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GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

TAIYO POWER & STORAGE LIMITED

Radcliffe BESS, Kearsley Road, Radcliffe

Phase I Geo-Environmental Assessment Report

LN/M5678/13072 Rev B

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PROJECT QUALITY CONTROL DATA SHEET

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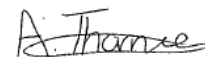
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DRAWINGS

Drawing Number	Rev	Title
121-10014	14	Location Plan
121-10003	013	Proposed Site Layout
M5678/01	-	Site Location Plan
M5678/02	-	Site Features Plan

APPENDICES	
Appendix	Title
Appendix A	BSL Methodology and Guidance
Appendix B	Historical Maps
Appendix C	Geo-Environmental Data Report
Appendix D	BGS Exploratory Hole Records
Appendix E	UXO Screening Map

1.0 INTRODUCTION

1.1 Context

This report describes a desk-based Phase I Geo-Environmental Assessment Report carried out by Brownfield Solutions Limited (BSL) for Taiyo Power & Storage Limited on a site off Ringley Road West, Radcliffe and has been completed in general accordance with the following guidance:

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

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

1.2 Proposed Development

The proposed development is for a Battery Energy Storage System (BESS) facility, comprising battery containers, transformers/inverters, storage and sub-stations, with an associated cable routing corridor to the north and an access route to the south as shown on the proposed development plan, drawing No. 121-10003 Rev 013 provided to BSL by the client. It should be noted that since the time of writing the proposed development plan has been updated. It is understood that the site area has now slightly increased however this appears to relate to proposed access routes or service runs. The searches obtained for this report are based off the original boundary provided, and therefore distances to off-site sources may differ between the content of this report and the actual distances. However, this will not have an affect on the recommendations of this report.

1.3 Objectives and Scope

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

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

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

1.4 Limitations

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

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

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

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

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

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

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

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

2.0 THE SITE

2.1 Location

The site is located off Wood Street, Radcliffe, M26 1EB, centred on National Grid Reference 377492, 406038 as shown on the Site Location Plan, Drawing No. M5678/01.

2.2 Site Description

A site reconnaissance survey was carried out at the site on 24th April 2024. The main site features and potential issues identified during this survey are detailed below and are shown on the Site Features Plan, Drawing No. M5678/02. A selection of photographs from the site walkover are presented to the rear of this report.

Feature	Description
Site Area	1.25 hectares.
Site Access	It is understood the site is accessed through the fields to the west of an unnamed track, off Wood Street.
Site Overview Imagery	 Orientated North Note, the above does not include the newly proposed roads / service runs. Update from Google: All images: Imagery Google©2023, Imagery ©2023 Airbus, CNES / Airbus, Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies, The Geoinformation Group, Map data ©2023.
Current Land Use and Site Features	The site comprises an open field of grassland, which is the proposed main development area. The field appears to be used for animal grazing, with an associated access path in the south. A metal barrier is found on the access path at the end of Wood Street. Metal gates are present from the access track into the main field. In the most northern part of the site, the site boundaries follow an access path, which is the proposed cabling corridor, leading to the adjacent electrical substation in the north. The electrical sub-station appears to comprise various electrical infrastructure, with single storey brick buildings. There are overhead services (power) crossing from the west of the open field in a north-east to south-west direction, terminating at the electrical sub-station.
Potential Sources of Gross Contamination	No potential sources of gross contamination were noted on-site, however, an electrical substation is noted to the north of the main development area.
Vegetation / Ecology	There are mature/semi-mature trees noted along the western boundary, which are part of the Outwood Country Park.
Topography	The site is generally flat with a gentle slope downwards to the north.

Feature	Description
Site Boundaries	The site is bound by mature and semi-mature trees in the east while barbed wire and electrical fencing make up boundaries in the west, south and north of the grassland field.
Surrounding Area	The site is set within a predominantly agricultural area, bordered by grassland fields to the west and south. An electrical substation exists to the north of the proposed main development area and adjacent to the west of the newly proposed cabling corridor. To the east, north-east and south-east, Outward Country Park is noted with residential houses are located further afield.

