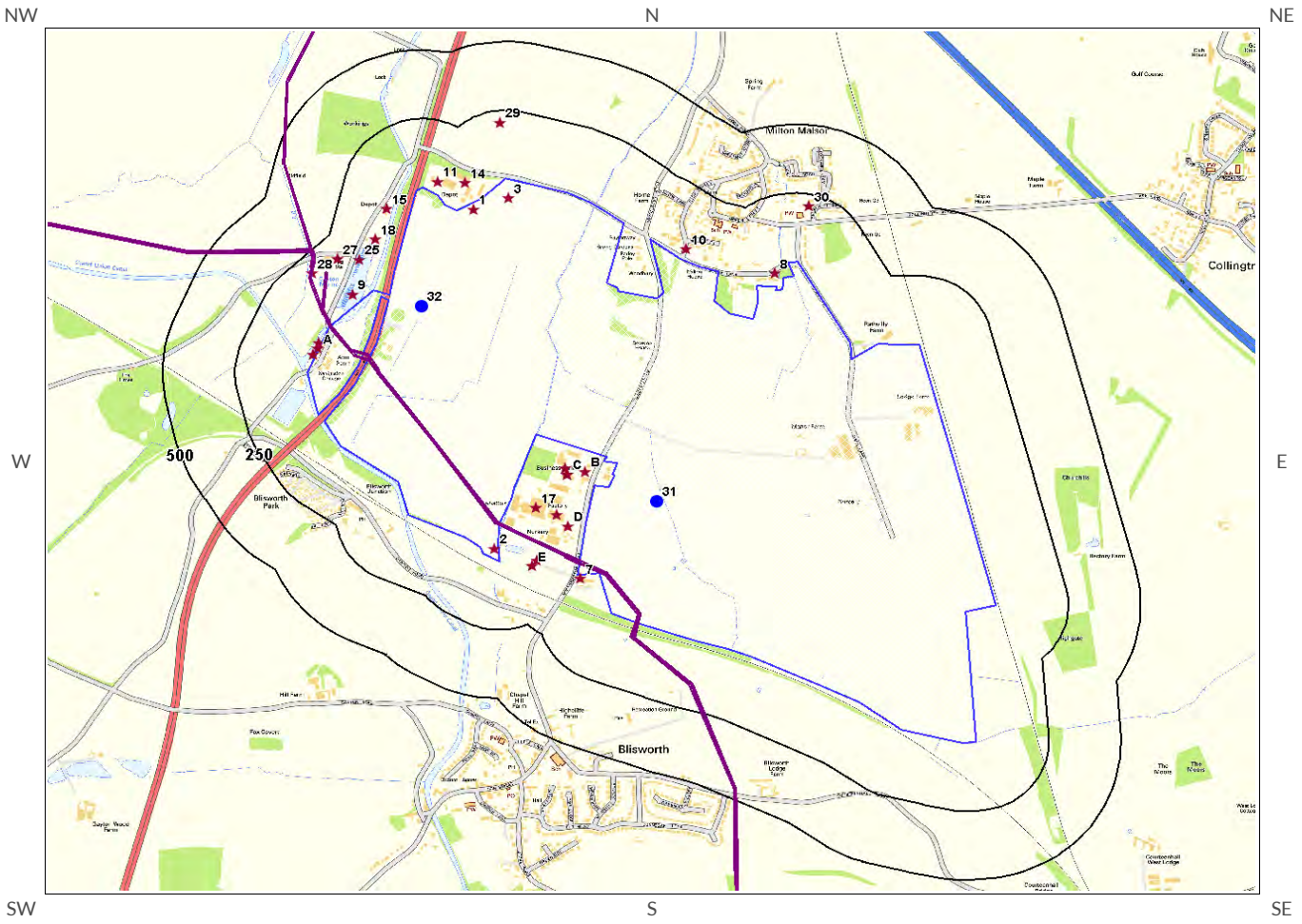
3

The following waste treatment, transfer or disposal sites records are represented as points on the Landfill and Other Waste Sites map:

ID	Distance (m)	Direction	NGR	Details	
13B	147.0	N	472800 255800	Site Address: Weldon Plant Ltd, Milton Malsor, Northants, NN7 3AA Type: Landfill taking Non-Biodegradeable Wastes Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: WEL001 EPR reference: EA/EPR/XP3395NA/A001 Operator: Weldon Plant Ltd Waste Management licence No: 70648 Annual Tonnage: 422955.0	Issue Date: 01/05/1990 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Closure Site Name: Milton Malsor Landfill Correspondence Address: -, -

ID	Distance (m)	Direction	NGR	Details	
14B	147.0	N	472800 255800	Site Address: Weldon Plant Ltd, Milton Malsor, Northants, NN7 3AA Type: Landfill taking Non-Biodegradeable Wastes Size: >= 75000 tonnes Environmental Permitting Regulations (Waste) Licence Number: WEL001 EPR reference: - Operator: Weldon Plant Ltd Waste Management licence No: 70648 Annual Tonnage: 0.0	Issue Date: 01/05/1990 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: Milton Malsor Landfill Correspondence Address: Weldon Plant Ltd, Lammas Road, Weldon Industrial Estate, Corby, Northants, NN17 1JF
15	357.0	NW	471707 255261	Site Address: X1 Type: Physical Treatment Facility Size: < 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: IPC037 EPR reference: EA/EPR/ZP3692ND/A001 Operator: Northamptonshire County Council Waste Management licence No: 73237 Annual Tonnage: 50000.0	Issue Date: 01/11/2004 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued Site Name: Gayton Landfill (post Op) Treatment Plant Correspondence Address: -, -

3. Current Land Use Map



Current Land Use Legend

Mapping sourced from Ordnance Survey

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Site Outline

250
500
Search Buffers (m)

Current Industrial Sites

Petrol & Fuel Sites

Underground High Pressure Oil & Fuel Pipelines



3. Current Land Uses

3.1 Current Industrial Data

Records of potentially contaminative industrial sites within 250m of the study site: 30

The following records are represented as points on the Current Land Uses map.

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
1	0.0	On Site	B S I Transport	472543 255572	Gayton Road, Milton Malsor, Northampton, NN7 3AB	Distribution and Haulage	Transport, Storage and Delivery
2	0.0	On Site	Filter Bed		NN7	Waste Storage, Processing and Disposal	Infrastructure and Facilities
3	0.0	On Site	Sand Pit		NN7	Sand, Gravel and Clay Extraction and Merchants	Extractive Industries
4A	4.0	NW	Depot		NN7	Container and Storage	Transport, Storage and Delivery
5A	9.0	NW	Grand Junction Boat Co	471989 255043	Blisworth Arm, Blisworth, Northampton, NN7 3EF	Marine Equipment Including Boats and Ships	Industrial Products
6A	10.0	NW	Crane		NN7	Travelling Cranes and Gantries	Industrial Features
7	14.0	S	James King Plant Ltd	254226	24, Northampton Road, Blisworth, Northampton, NN7 3DW	Construction and Tool Hire	Hire Services
8	34.0	NW	Electricity Sub Station		NN7	Electrical Features	Infrastructure and Facilities
9	37.0	NW	Jetty		NN7	Moorings and Unloading Facilities	Water
10	37.0	NE	Electricity Sub Station		NN7	Electrical Features	Infrastructure and Facilities
11	42.0	NE	Depot		NN7	Container and Storage	Transport, Storage and Delivery
12B	59.0	NW	Elite Caravans	472928 254616	Northampton Road, Blisworth, Northampton, NN7 3DW	New Vehicles	Motoring
13D	62.0	W	Tank		NN7	Tanks (Generic)	Industrial Features
14	75.0	NW	Depot		NN7	Container and Storage	Transport, Storage and Delivery
15	84.0	W	Depot		NN7	Container and Storage	Transport, Storage and Delivery
16B	87.0	S	Jbj Business Park		NN7	Business Parks and Industrial Estates	Industrial Features
17	92.0	E	Abattoir		NN7	Fish, Meat and Poultry Products	Foodstuffs
18	92.0	W	A B C Leisure Group Ltd	472205 255463	Gayton Marina, Blisworth Arm, Blisworth, Northampton, NN7 3ER	Boat Hiring Services	Hire Services
19C	102.0	NW	Echo Foods Ltd	472867 254606	Unit 22 J B J Business Park, Northampton Road, Blisworth, Northampton, NN7 3DW	Fish, Meat and Poultry Products	Foodstuffs

ID	Distance (m)	Direction	Company	NGR	Address	Activity	Category
20C	102.0	NW	C F M	472867 254606	Unit 7 J B J Business Park, Northampton Road, Blisworth, Northampton, NN7 3DW	Vehicle Repair, Testing and Servicing	Repair and Servicing
21C	102.0	NW	J & K Auto Products	472867 254606	Unit 24 J B J Business Park, Northampton Road, Blisworth, Northampton, NN7 3DW	Industrial Coatings and Finishings	Industrial Products
22C	102.0	NW	J B J Machinery	472867 254606	Unit 29 J B J Business Park, Northampton Road, Blisworth, Northampton, NN7 3DW	Agricultural Machinery and Goods	Industrial Products
23D	106.0	W	Factory		NN7	Unspecified Works Or Factories	Industrial Features
24E	114.0	E	Sewage Works		NN7	Waste Storage, Processing and Disposal	Infrastructure and Facilities
25	121.0	NW	Jetty		NN7	Moorings and Unloading Facilities	Water
26E	130.0	E	Works		NN7	Unspecified Works Or Factories	Industrial Features
27	167.0	NW	Pumping Station		NN7	Water Pumping Stations	Industrial Features
28	186.0	NW	Pumping Station		NN7	Water Pumping Stations	Industrial Features
29	205.0	N	Landfill Site		NN7	Refuse Disposal Facilities	Infrastructure and Facilities
30	206.0	N	Electricity Sub Station		NN7	Electrical Features	Infrastructure and Facilities

3.2 Petrol and Fuel Sites

Records of petrol or fuel sites within 500m of the study site: 2

The following petrol or fuel site records provided by Catalist are represented as points on the Current Land Use map:

ID	Distance (m)	Direction	NGR	Company	Address	LPG	Status
31	0.0	On Site	473175 254509	Obsolete	J B J Garage, Northampton Road, Northampton Road, Blisworth, Northampton, Northamptonshire, NN7 3DW	Not Applicable	Obsolete
32	0.0	On Site	472364 255220	Obsolete	Blisworth Service Station, Oxford Road, Oxford Road, Blisworth, Northampton, Northamptonshire, NN7 3EF	Not Applicable	Obsolete

3.3 Underground High Pressure Oil and Gas Pipelines

Records of high pressure underground pipelines within 500m of the study site: 4

The following Underground High Pressure Oil and Gas pipeline records provided by Linewatch are represented as linear features on the Current Land Use map:

ID	Distance (m)	Direction	Address	Operator	Telephone
33	0.0	On Site	Land And Wayleaves Department, BPA, 5-7 Alexandra Road, Hemel Hempstead, Hertfordshire, HP2 5BS	BPA pipelines	01442 242200
34	0.0	On Site	Land And Wayleaves Department, BPA, 5-7 Alexandra Road, Hemel Hempstead, Hertfordshire, HP2 5BS	BPA pipelines	01442 242200
35	200.0	NW	Land And Wayleaves Department, BPA, 5-7 Alexandra Road, Hemel Hempstead, Hertfordshire, HP2 5BS	BPA pipelines	01442 242200
36	203.0	NW	Land And Wayleaves Department, BPA, 5-7 Alexandra Road, Hemel Hempstead, Hertfordshire, HP2 5BS	BPA pipelines	01442 242200

4. Geology

4.1 Artificial Ground and Made Ground

Database searched and no data found.

The database has been searched on site, including a 50m buffer.

4.2 Superficial Ground and Drift Geology

The database has been searched on site, including a 50m buffer.

Lex Code	Description	Rock Type
ODT	OADBY MEMBER	DIAMICTON
ALV	ALLUVIUM	CLAY, SILT, SAND AND GRAVEL [UNLITHIFIED DEPOSITS CODING SCHEME]
GFDMP	GLACIOFLUVIAL DEPOSITS, MID PLEISTOCENE	SAND AND GRAVEL [UNLITHIFIED DEPOSITS CODING SCHEME]
ODT	OADBY MEMBER	DIAMICTON
GFDMP	GLACIOFLUVIAL DEPOSITS, MID PLEISTOCENE	SAND AND GRAVEL [UNLITHIFIED DEPOSITS CODING SCHEME]

4.3 Bedrock and Solid Geology

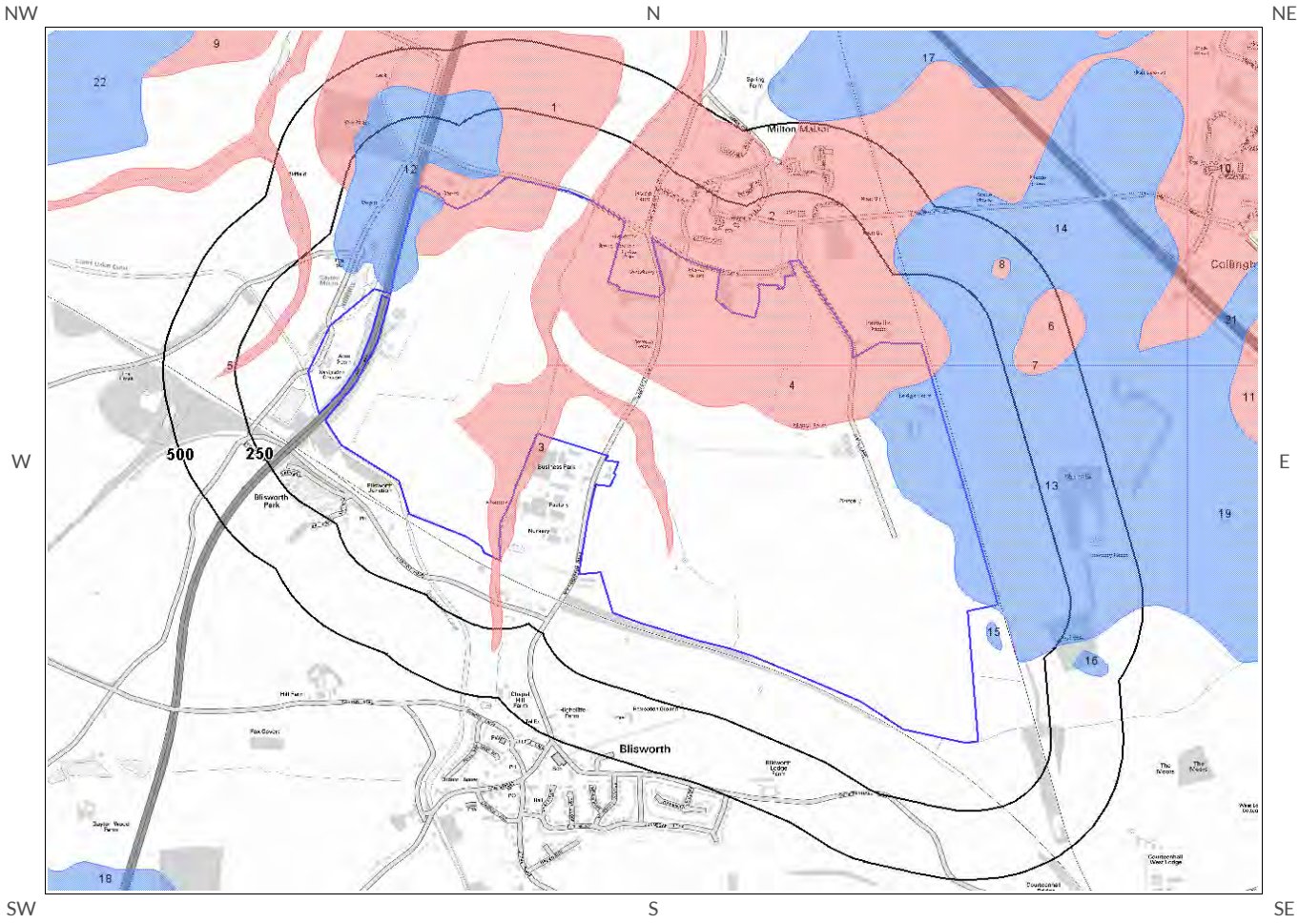
The database has been searched on site, including a 50m buffer.

Lex Code	Description	Rock Type
MRB-FLMST	MARLSTONE ROCK FORMATION	LIMESTONE, FERRUGINOUS
WHM-MDST	WHITBY MUDSTONE FORMATION	MUDSTONE
DYS-SIMD	DYRHAM FORMATION	SILTSTONE AND MUDSTONE, INTERBEDDED

(Derived from the BGS 1:50,000 Digital Geological Map of Great Britain)

5. Hydrogeology and Hydrology

5a. Aquifer Within Superficial Geology



Aquifer Within Superficial Geology

Mapping sourced from Ordnance Survey

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Site Outline

250
500
Search Buffers (m)

Principal Aquifer

Secondary (A) Aquifer - Permeable Layers

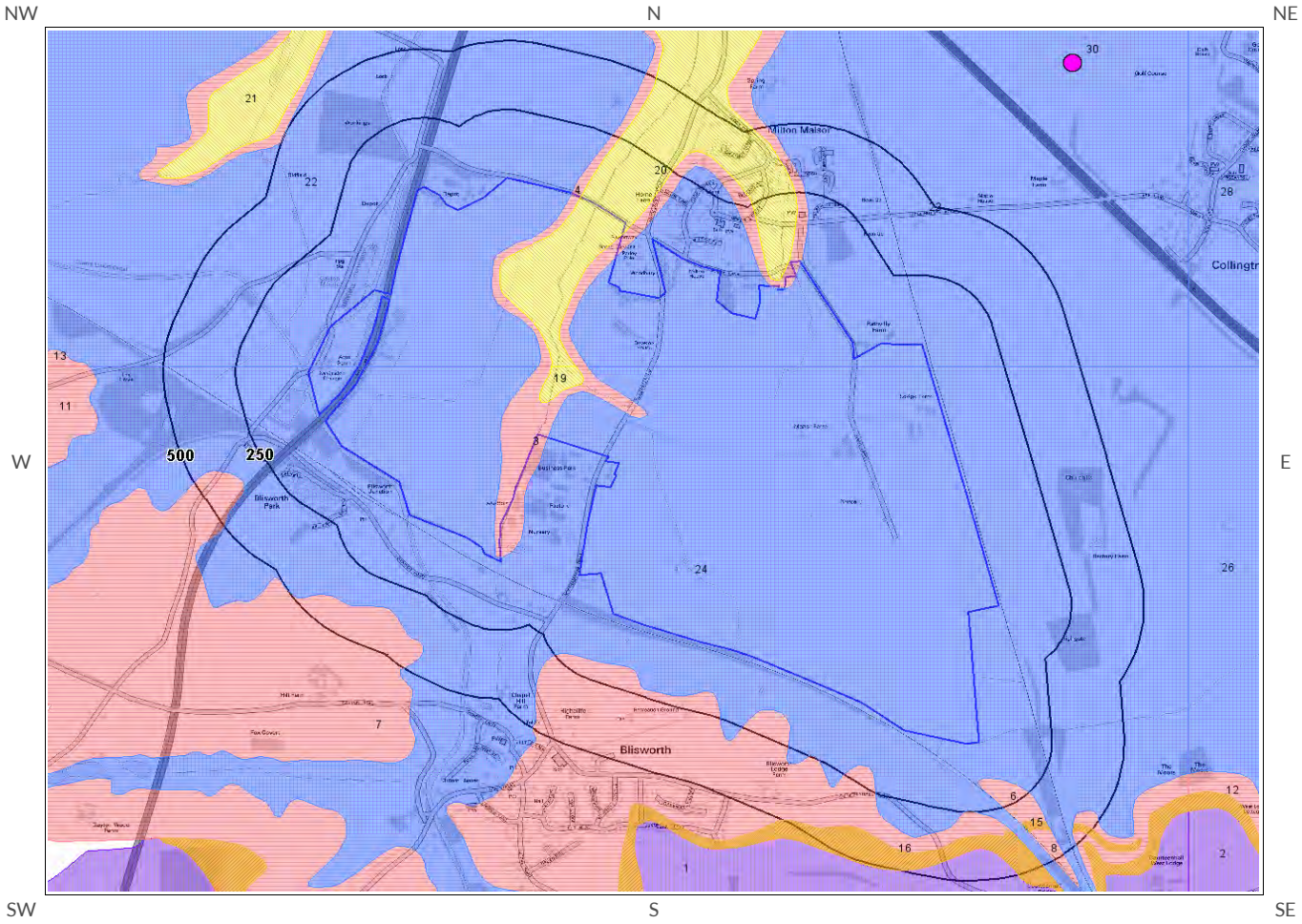
Secondary (B) Aquifer - Lower Permeability Layers

Secondary Aquifer - Undifferentiated Layers

Unproductive

Unknown (lakes and landslip)

5b. Aquifer Within Bedrock Geology and Abstraction Licenses



Aquifer Within Bedrock Geology and Abstraction Licenses

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Site Outline

250
500
Search Buffers (m)

Principal Aquifer

Secondary (A) Aquifer - Permeable Layers

Secondary (B) Aquifer - Lower Permeability Layers

Groundwater Abstraction Licence

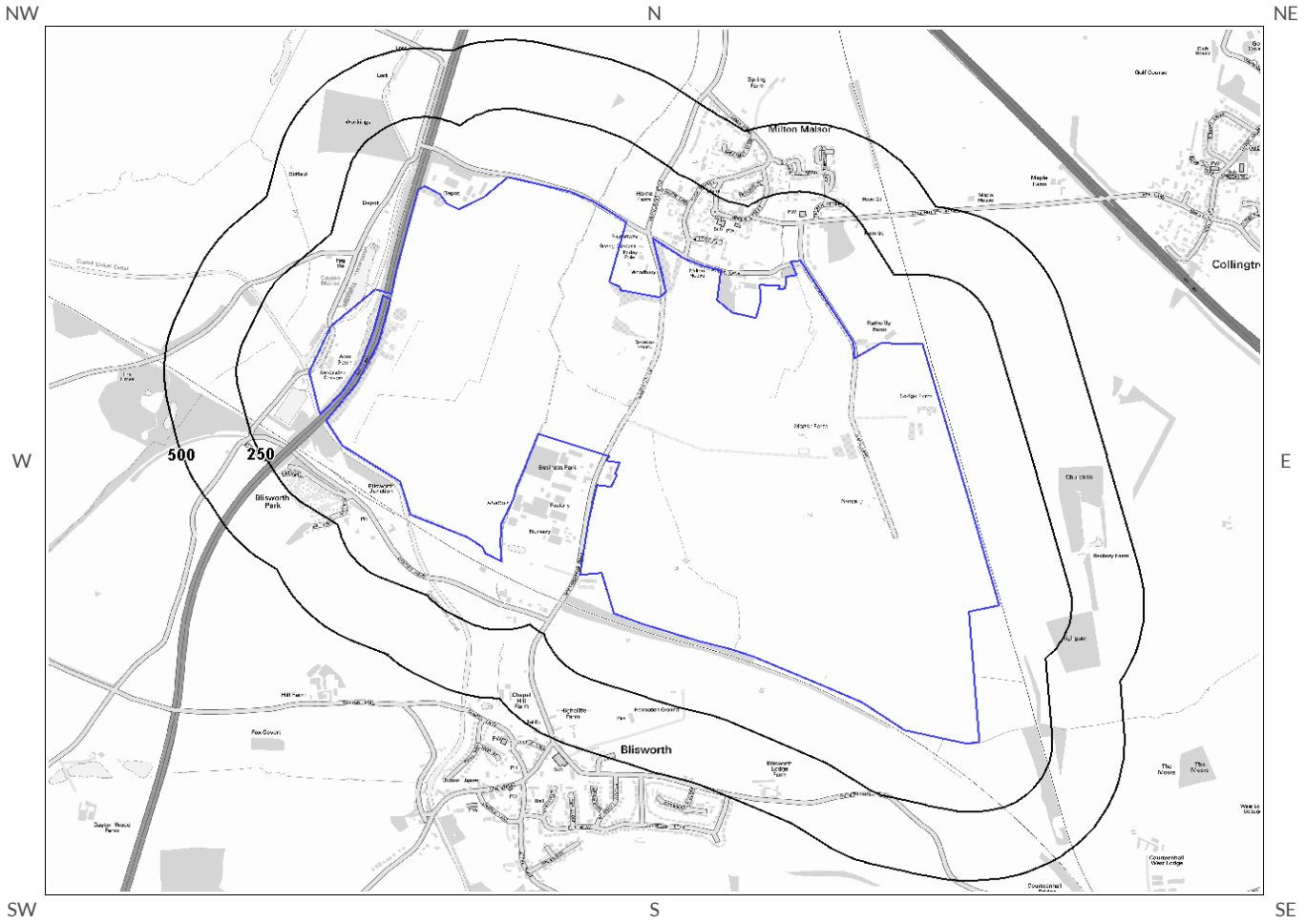
Secondary Aquifer - Undifferentiated Layers

Unproductive

Unknown (lakes and landslip)

Surface Water Abstraction Licence

5c. Hydrogeology – Source Protection Zones and Potable Water Abstraction Licenses



Map LegendSource Protection Zonesand PotableWater Abstraction Licenses

Mapping sourced from Ordnance Survey®

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Site Outline

250
500
Search Buffers (m)

Source Protection Zone 1 - Inner Catchment

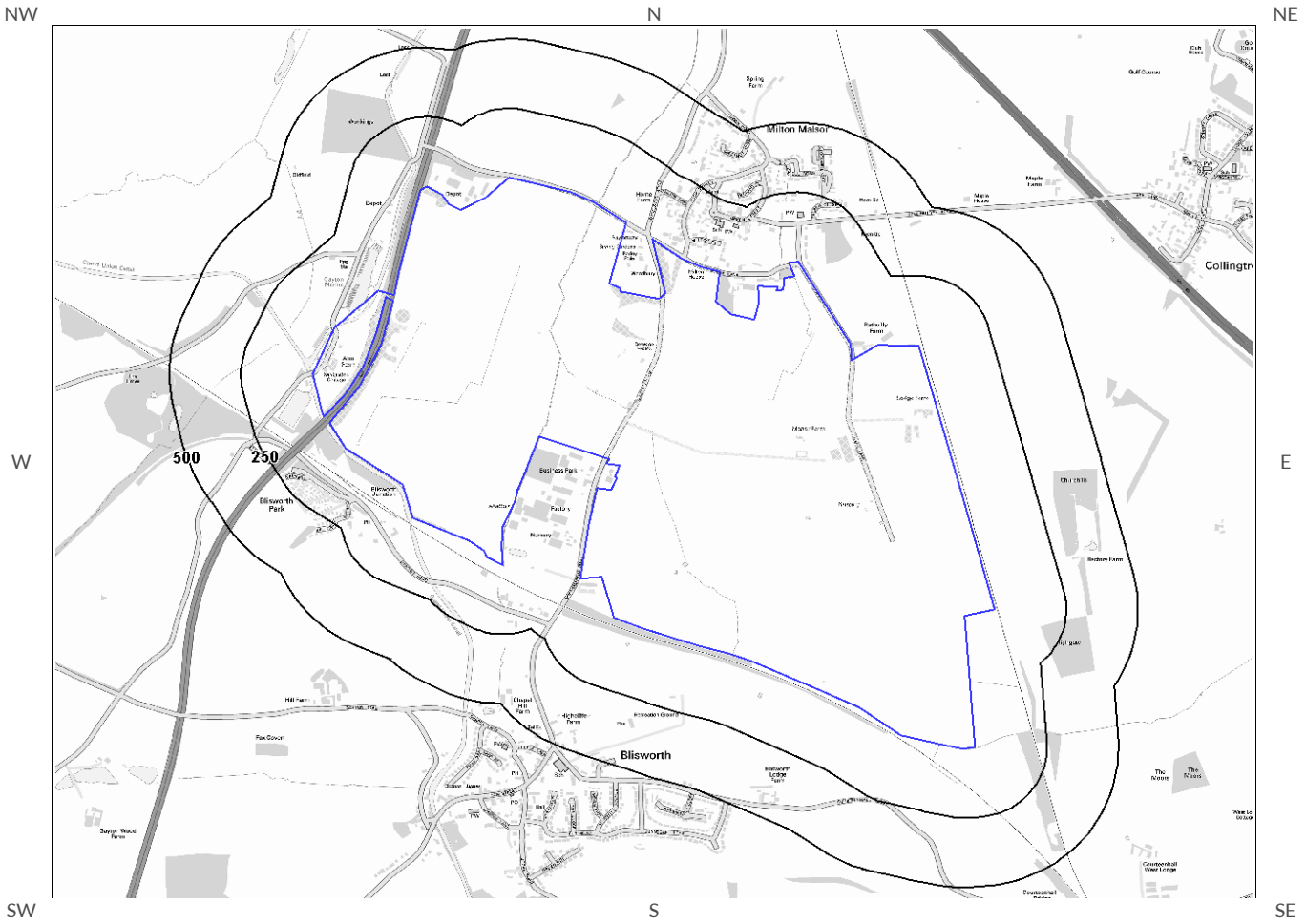
Source Protection Zone 2 - Outer Catchment

Source Protection Zone 3 - Total Catchment

Source Protection Zone 4 - Zone of Special Interest

Potable Water Abstraction Licence

5d. Hydrology Source Protection Zones within confined aquifer



Hydrology Source Protection Zones

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Site Outline

250
500
Search Buffers (m)

Source Protection Zone 1C - Inner Catchment within Confined Aquifer

Source Protection Zone 2C - Outer Catchment within Confined Aquifer

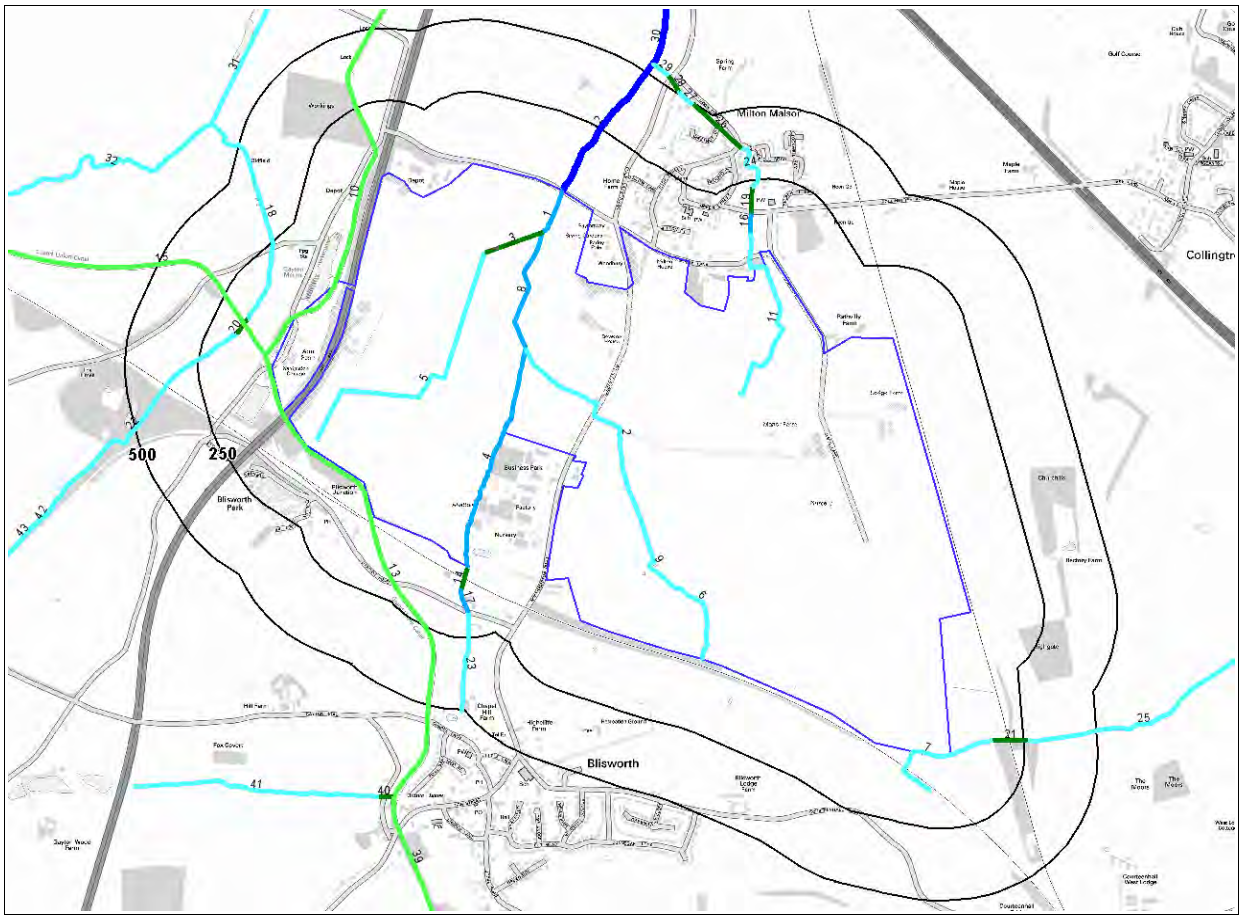
Source Protection Zone 3C - Total Catchment within Confined Aquifer

Potable Water Abstraction Licence

5 e. Hydrology – Detailed River Network and River Quality

NW N NE

W E



SW S SE

Hydrology – Detailed River Network and River Quality

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Site Outline

Search Buffers (m) 250 500

Primary River
Secondary River
Tertiary River
Lake/Reservoir
Underground River (inferred)
General Quality Assessment: Biology
General Quality Assessment: Chemistry

Canal
Canal Tunnel
Culvert
Multiple Channel Culvert
Underground River (Potential Sewer)
Underground River (local knowledge)



5. Hydrogeology and Hydrology

5.1 Aquifer within Superficial Deposits

Are there records of strata classification within the superficial geology at or in proximity to the property? Yes

From 1 April 2010, the Environment Agency's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the GroundSure Enviroinsight User Guide.

The following aquifer records are shown on the Aquifer within Superficial Geology Map (5a):

ID	Distance (m)	Direction	Designation	Description
1	0.0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
2	0.0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
3	0.0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
4	0.0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
12	0.0	On Site	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
13	0.0	On Site	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
14	49.0	E	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
15	56.0	S	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
5	225.0	W	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
6	284.0	E	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
7	286.0	E	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
16	334.0	SE	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow

ID	Distance (m)	Direction	Designation	Description
8	350.0	NE	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers

5.2 Aquifer within Bedrock Deposits

Are there records of strata classification within the bedrock geology at or in proximity to the property? Yes

From 1 April 2010, the Environment Agency's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive. For further details on the designation and interpretation of this information, please refer to the GroundSure Enviroinsight User Guide.

The following aquifer records are shown on the Aquifer within Bedrock Geology Map (5b):

ID	Distance (m)	Direction	Designation	Description
3	0.0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
4	0.0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
5	0.0	On Site	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
19	0.0	On Site	Secondary (undifferentiated)	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type
20	0.0	On Site	Secondary (undifferentiated)	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type
22	0.0	On Site	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
23	0.0	On Site	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
24	0.0	On Site	Unproductive	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow
6	131.0	S	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
7	145.0	SW	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
15	328.0	SE	Secondary B	Predominantly lower permeability layers which may store/yield limited amounts of groundwater due to localised features such as fissures, thin permeablehorizons and weathering. These are generally the water-bearing parts of the former non-aquifers
16	335.0	S	Secondary B	Predominantly lower permeability layers which may store/yield limited amounts of groundwater due to localised features such as fissures, thin permeablehorizons and weathering. These are generally the water-bearing parts of the former non-aquifers
8	366.0	SE	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
1	384.0	S	Principal	Geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale. Generally principal aquifers were previously major aquifers

ID	Distance (m)	Direction	Designation	Description
9	424.0	SE	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
17	438.0	SE	Secondary B	Predominantly lower permeability layers which may store/yield limited amounts of groundwater due to localised features such as fissures, thin permeablehorizons and weathering. These are generally the water-bearing parts of the former non-aquifers

5.3 Groundwater Abstraction Licences

Are there any Groundwater Abstraction Licences within 2000m of the study site? No

Database searched and no data found.

