

Phase II Geoenvironmental Site Assessment

Site: Tupa, Penley
Reference: 17-510-R2
Date: May 24





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QUALITY ASSURANCE

Report reference	17-510-R2
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REV REF:	DESCRIPTION	AUTHOR	CHECKED	AUTHORISED	DATE
R2-1	First issue	JW	MJ	SC	May 2024

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EXECUTIVE SUMMARY

Site Address	Land off Penley Hall Drive, Penley, Wrexham, LL13 0JP
Grid Reference	E 341796, N 340177
Site Area	0.99 Ha.
Proposed Development	Fisher German LLP intends to construct a low-rise residential development comprising nine dwellings with associated gardens, estate roads and infrastructure.
Current Site Use	The subject site is an irregular-shaped parcel of land that can be accessed via a single-track lane off Winston Way. A single-storey brick structure with a potential asbestos cement sheet roof is located in the centre of the site. This structure is formed of two elongated wings connected by a narrow brick corridor in the centre. No other structures have been noted on site. Vehicular access to the site can be gained via a field gate that is located on the north western boundary of the site. This can be accessed via a single-track lane to the north of Winston Way. There is no current pedestrian access to the site with all gates being overgrown. Scrub vegetation is present across the site with several sporadic semi-mature and mature trees also observed. The north east corner of the site is overgrown with dense woodland. Localised areas of the south, west and east of the site are also overgrown. The presence of dense vegetation was a constraint to the ground investigation. No surface water features are noted on site; however, surface water pooling and boggy ground have been noted in the southern sector. The building has a cement-bound corrugated roof. Due to the age of the structure, the noted cement sheeting and other building fabrics may comprise asbestos-containing material.
Site History	An examination of the relevant historical Ordnance Survey maps circa 1873 shows that the site comprised undeveloped land that formed part of the wider Penley Hall estate. Several trees are noted across the site and a pond is noted in the southern sector of the site. The pond is an elongated water body that extends off the southern boundary to the east. By 1954, the large pond located in the southern sector of the site had been infilled and was no longer mapped. During this time period several small rectangular structures have been constructed, along with the construction of roads and footpaths in the west of the site. These are believed to form part of a Polish Hospital that is mapped to the west of the site. Through to the 1990's, buildings across the site have been constructed and then subsequently removed, along with a tennis court in the south-eastern sector of the site. During the early 2000s through to the present day, the site has been left abandoned and the site has become heavily overgrown.



ENVIRONMENTAL SETTING

Geology	Drift Geology	Glacial Till - DIAMICTON
	Bedrock Geology	Helsby Sandstone Formation - SANDSTONE, Gravelly
	Faults	No geological faults have been recorded in close proximity to the site.
Geomorphology	Based on the initial geological assessment, a review of available topographic data and pertinent mapping, E3P has undertaken a preliminary geomorphological evaluation of the landform and its possible mechanism for formation. The site is relatively flat with localised drainage ditches. Due to the historical development of the site, limited levelling has likely been carried out on site. A pond on the south side of the site had been infilled pre-1974. A drainage ditch is located on the east side of the site, likely excavated during development.	
Hydrogeology	A Secondary (undifferentiated) Aquifer has been recorded on site in the drift geology with a Principal Aquifer in the bedrock geology. No groundwater abstraction licences are recorded within 1 km of the site.	
Hydrology	A small pond is located roughly 20 m to the north east of the site. The majority of the site is listed within Flood Risk Zone 1 and is seen to be at low risk of flooding. It should be noted that in the north-western sector of the site, there is an isolated pocket that is noted to be in Flood Risk Zone 3 and the southern sector an isolated pocket is noted to be in Flood Risk Zone 2.	
Utility Locations	A formal drainage survey has not been completed; however, a utility inspection chamber was identified in the centre, and it is likely that further infrastructure is present leading to the former hospital building. Following a review of statutory plans the following utility infrastructure has been noted:  Low voltage cables within the single tracked access road in the west of the site.  Overhead telephone infrastructure is recorded in the southern and western sectors of the site.	
Landfill Sites and Waste Sites	No landfill sites (current or historic) are located within 250 m of the site. In the southern sector, there is an infilled pond, and in this area, there is the potential for Made Ground infill as well as organic-rich alluvium deposits to be present. Made Ground deposits may produce hazardous ground gases such as methane and carbon dioxide.	
Radon	Radon Class 1 - less than 1% of homes are estimated to be at or above the Action Level. No radon protection measures required.	
Unexploded Ordnance	Low risk UXO area - no further works required.	
PFAS	No potential current or historical sources of PFAS have been identified on site. No further risk assessment required.	
Hazardous Installations	No hazardous installations that could potentially prejudice the proposed construction of highly sensitive residential dwellings have been identified within influencing distance of the subject site.	



PREVIOUS REPORTS

The following previous reports have been completed:

-  Tupa, Penley Phase I Site Assessment, ref 17-510-R1, Dated March 2024

A full summary of findings is provided in section 1.5.

E3P GROUND INVESTIGATION

Ground Investigation Works	E3P has completed an intrusive ground investigation comprising:  10 x mechanically excavated trial pits,  6 x window sample boreholes,  Construction of environmental monitoring installations.
Ground Conditions	Made Ground – 0.00 m bgl to 0.50 m bgl Made Ground deposits were encountered within the south (TP105) and the south-east (WS101 and TP101) to depths of between 0.30 m and 0.50 m bgl although, in general, Made Ground was not encountered within any of the other exploratory hole locations. Deposits within TP105 are believed to be in the position of the former pond feature and comprise a reworked silty, sandy clay topsoil above brown sandy gravels of sandstone and brick with cobbles of whole brick identified within the matrix. Between 0.40 and 0.50 m bgl, an organic odour has been noted within the Made Ground deposits. WS101 and TP101 were advanced in the position of the former tennis courts in the south east and with a thin layer of tarmacadam (up to 0.05 m in thickness) overlying reworked sandy gravels of mudstone, sandstone and fragments of brick. Within TP101 between 0.05–0.20 m bgl black sandy gravel of ash and clinker has been identified. Topsoil – 0.00 m bgl to 0.50 m bgl Topsoil deposits have been encountered in the majority of locations with the exception of WS101, TP101 and TP105 between ground level and depths of 0.20 m bgl to a maximum of 0.50 m bgl (TP106). Topsoil encountered comprised predominantly dark brown silty sandy CLAY with the exception of TP102, where topsoil was encountered as dark brown clayey silty gravelly SAND, with fine gravels of sandstone. Drift – 0.20m bgl to 4.39 m bgl Drift deposits were encountered within all exploratory hole locations between 0.20 m bgl to a maximum proven depth of 4.39 m bgl within WS102. The drift deposits were generally consistent, comprising firm to very stiff brown slightly gravelly sandy CLAY with gravel of sandstone and mudstone. Within WS105 between 0.50–1.20 m bgl, firm light brown sandy CLAYs have been encountered.



Ground Conditions

Solid

No solid geology was encountered during this phase of intrusive investigation.

E3P has reviewed online records and there are no freely available borehole records within 200 m of the site boundary, thus the depth to bedrock on site is unknown.

Groundwater

Groundwater was encountered as seepages throughout site from depths between 0.30–1.00 m bgl.

Perched water strikes have been located on site during the investigation, these were typically associated with natural granular overlying cohesive which created a perched waterbody.

CONTAMINATED LAND ASSESSMENT

Initial Conceptual Site Model

Human Health

Source

- ✚ Made Ground historical development – heavy metals, PAH, TPH, ACM
- ✚ Made Ground infilled pond feature – heavy metals, PAH, TPH, S/VOC, ACM

Pathway

- ✚ Dermal contact and ingestion
- ✚ Vapour inhalation and dust inhalation.

Receptors

- ✚ Future site users
- ✚ Adjacent land users

Controlled Waters

Source

- ✚ Made Ground – heavy metals, PAH, TPH,

Pathway

- ✚ Vertical and lateral migration

Receptors

- ✚ Principal bedrock aquifer

Ground Gas

Source

- ✚ Made Ground
- ✚ Deposits associated with the former pond in the southern sector

Pathway

- ✚ Inhalation and accumulation

Receptors

- ✚ Future site users



Human Health	Limited non-volatile PAH impact has been identified within an isolated pocket of shallow ashy Made Ground deposits in TP101 in the position of the former tennis courts in the south east of the site. All of the identified elevated concentrations have primary exposure pathways related to dermal contact and ingestion of soils (PL2), inhalation of particulate (PL3) and consumption of homegrown vegetables (PL1). The risk to chronic human health associated with the elevated concentrations of non-volatile PAH compounds can be mitigated through the installation of a suitable cover system in areas where Made Ground deposits are present to remove any potential for direct exposure to impacted soils. The specific design and installation process for the appropriate cover systems will be clearly defined within the site remediation and enabling works strategy. Subsoil and Topsoil Chemical analysis of the topsoil deposits and the natural clay drift deposits across the site has identified these soils to be acceptable for use as subsoil within the proposed garden areas, however, further chemical validation samples may be required to meet regulatory sampling frequency.
Controlled Waters	The ICSM developed within the context of the site setting has identified that there is a limited pollutant pathway due to the presence of CLAY that offers protection to the underlying principal aquifer. The groundwater sampling undertaken by E3P has not recorded exceedances when compared to DWS values. However, leachate analysis has identified exceedances of Arsenic, Lead, Nickel, and Zinc within TP105 at 0.50 m bgl when compared to DWS values. The leachate assessment often overestimates the risk and soil analysis from the same sample has not identified an exceedance of chromium. Thus there is no observed source and the current risk to controlled waters is considered to be low.
Ground Gas	The ground gas monitoring undertaken as part of this investigation suggests that the site can be classified as Characteristic Situation (CS)1 – Very Low Gas Risk, however, the monitoring data is currently unreliable due to all monitoring wells being recorded as flooded due to the prolonged rain fall experienced across the UK throughout April 2024. Further monitoring will be required across the site to truly assess the ground gas regime. Due to ground water flooding that was present in the southern sector of the site during the intrusive works investigation, the true presence of the infilled pond in this area of the site has not been fully investigated. This feature has the potential for hazardous ground gases such as methane and carbon dioxide, thus further monitoring must be considered in this area of the site.
Potable Water Infrastructure	Based on the assessment of current site conditions it is unlikely that barrier pipe will be required at the proposed development.



COAL MINING ASSESSMENT

Coal Mining/Land Stability	The site is not located within a Coal Authority mining reporting area – Low risk from coal mining related hazards.
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GEOTECHNICAL ASSESSMENT

Underground Obstructions & Subterranean hazards	No obstructions identified during the intrusive site investigation. A large drain was present in the western sector, and it is likely that Made Ground and buried foundations will be present below the structures in the centre of the site.										
Allowable Bearing Capacity	The underlying cohesive CLAY deposits identified across the site between 0.20 m bgl and 4.39 m bgl have an allowable bearing capacity ranging from 135–462 kN/m ² for firm to very stiff gravelly and sandy CLAY.										
Foundation Options	Several foundation options should be considered for low-rise housing based on confirmed soil mechanics, cost, and construction feasibility. In this instance, it is thought that the following foundation options for low-rise housing: - Strip Foundations bearing on the stiff high strength clay; - Trench Fill foundations should be considered where the target bearing stratum is greater than 1.50m below the proposed level; In areas of the site where no infilled features are present it is not anticipated that abnormal foundations will be required onsite, however following further investigation into the infilled pond feature in the southern sector of the site and below the current structures in the centre of the site a re-assessment of the foundation solutions will be required. It is likely that in the position of the infilled pond feature abnormal/engineered foundations will be required onsite. Should significant Made Ground and soft clays be identified on site, that will be subject to volume change, an abnormal foundation solution (MTF, VSC, Pile) may be required. Intrusive site investigation will be required to determine the required foundation solution.										
Foundations Near Trees	Foundation depths within the conjectured influence of former, existing, or proposed trees will need to be deepened to ensure that structural loading bears within the underlying target founding stratum, which cannot be subject to volumetric instability associated with fluctuation in moisture content. An abnormal foundation solution (MTF, VSC, Pile) may be required.										
Heave Precautions Near Trees	The site is underlain by cohesive clay deposits to a maximum proven depth of 4.39 m bgl. An assessment of the volume change potential of the cohesive stratum will be required (not included within this scope of works). This assessment may indicate that heave precautions will be required at the site. The full extent of precautions will only be determined after further works. <table border="1"> <thead> <tr> <th>VOLUME CHANGE POTENTIAL</th><th>VOID DIMENSION AGAINST SIDE OF FOUNDATION AND GROUND BEAM</th><th>VOID DIMENSION UNDER GROUND BEAMS, AND SUSPENDED IN-SITU CONCRETE GROUND FLOOR</th><th>VOID DIMENSION UNDER SUSPENDED PRECAST CONCRETE AND TIMBER FLOORS⁽¹⁾</th></tr> </thead> <tbody> <tr> <td>High</td><td>35mm</td><td>150mm</td><td>300mm</td></tr> </tbody> </table>			VOLUME CHANGE POTENTIAL	VOID DIMENSION AGAINST SIDE OF FOUNDATION AND GROUND BEAM	VOID DIMENSION UNDER GROUND BEAMS, AND SUSPENDED IN-SITU CONCRETE GROUND FLOOR	VOID DIMENSION UNDER SUSPENDED PRECAST CONCRETE AND TIMBER FLOORS ⁽¹⁾	High	35mm	150mm	300mm
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High	35mm	150mm	300mm								



	Medium Low	25mm 0mm	100mm 50mm	250mm 200mm
Building Floor Slabs	Ground-bearing floor slabs are not considered viable given the anticipated depths of Made Ground > 600 mm and shallow cohesive soils.			
Soakaway Drainage	Due to the presence of low permeability cohesive drift deposits throughout site, soakaway drainage may not be suitable.			
Sulphate Assessment	Concrete classification will be DS1 AC1s.			
Highway & Infrastructure Construction	Unsuitable materials have been identified within the areas of the infilled ponds, where a proposed highway or infrastructure is to be constructed in these areas, remediation works will be required to ensure the site is engineered to a suitable geotechnical design specification.			
CBR Design %	Granular soils can be re-engineered to ensure 5% within the subgrade during favourable climatic conditions. Natural clay soils will provide a CBR in the order of 3–5% during drier climatic periods. However, if water is allowed to shed onto the formation, the CBR will reduce to < 2%, which will require specialist engineering of the subgrade.			
Enabling Earthworks	Development levels are unknown at this time; however, it is not likely that significant cut-and-fill works will be required to prepare the development platform. As part of the earthworks design, materials should be assessed and characterised prior to re-use in the construction of upfill to a geotechnical design. All future earthworks should be completed in accordance with a Geotechnical Design Report (GDR) that will consider the ground model within the context of the potential for settlement induced by surcharge from earthworks, dynamic and permanent loading of the development and all known hazards.			
Civil Engineering Excavations	The E3P Intrusive Ground Investigation has not identified the presence of weathered/competent bedrock at a shallow depth. The sides of the exploratory trial pit excavations appeared to be generally stable during excavation. The natural strata were excavated with relative ease. Minor water ingress was noted upon the excavation of trial pits across the site due to perched water strikes within shallow granular deposits. Excavations may require localised dewatering/sump pumping during the construction of site drainage infrastructure.			
Waste Characterisation	Any material that is to be disposed off-site should undergo assessment using Technical Guidance WM3: <i>Waste Classification – Guidance on the classification and assessment of waste</i> . This can be done upon request and in line with the Environment Agency sampling frequencies.			



RECOMMENDATIONS

Based on the findings of the Geoenvironmental site assessment and the various conclusions drawn, the following additional works are recommended to be completed in due course:

- 🔧 Further investigation
 - With a detailed investigation into the presence and extents of the infilled pond in the southern sector.
 - Detailed geotechnical laboratory testing to classify the underlying stratum.
 - Following the removal of all structures across the site further investigation below these features will be required.
- 🔧 Plot-specific foundation schedule (upon receipt of the final development levels).
- 🔧 Arboricultural survey.
- 🔧 Geotechnical Earthworks Strategy (infrastructure).
- 🔧 Remediation and enabling works strategy.



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DRAWING LIST

17-510-R2-001 - Site Location Plan
 17-510-R2-002 - Proposed Development Plan
 17-510-R2-003 - Historical Features Plan
 17-510-R2-004 - Site Features Plan
 17-510-R2-006 - Exploratory Hole Location Plan
 17-510-R2-007 - Depth of Topsoil Plan
 17-510-R2-010 - Depth to Founding Strata Plan
 17-510-R2-011 - Development Constraints Plan
 17-510-R2-013 - Conceptual Site Model
 17-510-R2-016a/b - Cross Sections



1. INTRODUCTION

1.1. BACKGROUND

Fisher German LLP have commissioned E3P on behalf of their client (the landowner) to undertake a Phase II Geoenvironmental Site Assessment at Land off Penley Hall Drive, Penley, Wrexham, LL13 0JP.

This report is required to determine potential contaminated land liabilities, remediation requirements and geotechnical engineering works that will be required as part of the proposed development for a low-rise residential development.

1.2. PROPOSED DEVELOPMENT

The landowner intends to construct a 9 unit low-rise residential development associated gardens, estate roads and infrastructure. Drawing 17-510-R1-002 (APPENDIX IV) identifies the proposed development layout.

A snapshot of the proposed development layout is indicated in Figure 1.

Figure 1 Snapshot of Proposed Development





1.3. OBJECTIVES AND SCOPE

The objectives of the geoenvironmental investigation are as follows:

- ✿ Review historical plans, geology, hydrogeology, site sensitivity, floodplain issues, mining records and any local authority information available to complete a desk study in line with Environment Agency (EA) document Land Contamination: Risk Management (LCRM) (updated June 2023).
- ✿ Undertake a phase of sampling and analysis to provide an overview of the environmental issues identified.
- ✿ Assess the implications of any potential environmental risks, liabilities and development constraints associated with the site concerning the site's future use and off-site receptors.
- ✿ Assess the geotechnical information and provide recommendations concerning foundations, pavement construction and floor slabs. and,
- ✿ Provide recommendations regarding future works required.

1.4. SCOPE OF WORKS

The scope of works includes the elements included in Table 1.

Table 1 Scope of Works

GROUND INVESTIGATION
✿ Design of suitable ground investigation
✿ Window sample probeholes with the construction of environmental monitoring installations
✿ Mechanically excavated trial pits
✿ Soil and groundwater sampling
TESTING AND MONITORING
✿ In-situ geotechnical testing
✿ Chemical analysis
✿ Groundwater monitoring
✿ Ground gas monitoring
ASSESSMENT AND REPORTING
✿ Factual and interpretative reporting
✿ Contamination risk assessment and conceptual site model
✿ Geotechnical assessment and interpretation



1.5. PREVIOUS REPORTS

The following previous site investigation reports have been provided to E3P for review:

Table 2 Previous Reports

AUTHOR	TITLE / REFERENCE	CLIENT	DATE
E3P	17-510-R1 – Tupa, Penley Phase I Site Assessment	Fisher German LLP	March 2024

The key findings of the previous Phase I GSA are summarised below, and this information and data has been used to design and implement the intrusive works laid out in this Phase II assessment.

SITE HISTORY

A review of the relevant historical Ordnance Survey maps circa 1873 shows that the site comprised undeveloped land that formed part of the wider Penley Hall estate. Several trees are noted across the site and a pond is noted in the southern sector of the site. The pond is an elongated water body that extends off the southern boundary to the east.

By 1954, the large pond located in the southern sector of the site had been infilled and was no longer mapped. During this time period several small rectangular structures have been constructed, along with the construction of roads and footpaths in the west of the site. These are believed to form part of a Polish Hospital that is mapped to the west of the site.

Through to the 1990's, buildings across the site have been constructed and then subsequently removed, along with a tennis court in the south eastern sector.

During the early 2000's through to the present day, the site has been left abandoned and become heavily overgrown.

According to online records, the site was previously used as one of three Polish Military Hospitals located in Penley.

The site was constructed as a United States Army hospital during the Second World War and founded in 1946. The site was built to care for Polish ex-servicemen who fought alongside the Allies during the war. At the peak, during the early 1950's the hospital cared for and housed 2000 patients and staff. The hospital was transferred to the NHS and run and managed by North East Wales NHS Trust, closing in 2002.

SITE SENSITIVITY

The site is underlain by a secondary undifferentiated drift and a principal bedrock aquifer. With the presence of semi to low-permeable drift deposits beneath the site, the area is classed as low to moderately sensitive. The site is situated with residential properties adjacent to the southern boundary.

CONTAMINATED LAND ASSESSMENT

Human Health

Made Ground associated with infilled features and historical developments may be present across the site. This Made Ground is a potential source of heavy metals, Polycyclic Aromatic Hydrocarbons (PAHs), Asbestos, Ground gas and VOCs associated with pesticides.



Construction workers and site end users may encounter potential contamination via dermal contact and ingestion, consumption of homegrown produce, inhalation of particulate and inhalation of gas.

Controlled Waters

The site is likely underlain by low-permeability clay that will afford protection to the underlying principal aquifer. However, while clay soil will mitigate sub-surface migration of potential contaminants, a construction water management plan will be required to protect ponds and ditches during construction works from both impacted soil and perched groundwater and from suspended solids.

Ground Gas

No Radon sites (current or historic) are located within 250 m of the site. The site has undergone some ground working with Made Ground and potential organic-rich deposits, particularly in the southern sector in the position of the former pond feature, that may produce hazardous ground gases such as methane and carbon dioxide.

COAL MINING RISK ASSESSMENT

The site is not located within a Coal Authority mining reporting area – Low risk from coal mining related hazards.

GEOTECHNICAL ASSESSMENT

Limited Made Ground fill deposits and obstructions are anticipated. Existing buildings will require demolition, with all relict foundations grubbing out before the proposed development's construction.

A historical infilled pond is located in the south of the site, which is a potential source of alluvial deposits, silts and possible organic peat deposits, and potential depths of Made Ground.

Further assessment of the site will be required to determine to presence of any infilled ponds and hedges and to assess the underlying Glacial Till (clay) for effects related to moisture variation due to trees.

Given the entire site is underlain by Glacial Till, soakaway drainage is unlikely to be feasible.

Abnormal foundations may be required in areas of soft clay and where deeper Made Ground is present. Deeper foundations may also be needed in areas of tree influence.

1.6. LIMITATIONS

The limitations of this report are presented in APPENDIX I.

1.7. RISK CLASSIFICATION

The description of risk classification and the likely action required as set out in CIRIA C552 are included in APPENDIX III.

1.8. CONFIDENTIALITY

E3P has prepared this report solely for the use of the client and those parties with whom a warranty agreement has been executed or with whom an assignment has been agreed. Should any third party wish to use or rely upon the report's contents, written approval must be sought from E3P; a charge may be levied against such consent.



2. E3P GROUND INVESTIGATION

2.1. GENERAL OVERVIEW

A ground investigation has been designed based on the findings of the desk study, with exploratory holes advanced to target specific potential contaminant sources. The investigation has also been used to collect geotechnical information to assist in the design and construction of the proposed development.

Exploratory fieldwork was completed on 20th March 2024. The works are summarised in Table 3.

2.2. LIMITATIONS OF THE INVESTIGATION

Multiple areas across site were heavily saturated/waterlogged and restricted plant access particularly in the southern sector.

An area of hardstanding containing unknown services, in the form of several manholes, was present in the western sector, where an exclusion zone was implemented during investigation works.

In the north-east corner, dense vegetation was present, which restricted the access and the investigation in this area of the site was limited. It should be noted that there are no planned development works in this sector of the site.

2.3. SCOPE OF INVESTIGATION

A summary of the fieldwork completed are included in Table 3.

Table 3 Summary of Fieldwork

POTENTIAL SOURCE/RATIONALE	LOCATION HOLE	TYPE	MAXIMUM DEPTH (M BGL)	MONITORING WELLS RESPONSE ZONE (M BGL)
Former Tennis Court (South-East)	WS101	Window Sample Borehole	4.31	1.0–4.0
	TP101	Trial Pit	1.50	N/A
General Ground Conditions Including the Presence/Nature of Obstructions	WS102	Window Sample Borehole	4.39	1.0–4.0
	WS103		3.39	1.0–3.0
	WS105		3.43	1.0–3.0
	WS106		3.42	1.0–3.0
	TP102	Trial Pit	2.10	N/A
	TP106		2.10	
	TP107		1.80	
	TP108		2.00	
	TP109		1.90	
	TP110		2.00	
Infilled Pond (South)	WS104	Window Sample Borehole	3.43	1.00–3.00
	TP103	Trial Pit	1.90	N/A
	TP104		2.00	
	TP105		1.90	



Mechanically excavated trial pits were advanced to investigate ground conditions and to retrieve environmental samples, spatially distributed to offer the maximum site coverage whilst also being advanced to target specific contaminant sources.

Window sample probeholes were advanced to undertake in-situ detailed geotechnical testing, obtain environmental samples and install groundwater and ground gas monitoring wells.

The sampling locations are illustrated in Drawing 17-510-R2-005 (APPENDIX IV). The ground conditions encountered are indicated on the logs, which are provided in APPENDIX VII.

The locations were recorded using hand-held GPS and what3words to an accuracy of 3 metres.

Return visits were made to monitor installations for groundwater level and gas concentrations. In addition, selected wells were purged, and samples of groundwater recovered for chemical analysis.

2.4. IN-SITU STANDARD PENETRATION TESTING (SPT)

In-situ geotechnical testing was conducted using the standard penetration test (SPT) and, where the ground is granular, a 60° cone (SPT(C)) was used instead of the sampling tube. The results are shown in the probehole logs in APPENDIX IV, presented in Table 20 and discussed in Section 12.0.

2.5. LABORATORY ANALYSIS

Selected soil samples were submitted for a range of chemical analysis, summarised in Table 4.

No geotechnical testing laboratory testing was requested by the client.

Table 4 Summary of Laboratory Analysis
CHEMICAL ANALYSIS

-  Metals
-  pH, total sulphate, water-soluble sulphate (2:1 extract)
-  Sulphide
-  Cyanide
-  Phenols
-  Total and speciated polycyclic aromatic hydrocarbons (PAHs)
-  Asbestos identification and quantification
-  Speciated and banded total petroleum hydrocarbons (TPHs)
-  Total Organic Carbon (TOC)
-  Leachate analysis

Chemical analysis has been undertaken by an accredited laboratory with the testing results summarised and discussed in Section 4 and the testing certificates included in APPENDIX VIII.



3. GROUND AND GROUNDWATER CONDITIONS

3.1. SUMMARY OF GROUND CONDITIONS

The ground investigation generally confirms the published geology and identifies the strata set out in Table 5.

Table 5 Summary of Strata

HOLE	DEPTH TO STRATUM (M BGL)				
	MADE GROUND	TOPSOIL	SAND	Sandy CLAY	Slightly gravelly, sandy CLAY
WS101	0.00–0.30	—	0.30–0.60	—	0.60–4.31
WS102	—	0.00–0.30	0.30–1.10	—	1.10–4.39
WS103	—	0.00–0.20	0.20–0.40	—	0.40–3.39
WS104	—	0.00–0.30	0.30–0.70	—	0.70–3.43
WS105	—	0.00–0.20	—	—	0.20–3.43
WS106	—	0.00–0.30	0.30–0.50	0.50–1.20	1.20–3.42
TP101	0.00–0.30	—	—	—	0.30–1.50
TP102	—	0.00–0.30	0.30–0.70	—	0.70–2.10
TP103	—	0.00–0.40	—	—	0.40–1.90
TP104	—	0.00–0.30	—	—	0.30–2.00
TP105	0.00–0.50	—	0.50–1.00	—	1.00–1.90
TP106	—	0.00–0.50	0.50–0.60	—	0.60–2.10
TP107	—	0.00–0.40	0.40–0.60	—	0.60–1.80
TP108	—	0.00–0.30	0.30–0.60	—	0.60–2.00
TP109	—	0.00–0.30	—	—	0.30–1.90
TP110	—	0.00–0.30	0.30–0.40	—	0.40–2.00

3.2. MADE GROUND

Made Ground deposits were encountered within the south (TP105) and the south-east (WS101 and TP101) to depths of between 0.30 m and 0.50 m bgl although, in general, Made Ground was not encountered within any of the other exploratory hole locations.

Deposits within TP105 are believed to be in the position of the former pond feature and comprise reworked silty, sandy clay topsoil above brown sandy gravel of sandstone and brick with cobbles of whole brick identified within the matrix. Between 0.40–0.50 m bgl an organic odour has been noted within the Made Ground deposits.

WS101 and TP101 were advanced in the position of the former tennis courts in the south-east of the site and with a thin layer of tarmacadam (up to 0.05 m in thickness) overlying reworked sandy gravels of mudstone, sandstone and fragments of brick. Within TP101 between 0.05–0.20 m bgl black sandy gravel of ash and clinker has been identified.

3.3. TOPSOIL

Topsoil deposits have been encountered in most locations with the exception of WS101, TP101 and TP105 between ground level and depths of 0.20 m bgl to a maximum of 0.50 m bgl (TP106).

Topsoil encountered comprised predominantly dark brown silty sandy CLAY except for TP102, where topsoil was encountered as dark brown clayey silty gravelly SAND, with fine gravels of sandstone.



3.4. DRIFT DEPOSITS

Drift deposits were encountered within all exploratory hole locations across the site between 0.20 m bgl to a maximum proven depth of 4.39 m bgl within WS102.

The drift deposits across the site were generally consistent, comprising of firm to very stiff brown slightly gravelly sandy CLAY with gravel of sandstone and mudstone. Within WS105 between 0.50–1.20 m bgl firm light brown sandy CLAYs have been encountered.

3.5. SOLID GEOLOGY

No solid geology was encountered during this phase of intrusive investigation.

E3P has reviewed online records and there are no freely available borehole records within 200 m of the site boundary, thus the depth to bedrock on site is unknown.

3.6. GROUNDWATER

Groundwater strikes were encountered as seepages. The depth of the seepages are shown on the exploratory hole records in APPENDIX VII and are summarised in Table 6.

Table 6 Summary of Groundwater Strikes

LOCATION	DEPTH TO STRIKE (M)	NOTES
TP101	0.30	Moderate ingress
TP102	0.70	Slow ingress
TP103	0.40	Slow ingress
TP104	0.30	Slow ingress
TP105	1.00	Slow ingress
TP107	0.60	Slow ingress
TP108	0.60	Slow ingress
TP109	0.30	Slow ingress
TP110	0.40	Slow ingress
WS101	0.70	Strike within borehole

3.7. VISUAL AND OLFACTORY EVIDENCE OF CONTAMINATION

Visual and olfactory evidence of potential contamination has been identified during the site investigation and these are summarised in Table 7.

Table 7 Summary of Visual and Olfactory Evidence of Contamination

LOCATION	DEPTH (M)	STRATUM	NOTES
TP101	0.05–0.20	Made Ground	Ash and clinker
TP105	0.40–0.50	Made Ground	Organic odour

3.8. OBSTRUCTIONS

No obstructions identified during the intrusive site investigation. A large drain was present in the western sector, and it is likely that Made Ground and buried foundations will be present below the structures in the centre of the site.



3.9. GEOLOGICAL CROSS SECTION

A geological cross section is included in APPENDIX IV as Drawing 17-510-016a/b, and a snapshot is shown below in Figure 2 and Figure 3.