3.0 GEO-ENVIRONMENTAL SETTING

3.1 Historical Setting

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

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

Feature	Distance (m) & Direction	Years Present	Description
Sand Pit / Mound	Onsite	1850 - 1956	An area labelled 'Sand Pit' appears on the earliest available mapping of 1850. The label is present within the site boundary; however, the extent of the pit is not clear. On the next available mapping of 1891, several irregular mounds are recorded on the main site area, likely indicating large stockpiles of material, possibly related to sand extraction. By the map of 1907-1908, this stockpile appears to be largely extended. The area appears to be a large sand/gravel pit; however, the orientation of the morphology indicates that the area is actually a large sand/gravel/refuse mound. This feature remains until 1955-1956 where the mound is indicated to be vegetated. At this stage it is assumed the mound unchanged. The mound is no longer shown on the map dated 1987 - 1988 when the embankment markings are removed. This is either due to excavation and levelling of the material, or because the area has been reclassified as the new ground level.
Railway, Sidings	From 0m E	1850 - 1977	The earliest mapping shows the 'East Lancashire Railway', running roughly south to north-east circa 35m to the east of the site. By 1891, it is labelled as the 'Clifton, Accrington & Colne Line' and consists of sidings that are indicated to be intersecting the line of the proposed cabling in the north-east. These sidings are later shown to be extending towards the 'Electric Power Station' and by 1921, 'Outwood Sidings' are developed, encompassing several lines. Furthermore, on the 1891 map, 'Outwood Sidings' is labelled, and extends from the main railway line towards the 'Outwood Colliery' to the south-east. By 1927, the 'Outwood Sidings' are relabelled to 'Outwood Colliery Sidings' while the main railway line is relabelled to 'Clifton Junc & Accrington Line'. The sidings extending towards the 'Electric Power Station' last appears on the map dated 1965-1967. The 'Outwood Colliery Sidings' are last shown on the map of 1973 - 1977. On this map, the main railway line appears to be no longer in use and relabelled to 'Dismantled Railway'. Current satellite imagery shows that the main railway line became Outwood trail, associated with the Outwood Country Park.
Electrical Substation	From 0m NW	1973 - Present	Between 1973 - 1977, a series of structures appear immediately to the west of the newly proposed cabling route in the north-east. On the large-scale map dated 1987 - 1988, it is labelled as 'Electrical Substation'. Two pylons are present, with overhead electricity lines running away from the substation to the south-west. According to current satellite imagery, the structure is still present and matches the same footprint therefore likely no changes have occurred to the structure. The substation was also noted on the site walkover.
	Circa 90m SE	1927 - 1967	An electrical substation associated with the brick works is indicated to be present in the surrounding area on the 1927 mapping and is no longer present on the 1973 - 1977 mapping.

Feature	Distance (m) & Direction	Years Present	Description
Ponds	On-site	1850 - 1893	A small pond is noted on the earliest small-scale historical map from 1850, intersecting the southern boundary of the site. This pond is infilled by the 1907 map. Several ponds were identified in the surrounding area of the site. The closest is shown to be 30m NW of the route of the proposed cabling in the north. According to the Groundsure Report, this pond was previously occupied by a sand pit. Therefore, it is possible that when the sand pit was decommissioned, it was allowed to fill with water over the years. The pond is last shown on the 1965 – 1967 mapping and no longer present on the subsequent map of 1973 – 1977, likely infilled.
	From circa 30m NW	1891 - 1967	
Sewage Works	60m NE	1927 - 1977	An area labelled 'Sewage Works' first appears on the mapping of 1927. This area comprises of filter beds, tanks, sluices and sludge beds which are labelled on the 1929 map. On the mapping of 1965 – 1967, the area is relabelled to 'Works'. The works is unlabelled, with several features demolished by the 1973-1977 map, and it is likely that the works are decommissioned by this point. However, a feature representing the sluice bed remains, and last appears on the map dated 1992. Current satellite imagery shows that the area is now part of the Outwood Country Park.
Colliery / Spoil Heap	70m E	1891 - 1993	On the earliest available mapping of 1891, an area is labelled 'Outwood Colliery', extending as close as 70m south-east of the site. Between 1909 and 1929, the area expands further south-east to include additional structures, shafts, tanks and reservoirs. By 1937, the structures within this area had been demolished and no longer appear except some shafts were relabelled to 'Old Shaft', indicating the colliery to have been decommissioned. On the map of 1955, the area is covered by symbols likely representing colliery spoil heaps, as well as a ruin. The heaps are last visible on the map of 1991, however the style of mapping changes following this map, and therefore it's not clear if the heap has been removed, or if it has become part of the current landscape. Current satellite imagery shows that the area is now occupied by Outwood Country Park.
Electric Power Station	110m NE	1907 - 1967	An electric power station with associated tanks and sidings appears on the first mapping of 1907 – 1908. The power station is indicated to have been extended further north on the map of 1927. It is last shown on map dated 1965 – 1967 and is no longer present on the 1973 – 1977 mapping.
Brick Works	130m SE	1927 - 2010	Buildings are shown in an area labelled 'Brick Works' on the mapping of 1927. By 1965 – 1967, some buildings have been demolished, and the area relabelled to 'Works'. The map of 1988 shows the area closest to the site as 'Disused Workings' while further south a few small buildings remain and are still labelled 'Works'. The works are last labelled on the 2010 map and are no longer labelled on the most recent map of 2024. The 2024 mapping shows most of the area to be covered in vegetation and appears to be part of the Outwood Country Park, according to current satellite imagery.