5.4 Surface Water Abstraction Licences

Are there any Surface Water Abstraction Licences within 2000m of the study site? Yes

The following Surface Water Abstraction Licences records are represented as points, lines and regions on the Aquifer within Bedrock Geology Map (5b):

ID	Distance (m)	Direction	NGR	Details	
30	1143.0	NE	474600 256100	Licence No: 5/32/04/*S/0042 Details: General Farming & Domestic Direct Source: Surface Water Source Of Supply Point: Spring At Milton Data Type: Point	Annual Volume (m^3): - Max Daily Volume (m^3): - Application No: - Original Start Date: 1/3/1966 Expiry Date: - Issue No: 100 Version Start Date: 1/3/1966 Version End Date:
Not shown	1702.0	NE	474260 257040	Licence No: 5/32/04/*S/0055 Details: Spray Irrigation - Direct Direct Source: Surface Water Source Of Supply Point: Wootton Brook At Collingtree Data Type: Line	Annual Volume (m^3): 27000 Max Daily Volume (m^3): 570 Application No: NA319 Original Start Date: 18/6/2002 Expiry Date: - Issue No: 1 Version Start Date: 18/6/2002 Version End Date:
Not shown	1702.0	NE	474260 257040	Licence No: 5/32/04/*S/0056 Details: Spray Irrigation - Storage Direct Source: Surface Water Source Of Supply Point: Wootton Brook At Collingtree Data Type: Line	Annual Volume (m^3): 12000 Max Daily Volume (m^3): 570 Application No: NA320 Original Start Date: 18/6/2002 Expiry Date: - Issue No: 1 Version Start Date: 18/6/2002 Version End Date:

ID	Distance (m)	Direction	NGR	Details	
Not shown	1721.0	NE	474300 257100	Licence No: 5/32/04/*S/0052B Details: Spray Irrigation - Direct Direct Source: Surface Water Source Of Supply Point: Wootton Brook Data Type: Line	Annual Volume (m^3): - Max Daily Volume (m^3): - Application No: - Original Start Date: 1/2/1988 Expiry Date: - Issue No: 100 Version Start Date: 1/3/1993 Version End Date:
Not shown	1721.0	NE	474300 257100	Licence No: 5/32/04/*S/0052A Details: Spray Irrigation - Direct Direct Source: Surface Water Source Of Supply Point: Wootton Brook Data Type: Line	Annual Volume (m^3): - Max Daily Volume (m^3): - Application No: - Original Start Date: 1/2/1988 Expiry Date: - Issue No: 100 Version Start Date: 1/3/1993 Version End Date:
Not shown	1721.0	NE	474300 257100	Licence No: 5/32/04/*S/0052B Details: Spray Irrigation - Storage Direct Source: Surface Water Source Of Supply Point: Wootton Brook Data Type: Line	Annual Volume (m^3): - Max Daily Volume (m^3): - Application No: - Original Start Date: 1/2/1988 Expiry Date: - Issue No: 100 Version Start Date: 1/3/1993 Version End Date:

5.5 Potable Water Abstraction Licences

Are there any Potable Water Abstraction Licences within 2000m of the study site? No

Database searched and no data found.

5.6 Source Protection Zones

Are there any Source Protection Zones within 500m of the study site? No

Database searched and no data found.

5.7 Source Protection Zones within Confined Aquifer

Are there any Source Protection Zones within the Confined Aquifer within 500m of the study site?

No

Historically, Source Protection Zone maps have been focused on regulation of activities which occur at or near the ground surface, such as prevention of point source pollution and bacterial contamination of water supplies. Sources in confined aquifers were often considered to be protected from these surface pressures due to the presence of a low permeability confining layer (e.g. glacial till, clay). The increased interest in subsurface activities such as onshore oil and gas exploration, ground source heating and cooling requires protection zones for confined sources to be marked on SPZ maps where this has not already been done.

Database searched and no data found.

5.8 Groundwater Vulnerability and Soil Leaching Potential

Is there any Environment Agency information on groundwater vulnerability and soil leaching potential within 500m of the study site? Yes

Distance (m)	Direction	Classification	Soil Vulnerability Category	Description
0	On Site	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.
0	On Site	Minor Aquifer/High Leaching Potential	H2	Deep, permeable, coarse textured soils which readily transmit a wide range of pollutants because of their rapid drainage and low attenuation potential.
0	On Site	Minor Aquifer/High Leaching Potential	H2	Deep, permeable, coarse textured soils which readily transmit a wide range of pollutants because of their rapid drainage and low attenuation potential.
125	SE	Minor Aquifer/High Leaching Potential	H3	Coarse textured or moderately shallow soils which readily transmit non-adsorbed pollutants and liquid discharges but have some ability to attenuate adsorbed pollutants because of their clay or organic matter content.
128	S	Minor Aquifer/Intermediate Leaching Potential	I1	Soils which can possibly transmit a wide range of pollutants.
351	S	Minor Aquifer/Intermediate Leaching Potential	I1	Soils which can possibly transmit a wide range of pollutants.
381	S	Major Aquifer/High Leaching Potential	H3	Coarse textured or moderately shallow soils which readily transmit non-adsorbed pollutants and liquid discharges but have some ability to attenuate adsorbed pollutants because of their clay or organic matter content.
465	N	Minor Aquifer/Intermediate Leaching Potential	I1	Soils which can possibly transmit a wide range of pollutants.

5.9 River Quality

Is there any Environment Agency information on river quality within 1500m of the study site? No

5.9.1 Biological Quality:

Database searched and no data found.

5.9.2 Chemical Quality:

Database searched and no data found.

5.10 Detailed River Network

Are there any Detailed River Network entries within 500m of the study site?	Yes

The following Detailed River Network records are represented on the Hydrology Map (5e):

ID	Distance (m)	Direction	Details	
1	0.0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
2	0.0	On Site	River Name: Drain Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
3	0.0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
4	0.0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
5	0.0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
6	0.0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
7	0.0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
8	0.0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
9	0.0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
10	0.0	On Site	River Name: Grand Union Canal (Northampton Arm) Welsh River Name: - Alternative Name: -	River Type: Canal Main River Status: Currently Undefined
11	0.0	On Site	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
12	4.0	NE	River Name: - Welsh River Name: - Alternative Name: -	River Type: Primary River Main River Status: Currently Undefined
13	5.0	SW	River Name: Grand Union Canal Welsh River Name: - Alternative Name: -	River Type: Canal Main River Status: Currently Undefined
14	8.0	SE	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
15	35.0	NW	River Name: Grand Union Canal Welsh River Name: - Alternative Name: -	River Type: Canal Main River Status: Currently Undefined
16	73.0	NW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
17	82.0	S	River Name: - Welsh River Name: - Alternative Name: -	River Type: Secondary River Main River Status: Currently Undefined
18	134.0	NW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
19	139.0	N	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
20	143.0	NW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
21	145.0	E	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined

ID	Distance (m)	Direction	Details	
22	155.0	NW	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
23	164.0	S	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
24	227.0	N	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
25	268.0	E	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined
26	366.0	N	River Name: - Welsh River Name: - Alternative Name: -	River Type: Culvert Main River Status: Currently Undefined
27	496.0	NE	River Name: - Welsh River Name: - Alternative Name: -	River Type: Tertiary River Main River Status: Currently Undefined

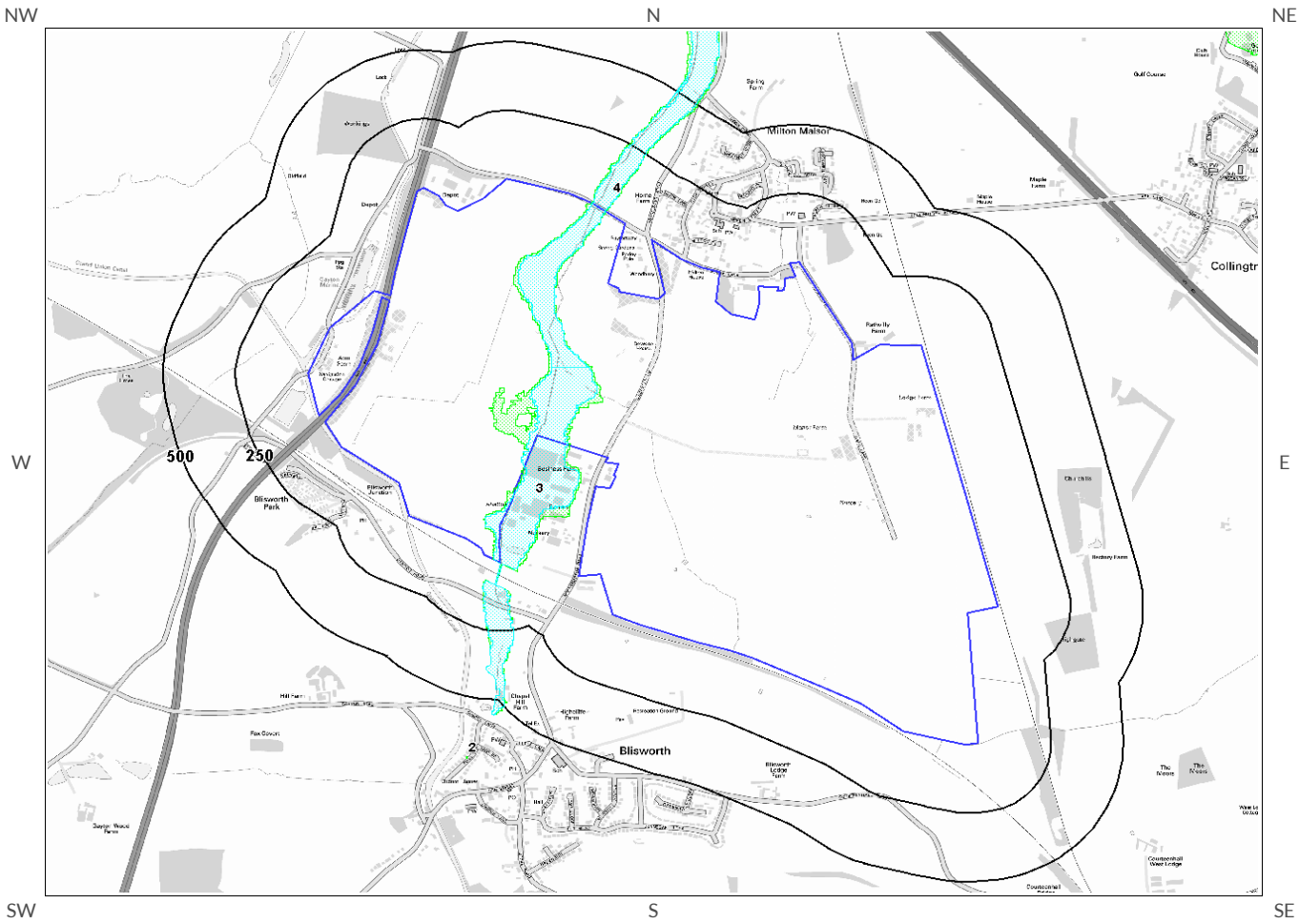
5.11 Surface Water Features

Are there any surface water features within 250m of the study site? Yes

The following surface water records are not represented on mapping:

Distance (m)	Direction
0.0	On Site
0.0	On Site
0.0	On Site
0.0	On Site
0.0	On Site
0.0	On Site
0.0	On Site
0.0	On Site
0.0	On Site
0.0	On Site
0.0	On Site
0.0	On Site
0.0	On Site
0.0	On Site
0.0	On Site
0.0	On Site
0.0	On Site
0.0	On Site
0.0	On Site
0.0	On Site
0.0	On Site
0.0	E
0.0	W
3.0	NW
4.0	NE
5.0	NW
13.0	E
23.0	E
25.0	SW
28.0	W
33.0	W
71.0	S
90.0	E
108.0	NW
130.0	NE
136.0	NW
143.0	NW
155.0	NW
164.0	S
187.0	S
194.0	NW
200.0	NW
233.0	N
242.0	NW
244.0	NE
248.0	N

6. Environment Agency Flood Map for planning (from rivers and the sea)



Environment Agency Flood Map for planning (from rivers and the sea)

Mapping sourced from Ordnance Survey

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Site Outline

250
500
Search Buffers (m)

Zone 2 Floodplain

Zone 3 Floodplain

Flood Storage Area

Area Benefiting from Flood Defences

Flood Defences



6. Flooding

6.1 Zone 2 Flooding

Environment Agency Zone 2 floodplains estimate the annual probability of flooding as between 1 in 1000 (0.1%) and 1 in 100 (1%) from rivers and between 1 in 1000 (0.1%) and 1 in 200 (0.5%) from the sea. Any relevant data is represented on Map 1 – Environment Agency Flood Map for Planning:

Is the site within 250m of an Environment Agency Zone 2 floodplain? Yes

The following floodplain records are represented as green shading on the Flood Map:

ID	Distance (m)	Direction	Update	Type
1	0.0	On Site	10-Feb-2015	Zone 2 - (Fluvial / Tidal Models)

6.2 Zone 3 Flooding

Zone 3 shows the extent of a river flood with a 1 in 100 (1%) or greater chance of occurring in any year or a sea flood with a 1 in 200 (0.5%) or greater chance of occurring in any year. Any relevant data is represented on Map 1 – Environment Agency Flood Map for Planning.

Is the site within 250m of an Environment Agency Zone 3 floodplain? Yes

The following floodplain records are represented as blue shading on the Flood Map:

ID	Distance (m)	Direction	Update	Type
3	0.0	On Site	10-Feb-2015	Zone 3 - (Fluvial Models)
4	0.0	On Site	10-Feb-2015	Zone 3 - (Fluvial Models)

6.3 Flood Defences

Are there any Flood Defences within 250m of the study site? No

Database searched and no data found.

6.4 Areas benefiting from Flood Defences

Are there any areas benefiting from Flood Defences within 250m of the study site? No

6.5 Areas benefiting from Flood Storage

Are there any areas used for Flood Storage within 250m of the study site? No

---

6.6 Groundwater Flooding Susceptibility Areas

6.6.1 Are there any British Geological Survey groundwater flooding susceptibility areas within 50m of the boundary of the study site?

Yes

Does this relate to Clearwater Flooding or Superficial Deposits Flooding? Superficial Deposits Flooding

Notes: Groundwater flooding may either be associated with shallow unconsolidated sedimentary aquifers which overlie unproductive aquifers (Superficial Deposits Flooding), or with unconfined aquifers (Clearwater Flooding).

6.6.2 What is the highest susceptibility to groundwater flooding in the search area based on the underlying geological conditions?

Potential at Surface

Where potential for groundwater flooding to occur at surface is indicated, this means that given the geological conditions in the area groundwater flooding hazard should be considered in all land-use planning decisions. It is recommended that other relevant information e.g. records of previous incidence of groundwater flooding, rainfall, property type, and land drainage information be investigated in order to establish relative, but not absolute, risk of groundwater flooding.

6.7 Groundwater Flooding Confidence Areas

What is the British Geological Survey confidence rating in this result? High

Notes: Groundwater flooding is defined as the emergence of groundwater at the ground surface or the rising of groundwater into man-made ground under conditions where the normal range of groundwater levels is exceeded.

The confidence rating is on a threefold scale - Low, Moderate and High. This provides a relative indication of the BGS confidence in the accuracy of the susceptibility result for groundwater flooding. This is based on the amount and precision of the information used in the assessment. In areas with a relatively lower level of confidence the susceptibility result should be treated with more caution. In other areas with higher levels of confidence the susceptibility result can be used with more confidence.

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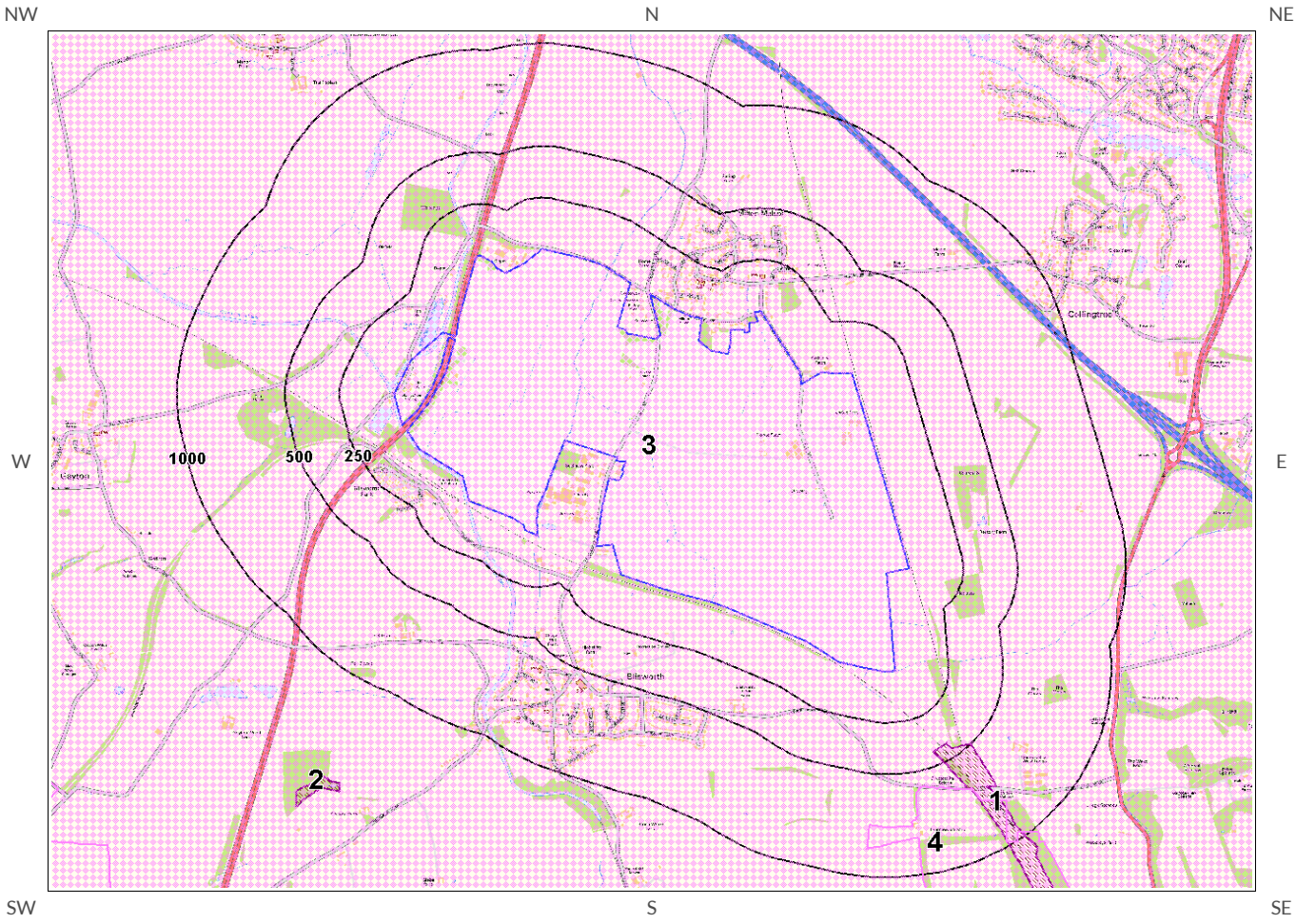
7. Designated Environmentally Sensitive Sites Map



Designated Environmentally Sensitive Sites Map

Mapping sourced from Ordnance Survey®

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Site Centre
Site Outline
100
250
Search Buffers (m)

AONB
National Park
SSSI
Special Protection Areas
Nitrate Vulnerable Zones
Green Belt
Environmentally Sensitive Areas
Special Areas of Conservation
World Heritage Sites
Nitrate Sensitive Areas
Ancient Woodland
National Nature Reserve
Local Nature Reserves
RAMSAR Sites



7. Designated Environmentally Sensitive Sites

Presence of Designated Environmentally Sensitive Sites within 2000m of the study site? Yes

7.1 Records of Sites of Special Scientific Interest (SSSI) within 2000m of the study site:

2

The following Site of Special Scientific Interest (SSSI) records provided by Natural England/Natural Resources Wales are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	SSSI Name	Data Source
1	427.0	SE	Roade Cutting	Natural England
2	1494.0	SW	Blisworth Rectory Farm Quarry	Natural England

7.2 Records of National Nature Reserves (NNR) within 2000m of the study site:

0

Database searched and no data found.

7.3 Records of Special Areas of Conservation (SAC) within 2000m of the study site:

0

Database searched and no data found.

7.4 Records of Special Protection Areas (SPA) within 2000m of the study site:

0

Database searched and no data found.

7.5 Records of Ramsar sites within 2000m of the study site:

0

Database searched and no data found.

7.6 Records of Ancient Woodland within 2000m of the study site:

0

Database searched and no data found.

7.7 Records of Local Nature Reserves (LNR) within 2000m of the study site:

0

Database searched and no data found.

7.8 Records of World Heritage Sites within 2000m of the study site:

0

Database searched and no data found.

7.9 Records of Environmentally Sensitive Areas within 2000m of the study site:

0

Database searched and no data found.

7.10 Records of Areas of Outstanding Natural Beauty (AONB) within 2000m of the study site:

0

Database searched and no data found.

7.11 Records of National Parks (NP) within 2000m of the study site:

0

Database searched and no data found.

7.12 Records of Nitrate Sensitive Areas within 2000m of the study site:

0

Database searched and no data found.

7.13 Records of Nitrate Vulnerable Zones within 2000m of the study site:

3

The following Nitrate Vulnerable Zone records produced by DEFRA are represented as polygons on the Designated Environmentally Sensitive Sites Map:

ID	Distance (m)	Direction	NVZ Name	Data Source
3	0.0	On Site	Existing	DEFRA
4	579.0	S	Existing	DEFRA
Not shown	1970.0	W	Existing	DEFRA

7.14 Records of Green Belt land within 2000m of the study site:

0

Database searched and no data found.



8. Natural Hazards Findings

8.1 Detailed BGS GeoSure Data

BGS GeoSure Data has been searched to 50m. The data is included in tabular format. If you require further information on geology and ground stability, please obtain a GroundSure GeoInsight, available from our website. The following information has been found:

8.1.1 Shrink Swell

What is the maximum Shrink-Swell* hazard rating identified on the study site? Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Ground conditions predominantly medium plasticity. Do not plant trees with high soil moisture demands near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE). There is a possible increase in construction cost to reduce potential shrink-swell problems. For existing property, there is a possible increase in insurance risk, especially during droughts or where vegetation with high moisture demands is present.

8.1.2 Landslides

What is the maximum Landslide* hazard rating identified on the study site? Moderate

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Significant potential for slope instability with relatively small changes in ground conditions. Avoid large amounts of water entering the ground through pipe leakage or soak-aways. Do not undercut or place large amounts of material on slopes without technical advice. For new build – consider the potential and consequences of ground movement during excavations, or consequence of changes to loading or drainage. For existing property – probable increase in insurance risk is likely due to potential natural slope instability after changes to ground conditions such as a very long, excessively wet winter.

* This indicates an automatically generated 50m buffer and site.

8.1.3 Soluble Rocks

What is the maximum Soluble Rocks* hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Significant soluble rocks are present. Problems unlikely except with considerable surface or subsurface water flow. No special actions required to avoid problems due to soluble rocks. No special ground investigation required or increased construction costs are likely. An increase in financial risk due to potential problems with soluble rocks is unlikely.

8.1.4 Compressible Ground

What is the maximum Compressible Ground* hazard rating identified on the study site? Moderate

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Significant potential for compressibility problems. Avoid large differential loadings of ground. Do not drain or de-water ground near the property without technical advice. For new build consider possibility of compressible ground in ground investigation, construction and building design. Consider effects of groundwater changes. Extra construction costs are likely. For existing property possible increase in insurance risk from compressibility, especially if water conditions or loading of the ground change significantly.

8.1.5 Collapsible Rocks

What is the maximum Collapsible Rocks* hazard rating identified on the study site? Very Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Deposits with potential to collapse when loaded and saturated are unlikely to be present. No special ground investigation required or increased construction costs or increased financial risk due to potential problems with collapsible deposits.

8.1.6 Running Sand

What is the maximum Running Sand* hazard rating identified on the study site? Low

The following natural subsidence information provided by the British Geological Survey is not represented on mapping:

Hazard
Possibility of running sand problems after major changes in ground conditions. Normal maintenance to avoid leakage of water-bearing services or water bodies (ponds, swimming pools) should reduce likelihood of problems due to running sand. For new build consider possibility of running sand into trenches or excavations if water table is high or sandy strata are exposed to water. Avoid concentrated water inputs to site. Unlikely to be an increase in construction costs due to potential for running sand. For existing property no significant increase in insurance risk due to running sand problems is likely.

* This indicates an automatically generated 50m buffer and site.



9. Mining

9.1 Coal Mining

Are there any coal mining areas within 75m of the study site? No

Database searched and no data found.

9.2 Shallow Mining

What is the subsidence hazard relating to shallow mining on-site*? Low

*Please note this data is searched with a 150m buffer.

9.3 Brine Affected Areas

Are there any brine affected areas within 75m of the study site? No

Guidance: No Guidance Required.

Contact Details

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northampton@hydrock.com

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Rotherham, S60 1BY
Tel: 08708 506 506
Web:**www.environment-agency.gov.uk**
Email:**enquiries@environment-agency.gov.uk**

Public Health England

Public information access office
Public Health England, Wellington House
133-155 Waterloo Road, London, SE1 8UG
https://www.gov.uk/government/organisations/public-health-england
Email:**enquiries@phe.gov.uk**
Main switchboard**: 020 7654 8000**

The Coal Authority

200 Lichfield Lane
Mansfield
Notts NG18 4RG
Tel: 0345 7626 848
DX 716176 Mansfield 5
www.coal.gov.uk

Ordnance Survey

Adanac Drive, Southampton
SO16 0AS
Tel: 08456 050505

Local Authority
Authority: South Northamptonshire Council
Phone: 0845 230 0226
Web: http://www.southnorthants.gov.uk/
Address: Springfields, Towcester, Northants, NN12 6AE

Gemapping PLC

Virginia Villas, High Street, Hartley Witney,
Hampshire RG27 8NW
Tel: 01252 845444

Acknowledgements: Site of Special Scientific Interest, National Nature Reserve, Ramsar Site, Special Protection Area, Special Area of Conservation data is provided by, and used with the permission of, Natural England who retain the Copyright and Intellectual Property Rights for the data. PointX © Database Right/Copyright, Thomson Directories Limited © Copyright Link Interchange Network Limited © Database Right/Copyright and Ordnance Survey © Crown Copyright and/or Database Right. All Rights Reserved. Licence Number [03421028].
This report has been prepared in accordance with the GroundSure Ltd standard Terms and Conditions of business for work of this nature.

Standard Terms and Conditions

1 Definitions

In these terms and conditions unless the context otherwise requires:

"Beneficiary" means the person or entity for whose benefit the Client has obtained the Services.

"Client" means the party or parties entering into a Contract with GroundSure.

"Commercial" means any building or property which is not Residential.

"Confidential Information" means the contents of this Contract and all information received from the Client as a result of, or in connection with, this Contract other than

(i) information which the Client can prove was rightfully in its possession prior to disclosure by GroundSure and

(ii) any information which is in the public domain (other than by virtue of a breach of this Contract).

"Support Services" means Support Services provided by GroundSure including, without limitation, interpreting third party and in-house environmental data, providing environmental support advice, undertaking environmental audits and assessments, Site investigation, Site monitoring and related items.

"Contract" means the contract between GroundSure and the Client for the provision of the Services, and which shall incorporate these terms and conditions, the Order, and the relevant User Guide.

"Third Party Data Provider" means any third party providing Third Party Content to GroundSure.

"Data Reports" means reports comprising factual data with no accompanying interpretation.

"Fees" has the meaning set out in clause 5.1.

"GroundSure" means GroundSure Limited, a company registered in England and Wales under number 03421028.

"GroundSure Materials" means all materials prepared by GroundSure and provided as part of the Services, including but not limited to Third Party Content, Data Reports, Mapping, and Risk Screening Reports.

"Intellectual Property" means any patent, copyright, design rights, trade or service mark, moral rights, data protection rights, know-how or trade mark in each case whether registered or not and including applications for the same or any other rights of a similar nature anywhere in the world.

"Mapping" means a map, map data or a combination of historical maps of various ages, time periods and scales.

"Order" means an electronic, written or other order form submitted by the Client requesting Services from GroundSure in respect of a specified Site.

"Ordnance Survey" means the Secretary of State for Business, Innovation and Skills, acting through Ordnance Survey, Adanac Drive, Southampton, SO16 0AS, UK.

"Order Website" means the online platform through which Orders may be placed by the Client and accepted by GroundSure.

"Report" means a Risk Screening Report or Data Report for Commercial or Residential property.

"Residential" means any building or property used as or intended to be used as a single dwelling.

"Risk Screening Report" means a risk screening report comprising factual data with an accompanying interpretation by GroundSure.

"Services" means any Report, Mapping and/or Support Services which GroundSure has agreed to provide by accepting an Order pursuant to clause 2.6.

"Site" means the area of land in respect of which the Client has requested GroundSure to provide the Services.

"Third Party Content" means data, database information or other information which is provided to GroundSure by a Third Party Data Provider.

"User Guide" means the user guide, as amended from time to time, available upon request from GroundSure and on the website (www.GroundSure.com) and forming part of this Contract.

2 Scope of Services, terms and conditions, requests for insurance and quotations

2.1 GroundSure agrees to provide the Services in accordance with the Contract.

2.2 GroundSure shall exercise reasonable skill and care in the provision of the Services.

2.3 Subject to clause 7.3 the Client acknowledges that it has not relied on any statement or representation made by or on behalf of GroundSure which is not set out and expressly agreed in writing in the Contract and all such statements and representations are hereby excluded to the fullest extent permitted by law.

2.4 The Client acknowledges that terms and conditions appearing on a Client's order form, printed stationery or other communication, or any terms or conditions implied by custom, practice or course of dealing shall be of no effect, and that this Contract shall prevail over all others in relation to the Order.

2.5 If the Client or Beneficiary requests insurance in conjunction with or as a result of the Services, GroundSure shall use reasonable endeavours to recommend such insurance, but makes no warranty that such insurance shall be available from insurers or that it will be offered on reasonable terms. Any insurance purchased by the Client or Beneficiary shall be subject solely to the terms of the policy issued by insurers and GroundSure will have no liability therefor. In addition you acknowledge and agree that GroundSure does not act as an agent or broker for any insurance providers. The Client should take (and ensure that the Beneficiary takes) independent advice to ensure that the insurance policy requested or offered is suitable for its requirements.

2.6 GroundSure's quotations or proposals are valid for a period of 30 days only unless an alternative period of time is explicitly stipulated by GroundSure. GroundSure reserves the right to withdraw any quotation or proposal at any time before an Order is accepted by GroundSure. GroundSure's acceptance of an Order shall be binding only when made in writing and signed by GroundSure's authorised representative or when accepted through the Order Website.

3 The Client's obligations

3.1The Client shall comply with the terms of this Contract and

(i) procure that the Beneficiary or any third party relying on the Services complies with and acts as if it is bound by the Contract and

(ii) be liable to GroundSure for the acts and omissions of the Beneficiary or any third party relying on the Services as if such acts and omissions were those of the Client.

3.2 The Client shall be solely responsible for ensuring that the Services are appropriate and suitable for its and/or the Beneficiary's needs.

3.3 The Client shall supply to GroundSure as soon as practicable and without charge all requisite information (and the Client warrants that such information is accurate, complete and appropriate), including without limitation any environmental information relating to the Site and shall give such assistance as GroundSure shall reasonably require in the provision of the Services including, without limitation, access to the Site, facilities and equipment.

3.4 Where the Client's approval or decision is required to enable GroundSure to carry out work in order to provide the Services, such approval or decision shall be given or procured in reasonable time and so as not to delay or disrupt the performance of the Services.

3.5 Save as expressly permitted by this Contract the Client shall not, and shall procure that the Beneficiary shall not, re-sell, alter, add to, or amend the GroundSure Materials, or use the GroundSure Materials in a manner for which they were not intended. The Client may make the GroundSure Materials available to a third party who is considering acquiring some or all of, or providing funding in relation to, the Site, but such third party cannot rely on the same unless expressly permitted under clause 4.

3.6 The Client is responsible for maintaining the confidentiality of its user name and password if using the Order Website and the Client acknowledges that GroundSure accepts no liability of any kind for any loss or damage suffered by the Client as a consequence of using the Order Website.

4 Reliance

4.1The Client acknowledges that the Services provided by GroundSure consist of the presentation and analysis of Third Party Content and other content and that information obtained from a Third Party Data Provider cannot be guaranteed or warranted by GroundSure to be reliable.

4.2 In respect of Data Reports, Mapping and Risk Screening Reports, the following classes of person and no other are entitled to rely on their contents;

(i) the Beneficiary,

(ii) the Beneficiary's professional advisers, (iii) any person providing funding to the Beneficiary in relation to the Site (whether directly or as part of a lending syndicate),

(iv) the first purchaser or first tenant of the Site, and

(v) the professional advisers and lenders of the first purchaser or tenant of the Site.

4.3 In respect of Support Services, only the Client, Beneficiary and parties expressly named in a Report and no other parties are entitled to rely on its contents.

4.4 Save as set out in clauses 4.2 and 4.3 and unless otherwise expressly agreed in writing, no other person or entity of any kind is entitled to rely on any Services or Report issued or provided by GroundSure. Any party considering such Reports and Services does so at their own risk.

5 Fees and Disbursements

5.1GroundSure shall charge and the Client shall pay fees at the rate and frequency specified in the written proposal, Order Website or Order acknowledgement form, plus (in the case of Support Services) all proper disbursements incurred by GroundSure. The Client shall in addition pay all value added tax or other tax payable on such fees and disbursements in relation to the provision of the Services (together "Fees").

5.2 The Client shall pay all outstanding Fees to GroundSure in full without deduction, counterclaim or set off within 30 days of the date of GroundSure's invoice or such other period as may be agreed in writing between GroundSure and the Client ("Payment Date"). Interest on late payments will accrue on a daily basis from the Payment Date until the date of payment (whether before or after judgment) at the rate of 8% per annum.

5.3 The Client shall be deemed to have agreed the amount of any invoice unless an objection is made in writing within 28 days of the date of the invoice. As soon as reasonably practicable after being notified of an objection, without prejudice to clause 5.2 a member of GroundSure's management team will contact the Client and the parties shall then use all reasonable endeavours to resolve the dispute within 15 days.

6 Intellectual Property and Confidentiality

6.1 Subject to

(i) full payment of all relevant Fees and

(ii) compliance with this Contract, the Client is granted (and is permitted to sub-licence to the Beneficiary) a royalty-free, worldwide, non-assignable and (save to the extent set out in this Contract) non-transferable licence to make use of the GroundSure Materials.

6.2 All Intellectual Property in the GroundSure Materials are and shall remain owned by GroundSure or GroundSure's licensors (including without limitation the Third Party Data Providers) the Client acknowledges, and shall procure acknowledgement by the Beneficiary of, such ownership. Nothing in this Contract purports to transfer or assign any rights to the Client or the Beneficiary in respect of such Intellectual Property.