Figure 2 Geological Cross Section (North-South)

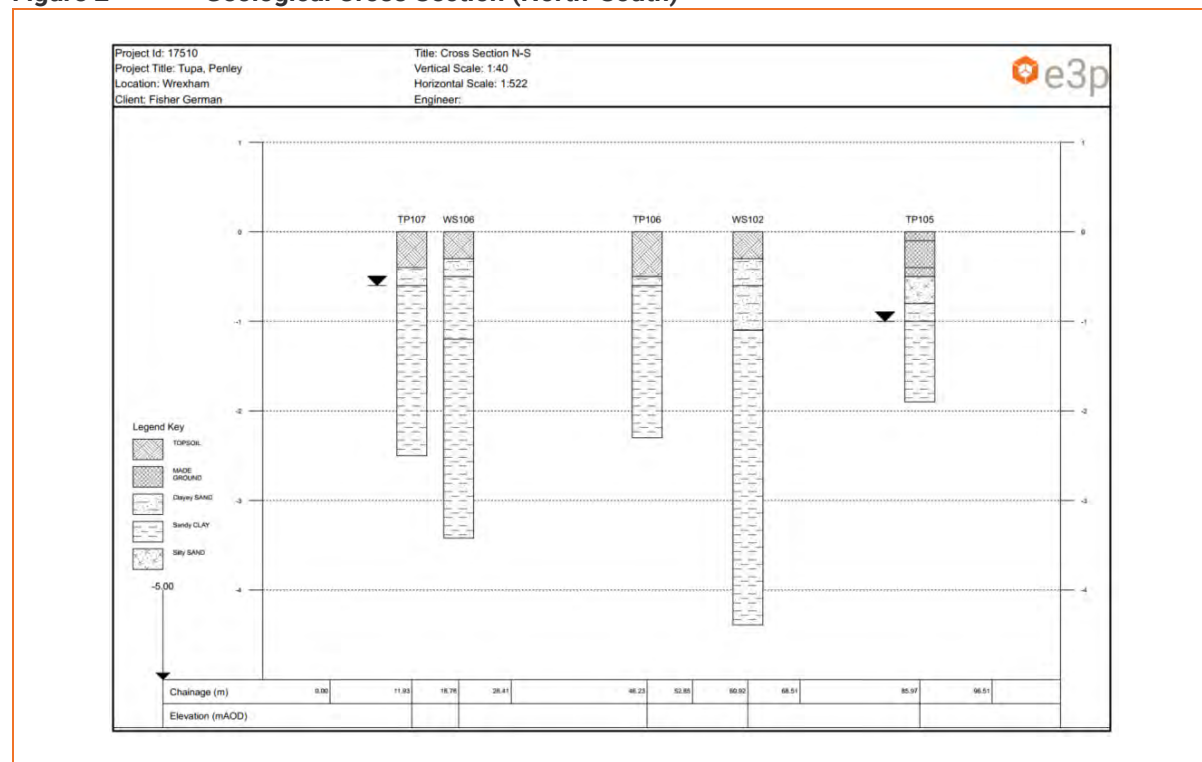
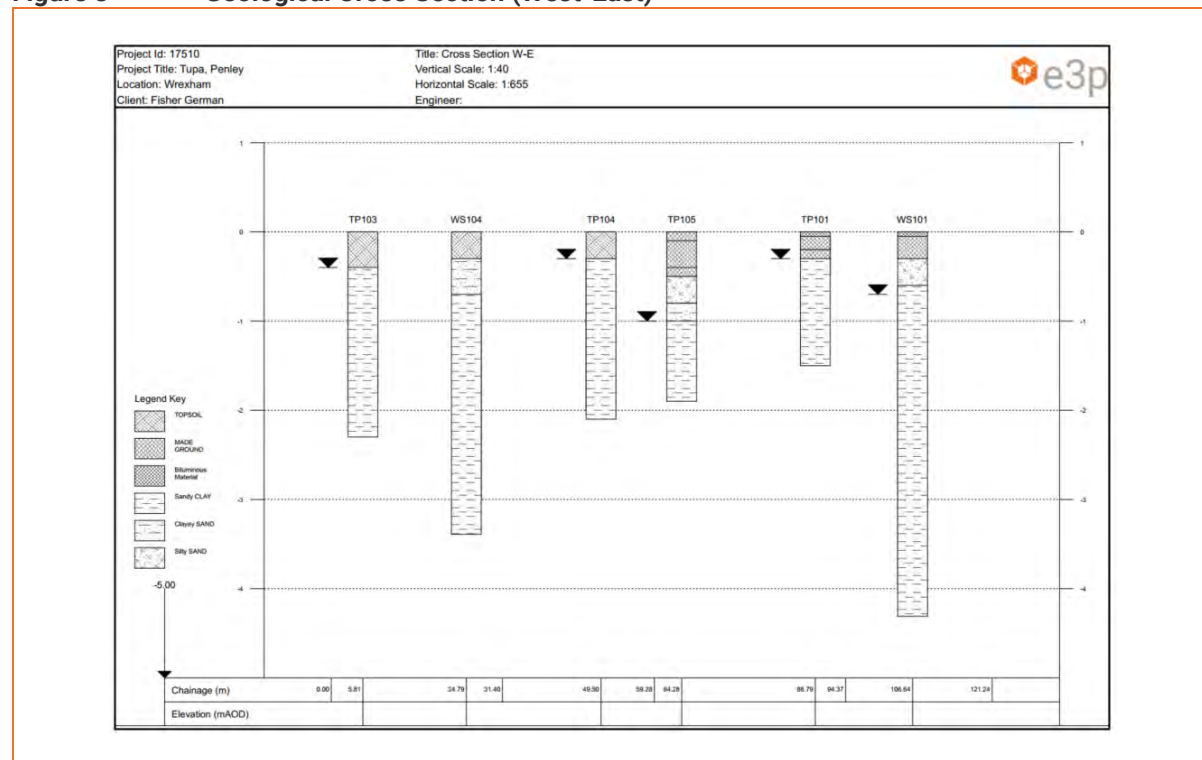


Figure 3 Geological Cross Section (West-East)





4. TIER 2 QUALITATIVE CONTAMINATED LAND RISK ASSESSMENT

E3P has undertaken a Tier 2 qualitative land risk assessment with respect to human health, controlled waters and ground gas to determine if any potential contaminants within the underlying soils and groundwater pose an unacceptable level of risk to the identified receptors.

4.1. DEVIATING SAMPLES

Best practice sampling procedures including the use of appropriate sampling containers and adhering to the laboratory holding times for each contaminant analysis, were undertaken in order to avoid samples being deviating.

4.2. SAMPLE ANALYSIS POPULATION

Table 8 summarises the chemical analysis testing scheduled.

Table 8 Summary of Testing Schedule

TYPE OF SAMPLE	NO. OF SAMPLES	DETERMINANDS
Made Ground	3	Metals, pH, total sulphate, water-soluble sulphate (2:1 extract), Sulphide, Cyanide, Phenols, Total and speciated polycyclic aromatic hydrocarbons (PAHs), Asbestos identification and quantification, Speciated and banded total petroleum hydrocarbons (TPHs), Total Organic Carbon (TOC)
	1	Leachate analysis
Topsoil	4	Metals, pH, total sulphate, water-soluble sulphate (2:1 extract), Sulphide, Cyanide, Phenols, Total and speciated polycyclic aromatic hydrocarbons (PAHs), Asbestos identification and quantification, Speciated and banded total petroleum hydrocarbons (TPHs), Total Organic Carbon (TOC)
Natural CLAY	10	Metals, pH, total sulphate, water-soluble sulphate (2:1 extract), Sulphide, Cyanide, Phenols, Total and speciated polycyclic aromatic hydrocarbons (PAHs), Speciated and banded total petroleum hydrocarbons (TPHs), Total Organic Carbon (TOC)
Natural SAND	4	Metals, pH, total sulphate, water-soluble sulphate (2:1 extract), Sulphide, Cyanide, Phenols, Total and speciated polycyclic aromatic hydrocarbons (PAHs), Speciated and banded total petroleum hydrocarbons (TPHs), Total Organic Carbon (TOC)

4.3. HUMAN HEALTH RISK ASSESSMENT

At Tier 2 stage, the long term (chronic) human health toxicity of the soil has been assessed by comparing the on-site concentrations of organic and inorganic compounds with reference values published in LQM/CIEH S4UL (S4UL3267).

Where Tier 2 screening values are not provided by LQM, other screening values have been used and these are referenced in Table 9.



The Tier 2 screening values for residential with plant uptake have been utilised for this assessment due to the proposed development being a residential end use. To remain conservative at an early stage, the screening values based on a 1% SOM have been utilised for this assessment.

The results of the comparison have been summarised in Table 9.

Table 9 Summary of Inorganic and Hydrocarbon Toxicity Assessment for a Residential End Use (with plant uptake)

DETERMINANT	UNIT	GAC	N	MC	LOC. OF EX	PL	ASSESSMENT
Arsenic	mg/kg	37	21	16	N/A	1	No Further Action
Cadmium	mg/kg	11	21	0.6	N/A	1	No Further Action
Chromium (VI)	mg/kg	6.0	21	<0.5	N/A	1	No Further Action
Lead	mg/kg	200**	21	63	N/A	1	No Further Action
Mercury	mg/kg	1.2	21	0.2	N/A	2	No Further Action
Nickel	mg/kg	130	21	76	N/A	1	No Further Action
Selenium	mg/kg	250	21	4.1	N/A	1	No Further Action
Copper	mg/kg	2400	21	50	N/A	1	No Further Action
Zinc	mg/kg	3700	21	120	N/A	1	No Further Action
Cyanide – Total	mg/kg	791	21	<0.5	N/A	1	No Further Action
Phenols – Total	mg/kg	120	21	<0.1	N/A	1	No Further Action
Asbestos	Fibres	NFD	12	-	N/A	4	No Further Action
Naphthalene	mg/kg	2.3	21	0.14	N/A	3	No Further Action
Acenaphthylene	mg/kg	170	21	<0.1	N/A	2	No Further Action
Acenaphthene	mg/kg	210	21	<0.1	N/A	1	No Further Action
Fluorene	mg/kg	170	21	<0.1	N/A	1	No Further Action
Phenanthrene	mg/kg	95	21	6	N/A	2	No Further Action
Anthracene	mg/kg	2400	21	2.2	N/A	2	No Further Action
Fluoranthene	mg/kg	280	21	24	N/A	2	No Further Action
Pyrene	mg/kg	620	21	21	N/A	2	No Further Action
Benzo(a)Anthracene	mg/kg	7.2	21	13	TP101 – 0.10 m	2	Further Action
Chrysene	mg/kg	15	21	11	N/A	2	No Further Action
Benzo(b)Fluoranthene	mg/kg	2.6	21	18	TP101 – 0.10 m	2	Further Action
Benzo(k)Fluoranthene	mg/kg	77	21	6.5	N/A	2	No Further Action
Benzo(a)Pyrene	mg/kg	2.2	21	15	TP101 – 0.10 m	2	Further Action
Indeno(123-cd)Pyrene	mg/kg	27	21	11	N/A	2	No Further Action
Dibenzo(a,h)Anthracene	mg/kg	0.24	21	1.7	TP101 – 0.10 m	2	Further Action
Benzo(ghi)Perylene	mg/kg	320	21	8.4	N/A	2	No Further Action
TPH C5-C6 (aliphatic)*	mg/kg	42	21	1	N/A	3	No Further Action
TPH C6-C8 (aliphatic)*	mg/kg	100	21	1	N/A	3	No Further Action
TPH C8-C10 (aliphatic)*	mg/kg	27	21	1	N/A	3	No Further Action
TPH C10-C12 (aromatic)*	mg/kg	74	21	15	N/A	3	No Further Action
TPH C12-C16 (aromatic)*	mg/kg	140	21	60	N/A	3	No Further Action
TPH C16-C21 (aromatic)*	mg/kg	260	21	77	N/A	1	No Further Action
TPH C21-C35 (aromatic)*	mg/kg	1100	21	180	N/A	1	No Further Action

Notes

PL1 = soil ingestion, PL2 = dermal contact and ingestion, PL3 = dust inhalation; PL4 = Vapour/Gas Inhalation

Abbreviations: GAC = general assessment criteria, N = number of samples, MC = maximum concentration; Loc of Ex = location of exceedance; PL = Contaminant Pathway; NFD = no fibres detected.

The pathway noted in the table is the primary pathway, however it may not be the only pathway of that contaminant

* The Tier 2 GAC for the hydrocarbon fraction is derived from the CIEH assessment for petroleum hydrocarbons Criteria Working Group (CWG) for both aliphatic and aromatic compounds. E3P has utilised the Tier 2 values for aliphatic compounds for the volatile and semi volatile fractions (C5-C12) and the Tier 2 values for aromatic compound for the non-volatile fractions (C12-C35). The comparison of a total (aliphatic/aromatic) compounds to an individual fraction is considered to be a conservative approach and satisfactory for the protection of human health.

** Tier 2 GAC for lead taken from C4SL CL:AIRE



Referring to Table 9, the result of this direct comparison indicates that the data exceeds the screening criteria for a residential end use for the following contaminants:

Organics

-  Benzo(a)Anthracene
-  Benzo(b)Fluoranthene
-  Benzo(a)Pyrene
-  Dibenzo(a,h)Anthracene

All exceedances have been identified within shallow ashy Made Ground deposits in TP101 in the position of the former tennis courts in the south east.

4.3.1. EXPOSURE PATHWAYS

The main exposure pathways based on the Tier 2 exceedances are:

-  Soil ingestion (PL1);
-  Dermal contact and ingestion (PL2); and
-  Consumption of homegrown vegetables (PL1).

4.3.2. HUMAN HEALTH RISK ASSESSMENT AND MITIGATION

Non-volatile PAH

All of the identified elevated concentrations have primary exposure pathways related to dermal contact and ingestion of soils (PL2), and consumption of homegrown vegetables (PL1). The risk to chronic human health associated with the elevated concentrations of non-volatile PAH compounds can be mitigated through the installation of a suitable cover system in areas where Made Ground deposits are present to remove any potential for direct exposure to impacted soils.

The specific design and installation process for the appropriate cover systems will be clearly defined within the site remediation and enabling works strategy.

Subsoil and Topsoil

Chemical analysis of the topsoil deposits and the natural clay drift deposits across the site has identified these soils to be acceptable for use as subsoil within the proposed garden areas, however, further chemical validation samples may be required to meet regulatory sampling frequency.



4.4. CONTROLLED WATERS RISK ASSESSMENT

E3P has undertaken a controlled waters risk assessment for the site based on the consideration of the conceptual site model and the sensitive receptors which are summarised in Table 10.

Table 10 Controlled Waters Conceptual Model and Sensitivity Profile

DISCUSSION		SENSITIVITY RATING
Contaminant Source		
Made Ground Limited PAH contamination has been encountered within an isolated pocket of ashy Made Ground within TP101 in the position of the former tennis courts in the southeast of the site.		Low
Pathway		
Vertical Migration Vertical migration of potential mobile contamination is limited due to cohesive deposits underlying the site, thus offering protection to the principal bedrock aquifer.		Low
Lateral migration Lateral migration of potential contaminants through granular deposits is considered to be limited, but possible due to the presence of isolated granular deposits, however protection is offered due to interbedded cohesive deposits across the site.		Low
Receptor		
Aquifer Classification in Superficial Drift Deposits	Secondary Undifferentiated Aquifer	Medium
Aquifer Classification in Bedrock	Principal Aquifer	High
Groundwater Source Protection Zone or Drinking Water Safeguard Zone	The site is not affected.	Low
Distance to the Closest Groundwater Abstraction Point	No groundwater/potable abstractions within 1 km of the Site.	Low
Is the Site Located Within 50 m of a Surface Watercourse?	A pond is located roughly 25 m to the north east of the site boundary, however there were no surface water courses noted within 50 m of the site boundary.	Low/Moderate

The ICSM developed within the context of the site setting has identified that there is a limit pollutant pathway due to the presence of cohesive CLAYs that offer protection to the underlying principal bedrock aquifer.

The Tier 2 assessment in line with LCRM (2023) has included a comparison of leachate analysis from samples of the Made Ground and groundwater samples to drinking water standards (DWS).

Water samples were obtained utilising a bailer.

These are presented in Table 11.



Table 11 Comparison of Groundwater and Leachate Analysis with Tier 2 Screening Levels

DETERMINAND	UNIT	EQS ^{1,2}	DWS _{3,4}	NO. OF GW SAMPLES	MAX CONC. IN GROUNDWATER	LOCATION OF EXCEEDANCE	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA								
Arsenic	µg/l	50	10	2	1.6	–	1	26	TP105 – 0.40 m	Further Action
Cadmium	µg/l	0.08-0.25	5	2	<0.11	–	1	0.2	–	No Further Action
Chromium (VI)	µg/l	3.4	–	–	–	–	1	<20	–	No Further Action
Chromium (III)	µg/l	4.7	50	2	0.95	–	1	27	–	No Further Action
Copper	µg/l	1	2000	2	4.9	–	1	8.4	–	No Further Action
Total Cyanide	µg/l	1	50	2	<0.05	–	1	<0.005	–	No Further Action
Lead	µg/l	1.2	10	2	<0.5	–	1	13	TP105 – 0.40 m	Further Action
Mercury	µg/l	–	1.0	2	<0.05	–	1	0.06	–	No Further Action
Nickel	µg/l	4	20	2	5.8	–	1	22	TP105 – 0.40 m	Further Action
Selenium	µg/l	–	10	2	1.2	–	1	43	TP105 – 0.40 m	Further Action
Zinc	µg/l	10.9	–	2	67	–	1	180	–	No Further Action
pH	6–9			2	6.8–7.9	–	1	6.5	–	No Further Action
Polycyclic Aromatic Hydrocarbons										
Naphthalene	µg/l	2	10*	2	<0.5	–	1	<0.01	–	No Further Action
Anthracene	µg/l	0.1	10*	2	<0.5	–	1	<0.01	–	No Further Action
Benzo[b]fluoranthene	µg/l	0.00017*	10*	2	<0.5	–	1	<0.01	–	No Further Action
Benzo[k]fluoranthene	µg/l	0.00017*	10*	2	<0.5	–	1	<0.01	–	No Further Action
Benzo(a)pyrene	µg/l	0.00017*	10*	2	<0.5	–	1	<0.01	–	No Further Action
Indeno(123-cd)pyrene	µg/l	0.00017*	10*	2	<0.5	–	1	<0.01	–	No Further Action
Fluoranthene	µg/l	0.0063	10*	2	<0.5	–	1	<0.01	–	No Further Action
Benzo(ghi)perylene	µg/l	1.7–4	10*	2	<0.5	–	1	<0.01	–	No Further Action
Aromatic Hydrocarbon										
TPH C5-C7 (benzene)	µg/l	10	1	2	<0.1	–	1	<0.1	–	No Further Action
TPH C7-C8 (toluene)	µg/l	74	700	2	<0.1	–	1	<0.1	–	No Further Action
TPH C8-C10 (xylene)	µg/l	30	300	2	<0.1	–	1	<0.1	–	No Further Action
TPH C10-C12 (naphthalene)	µg/l	2	90	2	<0.1	–	1	<0.1	–	No Further Action
TPH C12-C16	µg/l	–	90	2	<0.1	–	1	<0.1	–	No Further Action
TPH C16-C35	µg/l	–	90	2	<0.1	–	1	<0.1	–	No Further Action
Aliphatic Hydrocarbon										
TPH C5-C6	µg/l	–	1000 ⁵	2	<0.1	–	1	<0.1	–	No Further Action
TPH C6-C8	µg/l	–	1000 ⁵	2	<0.1	–	1	<0.1	–	No Further Action



DETERMINAND	UNIT	EQS ^{1, 2}	DWS _{3,4}	NO. OF GW SAMPLES	MAX CONC. IN GROUNDWATER	LOCATION OF EXCEEDANCE	NO. OF LEACHATE SAMPLES	MAX CONC. IN LEACHATE	LOCATION OF EXCEEDANCE	ASSESSMENT
		AA								
TPH C8-C10	µg/l	–	300	2	<0.1	–	1	<0.1	–	No Further Action
TPH C10-C12	µg/l	–	300	2	<0.1	–	1	<0.1	–	No Further Action
TPH C12-C16	µg/l	–	300	2	<0.1	–	1	<0.1	–	No Further Action
TPH C16-C21	µg/l	–	300**	2	<0.1	–	1	<0.1	–	No Further Action
TPH C21-C35	µg/l	–	300**	2	<0.1	–	1	<0.1	–	No Further Action

Notes

Solubility <0.01µg/l

AA – Annual Average

* Polyaromatic hydrocarbons (PAH) - Benzo(a)pyrene (BaP), Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(g,h,i)-perylene and Indeno(1,2,3-cd)-pyrene. Benzo(a)pyrene can be considered as a marker for the other PAHs, hence only benzo(a)pyrene needs to be monitored for comparison with the biota EQS or the corresponding AA-EQS in water

** There are no WHO Guideline Values for aliphatic fractions C16-C21 and C21-C35, therefore the guideline value for aliphatic fractions inclusive of C8-C16 (300µg/l) has been applied.

1. The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 (legislation.gov.uk)
2. The Water Supply (Water Quality) Regulations 2018 (legislation.gov.uk)
3. Guidelines for drinking-water quality, 4th edition, incorporating the 1st addendum (who.int)
4. CL:AIRE publishes Petroleum Hydrocarbons in Groundwater guidance (claire.co.uk)
5. A total TPH criteria of 1000 mg/kg will act as a surrogate criterion for remaining aliphatic and aromatic TPH fractions.



4.4.1. CONTROLLED WATER RISK ASSESSMENT AND MITIGATION

This comparison indicates that the data exceeds the DWS values for the following inorganic compound:

-  Arsenic – Leachate.
-  Lead – Leachate.
-  Nickel – Leachate.
-  Zinc – Leachate.

It should be noted that no exceedances of the DWS values have been noted as part of the groundwater sampling.

The leachate test is aggressive (de-ionised water) and is not in aqueous equilibrium (steady state) within the solid sample. This may cause rapid dissolution and overestimation of the aqueous phase concentrations compared to groundwater in contact with contaminated soils.

4.4.2. DISCUSSION OF CONTROLLED WATERS RISK ASSESSMENT

Historically, the site has been subject to limited historical development. As a result, limited Made Ground deposits have been encountered in isolated areas of the site. As part of these Made Ground deposits, chemical compounds that are potentially present within the matrix may have subsequently leached into the underlying ground and contaminated groundwater both within the Made Ground and natural drift deposits.

Several exceedances of heavy metals have been identified in a leachate sample taken from TP105 at 0.50 m bgl, where Arsenic, Lead, Nickel, and Zinc have been identified above the DWS value. The leachate analysis can often overestimate the risk due to the testing method. It should be noted that soil analysis on the same sample has not identified any heavy metal exceedances. As such the exceedance is identified to be a low risk as there is no identified source of the elevated readings.

The site is mainly underlain by cohesive low permeability CLAY; this in turn will reduce the potential for downward and lateral migration. Consequently, the controlled water receptor (principal aquifer) is deemed to be at a low risk from on-site contamination.

The proposed development will create a mixture of hardstanding and engineered soft cover, in areas where Made Ground is present, thus reducing the amount of infiltration generated. This will, in turn, reduce the potential for the mobilisation of any possible contamination towards the underlying aquifer. Given that the site is underlain by low permeability clay, the leaching of contaminants will be significantly reduced as the Made Ground will be contained beneath the impermeable surface covering and above the natural clay aquitard.

4.5. GROUND GAS RISK ASSESSMENT

4.5.1. RATIONALE

Hazardous ground gas qualitative risk assessment is based on a conceptual site model (CSM) similar to that used for soil and groundwater contamination sources (i.e. source pathway receptor pollutant linkages).



The risk can be assessed based on knowledge of the ground conditions and CSM and a measure of hazardous gas concentrations and gas flow at the site within monitoring standpipes.

4.5.2. SOURCES AND PATHWAYS OF GROUND GAS

Table 12 summarises the potential sources and pathways of ground gas within the context of the recorded site setting and proposed development.

Table 12 Identified Potential Sources of Ground Gas

SOURCE

Made Ground

Made Ground deposits were encountered within the south (TP105) and the south-east (WS101 and TP101) to depths of between 0.30 m and 0.50 m bgl although, in general, Made Ground was not encountered within any of the other exploratory hole locations.

Deposits within TP105 are believed to be in the position of the former pond feature and comprise reworked silty, sandy clay topsoil above brown sandy gravels of sandstone and brick with cobbles of whole brick identified within the matrix. Between 0.40–0.50 m bgl an organic odour has been noted within the Made Ground deposits.

WS101 and TP101 were advanced in the position of the former tennis courts in the south east and with a thin layer of tarmacadam (up to 0.05 m in thickness) overlying reworked sandy gravels of mudstone, sandstone and fragments of brick. Within TP101 between 0.05–0.20 m bgl black sandy gravel of ash and clinker has been identified.

Drift Strata

No PEAT deposits or organic material were encountered during the intrusive investigation. The site was proven to be underlain by cohesive CLAY deposits locally interbedded with granular deposits.

Solid Strata

No solid strata were encountered during the intrusive investigation.

Landfill Sites

No landfill sites (current or historic) are located within 250 m of the site.

In the southern sector, there is an infilled pond, and in this area, there is the potential for Made Ground infill as well as organic-rich alluvium deposits to be present. During the site investigation this area was waterlogged, as such the investigation was limited.

Other Gases

Radon Class 1 - less than 1% of homes are estimated to be at or above the Action Level. No radon protection measures required.

Additionally, no volatile contamination has been identified as part of the soil analysis onsite.

4.5.3. MONITORING FREQUENCY

The CIRIA C665 guidance on gas risk assessment includes recommendations for periods and frequencies for monitoring visits. These recommendations consider the nature of the proposed development and the likely generation potential of the source.



The proposed development comprises private residential properties, which would be classified as a Type A development (high sensitivity) in accordance with BS8485:2015+A1:2019. However, it is considered that the likely generation potential of the identified gas sources (considering the likelihood of future increases in gas generation) would be best classified as low.

Therefore, within the context of the proposed residential end-use and ground gas generation potential, the gas assessment requires six visits over three months, with at least two sets of readings at low or falling atmospheric pressure.

4.5.4. GROUND GAS RISK ASSESSMENT METHODOLOGY

The potential impact on the development from ground gases has been assessed with reference to standards and guidelines published in:

- 📌 CIRIA Report 665 – Assessing risks posed by hazardous ground gases to buildings (2007)
- 📌 BS8485:2015+A1:2019 – Code of Practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings

BS8485 provides guidance on the level of gas protection requirements based upon the characteristic situation (CS) and the proposed development based on building type.

Therefore, in accordance with BS8485, based on the measured flow rates and hazardous gas concentrations, individual hazardous gas flow rates (Q_{hg}) shall be derived for each monitoring point, from which the site characteristic hazardous gas flow rate (Q_{hgs}), and then the Characteristic Situation (CS) can be determined.

The following equation should be utilised:

$$Q_{hg} = q \left(\frac{C_{hg}}{100} \right)$$

Where:

q is the measured flow rate (in litres per hour) of combined gases from the monitoring standpipe
 C_{hg} is the measured hazardous gas concentration (in percentage volume/volume).

The subsequent derived gas screening value (GSV) should be the maximum Q_{hg} (flow rate x concentration as a percentage volume) for all the monitoring events.

A 'worst case check' may be carried out using the maximum recorded flow in any hole with the maximum concentration in any hole to present the plausible worst case conditions. Adoption of the worst case Q_{hg} requires thorough justification and reference to the CSM.

The final derived GSV can then be used to characterise the site as summarised in Table 13.



Table 13 Site Characterisation by GSV (BS8485:2015)

CS	HAZARD POTENTIAL	GSV (L/HR) FOR METHANE AND CARBON DIOXIDE	ADDITIONAL FACTORS
CS1	Very Low	< 0.07	Typically <1% methane concentration and <5% carbon dioxide concentration (otherwise consider an increase to CS2)
CS2	Low	< 0.70	Typical measured flow rate <70 l/h (otherwise consider an increase to CS3)
CS3	Moderate	< 3.5	N/A
CS4	Moderate to High	< 15	N/A
CS5	High	< 70	N/A
CS6	Very High	> 70	N/A

Notes

- 1) The CS is equivalent to the characteristic GSV in CIRIA C665.
- 2) The worst-case ground gas regime identified on the site, either methane or carbon dioxide, at the worst-case temporal conditions that the site may be expected to encounter should be considered.
- 3) Gas Screening Value is the Borehole Gas Volume Flow Rate, in litres per hour, multiplied by the concentration in the air stream of the particular gas being considered.
- 4) The Gas Screening Value thresholds should not generally be exceeded without the completion of a detailed ground gas risk assessment taking into account site-specific conditions.

It should be noted that in the first instance, this assessment has been carried out in accordance with BS8485:2015+A1(2019) and the thresholds given in

4.5.5. MONITORING METHODOLOGY

Concentrations of methane (CH₄), carbon dioxide (CO₂) and oxygen (O₂) (hydrogen sulphide) were measured using a calibrated infrared gas analyser (GFM435) with gas flow rates measured using an integrated flow meter.

Gas measurements were recorded for a minimum of 300 seconds (5 minutes) at each location, increasing to 600 seconds if elevated concentrations identified, at which point the maximum concentration of CH₄ and CO₂, together with the lowest concentration of O₂ were recorded.

The results of the ground gas monitoring are presented in Table 14.

In addition to the raw data, the results for each individual standpipe have been assessed with reference to guidance provided in BS8485:2015. Based on the initial peak measured flow rates and hazardous gas concentrations, individual hazardous gas flow rates (Q_{hg}) have been derived for each monitoring point, from which an individual Characteristic Situation (CS) can ultimately be determined.

4.5.6. SUMMARY OF MONITORING RESULTS

Table 14 presents of the ground gas and groundwater monitoring results to date.



Table 14 Summary of Ground Gas Monitoring Results

WELL	STRATA	DATE	CH ₄ PEAK (%V/V)	CH ₄ STEADY (%V/V)	CH ₄ Q _{hg} (l/hr)	CO ₂ PEAK (%V/V)	CO ₂ STEADY (%V/V)	CO ₂ Q _{hg} (l/hr)	O ₂ (%V/V)	ATMOS (mb)	ATMOS. DYNAMIC	PEAK FLOW (l/hr)	STEADY FLOW (l/hr)	RESPONSE ZONE (m bgl)	DEPTH TO BASE (m bgl)	DEPTH TO WATER (m bgl)
WS101	Natural CLAY Drift	03/04/2024	0.1	0.1	0.0001	0.1	0.1	0.0001	20.4	985	Rising	0.1	0.1	1.00–4.00	3.80	0.15
		18/04/2024	0.1	0.1	0.0001	0.1	0.1	0.0001	20.6	1010	Falling	0.1	0.1		3.91	0.32
WS102	Natural CLAY Drift	03/04/2024	0.1	0.1	0.0001	0.7	0.3	0.0007	20.2	988	Rising	0.1	0.1	1.00–4.00	3.69	0.15
		18/04/2024	0.1	0.1	0.0001	0.2	0.1	0.0002	20.6	1012	Falling	0.1	0.1		3.76	0.26
WS103	Natural CLAY Drift	03/04/2024	0.1	0.1	0.0001	0.8	0.8	0.0008	19.9	985	Rising	0.1	0.1	1.00–3.00	2.80	0.05
		18/04/2024	0.1	0.1	0.0001	0.1	0.1	0.0001	20.6	1010	Falling	0.1	0.1		2.79	0.88
WS104	Natural CLAY Drift	03/04/2024	0.1	0.1	0.0001	0.2	0.2	0.0002	20.4	985	Rising	0.1	0.1	1.00–3.00	2.90	0.10
		18/04/2024	0.1	0.1	0.0001	2.2	0.9	0.0022	18.9	1011	Falling	0.1	0.1		2.88	1.15
WS105	Natural CLAY Drift	03/04/2024	Area in the position of the well flooded.											1.00–3.00	N/A	
		18/04/2024														
WS106	Natural CLAY Drift	03/04/2024	0.1	0.1	0.0001	1.0	0.1	0.0010	20.4	985	Rising	0.1	0.1	1.00–3.00	2.60	0.20
		18/04/2024	0.1	0.1	0.0001	3.2	3.1	0.0032	19.9	1011	Falling	0.1	0.1	1.00–3.00	2.55	0.15

Notes

CIRIA Characteristic Situation

Q_{hg}

	CS1
	CS2
	CS3
	CS4

<0.07

<0.7

<3.5

<15

Typical Max CO₂ <5 % Typical Max CH₄ <1 %

Flow rate not to exceed 70 l/hr otherwise consider increase to CS3

Quantitative Risk Assessment required to evaluate scope of protective measures

Values in **BOLD** exceed CS1 Thresholds

Values in **BLUE** denote water above level of response zone (flooded)



4.5.7. GROUNDWATER

The water level within several of the monitoring wells was recorded to be above the top of the response zone (flooded) on a number of occasions, as summarised in Table 15, thus rendering some of the monitoring data unreliable. Therefore, each time a flooded well was encountered, the well was bailed and left to re-equilibrate. Wells were re-monitored after a period of 20–30 minutes.

Table 15 Flooded Monitoring Well Data

WELL	VISIT 1 03/04/2024	VISIT 2 18/04/2024
WS101	Y	Y
WS102	Y	Y
WS103	Y	Y
WS104	Y	-
WS105	Y	Y
WS106	Y	Y

Within monitoring wells, groundwater levels were observed to rise over the monitoring period, however, due to the predominantly low permeability cohesive drift stratum, it is likely that water levels are representative of surface water collecting within the standpipes and not a true representation of groundwater.

4.5.8. BAROMETRIC PRESSURE

Visit 1 was undertaken during a period of relatively low/rising pressure, with pressure recorded to be 985 m bar.

Visit 2 was undertaken during a period of relatively high/falling pressure, with pressure recorded to be 1010 m bar.

4.5.9. GAS FLOW

Throughout the monitoring period, flow rates were recorded to be 0.1 l/hr (limit of detection of the analyser).

4.5.10. GAS CONCENTRATIONS

The maximum methane value recorded within the monitoring wells was 0.1% v/v (limit of detection of the analyser).

Carbon dioxide concentrations were recorded at concentrations ranging from 0.1% v/v to 3.2% v/v (WS106).

4.5.11. RADON RISK

The Groundsure report indicates the site is situated in an area where less than 1% of homes are above the “Action Level” and that the BGS reports that full radon protective measures are not necessary for the construction of new dwellings or extensions.



4.5.12. CONCLUSION

The determined Characteristic Situation for each standpipe for each visit is presented in Table 16. This indicates that based on the peak flow rates the majority of the monitoring visits classify as Characteristic Situation (CS)1 – Very Low Gas Risk.

Table 16 Gas Risk Profile and Location

WELL	DEPTH TO WATER (m bgl)	MAX FLOW (l/hr)	MAX CH ₄ (%V/V)	MAX CH ₄ Q _{hg} (l/hr)	MAX CO ₂ (%V/V)	MAX CO ₂ Q _{hg} (l/hr)	CHARACTERISTIC SITUATION
WS101	0.15–0.32	0.1	0.1	0.0001	0.1	0.0001	CS1
WS102	0.15–0.26	0.1	0.1	0.0001	0.7	0.0007	CS1
WS103	0.50–0.88	0.1	0.1	0.0001	0.8	0.0008	CS1
WS104	0.00–1.15	0.1	0.1	0.0001	2.2	0.0022	CS1
WS106	0.15–0.20	0.1	0.1	0.0001	3.2	0.0032	CS1

The ground gas monitoring undertaken as part of this investigation suggests that the site can be classified as Characteristic Situation (CS)1 – Very Low Gas Risk, however, the monitoring data is currently unreliable due to all monitoring wells being recorded as flooded due to the prolonged rain fall experienced across the UK throughout April 2024. Further monitoring will be required across the site to truly assess the ground gas regime.

Due to ground water flooding that was present in the southern sector during the intrusive works investigation, the true presence of the infilled pond in this area of the site has not been fully investigated. This feature has the potential for hazardous ground gases such as methane and carbon dioxide.

It is recommended that the full ground gas assessment and recommended protection measures (if applicable) are agreed with the local authority prior to their adoption on site. Furthermore, all protection measures adopted should be validated by a suitably qualified engineer.