In summary, the map evidence indicates that the site comprises a sand pit and a small pond in the south-east section of the site from the earliest available mapping of 1850, until 1907 when the southern part of the site is covered in a large sand/gravel/refuse mound that extends southwards offsite. After 1955, the mound is vegetated, suggesting that the mounds were not altered after this date. By 1987, the mounds were labelled on the historical maps, suggesting the mounds were likely retained as landscaping, or potentially excavated. Majority of the site still comprises grassland up to present day as noted during the site walkover.

Historical land use in the surrounding area has been predominantly industrial and agricultural with railway lines and sidings associated with Outwood Colliery to the east and Electric Power Station and

Electric Substation to the north of the site. Brick works and sewage works were also noted within the vicinity of the site.

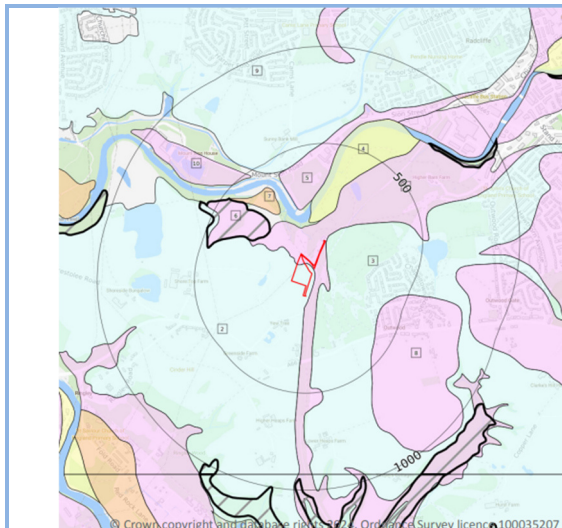
3.2 Published Geology

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

- British Geological Survey (BGS) 1:50,000 Scale Geological Map Sheet SD70NE. Solid and Drift Edition.
- BGS Geology of Britain Map Viewer.
- BGS GeoIndex Onshore.
- Coal Authority Interactive Map.
- Geo-Environmental Data Report.

Extracts of the 1:10,000 geological mapping from the Geo-Environmental Data Report are presented below for reference:

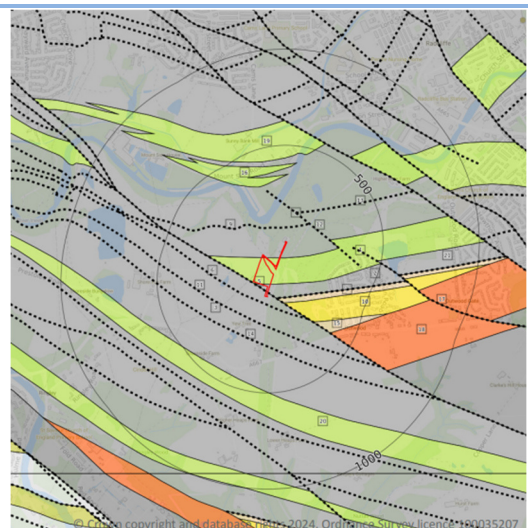
BGS 1:10 000 Superficial Geology



Key:

- Glaciofluvial Deposits (Sand & Gravel)
- Devensian Till (Diamicton)

BGS 1:10 000 Solid Geology



Key:

- Newton Heath Sandstone (Sandstone)
- Pennine Middle Coal Measures Formation (Mudstone, Siltstone & Sandstone)

Made Ground

BGS mapping does not display any made ground deposits on site. There is a lack of development onsite. However, information from the Geo-Environmental Data Report presented in Appendix C indicates the southern part of the site to be underlain by made ground (undivided), which is consistent with the large refuse heap / spoil heap identified on the historical mapping and therefore made ground is likely present.

Superficial Deposits

Majority of the site is indicated to be underlain by Devensian Till, with most northern part of the site, along the line of the proposed cabling, underlain by Glaciofluvial deposits. These strata typically comprise Diamicton, and sand and gravel respectively.

Solid Geology

The deeper solid geology underneath the central section of the site is indicated to be part of Pennine Middle Coal Measures Formation (Newton Heath Sandstone) which typically comprises sandstone. The

deeper solid geology underneath the most northern and southern part of the site is indicated to be part of the Pennine Middle Coal Measures Formation which typically comprises mudstone, siltstone and sandstone.

A fault is shown to intersect the most southern part of the site in a north-west to south-east direction. However, any movements associated with this fault should now have stopped.