6.3 Third Party Data Providers may enforce any breach of clauses 6.1 and 6.2 against the Client or Beneficiary.

6.4 The Client shall, and shall procure that any recipients of the GroundSure Materials shall:

(i) not remove, suppress or modify any trade mark, copyright or other proprietary marking belonging to GroundSure or any third party from the Services;

(ii) use the information obtained as part of the Services in respect of the subject Site only, and shall not store or reuse any information obtained as part of the Services provided in respect of adjacent or nearby sites;

(iii) not create any product or report which is derived directly or indirectly from the Services (save that those acting in a professional capacity to the Beneficiary may provide advice based upon the Services);

(iv) not combine the Services with or incorporate such Services into any other information data or service;

(v) not reformat or otherwise change (whether by modification, addition or enhancement), the Services (save that those acting for the Beneficiary in a professional capacity shall not be in breach of this clause 6.4(v) where such reformatting is in the normal course of providing advice based upon the Services);

(vi) where a Report and/or Mapping contains material belonging to Ordnance Survey, acknowledge and agree that such content is protected by Crown Copyright and shall not use such content for any purpose outside of receiving the Services; and

(vii) not copy in whole or in part by any means any map prints or run-on copies containing content belonging to Ordnance Survey (other than that contained within Ordnance Survey's OS Street Map) without first being in possession of a valid Paper Map Copying Licence from Ordnance Survey,

6.5 Notwithstanding clause 6.4, the Client may make reasonable use of the GroundSure Materials in order to advise the Beneficiary in a professional capacity. However, GroundSure shall have no liability in respect of any advice, opinion or report given or provided to Beneficiaries by the Client.

6.6 The Client shall procure that any person to whom the Services are made available shall notify GroundSure of any request or requirement to disclose, publish or disseminate any information contained in the Services in accordance with the Freedom of Information Act 2000, the Environmental Information Regulations 2004 or any associated legislation or regulations in force from time to time.

7.Liability: Particular Attention Should Be Paid To This Clause

7.1 This Clause 7 sets out the entire liability of GroundSure, including any liability for the acts or omissions of its employees, agents, consultants, subcontractors and Third Party Content, in respect of:

(i) any breach of contract, including any deliberate breach of the Contract by GroundSure or its employees, agents or subcontractors;

(ii) any use made of the Reports, Services, Materials or any part of them; and

(iii) any representation, statement or tortious act or omission (including negligence) arising under or in connection with the Contract.

7.2 All warranties, conditions and other terms implied by statute or common law are, to the fullest extent permitted by law, excluded from the Contract.

7.3 Nothing in the Contract limits or excludes the liability of the Supplier for death or personal injury resulting from negligence, or for any damage or liability incurred by the Client or Beneficiary as a result of fraud or fraudulent misrepresentation.

7.4 GroundSure shall not be liable for

(i) loss of profits;

(ii) loss of business;

(iii) depletion of goodwill and/or similar losses;

(iv) loss of anticipated savings;

(v) loss of goods;

(vi) loss of contract;

(vii) loss of use;

(viii) loss or corruption of data or information;

(ix) business interruption;

(x) any kind of special, indirect, consequential or pure economic loss, costs, damages, charges or expenses;

(xi) loss or damage that arise as a result of the use of all or part of the GroundSure Materials in breach of the Contract;

(xii) loss or damage arising as a result of any error, omission or inaccuracy in any part of the GroundSure Materials where such error, omission or inaccuracy is caused by any Third Party Content or any reasonable interpretation of Third Party Content;

(xiii) loss or damage to a computer, software, modem, telephone or other property; and

(xiv) loss or damage caused by a delay or loss of use of GroundSure's internet ordering service.

7.5 GroundSure's total liability in relation to or under the Contract shall be limited to £10 million for any claim or claims.

7.6 GroundSure shall procure that the Beneficiary shall be bound by limitations and exclusions of liability in favour of GroundSure which accord with those detailed in clauses 7.4 and 7.5 (subject to clause 7.3) in respect of all claims which the Beneficiary may bring against GroundSure in relation to the Services or other matters arising pursuant to the Contract.

8 GroundSure's right to suspend or terminate

8.1 If GroundSure reasonably believes that the Client or Beneficiary has not provided the information or assistance required to enable the proper provision of the Services, GroundSure shall be entitled to suspend all further performance of the Services until such time as any such deficiency has been made good.

8.2 GroundSure shall be entitled to terminate the Contract immediately on written notice in the event that:

(i) the Client fails to pay any sum due to GroundSure within 30 days of the Payment Date; or

(ii) the Client (being an individual) has a bankruptcy order made against him or (being a company) shall enter into liquidation whether compulsory or voluntary or have an administration order made against it or if a receiver shall be appointed over the whole or any part of its property assets or undertaking or if the Client is struck off the Register of Companies or dissolved; or

(iii) the Client being a company is unable to pay its debts within the meaning of Section 123 of the Insolvency Act 1986 or being an individual appears unable to pay his debts within the meaning of Section 268 of the Insolvency Act 1986 or if the Client shall enter into a composition or arrangement with the Client's creditors or shall suffer distress or execution to be levied on his goods; or

(iv) the Client or the Beneficiary breaches any term of the Contract (including, but not limited to, the obligations in clause 4) which is incapable of remedy or if remediable, is not remedied within five days of notice of the breach.

9. Client's Right to Terminate and Suspend

9.1 Subject to clause 10.1, the Client may at any time upon written notice terminate or suspend the provision of all or any of the Services.

9.2 In any event, where the Client is a consumer (and not a business) he/she hereby expressly acknowledges and agrees that:

(i) the supply of Services under this Contract (and therefore the performance of this Contract) commences immediately upon GroundSure's acceptance of the Order; and

(ii) the Reports and/or Mapping provided under this Contract are

(a) supplied to the Client's specification(s) and in any event

(b) by their nature cannot be returned.

10 Consequences of Withdrawal, Termination or Suspension

10.1 Upon termination of the Contract:

(i) GroundSure shall take steps to bring to an end the Services in an orderly manner, vacate any Site with all reasonable speed and shall deliver to the Client and/or Beneficiary any property of the Client and/or Beneficiary in

GroundSure's possession or control; and

(ii) the Client shall pay to GroundSure all and any Fees payable in respect of the performance of the Services up to the date of termination or suspension. In respect of any Support Services provided, the Client shall also pay GroundSure any additional costs incurred in relation to the termination or suspension of the Contract.

11 Anti-Bribery

11.1 The Client warrants that it shall:

(i) comply with all applicable laws, statutes and regulations relating to anti-bribery and anti-corruption including but not limited to the Bribery Act 2010;

(ii) comply with such of GroundSure's anti-bribery and anti-corruption policies as are notified to the Client from time to time; and

(iii) promptly report to GroundSure any request or demand for any undue financial or other advantage of any kind received by or on behalf of the Client in connection with the performance of this Contract.

11.2 Breach of this Clause 11 shall be deemed a material breach of this Contract.

12 General

12.1 The Mapping contained in the Services is protected by Crown copyright and must not be used for any purpose other than as part of the Services or as specifically provided in the Contract.

12.2 The Client shall be permitted to make one copy only of each Report or Mapping Order. Thereafter the Client shall be entitled to make unlimited copies of the Report or Mapping Order only in accordance with an Ordnance Survey paper map copy license available through GroundSure.

12.3 GroundSure reserves the right to amend or vary this Contract. No amendment or variation to this Contract shall be valid unless signed by an authorised representative of GroundSure.

12.4 No failure on the part of GroundSure to exercise, and no delay in exercising, any right, power or provision under this Contract shall operate as a waiver thereof.

12.5 Save as expressly provided in this Contract, no person other than the persons set out therein shall have any right under the Contract (Rights of Third Parties) Act 1999 to enforce any terms of the Contract.

12.6 The Secretary of State for Business, Innovation and Skills ("BIS") or BIS' successor body, as the case may be, acting through Ordnance Survey may enforce a breach of clause 6.4(vi) and clause 6.4(vii) of these terms and conditions against the Client in accordance with the provisions of the Contracts (Rights of Third Parties) Act 1999.

12.7 GroundSure shall not be liable to the Client if the provision of the Services is delayed or prevented by one or more of the following circumstances:

(i) the Client or Beneficiary's failure to provide facilities, access or information;

(ii) fire, storm, flood, tempest or epidemic;

(iii) Acts of God or the public enemy;

(iv) riot, civil commotion or war;

(v) strikes, labour disputes or industrial action;

(vi) acts or regulations of any governmental or other agency;

(vii) suspension or delay of services at public registries by Third Party Data Providers;

(viii) changes in law; or

(ix) any other reason beyond GroundSure's reasonable control.

In the event that GroundSure is prevented from performing the Services (or any part thereof) in accordance with this clause 12.6 for a period of not less than 30 days then GroundSure shall be entitled to terminate this Contract immediately on written notice to the Client.

12.8 Any notice provided shall be in writing and shall be deemed to be properly given if delivered by hand or sent by first class post, facsimile or by email to the address, facsimile number or email address of the relevant party as may have been notified by each party to the other for such purpose or in the absence of such notification the last known address.

12.9 Such notice shall be deemed to have been received on the day of delivery if delivered by hand, facsimile or email (save to the extent such day is not a working day where it shall be deemed to have been delivered on the next working day) and on the second working day after the day of posting if sent by first class post.

12.10 The Contract constitutes the entire agreement between the parties and shall supersede all previous arrangements between the parties relating to the subject matter hereof.

12.11 Each of the provisions of the Contract is severable and distinct from the others and if one or more provisions is or should become invalid, illegal or unenforceable, the validity and enforceability of the remaining provisions shall not in any way be tainted or impaired.

12.12 This Contract shall be governed by and construed in accordance with English law and any proceedings arising out of or connected with this Contract shall be subject to the exclusive jurisdiction of the English courts.

12.13 GroundSure is an executive member of the Council of Property Search Organisation (CoPSO) and has signed up to the Search Code administered by the Property Codes Compliance Board (PCCB). All Risk Screening Reports shall be supplied in accordance with the provisions of the Search Code.

12.14 If the Client or Beneficiary has a complaint about the Services, written notice should be given to the Compliance Officer at GroundSure who will respond in a timely manner.

12.15 The Client agrees that it shall, and shall procure that each Beneficiary shall, treat in confidence all Confidential Information and shall not, and shall procure that each Beneficiary shall not (i) disclose any Confidential Information to any third party other than in accordance with the terms of this Contract; and (ii) use Confidential Information for a purpose other than the exercise of its rights and obligations under this Contract. Subject to clause 6.6, nothing shall prevent the Client or any Beneficiary from disclosing Confidential Information to the extent required by law. **© GroundSure Limited June 2013**

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

GeoReports

Hydrock Consultants

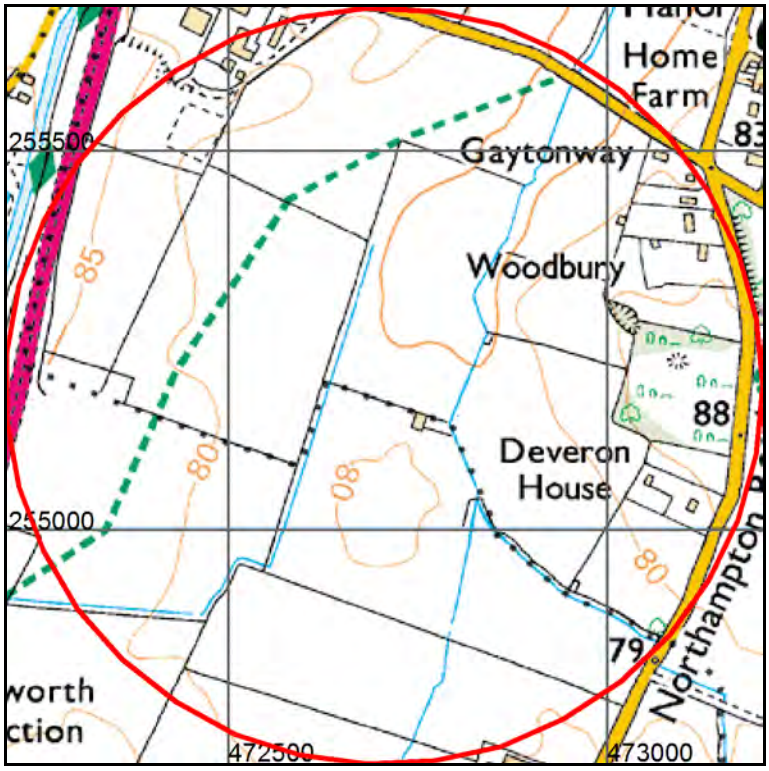
Radon Report: England and Wales

Advisory report on the requirement for radon protective measures in new buildings, conversions and extensions to existing buildings. The report also indicates whether a site is located within a radon Affected Area

Report Id: ***GR_210997/1***

Client reference: C151171

Search location



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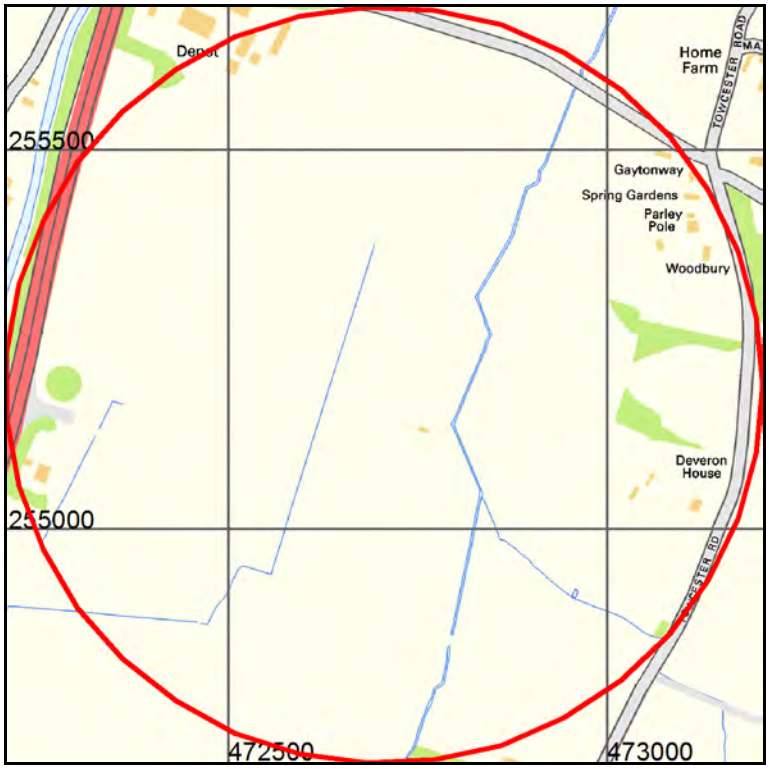
Scale: 1:10 000 (1cm = 100 m)



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OS Street View: Scale: 1:10 000 (1cm = 100 m)

This report describes a site located at National Grid Reference 472706, 255190. Note that for sites of irregular shape, this point may lie outside the site boundary. Where the client has submitted a site plan the assessment will be based on the area given.

Search location indicated in red

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Radon Report: England and Wales

This is an advisory report on the requirement for radon protective measures in new buildings, conversions and extensions. The report also indicates whether a site is located within a radon Affected Area

Requirement for radon protective measures
The determination below follows advice in *BR211 Radon: Guidance on protective measures for new buildings (2007 edition)*, which also provides guidance on what to do if the result indicates that protective measures are required.

BASIC RADON PROTECTIVE MEASURES ARE REQUIRED FOR THE REPORT AREA.

The BGS is not able to provide advice on the technical specifications of 'basic' and 'full' radon protective measures. This information is detailed in **BRE Report BR211 Radon: guidance on protective measures for new buildings** which may be purchased from **brebookshop.com.** This report offers guidance on the technical solutions that are required to satisfy Building Regulations requirements.

Technical solutions to radon protection in new build and existing dwellings in radon affected areas are available on the BRE web site at:
http://www.bre.co.uk/page.jsp?id=1626 and http://www.bre.co.uk/radon/ and in a range of technical reports available from **brebookshop.com;** Tel: 01923 664262, email: bookshop@bre.co.uk.
Summary guidance is available on the web at:
http://www.bre.co.uk/radon/protect.html.

If you require further information or guidance, you should contact your local authority building control officer or approved inspector.

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Radon in existing buildings

Is this property in a radon affected area – YES

The answer to the standard enquiry on house purchase known as **CON29 Standard Enquiry of Local Authority 3.13 Radon Gas: Location of the Property in a radon Affected Area is YES** this property is in a Radon Affected Area as defined by Public Health England (PHE).

The estimated probability of the property being above the Action Level for radon is: 3-5% (INTERMEDIATE PROBABILITY).

The result informs you of the estimated probability that this particular property is above the Action Level for radon. This does not necessarily mean there is a radon problem in the property. The only way to determine whether it is above or below the Action Level is to carry out a radon measurement within the existing property.

Radon Affected Areas are designated by Public Health England. They advise that radon gas should be measured in all properties within Radon Affected Areas.

If you are buying a new build property in a Radon Affected Area, you should ask the builder whether radon protective measures were incorporated in the construction of the property.

If you are buying a currently occupied property in a Radon Affected Area you should ask the present owner whether radon levels have been measured in the property. If they have, ask whether the results were above the Radon Action Level and if so whether remedial measures were installed, radon levels were retested, and the that the results of re-testing confirmed the effectiveness of the measures.

In radon affected homes, the problem of radon can usually be tackled with simple, effective and relatively inexpensive measures. These measures are comparable in cost to work such as damp-proofing and timber treatment. You can get practical advice about construction work to reduce radon levels from the Building Control Officer at your local council.

For further information, advice about radon, its health risks and details of how to order the radon test, please contact the PHE Radon Helpline on 01235 822622 or go online at www.ukradon.org or write to Radon Survey, Public Health England, Centre for Radiation, Chemical and Environmental Hazards, Chilton, Didcot, Oxon, OX11 0RQ, email: radon@hpa.org.uk. You can obtain an information pack from the PHE free Radon answerphone on 0800 614529

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What is radon?

Radon is a naturally occurring radioactive gas, which is produced by the radioactive decay of radium which, in turn, is derived from the radioactive decay of uranium. Uranium is found in small quantities in all soils and rocks, although the amount varies from place to place. Radon released from rocks and soils is quickly diluted in the atmosphere. Concentrations in the open air are normally very low and do not present a hazard. Radon that enters enclosed spaces such as some buildings (particularly basements), caves, mines, and tunnels may reach high concentrations in some circumstances. The construction method and degree of ventilation will influence radon levels in individual buildings. A person's exposure to radon will also vary according to how particular buildings and spaces are used.

Inhalation of the radioactive decay products of radon gas increases the chance of developing lung cancer. If individuals are exposed to high concentrations for significant periods of time, there may be cause for concern. In order to limit the risk to individuals, the Government has adopted an Action Level for radon in homes of 200 becquerels per cubic metre (Bq m^{-3}). The Government advises householders that, where the radon level exceeds the Action Level, measures should be taken to reduce the concentration.

Radon in workplaces

The Ionising Radiation Regulations, 1999, require employers to take action when radon is present above a defined level in the workplace. Advice may be obtained from your local Health and Safety Executive Area Office or the Environmental Health Department of your local authority. The BRE publishes a guide (BR293)**: Radon in the workplace.** BRE publications may be obtained from the BRE Bookshop, Tel: 01923 664262, email: bookshop@bre.co.ukwebsite: www.brebookshop.com

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Contact Details

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Environmental Science Centre
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Fax: 0115 9363276
Email: enquiries@bgs.ac.uk

Wallingford (WL) Office
British Geological Survey
Maclean Building
Wallingford
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OX10 8BB
Tel: 01491 838800
Fax: 01491 692345
Email: hydroenq@bgs.ac.uk

Murchison House (MH) Office
British Geological Survey
Murchison House
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Fax: 0131 650 0252
Email: enquiry@bgs.ac.uk

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Terms and Conditions

General Terms & Conditions

This Report is supplied in accordance with the GeoReports Terms & Conditions available on the BGS website at www.bgs.ac.uk/georeports and also available from the BGS Central Enquiries Desk at the above address.

Important notes about this Report

- The data, information and related records supplied in this Report by BGS can only be indicative and should not be taken as a substitute for specialist interpretations, professional advice and/or detailed site investigations. You must seek professional advice before making technical interpretations on the basis of the materials provided.
- Geological observations and interpretations are made according to the prevailing understanding of the subject at the time. The quality of such observations and interpretations may be affected by the availability of new data, by subsequent advances in knowledge, improved methods of interpretation, and better access to sampling locations.
- Raw data may have been transcribed from analogue to digital format, or may have been acquired by means of automated measuring techniques. Although such processes are subjected to quality control to ensure reliability where possible, some raw data may have been processed without human intervention and may in consequence contain undetected errors.
- Detail, which is clearly defined and accurately depicted on large-scale maps, may be lost when small-scale maps are derived from them.
- Although samples and records are maintained with all reasonable care, there may be some deterioration in the long term.
- The most appropriate techniques for copying original records are used, but there may be some loss of detail and dimensional distortion when such records are copied.
- Data may be compiled from the disparate sources of information at BGS's disposal, including material donated to BGS by third parties, and may not originally have been subject to any verification or other quality control process.
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- The topography shown on any map extracts is based on the latest OS mapping and is not necessarily the same as that used in the original compilation of the BGS geological map, and to which the geological linework available at that time was fitted.
- Note that for some sites, the latest available records may be quite historical in nature, and while every effort is made to place the analysis in a modern geological context, it is possible in some cases that the detailed geology at a site may differ from that described.

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Appendix E

Hydrock Methodology

Hydrock desk study report appendix on Hydrock Methodology, version 29 updated 25-01-16 applies to this report.

1.0 HYDROCK REPORT APPENDIX ON HYDROCK METHODOLOGY

This appendix provides additional background information on certain approaches and methods used by Hydrock Consultants Ltd in the preparation of this report.

Throughout the report the term 'geotechnical' is used to describe aspects relating to the physical nature of the site (such as foundation requirements) and the term 'geo-environmental' is used to describe aspects relating to ground-related environmental issues (such as potential contamination). However, it should be appreciated that this is an integrated investigation and these two main aspects are inter-related. The geo-environmental sections are written in broad agreement with BS 10175:2011+A1:2013.

The **first stage** of a two-staged investigation and assessment of a site is the Preliminary Investigation (BS 10175:2011+A1:2013), often referred to as the Phase 1 Study[1], comprising desk study and walk-over survey, which culminates in the Preliminary Risk Assessment. A preliminary conceptual site model (CSM) is developed. From this are identified any geotechnical and geo-environmental hazards and the qualitative degree of risk associated with them. From the geo-environmental perspective, the Hazard Identification process uses professional judgement to evaluate all the hazards in terms of **possible contaminant linkages** (of source-pathway-receptor). Possible contaminant linkages are potentially unacceptable risks in terms of the current contaminated land regime legal framework and require either remediation or further assessment. These are normally addressed via intrusive ground investigation and generic risk assessment.

The **second stage** is the Ground Investigation, Generic Risk Assessment and Geotechnical Interpretation. This represents the further assessment mentioned above. The Ground Investigation comprises field work and laboratory testing based on the findings of the Preliminary Risk Assessment, to reduce uncertainty in the geotechnical and geo-environmental hazard identification. This may include the Exploratory, Main and Supplementary Investigations described in BS 10175:2011+A1:2013.

For the geotechnical aspects of the report, the general requirements of Eurocode 7 (BS EN 1997-2:2007) are to produce a Ground Investigation Report (GIR) which shall form part of the Geotechnical Design Report (GDR). The geotechnical section of this report is intended to fulfil the general requirements of the GIR as outlined in BS EN 1997-2, Section 6.

The GIR contains the factual information including geological features and relevant data, and a geotechnical evaluation of the information stating the assumptions made in the interpretation of the test results.

[1] Please note that it does not refer to a site development phase.

2.0 SITE INVESTIGATION INFORMATION

2.1 Unexploded Ordnance

Clients have a legal duty under the CDM 2015 Regulations to provide designers and contractors with project-specific health and safety information needed to identify hazards and risks. This includes the possibility of unexploded ordnance (UXO) being encountered on the site. Further details are given in CIRIA report C681 (Stone *et al* 2009).

A non-specialist UXO screening exercise has been carried out for the site by considering (a) any evidence of UK defence activities on or near the site evident from the gathered desk study information and (b) the unexploded aerial delivered bomb (UXB) regional risk maps produced by Zetica. Other data sources are available, but as a first stage screening exercise the freely available Zetica maps have been used. The level of risk stated is that determined by Zetica, a company experience in the desk study, field investigation and clearance of UX0/UXB.

2.2 Hydrogeology

Under the Water Framework Directive the designations of principal and secondary aquifers is based on the Environment Agency interactive aquifer designation map. Where aquifers have been mapped, and they are capable of sustaining a yield of 10 m^3/day or supplying 50 people on a continuous basis, the Environment Agency has designated a number of Groundwater Bodies to help manage water quality under the River Basin Management Plans. Groundwater Bodies are defined based on their support for ecosystems as well as their capacity to supply drinking water. Note that some localised small aquifers capable of supporting the above supply may be too small to map and can be identified only by investigation.

Where an aquifer exists and it contains groundwater but is incapable of sustaining the above supply, the groundwater is not part of a Groundwater Body and may not be considered a strategic resource. In which case the groundwater is not a receptor, but can be a pathway to other receptors by virtue of its ability to transport contaminants.

2.3 Geotechnical Testing

Derived values of geotechnical parameters and/or coefficients are obtained from test results, by theory, correlation or empiricism in line with BS EN 1997-2:2007, Section 1.6.

Where derived geotechnical parameters are to be used in designs in accordance with EC7, there are two further stages of interpretation that will be carried out by the geotechnical designer. The first of these is the selection of **characteristic values** for geotechnical parameters using the derived values and complemented by well-established experience as per EN BS 1997-1:2004, Section 2.4.5.2. The characteristic value is a cautious estimate of the value affecting the occurrence of the limit state. Consequently, any particular material type may have more than one characteristic value for each parameter because there may be more than one limit state depending what is being designed.

The second stage is the selection of **design values** as per EN BS 1997-1:2004, Section 2.4.6.2. The design values is either derived from the characteristic value by applying the relevant partial

factor or is assessed directly. Similarly, there can be several design values for the same material type.

In the event that geotechnical designs are included in this report, selection of the characteristic and design values is included. Otherwise, it is the duty of the geotechnical designer to determine these within a separate design report.

3.0 RISK ASSESSMENT RATIONALE

The work presented in this report has been carried out in accordance with recognised best practice as detailed in guidance documents such as in the CLR 11 Model Procedures (Environment Agency 2004a), GP3 (Environment Agency August 2013), BS 5930:2015 and BS 10175:2011+A1:2013. Important aspects of the risk assessment process are transparency and justification. The particular rationale behind the risk assessments presented is given in this appendix.

A preliminary risk assessment is made of both geotechnical and geo-environmental hazards identified at the desk study stage and confirmed (or amended) at the ground investigation stage. In the case of geo-environmental hazards this is based on a simple matrix of probability of occurrence versus the consequence, as explained below, and is referred to as the **exposure model**. In the case of the geotechnical hazard identification, this is referred to as the **ground model**.

The geo-environmental risk assessment process proceeds to the next level, the generic risk assessment, in which actual contaminant concentrations are considered.

3.1 Preliminary Risk Assessment

In line with the CLR 11 Model Procedures (Environment Agency 2004a), the Preliminary Risk Assessment includes a geo-environmental Hazard Identification, which seeks to list all the suspected contaminant **sources**, the **receptors** that might be harmed by those sources and the **pathways** via which the sources might reach the receptors to cause the harm. The source-pathway-receptor concept is known as a contaminant linkage (formerly a pollutant linkage) and only when a linkage is complete is there any possibility of risk of harm arising.

The Hazard Identification process uses professional judgement to evaluate all the hazards in terms of **possible contaminant linkages**. Possible contaminant linkages are potentially unacceptable risks in terms of the current contaminated land regime legal framework and require either remediation or further assessment. These are normally addressed via intrusive ground investigation and the chemical analysis of soil and water samples.

Where no ground investigation has been carried out (i.e. in a desk study only report) there is greater uncertainty in the information available and so a geoenvironmental consequences and probability assessment is undertaken.

Some linkages may be identified which constitute a theoretical connection between a source and a receptor, but professional judgement shows them not to be possible for some reason. These are labelled ‘no linkage’ in the summary table and no further action is required. If a linkage is possible, a comparison is made of consequence against probability in accordance with the guidance given in CIRIA Report C552 (Rudland *et al* 2001), but is modified as mentioned below.

Classification of consequences and probability are given in CIRIA Report C552 Tables 6.3 and 6.4, respectively, but there are a number of inconsistencies in the original Table 6.3, in particular relating to ‘significant harm or significant possibility of significant harm’ (SH/SPOSH). Consequently, the table has been updated by Hydrock in line with current practice and the

revision presented in R&D Publication 66, Annex 4 (NHBC and Environment Agency. 2008, and is given in Table 3.1 below.

The basis of the classification is that 'severe' and 'medium' are likely to result in SH/SPOSH as defined by the EPA 1990, Part 2A, with 'severe' resulting in acute harm. 'Mild' lies below the level of SH/SPOSH but above the level of 'no harm' as implied by the relevant Generic assessment criterion (GAC, see below). Minor lies below the 'no harm' level.

Table 3.1: Classification of Consequences of Geo-environmental Risks

Classification of Consequences for Geo-environmental Risks		
Classification	**Definition**	**Examples**
Severe	Concentration of contaminants is likely to (or is known from previous data to) exceed that indicative of unacceptable intake or contact. Highly elevated concentrations **likely** to result in "significant harm" to human health as defined by the EPA 1990, Part 2A, if exposure occurs. I.e. >>SH/SPOSH, concentrations are high enough to cause acute (short-term) effects. Equivalent to EA **Category 1** pollution incident including persistent and/or extensive effects on water quality; leading to closure of a potable abstraction point; major impact on amenity value or major damage to agriculture or commerce. Major damage to aquatic or other ecosystems, which is likely to result in a substantial adverse change in its functioning or harm to a species of special interest that endangers the long-term maintenance of the population. Catastrophic damage to crops, buildings or property.	Human health: short-term (acute) effects likely to result in significant harm. E.g. high conc. of cyanide on the surface of an informal recreational area. Significant harm to humans is defined as death, disease*, serious injury, genetic mutation, birth defects or the impairment of reproductive functions. Planting: complete and rapid die-back of landscaped areas. Controlled waters: short-term pollution, e.g. major spillage into controlled water. Major fish kill in surface water from large spillage of contaminants from site. Highly elevated concentrations of List I and II substances present in groundwater close to small potable abstraction (high sensitivity). Buildings etc.: catastrophic damage, e.g. explosion causing collapse. (can also equate to immediate human health risk if buildings are occupied). Ecosystems: acute risk to a particular ecosystem or organism forming part of that ecosystem in a designated protected area, e.g. by contamination spillage. Damage to a protected area of international significance (e.g. Ramsar site). Site workers: risk assessment required to determine PPE and this may involve USEPA Level A, B or C protection.

Classification of Consequences for Geo-environmental Risks		
Classification	**Definition**	**Examples**
Medium	Concentration of contaminants is likely to (or is known from previous data to) exceed that indicative of unacceptable intake or contact. Elevated concentrations which could result in "significant harm" to human health as defined by the EPA 1990, Part 2A if exposure occurs. I.e. >SH/SPOSH. Equivalent to **EA Category 2** pollution incident including significant effect on water quality; notification required to abstractors; reduction in amenity value or significant damage to agriculture or commerce. Significant damage to aquatic or other ecosystems, which may result in a substantial adverse change in its functioning or harm to a species of special interest that may endanger the long-term maintenance of the population. Significant damage to crops, buildings or property.	Human health: long-term (chronic) effects likely to result in significant harm. E.g. high conc. of contaminants close to the surface of a development site. Significant harm to humans is defined as death, disease*, serious injury, genetic mutation, birth defects or the impairment of reproductive functions. Planting: stressed or dead plants in landscaped areas. Controlled waters: pollution of sensitive water resources, e.g. leaching into principal or secondary aquifers or rivers. Buildings etc.: damage renders unsafe to occupy e.g. foundation damage resulting in instability. Ingress of contaminants through plastic potable water pipes. Ecosystems: chronic death of species in a particular ecosystem in a designated protected area, e.g. by contamination spillage. Damage to a protected area of national significance (e.g. Site of Special Scientific Interest). Site workers: risk assessment required to determine PPE and this may involve USEPA Level B, C or D protection.
Mild	Concentration of contaminants is likely to (or is known from previous data to) exceed that indicative of no harm but not unacceptable intake or contact. Exposure to human health **unlikely** to lead to "significant harm". I.e. >SVG/GAC but <SH/SPOSH. Equivalent to **EA Category 3** pollution incident including minimal or short lived effect on water quality; marginal effect on amenity value, agriculture or commerce. Minor or short lived damage to aquatic or other ecosystems, which is unlikely to result in a substantial adverse change in its functioning or harm to a species of special interest that would endanger the long-term maintenance of the population. Minor damage to crops, buildings or property.	Human health: harm but probably not significant harm unless particularly sensitive individual within the receptor group. May be aesthetic/olfactory impacts. Exposure could lead to slight short-term effects (e.g. mild skin rash). Planting: damage to plants in landscaped areas, e.g. stunted growth, discoloration. Controlled waters: pollution of non-sensitive water bodies e.g. leaching into non-classified groundwater or minor ditches. Buildings etc.: damage to sensitive buildings etc. Surface spalling of concrete. Ecosystems: minor change in a particular ecosystem in a designated protected area, but not significant harm. Damage to a locally important area. Site workers: risk assessment required to determine PPE and this may involve USEPA Level C or D protection.

Classification of Consequences for Geo-environmental Risks		
Classification	**Definition**	**Examples**
Minor	Concentration of contaminants is likely to (or is known from previous data to) be less than that indicative of no harm. No measurable effects on humans. I.e. <SGV/GAC. Equivalent to insubstantial pollution incident with no observed effect on water quality or ecosystems. Repairable effects of damage to buildings, structures and services.	No measurable effects, but simple PPE required (USEPA Level D protection, i.e. overalls, boots, goggles, hard hat). The loss of plants in a landscaping scheme. Discoloration of concrete.

CIRIA Report C552 Table 6.4 is reproduced as Table 3.2 below. This provides an estimate of the probability that the event described by the contaminant linkage will occur. For example, the likelihood that pollution of groundwater will occur by leaching of metals into the aquifer.

Table 3.2: Classification of Probability of Geo-environmental Risks

Classification of Probability of Geo-environmental Risks	
Classification	**Definition**
High Likelihood	There is a contaminant linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	There is a contaminant linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event in not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a contaminant linkage and circumstances are possible under which an event could occur. However, it is no means certain that even over a longer period such event could take place, and is less likely in the shorter term.
Unlikely	There is a contaminant linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

The perceived level of risk for each pathway is then derived from the probability versus consequences matrix, modified after CIRIA Report C552 Table 6.5, given in Table 3.3 below. Note that by definition, no contaminant linkage equates to no risk.

Table 3.3: Qualitative Risk Level from Consequence and Probability

		Consequence			
Probability	*product*	**Severe**	**Medium**	**Mild**	**Minor**
	High Likelihood	Very high risk	High risk	Moderate risk	Low risk
	Likely	High risk	Moderate risk	Low risk	Very low risk
	Low Likelihood	Moderate risk	Low risk	Low risk	Very low risk
	Unlikely	Low risk	Very low risk	Very low risk	Very low risk
	No Linkage	No risk			

This approach assumes an equivalence between probability and consequences and ignores the difficulty that can arise where to probability of occurrence appears to be almost negligible but the consequences are very severe. In such conditions there is a degree of subjectivity in assessing the level of risk and it could be low, moderate or high. Such risks may require specialist consideration beyond the scope of this standard report.