4.6. POTABLE WATER SUPPLY

This section provides a summary of the site investigation data with reference to the selection of potable water supply pipework. The assessment is made with reference to the UK Water Industry Research (UKWIR) publication “Guidance on the selection of Water Supply Pipes to be used in Brownfield Sites”

Table 17 Pipeline Selection PE Threshold Concentrations

CONTAMINANT GROUP	PE-THRESHOLD (MG/KG)	CONCENTRATIONS AT CURRENT PIPELINE DEPTH (MG/KG)
Total VOC	0.5	N/A
Total BTEX And MTBE	0.1	N/A
Total SVOCs (Excluding PAH and those substances marked with an *)	2	N/A
EC5-EC10 Aliphatic and Aromatic Hydrocarbons	2	<1.0
EC10-EC16- Aliphatic and Aromatic Hydrocarbons	10	<1.0
EC16-EC40 Aliphatic and Aromatic Hydrocarbons	500	<1.0
Phenols (From SVOC Analysis)*	2	N/A
Cresols and Chlorinated Phenols (From SVOC Analysis)	2	N/A
Ethers*	0.5	NA
Nitrobenzene*	0.5	NA



CONTAMINANT GROUP	PE-THRESHOLD (MG/KG)	CONCENTRATIONS AT CURRENT PIPELINE DEPTH (MG/KG)
Ketones*	0.5	NA
Aldehydes*	0.5	NA
Amines	Fail	NA
Other Consideration		
Are there any exceedances of the PE threshold outside of the pipeline depth?	N/A	
Is free product present in soil and groundwater?	None	
Could hydrocarbon impact at greater depth than current pipeline depth be mobilised by rising groundwater levels?	None	
Will soils impacted with above determinands likely be utilised elsewhere on site?	No	
Will soils be imported to site as part of any future earth works	Currently unknown, however it is unlikely soils will be required to be imported to site.	

Notes - Pipe line depth normally between 0.75m – 1.35m

Based on the assessment of current site conditions it is unlikely that barrier pipe will be required at the proposed development.



4.7. DEVELOPED CONCEPTUAL SITE MODEL

Following the completion of the intrusive site investigation, chemical analysis and risk assessment, the conceptual model shown in Table 18 has been prepared for the site.

Table 18 **Developed Conceptual Model**

CONTAMINANT RISK			LIKELIHOOD	SEVERITY	MITIGATION DISCUSSION	RESIDUAL RISK
SOURCES	MIGRATION PATHWAYS	RECEPTORS				
SOIL						
HUMAN HEALTH						
Made Ground non-volatile PAH	Accidental ingestion and/or dermal contact with contaminated soil and/or leachate. PL1/PL2 Inhalation of contaminated dust. PL3	Human Health – construction workers Human Health – end users	Low likelihood	Medium	The intrusive investigation has identified elevated non-volatile PAH within shallow Made Ground soils associated with TP101 on site. Site personnel have a greater chance of coming into contact with impacted soils. Particularly during excavation and soil recovery works. Recommendation: Construction works are to be completed with appropriate PPE and welfare facilities.	Very low
		Human Health – end users	Low likelihood	Medium	Development of the road hardstanding and engineered clean cover system in areas in which Made Ground deposits are present shall break	Very low



CONTAMINANT RISK			LIKELIHOOD	SEVERITY	MITIGATION DISCUSSION	RESIDUAL RISK
SOURCES	MIGRATION PATHWAYS	RECEPTORS				
					migration pathways to end users.	
Volatile Compounds VOCs, hydrocarbons, volatile PAHs	Inhalation of vapours. PL4 Migration through permeable strata and preferential pathways.	Human Health – end users Human Health – Off-site receptors	Unlikely	Medium	No visual or olfactory evidence of impact has been identified during the site investigation. Laboratory analysis confirms that no volatile compounds have been identified within this location.	Very low
Made Ground Asbestos (Asbestos containing materials (ACM) and loose fibres)	Inhalation (of fibres). Construction works disturbing bound material and releasing fibres. PL3	Human Health - Site personnel, end land users, and users of adjacent sites	Unlikely	Low	No asbestos or ACMs were identified during intrusive investigation works or laboratory analysis of samples. Recommendation: No further action required.	Very low
Made Ground Sulphate from potential ash within the Made Ground.	Sulphate attack on concrete. PL6	Building concrete	Low likelihood	Low	The soils generally meet class DS-1, AC-1. Recommendation: Concrete should be designed in accordance with the chemical testing results.	Very low
Made Ground Organic contaminants such as hydrocarbons, solvents	Ingestion of tainted water supply. PL7	Human Health – End Users Water pipeline	Low likelihood	Low	No significant contamination identified at pipeline depth (0.75–1.35 m). Recommendation: It is unlikely that barrier pipe will be required following a pipeline risk assessment.	Very low



CONTAMINANT RISK			LIKELIHOOD	SEVERITY	MITIGATION DISCUSSION	RESIDUAL RISK
SOURCES	MIGRATION PATHWAYS	RECEPTORS				
Made Ground Phytotoxic contaminants	Direct contact (plant uptake). PL8	Flora	Likely	Medium	Contaminants present identified in the Made Ground may be taken up by flora in soft landscaping/gardens. Recommendation: Cover system in areas where Made Ground deposits are present.	Low
CONTROLLED WATERS						
Made Ground (TP101, TP105 & WS101)	Leaching of contaminants from Made Ground through infiltration and percolation of rainwater. PL5	Controlled waters, underlying Principal aquifer	Low likelihood	Medium	The risk of potential contamination within the Made Ground leaching towards the underlying principal bedrock aquifer is limited due to the presence of low permeability cohesive CLAYs across the site.	Low
		Infrastructure and services	Low likelihood	Medium	The development of the proposed road (hardstanding and drainage) will reduce the leachate produced from contaminated soils.	Low
Groundwater	Contact with contaminated groundwater. PL2	Human Health – site personnel	Low likelihood	Low	The site is underlain by low permeability cohesive clay deposits that will act as a natural clay aquitard reducing the potential from migration of potential contaminants towards the groundwater.	Low

GROUND GAS



CONTAMINANT RISK			LIKELIHOOD	SEVERITY	MITIGATION DISCUSSION	RESIDUAL RISK
SOURCES	MIGRATION PATHWAYS	RECEPTORS				
Ground gases methane and carbon dioxide	Inhalation of ground gas. PL4	Human Health – site personnel	Low likelihood	Medium	Preliminary monitoring has not identified any elevated ground gas readings across the site.	Low
	Accumulation of ground gas in confined spaces (asphyxiation or explosion)	Human Health – end users Infrastructure and services			Further investigation maybe required to assess the ground gas regime in the position of the infilled pond in the south that was inaccessible during the site investigation.	
Radon	Inhalation of ground gas. PL4	Human Health – site personnel	Unlikely	Low	The site is situated in an area where <1% of homes are above the “Action Level”	Very low
	Accumulation of ground gas in confined spaces (carcinogenic)	Human Health – end users			No radon protection measures will be required within dwellings onsite.	

Main Exposure Pathways:

PL1 = soil ingestion, PL2 = dermal contact and ingestion, PL3 = dust inhalation; PL4 = vapour/gas inhalation; PL5 = vertical / lateral migration; PL6 = corrosion of concrete; PL7=tainting of water supply; PL8 = uptake by plants.

LEVEL OF RISK

Very Low		MODERATE	
Low		Moderate/High	
Low/Moderate		High	



5. GEOTECHNICAL ASSESSMENT

5.1. SOIL CONSISTENCY

Undrained shear strength values were measured in the field using hand shear vane. Results of the tests are presented in Table 19 respectively, which indicate the clay soils to vary between firm and very stiff. Strength test data is generally consistent with the field descriptions of the soils.

Table 19 Summary of Hand Shear Vane Tests

LOCATION	DEPTH (M BGL)	SHEAR STRENGTH (KPA)	CALCULATED ALLOWABLE BEARING CAPACITY (KN/M ²)
TP101*	0.50	84	197.40
	1.00	197	462.95
	1.50	197	462.95
TP102*	1.00	96	225.60
	1.50	197	462.95
	2.00	197	462.95
TP103*	0.50	87	204.45
	1.00	155	364.25
	1.50	197	462.95
	1.90	197	462.95
TP104*	0.50	96	225.60
	1.00	152	357.20
	1.50	197	462.95
	2.00	197	462.95
TP105*	1.00	80	188.00
	1.50	197	462.95
	1.90	197	462.95
TP106*	1.00	93	218.55
	1.50	197	462.95
	2.00	197	462.95
TP107*	1.00	104	244.40
	1.50	197	462.95
	1.80	197	462.95
TP108*	1.00	99	232.65
	1.50	197	462.95
	2.00	197	462.95
TP109*	0.50	58	136.30
	1.00	158	371.30
	1.50	197	462.95
	1.90	197	462.95
TP110*	0.50	101	237.35
	1.00	197	462.95
	1.50	197	462.95
	2.00	197	462.95

Notes: ABC Calculated using Stroud and Butler et al 1974.

* granular content within soil tests may underestimate true shear strength

Results of the standard penetration tests, including undrained shear strengths derived from SPTs are included in Table 20.



Table 20 Standard/Cone Penetration Test Results

BOREHOLES	DEPTH (m bgl)	MATERIAL FIELD DESCRIPTION	CPT/SPT "N" VALUE	CORRECTED "N" VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (kN/m ²)	ALLOWABLE BEARING CAPACITY (kN/m ²)*
WS101	1	Brown slightly gravelly sandy CLAY	15	15.12	N/A	High strength	Very Stiff	75.61	155.46
	2		36	32.89	N/A	Very high strength	Very Stiff	164.44	338.08
	3		29	25.22	N/A	High strength	Very Stiff	126.10	259.26
	4		50	42.24	N/A	Very high strength	Very Stiff	211.21	434.25
WS102	1	Brown slightly gravelly sandy CLAY	16	16.13	N/A	High strength	Very Stiff	80.65	165.82
	2		35	31.97	N/A	Very high strength	Very Stiff	159.87	328.69
	3		32	27.83	N/A	High strength	Very Stiff	139.14	286.08
	4		50	42.24	N/A	Very high strength	Very Stiff	211.21	434.25
WS103	1	Brown slightly gravelly sandy CLAY	13	13.11	N/A	Medium strength	Stiff	65.53	134.73
	2		34	31.06	N/A	Very high strength	Very Stiff	155.30	319.30
	3		50	43.48	N/A	Very high strength	Very Stiff	217.41	447.00
WS104	1	Brown slightly gravelly sandy CLAY	15	15.12	N/A	High strength	Very Stiff	75.61	155.46
	2		41	37.46	N/A	Very high strength	Very Stiff	187.28	385.04
	3		50	43.48	N/A	Very high strength	Very Stiff	217.41	447.00
WS105	1	Brown slightly gravelly sandy CLAY	14	14.11	N/A	Medium strength	Stiff	70.57	145.09
	2		33	30.15	N/A	Very high strength	Very Stiff	150.73	309.91
	3		50	43.48	N/A	Very high strength	Very Stiff	217.41	447.00



BOREHOLES	DEPTH (m BGL)	MATERIAL FIELD DESCRIPTION	CPT/S PT "N" VALUE	CORRECTED "N" VALUE (N ₁) ₆₀	TERZAGHI & PECK RELATIVE DENSITY (SANDS)	EUROCODE SOIL STRENGTH	CONSISTENCY (BS 5930)	TERZAGHI & PECK APPROXIMATE UNDRAINED SHEAR STRENGTH (KN/M ²)	ALLOWABLE BEARING CAPACITY (KN/M ²)*
WS106	1	Brown slightly gravelly sandy CLAY	16	16.13	N/A	High strength	Very Stiff	80.65	165.82
	2		39	35.63	N/A	Very high strength	Very Stiff	178.14	366.26
	3		50	43.48	N/A	Very high strength	Very Stiff	217.41	447.00

NOTES

* The Allowable Bearing Capacity (ABC) should be considered indicative.

The interpretation of in situ mass undrained shear strength (cu) data from SPT Blow Count (N) results and the influence of the Plasticity Index (PI) was reported in Standard Penetration Test in Insensitive Clays and Soft Rocks. Stroud (1974). The standard penetration test and the engineering properties of glacial materials subsequently. Stroud and Butler (1975) and (1989).

Allowable bearing capacity on sands. Soil Mechanics in Engineering Practice Terzaghi, K. & Peck, R.B. 1996.



5.2. PH AND SULPHATE

Chemical analyses for pH and soluble sulphate content contained in APPENDIX VIII (summarised in Table 21), shows that the soils at the site meet Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with BRE *Special Digest 1* (2005).

Table 21 Summary of pH and Sulphate Data

LOCATION	DEPTH (M BGL)	SO ₄ IN 2:1 WATER/SOIL (G/L)	PH VALUE	CLASSIFICATION
TP105	0.20	0.022	7.5	DS-1, AC-1s
TP105	0.40	<0.01	7.5	DS-1, AC-1s
TP101	0.10	0.45	8.8	DS-1, AC-1s
TP101	0.50	<0.01	8.0	DS-1, AC-1s
TP102	0.10	<0.01	7.1	DS-1, AC-1s
TP102	0.50	<0.01	7.3	DS-1, AC-1s
TP104	1.00	0.076	7.5	DS-1, AC-1s
TP105	0.50	<0.01	7.6	DS-1, AC-1s
TP106	0.20	<0.01	8.2	DS-1, AC-1s
TP106	0.90	<0.01	7.0	DS-1, AC-1s
TP107	0.80	<0.01	8.0	DS-1, AC-1s
TP108	0.10	<0.01	6.7	DS-1, AC-1s
TP108	0.50	<0.01	7.4	DS-1, AC-1s
TP109	1.10	0.021	8.0	DS-1, AC-1s
TP110	0.10	<0.01	7.7	DS-1, AC-1s
TP110	1.20	<0.01	8.2	DS-1, AC-1s
WS102	0.90	<0.01	7.8	DS-1, AC-1s
WS103	0.80	0.015	7.9	DS-1, AC-1s
WS104	0.60	<0.01	7.7	DS-1, AC-1s
WS105	1.20	<0.01	8.1	DS-1, AC-1s
WS106	0.90	<0.01	7.9	DS-1, AC-1s

5.2.1. HIGHWAYS AND CONCRETE

MCHW Series 600 provides a criterion of 1500mg/l for water-soluble sulphate within 500mm of any concrete structure. A second criteria of 300 mg/l is given with respect to soils within 500mm of steel structures.

5.3. GROUNDWATER

Table 22 Summary of Groundwater Strikes

LOCATION	DEPTH (M BGL)	DESCRIPTION OF STRIKE	STRATA	EVIDENCE OF CONTAMINATION
SITE INVESTIGATION WATERSTRIKE INFORMATION				
TP101	0.30	Moderate ingress	SAND (Overlying CLAY)	None
TP102	0.70	Slow ingress	SAND (Overlying CLAY)	None
TP103	0.40	Slow ingress	SAND (Overlying CLAY)	None
TP104	0.30	Slow ingress	SAND (Overlying CLAY)	None
TP105	1.00	Slow ingress	SAND (Overlying CLAY)	None
TP107	0.60	Slow ingress	SAND (Overlying CLAY)	None
TP108	0.60	Slow ingress	SAND (Overlying CLAY)	None



LOCATION	DEPTH (M BGL)	DESCRIPTION OF STRIKE	STRATA	EVIDENCE OF CONTAMINATION
SITE INVESTIGATION WATERSTRIKE INFORMATION				
TP109	0.30	Slow ingress	SAND (Overlying CLAY)	None
TP110	0.40	Slow ingress	SAND (Overlying CLAY)	None
WS101	0.70	Strike within borehole	CLAY	None
Location	Depth Range (m bgl)	Period of monitoring (April 2024)	Weather conditions during monitoring	comments
Groundwater Monitoring Summary from Installations				
WS101	0.15–0.32	03/04/2024 – 18/04/2024	Prolonged heavy rain	Well Flooded
WS102	0.15–0.26			Well Flooded
WS103	0.50–0.88			Well Flooded
WS104	0.00–1.15			Well Flooded
WS105	0.00			Surface water flooding
WS106	0.15–0.20			Well Flooded

Water strikes appear to be consistent within shallow SAND drift deposits overlying CLAY stratum, suggesting that these water strikes are not true groundwater and are a perched waterbody, that is from surface water percolating through the upper deposits.

Perched water strikes have been located on site during the investigation, these were typically associated with natural granular overlying cohesive which created a perched waterbody.

5.4. SITE PREPARATION

Our assessment has been based on the fact that the site will be cleared and any vegetation below areas of proposed development stripped in accordance with Series 200 of the *Manual of Contract Documents for Highway Works (MCHW)*. This should include the following:

- ✿ Roots present below the footprint of proposed structures and infrastructure should be grubbed out and the resulting void infilled with suitable compacted engineered fill.
- ✿ Demolition of all existing buildings and removal of all concrete hardstanding.
- ✿ Redundant services should be sealed off and grubbed out and replaced with suitable compacted engineered fill.
- ✿ Buried structures and old foundations have been encountered on site. These should be excavated from below the proposed development footprint with the resulting void backfilled.



5.5. FOUNDATION CONDITIONS AND ASSESSMENT OF POTENTIAL BEARING CAPACITIES

In due consideration of the identified ground conditions, in-situ and laboratory geotechnical testing, E3P has undertaken an assessment of the safe allowable bearing capacity (ABC) within the underlying natural stratum to assist in the detailed design of foundations and infrastructure and determine the target founding stratum. The results of this assessment are summarised in Table 23.

Table 23 Summary of ABC

COHESIVE SOILS			
Description	Depth (range m bgl)	Undrained Shear Strength (Cu) (kN/m ²)	Allowable Bearing Capacity (kN/m ²)
Firm to Stiff Brown CLAY	0.50–1.00	58–99	136–232
Stiff to Very Stiff Brown CLAY	1.00–2.45	65.53–187.28	134.73–385.04
Very Stiff Brown CLAY	3.00–4.39	126.10–217.41	259.216–462.95

The above ABC data demonstrates that the underlying firm to stiff cohesive clays have suitable allowable bearing capacity throughout, increasing with depth.

5.6. FOUNDATIONS OPTIONS APPRAISAL

Based on the assessment of the relative undrained shear strength, relative in-situ densities and corresponding safe allowable bearing capacity, the following recommendations have been developed for the site of the potential foundation solutions that may be adopted for the future residential development. The suitable target founding stratum has been identified as the underlying firm to very stiff glacial clays.

It is likely that the majority of the proposed plots on site would be constructed using strip or trench-fill foundations bearing on the underlying stiff to very stiff high-strength natural clays.

In the position of the infilled pond feature in the south of the site, following further investigation an abnormal/engineered foundation solution may be required in this area of the site. This might include Vibro Stone Collums (VSC), Mass Trench Fill (MTF) or Piled foundations.

Foundation depths should take account of the presence of existing and proposed trees, with foundations deepened locally to mitigate the potential for volumetric instability attributed to fluctuations in moisture content, in accordance with the requirements of NHBC standards.

It is recommended that at working drawing stage a foundation schedule is prepared for the development, taking account of the physical change of natural clay soils and the current/proposed locations of trees.

At this time, it is not possible to accurately define the foundation types due to the absence of a detailed tree survey and final development levels; however, based on our extensive experience of similar sites, we would anticipate that the final foundation solution would be a combination of the following:



- Shallow strip foundations bearing on firm to very stiff gravelly CLAY at circa 1 m bgl; and
- Trench fill to support reinforced strip foundations in areas of variable ground and/or potential tree influence.

5.7. GROUND FLOOR SLABS

Current building control regulations require that where infilled ground is present to depths in excess of 600 mm, or where the substratum is variable in terms of the structure and settlement potential, or where clay soils are present within the influence of existing or proposed trees, a suspended floor slab is required.

In this instance, it is considered that for the majority of substructures, the underlying stratum would have in excess of 600 mm of infill and, as such, a suspended floor slab will be required.

Where a cast in-situ suspended slab is utilised with no subfloor void, appropriate compressible material (heave precautions) will be required in the construction of the substructure.

In clay soils if the foundation depth is greater than 1.5m, allowance should be made in the design for heave. This must incorporate either a clear void of a specified minimum depth under the suspended floor, or a proprietary compressible material/void former below the underside of the floor construction.

Ground bearing slabs should not be used in ground conditions where heave can occur or where the foundation depth is greater than 1.5m. Under these circumstances a suspended floor construction should be used.

5.8. SETTLEMENT

The site has been appraised through desk-based information and site investigation data in order to inform geotechnical risk where possible. Table 25 below has been formulated to determine if settlement risks are required to be further appraised. Where any item is determined to be appraised a settlement appraisal for the site should be prepared upon receipt of development levels and layout.

Table 24 Summary of Geotechnical Information for Settlement

RISK	COMMENT	ASSESSMENT
Site is located in an area deemed to be at Risk from Ground Dissolution from desk-based information	The site is in a low risk area of ground dissolution based on BGS data searches.	No Further Assessment Required
Site is in an area where geology is reported as having a compressible risk from desk-based information	None	No Further Assessment Required
Do historical maps indicate relic excavation features such as opencast or ponds that have been infilled.	Infilled pond located on the south side of site.	Further investigation will be required in this area of the site – inaccessible during the preliminary ground investigation.
Has the site been proven to be underlain by anthropogenic materials to an unknown specification?	Made ground is limited and localised (south-east) Likely to be present below the current onsite structures.	Further assessment required following the demolition of all onsite structures.



RISK	COMMENT	ASSESSMENT
Have Oedometers and/or ground conditions reported compressible stratum on site?	N/A	No Further Assessment Required
Have High walls been identified on site that could result in differential settlement?	N/A	No Further Assessment Required
Has any evidence been observed on site indicating settlement (non structural assessment)	N/A	No Further Assessment Required
Is voided ground present beneath the site?	None identified.	Further assessment will be required below the onsite structures.
Is the site in an area where a mobile groundwater regime is present in influencing distance of foundations and infrastructure?	N/A	No Further Assessment Required
Will the site be subject to changes in site levels that may induce heave or settlement?	Unlikely that significant level changes will take place onsite.	No Further Assessment Required

The site has been appraised as having a low risk for potential future settlement risk. In order to determine the level of risk and appropriate mitigation options a detailed settlement appraisal is required for the site. This does not form a part of the structural engineer's settlement calculations associated with the sub structure however loadings will need to be considered for surcharging both static and variable pressures.

5.9. HEAVE PRECAUTIONS

The site has been proven to be underlain by clay soils which are susceptible to volumetric instability due to fluctuations in moisture content, particularly within influencing distance of trees as per the NHBC/LABC conjectures zones of influence.

The plasticity of the underlying clay has not been assessed during this phase of works as it was outside of the requested scope, however as the site is underlain by cohesive deposits an assessment into the plasticity of the soils will be required. Following the confirmation of the plasticity of the soils the following heave precautions should be followed, detailed within Table 29 should be followed.

Table 25 Position of Heave Precautions

SITUATION	TRENCH FILL	PIER AND BEAM	PILE AND BEAM
External trench fill and pier foundations. Unless NHBC is satisfied that the soil is not desiccated compressible material should be provided to the:	Inside faces of external wall foundations deeper than 1.5m, based on the appropriate tree height.	All faces of pier foundations deeper than 1.5m, based on the appropriate tree height.	N/A
External ground beams. Unless NHBC is satisfied that the soil is not desiccated, compressible material or void formers should be provided to the:	N/A	Inside faces	Inside faces



SITUATION	TRENCH FILL	PIER AND BEAM	PILE AND BEAM
Internal trench fill foundations and ground beams. Compressible material required:	No	No	No
External and internal ground beams. Compressible material, void former or void should be provided to the underside of:	N/A	All	All
Heave precautions required for proposed trees where the soil is not desiccated:	No	No	No

Note: Information taken from NHBC Standards 2024, Chapter 4.2, Table 8 – Position of heave precautions

A summary of heave precautions is presented in Table 26.

Table 26 Summary of Heave Precautions

VOLUME CHANGE POTENTIAL	VOID DIMENSION AGAINST SIDE OF FOUNDATION AND GROUND BEAM	VOID DIMENSION UNDER GROUND BEAMS, AND SUSPENDED IN-SITU CONCRETE GROUND FLOOR	VOID DIMENSION UNDER SUSPENDED PRECAST CONCRETE AND TIMBER FLOORS ⁽¹⁾
High	35mm	150mm	300mm
Medium	25mm	100mm	250mm
Low	0mm	50mm	200mm

In addition to the requirements of the 'Drainage' section, drainage near trees should incorporate additional provisions. Where there is a volume change potential within the ground, the provisions include:

- ✳ Increased falls to cater for any ground movement.
- ✳ Deeper and wider backfill of granular material.
- ✳ A drainage system that is capable of movement should heave and shrinkage occur.
- ✳ Drainage pipes should not be encased in concrete.
- ✳ Additional clearance is required where drains pass through the structure of a building to allow for additional movement.

5.10. HIGHWAYS CONSTRUCTION

A programme of remediation and enabling works will be required to remediate the proposed road subgrade in accordance with the requirements of the Manual of Contract Documents for Highway Works Volume 1 Specification For Highway Works (Series 600-Earthworks) for a method compaction.

Bulk earthworks to construct highways to the underside of capping. Enabling works contractor will need to do CBRs to determine the capping layer etc.

5.11. DRAINAGE

Where loose or soft materials (Made Ground) have been identified at drainage invert levels, there will need to be consideration for the use of reinforced pipe bedding.



Shrinkage and heave of clay soils can affect pipelines. To protect against the effects of heave, drainage should be designed:

-  To take account of potential ground movement as shown in Table 27 , including where pipes and services pass through substructure walls or foundations.
-  With gradients which may need to be steeper.
-  To use alternative means of catering for the movement when sufficient falls cannot be provided, for example, by deepening the excavation and laying pipework on a granular bedding of suitable thickness to reduce the extent of potential movement.



Table 27 Potential Ground Movement for Drainage

VOLUME CHANGE POTENTIAL	HIGH	MEDIUM	LOW
Potential ground movement	150mm	100mm	50mm

5.12. EXCAVATIONS

Trial pits were generally stable in both granular Made Ground and natural strata; as such, it is considered that near-surface excavations will be feasible.

Site observations indicated that excavations should be feasible in the near surface with normal plant.

If local pumping of groundwater is required during the advancement of excavations for the proposed foundations, then consideration should be given to the potential for dewatering gravels in the surrounding areas that may cause structural damage to building substructures near the site.

Table 28 Civil Engineering Excavation Risk Matrix

RISK ITEM	PRESENT	COMMENT
Running Sands	No	No running sand has been identified.
Minor Water Ingress	Yes	Minor water ingress was noted upon the excavation of trial pits across the site due to perched water strikes within shallow granular deposits. Excavations may require localised dewatering/sump pumping during the construction of site drainage infrastructure. Ingress of water into foundation excavation will potentially flood foundation excavations, limiting the viability of spread foundations to be constructed.
Shallow Bedrock	No	Depth of bedrock not identified during investigation.

5.13. SIDE STABILITY AND EASE OF EXCAVATION

The sides of the exploratory trial pit excavations appeared to be generally stable during excavation. The natural strata were excavated with relative ease.

5.14. CONSTRUCTION ACTIVITY AND INSPECTION

The following activities and inspections should be incorporated in to the site works:

- ☛ Due to the variability of the soils at the site, it is recommended that sufficient allowance is made for the inspection of formations and sub formations to foundations and pavement construction.
- ☛ Excavations where access is required should be subject to a risk assessment from a competent person and, where appropriate, mitigation measures such as benching back the sides or use of support systems in accordance with CIRIA R97 should be utilised.
- ☛ It is considered that dewatering may be required, especially following periods of heavy rainfall. Removal of surface water and water within trenches should be possible with conventional sump pumping. Discharge of any water should be agreed with the relevant regulatory body and be undertaken under a trade effluent discharge, where required. Measures to remove silt and suspended solids may be required and consideration should be given to provision of space for settling tanks or an attenuation pond.



- ✿ Where access to confined spaces is required, appropriate mitigation measures should be addressed within the construction stage health and safety plan. Particular account should be taken of the gas results.
- ✿ The presence of potential contamination and mitigation measures should be addressed as part of the construction stage health and safety plan and should include measures to design out the risks, reduce their impact and, finally, to include the use of personnel protective equipment (PPE).



5.15. DEVELOPED GEOTECHNICAL RISK REGISTER

POTENTIAL ABNORMAL CONSTRAINT	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Remediation of contaminated soils	On site	<10%	Limited non-volatile PAH impact has been identified within an isolated pocket of shallow ashy Made Ground deposits in TP101 in the position of the former tennis courts in the south east of the site. The risk posed to chronic human health associated with the elevated concentrations of non-volatile PAH compounds can be mitigated through the installation of a suitable cover system in areas where Made Ground deposits are present to remove any potential for direct exposure to impacted soils.
Bedrock	N/A	N/A	Bedrock has not been encountered during this phase of intrusive site works.
Cohesive Stratum overlying shallow Bedrock (<3.00m)	N/A	N/A	Bedrock was not encountered; however, the site is underlain by cohesive clay drift deposits.
Obstructions	Centre & West of Site	20–30%	No obstructions identified during the intrusive site investigation. A large drain was present in the western sector of the site, and it is likely that Made Ground and buried foundations will be present below the structures in the centre of the site.
Artificially levelled and filled platforms	Southeast & Central sectors	Up to 30%	Limited artificial levelling has been identified onsite with isolated pockets of Made Ground being associated with the former tennis courts in the southeast of the site. It is considered likely that limited artificially levelling may be present in the immediate vicinity of the current structures.
Retaining walls	N/A	N/A	None Identified
Trench collapse	N/A	N/A	Trial pits excavated on site have been relatively stable and no risk of running sands have been identified on site.
Mature trees	Onsite	Up to 50%	Arboriculture survey required to determine areas of potential tree influence. A number of large mature and semi mature trees are present in throughout site.



POTENTIAL ABNORMAL CONSTRAINT	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Volume change potential clay	Onsite	TBC – 100%	The site is underlain by cohesive clay deposits to a maximum proven depth of 4.39 m bgl. An assessment of the volume change potential of the cohesive stratum will be required (not included within this scope of works). This assessment may indicate that heave precautions will be required at the site. The full extent of precautions will only be determined after further works.
Peat	N/A	N/A	None Identified
Concrete design	Onsite	100%	Concrete classification indicates that the soils across the site meet Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s.
Low-permeability ground	Onsite	100%	Soakaways unlikely to be effective in areas where low permeability cohesive deposits are present or where areas of potentially contaminated soil and groundwater are present.
Services/sensitive structures	Southern and western sectors	10-15%	A formal drainage survey has not been completed; however, a utility inspection chamber was identified in the centre of the site, and it is likely that further infrastructure is present leading to the former hospital building. Following a review of statutory plans the following utility infrastructure has been noted onsite: - Low voltage cables are noted within the single tracked access road in the west of the site. - Overhead telephone infrastructure is recorded in the southern and western sectors of the site.



POTENTIAL ABNORMAL CONSTRAINT	LOCATION ON SITE	ESTIMATED AREA OF SITE AT RISK (%)	ASSESSMENT AND MITIGATION
Abnormal foundation solutions	TBC	TBC	In areas of the site where no infilled features are present it is not anticipated that abnormal foundations will be required onsite, however following further investigation into the infilled pond feature in the southern sector of the site and below the current structures in the centre of the site a re-assessment of the foundation solutions will be required. It is likely that in the position of the infilled pond feature abnormal/engineered foundations will be required onsite. Should significant Made Ground and soft clays be identified on site, that will be subject to volume change, an abnormal foundation solution (MTF, VSC, Pile) may be required. Intrusive site investigation will be required to determine the required foundation solution.
Areas not investigated	Northern and southern sectors	20%	Multiple areas across site were heavily saturated/waterlogged and restricted plant access particularly in the southern sector of the site. This limited the investigation into infilled pond feature. Additionally, an area of dense vegetation located in the north-east side of site further restricted the access and the investigation in this area of the site was limited. It should be noted that there are no planned development works in this sector of the site.
Surface water features	Southern sectors	5%	No longer mapped as a pond feature, however, the southern sector of the site was extremely waterlogged with standing water.
Historically infilled pond	South	25	Historically infilled pond is located in the southern sector of the site. The investigation into this feature was limited due to the ground conditions at the time of the site investigation and it is recommended that further works is undertaken to investigate this feature.



5.16. FURTHER WORKS

Based on the findings of the intrusive site investigation, the following additional works are recommended to be completed in due course:

- Further investigation
 - With a detailed investigation into the presence of the infilled pond in the southern sector.
 - Detailed geotechnical laboratory testing to classify the underlying stratum.
 - Following the removal of all structures across the site.
- Plot-specific foundation schedule (upon receipt of the final development levels).
- Arboricultural survey.
- Geotechnical Earthworks Strategy (infrastructure).
- Remediation and enabling works strategy.

END OF REPORT

APPENDIX I

LIMITATIONS





GENERAL

1. This report and any associated works (together comprising the "Services") were compiled and carried out by E3P for the client (as present in Section 1) under the E3P "Terms of Business" or with those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed and outlined in the body of the report.
2. Unless explicitly agreed otherwise, in writing, this report has been prepared under E3P Standard Terms and Business as included within our proposal to the Client.
3. Project-specific appointment documents may be agreed upon at our discretion and a charge may be levied for both the time to review and finalise appointment documents and also for associated changes to the appointment terms. E3P reserves the right to amend the fee should any changes to the appointment terms create an increased risk to E3P.
4. The report needs to be considered in light of the proposal and associated limitations of scope. The report needs to be read in full and isolated sections cannot be used without full reference to other elements of the report and any previous works referenced within the report.

PHASE 1 GEOENVIRONMENTAL AND PRELIMINARY RISK ASSESSMENTS

5. Coverage: This section covers reports with the following titles or combination of titles: Phase 1; Desktop Study; Geoenvironmental Assessment; Development Appraisal; Preliminary Environmental Risk Assessment; Constraints Report; Due Diligence Report; Geotechnical Development Review; Environmental Statement; Environmental Chapter; Baseline Environmental Assessment; Project Scope Summary Report (PSSR), Program Environmental Impact Report (PEIR), Geotechnical Development Risk Register; Agricultural Land Assessment; Mineral Safeguarding Assessment; Desk Top Coal Mining Risk Assessment; Hydrogeological Appraisal; Construction Environmental Management Plan; and Site Water Management Plan.
6. The works undertaken to prepare this report comprised a study of available and easily documented information from a variety of sources (including the Client), together with (where appropriate) a brief walkover inspection of the Site and correspondence with relevant authorities and other interested parties. Due to the short timescales associated with these projects responses may not have been received from all parties. E3P cannot be held responsible for any disclosures that are provided post-production of our report and will not automatically update our report.
7. The opinions given in this report have been dictated by the finite data on which they are based and are relevant only for the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, E3P reserves the right to review such information and, if warranted, to modify the opinions accordingly.
8. It should be noted that any risks identified in this report are perceived risks based on the information reviewed. Actual risks can only be assessed following intrusive investigations of the site.



