



**BROWNFIELD
SOLUTIONS LTD**

GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

UNITED LIVING

Whiston, Prescot

Phase I Geo-Environmental Assessment Report

JL/C5980/13829

January 2025

PROJECT QUALITY CONTROL DATA SHEET

Site Name:	Whiston, Prescot		
Document Name:	Phase I Geo-Environmental Assessment Report		
Reference:	JL/C5980/13829		
Status:	-	22/01/2025	Final.

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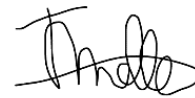
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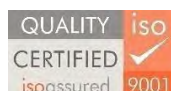


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DRAWINGS

Drawing Number	Rev	Title
23076/255	-	Proposed Development Layout Plan
C5980/01	-	Site Location Plan
C5980/02	-	Site Features Plan

APPENDICES

Appendix	Title
Photographs	Site Walkover Photographs
Appendix A	BSL Methodology and Guidance
Appendix B	Historical Maps
Appendix C	Geo-Environmental Data Report
Appendix D	BGS Exploratory Hole Records
Appendix E	Mining Search Report
Appendix F	UXO Screening Map

1.0 INTRODUCTION

1.1 Context

This report describes a desk-based Phase I Geo-Environmental Assessment Report carried out by Brownfield Solutions Limited (BSL) for United Living on a site off Main Drive, Whiston and has been completed in general accordance with the following guidance:

-
- Environment Agency guidance - Land Contamination: Risk Management (LCRM).
 - BS 10175:2011+A2:2017 Investigation of Potentially Contaminated Sites.
 - BS5930: 2015+A1:2020 Code of Practice for Ground Investigations.
 - BS EN 1997-1:2004+A1:2013 Eurocode 7. Geotechnical design. General rules plus UK National Annex.
 - BS EN 1997-2:2007 Eurocode 7 Geotechnical design. Ground investigation and testing plus UK National Annex.
 - NHBC Standards. Chapter 4.1: Land Quality - Managing Ground Conditions.
-

Definitions of terms and acronyms used within this report is presented in Section 7.0.

1.2 Proposed Development

The proposed development is for a residential end use comprising 235 residential houses, containing a mix of two storey semi-detached and detached dwellings along with 2.5 storey townhouses and mews, with associated private gardens, highways, public open space (POS) areas and infrastructure as shown on the proposed development plan, drawing No. 23076/255 provided to BSL by the client.

1.3 Objectives and Scope

The objectives of this assessment were to determine the environmental setting and ground conditions of the site, highlighting potential areas of concern that may govern the redevelopment.

The scope of works comprises a Phase I Assessment and site walk-over, with a review of the site, surroundings, historical uses and environmental setting in order to develop a preliminary Conceptual Site Model (CSM).

This report is intended to meet the requirements of a Preliminary Investigation as defined in BS10175:2011+A2:2017 and has been produced in general accordance with the recommendations for a Tier 1 Preliminary Risk Assessment as described in LCRM guidance.

1.4 Limitations

This Phase 1 Geo-Environmental Assessment Report has been prepared in accordance with the relevant legislative framework, guidance and risk assessment methodology as outlined in Appendix A.

The findings and opinions conveyed via this assessment are based on information obtained from a number of sources as detailed within this report, BSL have assumed this information is correct and reliable. Nevertheless, BSL cannot and does not guarantee the authenticity or reliability of the information it has relied upon.

BSL have used reasonable skill, care and diligence in the production of this report. There may be other conditions prevailing on the site which are outside the scope of work and have not been highlighted by this assessment and therefore have not been taken into account by this report. Responsibility cannot be accepted for such site conditions not revealed by the assessment.

This report has been prepared for the sole use and reliance of the Client, United Living. No other third party may rely upon or reproduce the contents of this report without the written permission of Brownfield Solutions Ltd (BSL); a charge may be levied against such approval. If any unauthorised third party comes into possession of this report, then they rely on it at their own risk and BSL do not owe them any Duty of Care. This report may not be relied upon by the client or submitted to a third party for their reliance for the purposes of valuation, mortgage, insurance and regulatory approval, until all invoices have been settled in full.

Any recommendations made in this report should be confirmed with the Regulatory Authorities prior to implementation to ensure compliance.

This assessment has been based on the proposed planning layouts provided. Any subsequent change to the planning layout may have an impact on the validity of recommendations made within this report. Furthermore, new information, changed practices or new legislation may necessitate revised interpretation of the report after the date of its submission.

The site plans enclosed in this report should not be scaled off. Any site boundary line depicted on plans does not imply legal ownership of land.

Notwithstanding site observations concerning the presence or otherwise of archaeological issues, asbestos-containing materials (ACM) or invasive weeds (e.g. Japanese knotweed), this report does not constitute a formal survey of these potential issues and specialist advice should be sought.

2.0 THE SITE

2.1 Location

The site is located off Main drive, Whiston, Prescot, L35 3PW, centred on National Grid Reference 347199 390255 as shown on the Site Location Plan, Drawing No. C5980/01.

2.2 Site Description

A site reconnaissance survey was carried out at the site on 14th January 2025. The main site features and potential issues identified during this survey are detailed below and are shown on the Site Features Plan, Drawing No. C5980/02. A selection of photographs from the site walkover are presented to the rear of this report.

Feature	Description
Site Area	6.15 hectares.
Site Access	Access to the site is gained off Main Drive to the south of the site. Access is open with no boundary separating the site from the public road.
Site Overview Imagery	 Orientated North Update from Google: All images: Imagery Google©2023, Imagery ©2023 Airbus, CNES / Airbus, Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies, The Geoinformation Group, Map data ©2023.
Current Land Use and Site Features	The site is predominantly occupied by open fields with areas of thick vegetation. There is a shallow pond approximately 10 meters in diameter, located within the north-west of the site. Evidence of underground services onsite includes two water chambers/ above ground manholes present in the western area of the site and spray paint indicating the potential presence of underground services was seen to be running along the southern border of the site, parallel to the road. A suspected mineshaft was noted toward the south-east of the site, evidenced by a slight depression in the field in the approximate location of a recorded mineshaft. A number of gas monitoring wells were noted toward the west of the site.
Potential Sources of Gross Contamination	No potential sources of gross contamination were identified.
Vegetation / Ecology	The site is generally covered with grass. There are semi-mature and mature trees throughout the north-west of the site and sporadically along the sites north, south and eastern boundaries. In addition, there are patches of dense brambles in the north-west and along the sites southern border.
Topography	The site generally slopes from the south-west to the north-east with a gentle gradient. While the north-west section of the site is mostly flat, access to this area is only possible from the southern portion of the site. The southern area includes a steep slope running from the south-east to the north-west, near to the existing pond.

Feature	Description
Site Boundaries	The north the site is bound by wooden fencing separating the site from residential gardens, and heras fencing, separating the site from a construction site on the other side. To the east and west the site is bound by a mix of dense vegetation, chicken wire fencing, and heras fencing. The south of the site is bordered by Main Drive.
Surrounding Area	The site is set within a residential area. A construction site is present to the north and east, appearing to be a developing residential housing estate. Residential homes are present to the south and playing fields present to the west, with homes beyond these.

3.0 GEO-ENVIRONMENTAL SETTING

3.1 Historical Setting

A review of the available historical Ordnance Survey Maps and satellite imagery has been conducted, with the pertinent issues that may have affected the site, or its environs, summarised below. The Historical Maps are presented in Appendix B. A review of the historical industrial data within the geo-environmental data report has also been undertaken below, the report is presented in Appendix C.

Notable features on site, and potentially contaminative or geotechnically relevant features within 100m of the site boundary have been presented. Any features that have potentially been infilled will be considered up to 250m from the site boundary.

Feature	Distance (m) & Direction	Years Present	Description
Prince's House Buildings	On-Site	1850 - 1956	A number of buildings labelled Prince's House are shown to be present within and abutting the sites western boundary from the earliest map of 1850. The buildings that are present within the site associated with Prince's House are last shown on the map of 1956, no longer shown on the subsequent map of 1966. The buildings abutting the western boundary remain present on the most recent map of 2025.
	Abutting western boundary	1850 – Present	
Pond	On-site	1891 – 2010	Pond is first indicated to be present on the 1891 map, within the north west of the site and remains present until the 2010 map, no longer shown on the latest 2025 map. During site walkover it was noted that this pond is still present.
	40m SW	1891 - Present	Pond is first indicated to be present on the 1891 map 40m south west of the site. Still present on most recent map dated 2025.
	50m W	1850 - Present	Pond is indicated to be present on the earliest map in 1850, 50m west of the site. Still present on most recent map dated 2025.
	80m S	1850 - 1955	Pond is indicated to be present on the earliest map in 1850, 80m south east of the site until the map of 1955, no longer shown on the consequent map of 1959. A caravan park has since been constructed in its place.
	85m SE	1850 - 2010	Pond is indicated to be present on the earliest map in 1850, 85m south east of the site. Still present on the 2010 map, but not on the latest 2025 map. Believed to be infilled during this time.
	90m W	1850 - Present	Pond is indicated to be present on the earliest map in 1850, 90m west of the site. Still present on most recent map dated 2025.
Pump house	5m S	1985 - 2010	A pump house is indicated to be present 5m south of the site, first appearing on the 1985 map, and remaining present until the map of 2010 no longer shown on the map of 2025.
Tank	25m W	1927 - 1959	A tank is indicated 25m west of the site, first appearing on the 1927 map, and lastly appearing on the 1959 map. In the next available map dated 1985 the tank is no longer present, presumed to have been removed circa 1959 - 1985.
	30m W	1937 – 1959	A tank is indicated 30m west of the site, first appearing on the 1937 map, and lastly appearing on the 1959 map. In the next available map dated 1985 the tank is no longer present, presumed to have been removed circa 1959 - 1985.
Coal pit	50m W	1850	A coal pit is indicated to be present on the earliest mapping dated 1850, however is no longer present on the next available map dated 1891, being replaced by an area of vegetation, and is presumed to have been infilled between 1850-1891.
Electrical substation	95m N	1959 – Present	An building associated with new residential development is seen to be present 95m N of the site on the map of 1959, this building is labelled as an electrical substation on the maps of 1973 and 1995, this remains as an electrical substation on present day mapping.

Feature	Distance (m) & Direction	Years Present	Description
Sandstone quarry	250m N	1850	A sandstone quarry, labelled stone quarry is first shown on the earliest map dated 1850, circa 250m north of the site, however on the next available map dated 1891 it is shown as an area of vegetation labelled old quarry, implying the quarry to have been infilled potentially prior to 1850, definitely prior to 1891.

In summary, the map evidence indicates that the site has remained as open fields from 1850 up until the present day. A pond is present towards the north west of the site. A building was present toward the western boundary of the site but has since been demolished.

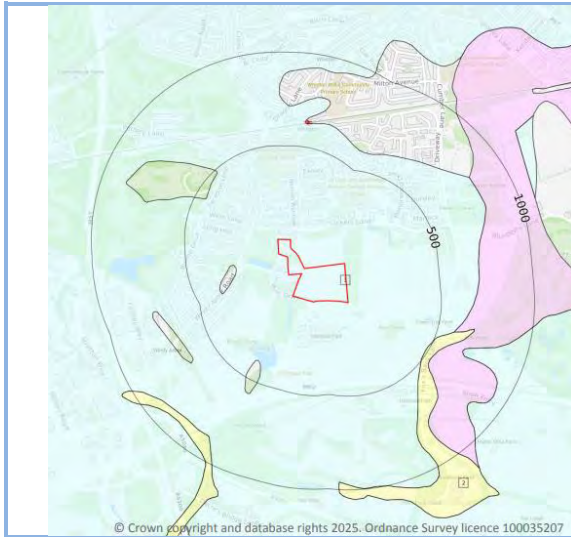
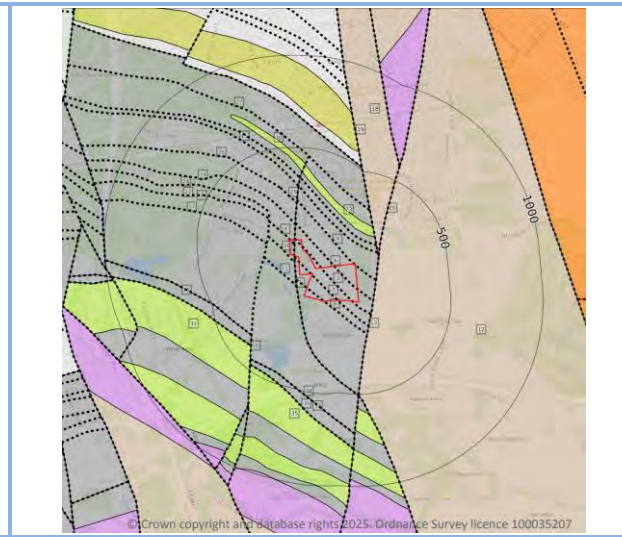
Potential historic offsite sources of contamination include the two tanks 30m west of the site, alongside the coal pit located 70m west of the site, and the historic quarries 250m to the north.

3.2 Published Geology

The following publications of the British Geological Survey (BGS) were examined in respect of the geology underlying the site:

- British Geological Survey (BGS) 1:50,000 Scale Geological Map Sheet 97 Runcorn. Solid and Drift Edition.
- BGS Geology of Britain Map Viewer.
- BGS GeoIndex Onshore.
- BGS 1:10,000 Scale Geological Map SJ48NE.
- Mining Remediation Authority Interactive Map.
- Geo-Environmental Data Report.

Extracts of the 1:50,000 geological mapping from the Geo-Environmental Data Report are presented below for reference:

BGS 1:50 000 Superficial Geology

BGS 1:50 000 Solid Geology

Made Ground

BGS mapping does not display any significant made ground deposits on site, and based on the historical mapping and the lack of previous development that has taken place, only small amounts and thicknesses of made ground deposits on the western border may be present.

Superficial Deposits

The site is indicated to be underlain by glacial Till (Diamicton). This stratum typically comprises a mixture of clay, silt, sand, and gravel, suspended in an unconsolidated matrix.

Solid Geology

The deeper solid geology is indicated to be part of the Pennine Middle Coal Measures Formation, which typically comprises interbedded mudstone, siltstone, and sandstone with coal seams.

A fault is shown to traverse the north western corner of the site in a north to south direction. However, any movements associated with this fault should now have stopped.

The site is also in an area where coal seams are abundant, traversing the site in a north west to south east direction. A Coal Mining Risk Assessment (CMRA) would be required to assess seam locations, depths, thickness and associated potential risks in detail.

3.3 BGS Exploratory Hole Records

There are no BGS exploratory hole records within a relevant distance of the site (assumed as an approximate 50m radius).

3.4 Mining and Mineral Extraction

Coal Mining

The online Coal Authority Interactive Map layers have been reviewed and the details are summarised in the table below:

Relevant Interactive Map Data	Issue at Subject Site?
Coal Authority Reporting Area	Yes
High Risk Development Area	Yes

As the site lies within the Coal Authority Reporting Area, a mining search has been undertaken as the site could be affected by past or current coal mining.