Finally, a description of the classified risks and the likely action required can be determined from Table 3.4 below.

Table 3.4: Description of the Classified Risks and Likely Action Required

Description of Classified Risks and Likely Action Required	
Very High Risk	A significant contaminant linkage, including actual evidence of significant harm or significant possibility and significant harm, is clearly identifiable at the site (e.g. from visual or documentary evidence) under current conditions, with potential for legal and/or financial consequences for the site owner or other Responsible Person. Remediation advisable based on acute impacts being likely. Immediate action should be considered.
High Risk	A contaminant linkage is identifiable at the site under current and future use conditions. Although likely, there is no obvious actual evidence of significant harm or significant possibility and significant harm under current conditions. Extent of risk is therefore subject to confirmation by investigation and risk assessment and most likely to be deemed significant. Realisation of the risk is likely to present a substantial liability to the site owner or other Responsible Person. Remediation required for redevelopment and may also be required under Part 2A for existing receptors.
Moderate Risk	A contaminant linkage is identifiable at the site under current and future use conditions. However, it is not likely to be a significant linkage under current conditions. It is either relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely, that the harm would be relatively mild. Actual extent of risk subject to confirmation by additional investigation and risk assessment and most likely to lie between no possibility of harm (under current conditions) and significant possibility of significant harm (under conditions created by new use). Remediation may be required for redevelopment.
Low risk	Potential pathways and receptors exist but history of contaminative use or site conditions indicates that contamination is likely to be of limited extent and below the level of no possibility of harm. It is unlikely that the site owner or other Responsible Person would face substantial liabilities from suck a risk. Precautionary investigations and risk assessment advisable on change of use. Any subsequent remedial works are likely to be relatively limited.
Very Low Risk	No contaminant linkage likely to exist under current or future conditions, but this cannot be completely discounted. If harm is realised, it is likely at worst to be mild or minor. Site not capable of being determined under Part 2A where the local authority inspects the site. No further action recommended.
No Risk	No contaminant linkage exists.

3.2 Contaminant Analysis of Samples

The Model Procedures of CLR 11 provide guidance on key information sources with respect to potential contamination arising from past land uses of a site. In particular, the now withdrawn CLR 8 (Environment Agency 2002b), the DoE Industry Profile documents and ISO10381-5 provide good summaries of priority pollutants for UK sites. Additionally, the Environment Agency (2004b) has produced a list of priority pollutants for ecological risk assessment. These documents have been used, with the findings of the Phase 1 investigation, to scope the analyses of chemicals of potential concern. It should be noted that whilst CLR 8 was withdrawn in August 2008 it was not replaced and its findings are still considered useful.

Hydrock considers there to be a minimum requirement for soil chemical analysis, even for greenfield sites, in order to satisfy the 'suitable for use' criterion of the planning regime. This is represented by the 'Hydrock default list of determinands for solids'. The default list is derived

from the above guidance, particularly Tables 2.1 and 2.2 of CLR 8, listing potential inorganic and organic contaminants on typical former **industrial** land in the UK.

Since not all redevelopment sites have former industrial land uses, the default list designed to screen for unacceptable risks to property development and future occupiers comprises those substances with human, vegetation and construction materials receptors. The list includes common metals, metalloids and inorganic species, pH, asbestos fibres and screening tests for common organic compound groups which are deemed chemicals of potential concern. Sulfate is a contaminant whose principal receptor is concrete in the ground and is not considered toxic except in extreme conditions. Sulfate analysis is included in the list of geotechnical tests. Some common determinands such as elemental sulfur and sulfide are not included because there is insufficient information available to calculate meaningful assessment criteria.

The Hydrock default list of determinands for water or soil leaching samples is based on the prevailing UK drinking water standards and the environmental quality standards (EQS) values under the UK's obligations under the European Water Framework Directive (WFD). It includes the most common contaminants for use as a screening exercise but does not represent a complete list.

The two Hydrock default lists of determinands are used as a minimum requirement whatever the findings of the Phase 1 investigation. Added to this may be other suites of determinands based on the findings and review of the aforementioned documents.

Assessment is made of all chemicals of potential concern recorded on the site above the laboratory reporting limit. The reporting limits are less than the generic assessment criteria where this is possible. There are two main reasons why this may not be the case.

Firstly, low-level detection may be available using a more detailed analysis method, but this would be disproportionally expensive for routine screening purposes. More detailed testing may be recommended in some instances as an additional phase of investigation once the results of the screening exercise are known.

Secondly, there may be no suitable laboratory method available. In which case it is impossible to give a definitive opinion.

3.3 Generic Risk Assessment Criteria for Human Health

3.3.1 Policy

Generic assessment criteria (GAC) are criteria derived using largely generic assumptions about the characteristics and behaviour of sources, pathways and receptors. These assumptions will be conservative in a defined range of conditions. The Contaminated Land Exposure Assessment (CLEA) framework uses Soil Guideline Values (SGV) in assessing risks to human health from exposure to soils contaminated with selected contaminants. It has been assumed in this report that the exposure conditions are within the generic conditions used to derive the SGVs.

It should be noted that exceedance of GACs does not automatically mean that the soil is "contaminated". The derivation of GACs includes a number of precautionary assumptions such that non-exceedance will indicate that risk to human health is acceptable and that the land is

suitable for use, with regard to the contaminant in question. SGVs are not binding standards, but may be used to inform judgments about the need for action and the selection of remediation standards or target values for individual sites.

However, the legal test for land contamination under the statutory guidance of Part 2A of the Environment Protection Act 1990 (i.e. "significant harm or significant possibility of significant harm") is **unacceptable** intake or direct bodily contact. Defra (September 2005 and July 2008) has made it clear that exceedance of a GAC does not necessarily meet this legal test, i.e. exceedance of a GAC does not necessarily equate to unacceptable risk. Consequently, the GACs must be considered as screening values only. The situation was clarified by Defra (July 2008) in its guidance on the legal definition of contaminated land and in 2012 by the publication of revised contaminated land statutory guidance. One of the key policy aspects of this revision is to clarify that GACs are only one tool in the decision-making process and that background concentrations and a number of other relevant factors should also be taken into account. The aim is to prevent over-cautious determination of land as being contaminated.

The Environment Agency (2009a) has stated that the Health Criteria Values (HCV) used to derive GACs represent minimal or tolerable risk for long-term human exposure to chemicals in the soil. "Science alone cannot answer the question of whether or not a given *possibility of significant harm* is *significant*, since what is either *significant* or *unacceptable* is a matter of socio-political judgement, and the law entrusts decisions on this to the enforcing authorities (Defra July 2008)."

The former Health Protection Agency (2009) (now Public Health England) also described how HCVs do not represent unacceptable intake and that unacceptable intake is not a toxicological parameter. It further asserts that "unacceptable intake is a policy decision which can only be taken by the local authority." Pointers provided to local authorities in this regard are provided by the following: "The HCVs, and GACs based upon them represent trigger values above which there might be a possibility of significant harm. Whether there is a significant possibility will be linked to factors such as the margin of exceedance, the duration and frequency of exposure, and other site-specific factors."

The 2012 National Planning Policy Framework states that the standard of remediation to be achieved through the grant of planning permission for new development, including permission for land remediation activities, is the removal of unacceptable risk and making sure the site is suitable for its new use. As a minimum, after carrying out the development and commencement of its use, the land should not be capable of being determined as contaminated under Part 2A. The requirements for planning are, therefore, the same as for Part 2A.

The 2012 contaminated land statutory guidance says that GAC represent cautious estimates of levels of contaminants in soil at which there is considered to be no risk to health or, at most, a minimal risk to health. They may be used to indicate when land is very unlikely to pose a significant possibility of significant harm to human health. They should not:

- be used as direct indicators of whether a significant possibility of significant harm to human health may exist. Also, the local authority should not view the degree by which GACs are exceeded (in itself) as being particularly relevant to this consideration, given that the degree of risk posed by land would normally depend on many factors other than simply the amount of contaminants in soil.

- be seen as screening levels which describe the boundary between Categories 3 and 4 (see below);
- be viewed as indicators of levels of contamination above which detailed risk assessment would automatically be required under Part 2A or, under the planning system, in relation to ensuring that land affected by contamination does not meet the Part 2A definition of contaminated land after it has been developed; nor
- be used as generic remediation targets under the Part 2A regime.

Where it is judged that significant uncertainties remain following assessment against generic criteria, there are two options for the developer: either the implementation of an agreed remedial strategy, or to undertake additional testing and/or a detailed quantifiable risk assessment to determine whether remediation is indeed necessary.

Category 4 Screening Levels (C4SL) are criteria developed to screen out land affected by contamination under Part 2A of the EPA 1990 (see Section 3.12 below). They represent a low level of risk, whilst still being protective of human health. The Defra policy document (March 2014) states that "it is anticipated that, where they exist, C4SLs will be used as generic screening criteria that can be used within a GQRA, albeit describing a higher level of risk than the currently or previously available SGVs."

Defra also states that "the Part 2A regime and the planning regime are inter-linked such that the National Planning Policy Framework states that "after development, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990" and that "Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner." The Part 2A Statutory Guidance and accompanying Impact Assessment were developed on the basis that Category 4 Screening Levels could be used under the planning regime, as they would be in Part 2A investigations directly. The estimated benefits that were expected to accrue from the changes to the Part 2A Statutory Guidance and specifically from the use of the new Category 4 Screening Levels were based on this assumption. However, policy responsibility for the National Planning Policy Framework and associated Planning Practice Guidance falls to the Department for Communities and Local Government."

DCLG's Planning Policy Guidance (Reference ID: 33-007-20140612 Land affected by contamination, dated 12 June 2014) states that "if there is a reason to believe contamination could be an issue, developers should provide proportionate but sufficient site investigation information (a risk assessment) to determine the existence or otherwise of contamination, its nature and extent, the risks it may pose and to whom/what (the 'receptors') so that these risks can be assessed and satisfactorily reduced to an acceptable level. Defra has published a policy companion document considering the use of 'Category 4 Screening Levels' in providing a simple test for deciding when land is suitable for use and definitely not contaminated land."

In a letter to Local Authorities dated 3 September 2014, Defra Parliamentary Under Secretary Lord de Mauley confirmed that the Impact Assessment agreed during the revision of the Part 2A Statutory Guidance was developed on the basis that C4SLs could be used under the planning regime, and noted this intent is reflected in the above-mentioned revision of the Planning Policy Guidance. He highlighted that C4SLs provide a simple test for deciding when land is suitable for use. He concluded that the introduction of C4SLs has an important part to play in the

assessment of potentially contaminated land and encouraged Local Authority officials to read Defra's Policy Companion Document.

The NHBC (October 2014) has endorsed the use of C4SLs in the planning framework. "NHBC considers that:

- C4SLs may be used for schemes in England and Wales as generic screening levels for contaminants in soils, as long as they are justifiable and defensible in the conceptual site model for the site. Where representative contaminant concentrations exceed C4SLs, remediation or further detailed assessment will normally be required.
- Developers should, however, check that the use of C4SLs would be accepted by regulators under the relevant planning regime.
- Where a land use scenario covered by a C4SL applies in England and Wales, that use of C4SLs will satisfy NHBC Standards – Chapter 4.1 requirements. For lead, the C4SL value should be adopted as the screening level, though normal background concentrations can be considered when appropriate."

Public Health England has also communicated with Hydrock on a site-specific basis, confirming (in this instance) that the soil benzo(a)pyrene levels below C4SL not to be of particular concern as long as the Local Authority as the regulator is also satisfied.

On this basis, Hydrock considers the C4SLs to be more pragmatic assessment criteria for use in the planning regime. However, it is recommended that the opinion be sought of the Local Authority in question.

3.3.2 Methodology

The sample analyses are divided into representative data sets for the assessment, based on the conceptual model and taking into account such characteristics as variation in soil properties or historical, existing or proposed land uses. The 'averaging area' is the area of soil to which a receptor is exposed or which otherwise contributes to the creation of hazardous conditions.

The determination of averaging areas is clarified in the CLEA Frequently Asked Questions (30 January 2006) document available from the Agency CLEA web pages. In applying statistical tests, the risk assessor is asking the question "are mean (95 percentile upper confidence limit) soil concentrations within the averaging area equal to, or greater than, the SGV/GAC?" If a garden lies within a larger averaging area, but that averaging area is representative of conditions within the garden, then this is the average concentration a receptor using the garden will be exposed to. An averaging area can, therefore, be larger than a single garden and part of a larger zoned area if:

- contaminant concentrations are within the same statistical population, the sample data being representative of the averaging area and the mean concentration of the averaging area;
- hot spots are treated as separate zones or averaging areas; and
- the sampling strategy takes into account uncertainty (spatial heterogeneity) in contaminant concentration.

The approach taken in this report is to characterize the materials that are likely to form the ground cover in garden areas by zoning the site. Each averaging area has been chosen to describe the area(s) of the site, zoned according to material type and existing conditions, within which assessment against GACs has taken place. As pointed out in P5-066/TR (Environment Agency 2000) and by Nathanail (2004), this is a logical way of investigating a large plot of land that is intended for residential use, particularly if the development layout may not have been finalised.

The original Soil Guideline Values were all withdrawn in August 2008 and the Agency started a programme of publishing replacements using its 'new approach', which involves a number of changes to the way exposure is assessed. This was started using the CLEA 1.04 software. The current version is CLEA 1.07. This programme was put in abeyance when Defra started to re-draft the Part 2A statutory guidance and was never re-started.

This new approach included SGVs only at 6% soil organic matter (SOM) content and none for the residential without plant uptake land use. The contaminated land community has addressed this deficiency by publishing other lists of GACs (EIC/AGS/CL:AIRE 2009 and LQM/CIEH (Nathanail *et al* 2009)) and these have been given equal status to the SGVs in the 2012 revised statutory guidance. Hydrock adopted all these SGVs and GACs and where none are published has derived in-house values using generic assumptions about the characteristics and behaviour of sources, pathways and receptors, the CLEA 1.07 software and research of the recommended data sources.

Since the publication of these lists, CL:AIRE (December 2013) has highlighted that several of the original USEPA data sets used as default input parameters in CLEA have been revised based on a better understanding of the science. These are the outdoor soil-to-skin adherence factor, the exposure frequency for dermal contact, the indoor soil vapour inhalation rates and the produce consumption rates. The first three of these changes are based on updated research in a USEPA 2011 document cited by CL:AIRE. These supersede a draft 2006 USEPA document that was used in the default CLEA model and represent new science. The produce consumption rates used by CL:AIRE are from the most recent National Diet and Nutrition Survey (NSDS) (2008/2009 to 2010/11).

In November 2014 Hydrock used these revised parameters to update all the previously published GACs using modifications to CLEA 1.06. These changes are now built into CLEA 1.07 when the C4SL land uses are selected.

The mean and 90th percentile consumption rates from SP1010 Table 3.4 are used. In the derivation of the C4SLs, CL:AIRE used the 90th percentile consumption rates for the "top two" produce types for each substance and mean consumption rates are used for the remaining produce types (SP1010 Table 3.3). This approach has been followed by Hydrock for the C4SL substances. However, the procedure for determining which are the "top two" is time consuming and has not been replicated by Hydrock for all the other chemicals. The 90th percentile values have been taken for all produce types (and is slightly more conservative).

The GACs adopted by Hydrock for the standard CLEA land uses are given in Table 3.5 together with the source of the GAC. The table also lists GACs for open space (see below).

Please note also that CLEA 1.07 allows for other variations, most notably of soil type (9 options) and building type (5 residential options). The defaults are a sandy loam soil, a small terraced house in the residential setting and a pre-1970s office block in the commercial setting. These are generally conservative and the resultant SGV/GAC are protective of other combinations (unlike the default SOM mentioned above). It is not practical to include all permutations in Table 3.5 and in the cases where specific GACs have been derived, this is referred to in the text of the report and the relevant values included in the assessment tables.

Lead is a special case as the former SGV was not based on the CLEA model, but equations utilising blood lead concentrations. There is currently no guidance on how to risk assess lead in order to produce a GAC. The provisional C4SL for lead was derived using a number approaches, again based on blood lead concentrations, but for three different toxicological effects. The use of biokinetic modelling allows conversion to units suitable for use in the CLEA model. The final C4SLs for residential (with home-ground produce) stipulated in the Defra policy document is less than the withdrawn SGV although the SGV was supposed to represent a lower level of risk. It is clear from the work undertaken to develop the C4SLs why the SGVs were withdrawn. Consequently, and in view of the Defra policy document, Hydrock has adopted the C4SLs for lead *in lieu* of the withdrawn SGV or any specifically derived GAC (which would require a thorough review of lead toxicology). The lead C4SLs are, therefore, included under the term "GACs" in this report.

Further details including data sources can be obtained on request. It is Hydrock's policy to continually review GACs and updates are made in response to the latest Government guidance or as more data on the substances becomes available. The date of the last update of the table is indicated.

Table 3.5: Soil GACs Adopted by Hydrock (mg/kg) - on following pages

Updated 18/11/15		Human Health Generic Assessment Criteria (mg/kg)											
Contaminant	**Source of GAC**	Human health - residential without plant uptake (1%SOM)	Human health - residential without plant uptake (2.5%SOM)	Human health - residential without plant uptake (6%SOM)	Human health - residential with plant uptake (1%SOM)	Human health - residential with plant uptake (2.5%SOM)	Human health - residential with plant uptake (6%SOM)	Human health - allotments (1%SOM)	Human health - allotments (2.5%SOM)	Human health - allotments (6%SOM)	Human health - commercial (1%SOM)	Human health - commercial (2.5%SOM)	Human health - commercial (6%SOM)
							Default for SGV			Default for SGV			Default for SGV
Hydrock Default Suite													
Arsenic	SGV report + CLEA 1.07	40	40	40	37	37	37	49	49	49	640	640	640
Beryllium	LQM/CIEH + CLEA 1.07	73	73	73	73	73	73	56	56	56	390	390	390
Boron	LQM/CIEH + CLEA 1.07	11000	11000	11000	300	300	300	47	47	47	190000	190000	190000
Cadmium	SGV report + CLEA 1.07	87	87	87	14	14	14	2.4	2.4	2.4	220	220	220
Chromium (III)	LQM/CIEH + CLEA 1.07	890	890	890	890	890	890	15000	15000	15000	8400	8400	8400
Chromium (VI)	LQM/CIEH + CLEA 1.07	6.1	6.1	6.1	6.1	6.1	6.1	2.3	2.3	2.3	33	33	33
Copper	LQM/CIEH + CLEA 1.07	7300	7300	7300	2500	2500	2500	540	540	540	69000	69000	69000
Lead	C4SL (NB not minimal risk)	310	310	310	200	200	200	80	80	80	2300	2300	2300
Mercury, inorganic	SGV report + CLEA 1.07	240	240	240	170	170	170	81	81	81	3600	3600	3600
Nickel	Hydrock + CLEA 1.07	180	180	180	130	130	130	55	55	55	1700	1700	1700
Selenium	SGV report + CLEA 1.07	600	600	600	360	360	360	130	130	130	13000	13000	13000
Vanadium	LQM/CIEH + CLEA 1.07	1200	1200	1200	410	410	410	94	94	94	9000	9000	9000
Zinc	LQM/CIEH + CLEA 1.07	40000	40000	40000	3900	3900	3900	640	640	640	670000	670000	670000
Cyanide (free)	Hydrock + CLEA 1.07	800	800	800	790	790	790	2300	2300	2300	16000	16000	16000
Phenol	SGV report + CLEA 1.07	750	1300	2300	290	560	1100	69	140	290	760	1500	3200
Acenaphthene	LQM/CIEH + CLEA 1.07	3000	4700	6000	220	520	1100	35	95	210	84000	97000	100000
Acenaphthylene	LQM/CIEH + CLEA 1.07	2900	4600	6000	180	430	940	29	71	170	83000	97000	100000
Anthracene	LQM/CIEH + CLEA 1.07	31000	35000	37000	2400	5500	11000	390	940	2300	520000	540000	540000
Benz(a)anthracene	LQM/CIEH + CLEA 1.07	5.5	7.8	9.4	4.2	6.7	8.6	2.5	5.4	10	86	91	94
Benzo(a)pyrene	LQM/CIEH + CLEA 1.07	1.5	1.6	1.6	1.50	1.50	1.5	2.10	2.2	2.4	14	14	14
Benzo(b)fluoranthene	LQM/CIEH + CLEA 1.07	11.0	11.0	11.0	7.6	9.4	10.0	3.5	7.3	13	97	98	99
Benzo(ghi)perylene	LQM/CIEH + CLEA 1.07	71	72	72	64	69	71	69	110	150	630	640	640
Benzo(k)fluoranthene	LQM/CIEH + CLEA 1.07	15	16	16	12.0	14.0	15	6.7	13	23	140	140	140
Chrysene	LQM/CIEH + CLEA 1.07	13.0	16.0	15	7.7	11.0	13.0	2.6	5.8	12	140	140	140
Dibenz(ah)anthracene	LQM/CIEH + CLEA 1.07	1.30	1.40	1.40	1.10	1.30	1.40	0.75	1.4	2.3	12	12	13
Fluoranthene	LQM/CIEH + CLEA 1.07	1500	1600	1600	290	560	900	52	130	290	23000	23000	23000
Fluorene	LQM/CIEH + CLEA 1.07	2800	3800	4500	170	410	880	28	68	160	63000	68000	71000
Indeno(123cd)pyrene	LQM/CIEH + CLEA 1.07	6.3	6.6	6.7	4.3	5.5	6.2	1.8	3.8	7.1	58	59	60
Naphthalene	LQM/CIEH + CLEA 1.07	2.3	5.6	13.0	2.2	5.2	12.0	4.2	10	24	190	460	1100
Phenanthrene	LQM/CIEH + CLEA 1.07	1300	1500	1500	97	220	440	16	39	92	22000	22000	23000
Pyrene	LQM/CIEH + CLEA 1.07	3700	3800	3800	620	1200	2000	110	270	620	54000	54000	55000
TPH fractions													
TPH ali EC05-EC06	LQM/CIEH + CLEA 1.07	42	78	160	42	78	160	760	1800	4000	300	560	1200
TPH ali >EC06-EC08	LQM/CIEH + CLEA 1.07	100	230	530	100	230	530	2400	5700	13000	140	320	740
TPH ali >EC08-EC10	LQM/CIEH + CLEA 1.07	27	65	160	27	65	150	320	760	1700	78	190	450
TPH ali >EC10-EC12	LQM/CIEH + CLEA 1.07	48	120	280	48	120	280	2100	4200	7000	48	120	280
TPH ali >EC12-EC16	LQM/CIEH + CLEA 1.07	24	59	140	24	59	140	11000	13000	13000	24	59	140
TPH ali >EC16-EC35	LQM/CIEH + CLEA 1.07	65000	93000	110000	65000	92000	110000	260000	270000	270000	1000000	1000000	1000000
TPH ali >EC35-EC44	LQM/CIEH + CLEA 1.07	65000	93000	110000	65000	92000	110000	260000	270000	270000	1000000	1000000	1000000
TPH aro EC05-EC07	LQM/CIEH + CLEA 1.07	370	690	1400	73	150	310	14	28	60	1200	2300	4700
TPH aro >EC07-EC08	LQM/CIEH + CLEA 1.07	860	1800	3900	130	300	680	23	53	120	870	1900	4400
TPH aro >EC08-EC10	LQM/CIEH + CLEA 1.07	47	120	270	35	84	190	8.9	22	52	610	1500	3600
TPH aro >EC10-EC12	LQM/CIEH + CLEA 1.07	250	590	1200	75	180	390	13	32	76	360	900	2200
TPH aro >EC12-EC16	LQM/CIEH + CLEA 1.07	1800	2300	2500	150	330	670	23	58	140	36000	37000	38000
TPH aro >EC16-EC21	LQM/CIEH + CLEA 1.07	1900	1900	1900	260	550	930	46	110	260	28000	28000	28000
TPH aro >EC21-EC35	LQM/CIEH + CLEA 1.07	1900	1900	1900	1100	1500	1700	360	790	1500	28000	28000	28000
TPH aro >EC35-EC44	LQM/CIEH + CLEA 1.07	1900	1900	1900	1100	1500	1700	360	790	1500	28000	28000	28000
TPH >EC44-EC70	LQM/CIEH + CLEA 1.07	1900	1900	1900	1600	1800	1900	1100	2000	2900	28000	28000	28000
VOCs - BTEX & MTBE													
Benzene	SGV report + CLEA 1.07	0.38	0.70	1.4	0.099	0.2	0.42	0.02	0.041	0.09	27	48	90
Toluene	SGV report + CLEA 1.07	860	1800	3900	130	300	680	23	53	120	870	1900	4400
Ethylbenzene	SGV report + CLEA 1.07	240	540	1200	76	180	410	17	40	94	520	1200	2800
Xylene, o-	SGV report + CLEA 1.07	85	200	460	59	140	320	29	70	160	480	1100	2600
Xylene, m-	SGV report + CLEA 1.07	79	190	430	58	140	320	32	77	180	630	1500	3500
Xylene, p- (use this for combined m & p)	SGV report + CLEA 1.07	76	180	410	55	130	300	30	72	170	580	1400	3200
MTBE	EIC/AGS/CL:AIRE + CLEA 1.07	100	170	320	62	110	210	23	45	92	7500	12000	27000
VOCs - other benzenes													
Iso-propylbenzene	EIC/AGS/CL:AIRE + CLEA 1.07	17	40	95	15	38	89	33	81	190	390	950	2300
Propylbenzene	EIC/AGS/CL:AIRE + CLEA 1.07	57	140	320	46	110	260	35	86	200	400	980	2300
1,2,4-Trimethylbenzene	EIC/AGS/CL:AIRE + CLEA 1.07	0.58	1.4	3.3	0.47	1.2	2.7	0.39	0.96	2.3	39	94	210

Updated 18/11/15		Human Health Generic Assessment Criteria (mg/kg)											
Contaminant	**Source of GAC**	Human health - residential without plant uptake (1%SOM)	Human health - residential without plant uptake (2.5%SOM)	Human health - residential without plant uptake (6%SOM)	Human health - residential with plant uptake (1%SOM)	Human health - residential with plant uptake (2.5%SOM)	Human health - residential with plant uptake (6%SOM)	Human health - allotments (1%SOM)	Human health - allotments (2.5%SOM)	Human health - allotments (6%SOM)	Human health - commercial (1%SOM)	Human health - commercial (2.5%SOM)	Human health - commercial (6%SOM)
VOCs - chlorobenzenes													
Bromobenzene	EIC/AGS/CL:AIRE + CLEA 1.07	1.3	3	7	1.2	2.8	6.6	3.3	7.9	18	92	210	490
Chlorobenzene	LQM/CIEH + CLEA 1.07	0.47	1.1	2.4	0.46	1.0	2.4	6.1	14	33	56	130	290
1,2-Dichlorobenzene	LQM/CIEH + CLEA 1.07	24	57	130	23	55	130	97	240	560	570	1400	3200
1,3-Dichlorobenzene	LQM/CIEH + CLEA 1.07	0.44	1.1	2.5	0.41	0.98	2.3	0.26	0.63	1.5	30	73	170
1,4-Dichlorobenzene	LQM/CIEH + CLEA 1.07	60	140	330	38	92	220	16	38	91	230	540	1300
Hexachlorobenzene	LQM/CIEH + CLEA 1.07	0.20	0.50	2.5	0.20	0.50	1.9	0.17	0.42	0.91	0.2	53	55
Pentachlorobenzene	LQM/CIEH + CLEA 1.07	20	30	38	5.9	12	22	1.3	3.1	7.1	640	770	830
1,2,3-trichlorobenzene	LQM/CIEH + CLEA 1.07	1.5	3.7	8.8	1.5	3.6	8.6	4.8	12	28	100	250	590
1,2,4-trichlorobenzene	LQM/CIEH + CLEA 1.07	2.6	3.4	15	2.6	6.4	15	31	77	180	220	530	1300
1,3,5-trichlorobenzene	LQM/CIEH + CLEA 1.07	0.33	0.81	1.9	0.33	0.81	1.9	4.9	12	28	23	55	130
1,2,3,4-tetrachlorobenzene	LQM/CIEH + CLEA 1.07	24	56	120	15	36	78	4.5	11	26	120	300	730
1,2,3,5-tetrachlorobenzene	LQM/CIEH + CLEA 1.07	0.75	1.9	4.3	0.67	1.6	3.7	0.39	0.95	2.2	39	98	240
1,2,4,5-tetrachlorobenzene	LQM/CIEH + CLEA 1.07	0.73	1.7	3.5	0.34	0.78	1.6	0.065	0.16	0.38	20	49	96
VOCs - chloroalkanes & alkanes													
Bromodichloromethane	EIC/AGS/CL:AIRE + CLEA 1.07	0.027	0.049	0.10	0.022	0.040	0.082	0.017	0.033	0.070	2.0	3.5	7.1
Bromoform	EIC/AGS/CL:AIRE + CLEA 1.07	7.4	15	32	3.5	7.3	16	0.98	2.1	4.8	710	1400	3000
Chloroethane	EIC/AGS/CL:AIRE + CLEA 1.07	12	16	26	12	16	26	120	210	390	900	1200	2000
Chloroethene (aka vinyl chloride)	LQM/CIEH + CLEA 1.07	0.00077	0.0010	0.0015	0.00064	0.00087	0.0014	0.00057	0.0010	0.0019	0.059	0.077	0.12
Chloromethane	EIC/AGS/CL:AIRE + CLEA 1.07	0.012	0.014	0.019	0.012	0.014	0.019	0.068	0.13	0.24	1.0	1.1	1.5
1,1-Dichloroethane	EIC/AGS/CL:AIRE + CLEA 1.07	3.6	5.8	11	3.4	5.5	11	9.6	18	37	260	430	800
1,2-Dichloroethane	LQM/CIEH + CLEA 1.07	0.0092	0.013	0.023	0.0071	0.011	0.019	0.0048	0.0086	0.016	0.67	0.97	1.7
1,1-Dichloroethene	EIC/AGS/CL:AIRE + CLEA 1.07	0.33	0.58	1.2	0.32	0.57	1.2	2.9	5.8	12	24	43	87
Cis 1,2 Dichloroethene	EIC/AGS/CL:AIRE + CLEA 1.07	0.17	0.29	0.56	0.16	0.27	0.52	0.27	0.52	1.1	14	23	44
Trans 1,2 Dichloroethene	EIC/AGS/CL:AIRE + CLEA 1.07	0.28	0.50	1.0	0.27	0.48	0.98	0.97	1.9	4.2	21	37	76
Dichloromethane	EIC/AGS/CL:AIRE + CLEA 1.07	3.0	4.0	6.4	0.62	1.1	1.9	0.11	0.19	0.35	260	340	530
1,2-Dichloropropane	EIC/AGS/CL:AIRE + CLEA 1.07	0.034	0.06	0.12	0.034	0.060	0.12	0.64	1.3	2.7	3.1	5.5	11
Hexachloroethane	EIC/AGS/CL:AIRE + CLEA 1.07	0.31	0.77	1.8	0.27	0.66	1.6	0.28	0.069	1.6	8.2	20	48
Tetrachloroethene	LQM/CIEH + CLEA 1.07	1.5	3.3	7.5	1.3	2.9	6.7	1.7	3.9	9.0	120	280	620
1,1,1,2-Tetrachloroethane	LQM/CIEH + CLEA 1.07	1.5	3.6	8.2	1.2	2.8	6.5	0.82	1.9	4.6	110	250	560
1,1,2,2-Tetrachloroethane	LQM/CIEH + CLEA 1.07	4.1	8.3	18	1.7	3.5	7.8	0.42	0.92	2.1	280	560	1200
Tetrachloromethane	LQM/CIEH + CLEA 1.07	0.026	0.056	0.13	0.026	0.056	0.13	0.17	0.38	0.88	2.9	6.3	14
Trichloroethene	LQM/CIEH + CLEA 1.07	0.16	0.33	0.73	0.15	0.31	0.69	0.44	0.99	2.2	11	24	52
1,1,1-Trichloroethane	LQM/CIEH + CLEA 1.07	9.0	18	40	8.8	18	39	50	110	250	660	1400	3000
1,1,2 Trichloroethane	EIC/AGS/CL:AIRE + CLEA 1.07	1.3	2.5	5.5	0.76	1.6	3.5	0.29	0.64	1.4	89	180	380
Trichloromethane	LQM/CIEH + CLEA 1.07	1.3	2.3	4.6	0.98	1.8	3.6	0.37	0.73	1.5	100	180	350
Other phenols & chlorophenols													
2-Chlorophenol	LQM/CIEH + CLEA 1.07	110	170	220	3.9	9.1	20	0.60	1.4	3.4	3600	4000	4300
2,4-Dichlorophenol	LQM/CIEH + CLEA 1.07	94	150	200	0.91	2.1	4.7	0.14	0.31	0.72	3500	3900	4200
2,4-Dimethylphenol	EIC/AGS/CL:AIRE + CLEA 1.07	300	590	1000	20	46	100	3.2	7.4	17	1400	3100	7200
2-Methylphenol	EIC/AGS/CL:AIRE + CLEA 1.07	5300	7700	9900	85	190	430	13	29	67	160000	180000	180000
3-Methylphenol	EIC/AGS/CL:AIRE + CLEA 1.07	6800	9100	11000	85	190	420	13	29	65	170000	180000	190000
4-Methylphenol	EIC/AGS/CL:AIRE + CLEA 1.07	5400	7900	10000	84	190	420	13	29	65	160000	180000	180000
Pentachlorophenol	LQM/CIEH + CLEA 1.07	37	56	69	0.56	1.3	3.1	0.085	0.21	0.49	1200	1300	1400
2,3,4,6-Tetrachlorophenol	LQM/CIEH + CLEA 1.07	140	200	240	0.89	2.1	4.8	0.14	0.32	0.74	3900	4200	4300
2,4,6-Trichlorophenol	LQM/CIEH + CLEA 1.07	140	200	250	1.5	3.5	7.8	0.22	0.53	1.2	3900	4200	4400
Phthalates													
Bis (2-ethylhexyl) phthalate	EIC/AGS/CL:AIRE + CLEA 1.07	3900	4000	4100	290	660	1300	48	120	280	85000	86000	86000
Butyl benzyl phthalate	EIC/AGS/CL:AIRE + CLEA 1.07	61000	63000	64000	1500	3500	7800	230	560	1300	940000	940000	950000
Diethyl Phthalate	EIC/AGS/CL:AIRE + CLEA 1.07	14	29	65	120	270	610	19	43	98	14	29	65
Di-n-butyl phthalate	EIC/AGS/CL:AIRE + CLEA 1.07	650	650	650	13	32	72	2.1	5.1	12	15000	15000	15000
Di-n-octyl phthalate	EIC/AGS/CL:AIRE + CLEA 1.07	4900	4900	4900	2800	3800	4300	920	2000	3900	89000	89000	89000
Pesticides													
Aldrin	LQM/CIEH + CLEA 1.07	3.0	3.1	3.1	2.3	2.7	2.9	1.3	2.5	4.0	54	54	54
Atrazine	LQM/CIEH + CLEA 1.07	45	46	46	0.25	0.58	1.3	0.038	0.089	0.21	870	880	880
DDD	Hydrock + CLEA 1.07	1300	1300	1300	910	1100	1200	400	780	1200	22000	22000	22000
DDE	Hydrock + CLEA 1.07	1300	1300	1300	870	1100	1200	360	740	1300	22000	22000	22000
DDT	Hydrock + CLEA 1.07	1300	1300	1300	830	1000	1200	320	650	1100	21000	21000	21000
Dichlorvos	LQM/CIEH + CLEA 1.07	36	45	53	0.30	0.62	1.3	0.046	0.094	0.20	840	870	890
Dieldrin	LQM/CIEH + CLEA 1.07	5.0	5.4	5.6	0.74	1.5	2.7	0.13	0.32	0.74	90	91	92
Endosulfan - alpha	LQM/CIEH + CLEA 1.07	62	110	160	3.1	7.4	17	0.49	1.2	2.8	2300	3000	3400
Endosulfan - beta	LQM/CIEH + CLEA 1.07	76	130	180	2.9	7.0	16	0.46	1.1	2.6	2500	3100	3500
Hexachlorocyclohexanes - alpha (inc. Lindane)	LQM/CIEH + CLEA 1.07	660	840	940	20	48	110	3.1	7.7	18	14000	15000	15000
Hexachlorocyclohexanes - beta (inc. Lindane)	LQM/CIEH + CLEA 1.07	73	75	76	1.7	4.1	9.2	0.27	0.66	1.6	1100	1100	1100
Hexachlorocyclohexanes - gamma (inc. Lindane)	LQM/CIEH + CLEA 1.07	27	31	33	0.60	1.4	3.3	0.092	0.23	0.54	530	550	550