9. Where mention has been made to the identification of Japanese Knotweed and other invasive plant species and asbestos or asbestos-containing materials, this is for indicative purposes only and does not constitute or replace full and proper surveys completed by suitably qualified and experienced specialists in these fields.
10. E3P does not warrant work/data undertaken/provided by others.

INTRUSIVE INVESTIGATION REPORTS

11. Coverage: The following report titles (or combination) may cover this category of work: Geoenvironmental Site Investigation; Geotechnical Assessment; GIR (Ground Investigation Reports); Preliminary Environmental And Geotechnical Risk Assessment; Preliminary Summary; Coal Mining Risk Assessment, Ground Gas Addendum; and, Geotechnical Risk Register.
12. The investigation has been undertaken to provide information concerning either:
 - I. The type and degree of contamination present at the site in order to allow a generic quantitative risk assessment to be undertaken; or
 - II. Information on the soil properties present at the site to allow for geotechnical development constraints to be considered.
13. The scope of the investigation was selected on the basis of the specific development and land use scenario proposed by the Client and may be inappropriate to another form of development or scheme. If the development layout was not known at the time of the investigation the report findings may need revisiting once the development layout is confirmed.
14. Unless otherwise specified in the scope of works, any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (intrusive and sample locations etc) annotated on site plans are not drawn to scale but are centred over the approximate location. Such features should not be used for setting out and should be considered indicative only.
15. For contamination purposes, the objectives of the investigation are limited to establishing the risks associated with potential contamination sources with the potential to cause harm to human health, building materials, the environment (including adjacent land), or controlled waters.
16. For geotechnical investigations, the purpose is to broadly consider potential development constraints associated with the physical property of the soils underlying the site within the context of the proposed future or continued use of the site, as stated within the report.
17. The amount of exploratory work, soil property testing and chemical testing undertaken has necessarily been restricted by various factors which may include accessibility, the presence of services; existing buildings; current site usage or short timescales. The exploratory holes completed assess only a small percentage of the area in relation to the overall size of the Site, and as such can only provide a general indication of conditions.



18. The number of sampling points and the methods of sampling and testing do not preclude the possible existence of contamination where concentrations may be significantly higher than those actually encountered or ground conditions that vary from those identified. In addition, there may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this report.
19. The inspection, testing and monitoring records relate specifically to the investigation points and the timeframe that the works were undertaken. They will also be limited by the techniques employed. As part of this assessment, E3P has used reasonable skill and care to extrapolate conditions between these points based on assumptions to develop our interpretation and conclusions.
20. The assumption made in forming our conclusions is that the ground and groundwater conditions (both chemically and physically) are the same as have been encountered during the works undertaken at the specific points of investigation and at the time of the investigation.
21. Conditions can change between investigation points both spatially and over time and these interpretations should therefore be considered indicative. The assessment of extreme weather events and their impact on ground conditions is not within the scope of E3P's work.
22. The risk assessment and opinions provided are based on currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values. Specific assumptions associated with the risk assessment process have been outlined within the body or associated appendix of the report.
23. Additional investigations may be required in order to satisfy relevant planning conditions or to resolve any engineering and environmental issues.
24. Where soil contamination concentrations recorded as part of this investigation are used for commentary on the potential waste classification of soils for disposal purposes, these should be classed as indicative only. Due consideration should be given to the variability of contaminant concentrations taken from targeted samples versus bulk excavated soils and the potential variability of contaminant concentrations between sampling locations. Where major waste disposal operations are considered, targeted waste classification investigations should be designed and the waste classification and any subsequent disposal option agreed upon with licenced subcontractors and/or the relevant regulators.
25. The results of the asbestos testing are factually reported and interpretation is given as to how this relates to the previous use of the site, the types of ground encountered and site conceptualisation. This does not however constitute a formal asbestos assessment. These results should be treated cautiously and should not be relied upon to provide detailed and representative information on the delineation, type and extent of bulk ACMs and/or trace loose asbestos fibres within the soil matrix at the site.
26. If costs have been included in relation to additional site works, and/or site remediation works these must be considered as indicative only and must be confirmed by a qualified quantity surveyor.



EUROCODE 7: GEOTECHNICAL DESIGN

27. On 1st April 2010, BS EN 1997-1:2004 (Eurocode 7: Geotechnical Design – Part 1) became the mandatory baseline standard for geotechnical ground investigations.
28. In terms of geotechnical design for foundations, slopes, retaining walls and earthworks, EC7 sets guidance on design procedures including specific guidance on the numbers and spacings of boreholes for geotechnical design, there are limits to methods of ground investigation and the quality of data obtained and there are also prescriptive methods of assessing soil strengths and methods of design. Unless otherwise explicitly stated, the work has not been undertaken in accordance with EC7. A standard geotechnical interpretative report will not meet the requirements of the Geotechnical Design Report (GDR) under Eurocode 7. The GDR can only be prepared following confirmation of all structural loads and serviceability requirements. The report is likely to represent a Ground Investigation Report (GIR) under the Eurocode 7 guidance.

DETAILED QUANTITATIVE RISK ASSESSMENTS AND REMEDIATION AND ENABLING WORK STRATEGY REPORTS

29. These reports build upon previous report versions and associated notes. The scope of the investigation, further testing and monitoring and associated risk assessments were selected based on the specific development and land use scenario proposed by the Client and may not be appropriate to another form of development or scheme layout. The risk assessment and opinions provided are based on currently available approaches in the generation of Site Specific Assessment Criteria relating to contamination concentrations and are not considered to represent a risk in a specific land use scenario to a specific receptor. No liability can be accepted for the retrospective effects of any future changes or amendments to these values, associated models or associated guidance.
30. The outputs of the Detailed Quantitative Risk Assessments are based upon the manipulation of standard risk assessment models. These are our interpretation of the risk assessment criteria.
31. Before adoption on-site, assessment criteria will need to be discussed and agreed upon with the Regulatory Authorities prior to adoption on site. The regulatory discussion and engagement process may result in an alternative interpretation being determined and agreed. The process and timescales associated with the Regulatory Authority engagement are not within the control of E3P. All costs and programmes presented as a result of this process should be validated by a quantity surveyor and should be presumed to be indicative.
32. E3P does not accept liability for any subcontract work that has not been completed in strict accordance with an approved E3P Remediation and Enabling Works Strategy.

GEOTECHNICAL DESIGN REPORT (GDR)

33. The GDR can only be prepared following confirmation of all structural loads and serviceability requirements. All the relevant information needs to be provided to allow for a GDR to be produced.



MONITORING (INCLUDING REMEDIATION MONITORING REPORTS AND BUILD PHASE MITIGATION)

34. These reports are factual and comprise monitoring, normally groundwater and ground gas and data provided by contractors as part of earthworks or remedial works.
35. The data is presented and will be compared with assessment criteria.

APPENDIX II

GLOSSARY





TERMS

ACM	Asbestos-containing material	MMP	Materials management plan
ADS	Acoustic design statement	ND	Not detected
AST	Above-ground storage tank	NDP	Nuclear density probe
BGS	British Geological Survey	NMP	Noise management plan
BSI	British Standards Institute	NPSE	Noise policy statement for England
BTEX	Benzene, toluene, ethylbenzene, xylenes	NR	Not recorded
CA	Coal Authority	PAH	Polycyclic aromatic hydrocarbon
CBR	California bearing ratio	PCB	Polychlorinated biphenyl
CIEH	Chartered Institute of Environmental Health	PI	Plasticity index
CIRIA	Construction Industry Research Association	PID	Photo ionisation detector
CLEA	Contaminated land exposure assessment	POS	Public open space
CML	Council of Mortgage Lenders	PPE	Personnel protective equipment
CoC	Contaminants of concern	ProPG	Professional practice guidance
CSM	Conceptual site model	QA	Quality assurance
DNAPL	Dense non-aqueous phase liquid (chlorinated solvents, PCB)	SGV	Soil guideline value
DWS	Drinking water standard	SPH	Separate-phase hydrocarbon
EA	Environment Agency	SPT	Standard penetration test
EQS	Environmental quality standard	SVOC	Semi-volatile organic compound
FFL	Finished floor level	TPH	Total and speciated petroleum hydrocarbon
GAC	General assessment criteria	TPH CWG	Total Petroleum Hydrocarbon (Criteria Working Group)
GL	Ground level	UKWIR	United Kingdom Water Infrastructure Risk
GSV	Gas screening value	UST	Underground storage tank
HCV	Health criteria value	VCC	Vibro-concrete column
ICSM	Initial conceptual site model	VOC	Volatile organic compound
LEL	Lower explosive limit	VRSC	Vibro-replacement stone columns
LMRL	Lower method reporting limit	VSC	Vibro-stone columns
LNAPL	Light non-aqueous phase liquid (petrol, diesel, kerosene)	WHO	World Health Organisation



MCV	Moisture condition value	WRAP	Waste and Resources Action Programme
MIBK	Methyl isobutyl ketone	WTE	Water table elevation
m	Metres	ppm	Parts per million
km	Kilometres	mg/m³	Milligram per metre cubed
% v/v	Percent volume in air	m bgl bgl	Metres below ground level
mb	Millibars (atmospheric pressure)	m bcl	Metre below cover level
l/hr	Litres per hour	mAOD	Metres above ordnance datum (sea level)
µg/l	Micrograms per litre (parts per billion)	kN/m²	Kilonewtons per metre squared
ppb	Parts per billion	µm	Micrometre
mg/kg	Milligrams per kilogram (parts per million)	SSRT	Site Specific Remediation Target
PSD	Particle Size Distribution	DD	Dry Density
CL:AIRE	Contaminated Land: Applications in Real Environments	Mc	Moisture Content
ρ	Bulk Density	GPR	Ground Penetrating Radar
NDP	Nuclear Density Probe	FFL	Finished Floor Level
LEL	Lower Explosive Limit	UKWIR	UK Water Industry Research
CIRIA	Construction Industry Research and Information Association	LOD	Limit of Detection

APPENDIX III

RISK CLASSIFICATION





RISK CLASSIFICATION

RISK	DEFINITION
Low	There are unlikely to be significant contaminated land liabilities/geotechnical constraints associated with the property.
Low Moderate	There are unlikely to be significant contaminated land liabilities/geotechnical constraints associated with the property with regard to the proposed use. However, minor issues may require further consideration in the event of future redevelopment of the Site.
Moderate	Some potential contaminated land liabilities/geotechnical constraints are likely to affect the property as a result of historical and/or current activities. The risks identified are unlikely to pose an immediate significant issue but the purchaser/developer may wish to make further enquiries of the vendor or undertake further environmental improvements. Redevelopment of the Site will likely require further site investigation.
Moderate High	Some potentially significant contaminated land liabilities/geotechnical constraints have been identified at the property that requires further assessment, including intrusive ground investigations.
High	Significant potential contaminated land liabilities/geotechnical constraints have been identified at the property. Further assessment including intrusive ground investigation will be required to determine the level of risk and associated liability.

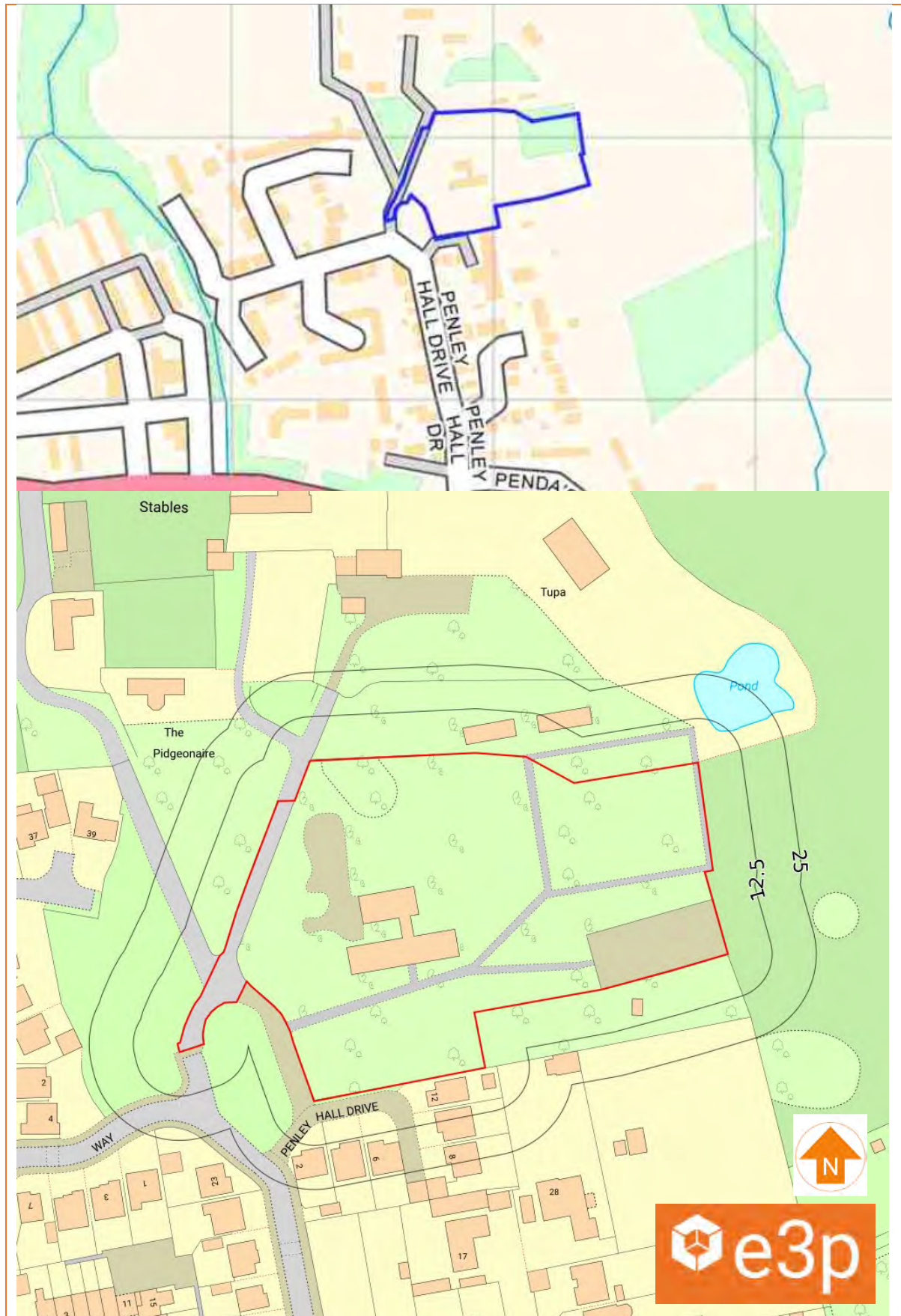
APPENDIX IV

DRAWINGS





DRAWING 17-510-R2-001 – Site Location Plan





Notes:					
P1	REVA	07.03.2024	OW	JW	MJ
Phase	Issue	Date	Drawn	Checked	PM

Client:	
Fisher German LLP	
Job Title:	
Tupa, Pensley	

Job No:
17-510
Drawing No:
002

Date:
07.03.2024
Scale:
1:1000 @ A3



Environmental Engineering
Partnership Ltd
Taylor Road, Trafford Park
Urmston, Manchester, M41 7JQ
Tel: 0161 707 9612
E-mail: info@e3p.co.uk
Website: www.e3p.co.uk

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Historical Features

-  Former Buildings and Structures
-  Former Pond
-  Former Hospital Building
-  Tennis Court

Notes:

Notes:

P1	REVA	07.03.2024	OW	JW	MJ
Phase	Issue	Date	Drawn	Checked	PM

Client:

Fisher German LLP

Job Title:

Tupa, Pensley

Job No:

17-510

Drawing No:

003

Date:

07.03.2024

Scale:

1:1000 @ A3

Drawing Title:

Historical Features Plan



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Site Features

- | | | | |
|--|--------------------------------|--|--------------|
| | Dense Vegetation | | Gates |
| | Boggy | | Tennis Court |
| | Former Hospital Building | | Manhole |
| | Heavily Vegetated Areas | | |
| | Heavily Vegetated and Boggy | | |
| | Footpath | | |
| | Heavily Vegetated Hardstanding | | |
| | Gates | | |
| | Mature Tree | | |

Notes:

P1	REVB	12.03.2024	EB	JW	MJ
P1	REVA	07.03.2024	OW	JW	MJ
Phase	Issue	Date	Drawn	Checked	PM

Client:

Fisher German LLP

Job Title:
Tupa, Pensley

Job No:

17-510
Drawing No:
004

Drawing Title:
Site Features Plan

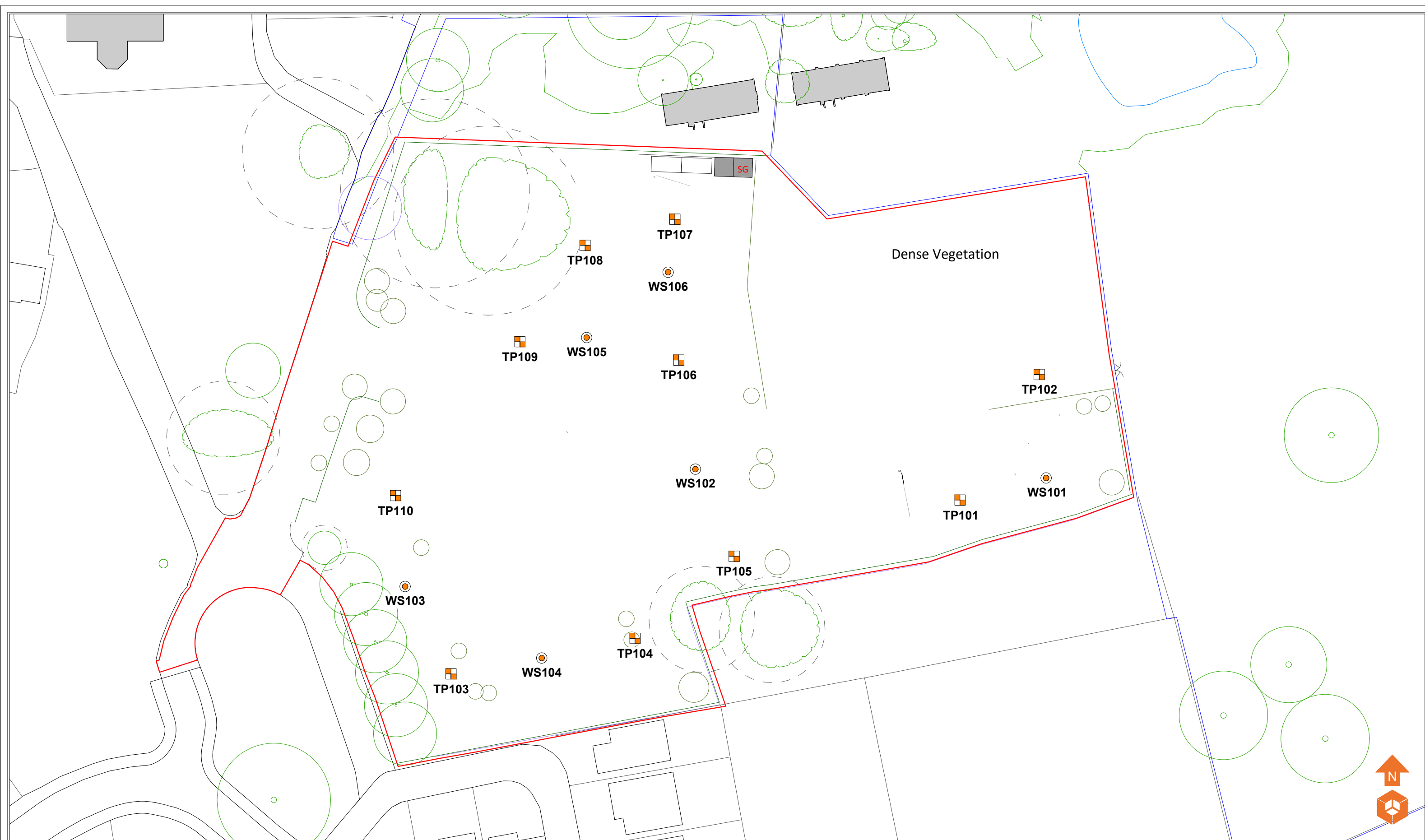
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12.03.2024
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Location Symbols

-  Approximate Window Sample Probehole Location (E3P March 2024)
-  Approximate Trial Pit Location (E3P March 2024)

Notes:

Client:

Fisher German LLP

Job No:

17-510

Date:

02.04.2024

Drawing No:

005

Scale:

NTS@ A3



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P1

REVA

02.04.2024

EB

JW

MJ

Phase

Issue

Date

Drawn

Checked

PM

Job Title:

Tupa, Pensley

Drawing Title:

Exploratory Hole Location
Plan

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Location Symbols

WS101 Approximate Window Sample Probehole Location (E3P March 2024)

TP101 Approximate Trial Pit Location (E3P March 2024)

Topsoil Depth (m)

Depth of Topsoil 0.10 - 0.19m

Depth of Topsoil 0.20 - 0.29m

Depth of Topsoil 0.30 - 0.39m

Depth of Topsoil 0.40 - 0.49m

Notes:					
P1	REVA	02.04.2024	EB	JW	MJ
Phase	Issue	Date	Drawn	Checked	PM

Client:	
Fisher German LLP	
Job Title:	
Tupa, Pensley	

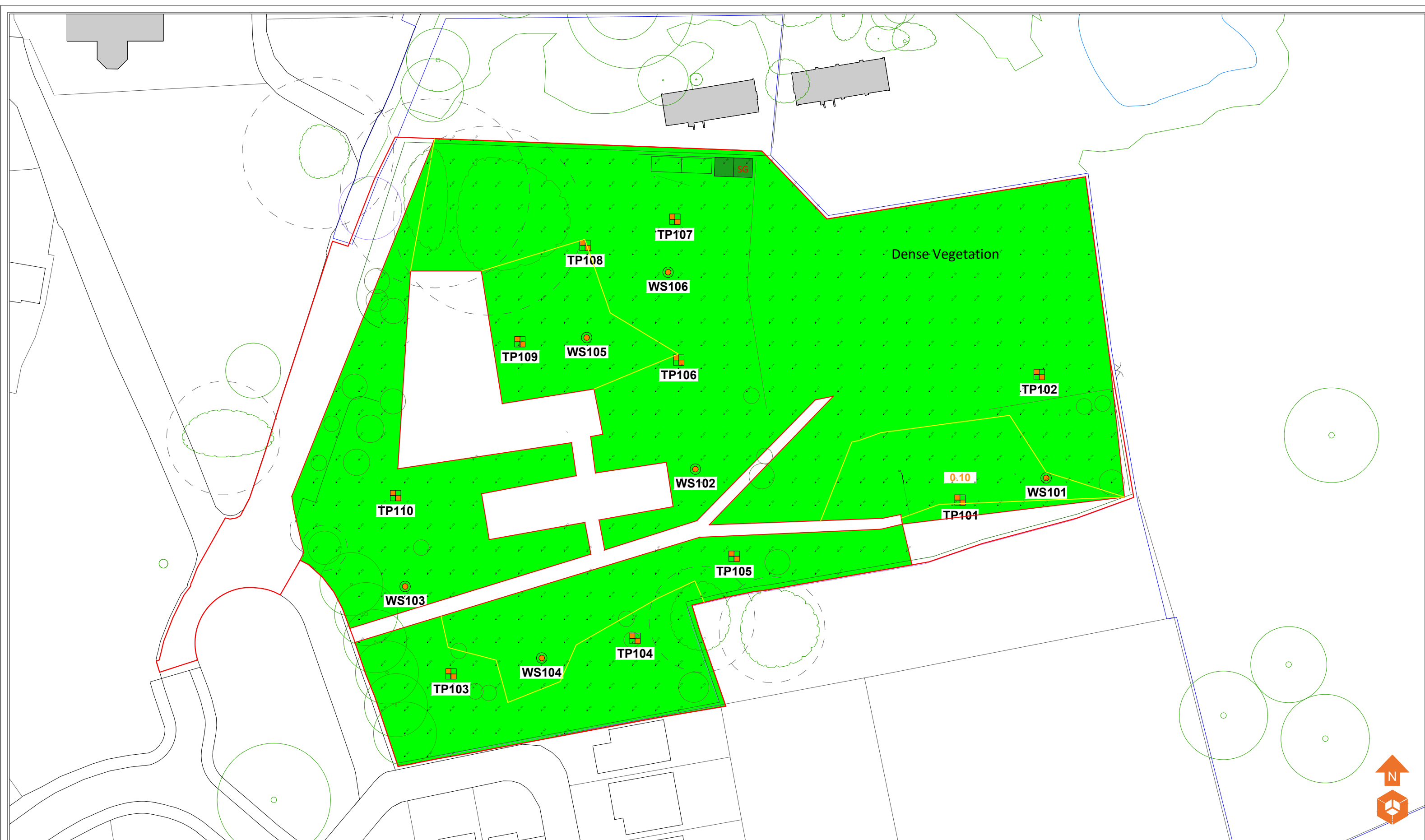
Job No:
17-510
Drawing No:
007

Date:
02.04.2024
Scale:
NTS@ A3



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Location Symbols

Approximate Window Sample Probehole Location (E3P March 2024)

Approximate Trial Pit Location (E3P March 2024)

Shallow Spread Footings

Depth to Founding Strata 0.00 - 1.24m

Depth to Founding Strata 1.25 - 1.49m

Mass Trench Fill Footings

Depth to Founding Strata 1.50 - 1.74m

Depth to Founding Strata 1.75 - 1.99m

Depth to Founding Strata 2.00 - 2.24m

Engineered Footings

Depth to Founding Strata 2.25 - 2.49m

Depth to Founding Strata >2.50m

Notes:

P1	REVA	30.04.2024	OW	MJ	MJ
Phase	Issue	Date	Drawn	Checked	PM

Client:

Fisher German LLP

Job Title:

Tupa, Pensley

Job No:

17-510

Drawing No:

008

Date:

30.04.2024

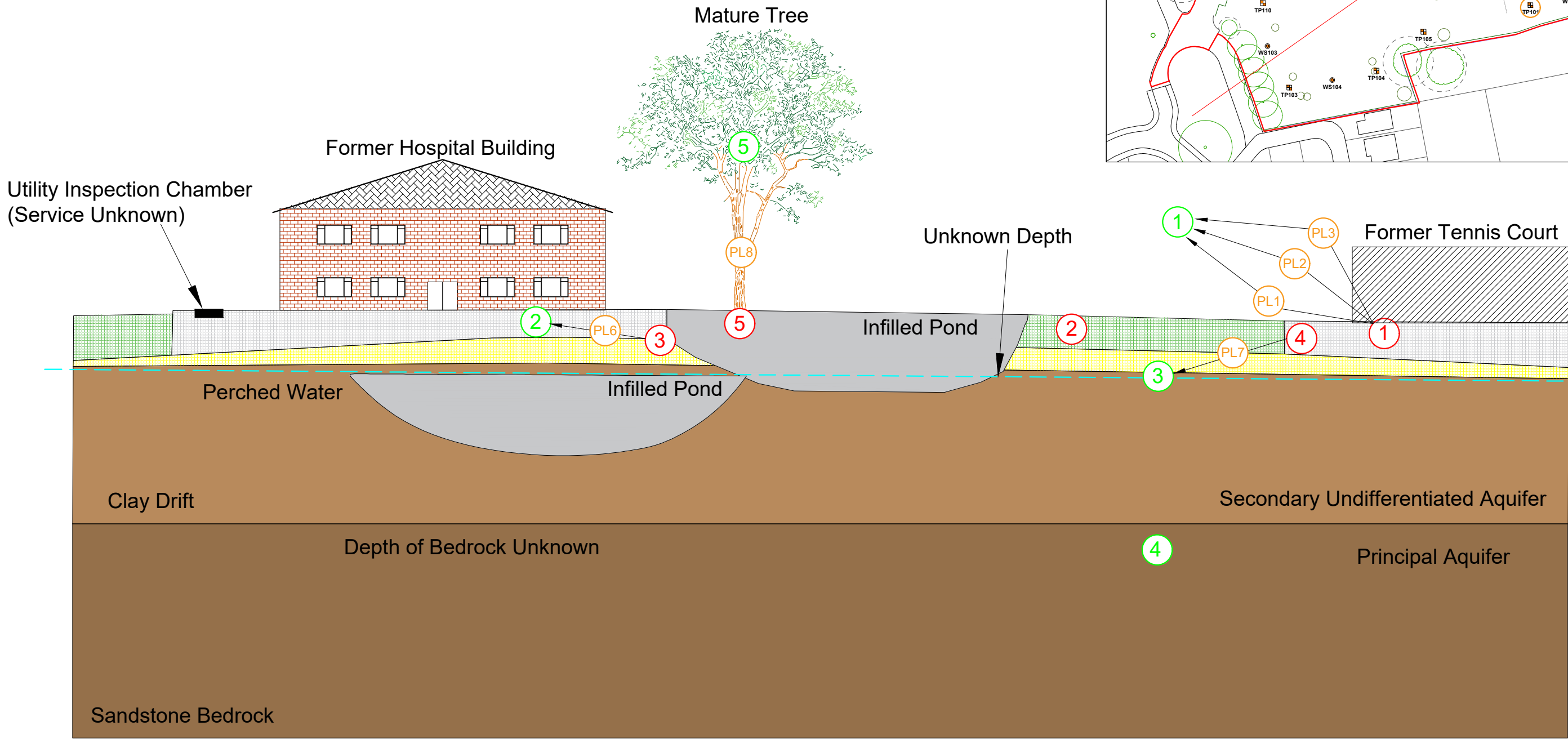
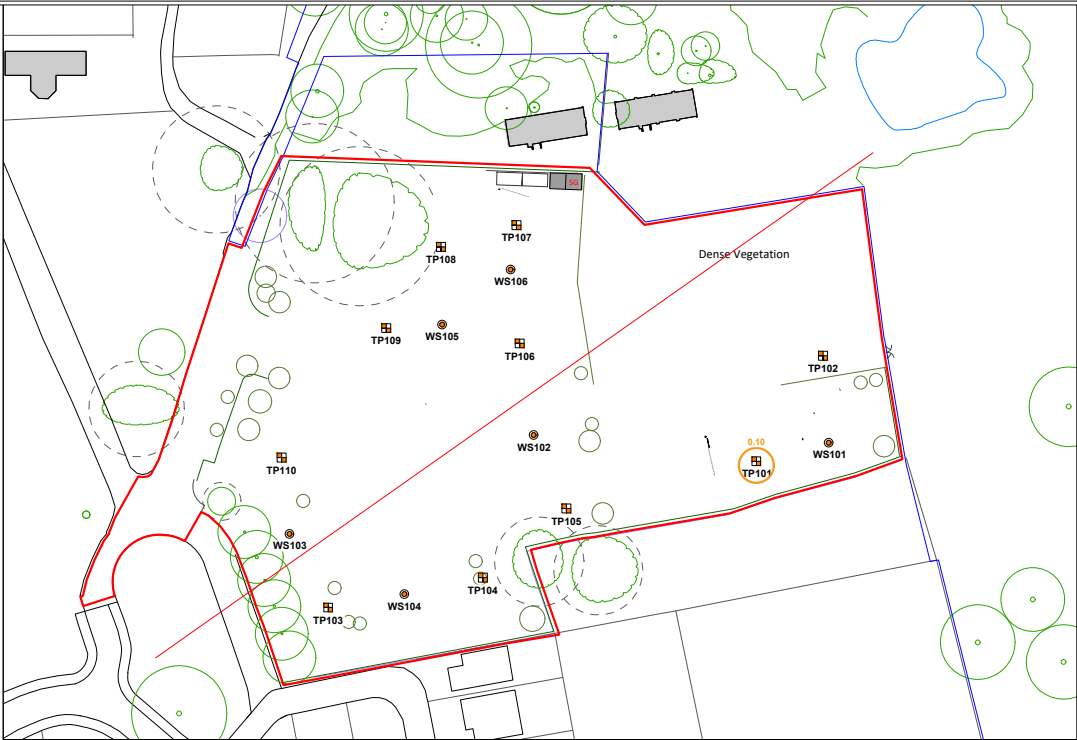
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NTS@ A3

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Geology Key Made Ground Clay Drift Sandstone Bedrock						Sources ① PAH ② Mobile Zinc ③ Sulphates ④ Organic Contaminants such as Hydrocarbons, Solvents ⑤ Phototoxic Contaminants						Receptors ① Future End Users/Construction Workers ② Building Concrete ③ Water Pipeline ④ Principal Aquifer ⑤ Flora									
Notes:						Client: Fisher German LLP						Job No: 17-510		Date: 30.04.2024		e3p Environmental Engineering Partnership Ltd Taylor Road, Trafford Park Urmston, Manchester, M41 7JQ Tel: 0161 707 9612 E-mail: info@e3p.co.uk Website: www.e3p.co.uk					
P1 P1 REVB REVA 30.04.2024 22.04.2024 OW OW MJ JW MJ MJ MJ						Job Title: Tupa, Pensley						Drawing No: 010									
Phase Issue Date Drawn Checked PM						Job Title: Tupa, Pensley						Drawing Title: Conceptual Site Model				The client must not amend any drawing, design or other intellectual property produced by E3P Ltd without permission in writing from E3P Ltd in advance of any amendments being made. In the event that such written permission is not obtained in advance of the amendments being made, E3P Ltd shall not be liable for any damage and/or losses occurring as a result of the amended drawing, design or intellectual property.					