The mining searches are presented in Appendix E, the main findings of which are presented below.

Highlighted Evidence	Issue	Details
Past Underground Mining	Yes	The property is in a surface area that could be affected by underground mining in 4 seams of coal at 146m to 391m depth, last worked in 1903. Any movement in the ground due to coal mining activity should have stopped. The property is in an area where the Authority believe there is coal at or close to the surface and may have been worked at some time in the past.
Present Underground Mining	No	
Future Underground Mining	No	
Mine Entries	Yes	There are 2 known coal mine entries on or within 20 metres of the boundary of the property. There may also be mine entries/additional mine entries in the local area which the Coal Authority has no knowledge of.
Past, present and future opencast coal mining	No	There is a historic opencast mining area registered approximately 180m west of the site.
Coal mining subsidence	No	
Mine gas	No	
Withdrawal of support	No	
Information from the Cheshire Brine Subsidence Compensation Board	No	

Non-Coal Mining

A historical mineral planning area was present approximately 180m west of the site. Groundsure reports the planning status for clay, shale, and brick surface mineral working existed from 1947 – 1952, this feature aligns with the historic opencast mining area reported on the Consultant's report.

3.5 Hydrogeology

Based on the inferred geology, a summary of the Environment Agency aquifer designations is presented in the table below:

Stratum	Coverage	Aquifer Designation
Superficial Till (Diamicton)	Full Site	Secondary Aquifer (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
Pennine Middle Coal Measures Formation	Full Site	Secondary (A) Aquifer. 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

A summary of the pertinent hydrogeological features within the Geo-Environmental Data Report are provided below:

Feature	Distance (m) & Direction	Details
Nearest Active Groundwater Abstraction	1192m E	Licence No: 2569028021 Details: Spray Irrigation - Direct Direct Source: Ground Water - North West Region Point: B/HOLE AT BLUNDELLS HILL GOLF CLUB, BLUNDELLS LANE, RAINHILL Annual Volume (m3): 21966.87 Original Start Date: 06/09/1994
Nearest Active Potable Groundwater Abstraction	1192m E	Licence No: 2569028021 Details: Drinking, Cooking, Sanitary, Washing, (Small Garden) - Commercial/Industrial/Public Services Direct Source: Ground Water - North West Region Point: B/HOLE AT BLUNDELLS HILL GOLF CLUB, BLUNDELLS LANE, RAINHILL Annual Volume (m3): 21966.87 Original Start Date: 06/09/1994
Source Protection Zones	78m SE	Type 3 Total catchment

3.6 Hydrology

A summary of the pertinent hydrological aspects within the Geo-Environmental Data Report are provided below:

Feature	Distance (m) & Direction	Details
Nearest Watercourse	35m SW	Unnamed inland river, watercourse contains water year round.
Nearest Surface Water Abstraction	1161m SW	Status: Historical Licence No: 2569028018 Details: Spray Irrigation - Direct Direct Source: "Surface, Non-Tidal - North West Region" Point: "OCHRE & DOG CLOG BRKS, TARBOCK HALL FARM, TARBOCK, PRESCOT" Annual Volume (m3): - Original Start Date: 13/05/1976
Closest Active Licenced Discharge Consent	-	None within 500m.

Information obtained from the Environment Agency (EA) Risk of Flooding from Rivers and the Sea (RoFRaS) database indicates that the risk of flooding across the site is negligible.

The British Geological Survey indicate there is a potential for groundwater flooding at the subject site, with a low risk rating.

No further consideration of flood risk is undertaken in this report. Specialist flood risk advice should be sought with regards to drainage and flooding.

3.7 Landfill and Waste Management Sites

There are no active landfill sites recorded within 500m.

There are four historic landfills within 500m recorded by Environment Agency and Natural Resources Wales, the closest being located 410m north west at Tushingham's Quarry, Coalgate Lane, Paradise Lane, Stadt-Moers Park, Whiston, Merseyside, Knowsley, registered to W F Doyle and Company Limited. First recorded in 1967 and last recorded in 1979. Stated to accept commercial waste.

There are no current waste management sites recorded within 250m of the site.

BSL recommends contacting the Local Authority for further information about LA tips.

3.8 Environmental Regulatory Data

A summary of the relevant environmental aspects, both on site and within 250m of the site contained in the Geo-Environmental Data Report, are presented in the table below:

Entry	On-site	0 – 50m	50 – 250m	Details
Recent Industrial Land Uses	-	1	4	The closest record is a pump house located 8m south of the site.
Current or Recent Fuel Stations	-	-	-	None within 250m .
Licensed Industrial Activities (Part A(1))	-	-	-	None within 250m.
Licensed Pollutant Release (Part A(2)/B)	-	-	-	None within 250m.
Radioactive Substances	-	-	-	None within 250m.
Pollution Incidents (EA/NRW)	-	-	2	The closest record was in 2002, and was 123m west of the site, pollutant was not identified, this was recorded as a category 3 (minor) impact to water. The other incident was in 2002, 238m west of the site, and was recorded as household waste, this was recorded as a category 3 (minor) impact to land.

In regard to the entries identified above, only recent industrial land uses are considered to be of significant relevance to be carried forward to the preliminary CSM. No other entries require further consideration.

3.9 Radon

Information from the environmental database report indicates the property is in an area where <1% of properties are above the Action Level for radon, and therefore radon protective measures are not required in accordance with BRE Report 211 'Radon – Guidance on protective measures for new dwellings'.

3.10 UXO Risk

In accordance with CIRIA Report C681, BSL have reviewed non-specialist UXO data for the site using the online Zetica Bomb Risk Mapping data.

There is no indication of former military use from the Phase I Assessment. The map indicates the site to be in an area where the bomb risk is low. A copy of the map is presented in Appendix F.

3.11 Other Potential Development Constraints

If asbestos is present in soils, these will need to be dealt with in accordance with the Control of Asbestos Regulations (CAR) 2012 and CARSOILS™.

There are known underground services on site, these may need to be disconnected prior to any construction activities.

4.0 PHASE 1 SUMMARY AND RISK ASSESSMENT

4.1 Introduction

The risk posed by any contaminants in soil or groundwater will depend on the nature and level of the source, the probability of exposure occurring, the potential pollution pathway and the likely effects on the receptors.

A contaminant is defined as a substance that has the potential to cause harm, a risk is considered to exist if such a substance is present at sufficient concentrations to cause harm and if a pathway is present through which a receptor could be exposed to the contaminant.

The following sections discuss the identified potential on-site and off-site sources, and any pollution that could impact receptors via the pathways associated with the proposed development. Pollution linkages are assessed which may represent a risk to human health and/or controlled water receptors from the information gained from the Phase I Assessment searches. The assessment has been carried out on a qualitative basis and aims to produce a complete and comprehensive Preliminary Conceptual Site Model.

Three potential impacts exist for any given site and all three need to be considered in the qualitative risk assessment, these are:

-
- On-site impacts.
 - The site impacting its surroundings.
 - Off-site sources impacting the subject site.
-

4.2 Potential Contaminative Sources

On-Site

From the information obtained, the following sources have been identified which may affect the redevelopment of the site for residential end use:

-
- Made ground associated with previous developments.
 - Solid geology - Coal Measures.
 - Mine shafts.
-

One pond was recorded on-site, however, it was still present at the time of the walkover and as such is not considered a risk for a potential contaminative source due to infilling, and can be discounted.

Off-Site

The following off-site sources have been identified which may affect the redevelopment of the site:

-
- Pump house (5m S).
 - Tanks (closest 25m W).
 - Coal Pit (50m W).
 - Infilled pond (80m S).
 - Electrical substation (95m N).
 - Opencast mine (180m W).
 - Infilled quarries (closest 250m N).
-

Three of the recorded off-site ponds were still present at the time of the walkover and as such are not considered a risk for a potential contaminative source due to infilling, and can be discounted

The closest pollution incident recorded in 2002, was 123m west of the site, pollutant was not identified. This has been discounted due to its proximity from site, and its low measured impact, being recorded as a category 3 (minor) impact to water, with no impact to ground or air. The other incident in 2002 was 238m west of the site, and was recorded as household waste. This has been discounted due to its proximity to site and its low measured impact, being recorded as a category 3 (minor) impact to land, with no impact to water or air.

Associated Contaminants

The contaminants commonly associated with the potential sources of contamination identified are tabulated below:

Contaminative Sources	Department of the Environment Industry Profile or Other Source	Commonly Associated Contaminants
On Site		
Made Ground	AGS Guides, CIRIA C665	Heavy metals, polycyclic aromatic hydrocarbons (PAHs), asbestos, ground gases (carbon dioxide and methane).
Solid geology – Coal Measures	CIRIA C665	Carbon dioxide, methane, carbon monoxide and hydrogen sulphide
Old mine shafts	BS8485 and BS8576	Heavy metals, PAHs, mine gases (carbon dioxide and methane, carbon monoxide, hydrogen sulphide)
Off Site		
Pump house		Localised oils, hydrocarbons
Tank	Road vehicle fuelling, service and repair	Petroleum hydrocarbons, BTEX, MTBE, VOCs
Infilled ponds	AGS Guides, CIRIA C665, BS8485 and BS8576	Heavy metals, polycyclic aromatic hydrocarbons (PAHs), asbestos, ground gases (carbon dioxide and methane)
Coal pit		PAHs, petroleum hydrocarbons, carbonised wastes
Electrical substation	Electrical works	PCBs, oils, BEFORE 1968
Opencast mine	BS8485 and BS8576	Mine gases (carbon dioxide, methane, carbon monoxide, hydrogen sulphide)
Infilled Stone quarries	AGS Guides BS8485 and BS8576	Heavy metals, PAHs, asbestos, ground gases (carbon dioxide and methane)

4.3 Pathways

A pathway is defined as a medium by which a contaminant comes into contact with, or otherwise impacts a receptor.

At this stage the potential contaminants identified above are considered to present potential risks to site end users and controlled waters through the following pathways:

Potential Pathways	
Pathways in respect to Human Health	• Ingestion of contaminated soils. • Dermal contact with contamination. • Inhalation of dusts. • Inhalation of gases or vapours in both indoor and outdoor air.
Pathways in respect to Controlled Waters – Surface water	• Surface run-off /over land flow. • Drainage discharge. • Base flow from groundwater.
Pathways in respect to Controlled Waters – Groundwater	• Leaching of mobile contamination into groundwater via the unsaturated zone. • Migration of perched groundwater in any permeable soils or along existing or proposed service runs. • Migration into the saturated zone and flow through the aquifers underlying the site.
Pathways in respect to Property/structures/water pipes	• Direct contact with substances deleterious to building materials and potable water supply pipelines. • Migration of ground gases (methane) into confined spaces (explosion and damage to property).

4.4 Receptors

The identified receptors are listed below:

-
- Residential end users (human health).
 - Structures/Property/Potable water supply pipes.
 - Nearest watercourse. Unnamed inland River 35m SW (Controlled waters).
 - Superficial Aquifer. Till (Diamicton) - Secondary (Undifferentiated) Aquifer (Controlled waters).
 - Bedrock Aquifer. Pennine Middle Coal Measures Formation - Secondary (A) Aquifer (Controlled waters).
-

Under current UK health and safety legislation, employers are required to carry out their own appropriate site-specific risk assessments and mitigation to protect employees. It has been assumed that any future construction works onsite will be undertaken in compliance with these requirements. Therefore, construction workers have not been specifically considered as part of this assessment.

4.5 Preliminary Conceptual Site Model (CSM)

The information obtained in the previous sections has been used to compile a Preliminary CSM. The identified potential contaminants and receptors have been assessed in the table below as to whether a plausible source-pathway-receptor pollutant linkage for the proposed end use of the site exists. The risk classification has been estimated in accordance with information in the BSL Guidance and Methodology in Appendix A.

The Preliminary CSM's are presented in the tables overleaf, any assessed risk above moderate will possibly require further action:

Human Health						
Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk	Justification
On site Made Ground Metals, PAHs, asbestos	Root uptake, ingestion, direct contact, inhalation of dusts	End-users	Low Likelihood	Medium	Moderate/ Low	The site has been subject to limited development throughout its history. The presence of made ground is considered likely in the west of the site. Generally, made ground deposits are not anticipated to be substantial in thickness, nor have any significant contaminative processes been identified on site. However, highly localised deep deposits may be present in the location of the former mine shafts. The risk is therefore considered to be moderate/ low. Further investigation and assessment will be required to confirm the risk.
On site Made Ground Metals and organic contamination	Migration into/chemical attack of water supply pipelines	Water Pipelines / End users	Unlikely	Medium	Low	Contaminants within the soil/groundwater could potentially attack the clean potable water supply pipe, contaminants should be assessed to determine the correct pipe material and level of precautions required.
On site Made Ground/Natural Geology - Coal measures Ground Gas (carbon dioxide and methane)	Migration into confined spaces, inhalation and asphyxiation/ explosion	End-users / Property	Unlikely	Severe	Moderate/ low	As discussed above, significant thickness' of made ground deposits are not likely to be present on site and the gas generation potential of these materials is likely to be very low. The Pennine Middle Coal Measures that underly the site exhibit low-permeability coal seams and mudstones, which typically restrict gas migration, this is supported by the Coal Authority showing no risk considered by mine gas to the site. Therefore, the risk posed by made ground and coal measures is currently assessed as moderate/ low with further investigation including gas monitoring and assessment required to confirm the risk.
On site Mine shaft Ground gas (carbon dioxide and methane)	Migration into confined spaces, inhalation and asphyxiation/ explosion	End-users / Property	Unlikely	Severe	Moderate/ Low	The onsite shaft is considered possible to accommodate significant thicknesses of made ground and is likely to act as a vector for ground gas or mine gas, however due to its highly localised and small area, this likelihood is assessed as unlikely. Assessed as moderate to low risk. Further investigation to determine made ground thickness within the shaft, including targeted ground gas monitoring, will be required to confirm the level of risk.
Off-site Pump House and ASTs (localised oils, hydrocarbons, PAHs)	Ingestion, direct contact, inhalation of vapours	End-users	Unlikely	Medium	Low	A pump house was indicated to be present 5m south of the site and tanks 25-30m west of the site, likely associated with residential use based on historical mapping evidence. Any oils, lubricants or fuels etc would likely have been used in very small quantities any spillages are likely to be small to negligible and it is unlikely for them to have migrated onto the site given the presence of low permeability cohesive soils that underly the site. The risk is therefore considered to be low.