The site is also in an area where coal seams are abundant. Coal Authority Interactive Map suggests that there are past shallow mine workings traversing the access path in the most southern part of the site. Given this, it is unlikely that the workings would cause significant mining instability as they are in an area where no structures are proposed. However, a Coal Mining Risk Assessment (CMRA) may be required to assess seam locations, depths, thickness and associated potential risks in detail.

3.3 BGS Exploratory Hole Records

There are 4 No. BGS exploratory hole records within a relevant distance of the site (assumed as an approximate 50m radius). However, three of the four logs are confidential. A summary of the available log is presented below:

Reference	Distance from Site (m) and Direction	Depth Made Ground (m)	Depth Superficial Deposits (m)	Depth Solid Geology (m)
SD70NE217	15m NE	GL-0.60 – Clay, ashes and stones	0.60 – 1.82 – Soft brown laminated sandy clay 1.82 – 2.43 – Soft brown wet slightly clayey sand 2.43 – 6.10 – Soft brown stoney clay	-

The BGS Borehole Logs are presented in Appendix D.

3.4 Mining and Mineral Extraction

Coal Mining

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

Relevant Interactive Map Data	Issue at Subject Site?
Coal Authority Reporting Area	Yes
High Risk Development Area	Yes (Section of the access path leading to the open field).

3.5 Hydrogeology

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

Stratum	Coverage	Aquifer Designation
Glaciofluvial Deposits	N of Site	Secondary (A) Aquifer. These are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.
Till	S of Site	Secondary Aquifer (Undifferentiated). The classification is assigned where it is not possible to attribute either category A or B to the aquifer.
Pennine Middle Coal Measures	Full Site	Secondary (A) Aquifer. These are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

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

Feature	Distance (m) & Direction	Details
Nearest Active Groundwater Abstraction	-	None within 2000m.
Nearest Active Potable Groundwater Abstraction	-	None within 2000m.
Source Protection Zones	-	None within 500m.

3.6 Hydrology

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

Feature	Distance (m) & Direction	Details
Nearest Watercourse	156m N	River Irwell. NW to SE flow.
Nearest Surface Water Abstraction	823m NW	Status: Historical Licence No: 2569004024 Details: Process water Direct Source: "Surface, Non-Tidal - North West Region" Point: "R IRWELL AT MOUNT SION WORKS, RADCLIFFE" Original Start Date: 03/02/1966
Closest Active Licenced Discharge Consent	339m N	Effluent Type: SEWAGE DISCHARGES - SEWER STORM OVERFLOW - WATER COMPANY Permit Number: 01BRY0037 Permit Version: 3 Receiving Water: RIVER IRWELL Status: VARIED UNDER EPR 2010 Issue date: 30/08/2017 Effective Date: 25/08/2017

Information obtained from the Environment Agency (EA) Risk of Flooding from Rivers and the Sea (RoFRaS) database indicates that there are no records for the site, suggesting the risk of flooding across the site from rivers or sea is negligible.

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

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

3.7 Landfill and Waste Management Sites

There are no active landfill sites recorded within 500m. However, there are 3 LA/mapping records which all states the presence of a refuse tip with the closest being 394m east of the site. The closest historical landfill to site (178m N) shown in the EA/NRW record is an inert industrial, commercial and household landfill last recorded in 1976. The other three records are between 336m and 447m away from site and were last recorded between 1985 and 1993.

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

The closest historical waste management site is recorded as a scrap metal yard, located 355m to the north of the site. There is limited information provided on the waste site. The other three historical waste management sites relate to an incinerator located 371-372m north-east of the site.

3.8 Environmental Regulatory Data

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

Entry	On-site	0 – 50m	50 – 250m	Details
Recent Industrial Land Uses	-	4	1	All the entries relate to electrical features with the closest one being an electrical substation, 11m NE of the site.
Current or Recent Fuel Stations	-	-	-	
Licensed Industrial Activities (Part A(1))	-	-	-	
Licensed Pollutant Release (Part A(2)/B)	-	-	-	
Radioactive Substances	-	-	-	
Pollution Incidents (EA/NRW)	-	-	-	

In regard to the entries identified above, only the electrical substation is considered to be of significant relevance to be carried forward to the preliminary CSM. No other entries require further consideration.

3.9 Radon

Information from the environmental database report indicates the property is in an area where 1-3% of properties are above the Action Level for radon, and therefore radon protective measures are not required in accordance with BRE Report 211 'Radon – Guidance on protective measures for new dwellings'.

3.10 UXO Risk

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

The map indicates the site to be in an area where the bomb risk is low. A copy of the map is presented in Appendix E.

4.0 PHASE 1 SUMMARY AND RISK ASSESSMENT

4.1 Introduction

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

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

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

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

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

4.2 Potential Contaminative Sources

On-Site

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

-
- Made ground associated with previous use on-site.
 - Unspecified refuse / spoil heap.
-

The refuse / soil heaps were placed over a century ago therefore any potential contaminants would have degraded over time. Given this, it is not considered to be a significant source. This is also likely to be the source of the made ground, which is also not considered to be a significant source.