Updated 18/11/15		Human Health Generic Assessment Criteria (mg/kg)											
Contaminant	**Source of GAC**	**Human health - residential without plant uptake (1%SOM)**	**Human health - residential without plant uptake (2.5%SOM)**	**Human health - residential without plant uptake (6%SOM)**	**Human health - residential with plant uptake (1%SOM)**	**Human health - residential with plant uptake (2.5%SOM)**	**Human health - residential with plant uptake (6%SOM)**	**Human health - allotments (1%SOM)**	**Human health - allotments (2.5%SOM)**	**Human health - allotments (6%SOM)**	**Human health - commercial (1%SOM)**	**Human health - commercial (2.5%SOM)**	**Human health - commercial (6%SOM)**
Dioxins, furans & dioxin-like-PCBs													
Total dioxins, furans & DL-PCB (aerial dep.)	SGV report + CLEA 1.07	0.012	0.012	0.012	0.0099	0.010	0.010	0.0075	0.0083	0.0086	0.24	0.24	0.24
Non-dioxin-like PCBs													
PCB-28	Hydrock + CLEA 1.07	0.63	0.63	0.63	0.24	0.37	0.47	0.056	0.12	0.22	9.0	9.0	9.0
PCB-52	Hydrock + CLEA 1.07	0.63	0.63	0.63	0.24	0.38	0.49	0.058	0.13	0.26	9.0	9.0	9.0
PCB-101	Hydrock + CLEA 1.07	0.63	0.63	0.63	0.50	0.57	0.60	0.290	0.52	0.74	9.0	9.0	9.0
PCB-138	Hydrock + CLEA 1.07	0.63	0.63	0.63	0.54	0.59	0.61	0.39	0.65	0.88	9.0	9.0	9.0
PCB-153	Hydrock + CLEA 1.07	0.63	0.63	0.63	0.56	0.60	0.61	0.49	0.75	0.95	9.0	9.0	9.0
PCB-180	Hydrock + CLEA 1.07	0.63	0.63	0.63	0.58	0.61	0.62	0.58	0.85	1.0	9.0	9.0	9.0
Explosives													
HMX	LQM/CIEH + CLEA 1.07	6700	6700	6700	5.9	13	27	0.89	2.0	4.0	110000	110000	110000
RDX	LQM/CIEH + CLEA 1.07	400	400	400	3.5	7.6	17	0.54	1.2	2.6	6400	6400	6400
2,4,6-Trinitrotoluene	LQM/CIEH + CLEA 1.07	65	65	66	1.6	3.8	8.4	0.25	0.61	1.4	1000	1000	1100
Other inorganics													
Antimony	EIC/AGS/CL:AIRE + CLEA 1.07	380	380	380	190	190	190	54	54	54	6600	6600	6600
Barium	EIC/AGS/CL:AIRE + CLEA 1.07	1400	1400	1400	790	790	790	270	270	270	22000	22000	22000
Mercury, elemental	SGV report + CLEA 1.07	0.24	0.60	1.5	0.24	0.60	1.5	4.3	11	26	4.3	11	26
Molybdenum	EIC/AGS/CL:AIRE + CLEA 1.07	670	670	670	250	250	250	59	59	59	18000	18000	18000
Thiocyanate	Hydrock + CLEA 1.07	13	13	13	13	13	13	28	28	28	190	190	190
Other organics													
Biphenyl	EIC/AGS/CL:AIRE + CLEA 1.07	34	84	200	34	84	200	15	36	86	34	84	200
Carbon disulphide	LQM/CIEH + CLEA 1.07	0.14	0.29	0.62	0.14	0.29	0.62	5.0	11	24	11	22	47
2,4-Dinitrotoluene	EIC/AGS/CL:AIRE + CLEA 1.07	240	250	250	1.5	3.4	7.6	0.23	0.51	1.2	3700	3800	3800
2,6-Dinitrotoluene	EIC/AGS/CL:AIRE + CLEA 1.07	110	120	130	0.82	1.8	4.1	0.12	0.28	0.63	1900	1900	1900
Hexachloro-1,3-butadiene	LQM/CIEH + CLEA 1.07	0.32	0.78	1.8	0.29	0.70	1.6	0.25	0.62	1.4	31	66	120
Mercury, methyl	SGV report + CLEA 1.07	12	16	20	10	13	15	8.0	8.0	8.0	370	390	410
Styrene	EIC/AGS/CL:AIRE + CLEA 1.07	52	120	280	11	25	58	1.6	3.9	9.1	630	1400	3400
Tributyl tin oxide	EIC/AGS/CL:AIRE + CLEA 1.07	12	14	15	0.28	0.67	1.5	0.040	0.11	0.25	230	230	240
2-Chloronaphthalene	EIC/AGS/CL:AIRE + CLEA 1.07	5.4	13	32	5.3	13	31	42	100	230	370	900	2100
Insufficient data to derive GAC													
n butylbenzene	Insufficient data (EIC)	-	-	-	-	-	-	-	-	-	-	-	-
sec butylbenzene	Insufficient data (EIC)	-	-	-	-	-	-	-	-	-	-	-	-
Carbazole	Insufficient data (EIC)	-	-	-	-	-	-	-	-	-	-	-	-
Dimethyl phthalate	Insufficient data (EIC)	-	-	-	-	-	-	-	-	-	-	-	-
Isopropyltoluene	Insufficient data (EIC)	-	-	-	-	-	-	-	-	-	-	-	-
1-Methylnaphthalene	Insufficient data (EIC)	-	-	-	-	-	-	-	-	-	-	-	-
2-Methylnaphthalene	Insufficient data (EIC)	-	-	-	-	-	-	-	-	-	-	-	-
Sulfur (elemental)	Insufficient data (Hydrock)	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	Insufficient data (EIC)	-	-	-	-	-	-	-	-	-	-	-	-
tert butylbenzene	Insufficient data (EIC)	-	-	-	-	-	-	-	-	-	-	-	-
NOTES													
If >1,000,000 is calculated, 1,000,000 is adopted.													
Red text - liquid at ambient temperature, calculated GAC exceeds saturation value and highlighed in red in CLEA - saturation value adopted for GAC													
Orange text - solid at ambient temperature, calculated GAC exceeds saturation value and highlighted red in CLEA - manual calculation not possible as only one HCV - saturated vapour concentration exceed, so saturation value adopted for GAC.													
Blue text - solid at ambient temperature, calculated GAC exceeds saturation value and highlighted red in CLEA - manual calculation not possible as only one HCV - aqueous solubility exceed, so original red-highlighted value adopted for GAC.													
Green text - solid at ambient temperature, calculated GAC exceeds saturation value and highlighted red in CLEA - manual calculation undertaken but result is greater than original red-highlighted value, so original red-highlighted value adopted for GAC.													

Updated 18/11/15							
Contaminant	**Source of GAC**	**Human health - POSresi (1%SOM)**	**Human health - POSresi (2.5%SOM)**	**Human health - POSresi (6%SOM)**	**Human health - POSpark (1%SOM)**	**Human health - POSpark (2.5%SOM)**	**Human health - POSpark (6%SOM)**
Hydrock Default Suite							
Arsenic	SGV report + CLEA 1.07	79	79	79	170	170	170
Beryllium	LQM/CIEH + CLEA 1.07	92	92	92	670	670	670
Boron	LQM/CIEH + CLEA 1.07	21000	21000	21000	46000	46000	46000
Cadmium	SGV report + CLEA 1.07	120	120	120	560	560	560
Chromium (III)	LQM/CIEH + CLEA 1.07	1500	1500	1500	27000	27000	27000
Chromium (VI)	LQM/CIEH + CLEA 1.07	7.7	7.7	7.7	220	220	220
Copper	LQM/CIEH + CLEA 1.07	12000	12000	12000	44000	44000	44000
Lead	C4SL (NB not minimal risk)	630	630	630	1300	1300	1300
Mercury, inorganic	SGV report + CLEA 1.07	470	470	470	1100	1100	1100
Nickel	Hydrock + CLEA 1.07	290	290	290	800	800	800
Selenium	SGV report + CLEA 1.07	1400	1400	1400	2600	2600	2600
Vanadium	LQM/CIEH + CLEA 1.07	2000	2000	2000	5000	5000	5000
Zinc	LQM/CIEH + CLEA 1.07	81000	81000	81000	170000	170000	170000
Cyanide (free)	Hydrock + CLEA 1.07	1600	1600	1600	3400	3400	3400
Phenol	SGV report + CLEA 1.07	760	1500	3200	760	1500	3200
Acenaphthene	LQM/CIEH + CLEA 1.07	15000	15000	15000	29000	30000	30000
Acenaphthylene	LQM/CIEH + CLEA 1.07	15000	15000	15000	29000	30000	30000
Anthracene	LQM/CIEH + CLEA 1.07	74000	74000	74000	150000	150000	150000
Benz(a)anthracene	LQM/CIEH + CLEA 1.07	17	18	18	26	33	40
Benzo(a)pyrene	LQM/CIEH + CLEA 1.07	2.6	2.6	2.6	4.5	5.6	6.5
Benzo(b)fluoranthene	LQM/CIEH + CLEA 1.07	18	18	18	30	38	45
Benzo(ghi)perylene	LQM/CIEH + CLEA 1.07	120	120	120	270	310	350
Benzo(k)fluoranthene	LQM/CIEH + CLEA 1.07	26	26	26	46	57	67
Chrysene	LQM/CIEH + CLEA 1.07	25	26	26	34	45	55
Dibenz(ah)anthracene	LQM/CIEH + CLEA 1.07	2.3	2.3	2.3	4.5	5.5	6.3
Fluoranthene	LQM/CIEH + CLEA 1.07	3100	3100	3100	6300	6300	6400
Fluorene	LQM/CIEH + CLEA 1.07	9900	9900	9900	20000	20000	20000
Indeno(123cd)pyrene	LQM/CIEH + CLEA 1.07	11	11	11	17	22	26
Naphthalene	LQM/CIEH + CLEA 1.07	3900	4100	4200	1100	1600	2300
Phenanthrene	LQM/CIEH + CLEA 1.07	3100	3100	3100	6200	6300	6300
Pyrene	LQM/CIEH + CLEA 1.07	7400	7400	7400	15000	15000	15000
TPH fractions							
TPH ali EC05-EC06	LQM/CIEH + CLEA 1.07	300	590000	600000	300	560	1200
TPH ali >EC06-EC08	LQM/CIEH + CLEA 1.07	600000	610000	620000	140	320	740
TPH ali >EC08-EC10	LQM/CIEH + CLEA 1.07	13000	13000	13000	77	190	450
TPH ali >EC10-EC12	LQM/CIEH + CLEA 1.07	13000	13000	13000	48	120	280
TPH ali >EC12-EC16	LQM/CIEH + CLEA 1.07	13000	13000	13000	24	59	140
TPH ali >EC16-EC35	LQM/CIEH + CLEA 1.07	250000	250000	250000	460000	480000	490000
TPH ali >EC35-EC44	LQM/CIEH + CLEA 1.07	250000	250000	250000	460000	480000	490000
TPH aro EC05-EC07	LQM/CIEH + CLEA 1.07	56000	56000	56000	1200	2300	4700
TPH aro >EC07-EC08	LQM/CIEH + CLEA 1.07	56000	56000	56000	870	1900	4400
TPH aro >EC08-EC10	LQM/CIEH + CLEA 1.07	5000	5000	5000	610	1500	3600
TPH aro >EC10-EC12	LQM/CIEH + CLEA 1.07	5000	5000	5000	360	900	10000
TPH aro >EC12-EC16	LQM/CIEH + CLEA 1.07	5000	5000	5000	10000	10000	10000
TPH aro >EC16-EC21	LQM/CIEH + CLEA 1.07	3800	3800	3800	7600	7700	7800
TPH aro >EC21-EC35	LQM/CIEH + CLEA 1.07	3800	3800	3800	7800	7800	7900
TPH aro >EC35-EC44	LQM/CIEH + CLEA 1.07	3800	3800	3800	7800	7800	7900
TPH >EC44-EC70	LQM/CIEH + CLEA 1.07	3800	3800	3800	7800	7800	7900
VOCs - BTEX & MTBE							
Benzene	SGV report + CLEA 1.07	72	72	73	90	100	110
Toluene	SGV report + CLEA 1.07	56000	56000	56000	870	1900	4400
Ethylbenzene	SGV report + CLEA 1.07	25000	25000	25000	520	1200	2800
Xylene, o-	SGV report + CLEA 1.07	41000	42000	43000	480	1100	2600
Xylene, m-	SGV report + CLEA 1.07	41000	42000	43000	630	1500	3500
Xylene, p- (use this for combined m & p)	SGV report + CLEA 1.07	41000	42000	43000	580	1400	3200
MTBE	EIC/AGS/CL:AIRE + CLEA 1.07	75000	75000	75000	20000	33000	63000
VOCs - other benzenes							
Iso-propylbenzene	EIC/AGS/CL:AIRE + CLEA 1.07	25000	25000	25000	390	950	2300
Propylbenzene	EIC/AGS/CL:AIRE + CLEA 1.07	25000	25000	25000	400	980	2300
1,2,4-Trimethylbenzene	EIC/AGS/CL:AIRE + CLEA 1.07	250	250	250	310	360	410

Updated 18/11/15							
Contaminant	**Source of GAC**	**Human health - POSresi (1%SOM)**	**Human health - POSresi (2.5%SOM)**	**Human health - POSresi (6%SOM)**	**Human health - POSpark (1%SOM)**	**Human health - POSpark (2.5%SOM)**	**Human health - POSpark (6%SOM)**
VOCs - chlorobenzenes							
Bromobenzene	EIC/AGS/CL:AIRE + CLEA 1.07	5200	5400	5600	850	2000	3500
Chlorobenzene	LQM/CIEH + CLEA 1.07	12000	13000	14000	680	1500	2900
1,2-Dichlorobenzene	LQM/CIEH + CLEA 1.07	95000	100000	100000	570	1400	3300
1,3-Dichlorobenzene	LQM/CIEH + CLEA 1.07	300	300	300	390	440	470
1,4-Dichlorobenzene	LQM/CIEH + CLEA 1.07	17000	17000	17000	220	540	1300
Hexachlorobenzene	LQM/CIEH + CLEA 1.07	6.5	6.5	6.5	11	11	11
Pentachlorobenzene	LQM/CIEH + CLEA 1.07	110	110	110	190	190	190
1,2,3-trichlorobenzene	LQM/CIEH + CLEA 1.07	1700	1800	1800	130	330	1600
1,2,4-trichlorobenzene	LQM/CIEH + CLEA 1.07	10000	11000	12000	320	790	1900
1,3,5-trichlorobenzene	LQM/CIEH + CLEA 1.07	1600	1700	1800	37	91	220
1,2,3,4-tetrachlorobenzene	LQM/CIEH + CLEA 1.07	830	830	830	120	1600	1600
1,2,3,5-tetrachlorobenzene	LQM/CIEH + CLEA 1.07	79	79	79	39	120	130
1,2,4,5-tetrachlorobenzene	LQM/CIEH + CLEA 1.07	13	13	13	25	26	26
VOCs - chloroalkanes & alkanes							
Bromodichloromethane	EIC/AGS/CL:AIRE + CLEA 1.07	73	73	74	56	67	81
Bromoform	EIC/AGS/CL:AIRE + CLEA 1.07	3900	3900	4000	2700	4700	5200
Chloroethane	EIC/AGS/CL:AIRE + CLEA 1.07	2600	3500	5700	2600	3500	5700
Chloroethene (aka vinyl chloride)	LQM/CIEH + CLEA 1.07	3.5	3.5	3.5	4.8	5	5.4
Chloromethane	EIC/AGS/CL:AIRE + CLEA 1.07	540	550	560	140	150	170
1,1-Dichloroethane	EIC/AGS/CL:AIRE + CLEA 1.07	46000	47000	48000	1800	3000	5600
1,2-Dichloroethane	LQM/CIEH + CLEA 1.07	29	29	29	21	24	28
1,1-Dichloroethene	EIC/AGS/CL:AIRE + CLEA 1.07	2200	3900	11000	2200	3900	5900
Cis 1,2 Dichloroethene	EIC/AGS/CL:AIRE + CLEA 1.07	1300	1300	1400	690	840	1000
Trans 1,2 Dichloroethene	EIC/AGS/CL:AIRE + CLEA 1.07	3800	4000	4000	1700	2100	2700
Dichloromethane	EIC/AGS/CL:AIRE + CLEA 1.07	760	760	760	1500	1500	1500
1,2-Dichloropropane	EIC/AGS/CL:AIRE + CLEA 1.07	1700	1900	2200	160	210	290
Hexachloroethane	EIC/AGS/CL:AIRE + CLEA 1.07	120	130	130	8.2	20	48
Tetrachloroethene	LQM/CIEH + CLEA 1.07	3400	3400	3400	420	950	2200
1,1,1,2-Tetrachloroethane	LQM/CIEH + CLEA 1.07	1400	1400	1400	1500	1800	2100
1,1,2,2-Tetrachloroethane	LQM/CIEH + CLEA 1.07	1400	1400	1400	1800	2100	2300
Tetrachloromethane	LQM/CIEH + CLEA 1.07	340	350	350	170	240	320
Trichloroethene	LQM/CIEH + CLEA 1.07	1200	1300	1300	660	860	1100
1,1,1-Trichloroethane	LQM/CIEH + CLEA 1.07	140000	140000	140000	1400	2900	6400
1,1,2 Trichloroethane	EIC/AGS/CL:AIRE + CLEA 1.07	990	990	1000	1100	1300	1500
Trichloromethane	LQM/CIEH + CLEA 1.07	1700	1700	1700	2700	2900	3100
Other phenols & chlorophenols							
2-Chlorophenol	LQM/CIEH + CLEA 1.07	610	610	610	1100	1100	1100
2,4-Dichlorophenol	LQM/CIEH + CLEA 1.07	610	610	610	1000	1100	1100
2,4-Dimethylphenol	EIC/AGS/CL:AIRE + CLEA 1.07	5000	5000	5000	1400	9600	9900
2-Methylphenol	EIC/AGS/CL:AIRE + CLEA 1.07	25000	25000	25000	15000	48000	49000
3-Methylphenol	EIC/AGS/CL:AIRE + CLEA 1.07	25000	25000	25000	27000	48000	49000
4-Methylphenol	EIC/AGS/CL:AIRE + CLEA 1.07	25000	25000	25000	27000	48000	49000
Pentachlorophenol	LQM/CIEH + CLEA 1.07	180	180	180	220	250	270
2,3,4,6-Tetrachlorophenol	LQM/CIEH + CLEA 1.07	610	610	610	1000	1100	1100
2,4,6-Trichlorophenol	LQM/CIEH + CLEA 1.07	610	610	610	1100	1100	1100
Phthalates							
Bis (2-ethylhexyl) phthalate	EIC/AGS/CL:AIRE + CLEA 1.07	9700	9700	9700	17000	17000	17000
Butyl benzyl phthalate	EIC/AGS/CL:AIRE + CLEA 1.07	130000	130000	130000	250000	260000	260000
Diethyl Phthalate	EIC/AGS/CL:AIRE + CLEA 1.07	49000	50000	50000	14	93000	96000
Di-n-butyl phthalate	EIC/AGS/CL:AIRE + CLEA 1.07	1300	1300	1300	2600	2700	2600
Di-n-octyl phthalate	EIC/AGS/CL:AIRE + CLEA 1.07	11000	11000	11000	20000	20000	20000
Pesticides							
Aldrin	LQM/CIEH + CLEA 1.07	6.6	6.6	6.6	13	13	13
Atrazine	LQM/CIEH + CLEA 1.07	100	100	100	180	180	180
DDD	Hydrock + CLEA 1.07	2700	2700	2700	5700	5700	5700
DDE	Hydrock + CLEA 1.07	2700	2700	2700	5700	5700	5700
DDT	Hydrock + CLEA 1.07	2600	2600	2600	5500	5500	5500
Dichlorvos	LQM/CIEH + CLEA 1.07	120	120	120	140	160	180
Dieldrin	LQM/CIEH + CLEA 1.07	12	12	12	23	23	23
Endosulfan - alpha	LQM/CIEH + CLEA 1.07	490	490	490	940	970	990
Endosulfan - beta	LQM/CIEH + CLEA 1.07	490	490	490	950	980	990
Hexachlorocyclohexanes - alpha (inc. Lindane)	LQM/CIEH + CLEA 1.07	2000	2000	2000	4000	4100	4100
Hexachlorocyclohexanes - beta (inc. Lindane)	LQM/CIEH + CLEA 1.07	150	150	150	300	300	310
Hexachlorocyclohexanes - gamma (inc. Lindane)	LQM/CIEH + CLEA 1.07	71	71	71	140	140	140

Updated 18/11/15							
Contaminant	**Source of GAC**	**Human health - POSresi (1%SOM)**	**Human health - POSresi (2.5%SOM)**	**Human health - POSresi (6%SOM)**	**Human health - POSpark (1%SOM)**	**Human health - POSpark (2.5%SOM)**	**Human health - POSpark (6%SOM)**
Dioxins, furans & dioxin-like-PCBs							
Total dioxins, furans & DL-PCB (aerial dep.)	SGV report + CLEA 1.07	0.023	0.023	0.023	0.049	0.049	0.049
Non-dioxin-like PCBs							
PCB-28	Hydrock + CLEA 1.07	1.2	1.2	1.2	2.5	2.5	2.5
PCB-52	Hydrock + CLEA 1.07	1.2	1.2	1.2	2.5	2.5	2.5
PCB-101	Hydrock + CLEA 1.07	1.2	1.2	1.2	2.5	2.5	2.5
PCB-138	Hydrock + CLEA 1.07	1.2	1.2	1.2	2.5	2.5	2.5
PCB-153	Hydrock + CLEA 1.07	1.2	1.2	1.2	2.5	2.5	2.5
PCB-180	Hydrock + CLEA 1.07	1.2	1.2	1.2	2.5	2.5	2.5
Explosives							
HMX	LQM/CIEH + CLEA 1.07	13000	13000	13000	23000	23000	24000
RDX	LQM/CIEH + CLEA 1.07	790	790	800	19	1500	1600
2,4,6-Trinitrotoluene	LQM/CIEH + CLEA 1.07	130	130	130	260	270	270
Other inorganics							
Antimony	EIC/AGS/CL:AIRE + CLEA 1.07	740	740	740	1700	1700	1700
Barium	EIC/AGS/CL:AIRE + CLEA 1.07	2700	2700	2700	5800	5800	5800
Mercury, elemental	SGV report + CLEA 1.07	4.3	11	26	4.3	11	26
Molybdenum	EIC/AGS/CL:AIRE + CLEA 1.07	1400	1400	1400	2900	2900	2900
Thiocyanate	Hydrock + CLEA 1.07	25	25	25	53	53	53
Other organics							
Biphenyl	EIC/AGS/CL:AIRE + CLEA 1.07	9500	9500	9500	34	84	19000
Carbon disulphide	LQM/CIEH + CLEA 1.07	11000	11000	12000	1300	1900	2700
2,4-Dinitrotoluene	EIC/AGS/CL:AIRE + CLEA 1.07	500	500	500	140	960	990
2,6-Dinitrotoluene	EIC/AGS/CL:AIRE + CLEA 1.07	250	250	250	290	490	500
Hexachloro-1,3-butadiene	LQM/CIEH + CLEA 1.07	25	25	25	48	50	51
Mercury, methyl	SGV report + CLEA 1.07	53	53	53	73	93	97
Styrene	EIC/AGS/CL:AIRE + CLEA 1.07	3000	3000	3000	630	1400	3400
Tributyl tin oxide	EIC/AGS/CL:AIRE + CLEA 1.07	31	31	31	63	64	65
2-Chloronaphthalene	EIC/AGS/CL:AIRE + CLEA 1.07	7500	8400	9000	110	1800	2800
Insufficient data to derive GAC							
n butylbenzene	Insufficient data (EIC)	-	-	-	-	-	-
sec butylbenzene	Insufficient data (EIC)	-	-	-	-	-	-
Carbazole	Insufficient data (EIC)	-	-	-	-	-	-
Dimethyl phthalate	Insufficient data (EIC)	-	-	-	-	-	-
Isopropyltoluene	Insufficient data (EIC)	-	-	-	-	-	-
1-Methylnaphthalene	Insufficient data (EIC)	-	-	-	-	-	-
2-Methylnaphthalene	Insufficient data (EIC)	-	-	-	-	-	-
Sulfur (elemental)	Insufficient data (Hydrock)	-	-	-	-	-	-
1,3,5-Trimethylbenzene	Insufficient data (EIC)	-	-	-	-	-	-
tert butylbenzene	Insufficient data (EIC)	-	-	-	-	-	-
NOTES							
If >1,000,000 is calculated, 1,000,000 is adopted.							
Red text - liquid at ambient temperature, calculated GAC exceeds saturation value and							
Orange text - solid at ambient temperature, calculated GAC exceeds saturation value a							
Blue text - solid at ambient temperature, calculated GAC exceeds saturation value and							
Green text - solid at ambient temperature, calculated GAC exceeds saturation value a							

3.3.3 Exceedance of Saturation Limits

In some instances the CLEA 1.07 model produces GACs with a warning that the value exceeds the saturation value, which is either the solubility of the substance in water or the vapour saturation limit. Limited guidance is given in SR4 (Section 4.12) on how to assess the GAC in these circumstances. Precedence is also set in a number of SGV reports, to date those dealing with the BTEX compounds. These two sets of documentation are contradictory. The original issue of SR4 (CLEA 1.04) (Environment Agency 2009b) gives an example of how to carry out a manual calculation using data for ethylbenzene, whereas the BTEX SGV reports (e.g. Environment Agency March 2009) state that the GAC should be limited to the saturation level. The revised version of SR4 (CLEA 1.05/6) (Environment Agency 2009c) retains the example, but the name ethylbenzene has been removed.

There are three options: to adopt the value as calculated, to limit the GAC to the saturation value, or to undertake a manual calculation as per Section 4.12 of SR4. Again, the guidance is confusing. SR3 (Environment Agency 2009b) cautions against adopting the saturation limit, which is the most conservative, saying that it may be over-conservative. However, this is the approach taken in the BTEX SGV reports.

Clearly, the adoption of a GAC under conditions where the saturation level is exceeded is subjective and professional judgement is involved. With this in mind, the protocol adopted by Hydrock is as follows, and has been derived at by considering the possible values from the three methods given above.

1. For substances where the GAC is highlighted in amber in CLEA, this is adopted as the GAC. For substances where the GAC is highlighted in red, the following apply.

2. For VOCs including BTEX and the volatile TPH Fractions (less than EC10), the saturation value is adopted in line with the latest recommendations in the BTEX SGV reports.

3. For substances which are liquid at ambient temperature, the saturation value is adopted.

4. For substances which are solid at ambient temperature, the manual calculation is undertaken provided there are both oral and inhalation HCVs. The result is compared with the red-highlighted GAC and the lower of the two adopted as the GAC. If there is only one HCV and the calculation cannot be performed, the red-highlighted value is adopted as the GAC where the saturation limit exceed the aqueous solubility, but the saturation value is adopted where the saturation limit exceed the saturated vapour concentration.

5. In some instances the GACs shows a large difference between different SOM where the saturation value has been taken for, say, 1% SOM and the calculated values for 2.5% and 6% SOM. Whilst this may appear inconsistent on first inspection, the results have been adopted as they are and the difference must be attributed to the physico-chemical influence of organic matter in the soil as modelled by CLEA.

3.3.4 GACs for Public Open Space

The first UK methodology for assessing public open space (POS) was published for the C4SLs (CL:AIRE December 2013) based on two land use scenarios:

- Public open space near residential housing (POS_{resi}) includes the predominantly grassed areas adjacent to high density housing and the central green area around which houses are located, as on many housing estates from the 1930s to 1970s. It also includes the smaller areas commonly incorporated in new developments as informal grassed areas or more formal landscaped areas with a mixture of open space and covered soil with planting. It is considered to be a predominantly grassed area up to 0.05 ha and a considerable portion of this (up to 50%) may be bare soil. The site is regularly used by children for playing and may be used for informal sports activities such as a football "kickabout".
- Public park (POS_{park}) is an area of open space provided for recreational use and usually owned and maintained by the Local Authority and could be used for a wide range of activities such as family visits and picnics, children's play area, sporting activities such as football on an informal basis (although this POS is not considered as a dedicated sports pitch) and dog walking. It is considered to be a relatively large are (>0.5 ha) of predominantly grassed open space with no more than 25% of exposed soil.

Hydrock has calculated GACs for these two standard land uses using the land use scenarios given in Tables 3.6 and 3.7 of the CL:AIRE report, but with the following modifications:

- POS_{resi} (Table 3.6), items omitted from the published table in error: building = small terraced house; occupancy period for lifetime averaging (for Cd) AC10-12 = 19, AC13-16 = 15 & AC17-18 = 16; and indoor inhalation rates updated according to a USEPA 2011 publication that supersedes the draft 2006 version used in the CLEA model previously.
- POS_{park} (Table 3.7), typographic errors in the published table: soil ingestion rate for AC1-12 = 50 mg/day and for AC13-18 = 20 mg/day.

Note that these corrections are included in the revised CLEA 1.07 when the C4SL land uses are selected. The calculated GACs are presented in Table 3.5 and are based on a sandy loam soil of pH 7 su.

3.4 Note on Petroleum Hydrocarbons

Petroleum hydrocarbon contamination is complex. The type of crude oil, its distillation, processing and blending, and the subsequent weathering in the environment all result in the development of petroleum residues of extreme chemical complexity (Environment Agency, 2003). The laboratory analysis of petroleum hydrocarbons is highly method dependent. In addition to contaminants such as fuels and lubricating oils, the analyses also pick up a range of other chemicals such as PAHs and phenols, together with naturally occurring substances like humic and fulvic matter in organic soils. For example, TPH determination on dried oak leaves can give a result of 18,000 mg/kg of TPH.

TPH can only be used as a surrogate for estimating the petroleum load of a soil if a spill is well defined but is generally not a sound basis for risk management and regulatory control. International approaches for assessing risks from petroleum hydrocarbons focus on dividing the components into groups and assigning toxicologically potency and fate-transport to each group.

Approaches have been developed internationally, one such proposal is discussed by the Dutch National Institute of Public Health and the Environment (RIVM) (Franken *et al* 1999). The approach is broadly to sub-divide the TPH into fractions based on equivalent carbon length for aliphatic (straight chain) and aromatic (cyclic) compounds. The choice of the fractions is based

on work carried out by, amongst others, the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG). The Working Group is guided by a steering committee consisting of representatives from industry, government and academia, with the remit *to develop scientifically defensible information for establishing soil cleanup levels that are protective of human health at petroleum contaminated sites.*

Generic assessment criteria can be developed for each TPH fraction in the same way as they can be for named substances, providing certain assumptions are made regarding the applicability of the data to all the compounds in each fraction. A significant part of the TPHCWG activity has been in determining fraction boundaries to maximize confidence in the eventual criteria.

A modified TPHCWG approach has been adopted in a framework developed by the Environment Agency (2005) for use within the UK. The 13 original TPHCWG fractions have been adopted, with the addition of >EC35-EC44. An undifferentiated (i.e. without aliphatic – aromatic split) fraction of >EC44-EC70 has also been suggested but the Agency says it will be reviewing the need for this in due course, once research has been carried out into the toxicity of these heavy-end products like resins and asphaltenes.

The UK suggested approach to petroleum hydrocarbon risk assessment is summarised as follows:

- Measure indicator chemicals and compare with their GAC – these are chemicals which are considered as key risk drivers at petroleum hydrocarbon contaminated sites. The chemicals of potential concern depend on the type of hydrocarbon product, but a (non-exhaustive) list has been suggested by the Environment Agency (2005):

  Non-threshold: benzene, benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3,cd)pyrene.

  Threshold: toluene, ethylbenzene, xylene, naphthalene, fluoranthene, phenanthrene, pyrene.

- Measure TPH fractions and compare with their GAC, based on threshold toxicity only.

  Aliphatic fractions: >EC5-EC6, >EC6-EC8, >EC8-EC10, >EC10-EC12, >EC12-EC16, >EC16-EC35, >EC35-EC44.

  Undifferentiated: >EC44-EC77 (subject to review and confirmation by Agency).

  Aromatic fractions: >EC5-EC7, >EC7-EC8, >EC8-EC10, >EC10-EC12, >EC12-EC16, >EC16-EC21, >EC21-EC35, >EC35-EC44.

- Carry out an additivity check on the TPH fractions if none of the individual fractions exceed their GAC. A Hazard Quotient is calculated for each fraction by dividing the measured concentration by the GAC and these are summed to give the Hazard Index. Where the Hazard Index exceeds unity, this can indicate a potentially significant risk to human health and consideration should proceed to the next stage (remediation or further assessment). Including all the fractions in a Hazard Index is conservative as it assumes all fractions add together in acting on the same target organ within the critical receptor. The Environment Agency (2005) has stated that fractions exhibiting different toxicological properties might be excluded from this process in due course, once research has been completed and further guidance published. The Louisiana Department of Environmental Quality (LDEQ) (2003) has published more detailed guidance, suggesting the following fractions be grouped: (a)

aliphatic >EC8-EC10, >EC10-EC12 & >EC12-EC16, (b) aromatic >EC8-EC10, >EC10-EC12 & >EC12-EC16 and (c) aromatic >EC16-EC21 & >EC21-EC35.

Hydrock has adopted the first two points from above approach and has developed generic assessment criteria for the TPH fractions up to EC35. These are used for assessment where an appropriate level of sampling and laboratory analysis has been carried out, but cannot be used where more generalised TPH analysis has been scheduled (such as DRO/GRO only).

There is, however, some uncertainty concerning the validity of the additivity check. The Environment Agency (2002a) stated in the now withdrawn CLR 9, Section 4.4, "that it is not valid to simply calculate the sum of the fractions 'soil concentration divided by SGV', and compare this with 1.", because total intake, not just intake from soil, needs to be included. It is assumed that the 2005 document takes this into account and that it is erring on the side of conservatism. Until this is formally resolved, Hydrock will report the additivity check for information, using the LDEQ groupings, but will caution against its use in setting remedial goals without further study or publication of definitive guidance. It is more realistic to carry out the additivity test on individual samples rather than on US_{95} values for the whole population, because it is unlikely that the TPH profile of the averaging area will be represented by the US_{95}s of every fraction. More likely, a sample high in one fraction will be low in another, particularly where a mixture of products is present in the ground.