Human Health						
Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk	Justification
Off site Electricity Substation PCBs	Ingestion, direct contact, inhalation of dusts	End-users	Unlikely	Medium	Low	The substation has been present since at least 1973, which pre-dates the ban on PCBs implemented in 1986, presenting a potential source of PCBs. However, these compounds were typically used in very low volumes with regular maintenance regimes carried out which would identify any significant leaks or spillages of this contaminant. In addition, PCBs are relatively immobile and are unlikely to have migrated away from the substation, especially as the substation appears to have been seated on a hard standing base which is likely to have contained any contaminants. The majority of the site will be occupied by the residential development with soft landscaping and given the residential nature of the proposed development, there is a low likelihood of exposure, and intrusive investigation is required to confirm the risk. The overall risk is considered to be low.
Off site Potentially Infilled Features Coal Pit/ Opencast Mine/ Quarry / Pond Ground Gas (carbon dioxide, methane)	Migration into confined spaces, inhalation and asphyxiation/ explosion	End-users / Property	Unlikely	Severe	Moderate/ Low	A coal pit, opencast mine, a quarry, and a pond were historically present from 50m to 250m from the site, later being infilled with unknown materials. These infilled features may present a potential for ground gas generation. Given the distance of these infilled features to the site and the presence of cohesive deposits associated with the Till indicated to be present in that area and the propensity for ground gas to migrate upwards it is considered unlikely any ground gases produced will migrate onsite. Additionally, considering the time since the potential infilling of the off site features any resultant ground gasses generated will have likely dissipated. The risk is therefore considered moderate / low with further investigation required to confirm the risk.

Controlled Waters						
Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk	Justification
Made Ground PAHs, Metals	Overland flow, / migration through saturated zone	Unnamed river 35m SW away (Surface waters)	Unlikely	Medium	Low	It is considered contaminants associated with the made ground and other past industrial uses are unlikely to impact the River. This is due to the small area of made ground present, the low permeability of the clays underlying the area, which will inhibit lateral migration, and the potential for contaminants to attenuate and degrade over this distance. The proposed development will include gardens which would minimise overland flow to the river and roadways would include drainage which would channel rainfall away. Therefore, a low risk is posed to the river from the made ground.
	Leaching through unsaturated zone / Migration through saturated zone	Secondary Superficial Undifferentiated Aquifer (Groundwater)	Unlikely	Medium	Low	Gross contamination is not anticipated to be present at the site. Contaminants are unlikely to be transmitted in low permeability strata such as Till, where migration of groundwater will be limited. The Secondary undifferentiated aquifer is not considered to be a significantly sensitive receptor. The site is not located within an SPZ and there are no groundwater abstractions for potable water supply within 1km of the site. New roadways with drainage are proposed as part of the development, however areas of gardens and soft landscaping are also planned. By virtue of the development taking place, this should contribute to an overall “betterment” of groundwater quality.
	Migration through saturated zone	Secondary A Bedrock Aquifer (Groundwater)	Unlikely	Medium	Low	There are no groundwater abstraction licences or Source Protection Zones within 1km of the site. New roadways with drainage are proposed as part of the development, however areas of gardens and soft landscaping are also planned. As stated above, the site is underlain by low permeability deposits, which will inhibit vertical migration, with a new surface water drainage system installed which will further reduce the risk to controlled waters, and by virtue of the development taking place, it should contribute to an overall “betterment” of groundwater quality..

Human Health Risk – Soils Contamination Summary

Based on the preliminary CSM and the current use of the site, the overall risk from land contamination at the site is considered to be **low to moderate / low** for a redeveloped site. This would need to be confirmed by appropriate intrusive investigation, testing and assessment.

Human Health Risk – Ground Gas Summary

A potential on-site gas source has been identified associated with natural solid geology, and underground historic mine workings. Off-site potential sources include historic infilled quarries and mines. Potentially viable linkages are considered to exist and the preliminary CSM considers these sources to be of **moderate / low to moderate** risk.

In accordance with BS8576 and CIRIA C665 as set out in Appendix A of this report, the gas generation potential is considered to be very low. The sensitivity of the development is high on account of the proposed residential use.

In line with current guidance, it is recommended that ground gas monitoring should comprise 6 visits over a 3 month period.

Controlled Waters Risk - Summary

Based on the preliminary CSM, BSL believes the overall risk to controlled waters at the site is **low**.

The above assessed level of risk will need to be confirmed by intrusive investigation and quantitative risk assessment.

5.0 PRELIMINARY GEOTECHNICAL ASSESSMENT

5.1 Hazard Identification

A preliminary geotechnical hazard identification exercise has been undertaken in general accordance with the Highways England document CD 622, 'Managing geotechnical risk'. Potential geotechnical hazards based on the expected ground conditions are listed below:

- Made ground of unknown nature; if placed in a non-engineered manner may cause excessive settlement of foundations, highways and infrastructure.
- Attack of buried concrete by aggressive ground conditions; the site may contain unknown made ground and potentially sulphate bearing soils. The coal measures are known to be high in naturally occurring sulphates.
- Shrink / swell of clay; settlement / heave of foundations and floor slabs when located within the influence of trees and vegetation.
- Shallow groundwater / groundwater rise causing resulting in difficulties with excavations due to trench collapse.
- Mining subsidence; the site is in an area of former shallow coal mine workings.

In respect to potential for mining induced stability, the site has two former coal mine shafts, where the Coal Authority holds no further details on treatment, except that shaft 347390-006 has been proved to be filled and may have been capped to an unknown specification. The site is also in an area of probable shallow coal mine workings and will likely require further investigation. Further research should be carried out in the form of a site-specific Coal Mining Risk Assessment to fully determine the risk. The location of the mine entries may have an impact on the development layout as an easement is required around the shaft for any proposed structures.

The above identified geotechnical hazards will need to be considered as part of further investigations and assessments.

5.2 Foundation and Geotechnical Design

The proposed development will comprise low-rise residential housing with associated gardens and infrastructure. The type of foundation solution should be informed by an onsite intrusive investigation to confirm ground conditions and obtain geotechnical parameters for preliminary design.

Given the historical coal mining that has occurred in the local area, it would be considered prudent to contact the Local Authority Building Control and take advice on any localised foundation designs that may be required (e.g. a reinforced raft design).

5.3 Drainage

Given the site is underlain by low permeability clays, it is unlikely that drainage to SuDS such as traditional soakaways will be suitable.

5.4 Recommendations

To confirm the ground conditions in respect to the identified potential geotechnical hazards and risks, an appropriate intrusive investigation will need to be undertaken.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Geo-Environmental Summary

The site has generally remained as greenfield since mapping began in 1850, having only a very small amount of residential development on site, although historical coal mining is present. Based on the proposed residential end-use, the overall risk to human health from on site contamination is considered to be low to moderate/ low.

The risk from off-site sources of contamination considered to be low to moderate/ low.

The risk from permanent ground gases is considered to be moderate/ low to moderate and further monitoring is recommended.

Radon is not considered to pose a risk.

The overall risk to controlled waters is considered to be low.

Intrusive investigations will be required to confirm the above assessed levels of risks and determine remedial requirements, if any.

6.2 Geotechnical Summary

Intrusive investigations will be required to confirm the most suitable foundation solution and to obtain parameters for concrete classification, floor slab and highways design.

Whilst the site lies within a Coal Authority Reporting Area, mining related instability is not considered to pose a risk to the site.

Drainage to SuDS is unlikely to be a viable option for the site subject to intrusive investigation and testing.

6.3 Further Work

To confirm the risks to the identified receptors and confirm the ground conditions in respect to the identified geotechnical and geo-environmental risks, an appropriate intrusive investigation will need to be undertaken. The following further works are recommended, although this list is not exhaustive and should be read in conjunction with any planning conditions that are applicable to the site:

-
- Topographical survey / utility mapping.
 - Demolition / Refurbishment Asbestos survey (where applicable).
 - Intrusive ground investigation comprising:
 - o Trial pitting, windowless sampling and rotary open hole drilling.
 - o Installation of standpipes in boreholes to allow gas concentrations and groundwater levels to be monitored.
 - o The undertaking of soil infiltration rate testing.
 - o Geotechnical testing of soils.
 - o Contamination analyses of soil.
 - Assessment and recommendations based on the above, including requirements for further work, if necessary.
-

7.0 ABBREVIATIONS AND DEFINITIONS

GLOSSARY	
Term / Abbreviation	Definition
AST	Above Ground Storage Tank.
B(a)P	Benzo (a) Pyrene.
BGS	British Geological Survey.
BRE	Building Research Establishment.
BS	British Standard.
BSL	Brownfield Solutions Ltd.
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes.
CBR	California Bearing Ratio (used in pavement/highways design).
CAR 2012	Control of Asbestos Regulations (2012).
CBCB	Cheshire Brine Compensation Board.
CBCD	Cheshire Brine Compensation District.
CBR	California Bearing Ratio.
CIEH	Chartered Institute of Environmental Health.
CIRIA	Construction Industry Research Association.
CL:AIRE	Contaminated Land: Applications in Real Environments.
CLEA	Contaminated Land Exposure Assessment.
CLO	Contaminated Land Officer.
COMAH	Control of Major Accident Hazards.
Contamination	Presence of a substance which is in, on or under land, and which has the potential to cause significant harm or to cause significant pollution of controlled water. There is no assumption in this definition that harm results from the presence of the contamination. Naturally enhanced concentrations of harmful substances can fall within this definition of contamination. Contamination may relate to soils, surface water, groundwater or ground gas.
Controlled Waters	Inland freshwater (any lake, pond or watercourse above the freshwater limit), water contained in underground strata and any coastal water between the limit of highest tide or the freshwater line to the three-mile limit of territorial waters.
CPT	Cone Penetration Test.
CSM	Conceptual Site Model. A schematic hypothesis of the nature and sources of contamination, potential migration pathways (including description of the ground and groundwater) and potential receptors, developed on the basis of the information from the preliminary investigation and refined during subsequent phases of investigation and which is an essential part of the risk assessment process. The conceptual site model is initially derived from the information obtained by the preliminary investigation (i.e. the Phase I Phase I Assessment). This conceptual model is used to focus subsequent investigations, where these are considered to be necessary, in order to meet the objectives of the investigations and the risk assessment. The results of intrusive investigations can provide additional data that can be used to further refine the conceptual site model.
DCP	Dynamic Cone Penetrometer.
DNAPL	Dense Non-Aqueous Phase Liquid.
DoWCoP	Definition of Waste Code of Practice.
DWS	Drinking Water Standard.
EA	Environment Agency.
EHO	Environmental health Officer.
EQS	Environmental Quality Standard.
GAC	Generic Assessment Criteria.

GLOSSARY	
Term / Abbreviation	Definition
GDR	Geotechnical Design Report.
GFR	Geotechnical Feedback Report.
GIR	Ground Investigation Report.
GSV	Gas Screening Value.
Harm	Adverse effect on the health of living organisms, or other interference with ecological systems of which they form part, and, in the case of human health, including property/structures and water supply pipelines.
Hazard	Inherently dangerous quality of a substance, procedure or event.
HDPE	High Density Polyethylene.
HSV	Hand Shear Vane.
K	Modulus of Subgrade Reaction.
LCRM	Land Contamination: Risk Management (EA guidance).
LNAPL	Light Non-Aqueous Phase Liquid (petrol, diesel, kerosene).
LOD	Limit of Detection (for particular method adopted).
MMP	Materials Management Plan.
Mv	Modulus of Volume of Compressibility.
ND	Not Detected.
NHBC	National House Building Council.
NR	Not Recorded.
OS	Ordnance Survey.
PAH	Polycyclic Aromatic Hydrocarbon.
Pathway	Mechanism or route by which a contaminant comes into contact with, or otherwise affects, a receptor.
PCB	Poly-Chlorinated Biphenyl.
PCSM	Preliminary Conceptual Site Model.
pH	Scale used to specify how acidic or basic a water-based solution is.
PHC	Petroleum Hydrocarbons.
PID	Photo Ionisation Detector.
PNEC	Predicted No-Effect Concentration.
Precision	Level of agreement within a series of measurements of a parameter.
PSD	Particle Size Distribution.
PVC	Polyvinyl Chloride.
Receptor	Human health, living organisms, ecological systems, controlled waters (surface waters and groundwater within aquifers), atmosphere, structures and utilities that could potentially be adversely affected by contaminant(s).
Risk	Probability of the occurrence, magnitude and consequences of an unwanted adverse effect on a receptor.
Risk Assessment	Process of establishing, to the extent possible, the existence, nature and significance of risk.
Sampling	Methods and techniques used to obtain a representative sample of the material under investigation.
SOM	Soil Organic Matter.
Source	Location from which contamination is, or was, derived. This could possibly be the location of the highest soil, groundwater or gas concentration of the contaminant(s).
SPT	Standard Penetration Test.
SVOCs	Semi Volatile Organic Compounds.
TOC	Total Organic Carbon.
TPH CWG	Total Petroleum Hydrocarbon (Criteria Working Group).

GLOSSARY	
Term / Abbreviation	Definition
TVOCs	Total volatile organic compounds.
UCS	Unconfined Compressive Strength.
Uncertainty	Parameter, associated with the result of a measurement that characterises the dispersion of the values that could reasonably be attributed to the measurement.
UST	Underground Storage Tank.
UXO	Unexploded Ordnance.
VCCs	Vibro Concrete Columns.
VSCs	Vibro Stone Columns
VOCs	Volatile Organic Compounds.
WAC	Waste Assessment Criteria.
WFD (in waste context)	Waste Framework Directive.
WFD (in water context)	Water Framework Directive.
Units	Definition
°	Degrees
Φ	Phi angle (in degrees)
g/l	Grams per Litre
Km	Kilometres
kPa	Kilo Pascal (Equivalent to kN/m ²)
KN/m ² /mm	Kilo Newton per metered squared per millimeter
kN/m ²	Kilo Newtons per metre squared
kPa	Kilo Pascal (Equivalent to kN/m ²)
l/hr	Litres per hour
MJ/kg	Mega joule per kilogram
MN	Mega Newton
M ² /MN	Mega Newton per metre squared
M	Metres
m bgl	Metres Below Ground Level
m OD	Metres Ordnance Datum (sea level)
µg/l	Micrograms per Litre (parts per billion)
µm	Micrometre
mb	Millibars (atmospheric pressure)
mg/kg	Milligrams per kilogram (parts per million)
mg/m ³	Milligram per metre cubed
mm	Millimetre
ppb	Parts Per Billion
Ppm	Parts Per Million

8.0 REFERENCES

References used in the production of this report are listed below; note not all of the below are relevant to the subject site and may not have been utilised.

Association of Ground Investigation Specialists. 'Description Of Anthropogenic Materials– A Practitioners' Guide'. 2018.

BS 8576 'Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)'. 2013.

BS 5930+A1:2020: 'Code of Practice for Site Investigations'. 2020.

BS 10175:2011+A2:2017 'Investigation of Potentially Contaminated sites - code of practice'. 2017.

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CIRIA C665 'Assessing Risks Posed by Hazardous Ground Gases to Buildings'. 2007.

CIRIA C681 'Unexploded Ordnance (UXO) A guide for the construction industry'. 2009.

CIRIA C753 'The SuDS Manual'. 2015.

CIRIA C758 'Abandoned Mine Workings Manual'. 2019.

CL:AIRE RB17 'A Pragmatic Approach to Ground Gas Risk Assessment'. 2012.

CL:AIRE TB19 'Managing Risks and Liabilities associated with Per and Polyfluoroalkyl Substances (PFASs)'. 2019.