Off-Site

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

-
- Electrical substation (adjacent to north-western boundary).
 - Ponds (from on-site).
 - Railway, sidings (closest 0m E).
 - Sewage works including tanks (60m NE).
 - Colliery including shafts, tanks, spoil heaps, reservoirs, sidings (70m E).
-

Associated Contaminants

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

Contaminative Sources	Department of the Environment Industry Profile or Other Source	Commonly Associated Contaminants
On Site		
Made Ground	AGS Guides BS8485 and BS8576	Heavy metals, polycyclic aromatic hydrocarbons (PAHs), asbestos, ground gases (carbon dioxide and methane).
Unspecified refuse / spoil heap	BS8485 and BS8576	Heavy metals, polycyclic aromatic hydrocarbons (PAHs), asbestos, ground gases (carbon dioxide and methane).
Off Site		
Electricity Substation	Electrical Works	Heavy metals, hydrocarbons, PCBs, inorganic compounds, solvents.
Railway	Railway Land Engineering works-Railway	Heavy metals, PAHs, petroleum hydrocarbons, PCBs, asbestos.
Infilled Ponds	AGS Guides BS8485 and BS8576	Heavy metals, polycyclic aromatic hydrocarbons (PAHs), asbestos, ground gases (carbon dioxide and methane).
Sewage works	Sewage Works CL:AIRE TB19 and TB22	Heavy metals, polycyclic aromatic hydrocarbons (PAHs), petroleum hydrocarbons, inorganics, asbestos, ground gases (carbon dioxide and methane).
Colliery	BS8485 and BS8576	Heavy metals, asbestos, PAHs, coal tars, VOCs, asbestos, ground gases (methane, carbon dioxide, carbon monoxide)

4.3 Pathways

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

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

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

4.4 Receptors

The identified receptors are listed below:

-
- Commercial end users (human health).
 - Structures/Property/Potable water supply pipes.
 - Nearest watercourse. River Irwell 164m N (Controlled waters).
 - Superficial Aquifer. Glaciofluvial/Till (Controlled waters).
 - Bedrock Aquifer. Pennine Middle Coal Measures (Controlled waters).
-

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

4.5 Preliminary Conceptual Site Model (CSM)

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

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

Human Health						
Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk	Justification
On site Made ground (including former refuse heap) Metals, PAHs, asbestos	Root uptake, ingestion, direct contact, inhalation of dusts	End-users	Unlikely	Medium	Low	The site has not undergone any previous development, with the exception of some surface workings as well as historic placement of refuse / spoil heaps, likely related to historic sand and gravel extraction. According to the Geo-Environmental Data Report, the southern part of the site is indicated to be underlain by made ground in the area of the historic heaps. As such, it is possible that potential contaminants may be present within the made ground. Given the presence of refuse heap in the southern part of the site and the site being within the vicinity of coal mining areas, it is possible that these may include colliery spoils. However, given that the latest change in morphology of the heap was by 1955, approximately 70 years have elapsed, therefore any potential organic contaminants would have degraded or attenuated over time. Inorganic contaminants such as metals or coal derivatives may persist, but would have likely degraded to a degree. As well as this, the proposed development is commercial and the nature of the site means that on site attendance is likely to be rare and sporadic and therefore the potential receptors are considered to be low sensitivity. As such, the risk is considered to be low.
On site Made Ground Metals and organic contamination	Migration into/chemical attack of water supply pipelines	Water Pipelines / End users	Unlikely	Medium	Low	Given the nature of the development, it is not considered that water supply pipelines will be required, or if they are, will be limited. Contaminants within the soil/groundwater could potentially attack the clean potable water supply pipe, contaminants should be assessed to determine the correct pipe material and level of precautions required.
On site Made ground (including former refuse heap) Ground Gas (carbon dioxide and methane).	Migration into confined spaces, inhalation and asphyxiation/explosion	End-users / property / structures	No Linkage	No Linkage	Negligible	Refuse heap was first identified on the map dated 1907 – 1908 and was likely no longer in use by 1955. It is possible that material used may have given rise to ground gases, however it is likely that the majority of degassing would have occurred in the 70-110 years since placement. Given this, it's unlikely that any significant degassing is occurring, and risks would be low. As well as this, principally, there are no existing or proposed enclosed structures that would permit the buildup of ground gases. Therefore, there is not considered to be a pathway, and therefore risks from ground gas are considered to be negligible.
Off site Electricity Substation	Ingestion, direct contact, inhalation of dusts	End-users	Low Likelihood	Medium	Moderate / Low	The predominant contaminant of concern with historic electrical substations is PCBs. The electrical substation adjacent to the newly proposed cabling corridor in the north-east was constructed between 1973 and 1977, before PCBs were banned therefore it is possible that there were potential contaminants from this