The analysis required for the above methodology, using the aliphatic / aromatic split of TPH fractions, is referred to by Hydrock its "**TPH Level 2 suite**" of determinands. In instances where a full numerical risk assessment is not required, Hydrock carries out a screening analysis known as its "**TPH Level 1 suite**" of determinands. The TPH is divided into fractions, but without the aliphatic / aromatic split. This allows a semi-quantitative risk assessment on the basis of taking a worst case condition. The fraction split with the lowest GAC is deemed to apply to the whole fraction. For example, if the Level 1 analysis indicates the presence of >EC8-EC10, the result is compared to the GACs for the aliphatic >C8-C10 and the aromatic >EC8-EC10 fractions. The worst case would be to assume the whole fraction is aliphatic because this is the lower of the two GACs. This is a conservative approach, and if the test is passed, there is no need to proceed further. However, if the test is failed this does not necessarily indicate unacceptable risks and a more detailed risk assessment is required, with the full TPH Level 2 analysis suite.

3.5 Note on PAHs

A number of authors have used to concept of PAH double ratio plots to investigate the possible source of PAHs in environmental samples.

NAVFAC (Appendix A, April 2003) defines three major source type: petrogenic - generated from organic matter in ancient sediments by geologic conditions (i.e. including petroleum hydrocarbons and refined products); pyrogenic – generated by combustion of organic matter (wood, coal, petroleum, wastes etc.); and biogenic – generated by modern biological processes or by diagenetic processes (e.g. oxidation of organic matter). The following broad trends in the data were recognised:

- a ratio of fluoranthene to pyrene (Fl/Py) of <1 is indicative petrogenic sources, and of >1 is indicative of pyrogenic sources; and

- a ratio of anthracene to phenanthrene (An/Ph) of <0.2 is indicative of pyrogenic sources and of >0.2 is indicative of petrogenic sources.

Yunker *et al* (2002) carried out a literature study of published PAH ratios for a number of petroleum sources, combustion sources and environmental sources. They identified the following broad trends in the data:

- a ratio of fluoranthene to fluoranthene plus pyrene (Fl/(Fl+Py)) of <0.4 is indicative of petroleum hydrocarbon sources; of 0.4-0.5 is indicative of liquid fossil fuel combustion products; and of >0.5 is indicative of grass, wood and coal combustion products;

- a ratio of benzo(a)anthracene to benzo(a)anthracene plus chyrsene (BaA/(BaA+Ch)) of <0.2 is indicative of petroleum hydrocarbon sources; of 0.2-0.35 is indicative of either petroleum hydrocarbon sources or combustion and of >0.35 is indicative of combustion products;

- a ratio of anthracene to anthracene plus phenanthrene (An/(An+Ph)) of <0.1 is indicative petroleum hydrocarbon sources, but can be emissions from lignite, diesel or oil combustion, and of >0.1 is indicative of combustion sources, but can be diesel, coal or some crude oil hydrocarbons;

- a ratio of indeno(1,2,3)pyrene to indeno(1,2,3)pyrene plus benzo(ghi)perylene (IP/(IP+Bghi)) of <0.2 is indicative of petroleum hydrocarbon sources; of 0.2-0.5 is indicative of petroleum hydrocarbon combustion; and >0.5 is indicative of grass, wood or coal combustion products.

Note that in these authors' study of these and a number of other ratios they cautioned there are exceptions to these generalisations on account of the variability and complexity of, for example, different crude oil sources.

Costa *et al* (2004) and Costa and Sauer (2005) used plots of fluoranthene to pyrene (Fl/Py) against benzo(a)anthracene to chrysene (BaA/Ch), benzo(a)anthracene to benzo(a)pyrene (BaA/BaP) and chrysene to benzo(a)pyrene (Ch/BaP) to distinguish coal tar and creosote contaminants from combustion products they referred to as urban background. They report distinctive areas on the plots relating to the sites being studied. Litton (2006) has also used these ratios to similar effect on other sites.

ALcontrol Laboratories (2006) also uses plots of fluoranthene to pyrene (Fl/Py) against benzo(a)anthracene to chrysene (BaA/Ch). Jones (2008) confirms that the following broad trends are derived from unpublished work at the laboratory:

- a ratio of Fl/Py of <0.65 is indicative of used engine oil when the ratio of BaA/Ch is higher (approaching 1.40) or other petroleum products when the ratio of BaA/Ch is lower (above about 0.35);

- a ratio of F/Py of 0.65-1 is indicative of petroleum combustion products; and

- a ratio of Fl/Py of <1 is indicative of coal when the ratio of BaA/Ch is higher (approaching 1.40) or other combustion soots when the ratio of BaA/Ch is lower (above about 0.35).

Stogiannidis and Laane (2015) undertook a review of published literature and produced a summary (their Table 4 plus supporting text) of a number of PAH ratios and threshold values for the initial screening or identification of pyrogenic or petrogenic PAHs.

It is evident from the literature that if a cross plot is made of two ratios it is often possible to see a separation in samples from different sources and, together with other supporting information, gain a better understanding of the likely source of the PAHs. Different ratios may give differing degrees of separation and so trying several plots is often useful. The work of Stogiannidis and Laane can help distinguish between oil-spill related PAHs and those produced by combustion.

3.6 Note on Cyanide

Cyanide toxicity is complicated but it is generally accepted that cyanide species exist in 'free' and 'complex' forms. Free cyanide species are toxic and it is generally agreed that free cyanide provides a more scientifically correct basis for the establishment of generic criteria. This approach has been followed in this report.

Metal-cyanide complexes (complex cyanide) are generally not considered toxic but in certain environmental fate reactions it is possible that dissociation may release toxic free cyanide into the water environment. This might occur where complex cyanides are exposed to direct sunlight and photolysis takes place. Such circumstances are considered very rare.

There is no published approach to assessing acute toxicity, but this can be a concern on gas works sites where spent oxide or, more particularly foul lime (aka "blue billy") from the older processes, may contain significant concentrations of free cyanide. This is a particular problem because young children may be attracted to the bright blue deposits.

A methodology was presented by Macklin *et al* (December 2012): an acute oral LOAEL dose was identified by the then Health Protection Agency as 0.4 mg/kg bw/day; a dose of 5 g of soil was selected based on USEPA studies, eaten by a 10 kg weight child. This equates to a trigger level of 800 mg/kg free cyanide in soil. Above this concentration, there is a plausible hazard of ingestion of a harmful or fatal dose.

3.7 Note on Polychlorinated Biphenyls

PCBs fall into two groups, the dioxin-like (DL) and the non-dioxin-like (NDL), by virtue of their toxicity.

The Environment Agency methodology for DL-PCBs is included with dioxins and furans in the published dioxins SGV report (Science Report SC050021 / Dioxins SGV). The basis of this report is that because of the additive nature of these substances it is inappropriate to produce individual SGVs. The approach is to obtain speciated analyses of 12 DL-PCBs and, using an Agency spreadsheet, calculate a Hazard Index for a prescribed mixture of substances. SGVs can only be produced for atmospheric fall-out sites where the proportions of the individual substances are assumed to be uniform across the UK according to a table listed in the document.

For potentially industrially contaminated sites (such as where PCBs have escaped from transformers) only a Hazard Index can be produced. This can be converted into a GAC by

calculation, but such a GAC is only applicable to conditions where the mixture of substances is unchanged. In effect, Hazard Indices will be calculated for each soil sample and provided these are all less than unity, the site poses no significant risk.

There is not Agency guidance with respect to NDL-PCBs. Hydrock has produced individual GACs for a number of these. A precautionary approach has been taken, in that the NDL-PCBs are assumed to have additive effects and the same approach is taken as with Hydrock's assessment of contamination by TPH fractions. Namely, each substance is compared with its GAC, but there is an additional stage in which a Hazard Index is also calculated. This is similar to the Agency's approach for DL-PCBs, but the Hazard Index calculation is performed at a different stage in the process.

Currently, these two approaches are separate. That is to say, there is no assumption of additvity of effect between DL- and NDL-PCBs. The logic for this is the fact that these two groups where established in the first place on account of their different effects.

The toxicity of the DL-PCBs is far greater than that of the NDL-PCBs. For example, the residential SGV for the full list of dioxins, furans and DL-PCBs under atmospheric fall-out conditions is 0.0087 mg/kg (NB: using only the 12 DL-PCBs in this list gives a GAC of 0.051 mg/kg), whist the lowest GAC for the NDL-PCBs is 0.32 mg/kg under the same exposure conditions. Analyses for DL-PCBs must be undertaken with very low laboratory reporting limits (typically 1ng/kg).

In real life examples, it is almost certain that both forms of PCBs will be present at a site. This is because the marketed products (known as Aroclors) were mixtures of many PCB congeners and they all appear to contain members from both groups (according to literature researched by Hydrock). Perhaps this is why the Agency has only issued guidance on the DL-PCBs.

Logically, if a site contains any PCBs (for example as a 'total' analysis) it is likely to contain DL-PCBs. In which case, the safe concentrations will be very low and can only be confirmed by re-analysing using low detection methods and following the Agency methodology on a sample-by-sample basis. This is effect means that GACs for NDL-PCBs are redundant. The implications of the Agency methodology have yet to be fully understood by the contaminated land community. For example, it would appear that standard laboratory tests for NDL-PCBs are irrelevant. Furthermore, standard reporting limits are far too high, typically 1ug/kg. The only instance where NDL-PCBs become the risk driver at a PCB contaminated site would be if for some reason the DL-PCBs had preferentially degraded.

The Hydrock methodology for PCB risk assessment is to carry out analyses for the 12 DL-PCBs (commonly referred to as the WHO-12) and the 7 most persistent NDL-PCBs (commonly referred to as the ICES-7) at a detection limit of 1 ng/kg (Table 3.6). This is considered conservative because it covers both groups even though the risk driver is most likely to be the DL-PCB group.

The WHO-12 are assessed using the Environment Agency SGV report methodology, to produce a Hazard Index, and the ICES-7 are compared to Hydrock-derived GACs with additivity check. Note that PCB118 appears in both lists and so in assessed under the Environment Agency methodology as a DL-PCB.

Table 3.6: PCB Suites

WHO-12 (dioxin-like)	ICES-7 (most persistent)
PCB-77	PCB-28
PCB-81	PCB-52
PCB-126	PCB-101
PCB-169	PCB-118
PCB-105	PCB-138
PCB-114	PCB-153
PCB-118	PCB-180
PCB-123	(Non-dioxin-like apart
PCB-156	from PCB-118)
PCB-157	
PCB-167	
PCB-189	

3.8 Note on Pesticides and Herbicides

Unless there is evidence to suggest that a certain pesticide or herbicide has been used on the land, the standard approach adopted by Hydrock is to screen for the presence of common pesticides in the organochlorine, organophosphorous and organonitrogen groups (OCP, OPP & OPN), for example on agricultural land. Note that the only available GACs are for pesticides in these groups (and then only a sub-set of the whole).

3.9 Note on Radon

Advice on radon protection in England is provided by Public Health England (www.ukradon.org), formerly the Health Protection Agency (*The Indicative Atlas of Radon in England and Wales,* HPA-RPD-033 (Miles *et al* 2007) and RCE-15 (2010)), and by the BRE (BRE Report BR 211 (Scivyer 2015)). An area of the country can be categorised according to the percentage of existing homes where radon is present above the Action Level: 0-1% lower probability, 1-3% and 3-10% intermediate probability and >10% higher probability. It is important to understand that the database on which these numbers are based is incomplete and contains more data points in areas of the country that have traditionally been known for high radon concentrations. As more properties are monitored, the categorisation may change.

The areas where >1% of homes exceed the Action Level are known as Radon Affected Areas.

The Building Regulations cite BR 211 and require basic radon protection measures in new buildings in areas of England and Wales where 3-10% of properties exceed the Action Level and full radon protection measures where >10% exceed the Action Level.

Landlords and employers have a legal duty to keep radon levels as low as practicable and to install remedial measures if levels are too high. Commercial new build includes protection measures similar to those for new homes, but once occupied they are subject to the HSW Act and the Ionising Radiations Regulations 1999.

Private residents are advised to have a radon test where their property is in a Radon Affected Area, and to fit remedial measures if levels are too high.

The Law Society's advice to conveyancing solicitors is to ask the vendor standard questions concerning whether the property is in a radon affected area, whether it was constructed with radon protection measures and whether a radon test has been carried out by the vendor. Hydrock understands that PHE is discussing with the Law Society the adoption of stronger wording to these questions.

In 2009 the then Health Protection Agency recommended that Building Regulations and supporting documents should be amended to ensure that *all* new buildings, extensions, conversions and refurbished buildings in the UK include basic radon protective measures as a minimum. This recommendation was rejected by the Government. Consequently, the current situation is that a developer is *required* only to install protective measures in buildings where >3% of existing properties are above the Action Level, but is not required to install them in Radon Affected Areas where 1-3% of existing properties exceed the Action Level (even though there may be future implications for occupiers of these buildings).

Note that whilst membranes intended to protect against radon *may* also protect against methane and carbon dioxide, this will only be the case if they have also been specifically designed (and installed) to protect against those gases (BS 8485:2015, Annex G).

3.10 Note on the Use of Non-UK Assessment Criteria

In rare instances reference to assessment criteria or other trigger values published by other authoritative bodies (other than those concerned with the UK contaminated land regime) may provide background information on the likely degree of contamination of a substance. Trigger levels indicative of naturally occurring concentrations or risk-based guidance from other countries often help place site analysis results into context. It must be remembered that use of non-UK assessment criteria is not in compliance with the UK contaminated land assessment regime given in the Model Procedures. However, these criteria can be of use as an aid to professional judgement and can help in determining a cost-effective and sustainable remedial strategy for a site, in consultation with the regulatory authorities.

3.11 Site-specific Assessment Criteria for Volatile Substances

The CLEA methodology includes the inhalation of indoor vapours where there are occupied buildings in the standard land use scenarios. For volatile substances such as those listed in Table 3.7 the percentage contribution of the indoor vapour pathway to the average daily exposure (ADE) can be seen to be significant (up to 100%). Consequently, if this pathway can be severed by the installation of a suitably designed and installed organic vapour barrier in the buildings only the remaining CLEA exposure pathways need to be considered for the site. Assessment criteria can be calculated for the remaining exposure pathways.

Site Specific Assessment Criteria (SSAC) have been calculated using CLEA UK using the same input parameters etc. as for the Hydrock GACs but with the indoor vapour pathway turned off in the model. The resulting SSACs can be used to inform on risk from these contaminants in the same way as GACs are used, but apply only if suitable membranes are provided and verified.

Table 3.7: Derivation of Site Specific Assessment Criteria for Volatile Substances for CLEA Standard Land Uses *Excluding the Indoor Vapour Pathway* (mg/kg) – on following page(s).

Updated 18/11/15		Human Health Generic Assessment Criteria (no indoor vapour pathway) (mg/kg)								
Contaminant	**Source of GAC**	Human health - residential without plant uptake, no indoor vapour (1%SOM)	Human health - residential without plant uptake, no indoor vapour (2.5%SOM)	Human health - residential without plant uptake, no indoor vapour (6%SOM)	Human health - residential with plant uptake, no indoor vapour (1%SOM)	Human health - residential with plant uptake, no indoor vapour (2.5%SOM)	Human health - residential with plant uptake, no indoor vapour (6%SOM)	Human health - commercial, no indoor vapour (1%SOM)	Human health - commercial, no indoor vapour (2.5%SOM)	Human health - commercial, no indoor vapour (6%SOM)
TPH fractions										
TPH ali EC05-EC06	LQM/CIEH + CLEA 1.07	320000	320000	320000	5000	11000	25000	300	560	1200
TPH ali >EC06-EC08	LQM/CIEH + CLEA 1.07	320000	320000	320000	15000	34000	71000	140	320	740
TPH ali >EC08-EC10	LQM/CIEH + CLEA 1.07	6400	6400	6400	1600	2900	4300	78	94000	94000
TPH ali >EC10-EC12	LQM/CIEH + CLEA 1.07	6500	6500	6500	4600	5500	6000	94000	95000	95000
TPH ali >EC12-EC16	LQM/CIEH + CLEA 1.07	6500	6500	6500	6300	6300	6400	95000	95000	95000
TPH ali >EC16-EC35	LQM/CIEH + CLEA 1.07	-	-	-	-	-	-	-	-	-
TPH ali >EC35-EC44	LQM/CIEH + CLEA 1.07	-	-	-	-	-	-	-	-	-
TPH aro EC05-EC07	LQM/CIEH + CLEA 1.07	29000	29000	29000	90	180	390	1200	2300	4700
TPH aro >EC07-EC08	LQM/CIEH + CLEA 1.07	29000	29000	29000	150	350	800	870	420000	420000
TPH aro >EC08-EC10	LQM/CIEH + CLEA 1.07	2600	2600	2600	58	140	310	38000	38000	38000
TPH aro >EC10-EC12	LQM/CIEH + CLEA 1.07	1800	1800	1800	83	200	430	38000	38000	38000
TPH aro >EC12-EC16	LQM/CIEH + CLEA 1.07	-	-	-	-	-	-	-	-	-
TPH aro >EC16-EC21	LQM/CIEH + CLEA 1.07	-	-	-	-	-	-	-	-	-
TPH aro >EC21-EC35	LQM/CIEH + CLEA 1.07	-	-	-	-	-	-	-	-	-
TPH aro >EC35-EC44	LQM/CIEH + CLEA 1.07	-	-	-	-	-	-	-	-	-
TPH >EC44-EC70	LQM/CIEH + CLEA 1.07	-	-	-	-	-	-	-	-	-
VOCs - BTEX & MTBE										
Benzene	SGV report + CLEA 1.07	37	37	37	0.13	0.27	0.59	530	530	540
Toluene	SGV report + CLEA 1.07	29000	29000	29000	150	350	800	870	420000	420000
Ethylbenzene	SGV report + CLEA 1.07	13000	13000	13000	110	260	600	180000	180000	190000
Xylene, o-	SGV report + CLEA 1.07	22000	22000	22000	190	460	1100	260000	280000	300000
Xylene, m-	SGV report + CLEA 1.07	22000	22000	22000	210	500	1200	260000	280000	300000
Xylene, p- (use this for combined m & p)	SGV report + CLEA 1.07	22000	22000	22000	200	470	1100	260000	280000	300000
MTBE	EIC/AGS/CL:AIRE + CLEA 1.07	39000	39000	39000	150	300	600	550000	550000	560000
VOCs - other benzenes										
Iso-propylbenzene	EIC/AGS/CL:AIRE + CLEA 1.07	13000	13000	13000	220	520	1200	180000	180000	180000
Propylbenzene	EIC/AGS/CL:AIRE + CLEA 1.07	13000	13000	13000	230	550	1200	180000	190000	190000
1,2,4-Trimethylbenzene	EIC/AGS/CL:AIRE + CLEA 1.07	130	130	130	2.5	6.1	14	1800	1800	1900
VOCs - chlorobenzenes										
Bromobenzene	EIC/AGS/CL:AIRE + CLEA 1.07	2900	3000	3000	22	52	120	31000	34000	37000
Chlorobenzene	LQM/CIEH + CLEA 1.07	6200	6300	6400	40	94	210	63000	77000	91000
1,2-Dichlorobenzene	LQM/CIEH + CLEA 1.07	54000	55000	56000	640	1500	3500	580000	670000	730000
1,3-Dichlorobenzene	LQM/CIEH + CLEA 1.07	130	130	130	1.7	4.1	9.3	3000	3100	3100
1,4-Dichlorobenzene	LQM/CIEH + CLEA 1.07	8800	8900	8900	100	250	570	130000	130000	130000
Hexachlorobenzene	LQM/CIEH + CLEA 1.07	-	-	-	-	-	-	-	-	-
Pentachlorobenzene	LQM/CIEH + CLEA 1.07	-	-	-	-	-	-	-	-	-
1,2,3-trichlorobenzene	LQM/CIEH + CLEA 1.07	950	960	960	31	74	160	12000	13000	13000
1,2,4-trichlorobenzene	LQM/CIEH + CLEA 1.07	6300	6500	6600	200	480	1100	49000	60000	69000
1,3,5-trichlorobenzene	LQM/CIEH + CLEA 1.07	920	940	940	31	74	160	9300	11000	12000
1,2,3,4-tetrachlorobenzene	LQM/CIEH + CLEA 1.07	-	-	-	-	-	-	-	-	-
1,2,3,5-tetrachlorobenzene	LQM/CIEH + CLEA 1.07	34	34	34	2.4	5.4	11.0	690	700	700
1,2,4,5-tetrachlorobenzene	LQM/CIEH + CLEA 1.07	-	-	-	-	-	-	-	-	-
VOCs - chloroalkanes & alkanes										
Bromodichloromethane	EIC/AGS/CL:AIRE + CLEA 1.07	38	38	38	0.11	0.22	0.46	500	520	530
Bromoform	EIC/AGS/CL:AIRE + CLEA 1.07	-	-	-	-	-	-	-	-	-
Chloroethane	EIC/AGS/CL:AIRE + CLEA 1.07	350000	350000	350000	780	1400	2600	2600	3500	5700
Chloroethene (aka vinyl chloride)	LQM/CIEH + CLEA 1.07	1.8	1.8	1.8	0.0038	0.0069	0.013	26	26	26
Chloromethane	EIC/AGS/CL:AIRE + CLEA 1.07	310	310	310	0.45	0.88	1.6	1900	2200	3000
1,1-Dichloroethane	EIC/AGS/CL:AIRE + CLEA 1.07	25000	25000	25000	64	120	240	1800	3000	5600
1,2-Dichloroethane	LQM/CIEH + CLEA 1.07	15	15	15	0.032	0.057	0.11	200	200	210
1,1-Dichloroethene	EIC/AGS/CL:AIRE + CLEA 1.07	5700	5700	5700	19	39	82	2200	3900	8000
Cis 1,2 Dichloroethene	EIC/AGS/CL:AIRE + CLEA 1.07	680	690	690	1.8	3.5	7.1	3900	6600	9900
Trans 1,2 Dichloroethene	EIC/AGS/CL:AIRE + CLEA 1.07	2100	2100	2100	6.5	13	27	3400	6200	13000
Dichloromethane	EIC/AGS/CL:AIRE + CLEA 1.07	390	390	390	0.70	1.3	2.3	7300	9000	9000
1,2-Dichloropropane	EIC/AGS/CL:AIRE + CLEA 1.07	1200	1300	1400	4.3	8.4	18	1200	2100	11000
Hexachloroethane	EIC/AGS/CL:AIRE + CLEA 1.07	64	64	64	1.8	4.3	9.3	900	920	930
Tetrachloroethene	LQM/CIEH + CLEA 1.07	1700	1700	1700	11	26	58	420	950	26000
1,1,1,2-Tetrachloroethane	LQM/CIEH + CLEA 1.07	730	730	730	5.4	13	29	10000	10000	11000
1,1,2,2-Tetrachloroethane	LQM/CIEH + CLEA 1.07	730	730	730	2.8	6.1	14	11000	11000	11000
Tetrachloromethane	LQM/CIEH + CLEA 1.07	180	180	180	1.1	2.5	5.7	1500	2500	2500
Trichloroethene	LQM/CIEH + CLEA 1.07	660	660	660	3.0	6.5	15	1500	3200	9000
1,1,1-Trichloroethane	LQM/CIEH + CLEA 1.07	75000	76000	76000	330	730	1600	1400	2900	6400
1,1,2 Trichloroethane	EIC/AGS/CL:AIRE + CLEA 1.07	510	510	510	2.0	4.2	9.4	7100	7300	7400
Trichloromethane	LQM/CIEH + CLEA 1.07	880	880	880	2.5	4.8	10	5200	9100	20000
Other inorganics										
Antimony	EIC/AGS/CL:AIRE + CLEA 1.07	-	-	-	-	-	-	-	-	-
Barium	EIC/AGS/CL:AIRE + CLEA 1.07	-	-	-	-	-	-	-	-	-

Updated 18/11/15		Human Health Generic Assessment Criteria (no indoor vapour pathway) (mg/kg)								
Contaminant	**Source of GAC**	Human health - residential without plant uptake, no indoor vapour (1%SOM)	Human health - residential without plant uptake, no indoor vapour (2.5%SOM)	Human health - residential without plant uptake, no indoor vapour (6%SOM)	Human health - residential with plant uptake, no indoor vapour (1%SOM)	Human health - residential with plant uptake, no indoor vapour (2.5%SOM)	Human health - residential with plant uptake, no indoor vapour (6%SOM)	Human health - commercial, no indoor vapour (1%SOM)	Human health - commercial, no indoor vapour (2.5%SOM)	Human health - commercial, no indoor vapour (6%SOM)
Mercury, elemental	SGV report + CLEA 1.07	4.3	11	26	4.3	11	26	4.3	11	26
Molybdenum	EIC/AGS/CL:AIRE + CLEA 1.07	-	-	-	-	-	-	-	-	-
Thiocyanate	Hydrock + CLEA 1.07									
Other organics										
Biphenyl	EIC/AGS/CL:AIRE + CLEA 1.07	-	-	-	-	-	-	-	-	-
Carbon disulphide	LQM/CIEH + CLEA 1.07	6200	6300	6300	33	70	150	2100	4200	75000
2,4-Dinitrotoluene	EIC/AGS/CL:AIRE + CLEA 1.07	-	-	-	-	-	-	-	-	-
2,6-Dinitrotoluene	EIC/AGS/CL:AIRE + CLEA 1.07	-	-	-	-	-	-	-	-	-
Hexachloro-1,3-butadiene	LQM/CIEH + CLEA 1.07	13	13	13	1.5	3.1	5.6	290	290	290
Mercury, methyl	SGV report + CLEA 1.07	-	-	-	-	-	-	-	-	-
Styrene	EIC/AGS/CL:AIRE + CLEA 1.07	1500	1500	1500	11	25	58	23000	23000	23000
Tributyl tin oxide	EIC/AGS/CL:AIRE + CLEA 1.07	-	-	-	-	-	-	-	-	-
2-Chloronaphthalene	EIC/AGS/CL:AIRE + CLEA 1.07	-	-	-	-	-	-	-	-	-
NOTES										
If >1,000,000 is calculated, 1,000,000 is adopted.										
Red text - liquid at ambient temperature, calculated GAC exceeds saturation value and highlighed in red in CLEA - saturation value adopted for GAC										
Orange text - solid at ambient temperature, calculated GAC exceeds saturation value and highlighted red in CLEA - manual calculation not possible as only one HCV - saturated vapour concentration exceed, so saturation valu										
Blue text - solid at ambient temperature, calculated GAC exceeds saturation value and highlighted red in CLEA - manual calculation not possible as only one HCV - aqueous solubility exceed, so original red-highlighted value ad										
Green text - solid at ambient temperature, calculated GAC exceeds saturation value and highlighted red in CLEA - manual calculation undertaken but result is greater than original red-highlighted value, so original red-highlighte										

3.12 Determination of Contaminated Land Under Part 2A of the Environmental Protection Act 1990

The legal test for land contamination under the statutory guidance of Part 2A of the Environment Protection Act 1990 (i.e. "significant harm or significant possibility of significant harm") is **unacceptable** intake or direct bodily contact.

The situation was clarified by Defra (July 2008) in its guidance on the legal definition of contaminated land.

Part 2A does not prescribe number-based thresholds because it would be very difficult to produce numbers which are meaningful and proportionate, given the lack of scientific information about many substances and the site specific nature of risks. Instead, it relies on local authorities to assess risks posed on individual sites, then decide whether (in their view) the risks represent SPOSH, and thus whether land qualifies as **contaminated**.

The intention of the approach is that local authorities can use their judgement to ensure that Part 2A focuses on the SPOSH it was designed to address, whilst avoiding unnecessary burdens on land where contaminants may be present but there is no SPOSH.

In making Part 2A decisions, local authorities are likely to face some difficult decisions caused by uncertainty on the nature of risks. But they should be confident in exercising their judgement on the basis of available information. Part 2A clearly leaves judgements about what constitutes a SPOSH to local authorities, and it is up to them to make decisions.

GACs are not proxy thresholds for SPOSH, and should not be used as such. They describe levels (based on cautious estimates and assumptions in hypothetical example situations) at which concentrations of contaminants in soil may cease to pose **no appreciable/ minimal** risk. They do not seek to describe levels at which there might be a SPOSH.

Thus, if a GAC is exceeded, the assessor will usually need to conduct a detailed quantitative risk assessment to discover whether there is a **possibility of significant harm** and, if so, the nature of that risk. Whether or not SPOSH exists will depend on the results of risk assessment, the existence and nature of any pollutant linkages, and (ultimately) the judgement of the local authority.

As a general guide:

(i) For substances where there is a GAC, the more the GAC is exceeded, the more likely it is that an authority should consider the risks to be SPOSH.

(ii) Generally, the cautious nature of GACs means that local authorities may conclude that SPOSH is unlikely to exist at concentrations close to GACs.

(iii) In some cases, land with concentrations of contaminants which marginally exceed a GAC (say, up to a few times the GAC) might give rise to SPOSH if, for example, the receptor is particularly sensitive; or if further assessment finds that exposure is higher than that estimated in the GAC; or if there is little uncertainty in the underlying toxicology and HCV.

(iv) In other cases a GAC may be exceeded by tens of times and there might be no SPOSH (e.g. if further assessment found that exposure was much lower than that estimated using the GAC).

In view of the above, Hydrock has not to attempted to derive numerical SPOSH concentrations, but to use GACs as screening values. Where GACs are exceeded, it is recommended that the linkages and the uncertainties in the data are reviewed in consultation the regulatory authority to aid its judgment on determination.

A possible next phase would be to refine the generic risk assessment with a detailed risk assessment. This would involve using site-specific input parameters relevant to the particular site, in the CLEA model.

Revised contaminated land statutory guidance was published by Defra in 2012 with respect to Part 2A. The Act itself is unchanged. A new four category test (and associated classifications) has been introduced to ensure a high standard without being excessive. The aims are to make the regime target higher risk sites more efficiently, remove excessive cost burdens and facilitate the development of technical tools to increase consistency over time. This includes supporting non-technical guidance including a possible framework to aid in deciding into which of the proposed four new Categories of land a site should be placed.

Conversely, the regime is not intended to intervene where there is only a low level of risk, particularly in cases where it is difficult to demonstrate anything other than a very small hypothetical risk, as might be the case with vast swathes of land.

Defra states that there is a need for a more pragmatic approach. In practice, deciding when regulatory intervention is justified involves making decisions about when to act on a wide spectrum of risk, with varying levels of uncertainty over the precise nature of the risks. A number of the changes are intended to clarify when land is “contaminated land”. These are most likely to affect the assessment and remediation of contaminated land and are listed below.

1. Statutory explanation of broad objectives of the regime to explain that regulators should seek a reasonable balance between dealing with unacceptable risks whilst ensuring that burdens on businesses and society are manageable and sustainable. The regime should be seen as an option of last resort; that land is in effect “innocent until proven guilty”. This should give greater clarity for all concerned on what the regime seeks to achieve, and what it seeks to avoid.

2. Local Authorities to produce risk summaries before land may be determined as “contaminated”. Summaries must be understandable to non-experts to provide greater transparency and accountability. Easier for all involved to understand what local authority considers risks to be. It should be easier for Local Authorities managers, lawyers and councillors to be involved in decision making, particularly more difficult sites where wider socio-economic effects need to be take into account. Easier to share experience between Local Authorities leading to greater consistency in decision making.

3. Clarification of the legal test of significant harm to human health to mean serious unhealthy conditions of the body or part of it, and not minor/trivial complaints. This is unlikely to have a major effect because, to date, no site in England and Wales has been determined on

grounds that significant harm to human health has actually been caused. However, greater clarity on the meaning of significant harm is likely to help clarify the related legal test of significant possibility of significant harm.

4. Explanation of how to decide when land is (and is not) "contaminated land". A new four category test which recognises the spectrum of risk encountered by assessors, and the reality that some sites are clearly contaminated land (Category 1), some clearly are not (Category 4), and others need more detailed consideration before a decision can be taken (Categories 2 and 3). Greater clarity that decision making is a two stage process in which the regulator must first understand the risk before deciding whether the risk is sufficiently high to justify regulatory intervention. The aim is to create legal certainty around what definitely is, and is not, contaminated land, whilst leaving Local Authorities with discretion to exercise local judgement on less straightforward land.

5. Category 4 will include normal background levels of contamination unless there is some exceptional reason to consider otherwise. Clarification that land at SGV/GAC levels is likely to be well into Category 4. Statutory backing for the sector to develop new tests to describe the top of Category 4 (including the production of Category 4 Screening Levels). This should provide clarity on when land will not be caught, reduced uncertainty and costs for landowners and businesses and faster decision making on non-problematic land.

6. Clarify the status of GACs and how they should (and should not) be used including a legal backing for the use of robust GACs produced by reputable, non-governmental, organisations within the sector (LQM/CIEH, EIC/AGS/CL:AIRE). Backing the development of new GACs (or similar tools) as might be developed by the sector to help implement the new Guidance. Specific legal backing for the current set of SGVs/GACs, and clarity on how they can (and cannot) be used.

7. Category 1 land is clearly caught by the regime when there is clear evidence of an unacceptable risk (e.g. similar land is known to have caused significant harm). This should give clarity on when land is definitely "contaminated land", and help frame the spectrum of risk raised by land contamination.

8. New category of land under which Local Authorities would decide whether a site is in Category 2 (contaminated land) or Category 3 (not contaminated land). The new test would rest on whether or not the local authority believes there is a strong case for regulatory action, taking account of the scientific evidence, the objectives of the regime, and other factors. The local authority would start by considering health risks alone, and if they clearly tend towards the Category 4 or the Category 1 the decision could be taken at this point. However, if this does not lead to a decision, the local authority would consider wider socio-economic factors (e.g. cost, views of local people, etc) before deciding. If the local authority still cannot decide, the default decision is that the site is not contaminated land.

9. Reduce "regulatory creep" (excessive remediation of land forced by regulatory uncertainty) with greater clarity on what the enforcing authority can "reasonably" require by way of remediation. Clarity that SGVs/GACs must not be used as "one size fits all" remediation requirements; and that Part 2A can only be used to force remediation to a level where land

is no longer contaminated land (i.e. to a point where land is in Category 3), but it should not be used to force remediation beyond this point.

10. Guidance on the process of risk assessment: the need to take a strategic approach; the aim of dismissing low risk sites as soon as possible in order to focus on finding higher risk sites; and the general need to ensure that risk assessment is conducted in a timely and efficient manner. Clarify that in considering possible future risks the local authority should consider likely future situations (e.g. rather than hypothetical worst possible case situations). Recognise that in practice there is often a need for authorities to bring in external experts and act in accordance with their advice. Recognise that scientific and technical uncertainty is an inevitable part of contaminated land risk assessment, and set out broadly how regulators should deal with it. It is important that this is recognised in the Guidance to support the regulators who have to make decisions in the face of uncertainty.

In deciding whether or not a significant possibility of significant harm to human health exists, the local authority should first understand the possibility of significant harm from the relevant contaminant linkage(s) and the levels of uncertainty attached to that understanding, before it goes on to decide whether or not the possibility of significant harm is significant.

The term “possibility of significant harm” means the risk posed by one or more relevant contaminant linkage(s) relating to the land. It comprises:

- the estimated likelihood that significant harm might occur to an identified receptor, taking account of the current use of the land in question; and
- the estimated impact if the significant harm did occur i.e. the nature of the harm, the seriousness of the harm to any person who might suffer it, and (where relevant) the extent of the harm in terms of how many people might suffer it.

Having completed its estimation of the possibility of significant harm, the local authority should produce a risk summary.

The decision on whether the possibility of significant harm being caused is significant (SPOSH) is a regulatory decision to be taken by the relevant local authority. In deciding whether the possibility of significant harm being caused is significant, the authority is deciding whether the possibility of significant harm posed by contamination in, on or under the land is sufficiently high that regulatory action should be taken to reduce it, with all that would entail.