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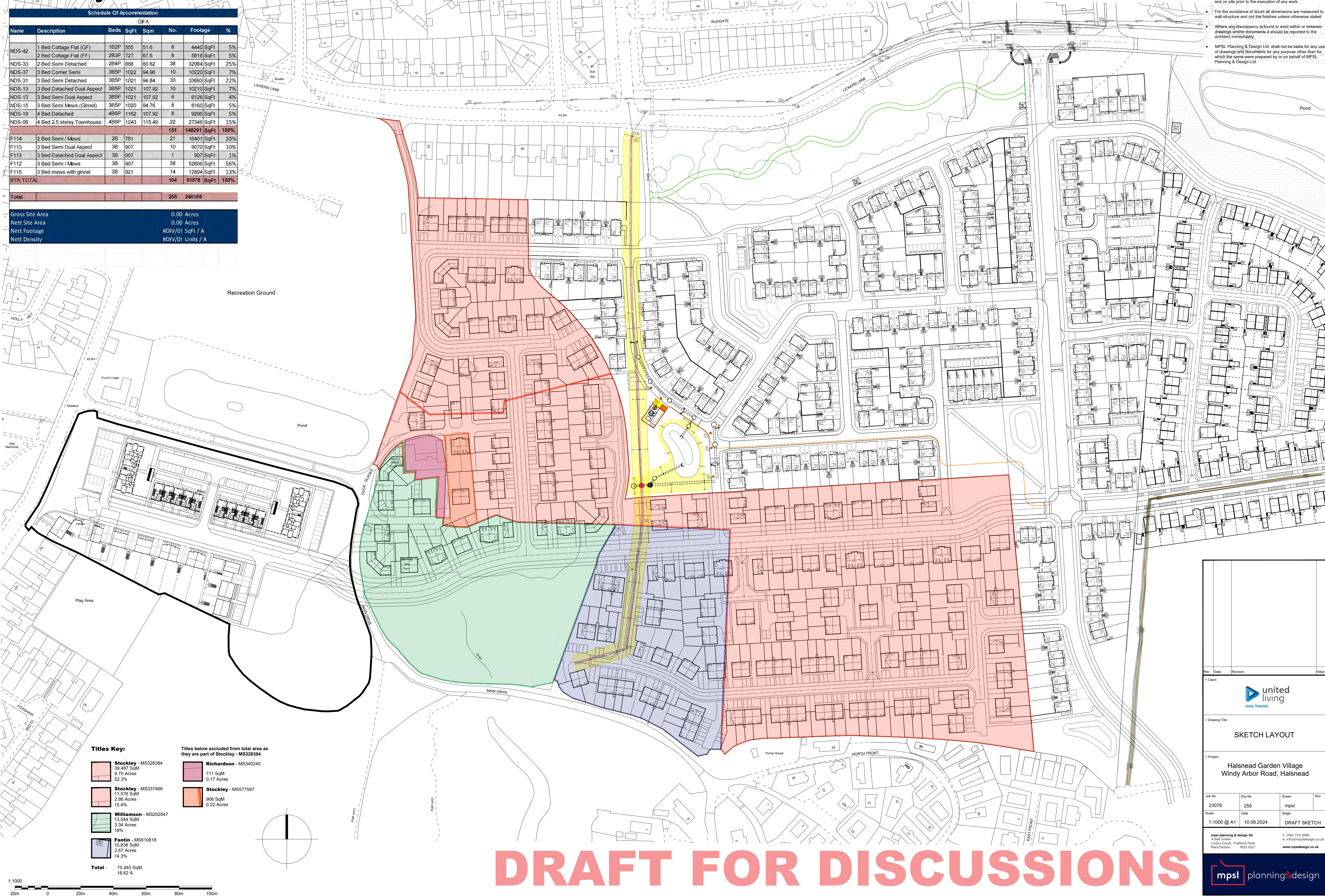
NHBC Standards. Chapter 4.1: Land Quality - Managing Ground Conditions.

NHBC. 'Hazardous Ground Gas - An essential guide for housebuilders'. May 2023.

Water Framework Directive, 2000.

DRAWINGS

Windy Arbor Road, Halsnead



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Rev

Date

Revision

Initial

Client

Drawing Title

SKETCH LAYOUT

Project

Halsnead Garden Village
Windy Arbor Road, Halsnead

Job No

23076

Orig No

255

Drawn

mpsl

Rev

Scale

1:1000 @ A1

Date

10.09.2024

Stage

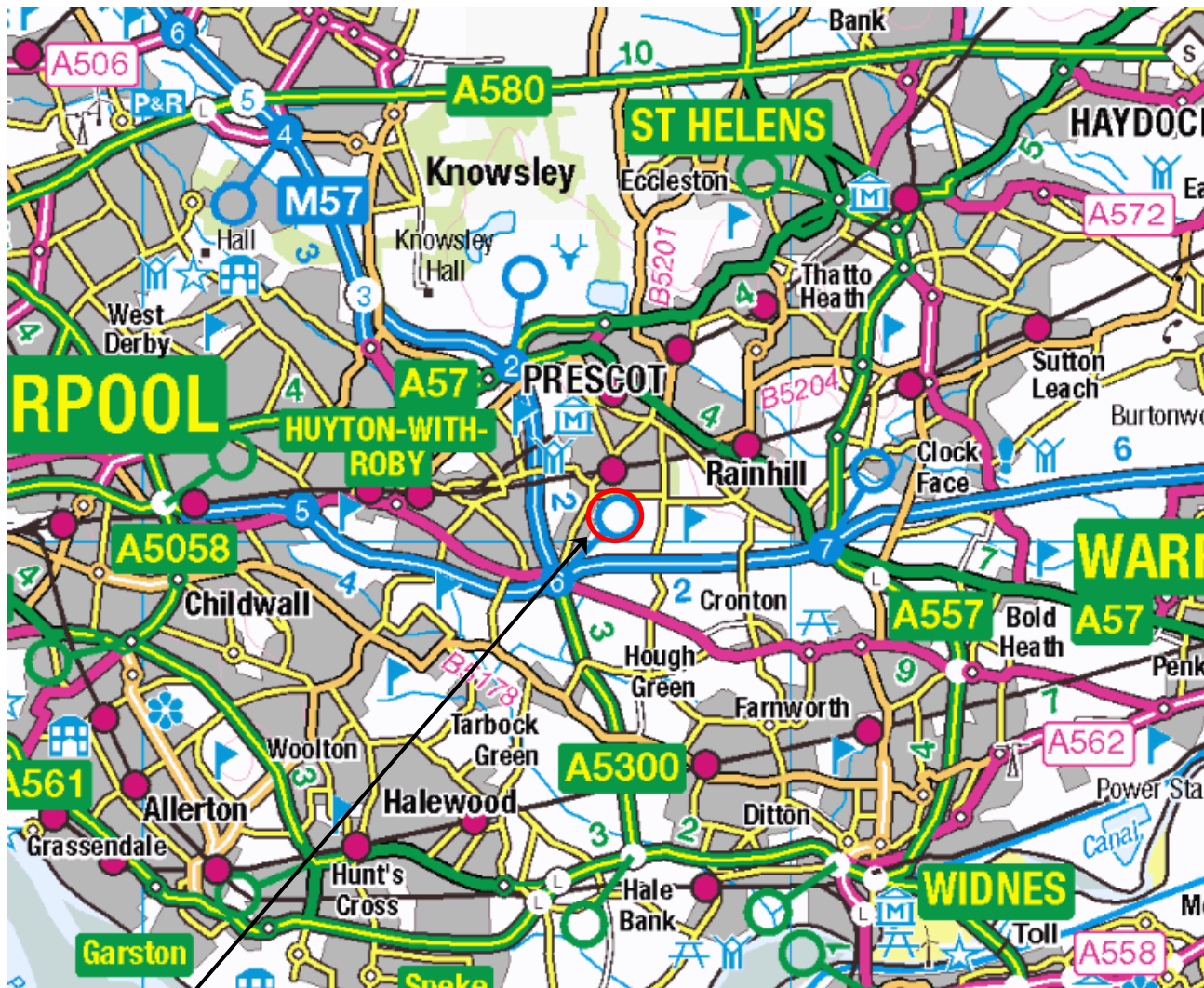
DRAFT SKETCH

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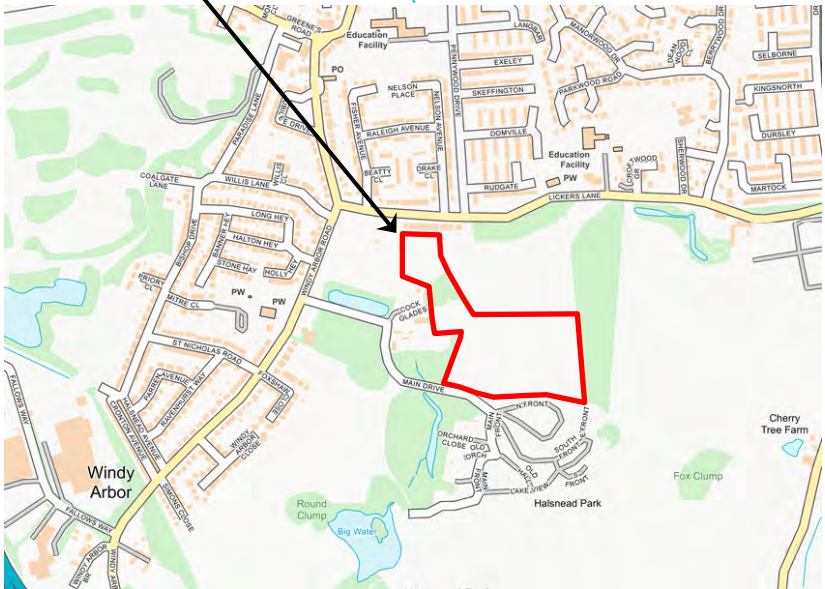
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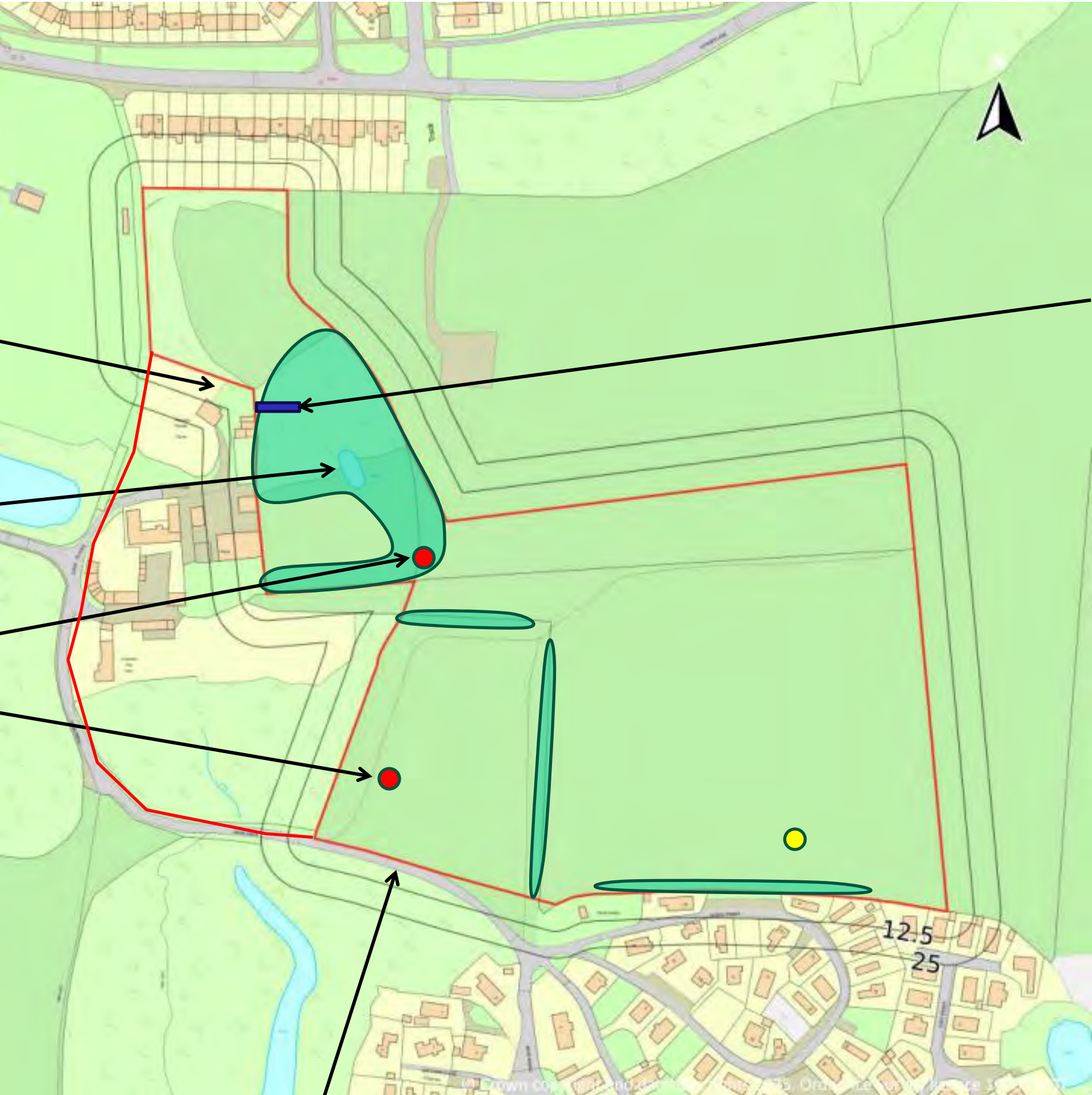
SITE LOCATION

NEAREST POSTCODE: L35 3PW

SITE ENTRANCE WHAT3WORDS: ///GATES.MAYBE.SWEEP



REV	DATE	DESCRIPTION	BY	CKD
 BROWNFIELD SOLUTIONS LTD CREATING SUSTAINABLE FUTURE THROUGH INNOVATION AND EXCELLENCE				
CLIENT UNITED LIVING				
PROJECT TITLE HALSNEAD GARDENS PHASE 1				
DRAWING TITLE SITE LOCATION PLAN				
DRAWING No. C5980/01	REVISION -	SCALE NTS	DATE 10/01/25	
DRAWN BY SD		CHECKED BY JM		



KEY

- APPROXIMATE SITE BOUNDARY
- DENSE VEGETATION
- BRICK WALL
- RAISED MANHOLE COVERS
- SUSPECTED MINE SHAFT

- NOTES
- ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE COMMENCING WORKS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ARCHITECT & ENGINEER FOR VERIFICATION. FIGURED DIMENSIONS ONLY ARE TO BE TAKEN FROM THIS DRAWING.
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CLIENT UNITED LIVING			
PROJECT TITLE HALSNEAD GARDENS PHASE 1			
DRAWING TITLE SITE FEATURES PLAN			
DRAWING No. C5980/02	REVISION -	SCALE NTS	DATE 14/01/25
DRAWN BY JL		CHECKED BY JEM	

PHOTOGRAPHS



Photograph 1: Site Entrance



Photograph 2: SW area of site



Photograph 3: Above ground manhole



Photograph 4: Dense vegetation toward NW of site



Photograph 5: Onsite pond



Photograph 6: 3ft high brick wall



Photograph 7: SE area of site



Photograph 8: Suspected mine shaft toward SE



Photograph 9: Previous gas monitoring well



Photograph 10: Evidence of underground services

APPENDIX A

BSL Methodology and Guidance

BSL Phase I Geo-Environmental Assessment Reports - Methodology and Guidance

Background

This Appendix provides information on the approaches, methods and guidance used by Brownfield Solutions Ltd in the preparation of this report.