Human Health						
Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk	Justification
Heavy metals, hydrocarbons, PCBs, inorganic compounds, solvents.						source. Due to the short distance between the site and the potential source, and the permeable nature of the superficial deposits in the most northern part of the site, potential contaminants are capable of migrating onto the site through the underlying soils. Nevertheless, PCBs typically have low mobility. As well as this, the current satellite imagery shows that the electrical substation is located on hardstanding which should limit the potential for leaching of contaminants if any localised spills occurred during operation and would break pathway of potential contaminants into the underlying made ground. As such the risk is considered to be moderate / low.
Off site Railway Sidings Metals, PAHs, petroleum hydrocarbons, PCBs, asbestos.	Ingestion, direct contact, inhalation of dusts / vapours	End-users	Low Likelihood	Medium	Moderate / Low	Historical mapping showed the presence of this feature which was likely used to convey materials and coal between nearby coal mines and electrical power stations. Generally, railway lines themselves are not particularly contaminative, with the main contaminant sources being from the materials falling off of trains, which is likely to be rare and of low volume. However, the main railway line is indicated to be 35m east of the proposed main development area and therefore minimal migration would be required for contaminants to enter the site. The railway line is shown to have been dismantled between 1973 and 1977. Therefore, any organic contaminants will have degraded over time. As well as this, the proposed development is a BESS facility therefore the site is not likely to be occupied full-time, with presence onsite likely to be rare and sporadic for maintenance works only. As such, the potential receptor is considered to be low sensitivity, and the risk is moderate / low.
Off site Potentially infilled pond / shaft Heavy metals, asbestos, PAHs	Ingestion, direct contact, inhalation of dusts	End-users	Unlikely	Medium	Low	Historical mapping indicated a pond, approximately 30m north-east of the site. According to Coal Interactive Map Viewer, this pond was previously occupied by a coal shaft. The pond was likely infilled between 1967 and 1977, therefore significant time has elapsed since the potential infilling. Given this, it's likely that significant degradation of any inorganic contaminants present within the infill material will have occurred. As such, the risk is considered to be low.
Off site Potentially infilled pond Ground gases (carbon dioxide)	Migration into confined spaces, inhalation and	End-users / property / structures	No Linkage	No Linkage	Negligible	The pond was likely infilled over 60 years ago therefore it is possible that if infilled, the ground may give rise to ground gases. It is likely that the majority of degassing will have already occurred, given the considerable time that has elapsed. Furthermore, the wider site area is primarily open fields and soft landscaping

Human Health						
Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk	Justification
and methane), Mine gas	asphyxiation/ explosion					therefore any gas generation would likely follow a preferred pathway vertically into the atmosphere. No enclosed structures are expected onsite according to the proposed development. Therefore, any build-up of gases in structures cannot occur. As such, there is no risk considered from the source.
Off site Sewage Works Heavy metals, PAHs, petroleum hydrocarbons, inorganics, asbestos.	Ingestion, direct contact, inhalation of dusts / vapours	End-users	Unlikely	Medium	Low	It is likely that, if mismanaged, the filter beds could leak contaminants into surrounding soils. However, the site was redeveloped over 20 years ago, and at this point it is possible, although not definite, that significant contamination would have been addressed. As well as this, the site is predominantly underlain by impermeable superficial deposits and the distance between the site and the potential source would therefore limit potential migration of contaminants. Furthermore, the proposed development is commercial and the nature of the site means that on site attendance is likely to be rare and sporadic. Therefore, the risk is considered to be low.
Off site Colliery Heavy metals, asbestos, PAHs, coal tars, VOCs, asbestos.	Ingestion, direct contact, inhalation of dusts / vapours	End-users	Low Likelihood	Medium	Moderate / Low	Outwood Colliery to the east of the site is considered to pose a potential risk through contamination via various determinands. Heavy metals and asbestos are relatively immobile / low mobility therefore it is unlikely that these contaminants would pose a significant risk to the development. However, organic contaminants may have migrated to site. All mining features within the area ceased to exist over 20 years ago, allowing for the degradation of organic contaminants. Furthermore, the proposed development is a BESS facility therefore on site attendance is likely to be rare and sporadic and the potential receptors are considered to be low sensitivity. As such, the risk is moderate / low.
Off site Colliery / Sewage works Ground gases (methane, carbon dioxide, carbon monoxide)	Migration into confined spaces, inhalation and asphyxiation/ explosion	End-users / property / structures	No Linkage	No Linkage	Negligible	Both the colliery and sewage works are shown to have been likely infilled over 20 years ago and therefore it's likely that any significant degassing will have already occurred. As well as this, the colliery and sewage work sites have remained undeveloped, and therefore the preferential pathway for ground gas migration is more likely to be vertically into the atmosphere, rather than horizontally into the site. No enclosed structures are expected onsite according to the proposed development. Therefore, any build-up of gases in structures cannot occur. As such, there is no risk considered from the source.