Site Features

- Dense Vegetation
- Former Tennis Court
- Former Hospital Building
- Inspection Chamber
- Flooded Vegetated Area
- Footpath
- Hardstanding Area (Concrete)
- Large Mature Trees

Notes:

P1	REVA	02.04.2024	EB	JW	MJ
Phase	Issue	Date	Drawn	Checked	PM

Client:

Fisher German LLP

Job Title:

Tupa, Pensley

Job No:

17-510

Drawing No:

015

Date:

02.04.2024

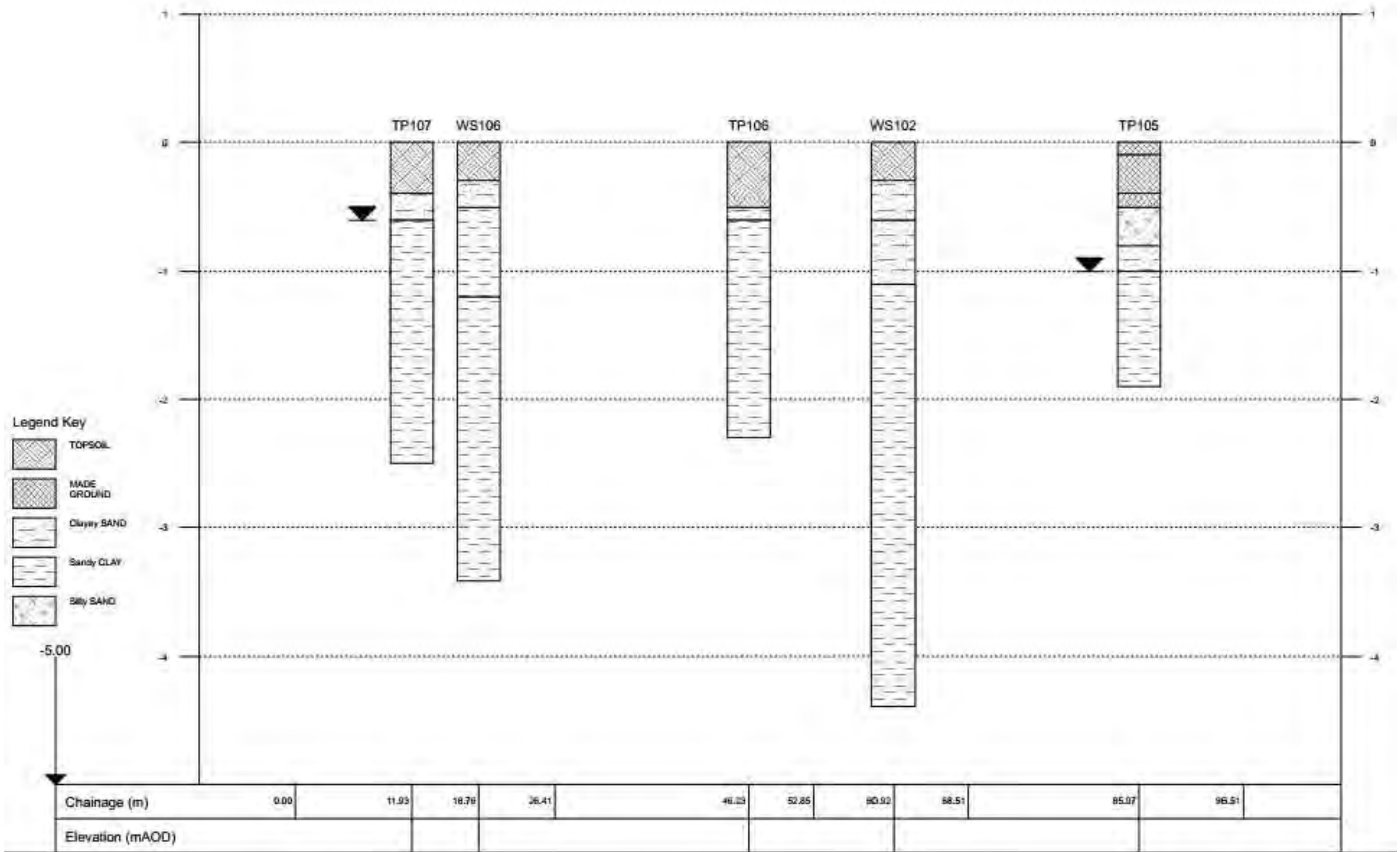
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Notes:

Client:

Fisher German LLP

Job No:

17-510

Date:

30.04.2024

Drawing No:

016A

Scale:

NTS@ A3



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Job Title:

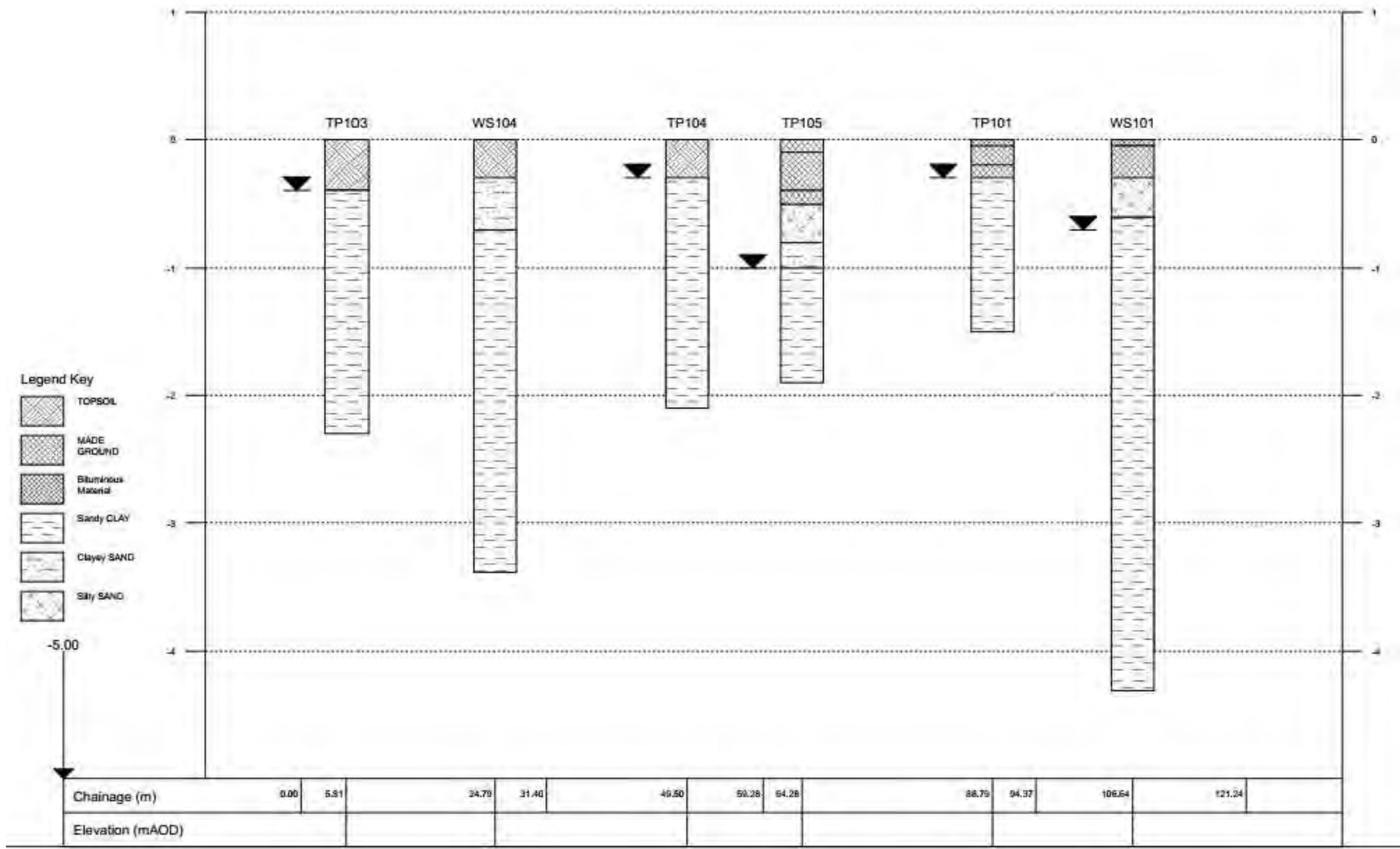
Tupa, Pensley

Drawing Title:

Cross Section Plan
N - S

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Phase	Issue	Date	Drawn	Checked	PM
P1	REVA	30.04.2024	OW	MJ	MJ



Notes:

Client:

Fisher German LLP

Job No:

17-510

Date:

30.04.2024

Drawing No:

016B

Scale:

NTS@ A3



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P1	REVA	30.04.2024	OW	MJ	MJ
Phase	Issue	Date	Drawn	Checked	PM

Job Title:

Tupa, Pensley

Drawing Title:

Cross Section Plan
W - E

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APPENDIX V

PHOTOGRAPHS





PLATE 1 VIEW OF FORMER HOSPITA BUILDING FACING SOUTH-EAST



PLATE 2 VIEW OF NORTH WEST SIDE OF FACING NORTHWEST





PLATE 3 VIEW OF FORMER TENNIS COURT FACING WEST



PLATE 4 VIEW OF SITE FACING SOUTH-EAST





PLATE 5 TRIAL PIT TP101 & ARISINGS



PLATE 6 TRIAL PIT TP104 & ARISINGS





PLATE 7 WINDOW SAMPLE WS101



PLATE 8 WINDOW SAMPLE WS106



APPENDIX VI

HISTORICAL MAPS



Site Details:

Penley, Wrexham

Client Ref: 007526
Report Ref: GS-8OP-CEB-JQ2-5WT
Grid Ref: 341795, 340171

Map Name: County Series

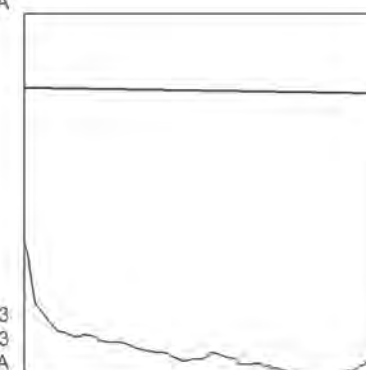
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Scale: 1:10,560

Printed at: 1:10,560



Surveyed 1873
 Revised 1873
 Edition N/A
 Copyright N/A
 Levelled N/A



Surveyed 1873
 Revised 1873
 Edition N/A
 Copyright N/A
 Levelled N/A

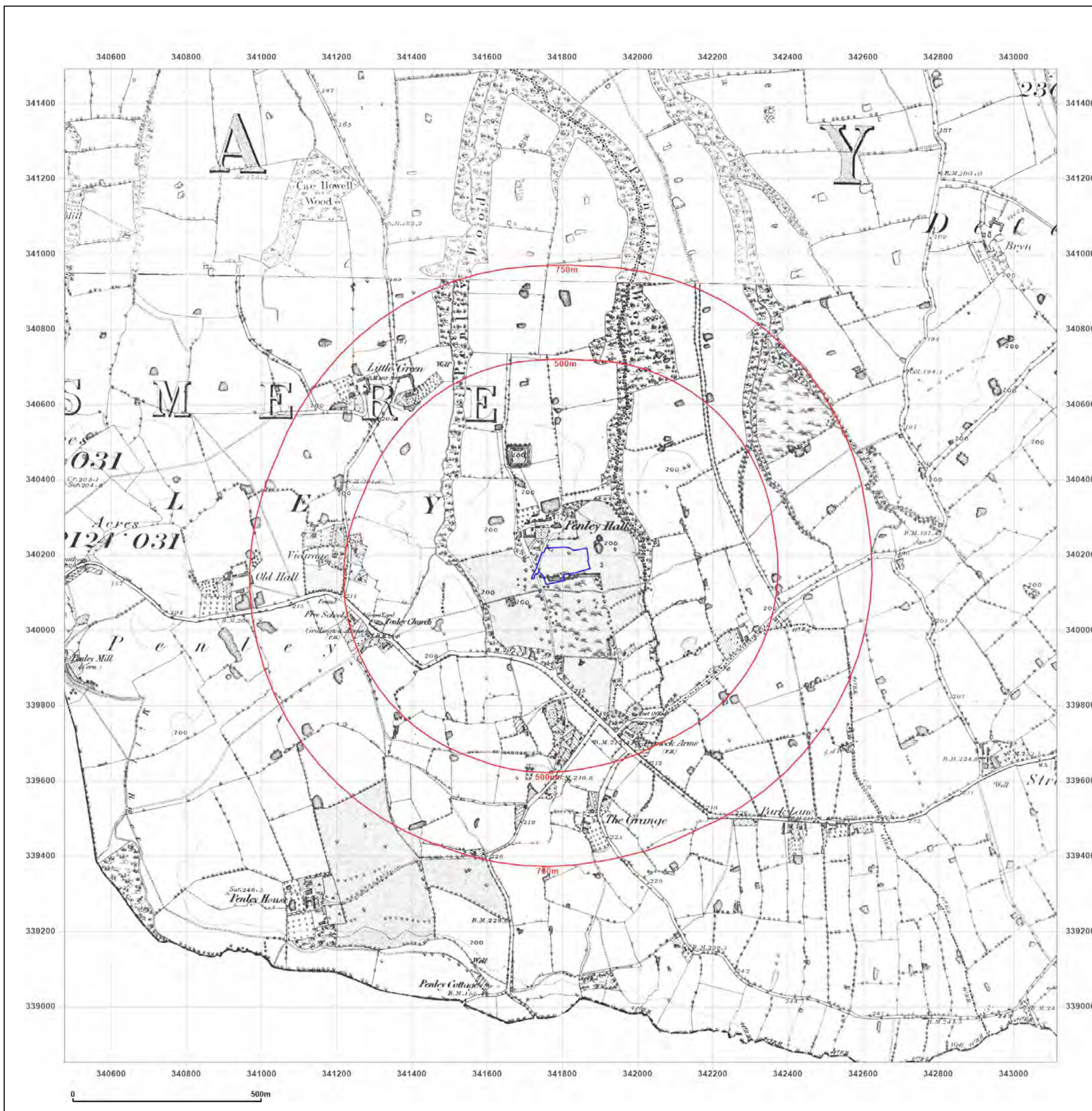


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Site Details:

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Client Ref: 007526
Report Ref: GS-8OP-CEB-JQ2-5WT
Grid Ref: 341795, 340171

Map Name: County Series

Map date: 1874

Scale: 1:10,560

Printed at: 1:10,560



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Revised 1874
Edition N/A
Copyright N/A
Levelled N/A

Surveyed 1874
Revised 1874
Edition N/A
Copyright N/A
Levelled N/A

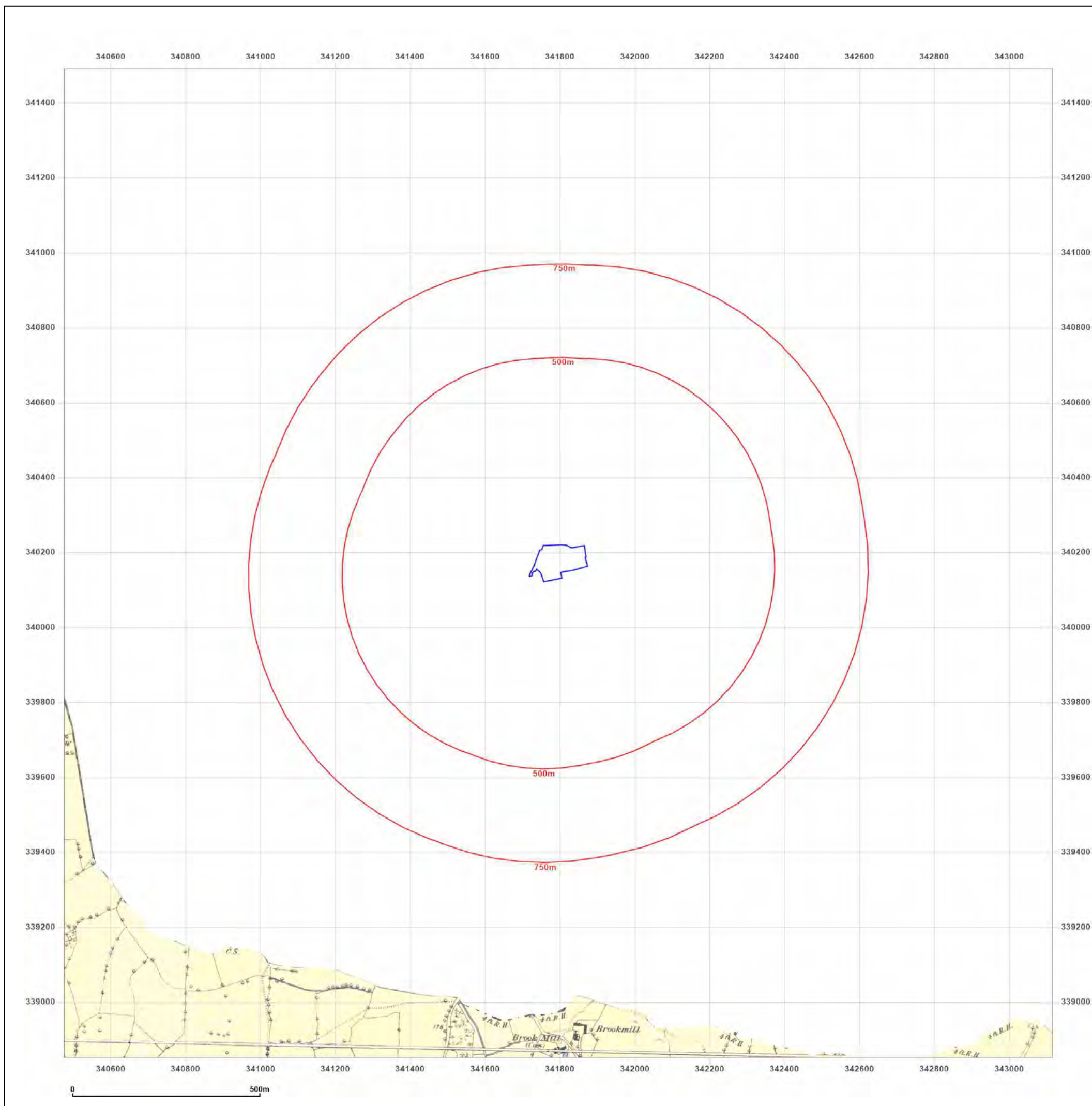


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Report Ref: GS-8OP-CEB-JQ2-5WT
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Map Name: County Series

Map date: 1883-1884

Scale: 1:10,560

Printed at: 1:10,560



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Edition N/A
Copyright N/A
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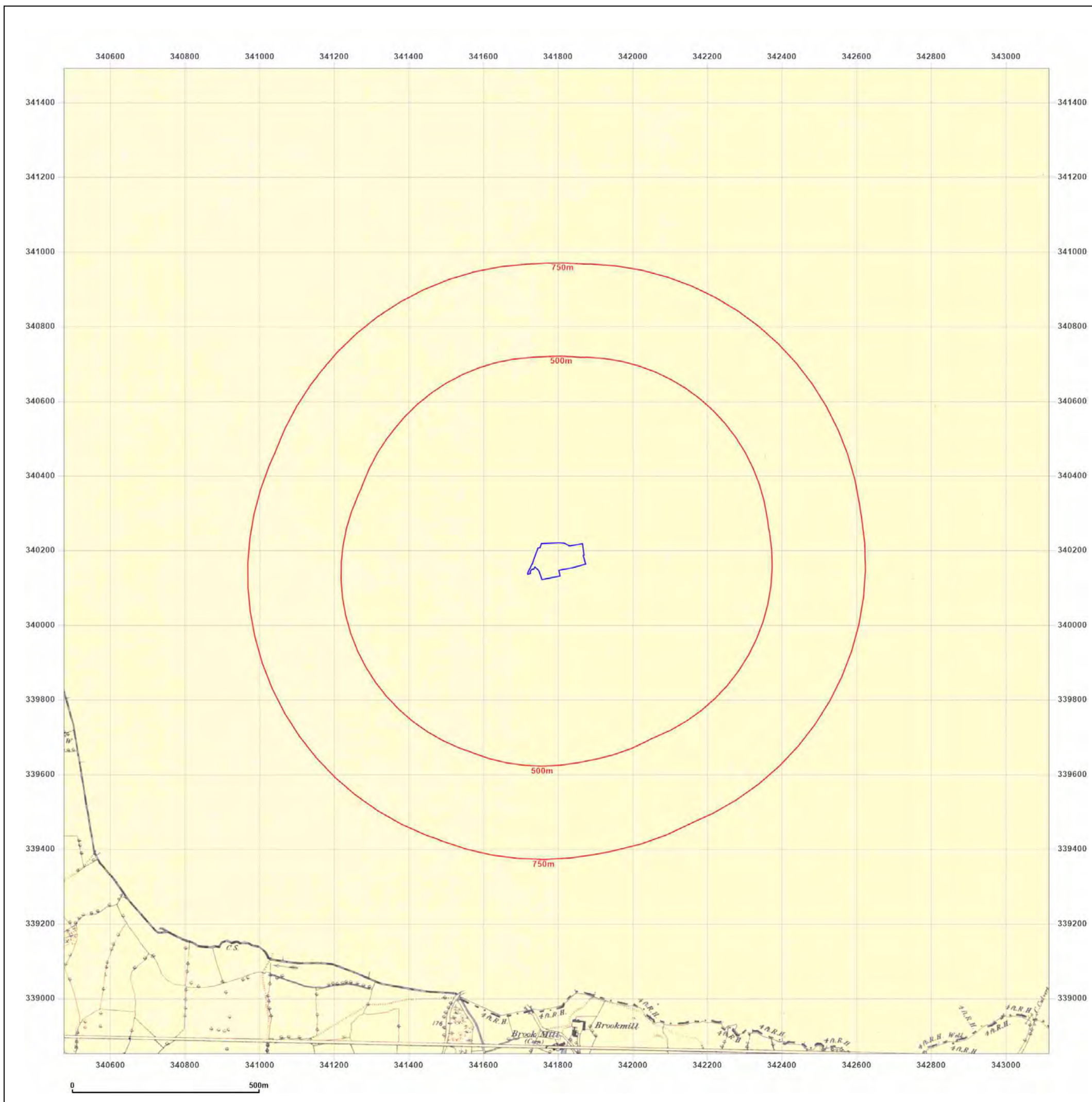


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Site Details:

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Client Ref: 007526
Report Ref: GS-8OP-CEB-JQ2-5WT
Grid Ref: 341795, 340171

Map Name: County Series

Map date: 1898

Scale: 1:10,560

Printed at: 1:10,560



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 Edition N/A
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Surveyed 1873
 Revised 1898
 Edition N/A
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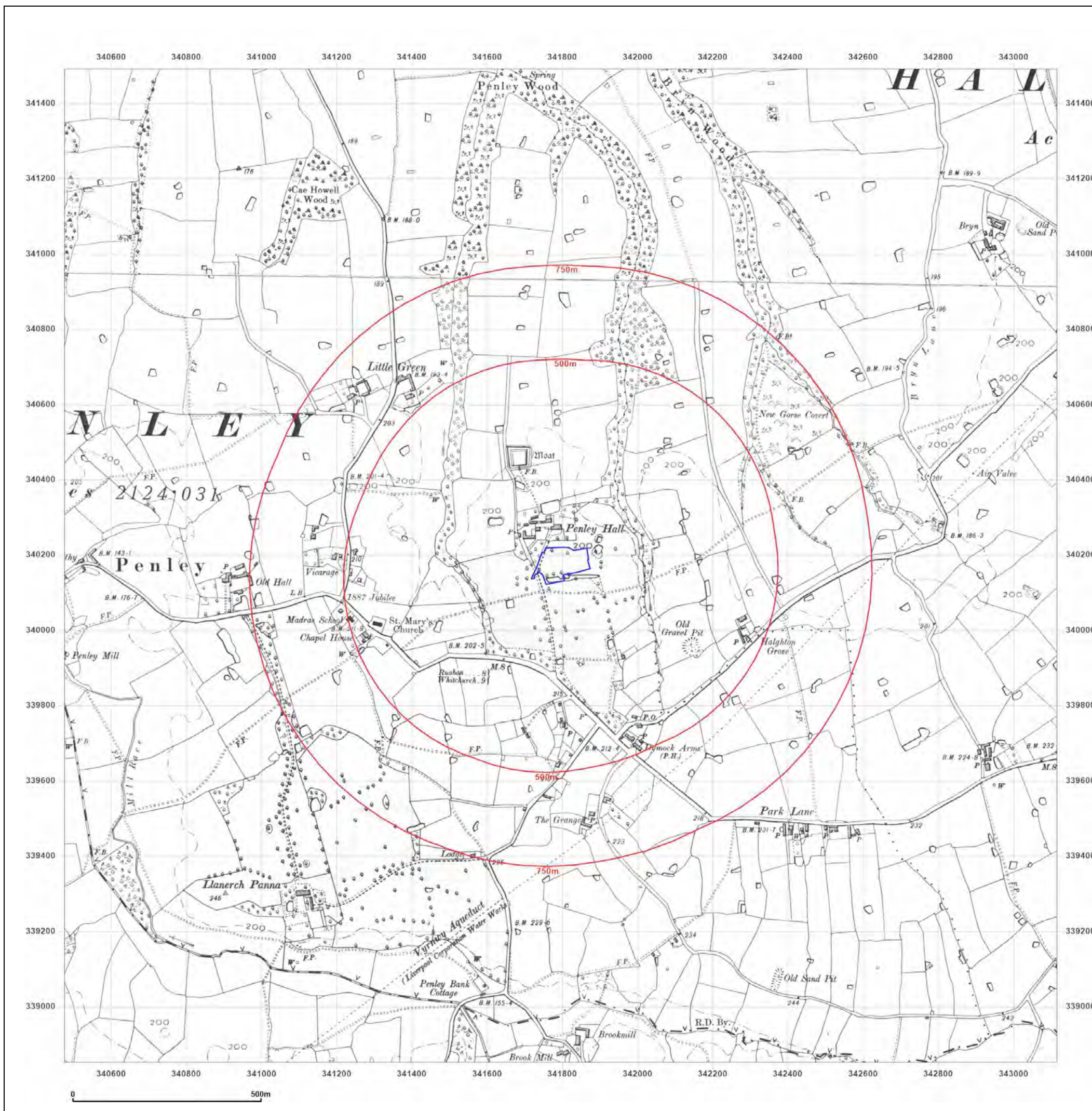


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Site Details:

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Report Ref: GS-8OP-CEB-JQ2-5WT
Grid Ref: 341795, 340171

Map Name: County Series

Map date: 1899

Scale: 1:10,560

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Revised 1899
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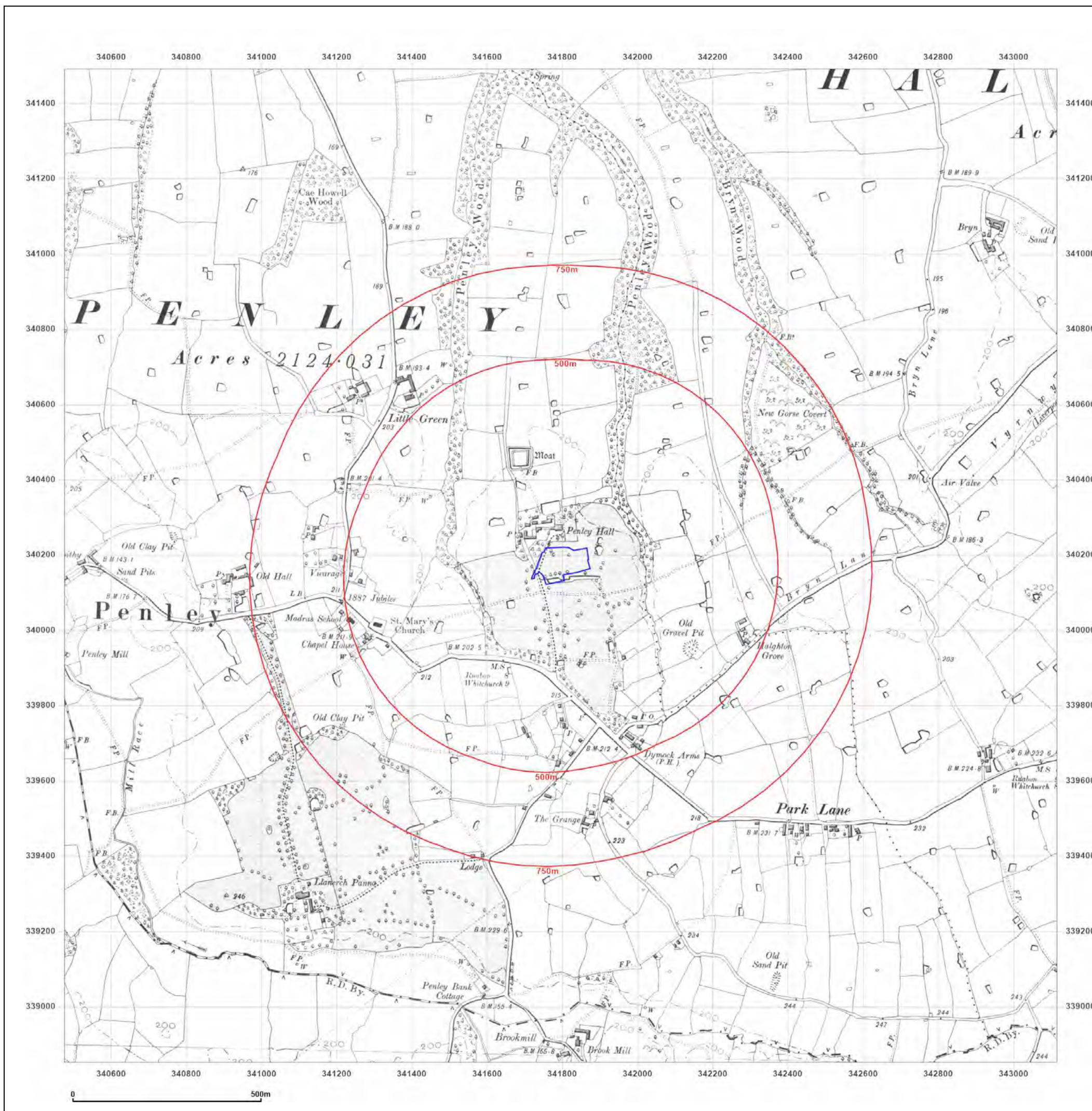


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Map Name: County Series

Map date: 1914

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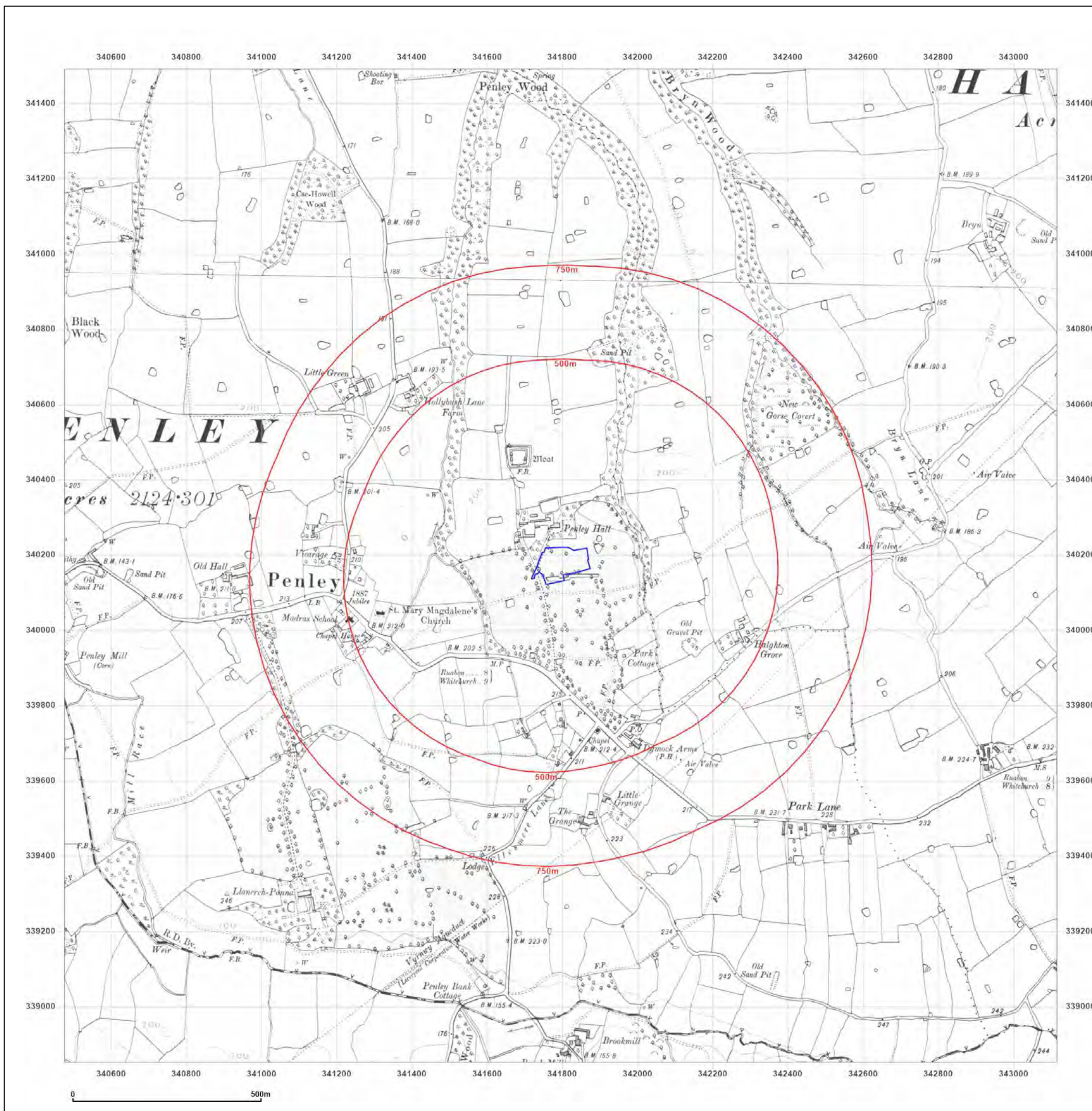


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Client Ref: 007526
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Map date: 1929-1930