The term 'geo-environmental' is used to describe aspects relating to ground-related environmental issues (such as potential soils and groundwater contamination). The term 'geotechnical' is used to describe aspects relating to the physical nature of the site (such as foundation requirements). It should be noted that this is an integrated investigation and these two main aspects are related, unless otherwise specified within the report.

Phase I reports are written in general accordance with the description of a Preliminary Investigation as defined in BS10175:2011+A2:2017 and are also produced in general accordance with the recommendations for a Tier 1 Preliminary Risk Assessment as described in LCRM guidance.

The first stage of the investigation and assessment of a site is the Preliminary Investigation/Tier 1 Preliminary Risk Assessment, often referred to as a Phase 1 Desk Study, comprising a desk study and walk-over survey and collation of desk-based searches, which culminates in the Preliminary Risk Assessment and the development of a preliminary/initial **Conceptual Site Model (CSM)**. From this are identified any potential geotechnical and geo-environmental hazards and the qualitative degree of risk associated with them. In the case of the geotechnical hazard identification, this is referred to as the **Ground Model**.

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 as part of Phase II investigations and reports.

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 an exploratory, a detailed or/and supplementary Investigations as described in BS 10175:2011+A2:2017. Phase II Assessments are produced in general accordance with the recommendations for a Tier 2 Generic Quantitative Risk Assessment as described in LCRM guidance and are also intended to fulfil the requirements of a Ground Investigation Report (GIR) as detailed in BS EN 1997-2:2007.

Contaminated Land - Legislative Background

Land contamination can be addressed in several ways, e.g. during planning, under Part 2A, following an incident, during an investigation into environmental damages, or during the application of an environmental permit, or its surrender.

For the planning process the key test is **as a minimum the site cannot be determined as contaminated land**, e.g. there is not significant harm, significant possibility of significant harm to human health or that there is not significant harm to, or the significant possibility that the pollution of controlled waters will occur.

Environmental liabilities and risks have been evaluated in terms of a source -pathway - target relationship in accordance with the approach set out in:

-  The 1995 Environment Act.
-  The Contaminated Land Statutory Guidance, DEFRA – April 2012.
-  The Contaminated Land (England) Regulations 2006.
-  The Contaminated Land (England) Amendment Regulations 2012.
-  Water Resources Act.
-  Water Framework Directive.
-  Environmental Damage Regulations.
-  Environment Agency (EA) - Land Contamination Risk Management (LCRM) 2019.

Contaminated land is defined within the legislative framework as land which is in such condition by reason of substances in, on or under the land that:

- 1) Significant harm is being caused or there is a significant possibility of such harm being caused.
- 2) Significant pollution of controlled waters is being or is likely to be caused.

The potential for harm is based on the presence of three factors:

Source - substances that are potential contaminants or pollutants that may cause harm.

Pathway - a potential route by which contaminants can move from the source to the receptor, and the impact of that migration on the source e.g., attenuation.

Receptor - a receptor that may be harmed, for example the water environment, humans and water, considering the sensitivity of the receptor.

Where a source, pathway and target are all present a pollutant linkage exists and there is potential for harm to be caused.



Where any one of the “pollution linkages” between the above is absent there is deemed to be no risk.

The presence of a source does not automatically imply that a contamination problem exists, since contamination must be defined in terms of pollutant linkages and unacceptable risk of harm. The nature and importance of both pathways and receptors are site specific and will vary according to the intended end use of the site, its characteristics and its surroundings.

The key principle which supports the S-P-R approach is ‘suitable for use’ criteria. This requires remedial action only where contamination is considered to pose unacceptable actual or potential risks to health or the environment and, taking into account the proposed use of the site.

Relevant Guidance Documents

This report has been prepared in accordance with the list of guidance below, however the list is not exhaustive:

- DETR: Circular 02/2000: Environmental Protection Act 1990: Part IIA: Contaminated land. 2012.
- Environment Agency technical advice to third parties on Pollution of Controlled Waters for Part IIA of the EPA1990, May 2002.
- BS 10175:2011+A2:2017.
- Environment Agency (EA) - Land Contamination Risk Management (LCRM). 2019.
- Groundwater Protection <https://www.gov.uk/government/collections/groundwater-protection>
- UK Technical Advisory Group (UKTAG) - - Water Framework Directive
- Incidents and their classification: the Common Incident Classification Scheme (CICS) – Used by the Environment Agency to classify pollution incidents.

Relevant Legislative Documents

The following is a non-exhaustive list of legislative framework documents that has been considered in the production of this report:

- The Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (2012).
- The Environment Protection Act (1990).
- The Water Resources Act (1991).
- The Environment Act (1995).
- The Contaminated Land (England) Act (2000).
- The Pollution Prevention and Control (England and Wales) Regulations (2000).
- The Landfill Regulations (England and Wales) Regulations (2002).
- The Landfill (England and Wales) (Amendment) Regulations (2004).
- Contaminated Land (England) Regulations (2012).
- The Environmental Damage (Prevention and Remediation) Regulations (2009).
- Environmental Permitting Regulations (England and Wales) Regulations (2010).
- The Water Environment (Water Framework Directive) (England and Wales) Regulations (2017).
- Health and Safety at Work Act.
- National Planning Policy Framework (NPPF) – latest version.

Contaminated Land Risk Assessment Approach

Contaminated Land Risk Assessment is a technique that identifies and considers the associated risk, determines whether the risks are significant and whether action needs to be taken. The four main stages of risk assessment are:



LCRM outlines the framework to be followed for risk assessment in the UK. The framework is designed to be consistent with UK legislation and policies including planning. The starting point of the risk assessment is to identify the context of the problem and the objectives of the process. Under LCRM, three tiers of risk assessment exist – Stage/Tier Preliminary Risk Assessment, Stage 2 Generic Quantitative Assessment and Stage 3 Detailed Quantitative Assessment.

Further information can be found at the below site:

<https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>

Formulating and developing a conceptual model for the site is an important requirement of risk assessment, this supports the identification and assessment of pollutant linkages. Development of the conceptual model forms the main part of preliminary risk assessment, and the model is subsequently refined or revised as more information and understanding is obtained through the risk assessment process.

Risk is a combination of the likelihood of an event occurring and the magnitude of its consequences. Therefore, both the likelihood and the consequences of an event must be taken into account when assessing risk.

The risk assessment process needs to take into account the degree of confidence required in decisions. Identification of uncertainties is an essential step in risk assessment.

The likelihood of an event is classified on a four-point system using the following terms and definitions from CIRIA C552, with reference to Incidents and their classification: the Common Incident Classification Scheme (CICS), Environmental Protection Act 1990: Part 2A – Contaminated Land Statutory Guidance 2012 and other guidance as appropriate which will be detailed within the main body of the report if applied.

The likelihood of a given receptor being impacted is related to a number of factors, e.g. the geology which could inhibit contaminant migration. For example, a site with a significant thickness of clay between it and a receptor may reduce migration of contamination via the subsurface, which will reduce the likelihood of a given receptor being impacted. The geology or drainage for example could offer a preferential pathway e.g. mines shafts/faults increasing the likelihood and potential magnitude of an impact. The depth of contamination will also affect the exposure pathway, for example petroleum hydrocarbons at depth are unlikely to reach a receptor via dermal contact but could via vapour pathways which will influence the likelihood of an impact being felt e.g. if there are no buildings on site.

The terms and definitions used for the assessment of the likelihood are provided below:

High likelihood: There is a pollution linkage and an event 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.

Examples - Extensive areas with concentrations above saturation limits for mobile contamination e.g. petroleum hydrocarbons within the water table.

Likely: There is a pollution linkage and all the elements are present and in the right place, which means it is probable that an event will occur. Circumstances are such that the event is not inevitable, but possible in the short term and likely over the long term.

Examples – Localised areas of contaminants with concentrations above saturation limits for mobile contamination e.g. localised petroleum hydrocarbons within the water table; shallow contamination above relevant human health generic assessment criteria is present with little or no hardstanding,

Low likelihood: There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain even over a longer period such event would take place, and is less likely in the short term.

Examples - A thickness/distance of low permeability deposits preventing contaminant migration to a receptor is present; a site is mostly covered hard standing preventing exposure to soil contamination.

Unlikely: There is a pollution linkage but circumstances are such that it is improbable the event would occur even in the long term.

Examples – A site is underlain by a substantial thickness of low permeability clays, between the source and potential receptors which will inhibit significantly, but not completely rule out migration to sensitive receptors.

The severity is also classified using a system based on CIRIA C552, with reference to Incidents and their classification: the Common Incident Classification Scheme (CICS), Environmental Protection Act 1990: Part 2A – Contaminated Land Statutory Guidance 2012 and other guidance as appropriate which will be detailed within the main body of the report, if applied. The terms and definitions are:

Severe: Short term (acute) risk to human health likely to result in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resources. Catastrophic damage to buildings or property. A short-term risk to a particular ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000);

Examples – High concentrations of contaminant on surface of recreation area, major spillage of contaminants from site into controlled waters, explosion causing building to collapse.

Medium: Chronic damage to human health ('significant harm' as defined in DETR 2000). Pollution of sensitive water resources. A significant change in a particular ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000);

Examples - Concentrations of contaminants exceed the generic assessment criteria, leaching of contaminants from a site to a Principal or Secondary Aquifer, death of species within a designated nature reserve.

Mild: Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000). Damage to sensitive buildings, structures, services or the environment.

Examples - Pollution of non-classified groundwater or damage to buildings rendering it unsafe to occupy.

Minor: harm, not necessarily significant harm, which may result in financial loss or expenditure to resolve. Non-permanent health effects to human health (easily prevented by use of personal protective clothing etc). Easily repairable effects of damage to buildings, structures and services.

Examples - Presence of contaminants at such concentrations PPE is required during site work, loss of plants in landscaping scheme or discolouration of concrete.

Once the likelihood and severity have been determined, a risk category can be assigned using the table below.

		Consequences			
		Severe	Medium	Mild	Minor
Probability	Highly likely	Very high	High	Moderate	Moderate/low
	Likely	High	Moderate	Moderate/low	Low
	Low likelihood	Moderate	Moderate/low	Low	Very low
	Unlikely	Moderate/low	Low	Very Low	Very low
	Negligible	Negligible Risk / No Linkage			

Definitions of the risk categories obtained from the above table are as follows together with an assessment of the further work that might be required:

Very high: There is a high probability that severe harm could arise to a designated receptor from an identified hazard or there is evidence that severe harm is currently happening. This risk, if realised, could result in substantial liability. Urgent investigation and remediation are likely to be required.

High: Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation is required and remedial works may be necessary in the short term and are likely over the longer term.

Moderate: It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it would be more likely to be relatively mild. Investigation is normally required to clarify the risk and determine the liability. Some remedial works may be required in the longer term.

Low: It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.

Very Low: There is a low possibility that harm could arise to a receptor. In the event of such harm being realised, it is not likely to be severe.

Some linkages may be identified which constitutes a theoretical connection between a source and a receptor, but professional judgement shows them not to be possible for some reason. These are labelled ‘negligible risk’ and ‘no linkage’ in the summary table, which give rise to an overall **negligible** risk category and no further action is required.

Ground Gas Risk Assessment

BS8485:2015+A1:2019, BS 8576:2013, CL:AIRE RB17, and NHBC ‘Hazardous Ground Gas - An essential guide for housebuilders’ 2023, are the current guidance which gives up-to-date advice on all aspects of permanent ground gas risk. BS8576 alongside CIRIA C682 also provides guidance on assessment of hydrocarbon vapour intrusion.

The CL:AIRE publication ‘Good Practice for Coal Mine Gas Emissions’ 2021 provides guidance on the assessment of risks from mine gas sources.

The above all outline good practice in investigation, the collection of relevant data and monitoring programmes in a risk-based approach to ground gas contamination. The aim of the guidance is for a consistent approach to decision making, particularly relating to the scope of protective design measures on a site-specific basis.

Legislative Framework

BS8485:2015+A1:2019, BS 8576:2013 and CIRIA C665 provides technical guidance, however they also recognise the context into which the guidance has to be employed. Government policy is based upon a “suitable for use approach”, which is relevant to both the current and proposed future use of land. When considering the current use of land, Part IIA of the Environment Protection Act 1990 provides the regulatory regime. The presence of hazardous ground gases could provide the “source” in a “pollutant linkage” which could lead the regulator to determine that considerable harm or there is a significant possibility of such harm being caused. Under such circumstances, the regulator would determine the land to be “contaminated land” under the provisions of the Act, setting out the process of remediation as described in the DETR Circular 02/2000 *Statutory guidance on contaminated land*.

Generation Potential of Sources

BS 8576:2013 Figure 6 provides a basis for assessing the generation potential from sources identified as part of the Phase I Assessment. These are summarised below:

Generation Potential	Typical Sources
Very Low	- Natural carbonate soil and strata, e.g. chalk and limestone. - Natural soil strata with a low degradable organic content, e.g. alluvium, peat. - In-filled pond less than 15 m diameter, in-filled before 1930s to 1940s. - Made ground with low degradable organic content (e.g. up to 5% organic material such as pieces of wood, pieces of paper, rags, etc. with a high proportion of ash and no food or other easily degradable waste). - Mine workings shallow or shaft (where there is clear evidence that they are flooded). - Inert landfill sites.
Low	- Natural soil strata with a high degradable organic content (DOC). - Made ground with total organic carbon (TOC) up to 6% (e.g. dock silt, no food or other easily degradable waste). - Foundry sand (includes phenolic binders, rags and wood that decay, albeit at low rates). - Landfill 1945 to mid 1960s (see also Moderate below).
Moderate	- Sewage sludge. - Mine workings – unflooded, more than 50 years since last worked (gas is liberated from coal when mine workings are excavated; this continues for up to about 50 years). - Landfill 1945 to mid 1960s (this could also be “low” or, if disturbed, “high”).
High	- Landfill mid 1960s to early 1990s. - Mine workings – unflooded – less than 50 years since last worked.
Very High	- Municipal landfill sites. - Landfill early 1990s onward.

Frequency and Duration of Monitoring

BS8576 notes to determine where and how to monitor ground gases requires consideration of credible pathways of possible exposure of the receptors, taking into account what is known about the geology and hydrogeology, building construction and services layout, foreseeable events such as flooding, changes in groundwater level, climate change, extreme weather conditions, the closure of mines, and possible changes to the gas regime caused by future development.

The monitoring period for a specific site should cover the “worst case” scenario. A “worst case” scenario will typically occur during falling atmospheric pressure and, in particular, weather conditions such as rainfall, frost and dry weather.