In deciding whether or not land is contaminated land on grounds of significant possibility of significant harm to human health, the local authority should use the four categorisations.

The decision between Categories 2 and 3 is a positive legal test, which means that the starting assumption should be that land does not pose a significant possibility of significant harm unless there is reason to consider otherwise. Category 3 may include land where the risks are not low, but nonetheless the authority considers that regulatory intervention under Part 2A is not warranted.

The local authority should first consider its assessment of the possibility of significant harm to human health, including the estimated likelihood of such harm, the estimated impact if it did occur, the timescale over which it might occur, and the levels of certainty attached to these

estimates. If the authority considers, on the basis of this consideration alone, that the strong case does or does not exist, the authority should make its decision on whether the land falls into Category 2 or Category 3 on this basis regardless of any other factors.

However, if the authority considers that it cannot make a decision, it should consider other factors which it considers are relevant, including:

- The likely direct and indirect health benefits and impacts of regulatory intervention including benefits of reducing or removing the risk posed by contamination, any risks from contaminants being mobilised during remediation and any indirect impacts such as stress-related health effects that may be experienced by affected people, particularly local residents. If it is not clear to the authority that the health benefits of remediation would outweigh the health impacts, the authority should presume the land falls into Category 3 unless there is strong reason to consider otherwise.
- The authority's initial estimate of what remediation would involve; how long it would take; what benefit it would be likely to bring; whether the benefits would outweigh the financial and economic costs; and any impacts on local society or the environment from taking action that the authority considers to be relevant.

Deregulatory Change to Definition of Contaminated Land as it Relates to Water Pollution.

Defra will commence Section 86 of the Water Act 2003 so that in future this would only be the case if there is significant pollution of controlled waters or significant possibility of such pollution. To explain how to decide whether or not "significant" pollution is being caused, the Statutory Guidance introduced new Category 1-4 tests similar to those for deciding when there is a significant risk to human health as described above. There will be new technical guidance produced by the Environment Agency. In practice, this change is likely to have little effect on the practical implementation of the Part 2A regime because the Environment Agency has already been prioritising sites likely to meet the new "significance" test.

The 'pollution of Controlled Waters' means the entry into controlled Waters of any poisonous, noxious or polluting matter or any solid waste matter. Given that the Part 2A regime seeks to identify and deal with significant pollution (rather than lesser levels of pollution), the local authority should seek to focus on pollution which: (i) may be harmful to human health or the quality of aquatic ecosystems or terrestrial ecosystems directly depending on aquatic ecosystems; (ii) which may result in damage to material property; or (iii) which may impair or interfere with amenities and other legitimate uses of the environment.

In deciding whether significant pollution of Controlled Waters is being caused, the local authority should consider that this test is only met where it is satisfied that the substances in question are continuing to enter controlled Waters; or that they have already entered the waters and are likely to do so again in such a manner that past and likely future entry in effect constitutes on-going pollution.

3.13 Generic Risk Assessment Criteria for Risk to Plants

Soil contaminants, if present at sufficient concentrations, can have an adverse effect on the plant population. Phytotoxic effects can be manifested by a variety of responses, such as growth inhibition, interference with plant processes, contaminant-induced nutrient deficiencies and

chlorosis (yellowing of leaves). All chemicals are probably capable of causing phytotoxic effects. Thus the phytotoxic potential of substances is dependent on the concentrations capable of having adverse effects on plants and the concentrations likely to be found at contaminated sites. Phytotoxicity is a difficult parameter to quantify given that experimental techniques vary widely and variations exist in plant tolerances, soil effects and synergistic/antagonistic reactions between chemicals.

Contaminants may be taken up and accumulated by plants through a range of mechanisms. The principal pathways are active and/or passive uptake through the plant root, adsorption to root surfaces and volatilisation from the soil surface followed by foliar uptake. After plant uptake, contaminants may be metabolised or excreted, or they may be bioaccumulated.

Many of the substances capable of adversely affecting vegetation exert this effect because of their water solubility, a characteristic that could result in their transport from contaminated sites into adjacent locations where the chemical may generate a phytotoxic response. This could be important if, for example, the adjacent site has important conservation status.

Whilst many contaminants may be phytotoxic, data are limited. Some heavy metals are essential as trace elements for plant growth but may become toxic at higher concentrations. Toxicity may be displayed in many forms, including signs of stress such as reduction in growth or yellowing of the tissue. The concentration in soil at which substances become phytotoxic depend on a range of factors including plant type, soil type, pH, the form and availability of the contaminant and other vegetation stress factors that may be present (such as drought).

Hydrock has carried out a review of a number of current and former guidance documents and other texts on phytotoxicity. It is not possible to produce a definitive list of phytotoxic substances on account of the variables mentioned above. However, a number of metals are repeatedly cited as commonly occurring priority pollutants. As a result, the following list is adopted as Hydrock's indicators of the potential for phytotoxicity: As, B, Cr, Cu, Ni and Zn.

As the CLEA framework is a risk based approach, applied to humans, an alternative strategy is required to assess the risk to plants from substances that are phytotoxic. Reference to published criteria and background concentrations can help put site data into context.

Published assessment criteria for the protection of plant life from a number of countries are given in Table 3.8. Also included in the table are some measures of natural background concentrations in typical soils.

The most authoritative source is the British Standard for topsoil, but this only lists three elements. CLR 11 states that the ICRCL Guidance Note 70/90 can be used for initial screening criteria. This approach has been adopted by Hydrock where BS 3882 is lacking, but where an ICRCL 70/90 criterion is lacking, the lowest criterion in Table 3.8 from, firstly MAFF, and, secondly, another country has been adopted. The adopted criteria are highlighted in Table 3.8. The MAFF value of 250 mg/kg has been chosen for As over the ICRCL value of 50 mg/kg as MAFF explains the 50 is applicable to vegetables and human health, whereas 250 is applicable to the plants themselves.

Table 3.8: Published Assessment Criteria and Natural Background Concentrations for Phytotoxic Elements (mg/kg)

Reference	As	B	Cr (total)	Cr (III)	Cr (VI)	Cu	Ni	Zn
Published assessment criteria (mg/kg)								
British Standard for topsoil (BS 3882:2015)						200 (pH>7) 135 (pH 6-7) 100 (pH 5.5-6.0)	110 (pH>7) 75 (pH 6-7) 60 (pH 5.5-6.0)	300 (pH>7) 200 (pH 6-7) 200 (pH 5.5-6.0)
MAFF Code of Good Agricultural Practice for the Protection of Soil (1998)	250			unlikely to be toxic except in v low pH. 400 for sites containing sewage sludge		500 (grass) but may fall to 250 for clover and sensitive species (at pH≥6)	110 (pH>7) 75 (pH 6-7) 60 (pH 5.5-6.0)	1000 (clover & grass at pH 6), may fall to 300 for sensitive species (at pH 6-7)
Australian Guideline B(1) (1999), Interim Urban Ecological Investigation Level (EIL). Soils not generally considered phytotoxic below these EILs.	20			400	1	100	60	200
Considered toxic to plants - Ponnamperuma *et al* (1979)		5 (hot water soluble)						
Dutch ecotoxicological intervention value (Swartjes 1993 & 1994) *	40	7	230			190		
Alberta Environment (1990) Tier 1 (draft) *	10 acid sandy soils			600 acid sandy soils	25 acid sandy soils	130 acid sandy soils		
Ontario MoE (1989) *	20 acid sandy soils 25 clay soils							
ICRCL 59/83 (1987) now withdrawn for human health assessment		3 (hot water soluble)				130	70	300
ICRCL 70/90 (1990) threshold trigger value	50				25	250		1000
New Zealand guidelines for timber treatment sites (1997), estimated based on Cu bioavailability *						500-1000 clay soils		
New Zealand guidelines for timber treatment sites (1997), soil criteria for protection of plant life (residential/agricultural setting)	10-20	3 (soluble)		600	25	130		

Reference	As	B	Cr (total)	Cr (III)	Cr (VI)	Cu	Ni	Zn
Natural Background Concentrations (mg/kg)								
Dutch background level (target value) (VROM 2000)	29		100			36	35	140
UK ICRCL 42/80 (2nd ed. 1983) - Normal conc. In agricultural soil	0.1-40	2-100	5-500			2-100	5-500	10-300
UK ICRCL 70/90 (1st ed. 1990) - Typical range (and mean) in agricultural soils	2.3 - 53 (11.0)					5.8-62 (19) [1.2-19 4.9) extractable]		29-210 (78.1) [1.5-21 (5.6) extractable]
Canadian assessment criteria (i.e. background) (CCME 1991)	5	1(hot water soluble)	20		2.5	30		60
New Zealand timber sites (1997) – background	2-30							
Australian Guideline B(1) (1999), typical background levels	1-50		5-1000			2-100	5-500	10-300
* cited in New Zealand Ministry for the Environment (1997) timber treatment chemicals guidelines.								

3.14 Generic Risk Assessment Criteria for Controlled Waters

The following aquifer definitions are adopted.

- **Principal aquifers** - These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.
- **Secondary aquifers** - These include a wide range of rock layers or drift deposits with an equally wide range of water permeability and storage. Secondary aquifers are subdivided into two types:
- **Secondary A** - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers; and
- **Secondary B** - predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.
- **Secondary undifferentiated** - has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type
- **Unproductive strata** - These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

The Environment Agency (August 2013) Groundwater Protection Policy (known as GP3) contains the legal framework, detailed policies, technical background and the tools to be used in the protection of groundwater.

The European Water Framework Directive (2000/60/EC) (WFD) and its daughter Directives establish a consolidated way of controlling water quality of the whole water environment. The UK Government has revised its guidance to the Environment Agency and Natural Resources Wales (the Agencies) to remain relevant to the second and subsequent planning cycles. *River basin planning guidance* (Defra and Welsh Government July 2014) is a point of reference for other regulators, bodies and individuals affected by or contributing to the river basin planning process. Parts of this guidance are transposed into The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015, which support The Water Environment (Water Framework Directive) (England and Wales) (Amendment) Regulations 2015 (Statutory Instrument 2015 No. 1623) which came into force on 14 September 2015. This updates the 2003 Regulations to include the revised EQS Directive (2013/39/EU) which has been amended to cover the second planning cycle, starting on 22 December 2015.

Water Framework Directive implementation in England and Wales: new and updated standards to protect the water environment (Defra and Welsh Government May 2014) informs interested parties of the new and updated environmental standards. There are a number of support documents produced by the UK Technical Advisory Group on the Water Framework Directive (UKTAG), including *Updated Recommendations on Environmental Standards* for the 2015-21 river basin management programme.

A groundwater body is defined as groundwater in an aquifer capable of supporting an abstraction of 10 m^3/day or 50 people over a sustained period under the WFD. Groundwater bodies are a strategic resource, even if there is no current abstraction. Lesser amounts of groundwater in an aquifer may not be considered as receptors in their own right, but may still be pathways to other receptors such as surface water bodies or aquatic ecosystems. However, if the conceptual site model indicates a potable supply of less than 10 m^3/day, this source will be included in the risk assessment.

One of the main objectives of the Agencies is to 'prevent or limit' inputs of substances. Substances are defined as either 'hazardous substances' or 'non-hazardous pollutants'. Directive 2006/118/EC include the objective of preventing the input of hazardous substances into groundwater and limiting inputs of other (non-hazardous) pollutants so as to avoid deterioration of the groundwater body. The revised EQS Directive 2013/39/EU Annex I contains a list of 'priority substances' in the field of water policy and includes those identified as 'priority hazardous substances'.

For practical purposes, the Agency interprets prevention of inputs of hazardous substances and any other substances which meet the criteria for persistence, toxicity and bioaccumulation taking into account those substances listed in WFD (2000/60/EC) Annex VIII.

The 'prevent' objective applies to active inputs such as industrial discharges and *de minimus* concentrations are set as a series of minimum reporting values (MRV). Inputs to Controlled Waters from contaminated land sites are classed as passive inputs under the WFD and, as such, were regulated under the Agency's 'limit' objective. However, paragraph 9.3 of the revised *River*

basin planning guidance (Defra and Welsh Government July 2014) states that the governments will issue revised Directions to take into account the recommendations of UKTAG (November 2013, amended January 2014) as well as Directive 2013/39/EU. These recommendations provide approached for hazardous and non-hazardous substances as follows.

- Hazardous substances – standards in groundwater help to assess whether or not measures to prevent inputs from identified sources have been successful and are based on 'limits of quantification' achieved routinely by competent laboratories (also known as minimum reporting values, MRV). Recommended standards are given in Table 13 of the UKTAG document. These standards are recommended for use in assessing risks posed by new developments (such as landfills) and whether or not existing activities and contaminated land with the potential to cause inputs are doing so.

  This is potentially more onerous than the previous 'limit' objective and the UKTAG document states that actions currently taken with respect to contaminated land are not always sufficient to prevent inputs of hazardous substances and additional remediation may be required. However, it also states that exemptions are available where measures would be disproportionately costly.

- Non-hazardous pollutants – standards in groundwater help to assess the extent to which inputs need to be limited to ensure they do not cause deterioration. Standards vary depending on the receptor at risk. Acceptable water quality targets are defined for protection of human health (based on drinking water standards (DWS)) and for protection of aquatic ecosystems (environmental quality standards (EQS)).

In the event, when the revised Directions were issued (namely, The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015) there was no mention of the use of MRVs with respect to inputs from land subjected to contamination. Consequently, MRVs are not used by Hydrock in this report.

All substances which are not determined to be hazardous are potentially non-hazardous pollutants. The final say lies with the Agencies as to which chemicals they consider to be of potential concern and whilst the indicator substances analysed for by Hydrock in this report may be indicative of the likely risk of pollution of Controlled Waters, this report may not be definitive and the relevant Agency may require additional work.

The definition of pollution is "the direct or indirect introduction, as a result of human activity, of substances or heat into the air water or land which may be harmful to human health or the quality of aquatic ecosystems or terrestrial ecosystems directly depending on aquatic ecosystems, which result in damage to material property, or which impair or interfere with amenities and other legitimate uses of the environment."

Pollution equates to harm. In order to protect receptors there is a regulatory regime. This involves setting an environmental standard at the receptor (i.e. minimum acceptable water quality). In recognition that pollutants may degrade *en route* to the receptor it is possible to set a limit value at the source of the pollution and compliance values at locations along the pathway, such that water reaching the receptor does not exceed the environmental standard. By definition, the target value is greater than or equal to the compliance value, which in turn is greater than or equal to the environmental standard, depending on the amount of degradation

expected. This concept is used in the Remedial Targets Methodology (Environment Agency 2006a) to determine how land contamination impacts on groundwater and surface water quality.

The applied environmental standards vary with the hydrogeological conditions and the perceived value of the water resource, and are subject to local assessment by the relevant Agency. Note that protection of Controlled Waters may involve work over and above that required for 'suitable use' of a site for the proposed development.

Note also that Article 6.3(e)(ii) of the WFD enables the regulatory authorities to exempt measures from the prevent and limit requirements where it would be disproportionately costly to remove or control the further movement of pollutants that are already in the ground. Where a continuing source that has given rise in the past to land contamination this must be brought under control to prevent further unacceptable inputs to groundwater, but it is clear that the extent is limited by what is considered to be 'reasonableness'.

This report provides an initial assessment of the risks of pollution of Controlled Waters using water quality targets (WQT) as screening values. These are the drinking water standards (DWS) and the environmental quality standards (EQS), the latter designed to protect the surface water ecosystems. EQS are available for inland surface waters (freshwater) and other surface waters (transitional and marine). In addition, the recommended standards for hazardous substances in groundwater (UKTAG November 2013, amended January 2014, Table 13, Column 2) are also used where appropriate.

DWS are given in the Water Supply Regulations 2010 (which amends to Water Quality (Water Supply) Regulations 2000, Schedule 1, Table B, Part 1 (Directive requirements) and Part 2 (national requirements)). Where no UK or EU drinking water standard exists, reference is made to the World Health Organization (2011).

The list of EQS for priority substances is published in Directive 2013/39/EU. In addition, each Member State has to define country-specific substances and their EQS (river basin specific pollutants). Those adopted by the UK listed by Defra and Welsh Government (May 2014) and the 2015 Directions. These documents form the basis for the DWS and EQS used in this report.

It is noted that the EQS for iron in *Water Framework Directive implementation in England and Wales: new and updated standards to protect the water environment* is given in Table 5.2a as 1 µg/l. The 'standard status' in that table is listed as an existing standard. However, the existing standard was 1 mg/l (i.e. 1000 µg/l) and the tabulated value appears to be an error. This has been carried forward to the 2015 Directions. Consequently, Hydrock continues to use 1000 µg/l in its assessments.

Several EQS are based on bioavailable metal proportions (i.e. copper, lead, manganese, nickel and zinc). For zinc, this is the concentration in excess of the ambient background concentration (ABC). A software tool (M-BAT) is available from the Water Framework Directive - UK TAG web site for calculating the bioavailable fraction of Cu, Mn, Ni and Zn, but not Pb, and it also lists regional ABC values (WFD-UKTAG July 2014). Use of the tool requires knowledge of certain determinants of the receiving waters. Consequently, unless otherwise stated in the report text, this modelling has not been used in Hydrock's initial screening exercise and so an assessment

based on the total dissolved metal concentrations will be conservative and a further level of risk assessment may be required.

Where this tool has been used, the bioavailability has been taken into account by calculating site-specific $PNEC_{dissolved}$ (Predicted No Effect Concentration) values. These enable the dissolved concentration data to be compared with the PNEC as if it were an EQS.

The WFD imposes a duty on the Agencies to classify surface water and groundwater bodies and to ensure long-term improvement (where necessary) to achieve acceptable standards. Threshold Values (TV) for individual groundwater bodies (GWB) are published. Each GWB has been identified by the Agencies and specific TVs calculated based on the perceived risks to that GWB. Failure of a TV is an indicator of potential adverse impact in specific circumstances. These TVs are not intended to be applied to meet the 'prevent or limit' objective of the Agencies (UKTAG September 2008) and are not to be used as part of specific site investigations (The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015) and they are not used by Hydrock in this report.

Generic criteria for contaminated soils which might result in groundwater contamination can be derived from generic assumptions using the Environment Agency (2006) Remedial Targets Methodology. A tiered approach is detailed in this document. In accordance with CLR 11, EQS and DWS can be used as generic water quality targets with respect to contamination of controlled waters.

It is clearly not cost-effective to analyse every water sample for all determinands. Hydrock has produced a default *de minimus* suite which includes a number of common water quality indicators plus a selection of the more common chemicals of potential concern, drawn from the lists of Specific Pollutants and Priority Substances / Priority Hazardous Substances plus additional common contaminants listed in the EPA-H1 Part 2 document, as being indicators of Good water quality under the terms of the Directive.

In addition to this, Hydrock will add to this list any chemicals identified as potential risks by reference to the conceptual site model.

Using the WQTs discussed above, the risks to groundwater and surface water from contaminants on site have been assessed according to the remedial targets methodology (RTM) prescribed by the Environment Agency (2006a).

The Level 1 soil zone assessment considers whether the contaminant concentrations in the soil moisture are sufficient to impact the water receptor(s). It is a conservative model and compares soil pore water concentrations with the above criteria, taking no account of dilution, dispersion or attenuation. Pore water concentrations can be estimated by analysis of perched water samples, analysis of eluates produced in the laboratory by standard leaching of soil samples, or by calculation from physico-chemical properties of the substances. Calculation may be more appropriate for poorly soluble substances where retention times may not be long enough during the standard leaching tests to reach equilibrium. However, the Environment Agency (2009d) cautions that the use of published k_d values to calculate pore water concentrations "can lead to a conservative estimate of risk" and suggest that leaching tests may be designed for non-volatile organics using BS 18772:2008.

The Level 2 groundwater assessment is applicable where groundwater quality data are available and compares these with the above criteria, again taking no account of dilution, dispersion or attenuation.

The remedial targets methodology also allows for more detailed assessment (soil Level 2, 3 or 4, or groundwater Level 3 or 4) for substances which fail the above-mentioned assessments. These are progressively more complex assessments and do take into account attenuation and/or dilution, as applicable to the conceptual exposure model. Such assessment is beyond the scope of this report.

Where more than one water quality target is available it is important to apply the one relevant to the critical receptor. The DWS apply to groundwater or to surface water used for abstraction and the EQS apply to surface water where the aquatic ecosystem is the receptor. EQS are available for *inland* surface waters (freshwater) and *other* surface waters (transitional and marine). Where the most appropriate water quality target cannot be determined with certainty, the lowest one is adopted in line with the precautionary principle.

For the purposes of this report, the site data are compared with the various targets as set out in Table 3.9

Table 3.9: Summary of Water Quality Risk Assessment Protocol

Scenario	Water body Receptors	Secondary Receptors	Example Contaminant Linkages	RTM Level and Samples Used (if Available)	Water Quality Targets
A	Groundwater.	Human health (abstraction).	Contaminants from site leach or seep into groundwater body and this is a (potential/actual) source of human consumption or a strategic resource.	RTM Level 2 - Groundwater. RTM Level 1 - Soil leachate (including any calculated pore water concentrations) or pore water.	DWS
A	Groundwater. Surface water.	Human health (abstraction).	Contaminants from site leach or seep into groundwater body and this feeds surface water by base flow. The surface water may be used for human consumption.		DWS
B	Groundwater. Surface water.	Aquatic ecosystem.	Contaminants from site leach or seep into groundwater body and this feeds surface water by base flow. The surface water may be an aquatic ecosystem.		EQS (inland)
C	Groundwater. Surface water.	Aquatic ecosystem.	Contaminants from site leach or seep into groundwater body and this feeds surface water by base flow. The surface water may be an aquatic ecosystem.		EQS (other)
D	Groundwater. Surface water.	Human health (abstraction). Aquatic ecosystem.	Contaminants from site leach or seep into groundwater body and this feeds surface water by base flow. The surface water may be used for human consumption and is an aquatic ecosystem.		DWS EQS (inland)

Scenario	Water body Receptors	Secondary Receptors	Example Contaminant Linkages	RTM Level and Samples Used (if Available)	Water Quality Targets
E	Surface water.	Human health (abstraction).	Contaminants from site leach or seep into surface water which may be used for human consumption.	RTM Level 1 - Soil leachate (including any calculated pore water concentrations) or pore water. Although not part of the RTM, these scenarios are used to compare surface water data to the water quality targets.	DWS
F	Surface water.	Aquatic ecosystem.	Contaminants from site leach or seep into surface water which may be an aquatic ecosystem.		EQS (inland)
G	Surface water.	Aquatic ecosystem.	Contaminants from site leach or seep into surface water which may be an aquatic ecosystem.		EQS (other)
H	Surface water.	Human health (abstraction). Aquatic ecosystem.	Contaminants from site leach or seep into surface water which may be used for human consumption and is an aquatic ecosystem.		DWS EQS (inland)

Notes:
Some EQS are water hardness dependent. This is measured either in the receiving water or in groundwater (if it is part of the pathway), or is estimated from national maps.
Inland waters EQS applicable to freshwater, other waters EQS applicable to marine or transitional waters.
Where both DWS and EQS are applicable, it is assumed that the EQS is for inland waters.
This table and the results of the assessment are considered as a first screening for potential risks of pollution of Controlled Waters. More specific requirements may be stipulated by the Environment Agency.

Note that in some instances the reporting limit (or detection limit) quoted by the laboratory may be greater than the water quality target that it is being assessed against. Where this is the case it is noted in the table. The current exercise is an initial screening assessment.

There are three main possible reasons for this. Firstly, it may be that the 'standard' method gives a relatively higher reporting limit, but that a lower one could be obtained using a more specialised technique. However, it would be disproportionately expensive to adopt the more costly specialist technique for this initial screening exercise. Secondly, it may be that the sample in question was not 'clean' because the matrix was contaminated by other substances which interfere with the analysis and so a less sensitive method has been used to protect the laboratory equipment. Thirdly, it may be that no method exists that can reach the required limit. Hydrock has contacted the Environment Agency's own National Laboratory Service and even they cannot reach low enough limits for several of the substances in the Hydrock default suite (Cr(VI), total cyanide, phenols and certain PAHs). Consequently, and depending on the particular chemicals, it may be possible with additional effort to refine the assessment, or it may be the case that it is not possible to say for certainty because suitable techniques are not available. Methods are being continually updated and new ones may become available.

The problem is compounded when EQS are revised downwards (eg the PAHs in 2013/39/EU Annex II) on the basis of toxicology, but laboratory techniques have yet to catch up. Indeed, the Directive acknowledges this in the revised Article 3b and where it states "... measurement, when carried out using the best available technique not entailing excessive costs, is referred to as "less than limit of quantification", and the limit of quantification of that technique is above the EQS, the result for the substance being measured shall not be considered for the purposes of assessing the overall chemical status of that water body."

In some cases all samples are below the detection limit but above the water quality target. It is not possible to make any judgement about these. However, in other cases, even though the detection limit is greater than the water quality target, some sample results do exceed the target.

3.14.1 Petroleum Hydrocarbons in Water

With respect to hydrocarbons in water, the Water Supply (Water Quality) Regulations 1989 (as amended 1999) contained a prescribed concentration of 10 µg/l for "dissolved or emulsified hydrocarbons (after extraction with petroleum ether); mineral oils". This was removed from the 2000 (consolidated 2007) Regulations. It was confirmed by email from the Drinking Water Inspectorate to Hydrock (1 November 2005) that dissolved hydrocarbons are no longer a prescribed substance under the Regulations. However, the 10 µg/l limit did remain in the Private Drinking Water Regulations 1991 until their revision at the end of 2009.

In the absence of a prescribed concentration for drinking water, many Environment Agency officers continue to use the superseded value. This is perhaps because petroleum hydrocarbons are a hazardous substance (former List 1) under the WFD. There is, however, no clear UK policy on hydrocarbon contamination of controlled waters. This is partly because analyses for 'petroleum hydrocarbons' are fraught with complications concerning false positives, the results being method dependent and not restricted to petroleum products.

Guidance written by the Environment Agency on risk assessment of hydrocarbons in groundwater is dated 2009 but has never been officially released through the Agency's website, although the dissemination status of the document is given as publicly available. This gives a table of water quality targets for hydrocarbons and lists "TPH (dissolved or emulsified hydrocarbons)". No minimum reporting value (MRV) is quoted, the value that would equate to a *de minimus* concentration under the prevention objective. The target of 10 µg/l is given and this is described as coming from the "Private Water Supply Regulations 1991 No. 2790 (due to be updated in 2009)". As mentioned above, the 2009 Regulations no longer list dissolved hydrocarbons.

Furthermore, the guidance also states that in cases where petroleum hydrocarbons have already entered the water, the Agency will regulate under its limit objective, rather than the prevention objective. This means that EQS or DWS will be appropriate. However, none exist.

In the absence of definitive guidance on petroleum hydrocarbons in water Hydrock recognises that it is not possible to provide EQS and so regulation with respect to aquatic ecosystems is impossible. However, it is possible to extend the use of DWS by calculating screening criteria for the speciated TPH fractions. This provides a rational, transparent and risk-based approach using established scientific principles, rather than simply adopting a withdrawn standard.

Whilst not strictly applicable to aquatic ecosystems, at least this approach can help inform the judgement as to the degree of degradation of a water body.

Accordingly Hydrock has calculated guidelines for drinking water quality based on the methodology proposed by the World Health Organisation (WHO, 2005). This is based on an adult consuming 2 litres of water per day. Whereas the WHO document assumes a body weight of 60kg, Hydrock has assumed 70kg in keeping with the UK Contaminated Land CLEA methodology.

A conservative allocation of 10% of the oral Tolerable Daily Intake (TDI) has been attributed to intake from drinking water. It is noted by the WHO (2005) that exposure from other sources would be expected to be very small and that it would be possible to allocate a greater percentage to drinking water if required. In other words, this approach is very conservative and is appropriate as an initial screening value and allows for potential additive toxicity and simultaneous exposure from other sources.

The TDIs used are the same as those used in the derivation of soil GACs and are listed in Table 3.10 along with the calculated health-based water quality targets for drinking water. Note, however, that the Environment Agency (2009d) states that when considering carbon bands, one does not know the range of toxicities and health effects of the individual chemicals, and it is precautionary to assume that the toxicological effects are additive when setting water quality targets even though the toxic endpoints and modes of action might in reality be quite different. The recommendation is to adopt a precautionary approach whereby the water quality target for each band is divided by the number of bands with detected concentrations.

Table 3.10: Calculated Water Quality Targets for Petroleum Hydrocarbons in Drinking Water

Determinand	TDI (µg/kg/day)	Solubility (µg/l)	Water Quality Target (see Note 1) (µg/l)	Notes
Ali EC5-EC6	5000	35900	**17500**[1]	
Ali >EC6-EC8	5000	5370	**17500**[1]	This concentration would be significantly above the solubility in water.
Ali >EC8-EC10	100	427	**350**[1]	
Ali >EC10-EC12	100	33.9	**350**[1]	This concentration would be significantly above the solubility in water.
Ali >EC12-EC16	100	0.759	**350**[1]	This concentration would be significantly above the solubility in water.
Ali >EC16-EC44	2000	0.00254	**7000**[1]	This concentration would be significantly above the solubility in water.
Aro EC5-EC7	223	1780000	**1**[1]	Based on the TDI for toluene as recommended by Environment Agency (2005) P5-080/TR3 gives 780. In reality the UK DWS for benzene = **1** takes precedence.
Aro >EC7-EC8	223	590000	**700**[1]	Calculated as 780, WHO DWS = **700** takes precedence.
Aro >EC8-EC10	40	64600	**140**[1]	
Aro >EC10-EC12	40	24500	**140**[1]	
Aro > EC12-EC16	40	5750	**140**[1]	
Aro >EC16-EC21	30	653	**105**[1]	
Aro >EC21-EC44	30	6.61	**105**[1]	This concentration would be significantly above the solubility in water.
Benzene	n/a	1780000	**1**	Calculation not possible as non-threshold substance, UK DWS = **1** takes precedence.
Toluene	223	590000	**700**	Calculated as 780, WHO DWS = **700** takes precedence.
Ethylbenzene	100	180000	**300**	Calculated as 350, WHO DWS = **300** takes precedence.
Xylene	180	200000	**500**	Calculated as 630, WHO DWS = **500** takes precedence.
MTBE	300	48000000	**15**	Calculated as 1050 so the odour threshold = **15** is adopted.

Determinand	TDI (µg/kg/day)	Solubility (µg/l)	Water Quality Target (see Note 1) (µg/l)	Notes
Note 1: The value to be used in a risk assessment (for carbon bands) is the value in the table divided by the number of bands with detected concentrations. Last updated 29/06/10				

In instances where a simple 'total' TPH is reported for water samples this should be considered indicative only. This is particularly the case if groundwater or surface water samples were not available and an indication of pore water quality has been derived by subjecting soil samples to a standard leaching procedure or calculation.

Where petroleum hydrocarbon contamination of Controlled Waters is suspected, Hydrock recommends that discussion with the Environment Agency is entered into at the earliest opportunity.

3.15 Statistical Tests of Soil Contamination Results

As discussed above, the sample analyses are divided into representative data sets for the assessment, based on the conceptual site model, and are referred to as 'averaging areas'. In this case it has been chosen to characterize materials that are likely to form the ground cover in critical receptor areas (e.g. gardens), on a material by material basis. The critical part of the soil column is the upper metre in terms of contact with end users of a development site.

Under the **land use planning system** where the aim is to demonstrate 'suitability for use' the key question will usually be "can we say confidently that the level of contamination of this land is low relative to some appropriate measure of risk, sometimes referred to as the critical concentration?" The critical concentration can be, for example, the relevant GAC.

It is necessary to demonstrate that (for each contaminant) the mean concentration on the site is **below** the critical concentration. The true mean concentration of a contaminant is not known because all the site soil has not been tested. An estimation of the true mean can be obtained from the samples tested during the investigation. The greater the number of samples tested, the closer the mean of these values is to the true mean.

In practice, this involves calculation of a quantity known as the 95th Upper Confidence Limit (UCL) of the true population mean, also known as the US_{95}. This is the estimate of the true mean at a 95% level of confidence (i.e. there is a 95% probability that the true mean will not be greater than this, given the values obtained from the investigation sample testing).

The statistical test that is carried out, therefore, is used to demonstrate that there is a 95% probability that the true mean falls below critical concentration (typically the GAC in a screening exercise).

In statistical language, a **null hypothesis** is stated; that the level of contamination is the same as, or higher than, the critical concentration. The **alternative hypothesis** is that the level of contamination is lower than the critical concentration. The statistical test is used to decide whether or not the null hypothesis is rejected.

If it is rejected, the assessor can conclude that the alternative hypothesis is more likely to be true, i.e. that contaminant concentrations are low relative to the critical concentration and that, potentially, the land is suitable for use. Conversely, if the null hypothesis is not rejected, the assessor should conclude that contaminant concentrations may be the same as, or higher than, the critical concentration and further measures may be needed.

A useful summary of the methodology is provided by CIEH & CL:AIRE (May 2008), which forms the basis for the approach adopted by Hydrock, and is described below. Appendix I of the C4SL report SP1010 (CL:AIRE, December 2013) contains a review of this methodology.

Firstly, the data set is assessed for outliers and normality. This is mainly a visual exercise rather than following a particular statistical method. Two graphs are considered, the data frequency histogram with a normal 'bell curve' for comparison and a quantlie-quantile (q-q) plot. The closer the data points lie to the 45° line, the closer they are to a normal distribution. Kinks in the q-q plot are indicative of more than one data set. Individual points away from the 45° line are indicative of outliers.

Additional evidence of outliers is obtained through a simple method of robust statistics advocated by the Royal Society of Chemistry (2001) and others. The measure of the mean is taken to be the median value because this is less susceptible to outliers and non-normal data sets. A value known as the mean absolute deviation (MAD) is calculated and from this can be calculated a robust standard deviation estimate by multiplying by 1.483.

A z-score can then be calculated, which is the absolute value of the data value minus the median, divided by the robust standard deviation. This is then compared with a critical value which, if exceeded, suggests a possible outlier. The critical value represents the number of standard deviations from the mean (or in this case the median). A critical value of 3 to 3.5 is generally considered appropriate. The attraction of this approach is that it is a robust, non-parametric method suitable for all data sets. It is not considered as definitive, but merely a tool to aid decision making.

If a potential outlier is identified it could be a laboratory or typographic error. If this is not the case it could be representative of a different contaminative incident and, therefore, be a hot-spot. However, it could also be simply the result of heterogeneous ground conditions and a relatively low number of sampling points. The initial review of the data is then coupled to a knowledge of the conceptual site model before an outlier is removed from the data set. A good reason is required to justify the removal of outliers and this will be reported in the text.

The second stage of the assessment is to carry out the statistical test as described previously. Two alternative methods are highlighted in the CIEH/CL:AIRE document. The one-sample t-test is said to be appropriate for normally distributed data (it is a parametric test) but is not sensitive to moderate departures from normality. The Chebychev Theorem is a non-parametric test which is said to be suitable for all data distributions. It is a less powerful test (statistically) and gives a more cautious result than the t-test because there is less certainty about the shape of the distribution.

The CL:AIRE review of 2013 considers the use of the t-test in more detail and states that if enough samples have been taken the distribution that describes the uncertainty about the mean depends only on the mean concentration and the size of between-location variation (as

measured by the observed standard deviation, not the shape of the variation. The review goes on to say that in certain circumstances, the use of the Chebychev Theorem may be unsound and suggests the use of statistical tests not based on the null hypothesis test.