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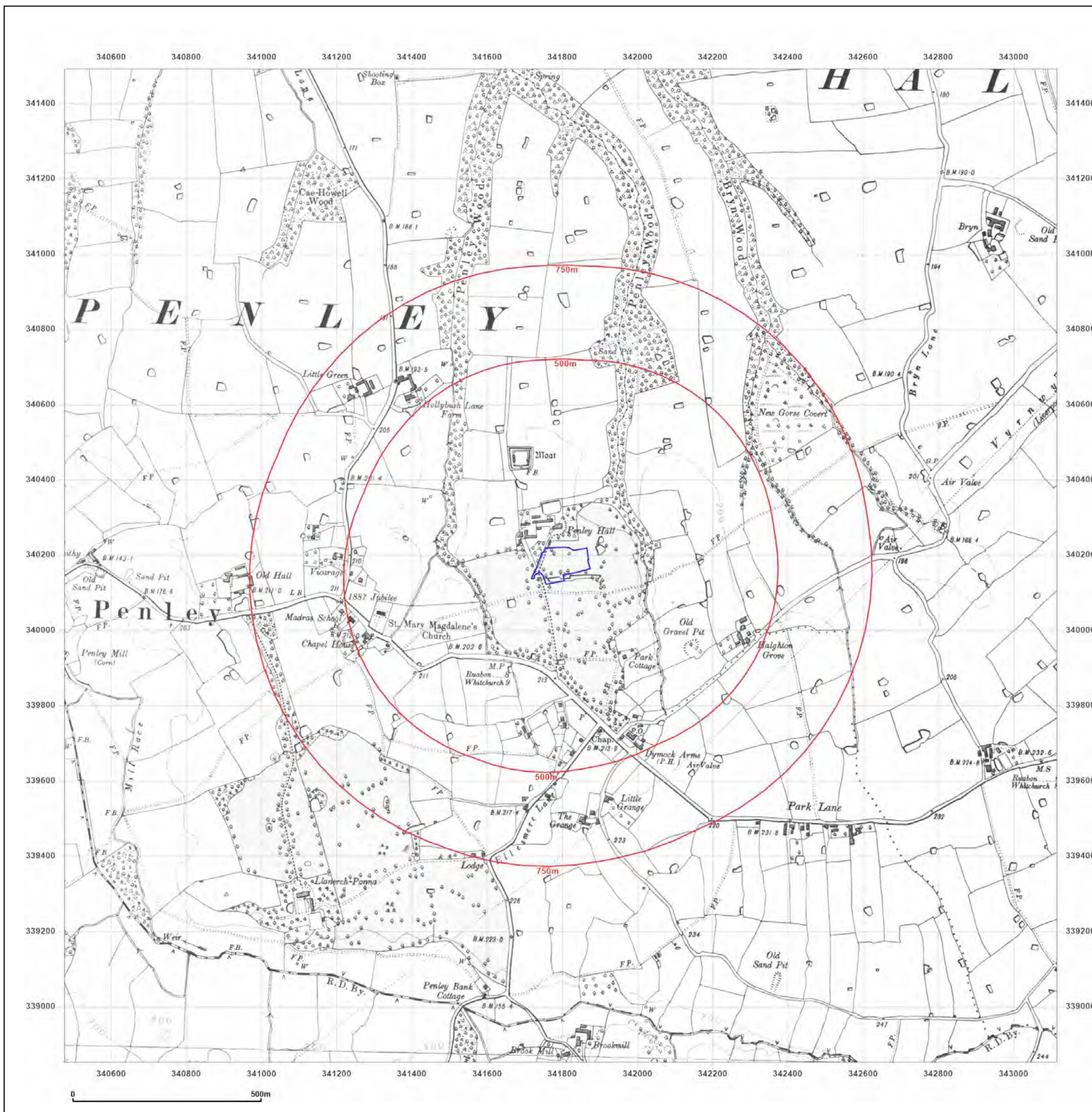


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Site Details:

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Client Ref: 007526
Report Ref: GS-8OP-CEB-JQ2-5WT
Grid Ref: 341795, 340171

Map Name: Provisional

Map date: 1949-1954

Scale: 1:10,560

Printed at: 1:10,560



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

Surveyed N/A
 Revised 1954
 Edition N/A
 Copyright 1954
 Levelled N/A

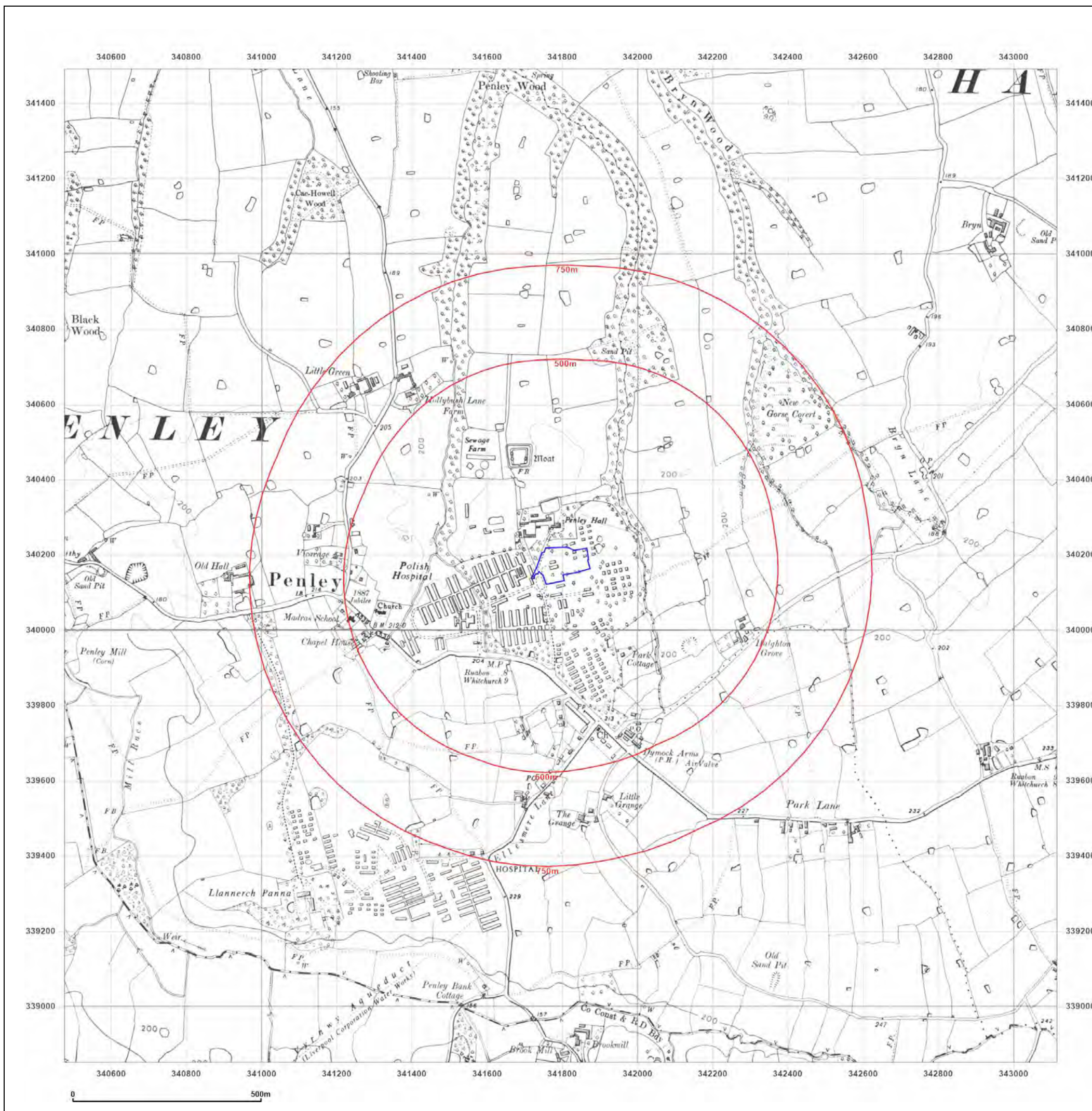


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Site Details:

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Client Ref: 007526
Report Ref: GS-8OP-CEB-JQ2-5WT
Grid Ref: 341795, 340171

Map Name: Provisional

Map date: 1970

Scale: 1:10,560

Printed at: 1:10,560



Surveyed N/A
Revised 1970
Edition N/A
Copyright 1954
Levelled N/A

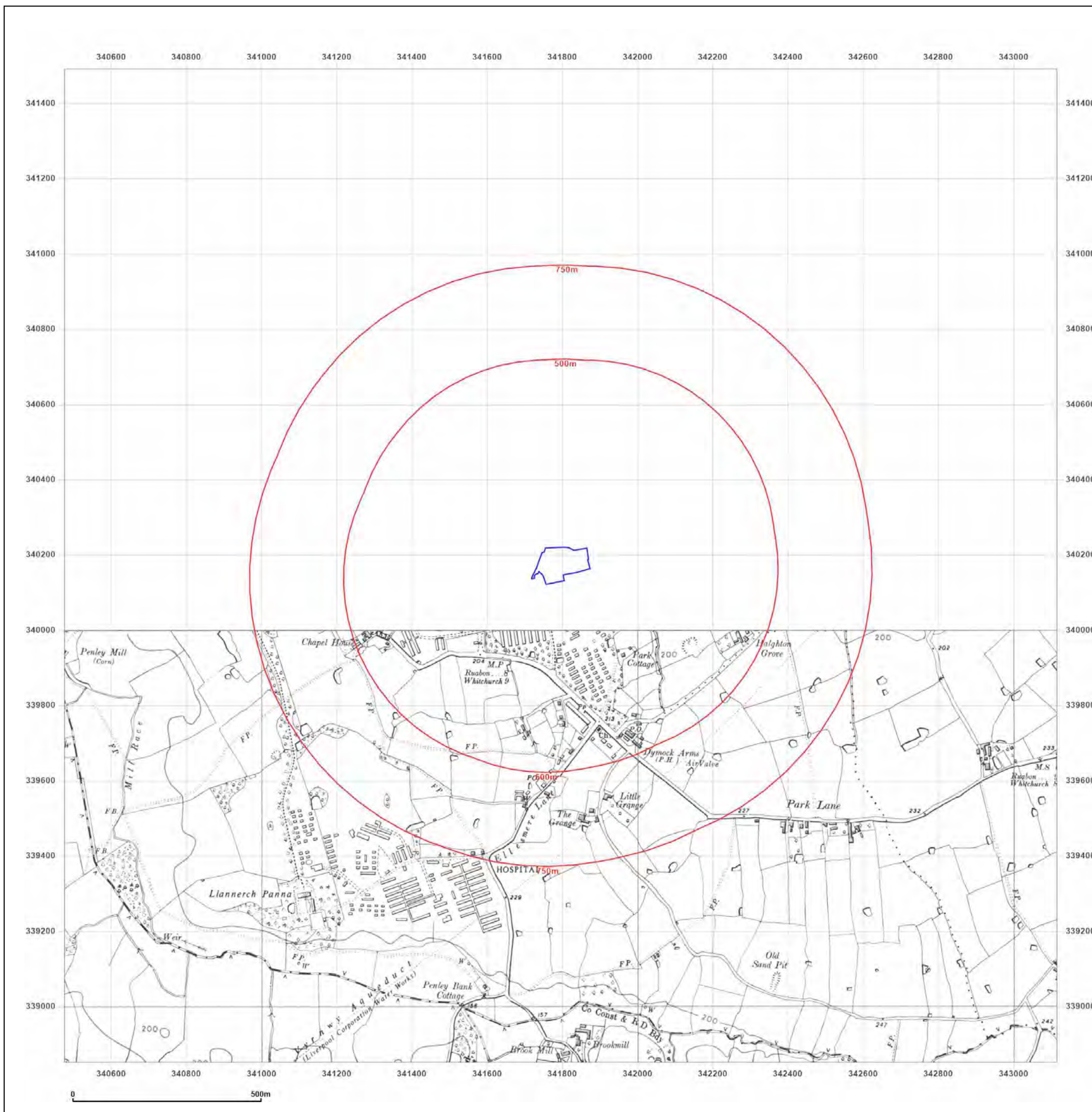


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Report Ref: GS-8OP-CEB-JQ2-5WT
Grid Ref: 341795, 340171

Map Name: National Grid

Map date: 1979-1980

Scale: 1:10,000

Printed at: 1:10,000



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Revised 1979
Edition N/A
Copyright 1979
Levelled 1973

Surveyed 1974
Revised 1980
Edition N/A
Copyright 1980
Levelled 1973

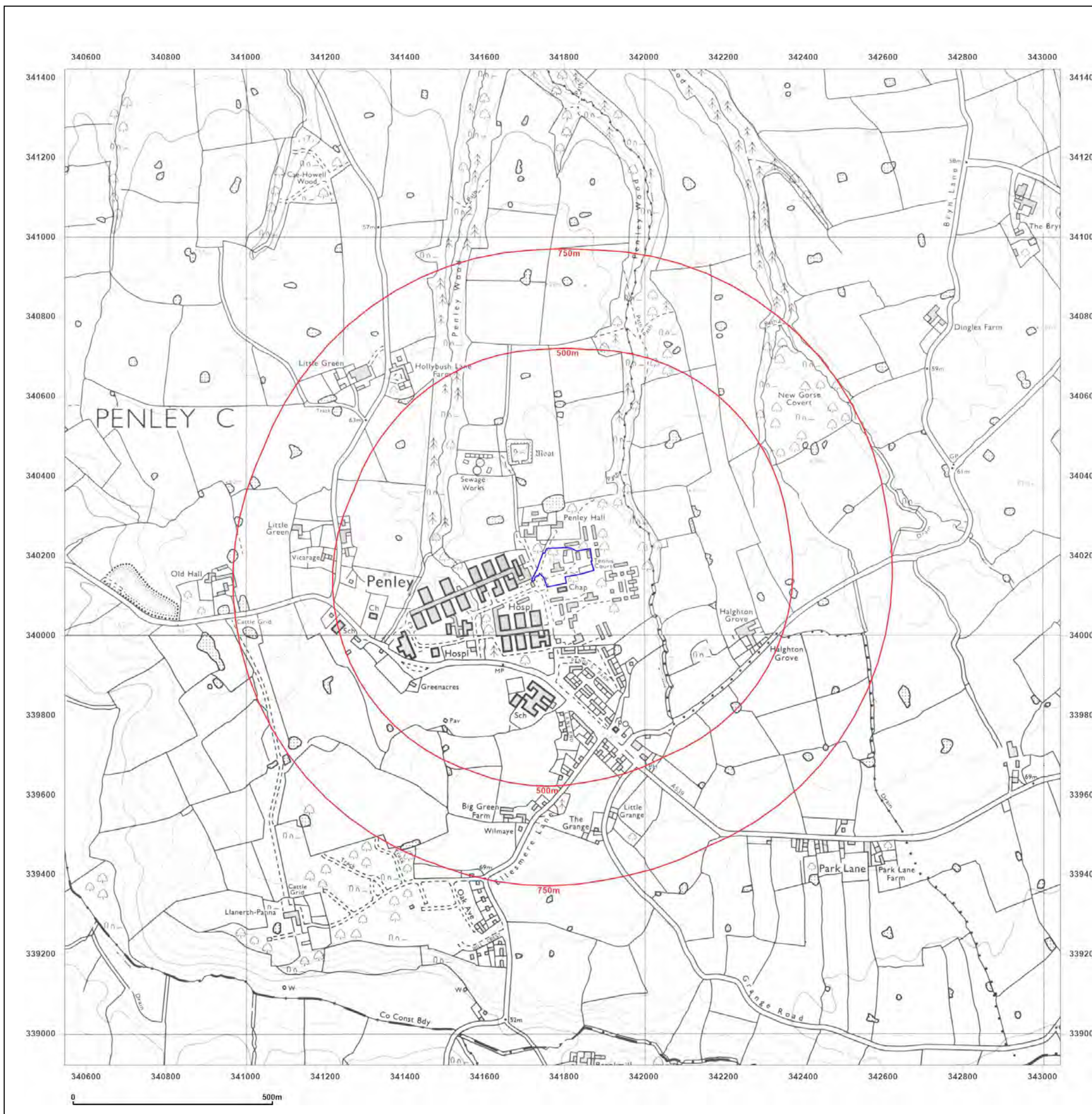


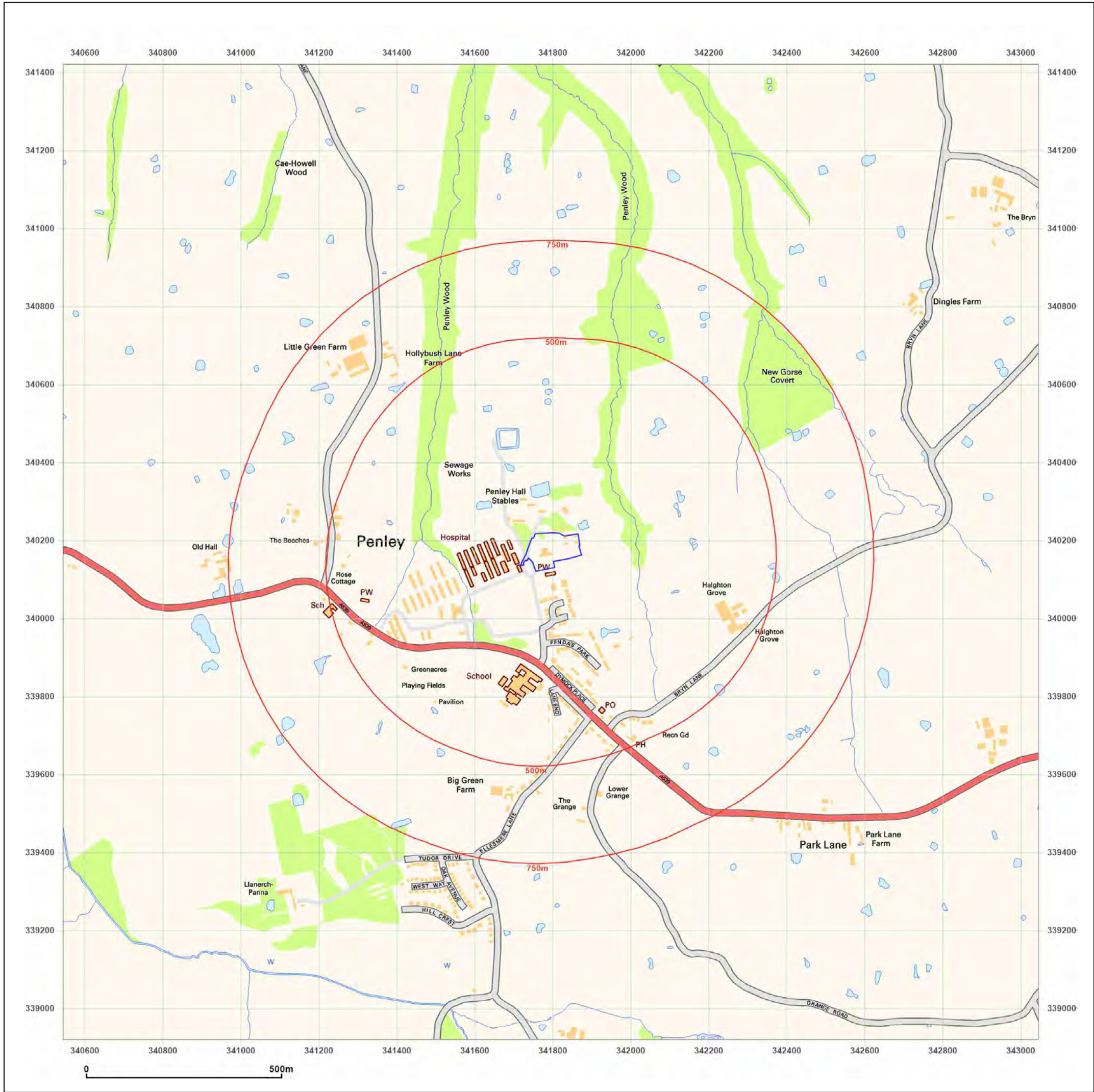
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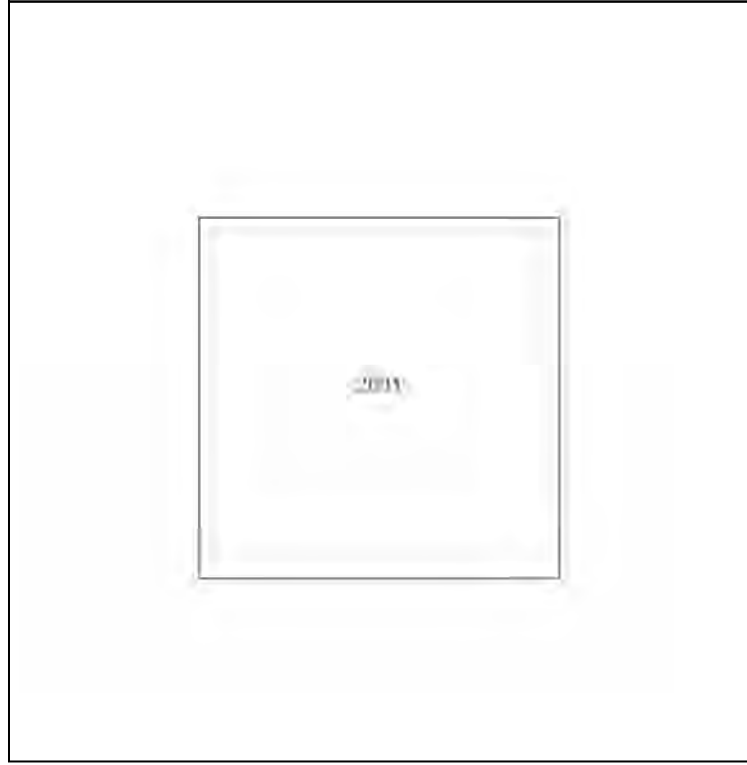


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Map Name: National Grid
Map date: 2001
Scale: 1:10,000
Printed at: 1:10,000



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Site Details:

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Report Ref: GS-8OP-CEB-JQ2-5WT
Grid Ref: 341795, 340171

Map Name: National Grid

Map date: 2010

Scale: 1:10,000

Printed at: 1:10,000

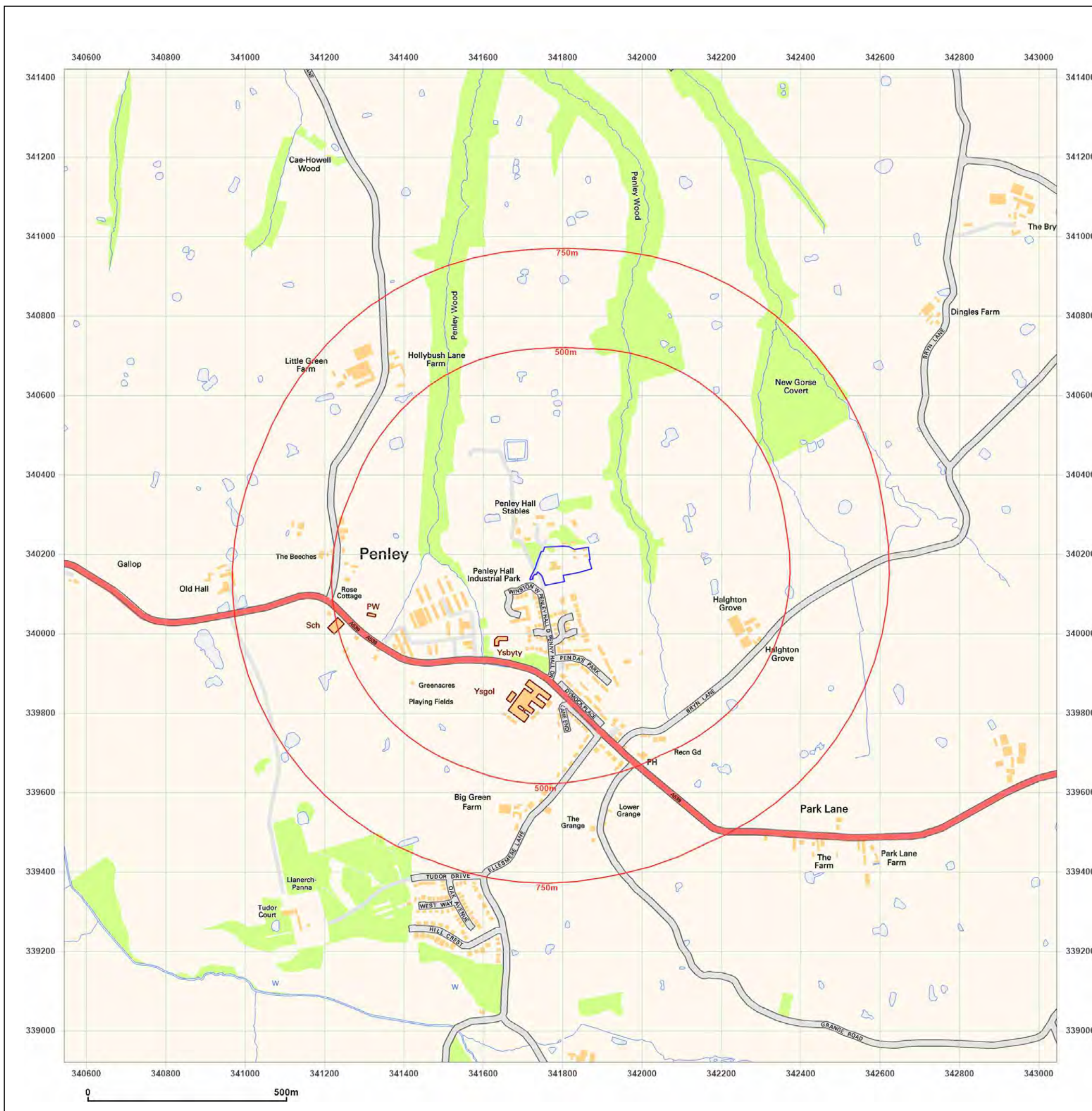


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Site Details:

Penley, Wrexham

Client Ref: 007526
Report Ref: GS-8OP-CEB-JQ2-5WT
Grid Ref: 341795, 340171

Map Name: County Series

Map date: 1874

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1874
Revised 1874
Edition N/A
Copyright N/A
Levelled N/A

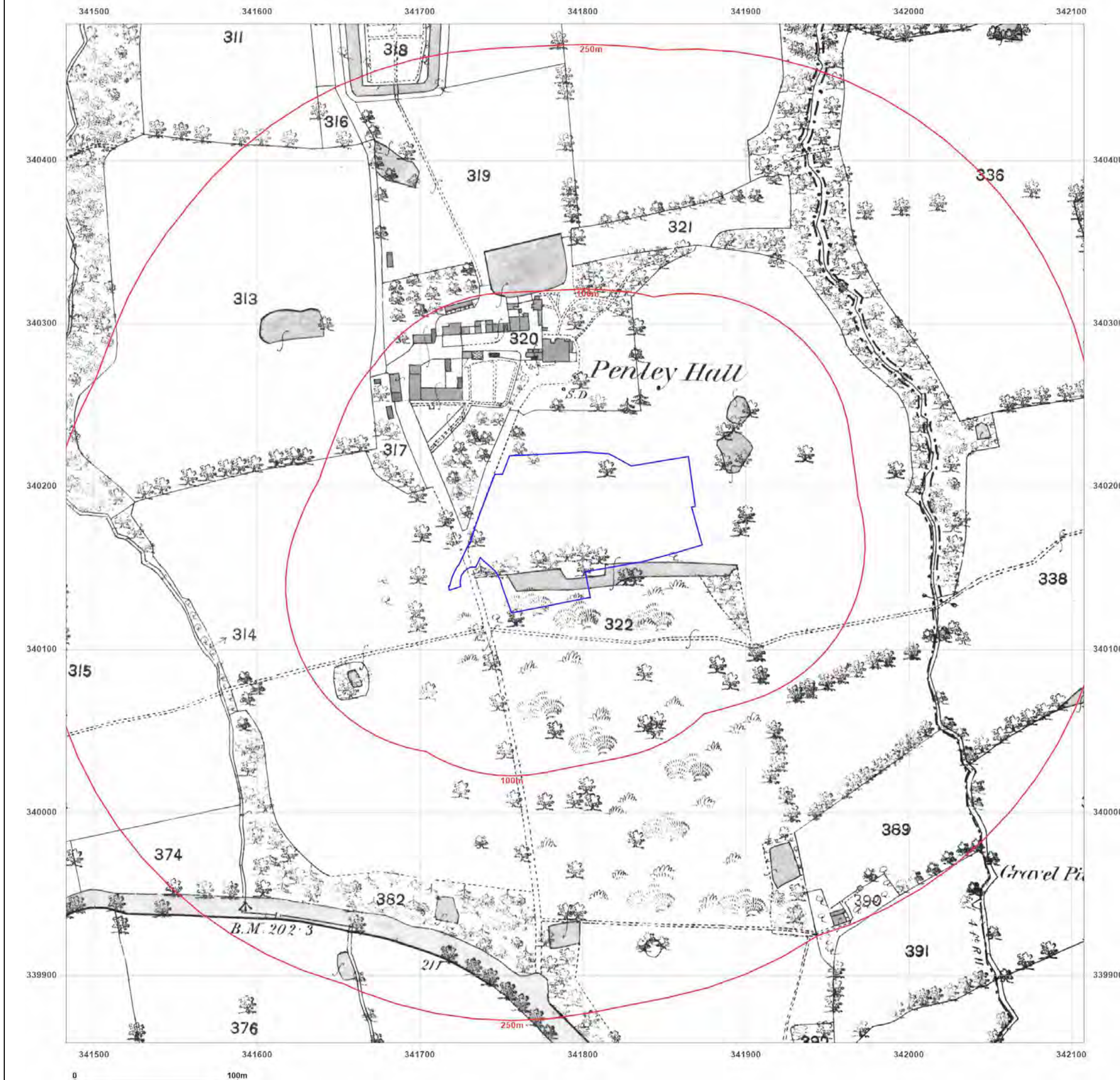


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Site Details:

Penley, Wrexham

Client Ref: 007526
Report Ref: GS-8OP-CEB-JQ2-5WT
Grid Ref: 341795, 340171

Map Name: County Series

Map date: 1876

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1876
Revised 1876
Edition N/A
Copyright N/A
Levelled N/A

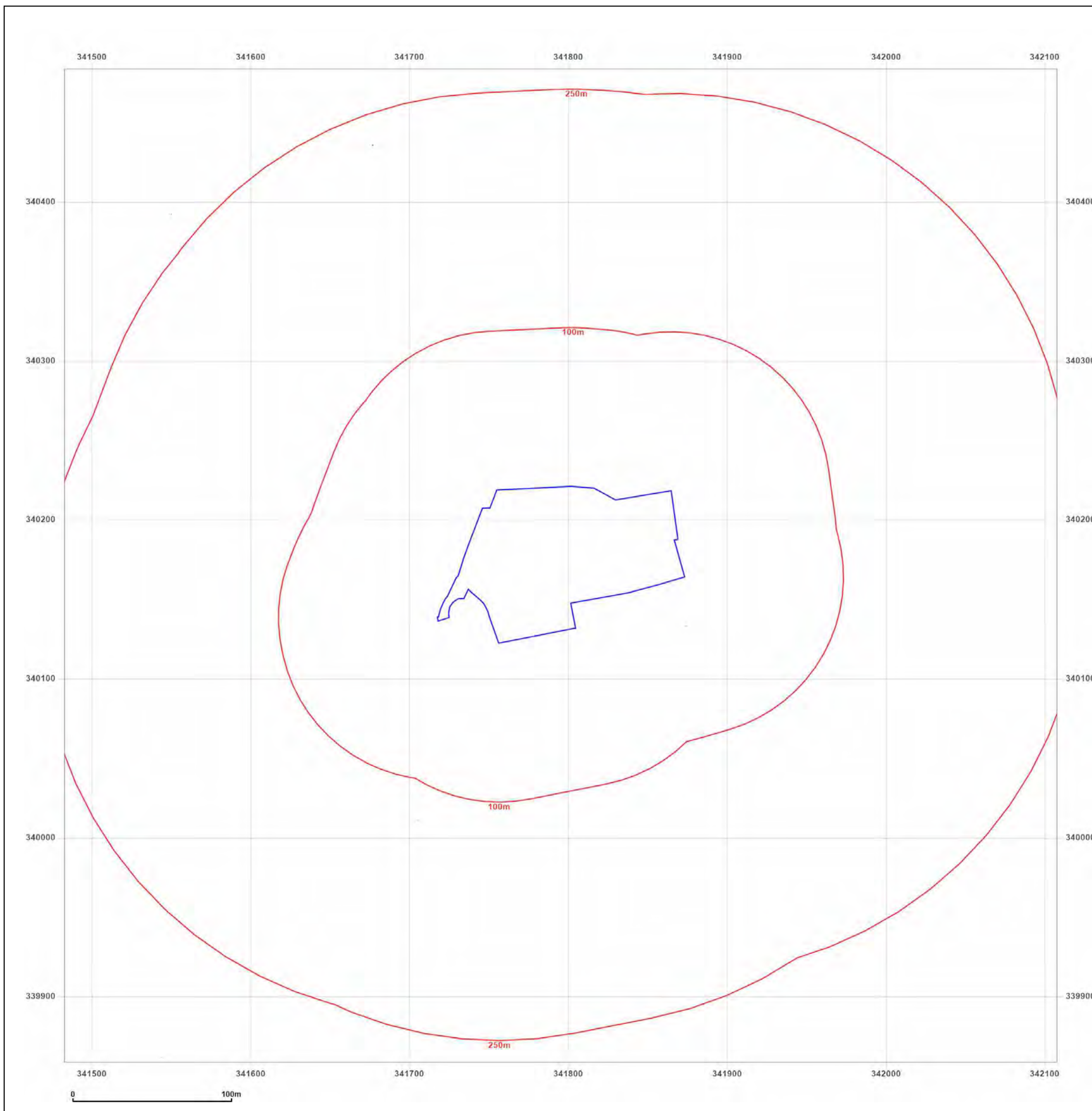


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Site Details:

Penley, Wrexham

Client Ref: 007526
Report Ref: GS-8OP-CEB-JQ2-5WT
Grid Ref: 341795, 340171

Map Name: County Series

Map date: 1899

Scale: 1:2,500

Printed at: 1:2,500



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

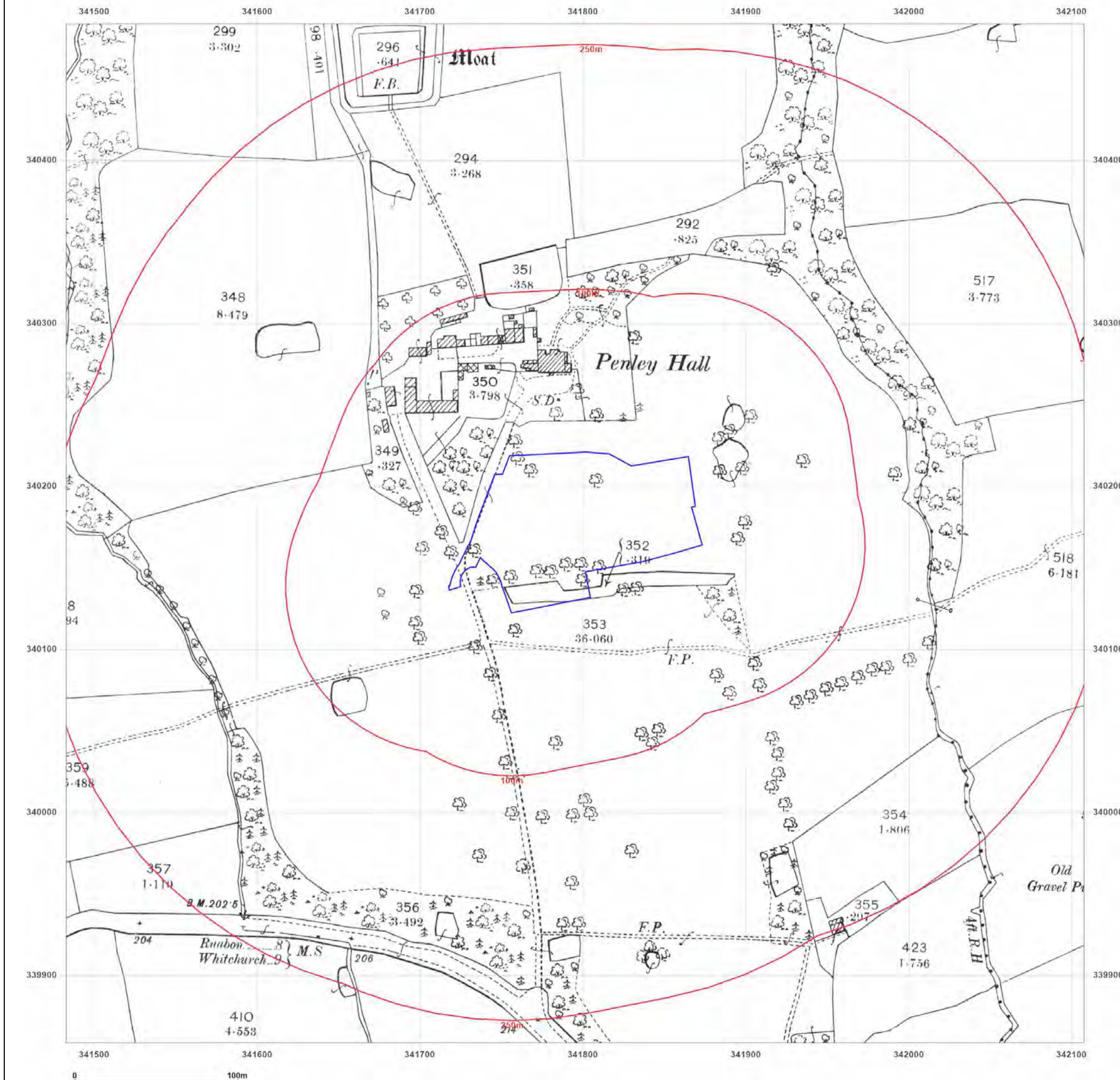


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Site Details:

Penley, Wrexham

Client Ref: 007526
Report Ref: GS-8OP-CEB-JQ2-5WT
Grid Ref: 341795, 340171

Map Name: County Series

Map date: 1926

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1926
 Revised 1926
 Edition N/A
 Copyright N/A
 Levelled N/A

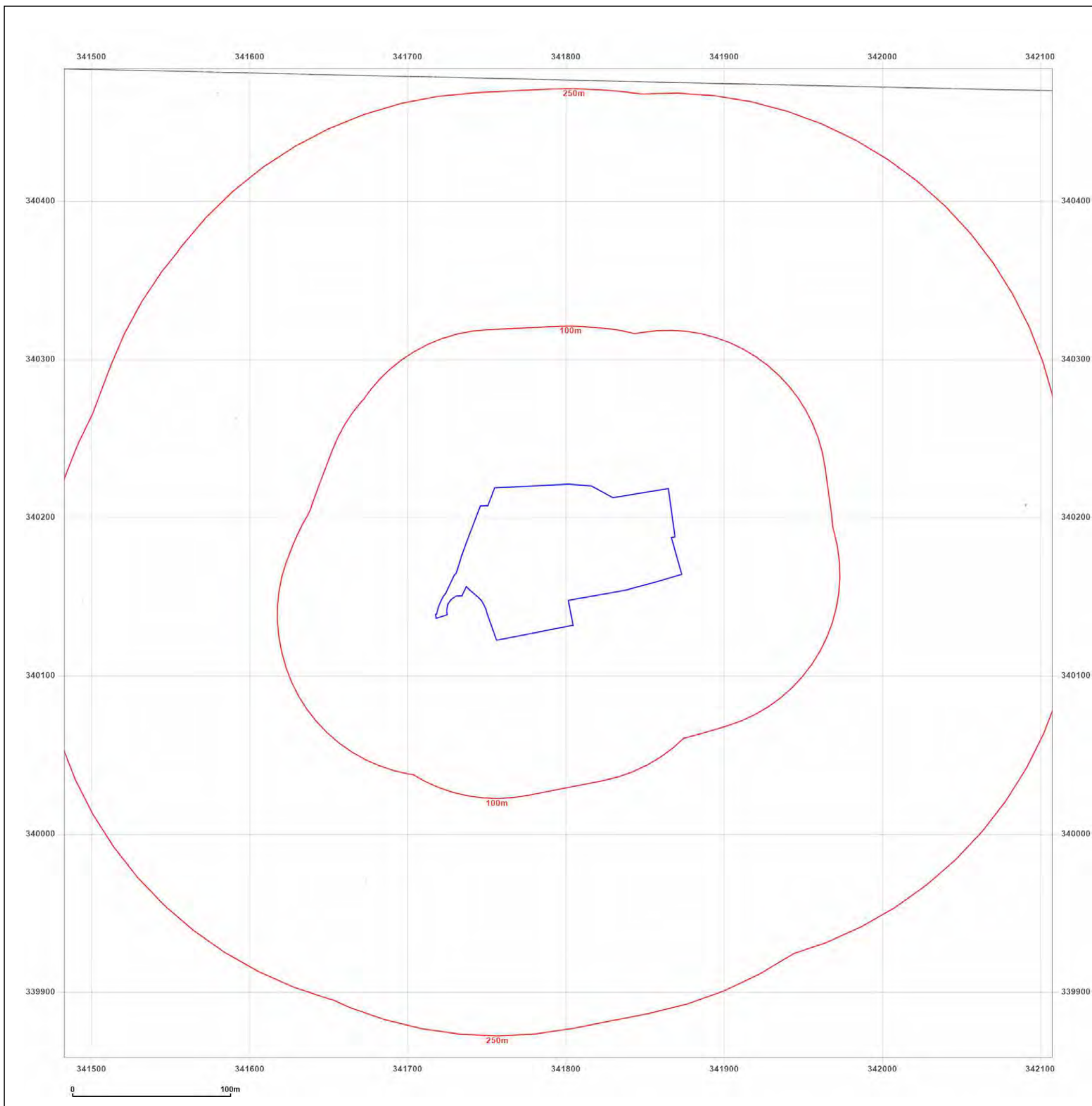


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Site Details:

Penley, Wrexham

Client Ref: 007526
Report Ref: GS-8OP-CEB-JQ2-5WT
Grid Ref: 341795, 340171

Map Name: National Grid

Map date: 1974

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1974
 Revised 1974
 Edition N/A
 Copyright 1975
 Levelled 1969

Surveyed 1974
 Revised 1974
 Edition N/A
 Copyright 1975
 Levelled 1969

Surveyed 1974
 Revised 1974
 Edition N/A
 Copyright 1975
 Levelled 1969

Surveyed 1974
 Revised 1974
 Edition N/A
 Copyright 1975
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Site Details:

Penley, Wrexham

Client Ref: 007526
Report Ref: GS-8OP-CEB-JQ2-5WT
Grid Ref: 341795, 340171

Map Name: National Grid

Map date: 1975

Scale: 1:2,500

Printed at: 1:2,500



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



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Site Details:

Penley, Wrexham

Client Ref: 007526

Report Ref: GS-8OP-CEB-JQ2-5WT

Grid Ref: 341795, 340171

Map Name: National Grid

Map date: 1992-1995

Scale: 1:2,500

Printed at: 1:2,500



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

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

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

Surveyed 1995
Revised N/A
Edition N/A
Copyright 1995
Levelled N/A



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Site Details:

Penley, Wrexham

Client Ref: 007526
Report Ref: GS-8OP-CEB-JQ2-5WT
Grid Ref: 341795, 340171

Map Name: LandLine

Map date: 2003

Scale: 1:1,250

Printed at: 1:1,250

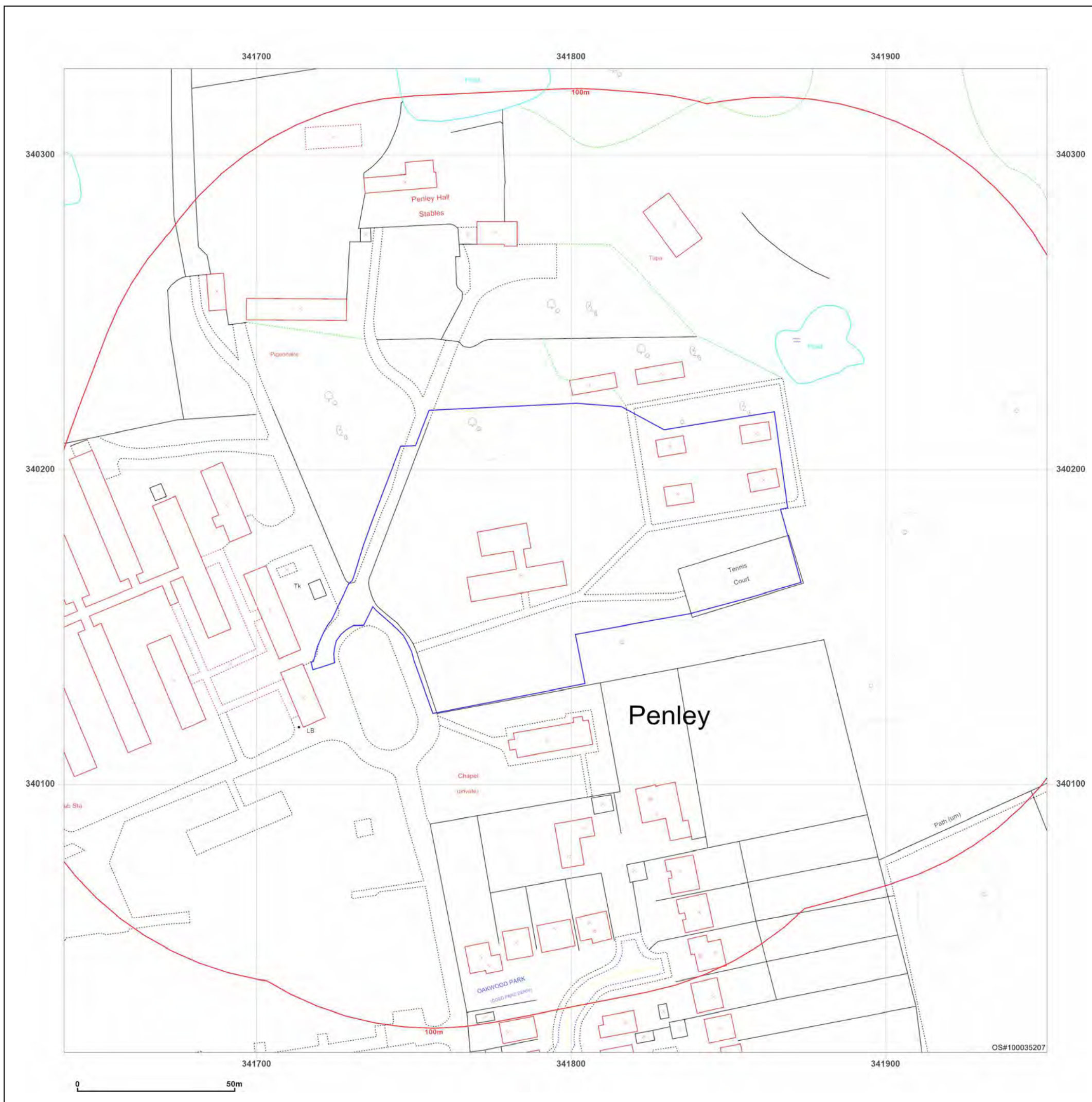


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Production date: 27 February 2024

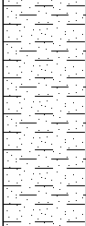
Map legend available at:
www.groundsure.com/sites/default/files/groundsure_legend.pdf



APPENDIX VII

EXPLORATORY HOLE LOGS



				Trial Pit Log				TrialPit No TP101 Sheet 1 of 1	
Project Name: Tupa, Penley				Project No. 17510		Co-ords: 341844.00 - 340167.00		Date 20/03/2024	
Location: Wrexham						Dimensions (m): 3.00 0.60		Scale 1:30	
Client: Fisher German						Depth 1.50		Logged J. WAUGH	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
 0.30	0.10	ES+L		0.20		  	MADE GROUND: Asphalt.		
				0.30			MADE GROUND: Black sandy gravel. Gravel is fine to coarse angular to subrounded of sandstone and clinker with inclusions of ash.		
	0.50	ES		0.50			MADE GROUND: Light orangish brown to grey silty sandy gravel. Gravel is fine to coarse angular to subrounded of mudstone and sandstone with fragments of brick.		
	0.50	HVP	84				Firm to stiff brown slightly gravelly sandy CLAY. Gravel is fine to medium angular to subrounded of mudstone.		
	1.00	B					Becoming very stiff		
1.00	HVP	197							
	1.50	HVP	197	1.50			End of Pit at 1.50m		
Trial Pit Photographs									
 20/03/2024 120° SE Tupa, Penley 17-510 TP101					 20/03/2024 125° SE Tupa, Penley 17-510 TP101				
TP101 - Excavation					TP101 - Arisings				
Remarks: 1. Complete. 2. Water strike noted as moderate ingress at 0.30 m bgl. 3. W3W: bonnet.severe.ensemble									
Stability: STABLE									

				Trial Pit Log			TrialPit No TP102 Sheet 1 of 1	
Project Name: Tupa, Penley				Project No. 17510		Co-ords: 341855.00 - 340186.00 Level:		Date 20/03/2024
Location: Wrexham						Dimensions (m): 3.00		Scale 1:30
Client: Fisher German						Depth 2.10		Logged J. WAUGH
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
 0.70	0.10	ES		0.30			Dark brown silty clayey gravelly fine to medium SAND with rootlets. Gravel is fine to medium subrounded of sandstone. (Topsoil).	
	0.50	ES					Greyish brown silty gravelly fine to medium SAND. Gravel is fine to coarse subangular to rounded of sandstone.	
	1.00	HVP	96				Firm to stiff brown slightly gravelly sandy CLAY. Gravel is fine to coarse subrounded to rounded of sandstone.	
	1.50	HVP	197	2.10			Becoming very stiff	
	2.00	HVP	197				End of Pit at 2.10m	
Trial Pit Photographs								
TP102 - Excavation				TP102 - Arisings				
Remarks: 1. Complete. 2. Water strike noted as slow ingress at 0.70 m bgl. 3. W3W: marmalade.continues.unwound								
Stability: STABLE								

				Trial Pit Log			TrialPit No TP103 Sheet 1 of 1		
Project Name: Tupa, Penley				Project No. 17510		Co-ords: 341766.00 - 340144.00 Level:		Date 20/03/2024	
Location: Wrexham						Dimensions (m): 3.00		Scale 1:30	
Client: Fisher German						Depth 2.30		Logged J. WAUGH	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
 0.40	0.20	ES		0.40			Dark brown silty sandy CLAY with frequent rootlets. (Topsoil).		
	0.50	HVP	87				Firm to stiff brown slightly gravelly sandy CLAY. Gravel is fine to coarse subrounded to rounded of sandstone.		
	1.00	HVP	155				<i>Becoming very stiff</i>		
	1.50 1.50	B HVP	197						
	1.90	HVP	197						
				2.30			End of Pit at 2.30m		
Trial Pit Photographs									
TP103 - Excavation					TP103 - Arisings				
Remarks: 1. Complete. 2. Water strike noted as slow ingress at 0.40 m bgl. 3. W3W: left.shorts.correctly									
Stability: STABLE									

Project Name: Tupa, Penley

Project No.
17510

Co-ords: 341809.00 - 340149.00
Level:

Date
20/03/2024

Location: Wrexham

Dimensions (m): 3.00

Scale
1:30

Client: Fisher German

Depth 2.10

0.60

Logged
J. WAUGH

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼ 0.30				0.30			Dark brown silty sandy CLAY with frequent rootlets. (Topsoil).	1
	0.50	HVP	96				Firm to stiff brown slightly gravelly sandy CLAY. Gravel is fine to coarse subrounded to rounded of sandstone.	
	1.00 1.00	ES HVP	152		Becoming very stiff			
	1.50	HVP	197					
	2.00	HVP	197	2.10				
							End of Pit at 2.10m	2
								3
								4

Trial Pit Photographs



TP104 - Excavation



TP104 - Arisings

Remarks: 1. Complete. 2. Water strike noted as slow ingress at 0.30 m bgl. 3. W3W: onto.claps.manicured

Stability: STABLE

				Trial Pit Log			TrialPit No TP105 Sheet 1 of 1		
Project Name: Tupa, Penley				Project No. 17510		Co-ords: 341822.00 - 340156.00 Level:		Date 20/03/2024	
Location: Wrexham						Dimensions (m): 3.00		Scale 1:30	
Client: Fisher German						Depth 1.90		Logged J. WAUGH	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
 1.00	0.20	ES+L		0.10			MADE GROUND: Dark brown silty sandy clay with frequent rootlets. (Reworked topsoil).		
	0.40	ES+L		0.40			MADE GROUND: Orangish brown sandy gravel. Gravel is fine to coarse angular to subrounded of sandstone and brick with frequent subangular cobbles of brick.		
	0.50	ES		0.50				MADE GROUND: Black slightly clayey slightly gravelly silty sand with a slight organic odour. Gravel is fine to medium angular to subrounded of sandstone with fragments of brick.	
	0.80	B		0.80				Grey silty fine to medium SAND.	
	1.00	HVP	80	1.00				Light orangish brown silty clayey fine to medium SAND.	
	1.50	HVP	197					Firm to stiff brown slightly gravelly sandy CLAY. Gravel is fine to coarse subrounded to rounded of sandstone.	
	1.90	HVP	197	1.90				Becoming very stiff	
					End of Pit at 1.90m				
Trial Pit Photographs									
TP105 - Excavation				TP105 - Arisings					
Remarks: 1. Complete. 2. Water strike noted as slow ingress at 1.00 m bgl. 3. Slight organic odour between 0.40 m bgl and 0.80 m bgl. 4. W3W: tadpole.tilt.waxing									
Stability: STABLE									



				Trial Pit Log			TrialPit No TP107 Sheet 1 of 1	
Project Name: Tupa, Penley				Project No. 17510		Co-ords: 341797.00 - 340216.00 Level:		Date 20/03/2024
Location: Wrexham						Dimensions (m): 3.00		Scale 1:30
Client: Fisher German						Depth 2.50		Logged J. WAUGH
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
 0.60				0.40			Dark brown silty sandy CLAY with frequent rootlets. (Topsoil).	
				0.60			Orangish brown silty clayey fine to medium SAND.	
	0.80	ES					Stiff brown slightly gravelly sandy CLAY. Gravel is fine to coarse subrounded to rounded of sandstone. <i>Becoming very stiff</i>	
	1.00	HVP	104					
	1.50	HVP	197					
1.80	HVP	197						
				2.50			End of Pit at 2.50m	
Trial Pit Photographs								
TP107 - Excavation				TP107 - Arisings				
Remarks: 1. Complete. 2. Water strike noted as slow ingress at 0.60 m bgl. 3. W3W: collected.traders.slides								
Stability: STABLE								

				Trial Pit Log				TrialPit No TP108 Sheet 1 of 1	
Project Name: Tupa, Penley				Project No. 17510		Co-ords: 341780.00 - 340214.00 Level:		Date 20/03/2024	
Location: Wrexham						Dimensions (m): 3.00 0.60		Scale 1:30	
Client: Fisher German						Depth 2.20		Logged J. WAUGH	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
 0.60	0.10	ES		0.30			Dark brown silty sandy CLAY with frequent rootlets. (Topsoil).		
							Orangish brown silty clayey fine to medium SAND.		
	0.50	ES		0.60			Firm to stiff brown slightly gravelly sandy CLAY. Gravel is fine to coarse subrounded to rounded of sandstone.		
	1.00	HVP	99						
	1.50	HVP	197				Becoming very stiff		
	2.00	HVP	197						
				2.20			End of Pit at 2.20m		
Trial Pit Photographs									
 20/03/2024 59° NE Tupa, Penley 17-510 TP108					 20/03/2024 16° N Tupa, Penley 17-510 TP108				
TP108 - Excavation					TP108 - Arisings				
Remarks: 1. Complete. 2. Water strike noted as slow ingress at 0.60 m bgl. 3. W3W: constrain.represent.saves									
Stability: STABLE									

Project Name: Tupa, Penley

Project No.
17510

Co-ords: 341775.00 - 340195.00
Level:

Date
20/03/2024

Location: Wrexham

Dimensions (m): 3.00

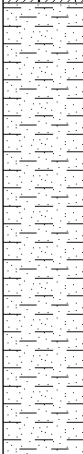
Scale
1:30

Client: Fisher German

Depth 2.10

0.60

Logged
J. WAUGH

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
 0.30				0.30			Dark brown silty sandy CLAY with frequent rootlets. (Topsoil).	1 — 2 — 3 — 4 —
	0.50	HVP	58				Firm brown slightly gravelly sandy CLAY. Gravel is fine to coarse subrounded to rounded of sandstone.	
	1.00 1.10	HVP ES	158				<i>Becoming very stiff</i>	
	1.50	HVP	197					
	1.90	HVP	197	2.10				
							End of Pit at 2.10m	

Trial Pit Photographs



TP109 - Excavation



TP109 - Arisings

Remarks: 1. Complete. 2. Water strike noted as slow ingress at 0.30 m bgl. 3. W3W: mysteries.rising.beaks

Stability: STABLE

				Trial Pit Log				TrialPit No TP110 Sheet 1 of 1	
Project Name: Tupa, Penley				Project No. 17510		Co-ords: 341754.00 - 340171.00 Level:		Date 20/03/2024	
Location: Wrexham						Dimensions (m): 3.00		Scale 1:30	
Client: Fisher German						Depth 2.00		Logged J. WAUGH	
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
 0.40	0.10	ES		0.30			Dark brown silty sandy CLAY with frequent rootlets. (Topsoil).		
	0.50	HVP	101	0.40			Orangish brown silty clayey fine to medium SAND.		
	1.00	HVP	197				Stiff brown slightly gravelly sandy CLAY. Gravel is fine to coarse subrounded to rounded of sandstone.		
	1.20	ES+L					Becoming very stiff		
	1.50	HVP	197						
	2.00	HVP	197	2.00			End of Pit at 2.00m		
Trial Pit Photographs									
 TP110 - Excavation					 TP110 - Arisings				
Remarks: 1. Complete. 2. Water strike noted as slow ingress at 0.40 m bgl. 3. W3W: redefined.dividers.digital									
Stability: STABLE									

Borehole Log

Borehole No.

WS101

Sheet 1 of 1

Project Name: Tupa, Penley

Project No.
17510

Co-ords: 341861.00 - 340172.00

Hole Type
WS

Location: Wrexham

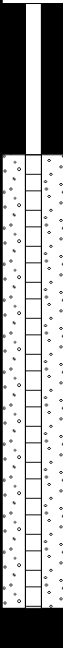
Level:

Scale
1:50

Client: Fisher German

Dates: 20/03/2024 -

Logged By
J. WAUGH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.05			MADE GROUND: Asphalt.	
					0.30			MADE GROUND: Greyish brown sandy gravel. Gravel is fine to coarse angular to subrounded of sandstone with fragments of brick.	
		0.50	ES		0.60			Greyish brown silty fine to medium SAND.	
		1.00	D					Brown slightly gravelly sandy CLAY. Gravel is fine to coarse subrounded to rounded of sandstone.	1
		1.00	U	N=15 (1,2/3,3,4,5)					
		1.00							
		2.00	D					Very stiff, high to very high strength brown slightly gravelly sandy CLAY. Gravel is fine to coarse subrounded to rounded of sandstone.	2
		2.00		N=36 (4,5/6,8,10,12)					
		3.00	D						3
		3.00		N=29 (5,6/6,7,8,8)					
		4.00	D						4
		4.00		50 (7,10/50 for 160mm)		4.00			
				4.31					
							End of borehole at 4.31 m		

Borehole Log

Borehole No.

WS102

Sheet 1 of 1

Project Name: Tupa, Penley

Project No.
17510

Co-ords: 341803.00 - 340169.00

Hole Type
WS

Location: Wrexham

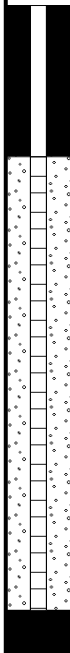
Level:

Scale
1:50

Client: Fisher German

Dates: 20/03/2024 -

Logged By
J. WAUGH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30			Dark brown silty sandy CLAY with frequent rootlets. (Topsoil).	
					0.60			Grey slightly gravelly clayey fine to medium SAND. Gravel is fine to medium subangular to subrounded of sandstone.	
		0.90	ES					Light orangish brown clayey fine to medium SAND.	1
		1.00	D	N=16 (1,2/3,4,4,5)	1.10			Brown slightly gravelly sandy CLAY. Gravel is fine to coarse subrounded to rounded of sandstone.	
		1.00						Very stiff, high to very high strength brown slightly gravelly sandy CLAY. Gravel is fine to coarse subrounded to rounded of sandstone.	
		2.00	D						2
		2.00	U	N=35 (2,5/5,7,10,13)					
		2.00							
		3.00	D						3
		3.00		N=32 (4,6/6,8,9,9)					
		4.00	D		4.00				4
		4.00		50 (8,12/50 for 240mm)	4.39				
								End of borehole at 4.39 m	5
									6
									7
									8
									9
									10

Remarks

1. Refused on very stiff CLAY. 2. Monitoring well installed. 3. Response zone 1.00 - 4.00 m bgl. 4. W3W: gossiping.cultivation.ignore



Borehole Log

Borehole No.

WS103

Sheet 1 of 1

Project Name: Tupa, Penley

Project No.
17510

Co-ords: 341760.00 - 340152.00

Hole Type
WS

Location: Wrexham

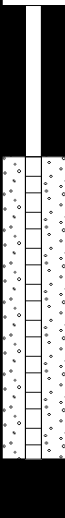
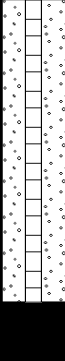
Level:

Scale
1:50

Client: Fisher German

Dates: 20/03/2024 -

Logged By
J. WAUGH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20			0.20			Dark brown silty sandy CLAY with frequent rootlets. (Topsoil).	
		0.40			0.40			Greyish brown clayey fine to medium SAND.	
		0.80	ES						1
		1.00		N=13 (1,2/2,3,4,4)				Stiff to very stiff, medium to very high strength brown slightly gravelly sandy CLAY. Gravel is fine to coarse subrounded to rounded of sandstone.	
		2.00	D						2
		2.00	U						
		2.00		N=34 (3,4/5,8,9,12)					
		3.00	D						3
		3.00		50 (7,11/50 for 240mm)	3.39				
									4
									5
									6
									7
									8
									9
									10

Remarks

1. Refused on very stiff CLAY. 2. Monitoring well installed. 3. Response zone 1.00 - 3.00 m bgl. 4. W3W: cloak.cupcake.incorrect





Borehole Log

Borehole No.

WS104

Sheet 1 of 1

Project Name: Tupa, Penley

Project No.
17510

Co-ords: 341785.00 - 340147.00

Hole Type
WS

Location: Wrexham

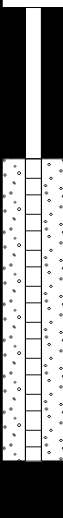
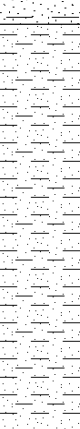
Level:

Scale
1:50

Client: Fisher German

Dates: 20/03/2024 -

Logged By
J. WAUGH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30			Dark brown silty sandy CLAY with frequent rootlets. (Topsoil).	
		0.60	ES		0.70			Light orangish brown clayey fine to medium SAND.	
		1.00	D					Brown slightly gravelly sandy CLAY. Gravel is fine to coarse subrounded to rounded of sandstone. Very stiff, high to very high strength brown slightly gravelly sandy CLAY. Gravel is fine to coarse subrounded to rounded of sandstone.	1
		1.00	U	N=15 (3,3/4,4,4,3)					
		1.00							
		2.00	D						2
		2.00		N=41 (3,5/6,9,12,14)					
3.00	D		3.00		3				
3.00		50 (6,6/50 for 280mm)	3.39						
					End of borehole at 3.43 m				4
									5
									6
									7
									8
									9
									10

Remarks

1. Refused on very stiff CLAY. 2. Monitoring well installed. 3. Response zone 1.00 - 3.00 m bgl. 4. W3W: wealth.outpost.yell





Borehole Log

Borehole No.