The benefits of additional information and whether it is likely to change the scope of gas protection should be considered, as are the consequences of failing to characterise adequately pollutant linkages. Investigations concerned with ground gas are required to provide monitoring data sufficient to allow prediction of worst case conditions enabling the confident assessment of risk and subsequent design of appropriate gas protection schemes. Monitoring programmes should not be an academic exercise in data collection. CL:AIRE publication TB17 “Ground Gas Monitoring and ‘Worst-Case’ Conditions” provides further guidance.

Below are matrices that will aid in determining an appropriate number of gas monitoring visits and the length of monitoring period.

Typical/idealised periods of monitoring

		Generation of Potential Source				
		Very Low	Low	Moderate	High	Very High
Sensitivity of Development	Low (Commercial)	1 month	2 months	3 months	6 months	12 months
	Moderate (Apartments)	2 months	3 months	6 months	12 months	24 months
	High (Low rise Residential)	3 months	6 months	6 months	12 months	24 months

Typical/idealised frequency of monitoring/Number of Visits Required

		Gas Generation of Potential Source				
		Very Low	Low	Moderate	High	Very High
Sensitivity of Development	Low (Commercial)	4	6	6	12	12
	Moderate (Apartments)	6	6	9	12	24
	High (Low rise Residential)	6	9	12	24	24

Notes

- 1 Generation potential of sources based on descriptions within BS 8576:2013.
- 2 At least two sets of readings should be at low and falling atmospheric pressure (but not restricted to periods below <1000 mb) known as worst case conditions. Historical data can be used as part of the data set (Table 5.5b).

RB17 Approach

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.

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 or if gas monitoring is required to better define the risks.

Under this approach, for sites with natural soils only with no credible methane source, then no action is required (no monitoring or gas protection measures) as this represents Characteristic Situation 1 (CS1).

Radon

Advice on radon protection in England is provided by the UK Health Security Agency, <https://www.ukradon.org/information/ukmaps> and by the BRE (BR 211 (Scivyer 2023)).

Areas 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.
-  >10% higher probability.

Basic radon protection measures are required in new buildings and extensions 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.

Unexploded Ordnance (UXO) Guidance

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.

BSL carry out non-specialist UXO screening exercises by considering any evidence of UK defence activities on or near the site evident from gathered desk study information and the unexploded aerial delivered bomb (UXB) online risk maps produced by Zetica. Other data sources are available, but as a first stage screening exercise the freely available online Zetica maps have been used. The level of risk stated is that determined by Zetica, a company experienced and considered competent in the assessment of UXO.

Geotechnical Guidance

A preliminary risk assessment of geotechnical hazards is carried out at the desk study stage and confirmed (or amended) at the ground investigation stage. The desk-based stage may include the requirements for a Coal Mining Risk Assessment (CMRA) which specifically assesses the risks from mining induced instability and related issues in high risk development areas: <https://www.gov.uk/guidance/planning-applications-coal-mining-risk-assessments>

APPENDIX B

Historical Maps

Site Details:

Whiston, Prescott, L35 3PW

Client Ref: C5980-6002-SD
Report Ref: GS-QLM-MGF-L3A-EIX
Grid Ref: 347185, 390293

Map Name: County Series

Map date: 1891

Scale: 1:10,560

Printed at: 1:10,560



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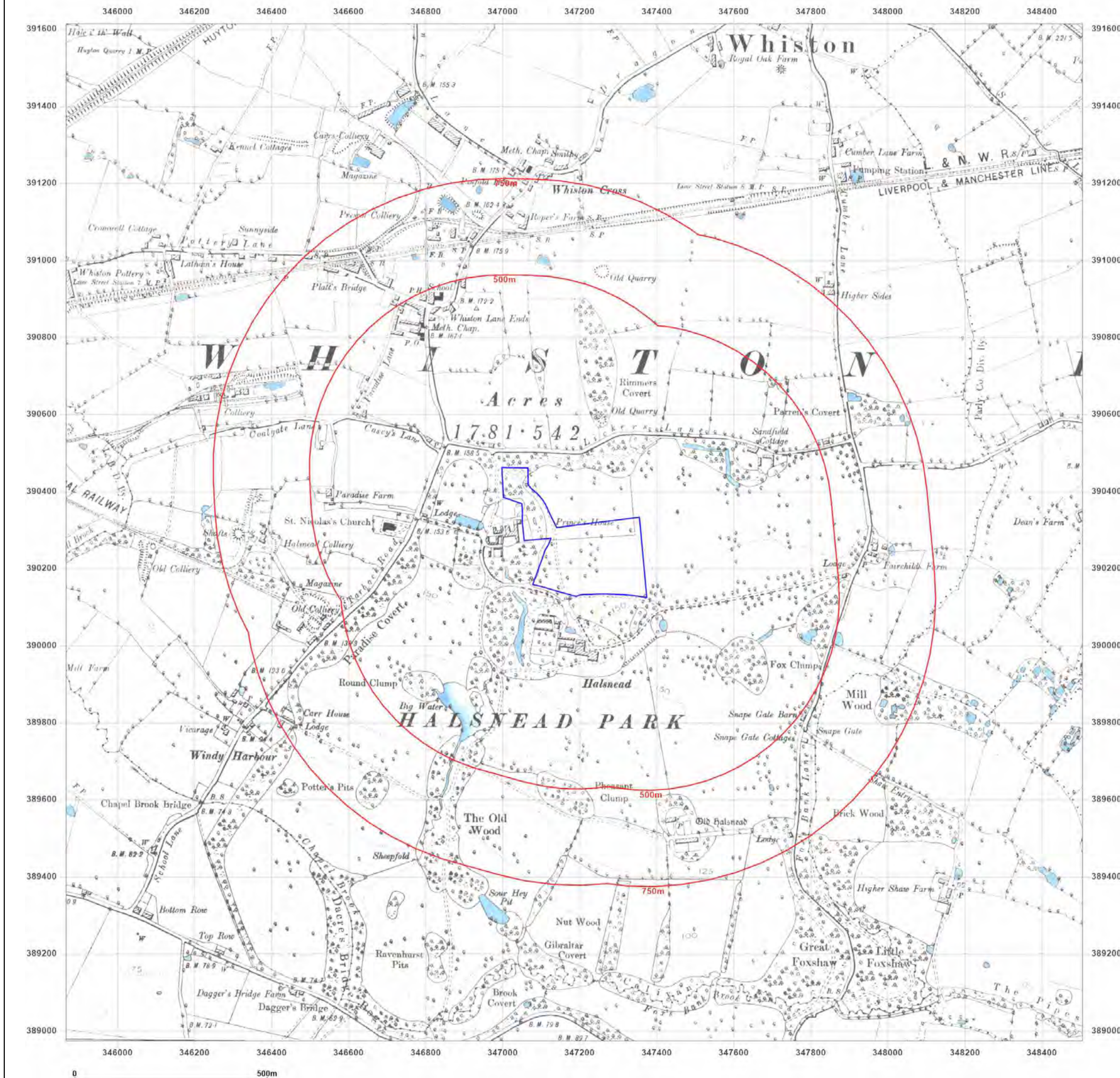


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Client Ref: C5980-6002-SD
Report Ref: GS-QLM-MGF-L3A-EIX
Grid Ref: 347185, 390293

Map Name: County Series

Map date: 1905-1906

Scale: 1:10,560

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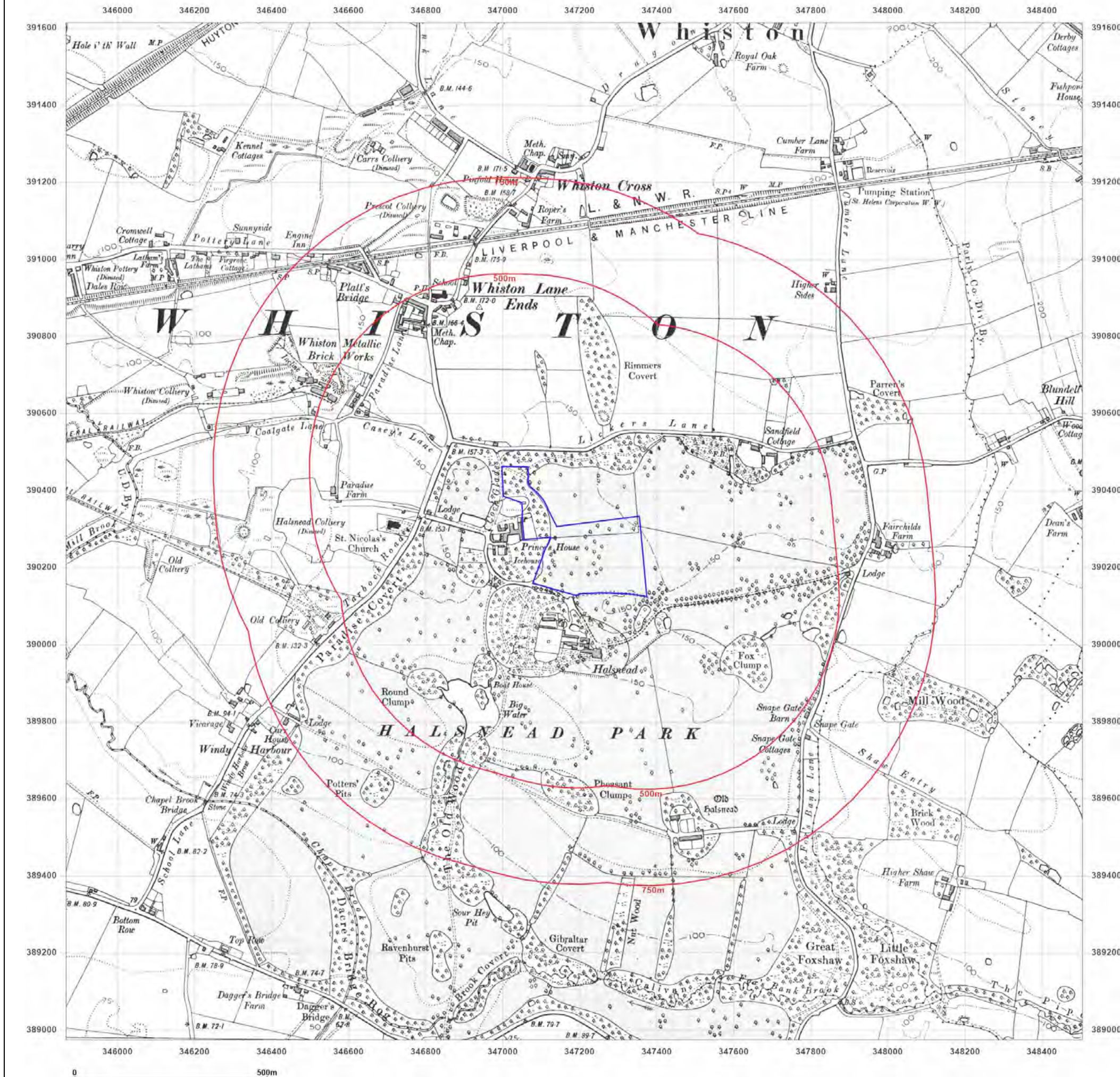


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Client Ref: C5980-6002-SD
Report Ref: GS-QLM-MGF-L3A-EIX
Grid Ref: 347185, 390293

Map Name: County Series

Map date: 1925

Scale: 1:10,560

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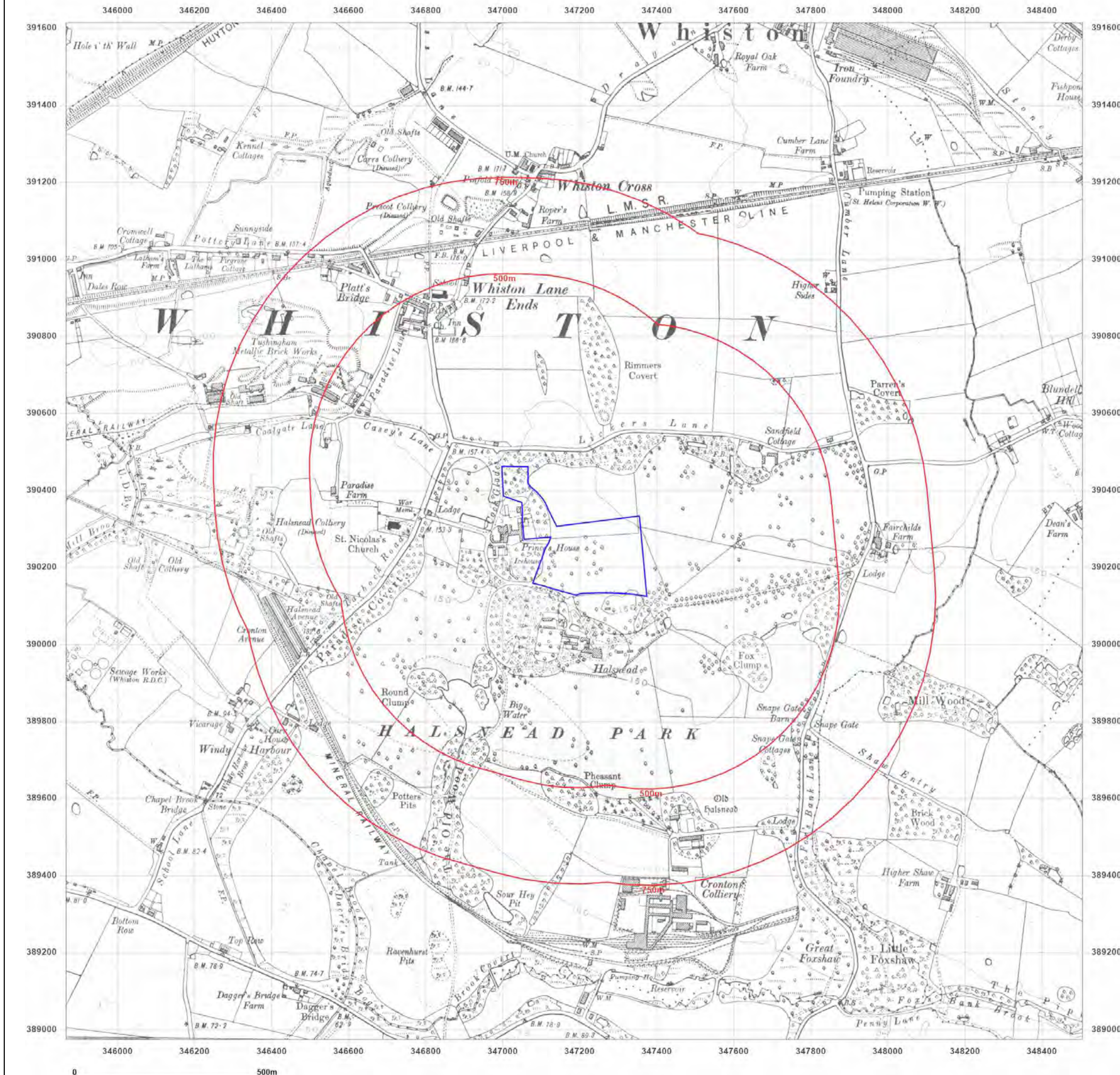