Controlled Waters						
Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk	Justification
Made Ground (including former refuse heap) Metals, PAHs, asbestos.	Overland flow, / migration through saturated zone	River Irwell 156m away (Surface waters)	Unlikely	Medium	Low	It is considered contaminants associated with the made ground and other past industrial uses are unlikely to impact the River. This is due to the impermeable Till underlying the majority of the site and the distance from the site to the potential receptor (over 150m), which will inhibit lateral migration and the potential for contaminants to attenuate and degrade over this distance. As well as this, the refuse heap last changed prior to 1955, approximately 70 to 110 years have elapsed since the last placement of material, therefore any potential organic contaminants would have likely significantly degraded over time. Therefore, a low risk is posed to the river from the made ground.
	Leaching through unsaturated zone / Migration through saturated zone	Secondary (Undifferentiated) Aquifer (Groundwater)	Unlikely	Medium	Low	As detailed above, any potential contaminants associated with the former refuse heap would have degraded over time as the heap was no longer in use since 1955. As well as this, there are no active portable groundwater abstractions within 2000m of the site. Furthermore, no Source Protection Zones are noted within 500m of the site. As such, the risk is considered to be low.
	Migration through saturated zone	Secondary (A) Aquifer (Groundwater)				

Human Health Risk – Soils Contamination Summary

Based on the preliminary CSM and the current use of the site, the overall risk from land contamination at the site is considered to be **low** for a developed site. Risks from off-site sources are considered to be **low to low / moderate**.

Human Health Risk – Ground Gas Summary

Based on the preliminary CSM, the proposed development is considered to be at negligible risk from ground and mine gases.

Note that the risks are considered negligible due to a lack of receptor on the source-pathway-receptor model. Given this, should the nature of the proposed development change, then this assessment should be revised as potential sources of ground gas were identified.

Controlled Waters Risk - Summary

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

5.0 PRELIMINARY GEOTECHNICAL ASSESSMENT

5.1 Hazard Identification

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

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

In respect to potential for mining induced stability, the site lies in an area where coal seams are abundant. According to the Coal Authority Interactive map, past shallow mine workings have occurred in the most southern part of the site, with access path within the area of past shallow workings. Furthermore, probable shallow workings are also believed to have occurred further south of the site and to the north. Nevertheless, no coal mine shafts have been recorded on site, with the closest coal mine shaft located 138m SE of the site.

Significant surface workings are recorded on-site and in the sider area, principally to the north, east and south. This is likely related to the sand / gravel extraction noted on historical mapping. The nearest BritPit is the Bottom O'th'Field Sand Pit, used for extraction of sand. At its closest point it is 5m NE of the site.

Due to the low sensitivity of the proposed BESS facility, it is possible that the workings to the south may not cause any significant instability issues. The LPA have confirmed that the Coal Authority would not expect the planning application to be supported by a Coal Mining Risk Assessment, or equivalent, to assess the risk to the development from coal mining legacy. The area where built development is proposed is not in the Development High Risk Area. Thus, a Coal Mining Risk Assessment is not considered to be required at this stage.

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

5.2 Foundation and Geotechnical Design

The proposed development will comprise a Battery Energy Storage System (BESS) facility with associated cable corridor to the north and an access route to the south. The type of foundation solution should be informed by an onsite intrusive investigation to confirm ground conditions and obtain geotechnical parameters for preliminary foundation and floor slab design. If concrete is being used in the ground, intrusive investigation should also obtain data to allow appropriate concrete classification in accordance with BRE SD1 and for preliminary highways/pavement design.

5.3 Drainage

Given the site is predominantly underlain by low permeability clays, it is unlikely that drainage to SuDS such as traditional soakaways will be suitable. It is understood that a drainage strategy will be submitted as part of the planning application.

5.4 Recommendations

To confirm the ground conditions in respect to the identified potential geotechnical hazards and risks, an appropriate intrusive investigation is recommended. This would likely comprise the drilling of boreholes and/or excavating trial pits and the completion of in-situ and laboratory geotechnical testing.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Geo-Environmental Summary

The site has had previous uses including a sand pit, pond and unspecified refuse heaps, however based on the proposed commercial development, the overall risk to human health from on-site soils contamination is considered to be low.

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

There is not considered to be a significant risk from permanent ground gases to the proposed development.

Radon is not considered to pose a risk, and protection will be not required.