WS105

Sheet 1 of 1

Project Name: Tupa, Penley

Project No.
17510

Co-ords: 341783.00 - 340203.00

Hole Type
WS

Location: Wrexham

Level:

Scale
1:50

Client: Fisher German

Dates: 20/03/2024 -

Logged By
J. WAUGH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.00	U		0.20			Dark brown silty sandy CLAY with frequent rootlets. (Topsoil).	
		1.00	D	N=14 (1,2/2,3,4,5)				Brown slightly gravelly sandy CLAY. Gravel is fine to coarse subrounded to rounded of sandstone.	1
		1.00							
		1.20	ES						
		2.00	D	N=33 (3,4/6,7,9,11)					2
		2.00							
		3.00	D	50 (6,9/50 for 280mm)	3.00				3
		3.00			3.43				
									4
									5
									6
									7
									8
									9
									10

Remarks

1. Refused on very stiff CLAY. 2. Monitoring well installed. 3. Response zone 1.00 - 3.00 m bgl. 4. W3W: handlebar.stance.soda





APPENDIX VIII

CHEMICAL TESTING

RESULTS





Amended Report

Report No.:	24-09305-2		
Initial Date of Issue:	03-Apr-2024	Date of Re-Issue:	10-Apr-2024
Re-Issue Details:	This report has been revised and directly supersedes 24-09305-1 in its entirety		
Client	E3P		
Client Address:	Taylor Road Trafford Park Urmston Manchester M41 7JQ		
Contact(s):	mjackson@e3p.co.uk JWaugh@e3p.co.uk		
Project	Tupa, Penley		
Quotation No.:	Q23-31421	Date Received:	25-Mar-2024
Order No.:	007769	Date Instructed:	25-Mar-2024
No. of Samples:	21		
Turnaround (Wkdays):	11	Results Due:	10-Apr-2024
Date Approved:	10-Apr-2024		

Approved By:

Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Leachate

Project: Tupa, Penley

Client: E3P	Chemtest Job No.: 24-09305					
Quotation No.: Q23-31421	Chemtest Sample ID.: 1784722					
	Client Sample ID.:					TP105
	Sample Type:					SOIL
	Top Depth (m):					0.4
	Date Sampled:					20-Mar-2024
	Time Sampled:					12:00
Determinand	Accred.	SOP	Type	Units	LOD	
pH at 20C	U	1010	2:1		4.0	6.5
Cyanide (Total) Low-Level	N	1300	2:1	mg/l	0.0050	< 0.0050
Arsenic (Dissolved)	U	1455	2:1	µg/l	0.20	26
Cadmium (Dissolved)	U	1455	2:1	µg/l	0.11	0.20
Chromium (Dissolved)	U	1455	2:1	µg/l	0.50	27
Copper (Dissolved)	U	1455	2:1	µg/l	0.50	8.4
Mercury (Dissolved)	U	1455	2:1	µg/l	0.05	0.06
Nickel (Dissolved)	U	1455	2:1	µg/l	0.50	22
Lead (Dissolved)	U	1455	2:1	µg/l	0.50	13
Selenium (Dissolved)	U	1455	2:1	µg/l	0.50	43
Zinc (Dissolved)	U	1455	2:1	µg/l	2.5	180
Chromium (Hexavalent)	U	1490	2:1	µg/l	20	< 20
C2 Aliphatic TPH >C5-C6	N	1675	2:1	µg/l	0.10	< 0.10
C2 Aliphatic TPH >C6-C8	N	1675	2:1	µg/l	0.10	< 0.10
C2 Aliphatic TPH >C8-C10	N	1675	2:1	µg/l	0.10	< 0.10
C2 Aliphatic TPH >C10-C12	N	1675	2:1	µg/l	0.10	< 0.10
C2 Aliphatic TPH >C12-C16	N	1675	2:1	µg/l	0.10	< 0.10
C2 Aliphatic TPH >C16-C21	N	1675	2:1	µg/l	0.10	< 0.10
C2 Aliphatic TPH >C21-C35	N	1675	2:1	µg/l	0.10	< 0.10
C2 Aliphatic TPH >C35-C44	N	1675	2:1	µg/l	0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	2:1	µg/l	5.0	< 5.0
C2 Aromatic TPH >C5-C7	N	1675	2:1	µg/l	0.10	< 0.10
C2 Aromatic TPH >C7-C8	N	1675	2:1	µg/l	0.10	< 0.10
C2 Aromatic TPH >C8-C10	N	1675	2:1	µg/l	0.10	< 0.10
C2 Aromatic TPH >C10-C12	N	1675	2:1	µg/l	0.10	< 0.10
C2 Aromatic TPH >C12-C16	N	1675	2:1	µg/l	0.10	< 0.10
C2 Aromatic TPH >C16-C21	N	1675	2:1	µg/l	0.10	< 0.10
C2 Aromatic TPH >C21-C35	N	1675	2:1	µg/l	0.10	< 0.10
C2 Aromatic TPH >C35-C44	N	1675	2:1	µg/l	0.10	< 0.10
C2 Total Aromatic Hydrocarbons	N	1675	2:1	µg/l	5.0	< 5.0
Total Petroleum Hydrocarbons	N	1675	2:1	µg/l	10	< 10
Benzene	U	1760	2:1	µg/l	1.0	< 1.0
Toluene	U	1760	2:1	µg/l	1.0	< 1.0
Ethylbenzene	U	1760	2:1	µg/l	1.0	< 1.0
m & p-Xylene	U	1760	2:1	µg/l	1.0	< 1.0
o-Xylene	U	1760	2:1	µg/l	1.0	< 1.0
Methyl Tert-Butyl Ether	N	1760	2:1	µg/l	1.0	< 1.0
Naphthalene	N	1800	2:1	µg/l	0.010	< 0.010
Acenaphthylene	N	1800	2:1	µg/l	0.010	< 0.010

Results - Leachate

Project: Tupa, Penley

Client: E3P	Chemtest Job No.: 24-09305					
Quotation No.: Q23-31421	Chemtest Sample ID.: 1784722					
	Client Sample ID.: TP105					
	Sample Type: SOIL					
	Top Depth (m): 0.4					
	Date Sampled: 20-Mar-2024					
	Time Sampled: 12:00					
Determinand	Accred.	SOP	Type	Units	LOD	
Acenaphthene	N	1800	2:1	µg/l	0.010	< 0.010
Fluorene	N	1800	2:1	µg/l	0.010	< 0.010
Phenanthrene	N	1800	2:1	µg/l	0.010	< 0.010
Anthracene	N	1800	2:1	µg/l	0.010	< 0.010
Fluoranthene	N	1800	2:1	µg/l	0.010	< 0.010
Pyrene	N	1800	2:1	µg/l	0.010	< 0.010
Benzo[a]anthracene	N	1800	2:1	µg/l	0.010	< 0.010
Chrysene	N	1800	2:1	µg/l	0.010	< 0.010
Benzo[b]fluoranthene	N	1800	2:1	µg/l	0.010	< 0.010
Benzo[k]fluoranthene	N	1800	2:1	µg/l	0.010	< 0.010
Benzo[a]pyrene	N	1800	2:1	µg/l	0.010	< 0.010
Indeno(1,2,3-c,d)Pyrene	N	1800	2:1	µg/l	0.010	< 0.010
Dibenz(a,h)Anthracene	N	1800	2:1	µg/l	0.010	< 0.010
Benzo[g,h,i]perylene	N	1800	2:1	µg/l	0.010	< 0.010
Total Of 16 PAH's	N	1800	2:1	µg/l	0.20	< 0.20
Total Phenols	U	1920	2:1	mg/l	0.030	< 0.030

Results - Soil

Project: Tupa, Penley

Client: E3P		Chemtest Job No.: 24-09305 24-09305 24-09305 24-09305 24-09305 24-09305 24-09305 24-09305 24-09305										
Quotation No.: Q23-31421		Chemtest Sample ID.: 1784721 1784722 1784723 1784724 1784725 1784726 1784727 1784728										
		Client Sample ID.: TP105 TP105 TP101 TP101 TP102 TP102 TP104 TP105										
		Sample Type: SOIL SOIL SOIL SOIL SOIL SOIL SOIL SOIL SOIL										
		Top Depth (m): 0.2 0.4 0.1 0.5 0.1 0.5 1 0.5										
		Date Sampled: 20-Mar-2024 20-Mar-2024 20-Mar-2024 20-Mar-2024 20-Mar-2024 20-Mar-2024 20-Mar-2024 20-Mar-2024										
		Time Sampled: 12:00 12:00 12:00 12:00 12:00 12:00 12:00 12:00										
		Asbestos Lab: NEW-ASB NEW-ASB NEW-ASB NEW-ASB NEW-ASB										
Determinand	HWOL Code	Accred.	SOP	Units	LOD							
ACM Type		U	2192		N/A	-	-	-		-		
Asbestos Identification		U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected		No Asbestos Detected		
Moisture		N	2030	%	0.020	14	19	14	16	21	14	17
Soil Colour		N	2040		N/A	Brown	Brown	Black	Brown	Brown	Brown	Brown
Other Material		N	2040		N/A	Stones	Stones	Stones	Stones	Stones	Stones	Stones
Soil Texture		N	2040		N/A	Sand	Sand	Sand	Clay	Sand	Sand	Clay
pH at 20C		M	2010		4.0	7.5	7.5	8.8	8.0	7.1	7.3	7.5
Boron (Hot Water Soluble)		M	2120	mg/kg	0.40							
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	0.022	< 0.010	0.45	< 0.010	< 0.010	< 0.010	0.076
Total Sulphur		U	2175	%	0.010	0.50	0.030	0.39	< 0.010	0.018	< 0.010	0.019
Cyanide (Total)		M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Sulphide (Easily Liberatable)		N	2325	mg/kg	0.50	3.6	4.8	140	2.9	3.8	16	3.4
Sulphate (Total)		U	2430	%	0.010	1.1	0.070	0.74	< 0.010	0.053	0.012	0.029
Arsenic		M	2455	mg/kg	0.5	15	16	2.9	8.1	7.9	4.2	2.1
Barium		M	2455	mg/kg	0.5							
Beryllium		U	2455	mg/kg	0.5							
Cadmium		M	2455	mg/kg	0.10	0.24	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chromium		M	2455	mg/kg	0.5	22	24	9.1	38	42	14	5.9
Copper		M	2455	mg/kg	0.50	42	33	7.8	50	25	19	4.2
Mercury		M	2455	mg/kg	0.05	0.20	0.15	0.07	< 0.05	< 0.05	0.09	< 0.05
Nickel		M	2455	mg/kg	0.50	26	28	5.7	42	43	14	4.3
Lead		M	2455	mg/kg	0.50	63	25	20	14	23	27	8.0
Selenium		M	2455	mg/kg	0.25	0.84	4.1	0.53	1.9	0.74	0.43	< 0.25
Vanadium		U	2455	mg/kg	0.5							
Zinc		M	2455	mg/kg	0.50	120	41	11	26	70	37	8.6
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total Organic Carbon		M	2625	%	0.20	3.0	1.9	14	< 0.20	1.2	0.31	0.25
TPH >C6-C8	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C8-C10	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C10-C12	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C12-C16	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	15	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C16-C21	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	60	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C21-C25	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	77	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C25-C35	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	180	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C35-C40	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	20	< 1.0	< 1.0	< 1.0	< 1.0
Total TPH >C6-C40	EH_1D_Total	M	2670	mg/kg	10	< 10	< 10	350	< 10	< 10	< 10	< 10

Results - Soil

Project: Tupa, Penley

Client: E3P		Chemtest Job No.: 24-09305 24-09305 24-09305 24-09305 24-09305 24-09305 24-09305 24-09305 24-09305											
Quotation No.: Q23-31421		Chemtest Sample ID.: 1784721 1784722 1784723 1784724 1784725 1784726 1784727 1784728											
		Client Sample ID.: TP105 TP105 TP101 TP101 TP102 TP102 TP104 TP105											
		Sample Type: SOIL SOIL SOIL SOIL SOIL SOIL SOIL SOIL SOIL											
		Top Depth (m): 0.2 0.4 0.1 0.5 0.1 0.5 1 0.5											
		Date Sampled: 20-Mar-2024 20-Mar-2024 20-Mar-2024 20-Mar-2024 20-Mar-2024 20-Mar-2024 20-Mar-2024 20-Mar-2024											
		Time Sampled: 12:00 12:00 12:00 12:00 12:00 12:00 12:00 12:00											
		Asbestos Lab: NEW-ASB NEW-ASB NEW-ASB NEW-ASB NEW-ASB											
Determinand	HWOL Code	Accred.	SOP	Units	LOD								
Naphthalene		M	2800	mg/kg	0.10	< 0.10	< 0.10	0.14	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	6.0	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene		M	2800	mg/kg	0.10	< 0.10	< 0.10	2.2	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	24	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	21	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene		M	2800	mg/kg	0.10	< 0.10	< 0.10	13	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene		M	2800	mg/kg	0.10	< 0.10	< 0.10	11	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	18	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	6.5	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	15	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	11	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10	< 0.10	1.7	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10	< 0.10	< 0.10	8.4	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's		N	2800	mg/kg	2.0	< 2.0	< 2.0	140	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Total Phenols		M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Results - Soil

Project: Tupa, Penley

Client: E3P		Chemtest Job No.: 24-09305											
Quotation No.: Q23-31421		Chemtest Sample ID.: 1784729											
		Client Sample ID.: TP106											
		Sample Type: SOIL											
		Top Depth (m): 0.2											
		Date Sampled: 20-Mar-2024											
		Time Sampled: 12:00											
		Asbestos Lab: NEW-ASB											
Determinand	HWOL Code	Accred.	SOP	Units	LOD								
ACM Type		U	2192		N/A	-	-		-	-	-	-	
Asbestos Identification		U	2192		N/A	No Asbestos Detected	No Asbestos Detected		No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	
Moisture		N	2030	%	0.020	14	17	14	21	12	16	18	10
Soil Colour		N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
Other Material		N	2040		N/A	Stones and Roots	Stones	Stones	Stones and Roots	Stones	Stones	Stones	Stones
Soil Texture		N	2040		N/A	Clay	Sand	Sand	Sand	Sand	Sand	Sand	Sand
pH at 20C		M	2010		4.0	8.2	7.0	8.0	6.7	7.4	8.0	7.7	8.2
Boron (Hot Water Soluble)		M	2120	mg/kg	0.40		0.49			< 0.40	< 0.40		
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.021	< 0.010	< 0.010
Total Sulphur		U	2175	%	0.010	< 0.010	0.019	0.014	0.018	< 0.010	0.019	0.023	< 0.010
Cyanide (Total)		M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Sulphide (Easily Liberatable)		N	2325	mg/kg	0.50	3.2	3.3	4.2	3.3	2.9	3.6	3.6	3.7
Sulphate (Total)		U	2430	%	0.010	0.011	0.047	0.026	0.067	< 0.010	0.039	0.054	< 0.010
Arsenic		M	2455	mg/kg	0.5	15	15	4.5	15	9.8	11	5.9	11
Barium		M	2455	mg/kg	0.5		210			73	130		
Beryllium		U	2455	mg/kg	0.5		1.7			0.6	1.2		
Cadmium		M	2455	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.60	< 0.10	< 0.10
Chromium		M	2455	mg/kg	0.5	22	55	9.9	64	16	38	11	37
Copper		M	2455	mg/kg	0.50	10	33	11	40	11	29	10	27
Mercury		M	2455	mg/kg	0.05	< 0.05	< 0.05	0.06	< 0.05	0.08	0.09	0.09	< 0.05
Nickel		M	2455	mg/kg	0.50	17	65	10	76	15	48	12	52
Lead		M	2455	mg/kg	0.50	13	34	26	39	33	35	56	27
Selenium		M	2455	mg/kg	0.25	0.42	0.91	0.39	0.85	0.63	0.93	0.34	0.54
Vanadium		U	2455	mg/kg	0.5		51			21	44		
Zinc		M	2455	mg/kg	0.50	26	100	43	120	27	89	29	78
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total Organic Carbon		M	2625	%	0.20	0.33	1.7	0.33	1.4	< 0.20	0.57	1.8	0.32
TPH >C6-C8	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C8-C10	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C10-C12	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C12-C16	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C16-C21	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C21-C25	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C25-C35	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C35-C40	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total TPH >C6-C40	EH_1D_Total	M	2670	mg/kg	10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10

Results - Soil

Project: Tupa, Penley

Client: E3P		Chemtest Job No.: 24-09305 24-09305 24-09305 24-09305 24-09305 24-09305 24-09305 24-09305 24-09305											
Quotation No.: Q23-31421		Chemtest Sample ID.: 1784729 1784730 1784731 1784732 1784733 1784734 1784735 1784736											
		Client Sample ID.: TP106 TP106 TP107 TP108 TP108 TP109 TP110 TP110											
		Sample Type: SOIL SOIL SOIL SOIL SOIL SOIL SOIL SOIL SOIL SOIL											
		Top Depth (m): 0.2 0.9 0.8 0.1 0.5 1.1 0.1 1.2											
		Date Sampled: 20-Mar-2024 20-Mar-2024 20-Mar-2024 20-Mar-2024 20-Mar-2024 20-Mar-2024 20-Mar-2024 20-Mar-2024											
		Time Sampled: 12:00 12:00 12:00 12:00 12:00 12:00 12:00 12:00											
		Asbestos Lab: NEW-ASB NEW-ASB NEW-ASB NEW-ASB NEW-ASB NEW-ASB NEW-ASB NEW-ASB											
Determinand	HWOL Code	Accred.	SOP	Units	LOD								
Naphthalene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's		N	2800	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Total Phenols		M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Results - Soil

Project: Tupa, Penley

Client: E3P		Chemtest Job No.: 24-09305 24-09305 24-09305 24-09305 24-09305								
Quotation No.: Q23-31421		Chemtest Sample ID.: 1784737 1784738 1784739 1784740 1784741								
		Client Sample ID.: WS102 WS103 WS104 WS105 WS106								
		Sample Type: SOIL SOIL SOIL SOIL SOIL								
		Top Depth (m): 0.9 0.8 0.6 1.2 0.9								
		Date Sampled: 20-Mar-2024 20-Mar-2024 20-Mar-2024 20-Mar-2024 20-Mar-2024								
		Time Sampled: 12:00 12:00 12:00 12:00 12:00								
		Asbestos Lab: NEW-ASB NEW-ASB								
Determinand	HWOL Code	Accred.	SOP	Units	LOD					
ACM Type		U	2192		N/A	-			-	
Asbestos Identification		U	2192		N/A	No Asbestos Detected			No Asbestos Detected	
Moisture		N	2030	%	0.020	13	14	17	15	13
Soil Colour		N	2040		N/A	Brown	Brown	Brown	Brown	Brown
Other Material		N	2040		N/A	Stones	Stones	Stones	Stones	Stones
Soil Texture		N	2040		N/A	Sand	Sand	Clay	Sand	Sand
pH at 20C		M	2010		4.0	7.8	7.9	7.7	8.1	7.9
Boron (Hot Water Soluble)		M	2120	mg/kg	0.40	< 0.40			< 0.40	
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	< 0.010	0.015	< 0.010	< 0.010	< 0.010
Total Sulphur		U	2175	%	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Cyanide (Total)		M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Sulphide (Easily Liberatable)		N	2325	mg/kg	0.50	4.0	2.8	2.6	4.4	2.9
Sulphate (Total)		U	2430	%	0.010	< 0.010	0.19	0.016	0.013	< 0.010
Arsenic		M	2455	mg/kg	0.5	5.9	11	13	13	1.9
Barium		M	2455	mg/kg	0.5	58			170	
Beryllium		U	2455	mg/kg	0.5	< 0.5			1.4	
Cadmium		M	2455	mg/kg	0.10	< 0.10	< 0.10	< 0.10	0.14	< 0.10
Chromium		M	2455	mg/kg	0.5	17	35	29	43	9.1
Copper		M	2455	mg/kg	0.50	13	26	10	34	3.5
Mercury		M	2455	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nickel		M	2455	mg/kg	0.50	11	45	23	66	13
Lead		M	2455	mg/kg	0.50	13	28	23	34	6.9
Selenium		M	2455	mg/kg	0.25	< 0.25	1.2	0.49	0.72	< 0.25
Vanadium		U	2455	mg/kg	0.5	18			37	
Zinc		M	2455	mg/kg	0.50	23	67	39	97	49
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total Organic Carbon		M	2625	%	0.20	< 0.20	0.30	0.71	0.44	< 0.20
TPH >C6-C8	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C8-C10	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C10-C12	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C12-C16	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C16-C21	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C21-C25	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C25-C35	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH >C35-C40	EH_1D_Total	N	2670	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total TPH >C6-C40	EH_1D_Total	M	2670	mg/kg	10	< 10	< 10	< 10	< 10	< 10

Results - Soil

Project: Tupa, Penley

Client: E3P		Chemtest Job No.:				24-09305	24-09305	24-09305	24-09305	24-09305
Quotation No.: Q23-31421		Chemtest Sample ID.:				1784737	1784738	1784739	1784740	1784741
		Client Sample ID.:				WS102	WS103	WS104	WS105	WS106
		Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):				0.9	0.8	0.6	1.2	0.9
		Date Sampled:				20-Mar-2024	20-Mar-2024	20-Mar-2024	20-Mar-2024	20-Mar-2024
		Time Sampled:				12:00	12:00	12:00	12:00	12:00
		Asbestos Lab:				NEW-ASB			NEW-ASB	
Determinand	HWOL Code	Accred.	SOP	Units	LOD					
Naphthalene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's		N	2800	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Total Phenols		M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1010	pH Value of Waters	pH at 20°C	pH Meter	
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.	
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	
1490	Hexavalent Chromium in Waters	Chromium [VI]	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazine.	
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection	
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.	
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection	
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.	
2010	pH Value of Soils	pH at 20°C	pH Meter	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930	
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES	
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry	
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.	
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N-dimethyl-p-phenylenediamine.	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.	
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazine.	

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID	
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS	
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.	
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge	
650	Characterisation of Waste (Leaching WAC)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge	

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

Water Sample Category Key for Accreditation

DW - Drinking Water

GW - Ground Water

LE - Land Leachate

NA - Not Applicable

PL - Prepared Leachate

PW - Processed Water

Report Information

RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com



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Final Report

Report No.: 24-10515-1**Initial Date of Issue:** 11-Apr-2024**Re-Issue Details:****Client** E3P**Client Address:** Taylor Road
Trafford Park
Urmston
Manchester
M41 7JQ**Contact(s):** mjackson@e3p.co.uk**Project** Tupa - Waters**Quotation No.:** Q23-31421**Date Received:** 05-Apr-2024**Order No.:** 007844**Date Instructed:** 05-Apr-2024**No. of Samples:** 2**Turnaround (Wkdays):** 5**Results Due:** 11-Apr-2024**Date Approved:** 11-Apr-2024**Approved By:****Details:** David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Water

Project: Tupa - Waters

Client: E3P		Chemtest Job No.:				24-10515	24-10515
Quotation No.: Q23-31421		Chemtest Sample ID.:				1789303	1789304
Order No.: 007844		Client Sample Ref.:				WS102	WS106
		Client Sample ID.:				WS102	WS106
		Sample Type:				WATER	WATER
		Sample Sub Type:					
		Date Sampled:				03-Apr-2024	03-Apr-2024
		Time Sampled:				0:00	0:00
Determinand	HWOL Code	Accred.	SOP	Units	LOD		
pH at 20C		U	1010		4.0	7.9	6.8
Cyanide (Total)		U	1300	mg/l	0.050	< 0.050	< 0.050
Arsenic (Dissolved)		U	1455	µg/l	0.20	1.2	1.6
Cadmium (Dissolved)		U	1455	µg/l	0.11	< 0.11	< 0.11
Chromium (Dissolved)		U	1455	µg/l	0.50	< 0.50	0.95
Copper (Dissolved)		U	1455	µg/l	0.50	3.3	4.9
Mercury (Dissolved)		U	1455	µg/l	0.05	< 0.05	< 0.05
Nickel (Dissolved)		U	1455	µg/l	0.50	3.4	5.8
Lead (Dissolved)		U	1455	µg/l	0.50	< 0.50	< 0.50
Selenium (Dissolved)		U	1455	µg/l	0.50	1.2	0.77
Zinc (Dissolved)		U	1455	µg/l	2.5	4.1	67
Aliphatic TPH >C5-C6	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	EH_2D_AL_#1	N	1675	µg/l	5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C8-C10	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	EH_2D_AR_#1	N	1675	µg/l	5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	EH_2D_Total_#1	N	1675	µg/l	10	< 10	< 10
Dichlorodifluoromethane		U	1760	µg/l	1.0	< 1.0	< 1.0
Chloromethane		U	1760	µg/l	1.0	< 1.0	< 1.0
Vinyl Chloride		N	1760	µg/l	1.0	< 1.0	< 1.0
Bromomethane		U	1760	µg/l	5	< 5	< 5
Chloroethane		U	1760	µg/l	2.0	< 2.0	< 2.0
Trichlorofluoromethane		U	1760	µg/l	1.0	< 1.0	< 1.0
1,1-Dichloroethene		U	1760	µg/l	1.0	< 1.0	< 1.0
Trans 1,2-Dichloroethene		U	1760	µg/l	1.0	< 1.0	< 1.0

Results - Water

Project: Tupa - Waters

Client: E3P		Chemtest Job No.:				24-10515	24-10515
Quotation No.: Q23-31421		Chemtest Sample ID.:				1789303	1789304
Order No.: 007844		Client Sample Ref.:				WS102	WS106
		Client Sample ID.:				WS102	WS106
		Sample Type:				WATER	WATER
		Sample Sub Type:					
		Date Sampled:				03-Apr-2024	03-Apr-2024
		Time Sampled:				0:00	0:00
Determinand	HWOL Code	Accred.	SOP	Units	LOD		
1,1-Dichloroethane		U	1760	µg/l	1.0	< 1.0	< 1.0
cis 1,2-Dichloroethene		U	1760	µg/l	1.0	< 1.0	< 1.0
Bromochloromethane		U	1760	µg/l	5	< 5	< 5
Trichloromethane		U	1760	µg/l	1.0	< 1.0	< 1.0
1,1,1-Trichloroethane		U	1760	µg/l	1.0	< 1.0	< 1.0
Tetrachloromethane		U	1760	µg/l	1.0	< 1.0	< 1.0
1,1-Dichloropropene		U	1760	µg/l	1.0	< 1.0	< 1.0
Benzene		U	1760	µg/l	1.0	< 1.0	< 1.0
1,2-Dichloroethane		U	1760	µg/l	2.0	< 2.0	< 2.0
Trichloroethene		N	1760	µg/l	1.0	< 1.0	< 1.0
1,2-Dichloropropane		U	1760	µg/l	1.0	< 1.0	< 1.0
Dibromomethane		U	1760	µg/l	10	< 10	< 10
Bromodichloromethane		U	1760	µg/l	5	< 5	< 5
cis-1,3-Dichloropropene		N	1760	µg/l	10	< 10	< 10
Toluene		U	1760	µg/l	1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene		N	1760	µg/l	10	< 10	< 10
1,1,2-Trichloroethane		U	1760	µg/l	10	< 10	< 10
Tetrachloroethene		U	1760	µg/l	1.0	< 1.0	< 1.0
1,3-Dichloropropane		U	1760	µg/l	2.0	< 2.0	< 2.0
Dibromochloromethane		U	1760	µg/l	10	< 10	< 10
1,2-Dibromoethane		U	1760	µg/l	5	< 5	< 5
Chlorobenzene		N	1760	µg/l	1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane		U	1760	µg/l	2.0	< 2.0	< 2.0
Ethylbenzene		U	1760	µg/l	1.0	< 1.0	< 1.0
m & p-Xylene		U	1760	µg/l	1.0	< 1.0	< 1.0
o-Xylene		U	1760	µg/l	1.0	< 1.0	< 1.0
Styrene		U	1760	µg/l	1.0	< 1.0	< 1.0
Tribromomethane		U	1760	µg/l	1.0	< 1.0	< 1.0
Isopropylbenzene		U	1760	µg/l	1.0	< 1.0	< 1.0
Bromobenzene		U	1760	µg/l	1.0	< 1.0	< 1.0
1,2,3-Trichloropropane		N	1760	µg/l	50	< 50	< 50
N-Propylbenzene		U	1760	µg/l	1.0	< 1.0	< 1.0
2-Chlorotoluene		U	1760	µg/l	1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene		U	1760	µg/l	1.0	< 1.0	< 1.0
4-Chlorotoluene		U	1760	µg/l	1.0	< 1.0	< 1.0
Tert-Butylbenzene		U	1760	µg/l	1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene		U	1760	µg/l	1.0	< 1.0	< 1.0
Sec-Butylbenzene		U	1760	µg/l	1.0	< 1.0	< 1.0

Results - Water

Project: Tupa - Waters

Client: E3P		Chemtest Job No.:				24-10515	24-10515
Quotation No.: Q23-31421		Chemtest Sample ID.:				1789303	1789304
Order No.: 007844		Client Sample Ref.:				WS102	WS106
		Client Sample ID.:				WS102	WS106
		Sample Type:				WATER	WATER
		Sample Sub Type:					
		Date Sampled:				03-Apr-2024	03-Apr-2024
		Time Sampled:				0:00	0:00
Determinand	HWOL Code	Accred.	SOP	Units	LOD		
1,3-Dichlorobenzene		N	1760	µg/l	1.0	< 1.0	< 1.0
4-Isopropyltoluene		U	1760	µg/l	1.0	< 1.0	< 1.0
1,4-Dichlorobenzene		U	1760	µg/l	1.0	< 1.0	< 1.0
N-Butylbenzene		U	1760	µg/l	1.0	< 1.0	< 1.0
1,2-Dichlorobenzene		U	1760	µg/l	1.0	< 1.0	< 1.0
1,2-Dibromo-3-Chloropropane		U	1760	µg/l	50	< 50	< 50
1,2,4-Trichlorobenzene		U	1760	µg/l	1.0	< 1.0	< 1.0
Hexachlorobutadiene		U	1760	µg/l	1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene		U	1760	µg/l	2.0	< 2.0	< 2.0
Methyl Tert-Butyl Ether		N	1760	µg/l	1.0	< 1.0	< 1.0
N-Nitrosodimethylamine		N	1790	µg/l	0.50	< 0.50	< 0.50
Phenol		N	1790	µg/l	0.50	< 0.50	< 0.50
2-Chlorophenol		N	1790	µg/l	0.50	< 0.50	< 0.50
Bis-(2-Chloroethyl)Ether		N	1790	µg/l	0.50	< 0.50	< 0.50
1,3-Dichlorobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50
1,4-Dichlorobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50
1,2-Dichlorobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50
2-Methylphenol (o-Cresol)		N	1790	µg/l	0.50	< 0.50	< 0.50
Bis(2-Chloroisopropyl)Ether		N	1790	µg/l	0.50	< 0.50	< 0.50
Hexachloroethane		N	1790	µg/l	0.50	< 0.50	< 0.50
N-Nitrosodi-n-propylamine		N	1790	µg/l	0.50	< 0.50	< 0.50
4-Methylphenol		N	1790	µg/l	0.50	< 0.50	< 0.50
Nitrobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50
Isophorone		N	1790	µg/l	0.50	< 0.50	< 0.50
2-Nitrophenol		N	1790	µg/l	0.50	< 0.50	< 0.50
2,4-Dimethylphenol		N	1790	µg/l	0.50	< 0.50	< 0.50
Bis(2-Chloroethoxy)Methane		N	1790	µg/l	0.50	< 0.50	< 0.50
2,4-Dichlorophenol		N	1790	µg/l	0.50	< 0.50	< 0.50
1,2,4-Trichlorobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50
Naphthalene		N	1790	µg/l	0.50	< 0.50	< 0.50
4-Chloroaniline		N	1790	µg/l	0.50	< 0.50	< 0.50
Hexachlorobutadiene		N	1790	µg/l	0.50	< 0.50	< 0.50
4-Chloro-3-Methylphenol		N	1790	µg/l	0.50	< 0.50	< 0.50
2-Methylnaphthalene		N	1790	µg/l	0.50	< 0.50	< 0.50
Hexachlorocyclopentadiene		N	1790	µg/l	0.50	< 0.50	< 0.50
2,4,6-Trichlorophenol		N	1790	µg/l	0.50	< 0.50	< 0.50
2,4,5-Trichlorophenol		N	1790	µg/l	0.50	< 0.50	< 0.50
2-Chloronaphthalene		N	1790	µg/l	0.50	< 0.50	< 0.50

Results - Water

Project: Tupa - Waters

Client: E3P		Chemtest Job No.:				24-10515	24-10515
Quotation No.: Q23-31421		Chemtest Sample ID.:				1789303	1789304
Order No.: 007844		Client Sample Ref.:				WS102	WS106
		Client Sample ID.:				WS102	WS106
		Sample Type:				WATER	WATER
		Sample Sub Type:					
		Date Sampled:				03-Apr-2024	03-Apr-2024
		Time Sampled:				0:00	0:00
Determinand	HWOL Code	Accred.	SOP	Units	LOD		
2-Nitroaniline		N	1790	µg/l	0.50	< 0.50	< 0.50
Acenaphthylene		N	1790	µg/l	0.50	< 0.50	< 0.50
Dimethylphthalate		N	1790	µg/l	0.50	< 0.50	< 0.50
2,6-Dinitrotoluene		N	1790	µg/l	0.50	< 0.50	< 0.50
Acenaphthene		N	1790	µg/l	0.50	< 0.50	< 0.50
3-Nitroaniline		N	1790	µg/l	0.50	< 0.50	< 0.50
Dibenzofuran		N	1790	µg/l	0.50	< 0.50	< 0.50
4-Chlorophenylphenylether		N	1790	µg/l	0.50	< 0.50	< 0.50
2,4-Dinitrotoluene		N	1790	µg/l	0.50	< 0.50	< 0.50
Fluorene		N	1790	µg/l	0.50	< 0.50	< 0.50
Diethyl Phthalate		N	1790	µg/l	0.50	< 0.50	< 0.50
4-Nitroaniline		N	1790	µg/l	0.50	< 0.50	< 0.50
2-Methyl-4,6-Dinitrophenol		N	1790	µg/l	0.50	< 0.50	< 0.50
Azobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50
4-Bromophenylphenyl Ether		N	1790	µg/l	0.50	< 0.50	< 0.50
Hexachlorobenzene		N	1790	µg/l	0.50	< 0.50	< 0.50
Phenanthrene		N	1790	µg/l	0.50	< 0.50	< 0.50
Anthracene		N	1790	µg/l	0.50	< 0.50	< 0.50
Carbazole		N	1790	µg/l	0.50	< 0.50	< 0.50
Di-N-Butyl Phthalate		N	1790	µg/l	0.50	< 0.50	< 0.50
Fluoranthene		N	1790	µg/l	0.50	< 0.50	< 0.50
Pyrene		N	1790	µg/l	0.50	< 0.50	< 0.50
Butylbenzyl Phthalate		N	1790	µg/l	0.50	< 0.50	< 0.50
Benzo[a]anthracene		N	1790	µg/l	0.50	< 0.50	< 0.50
Chrysene		N	1790	µg/l	0.50	< 0.50	< 0.50
Bis(2-Ethylhexyl)Phthalate		N	1790	µg/l	0.50	< 0.50	< 0.50
Di-N-Octyl Phthalate		N	1790	µg/l	0.50	< 0.50	< 0.50
Benzo[b]fluoranthene		N	1790	µg/l	0.50	< 0.50	< 0.50
Benzo[k]fluoranthene		N	1790	µg/l	0.50	< 0.50	< 0.50
Benzo[a]pyrene		N	1790	µg/l	0.50	< 0.50	< 0.50
Indeno(1,2,3-c,d)Pyrene		N	1790	µg/l	0.50	< 0.50	< 0.50
Dibenz(a,h)Anthracene		N	1790	µg/l	0.50	< 0.50	< 0.50
Benzo[g,h,i]perylene		N	1790	µg/l	0.50	< 0.50	< 0.50
4-Nitrophenol		N	1790	µg/l	0.50	< 0.50	< 0.50
Total Phenols		U	1920	mg/l	0.030	< 0.030	< 0.030

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1010	pH Value of Waters	pH at 20°C	pH Meter	RE PW TE TS PL DW GW
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.	GW
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	RE PW PL SW DW GW
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44 Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection	
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.	PL GW
1790	Semi-Volatile Organic Compounds (SVOCs) in Waters by GC-MS	Semi-volatile organic compounds	Solvent extraction / GCMS detection	
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.	PL GW

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

Water Sample Category Key for Accreditation

- DW - Drinking Water
- GW - Ground Water
- LE - Land Leachate
- NA - Not Applicable
- PL - Prepared Leachate
- PW - Processed Water

Report Information

RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

APPENDIX IV

ORIGIN OF CHEMICAL ASSESSMENT CRITERIA





CONSTITUENT	ORIGIN OF RISK ASSESSMENT VALUE
Arsenic	2014 LQM/CIEH S4ULs
Cadmium	2014 LQM/CIEH S4ULs
Chromium	2014 LQM/CIEH S4ULs
Lead	2014 LQM/CIEH S4ULs
Mercury	2014 LQM/CIEH S4ULs – methylmercury
Nickel	2014 LQM/CIEH S4ULs
Selenium	2014 LQM/CIEH S4ULs
Copper	2014 LQM/CIEH S4ULs
Zinc	2014 LQM/CIEH S4ULs
Cyanide – Total	2014 LQM/CIEH S4ULs
Phenols – Total	2014 LQM/CIEH S4ULs
Naphthalene	General assessment criteria (GAC) developed by CIEH/LQM Suitable 4 Use Levels with supporting data from SR3, SR7 and existing Tox report where applicable. 1% SOM.
Acenaphthylene	
Acenaphthene	
Fluorene	
Phenanthrene	
Anthracene	
Fluoranthene	
Pyrene	
Benzo(a)Anthracene	
Chrysene	
Benzo(b/k)Fluoranthene (iii)	
Benzo(a)Pyrene	
Indeno(123-cd)Pyrene	
Dibenzo(a,h)Anthracene	
Benzo(ghi)Perylene	
TPH C ₅ -C ₆ (aliphatic)	
TPH C ₆ -C ₈ (aliphatic)	
TPH C ₈ -C ₁₀ (aliphatic)	
TPH C ₁₀ -C ₁₂ (aliphatic)	
TPH C ₁₂ -C ₁₆ (aromatic)	
TPH C ₁₆ -C ₂₁ (aromatic)	
TPH C ₂₁ -C ₃₅ (aromatic)	