The method of determining when there are enough samples to be able to use the t-test is based on the condition that the relative standard error (RSE) is less than 0.25. The RSE is calculated from the relative standard deviation (RSD) by dividing my the square root of the number of samples. The RSD is the standard deviation divided by the mean. The number of samples required for an unbiased estimate of the average concentration are listed in Table 2 of Appendix I of SP1010, for various values of RSD and based on RSE of 0.25. The number of samples required and the RSE are calculated for each chemical on the Hydrock statistics spreadsheet and a note appears as to whether or not the t-test is applicable on this basis.

The risk assessor ultimately decides, based on all the evidence, whether to use the t-test (by selecting the data as being treated as normally distributed) or the Chebychev Theorem (data treated as non-normal). The chosen method is applied and the outcome recorded with respect to whether or not the null hypothesis is rejected and the site is potentially suitable for use.

Please note that under certain circumstances a 'divided by 0' error can occur in the spreadsheets used in the statistical analyses. This happens when all the data points are the same integer value, for example where all results are <3 mg/kg and they have been assumed to be 3 mg/kg. To prevent this error, one of the results can be altered by a small amount (e.g. 3 becomes 2.99999). This allows the statistical tests to be carried out but makes no difference to the outcome. However, it does mean that the q-q and histogram plots show a spurious point, which should be ignored.

It should be noted that a similar, but opposite, set of propositions applies in the case of a potential Part 2A determination where the level of contamination must be higher than some appropriate level of risk (critical concentration) (e.g. that indicative of SPOSH). In this case, however, a lower standard of proof may be accepted and the guidance suggests that if the statistical test of significance at the 95% confidence level does not indicate rejection of the null hypothesis, then the test should be repeated at the 51% level to see if there is evidence to suggest the null hypothesis be rejected on the balance of probabilities. Where no SPOSH concentrations are available and, say C4SLs, are being used as a low-level screen under Part 2A, the same approach as for the planning regime is appropriate.

When considering potential Part 2A sites, updated guidance published by Barnes *et al* (2010) recommends the t-test for all data sets where exceedance of a critical concentration is being tested (unless the data are negatively skewed, something these authors have never seen in contaminated land data sets).

3.15.1 Note on Clustered Data Sets

The assumption behind the statistical tests is that each sample represents an equal fraction of the averaging area (Nathanail, 2004). If the data are clustered, i.e. the sampling points are not equally spaced, the calculated US_{95} would be too high if targeted sampling has taken place around suspected high concentration areas to determine the extent of the high contamination. Conversely, the calculated US_{95} would be too low if there is a high density of sampling in an area of low contaminant concentration.

The sampling pattern used in this report has been reviewed to determine if clustering of data points is likely to affect the statistical tests significantly. In cases where the area represented by each sample is judged to be similar, the tests have been carried out without modification. The error in this approach is likely to be conservative to human health because the Hydrock approach to targeted sampling is more likely to produce more closely spaced higher concentrations than more closely spaced lower concentrations.

Erring on the conservative side is, however, counter-productive when it would indicate unnecessary remediation, i.e. remediation triggered by a US_{95} which is skewed by clustered data. This is taken into consideration in the risk evaluation part of the risk assessment exercise and can take the form of professional judgement, the modification of the averaging area datasets to decluster them, or the weighting of sample results to decluster the data set. The latter method involves weighting the measured concentrations according the proportion of the area they represent, giving greater weight to samples representative of a larger area.

3.15.2 Statistical Tests and Risk to Controlled Waters

Where only a few water quality tests are available, the maximum concentrations are compared with the standards because the 95 percentile will be close to the maximum value. However, where a larger population is available, the 95 percentile is compared with the standards, as recommended by the Environment Agency.

3.16 Ground Gas Risk Assessment

The permanent ground gases methane (CH_4) and carbon dioxide (CO_2) are monitored in accordance with the principles of BS 8576:2013 and the site records are reported in an appendix. Instrument calibration records are kept in accordance with Hydrock's in-house protocol for ground gas monitoring.

The risks associated with the methane and carbon dioxide are assessed using BS 8485:2015 and guidelines from CIRIA (Wilson *et al* 2007), the NHBC (Boyle and Witherington 2007) and CL:AIRE RB17 (Card *et al* 2012).

In the above guidance, 'Situation B' is defined as the specific development of low-rise (1 or 2 storey) housing with beam and block floors, vented sub-floor void and gardens. Initial risk classification can be made according to NHBC Table 8.1. This determines the appropriate risk strategy for protection, including the need to progress to generic quantitative risk assessment (GQRA). Even where no risk assessment is recommended by this table, one may be carried out if so desired. The GQRA is known as the 'NHBC traffic light classification' as it uses red, amber and green designations to portray levels of risk.

'Situation A' covers all other forms of development. This uses a modified version of the Wilson and Card (1999) methodology.

The idealised frequency of monitoring is suggested in CIRIA Tables 5.5a and 5.5b. These tables are adapted from Wilson and Haines (2005) Table 3 which gives examples of ground conditions with the various gas generation potentials, ranging from inert Made Ground (very low potential) to post 1960s domestic landfill (very high potential).

The report does not constitute a design for gas protection measures, but lists the recommendations given by the above-mentioned guidance for the particular "Situation" considered relevant. Reference should be made to BS 8485:2015 which provides guidance for the design, based on a system of scoring depending on the type of building, the type of structural barrier, ventilation protection measures and the gas membrane. The design of gas protection measures according to BS 8485:2015 requires the building(s), or different parts thereof, to be categorized into one of four building types: Type A, Type B, Type C or Type D. This is because the construction and use of the building, together with the control of future structural changes to the building and its maintenance (the building's management) should be assessed, since potential risks posed by ground gases are strongly influenced by these factors. Note that if a membrane is installed it must be verified in accordance with CIRIA C735 (Mallet *et al* 2014) or it will score zero points and will not be deemed to afford any protection.

CL:AIRE RB17 (Card *et al* 2012) is a pragmatic approach to ground gas risk assessment and was developed because gas concentration, pressure and flow rate measured in a well headspace may not be representative of the conditions in the surrounding formation. This approach is endorsed in BS 8485:2015. This is particularly the case where landfill or mine gases are not present, but there is scope for gas generation from Made Ground or naturally occurring organic matter in the soil. If generation rates are low, relatively high concentrations may be present in the soil pores but there is no driving force to expel gases at sufficiently high fluxes so as to represent a risk by entering enclosed living spaces.

In these low risk situations, the approach is to use the conceptual site model and the estimation of the likely gas generation from a source to identify:

- where gas monitoring is required to better define the risks;
- where it may be appropriate to reduce the period of monitoring required (or avoid extra monitoring in response to anomalous results); or
- gas protection measures where the total organic content (TOC) is not greater than 6%.

In summary:

Natural soils only with no credible methane source:

- no action required (monitoring or gas protection measures) as this represents Characteristic Situation 1 (CS1).

Natural soils with peat/organic alluvium or Made Ground with low organic content and a radon barrier is being provided:

- no action required (monitoring or gas protection measures).

Natural soils with peat/organic alluvium or Made Ground with low organic content and a radon barrier is *not* being provided:

- no gas monitoring required;
- if peat/organic alluvium is present this represents CS2 (note Table A1 in RB17 reads CS3 and this is an error according to Wilson (pers. Comm.);

- if Made Ground is present, is less than 1 m thick and is inert material such as sub-base of mineral soils no gas protection is required as this represents CS1;
- if Made Ground is present, is less than 5 m (maximum) and less than 3 m (average) thick determine TOC and forensic description (Table 3.11) and Characteristic Situation (and hence gas protection measures) (Table 3.12);
- if Made Ground is present, is greater than 5 m thick (for example and 'old refuse tip' on the Ordnance Survey map) determine Characteristic Situation (and hence gas protection measures) from TOC with forensic description plus gas generation modelling and gas monitoring to provide a lines of evidence approach. The findings of the TOC and gas modelling may mean gas monitoring for a period shorter than recommended by CIRIA.

Table 3.11: TOC and Forensic Description

Made Ground Fraction	TOC (%)
Fine soil <10mm organic	Laboratory test for TOC
Fine soil <10mm inorganic	Zero (inert) or confirm TOC with lab test
Coarse inert – clinker, gravel, concrete, brick etc.	Zero (inert)
Wood, trees, branches etc.	57 (=IPCC (2006) DOC of 43% x 1.33 according to Hesse (1971))
Vegetable matter	27 (=IPCC (2006) DOC of 20% x 1.33 according to Hesse (1971))
Metal, glass, ceramic and other inert matter	Zero (inert)
Paper and card	53 (=IPCC (2006) DOC of 40% x 1.33 according to Hesse (1971))
Other degradable matter	Food: 20 (=IPCC (2006) DOC of 15% x 1.33 according to Hesse (1971) Nappies: 32 (=IPCC (2006) DOC of 24% x 1.33 according to Hesse (1971) Construction / demolition waste: 5 (=IPCC (2006) DOC of 4% x 1.33 according to Hesse (1971)
Cloth and leather	32 (=IPCC (2006) DOC of 24% x 1.33 according to Hesse (1971))
Total TOC for the sample	**Weighted average of above based on mass of fractions**

Table 3.12: Characteristic Situation Based on TOC of Made Ground Maximum 5 m Thick, Average 3 m Thick

Maximum TOC (%) Made Ground in Place for 20 years or Less	Maximum TOC (%) Made Ground in Place for More Than 20 years	Characteristic Situation (CIRIA C665)
≤ 1.0	≤ 1.0	CS1
≤ 1.5	≤ 3.0	CS2
≤ 4.0	≤ 6.0	CS3
Not applicable for >CS3. Gas monitoring required if TOC > 4% (or 6% in old Made Ground)		

In a scenario where Made Ground is greater than 5 m thick the gas generation potential can be calculated according to the equation on page 10 of RB17, but ignoring the summation as no iteration is required if no new Made Ground is placed every year (Wilson, pers. comm.). The equation comes from LTGN03 (Environment Agency 2004c) and was originally developed to calculate the gas generation potential of landfill sites based on iterations representing the amount of waste deposited year by year. The rate constants (half-life) Hydrock uses as default

are the fast, medium and slow degradation waste types from LTGN03 (viz 0.185/yr, 0.1/yr and 0.03/yr, respectively).

The result of the above calculation is assumed to represent the surface emission rate from a given area and mass of degradable Made Ground. This can be converted into a borehole emission rate (rounded up to the nearest 0.5%) for comparison with CIRIA C665 by assuming one borehole is equivalent to 10 m^2 of ground surface (Pecksen 1986).

Furthermore, the above calculated surface emission rate can be used with the equations from the NHBC Appendix F (Boyle and Witherington 2007) to estimate gas content in as house and compare this with the permissible concentrations.

4.0 WATER SUPPLY PIPES

The current guidance on selection of materials for potable water supply pipes to be laid in contaminated land is contained in a document published jointly by Water UK and the Home Builders Federation (Water UK HBF 2014). The protocols in that document are for guidance and are not subject to enforcement by Water UK or any agency, but have been adopted by Water UK and by HBF as best practice for their members. It has been produced to replace the guidance published by UK Water Industry Research (UKWIR) (Report 10/WM/03/02 and reissued in 2010), which came under criticism from contaminated land specialists. Accordingly this guidance is used in the following assessment.

The contaminants are divided into a number of 'parameter groups'. Threshold values for a selection of organic contaminants that may have a detrimental effect on pipes and fittings, together with threshold values for certain parameters that could cause corrosion of metal pipes, are presented.

It is generally accepted that the UKWIR document contains a number of technical errors and inconsistencies and was not universally accepted (AGS June 2014). The Water UK guidance document states that UKWIR Tables 3.1 and G1 are "not considered a definitive guide" and replaces these with its own Table 1 which clarifies the guidance. This is reproduced as within Table 4.1 below and although not stated in the document, it is assumed the units are mg/kg.

With respect to VOCs it is not clear whether or not BTEX and MTBE are to be included within the total VOC category. They appear in the USEPA method 8260C list of priority pollutants, but the text does not say to exclude them from the VOC total even though there is a separate group for BTEX and MTBE. The text does specifically exclude certain sub-sets of the SVOC list and so Hydrock has taken the guidance at face value and includes BTEX and MTBE in the VOC total.

Table 4.1: Water UK Threshold Values for Water Pipes

Parameter Group	Testing Required?	PE Pipe Threshold (mg/kg)	Metal or Barrier Pipe Threshold
Total VOC Sum of all USEPA 8260C VOC >10ug/kg and TIC >20ug/kg	Where preliminary risk assessment has identified land potentially affected by contamination	0.5	No limit
Total BTEX and MTBE		0.1	No limit
Total SVOC Sum of all USEPA 8270D SVOC >10ug/kg and TIC >20ug/kg but excluding PAH and those substances marked with an asterisk below.		2	No limit
TPH >EC5-EC10		2	No limit

Parameter Group	Testing Required?	PE Pipe Threshold (mg/kg)	Metal or Barrier Pipe Threshold
TPH >EC10-EC16		10	No limit
TPH >EC16-EC40		500	No limit
Phenols* from SVOC analysis		2	No limit
Cresols* and chlorinated phenols* from SVOC analysis		2	No limit
Ethers*	Only where identified from former land use	0.5	No limit
Nitrobenzene*		0.5	No limit
Ketones*		0.5	No limit
Aldehydes*		0.5	No limit
Amines*		Nothing >LoD	No limit
Corrosive indicators, pH, conductivity EC and redox potential Eh	Where metal pipes are contemplated	No limit	Wrapped steel: corrosive if pH<7 and EC>400uS/cm. Wrapped ductile iron corrosive if pH<5, Eh not neutral and EC>400uS/cm. Copper: corrosive if pH<5 or >* and Eh positive.
Presence of liquid free phase hydrocarbons	Observation	None allowed	None allowed

Within the guidance the soil tested must be representative of that in which the pipes will be laid, be it existing ground, remediated ground or imported soil, and should be sampled to at least 0.5 m below the underside of the pipe and along the pipe runs with sufficient number of samples to satisfy sampling strategies set out in CLR 4, CRL 11 and P5-066/TR. Following this, the data are to be incorporated into a specified risk assessment methodology.

Note that, unless stated otherwise, the Hydrock report does not constitute a formal water pipe risk assessment. Rather, the findings of the standard site investigation are screened against the threshold values in Table 4.1 insofar as is practicable given the data availability to give an indication of the possible restrictions to the use of plastic water pipes.

Note that the use of barrier pipe (PE-Al-PE) is applicable for all brownfield sites according to the guidelines, unless there are liquid free phase hydrocarbons present.

Note also that the Water UK guidance also includes greenfield sites where the preliminary risk assessment indicates there is a potential for contamination to be present.

The Water UK guidance above concentrates on direct contact of pipes with contaminated soil. It also refers to contact with excessive vapour phase and contaminated groundwater, but does not define either of these nor give any threshold concentrations.

The guidance also cautions against the creation of new pathways during construction, mainly the ability of contaminated groundwater to flow into granular pipe bedding.

It is **strongly recommended** that site-specific approval of the materials for underground pipes to be used for water supply be obtained from the water company that will be supplying this site and/or adopting the pipe work.

5.0 FLOOD RISK

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6.0 WASTE MANAGEMENT

6.1 Introduction

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. This includes determining when waste that has been treated in some way can cease to be classed as waste for a particular purpose.

One of the ways this can be achieved is set out in the Development Industry Code of Practice (CoP) (CL:AIRE, March 2011). This builds on the Environment Agency guidance document Definition of waste: developing greenfield and brownfield sites (2006b).

The handling, re-use or disposal of waste is regulated by the Environment Agency. 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. This may be because the materials were never discarded in the first place, or because they have been submitted to a recovery operation and have been completely recovered so that they have ceased to be waste.

Further details are provided in the CoP.

The chemical analyses in this report were scheduled for the purposes of risk assessment with respect to human health, plant life and controlled waters as discussed in the report. Whilst the results may be useful in applying the Hazardous Waste Assessment Methodology given in Environment Agency Technical Guidance WM3, they are not primarily intended for that purpose and additional analysis may be required should waste classification be required for consideration of off-site disposal of contaminated soils. As part of the report, Hydrock may have undertaken a preliminary exercise to characterise the soils encountered in the investigation in order to inform the waste characterisation process. This has been undertaken using a proprietary web-based tool and in not necessarily identical to the assessment that could be made by a particular landfill operator.

Separate analyses are required to meet the Waste Acceptance Criteria for specific landfill sites.

6.2 Classification of Materials for Off-Site Disposal Purposes

With respect to the possible waste streams from a site, it is recommended that a phased approach is implemented. This phased approach comprises Waste Characterisation and Waste Acceptance Criteria.

6.2.1 Waste Characterisation

Background

All wastes going to landfill must be classified as ‘inert’, ‘non-hazardous’ or ‘hazardous’, with a sub-category of hazardous waste known as ‘stable non-reactive hazardous waste’. Individual landfill sites must operate in accordance with their Environmental Permits.

Basic Characterisation

The first step is to determine if a waste is hazardous or non-hazardous.

Contaminated soil is a 'mirror entry' in the Consolidated European Waste Catalogue, and is not necessarily a hazardous waste. It is only classified as hazardous if it contains dangerous substances above certain threshold concentrations. The Environment Agency document *Waste Sampling and Testing for Disposal to Landfill* (March 2013) suggests that waste holders should use the information collected as part of the contaminated land risk assessment to inform decisions as to the concentrations that might reasonably be expected to be present in the contaminated soil, given the past and current uses of the site.

The waste must be assessed against all the appropriate hazards in accordance with the Environment Agency Technical Guidance WM3. This makes certain worst case assumptions about the chemical composition if specific compounds are not analysed for.

The classification of the soils as waste in England and Wales is undertaken in accordance with the revised Waste Framework Directive (WFD) (2008/98/EC).

Defining the class of waste is carried out on the actual waste being disposed of and the destination landfill site will have the final decision on acceptability of the waste. Therefore, it is recommended that if soils are to be removed from the site, the appointed contractor should approach a landfill site with the available chemical data and seek a formal waste characterisation.

The waste characterisation in this report is for information purposes only and should be considered in the light of the final decision made by the landfill site.

6.2.2 Waste Acceptance Criteria

If the waste is destined for landfill, the second step is Waste Acceptance Criteria (WAC) testing to determine if the receiving landfill can accept the waste. Further sampling and testing may be required.

WAC testing must be carried out on waste classified as non-hazardous to check if it can be disposed of at an inert landfill. Otherwise, it can be disposed of at a non-hazardous landfill without WAC testing.

WAC testing must be carried out on waste classified as hazardous to check if it can be disposed of at a hazardous landfill (or in a special stable non-reactive hazardous waste landfill site/cell).

The WAC are a list of limit values for certain parameters obtained from total content tests and standard leaching tests. If the limit values are exceeded, the waste is not suitable for disposal at that class of landfill site and alternative disposal methods have to be found.

Maximum permissible limit values are determined by the EU (part of what is known as 'full waste acceptance criteria') but individual landfills may have more stringent values to take into account the environmental setting, liner system or additional nature of specific waste streams.

WAC tests should be performed on the soils leaving the site and is not normally part of a site investigation exercise.

6.3 Materials Management

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. This includes determining when waste that has been treated in some way can cease to be classed as waste for a particular purpose. One of the ways this can be achieved is set out in the Development Industry Code of Practice (CoP) (CL:AIRE, March 2011).

The handling, re-use or disposal of waste is regulated by the Environment Agency. 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. The MMP must be signed off by a Qualified Person as defined in the CoP.

7.0 REFERENCES

AGS. June 2014. AGS Position Paper. Potable water supply pipes in land potentially affected by contamination. Association of Geotechnical and Geoenvironmental Specialists. <<ags.og.uk>>.

ALBERTA ENVIRONMENT. 1990. Alberta Tier 1 Criteria for Contaminated Soil Assessment and Remediation. Waste Management and Chemicals Division, Soil Protection Branch. Draft.

ALCONTROL LABORATORIES. 2006. Land Division – Information Sheet: *Where have my PAHs come from??*

BARNES, B., GLENNIE, E., DAVEY, A,. and THOMAS, J. 2010. Cheby or not Cheby? Is that the question? L*and Contamination and Reclamation,* **18(2)**, 121-33.

BOYLE, R. and WITHERINGTON, P. JANUARY 2007. Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present. Report No. 10627-R01(04). NHBC, Milton Keynes. 93pp + apps.

BRITISH STANDARDS INSTITUTION. 2004. Eurocode 7 – Geotechnical design - Part 1: General rules. *BS EN 1997-1. Incorporating Corrigendum No.1.* BSI, London.

BRITISH STANDARDS INSTITUTION. 2007. Eurocode 7 – Geotechnical design - Part 2: Geotechnical investigation and testing. *BS EN 1997-2.* BSI, London.

BRITISH STANDARDS INSTITUTION. 2011. Code of Practice for Investigation of Potentially Contaminated sites. *BS 10175 Incorporating Amendment No.1:2013.* BSI, London.

BRITISH STANDARDS INSTITUTION. 2014. Soil quality. Guidance on leaching procedures for subsequent chemical and ecotoxicological testing of soils and soil materials. *BS EN ISO 18772.* BSI, London.

BRITISH STANDARDS INSTITUTION. 2015. Specification of topsoil and requirements for use. *BS 3882.* BSI, London.

BRITISH STANDARDS INSTITUTION. 2015. Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings. *BS 8485.* BSI, London.

BRITISH STANDARDS INSTITUTION. 2015. Code of practice for ground investigations. *BS 5930.* BSI, London.

CANADIAN COUNCIL OF MINISTERS OF THE ENVIRONMENT (CCME). 1991. Review and recommendations for Canadian Interim Environmental Quality Criteria for contaminated sites. Environment Canada.

CARD, G., WILSON, s. and MORTIMER, S. 2012. *A pragmatic approach to ground gas risk assessment*. CL:AIRE Research Bulletin RB17. CL:AIRE, London.

CIEH and CL:AIRE. May 2008. Guidance on comparing soil contamination data with a critical concentration. The Chartered Institute of Environmental Health and Contaminated Land: Applications in Real Environments. 66pp.

CL:AIRE. March 2011. The Definition of Waste: Development Industry Code of Practice, Version 2. Contaminated Land: Applications in the Real Environment (CL:AIRE), London.

CL:AIRE. December 2013. Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination. *Final Project Report SP1010,* 20 December 2013, Contaminated Land: Applications in Real Environments (CL:AIRE), London.

COSTA, H. J. and SAUER, T. C. 2005. Forensic approaches and considerations in identifying PAH background. *Environmental Forensics,* **6,** 9-16.

COSTA, H. J., WHITE, K. A. and RUSPANTINI, J. J. 2004. Distinguishing PAH background and MGP residues in sediments of a freshwater creek. *Environmental Forensics,* **5,** 171-182.

DCLG. March 2012. National Planning Policy Framework. DCLG, London.

DCLG. March 2012. Technical Guidance to the National Planning Policy Framework. DCLG, London.

DEPARTMENT OF THE ENVIRONMENT. 1994. Sampling strategies for contaminated land. DoE *Contaminated Land Research Report CLR Report No. 4.* DETR, Rotherham.

DEFRA. 1 September 2005. Soil Guideline Values and the Determination of Land as Contaminated Land under Part 2A. *Guidance Note CLAN 2/05*. Defra/LEQ, London.

DEFRA. July 2008. Guidance on the legal definition of contaminated land. Defra, London.

DEFRA. April 2012. Contaminated Land Statutory Guidance. Defra, London.

DEFRA. March 2014. SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document. Defra, London.

DEFRA and WELSH GOVERNMENT. May 2014. *Water Framework Directive implementation in England and Wales: new and updated standards to protect the water environment.*

DEFRA and WELSH GOVERNMENT. July 2014. *River basin planning guidance.*

EIC, AGS and CL:AIRE. 2009. The EIC/AGS/CL:AIRE Soil Generic Assessment Criteria for Human Health Risk Assessment. Environmental Industries Commission, Association of Geotechnical and Geoenvironmental Specialists and Contaminated Land: Applications in Real Environments. Available from <www.claire.co.uk>.

ENVIRONMENT AGENCY. 2000. Secondary Model Procedure for the Development of Appropriate Soil Sampling Strategies for Land Contamination. *R&D Technical Report P5-066/TR1*. The Environment Agency.

ENVIRONMENT AGENCY. 2002a. Contaminants in soils: collation of toxicological data and intake values for humans. *Contaminated Land Report 9.* The Environment Agency.

ENVIRONMENT AGENCY. 2002b. Possible contaminants for the assessment of land. *Contaminated Land Report 8.* The Environment Agency.

ENVIRONMENT AGENCY. 2003. Principles for Evaluation the Human Health Risks from Petroleum Hydrocarbons in Soils: A Consultation paper. *R&D Technical Report P5-080/TR1*. The Environment Agency.

ENVIRONMENT AGENCY. 2004a. Model procedures for the management of land contamination. *Contaminated Land Report 11.* The Environment Agency.

ENVIRONMENT AGENCY. 2004b. Soil screening values for use in UK ecological risk assessment. *R&D Technical Report P5-091/TR1*. The Environment Agency.

ENVIRONMENT AGENCY. 2004c. *Guidance on the management of landfill gas*. Landfill Technical Guidance Note 3 (LTGN03).

ENVIRONMENT AGENCY. 2005. The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils. *Science Report P5-080/TR3*. The Environment Agency.

ENVIRONMENT AGENCY. 2006a. Remedial Targets Methodology. Hydrogeological Risk Assessment for Land Contamination. The Environment Agency, Bristol, 123pp.

ENVIRONMENT AGENCY. 2006b. Definition of waste: developing greenfield and brownfield sites. The Environment Agency, Bristol.

ENVIRONMENT AGENCY. 2009a. Updated technical background to the CLEA model. *Science Report – SC050021/SR3.* The Environment Agency, Bristol, 164pp.

ENVIRONMENT AGENCY. 2009b. CLEA Software (Version 1.04) Handbook. *Science Report – SC050021/SR4.* The Environment Agency, Bristol, 121pp.

ENVIRONMENT AGENCY. 2009c. CLEA Software (Version 1.05) Handbook. *Science Report – SC050021/SR4.* The Environment Agency, Bristol, 129pp.

ENVIRONMENT AGENCY. 2009d. Petroleum Hydrocarbons in Groundwater: Supplementary Guidance for Hydrogeological Risk Assessment. The Environment Agency, Bristol, 48pp.

ENVIRONMENT AGENCY. March 2009. S*cience Report – SC050021/benzene SGV.* The Environment Agency, Bristol, 10pp.

ENVIRONMENT AGENCY. June 2009. S*cience Report – SC050021/Cd SGV.* The Environment Agency, Bristol, 11pp.

ENVIRONMENT AGENCY. September 2009. S*cience Report – SC050021/Dioxins SGV.* The Environment Agency, Bristol.

ENVIRONMENT AGENCY. March 2013. Waste sampling and Testing for Disposal to Landfill. Report EBPRI 11507B. The Environment Agency, Bristol, 36pp.

ENVIRONMENT AGENCY. August 2013. *Groundwater protection: Principles and practice (GP3).* Version 1.1. The Environment Agency, Bristol, 207pp.

ENVIRONMENT AGENCY. 2015. Waste classification. Guidance on the classification and assessment of waste (1st Ed.) *Technical Guidance WM3.* The Environment Agency.

FRANKEN, R.O.G., BAARS, A.J., CROMMENTUIJN, G.H. & OTTE, P. 1999. A proposal for revised Intervention Values for petroleum hydrocarbons ('minerale olie') on base of fractions of petroleum hydrocarbons. *RIVM Report 711701015*. (Dutch) National Institute of Public Health and the Environment. P.O. Box 1, 3720 BA Bilthoven.

HARTLESS, R. 1991. Construction of new buildings on gas-contaminated land. Building Research Establishment Report BR 212. BRE, Garston.

HEALTH PROTECTION AGENCY. 2009. An introduction to land contamination for public health professionals, Ver 1.2. HPA, Cardiff.

HEALTH PROTECTION AGENCY. 2010. Limitation of human exposure to radon. Advice from the Health Protection Agency. *Report RCE-15*. HPA, Cardiff.

HESSE, P. R. 1971*. A textbook of soil chemical analysis.* John Murray (Publishers) Ltd, London.

INTERDEPARTMENTAL COMMITTEE ON THE REDEVELOPMENT OF CONTAMINATED LAND. 1983. Notes on the Redevelopment of Scrap Yards and Similar Sites. *ICRCL 42/80 (2nd Ed).* DETR, Rotherham.

INTERDEPARTMENTAL COMMITTEE ON THE REDEVELOPMENT OF CONTAMINATED LAND. 1987. Guidance on the assessment of contaminated land. *ICRCL 59/83 (2nd Ed).* DETR, Rotherham.

INTERDEPARTMENTAL COMMITTEE ON THE REDEVELOPMENT OF CONTAMINATED LAND. 1990. Notes on the restoration and aftercare of metalliferous mining sites for pasture and grazing. *ICRCL 70/90.* DETR, Rotherham.

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION. 2005. Soil quality - Sampling - Part 5: Guidance on the procedure for the investigation of urban and industrial sites with regard to soil contamination. ISO 10381-5:2005.

IPCC. 2006 *2006 IPCC Guidelines for National Greenhouse Gas Inventories.* Volume 5, Waste. Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan.

JONES, J. 2008. Personal Communication.

LITTON, P. J. 2006. Personal Communication. Determining the source of hydrocarbon sheen using chromatogram fingerprinting and dual-ratio scatter plot analysis. Poster produced by BBL Inc, Tampa, Florida.

LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY. 2003. Risk Evaluation / Corrective Action Program. Appendix D. Louisiana Department of Environmental Quality Corrective Action Group, 20 October 2003.

MALLETT, H., COX, L., WILSON, S., and CORBAN, M. 2014. Good practice on the testing and verification of protection systems for buildings against hazardous ground gases. CIRIA Report C735. CIRIA, London.

MAKLIN, Y., KOWALCZYK, G., McCANN, R., WELFARE, W. and BROWN, M. December 2012. *Acute risks from soil contaminants: "Blue Billy".* SoBRA & RSC Toxicology Group Conference: Current Issues in Contaminated Land Risk Assessment, London, December 2012.

MILES, J. C. H., APPLETON, J. D., REES, D. M., GREEN, B. M. R., ADLAM. K. A. M. and MYRES. A. H. 2007. Indicative Atlas of Radon in England and Wales. Health Protection Agency and British Geological Survey. Report HPA-RPD-033.

MINISTRY OF AGRICULTURE FISHERIES AND FOOD. October 1998. Code of Good Agricultural Practice for the Protection of Soil.

MINISTRY OF HOUSING, SPATIAL PLANNING AND ENVIRONMENT. February 2000. Circular on Target Values and Intervention Values for Soil Remediation. DBO/1999226863. VROM, The Hague.

NATHANAIL, C. P. 2004. The use and misuse of CLR 7 acceptance tests for assessment of risks to human health from contaminated land. *Quarterly Journal of Engineering Geology and Hydrogeology*, **37**, 361-367.

NATHANAIL, P., McCAFFREY, C., ASHMORE, M., CHENG, Y., GILLETT, A., OGDEN, R. and SCOTT, D. 2009. The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment (2nd ed.). Land Quality Press, Nottingham.

NATIONAL ENVIRONMENTAL PROTECTION COUNCIL. 1999. National Environmental Protection (Assessment of Site Contamination) Measure 1999. Schedule B(1) – Guideline on Investigation Levels for Soil and Groundwater. National Environmental Protection Council Service Corporation, Adelaide, Australia.

NAVFAC. April 2003. Guidance for Environmental Background Analysis, Vol. II: Sediment. *NFESC User's Guide UG-2054-ENV.* Naval Facilities Engineering Command, Washington DC, USA.

NEW ZEALAND MINISTRY FOR THE ENVIRONMENT. June 1997. Health and Environmental Guidelines for Selected Timber Treatment Chemicals. NZ Ministry for the Environment, Wellington.

NHBC. October 2014. Publication of Category 4 Screening Levels for land affected by contamination. *Technical Extra*, **15**, 14-17.

NHBC and ENVIRONMENT AGENCY. 2008. Guidance for the safe development of housing on land affected by contamination. R&D Publication 66, 2 Volumes.

ONTARIO MINISTRY OF THE ENVIRONMENT. 1990. Guidelines for the decommissioning and clean-up of contaminated sites in Ontario.

PECKSEN, G. N. 1986. Methane and the development of derelict land. London Environmental Supplement, Summer 1985, No. 13. London Scientific Services, Land Pollution Group.

PONNAMPERUMA, F. N., LANTIN, R. S. and CLAYTON, M. T. C. 1979. Boron toxicity in rice soils. *Int. Rice Res. Newsletter,* **4, 8.**

ROYAL SOCIETY OF CHEMISTRY. 2001. Robust statistics: a method of coping with outliers. AMC Technical Brief No. 6.. Analytical Methods Committee, Royal Society of Chemistry.

RUDLAND, D. J., LANCEFIELD, R. M. and MAYELL, P. N. 2001. Contaminated land risk assessment. A guide to good practice. *CIRIA Report C552*. CIRIA, London. 158 pp.

SCIVYER, C. 2015. Radon: Guidance on protective measures for new buildings. Building Research Establishment Report BR 211. BRE, Garston.

STOGIANNIDIS, E. and LAANE, R. 2015. Source characterization of polycyclic aromatic hydrocarbons by using their molecular indices: an overview of possibilities. *In: WHITACRE, D. M. (ed.), Reviews of Environmental Contamination and Toxicology.* **234,** 49-133.

STONE, K., MURRAY, A., COOKE, S., FORAN, J. and GOODERHAM, L. 2009. Unexploded ordnance (UXO), a guide to the construction industry. *CIRIA Report C681*. CIRIA, London. 141 pp.

SWARTJES, F. and van den Berg, R. 1993. Remediation of contaminated soil and groundwater: proposals for criteria and priority setting. *Proc. Workshop on Contaminated Soils*, *October 1993*, Stockholm.

UKTAG. November 2013 (updated January 2014). *Updated recommendations on environmental standards. River Basin Management (2015-21)*. UK Technical Advisory Group on the Water Framework Directive.

UK WATER INDUSTRY RESEARCH (UKWIR). 2010 re-issued. Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites. *Report 10/WM/03/21*.

WATER UK HBF. January 2014. Contaminated Land Assessment Guidance. Water UK and the Home Builders Federation. 12pp.

WELSH ASSEMBLY GOVERNMENT. July 2004. Development and flood risk. Planning Policy Wales, Technical Advice Note 15.

WFD-UKTAG. July 2014. UKTAG River & Lake Assessment Method, Specific Pollutants (Metals), Metal Bioavailability Assessment Tool (M-BAT). Water Framework Directive – United Kingdom Technical Advisory Group. Stirling.WILSON, S.A. and CARD, G.B. 1999. Reliability and risk in gas protection design. *Ground Engineering,* February 1999, 33-36, plus letters in March 1999.

WILSON, S. and HAINES, S. 2005. Site investigation and monitoring for ground gas assessment – back to basics. *Land Contamination and Reclamation* **13(3),** 211-222.

WILSON, S., OLIVER, S., MALLETT, H., HUTCHINGS, H. and CARD, G. 2007. Assessing risks posed by hazardous ground gases to buildings. *CIRIA Report C665*. CIRIA, London. 182pp.

WORLD HEALTH ORGANIZATION. 2011. Guidelines for drinking-water quality (4th Edition). WHO, Geneva.

WORLD HEALTH ORGANIZATION. 2005. Petroleum products in drinking-water. Background documentation for development of WHO guidelines for Drinking-water Quality. *Report WHO/SDE/WSH/05.08/123*. WHO, Geneva.

YUNKER, M.B., MACDONALD, R.W., VINGARZAN, R., MITCHELL, R.H., GOYETTE, D AND SYLVESTRE, S. 2002. PAHs in the Fraser River basin: a critical appraisal of PAH ratios as indicators of PAH source and composition. *Organic Geochemistry*, **33,** 489-515.