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Report Ref: GS-QLM-MGF-L3A-EIX
Grid Ref: 347185, 390293

Map Name: County Series

Map date: 1938

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Printed at: 1:10,560



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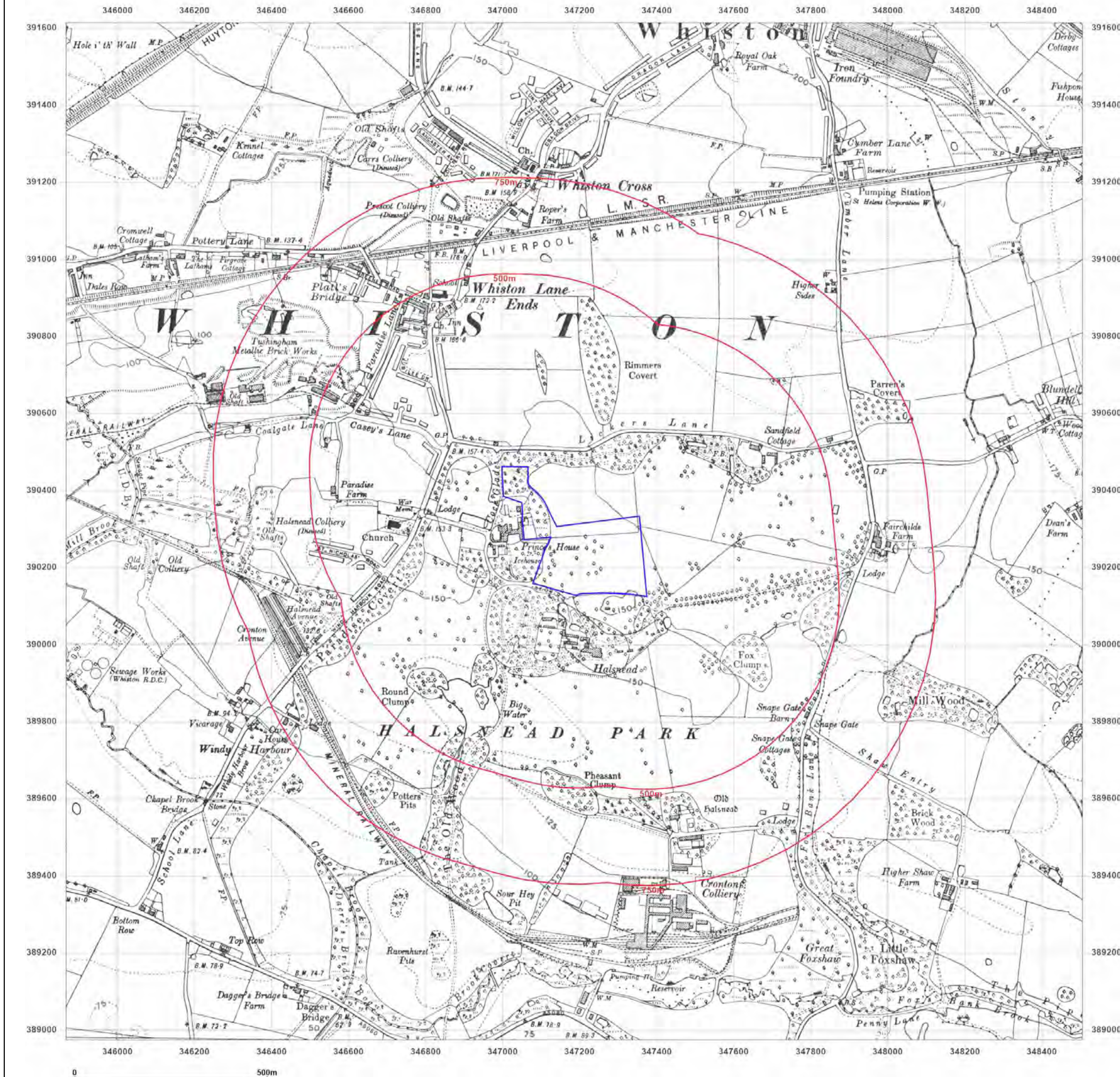


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Report Ref: GS-QLM-MGF-L3A-EIX
Grid Ref: 347185, 390293

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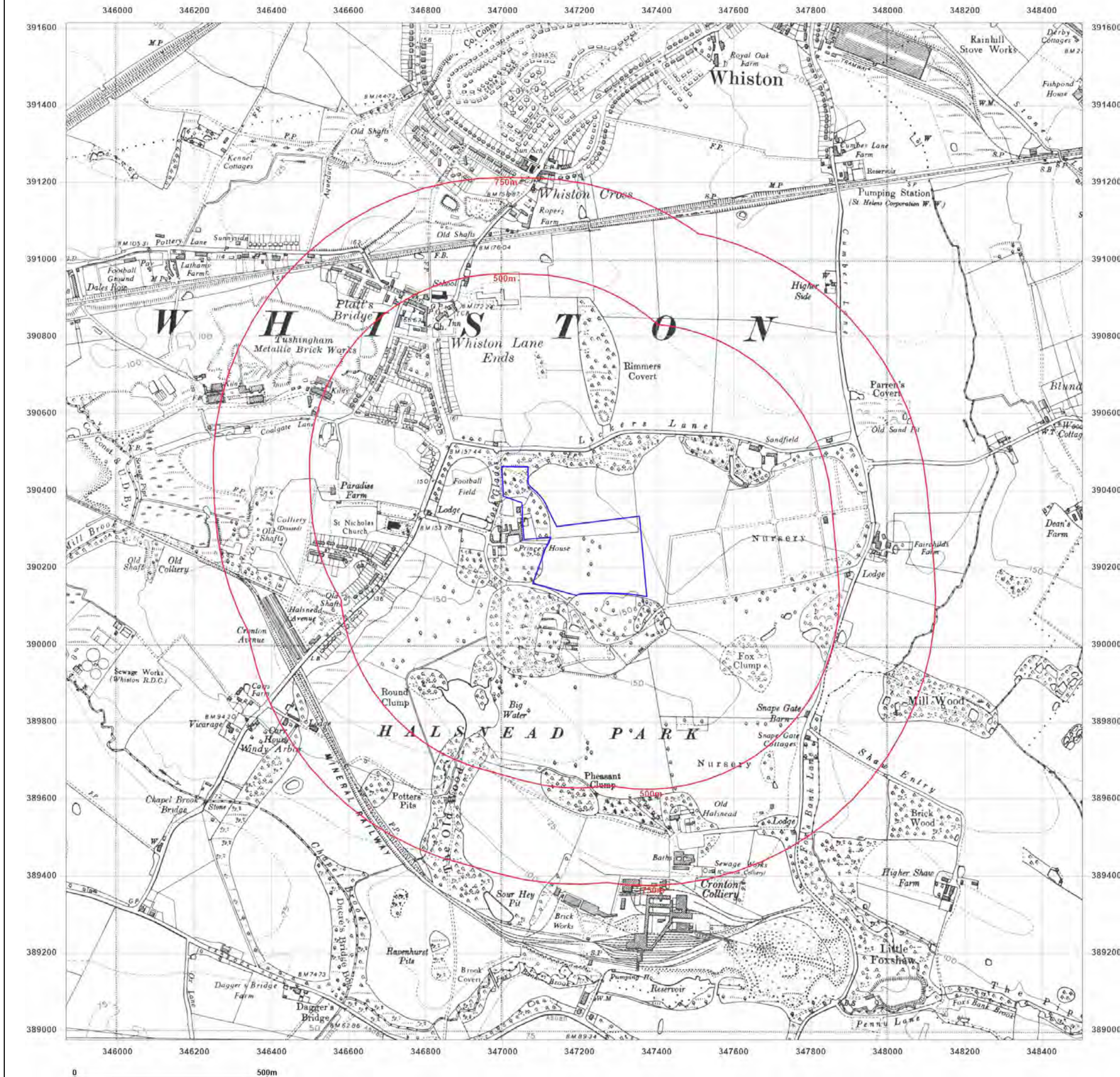


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Report Ref: GS-QLM-MGF-L3A-EIX
Grid Ref: 347185, 390293

Map Name: Provisional

Map date: 1955-1956

Scale: 1:10,560

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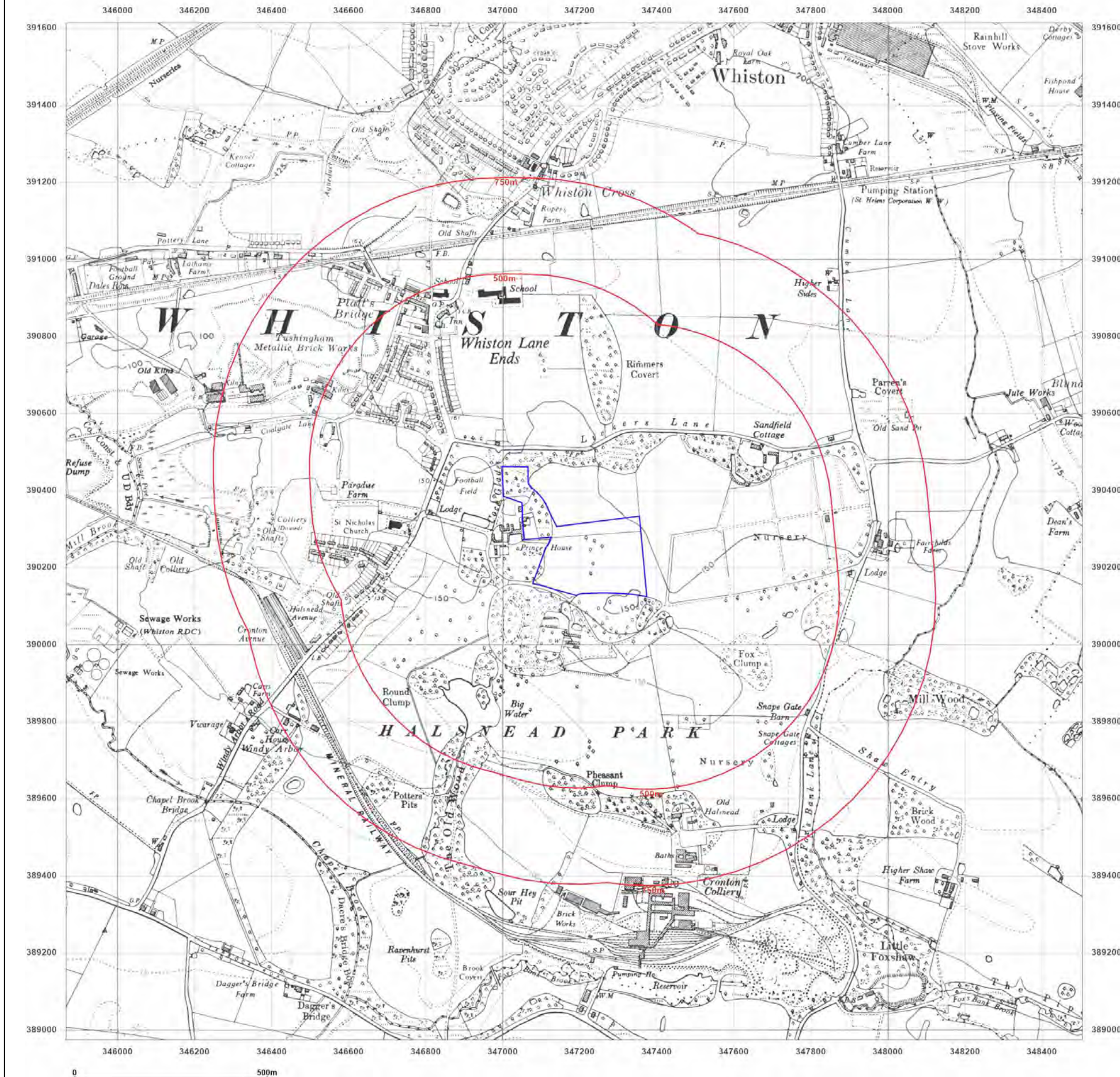


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Report Ref: GS-QLM-MGF-L3A-EIX
Grid Ref: 347185, 390293

Map Name: Provisional

Map date: 1966-1967

Scale: 1:10,560

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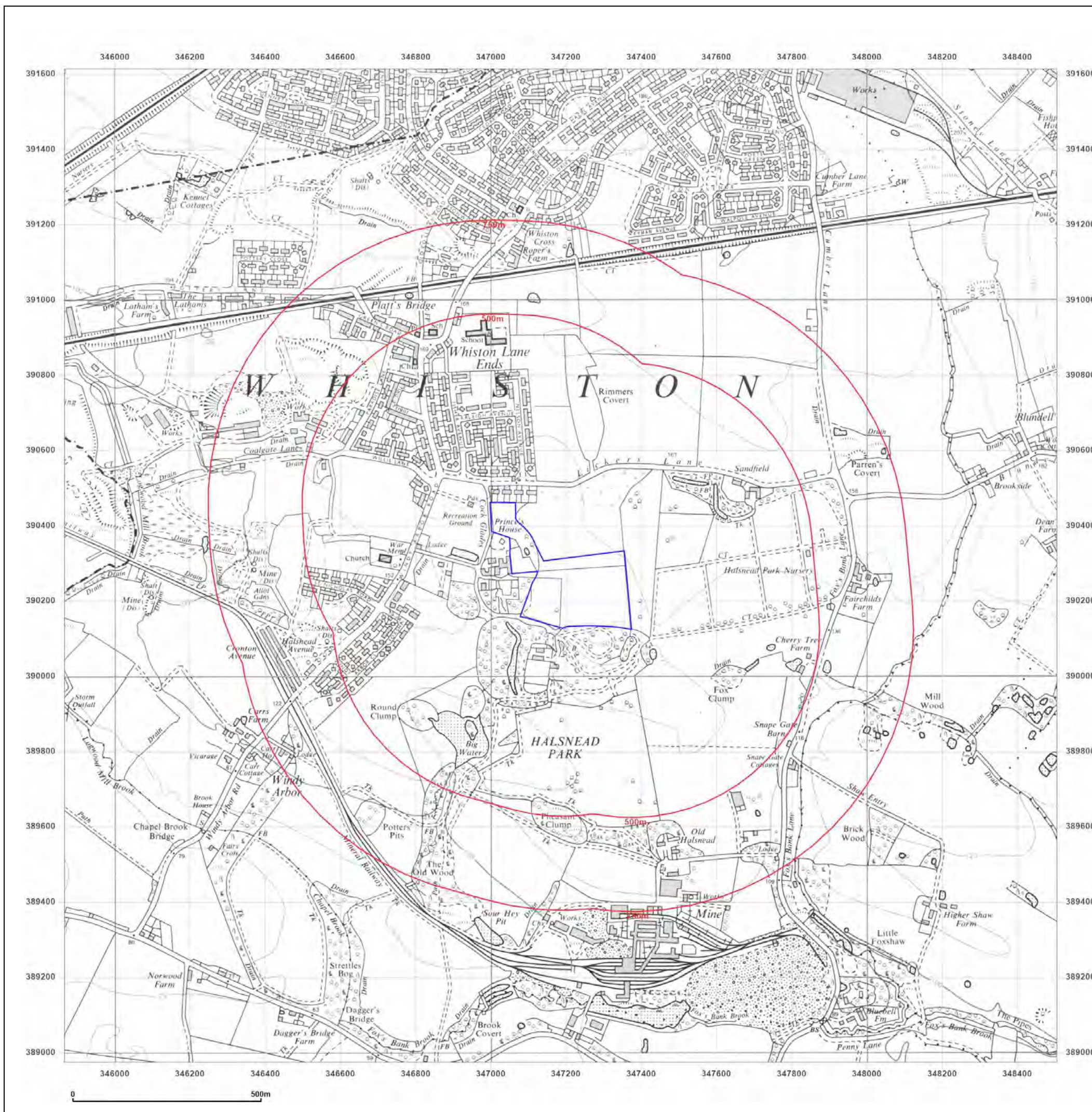


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Report Ref: GS-QLM-MGF-L3A-EIX
Grid Ref: 347185, 390293

Map Name: National Grid

Map date: 1977-1978

Scale: 1:10,000

Printed at: 1:10,000



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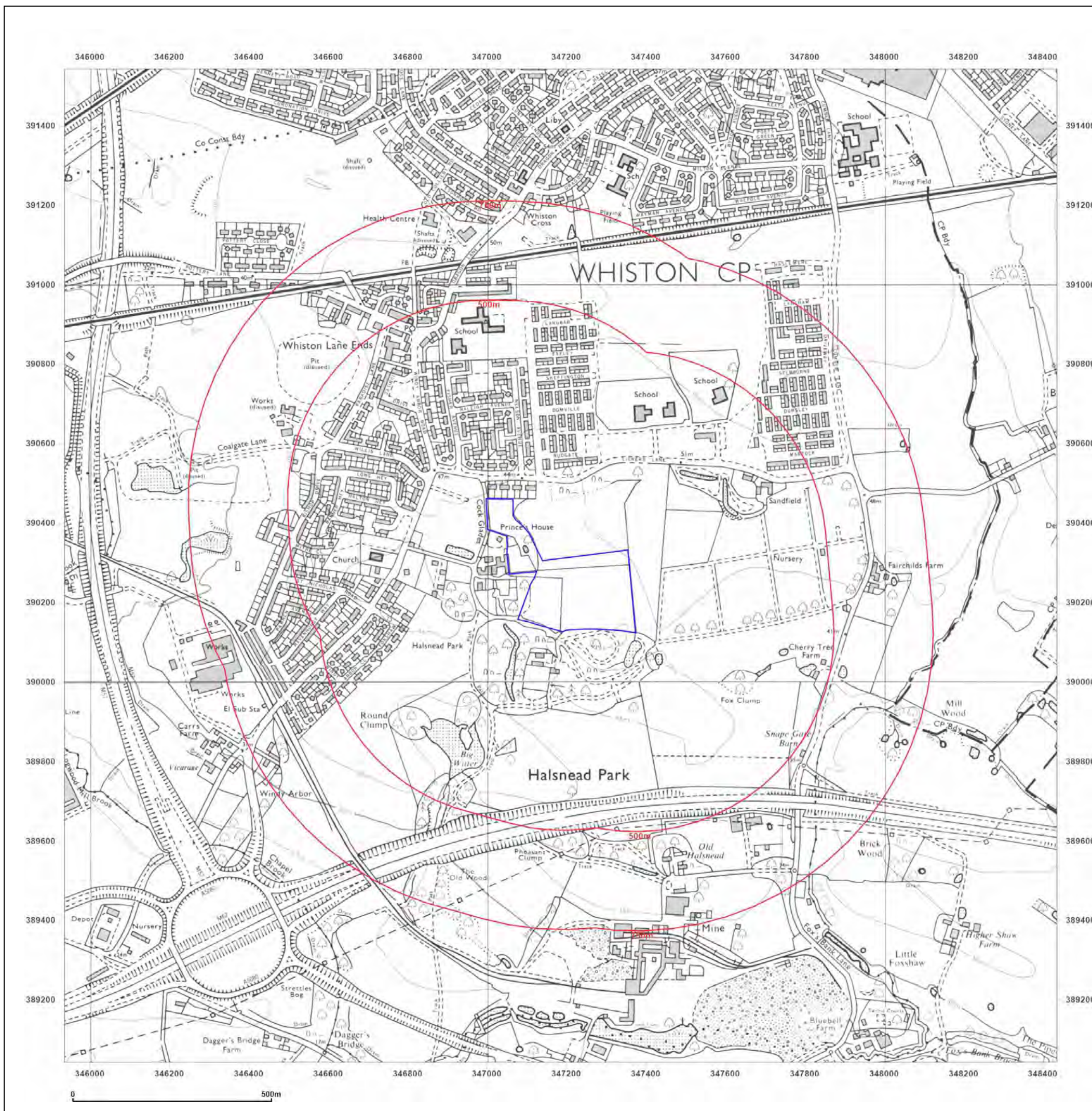


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Grid Ref: 347185, 390293

Map Name: National Grid

Map date: 1989-1990

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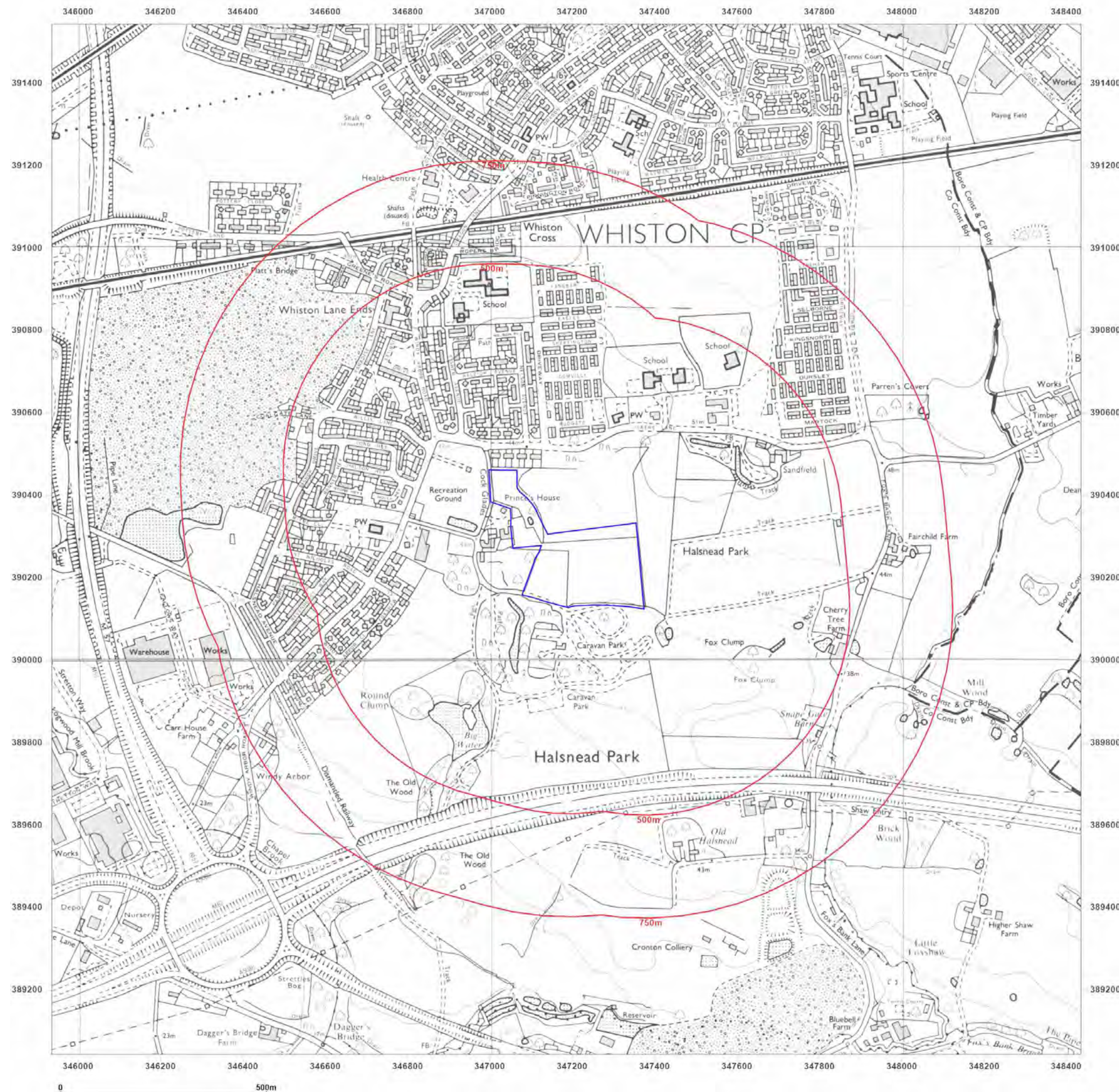


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Client Ref: C5980-6002-SD
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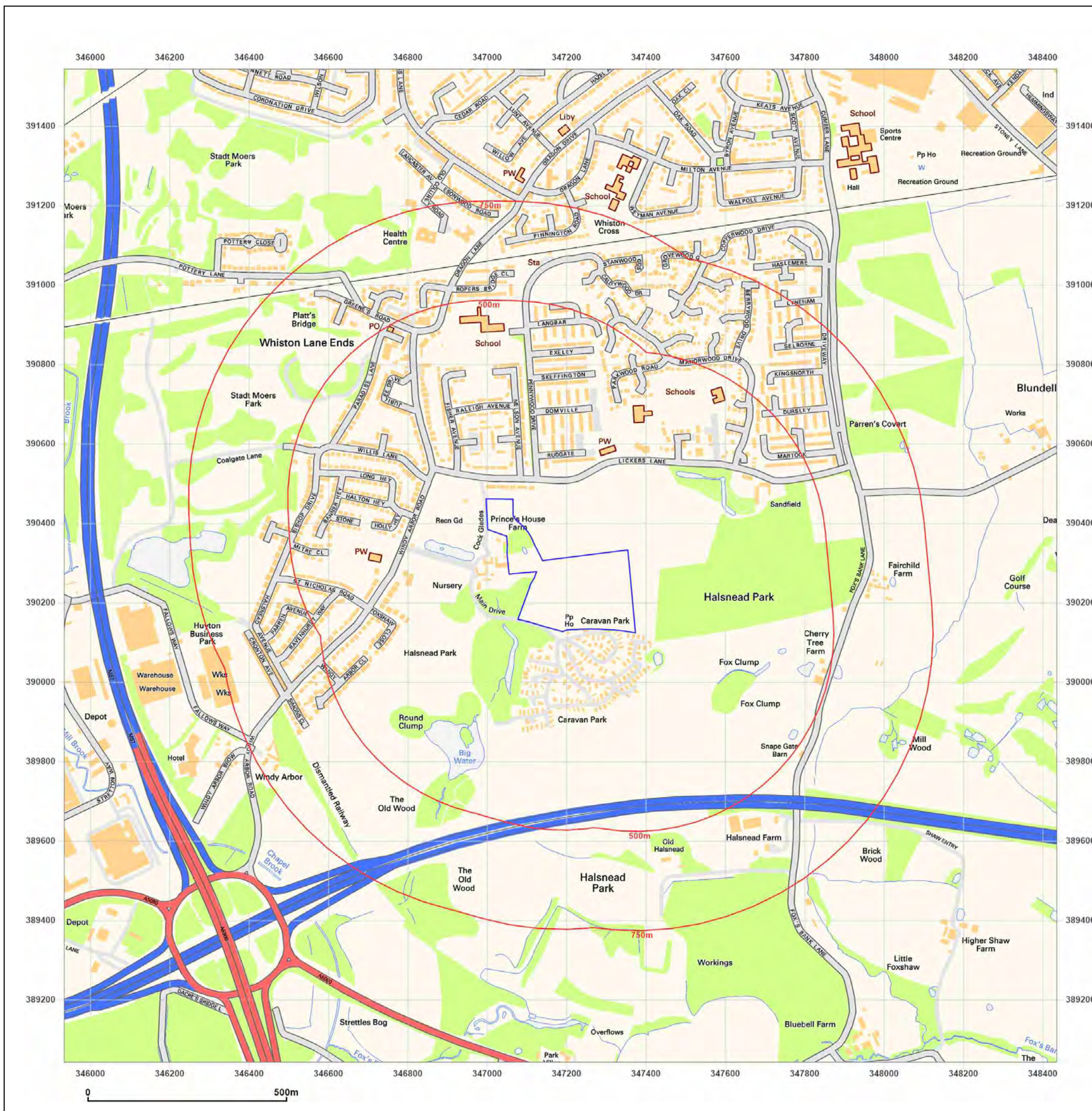


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Grid Ref: 347185, 390293

Map Name: National Grid

Map date: 2025

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Client Ref: C5980-6002-SD
Report Ref: GS-QLM-MGF-L3A-EIX_1250_1_1
Grid Ref: 346934, 390043

Map Name: National Grid

Map date: 1973

Scale: 1:1,250

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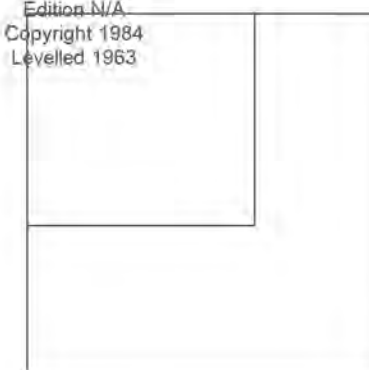
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Client Ref: C5980-6002-SD
Report Ref: GS-QLM-MGF-L3A-EIX_1250_1_1
Grid Ref: 346934, 390043

Map Name: National Grid

Map date: 1993

Scale: 1:1,250

Printed at: 1:2,000



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Grid Ref: 346934, 390543

Map Name: National Grid

Map date: 1973-1974

Scale: 1:1,250

Printed at: 1:2,000



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Map legend available at:
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Site Details:

Whiston, Prescot, L35 3PW

Client Ref: C5980-6002-SD
Report Ref: GS-QLM-MGF-L3A-EIX_1250_1_2
Grid Ref: 346934, 390543

Map Name: National Grid

Map date: 1974

Scale: 1:1,250

Printed at: 1:2,000



Surveyed 1973
Revised 1973
Edition N/A
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Site Details:

Whiston, Prescott, L35 3PW

Client Ref: C5980-6002-SD
Report Ref: GS-QLM-MGF-L3A-EIX_1250_1_2
Grid Ref: 346934, 390543

Map Name: National Grid

Map date: 1984

Scale: 1:1,250

Printed at: 1:2,000



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Revised N/A
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Site Details:

Whiston, Prescott, L35 3PW

Client Ref: C5980-6002-SD
Report Ref: GS-QLM-MGF-L3A-EIX_1250_1_2
Grid Ref: 346934, 390543

Map Name: National Grid

Map date: 1993

Scale: 1:1,250

Printed at: 1:2,000



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Revised N/A
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