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

Intrusive investigations in respect to potential contamination on-site is not considered to be necessary for the proposed development, given the lack of identified sensitive receptors or risks to human health or controlled waters.

6.2 Geotechnical Summary

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

Drainage to SuDS is unlikely to be a viable option for the site due to low permeability clays underlying the site. It is understood that a drainage strategy will be submitted as part of the planning application.

6.3 Further Work

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

-
- Intrusive geotechnical ground investigation, as required.
 - Assessment and recommendations based on the above, including requirements for further work, if necessary.
-

7.0 ABBREVIATIONS AND DEFINITIONS

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

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

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

8.0 REFERENCES

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

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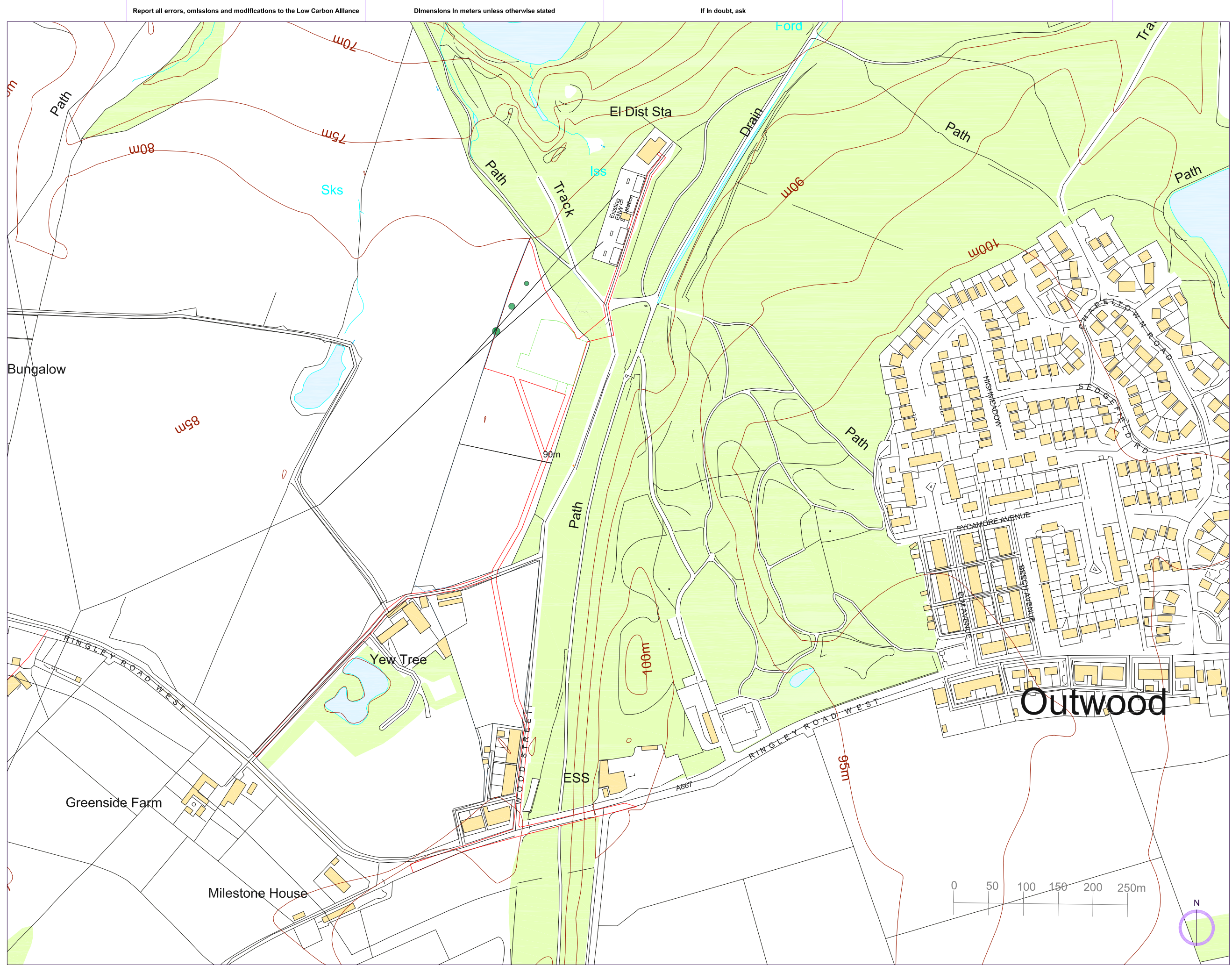
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MSTP	PC		
Date	Approved By		
01.04.2025	PC		
PROJECT	Radcliffe BESS		
TITLE	Location Plan		
CLIENT	Taiyo Power & Storage Ltd.		
STATUS			
Sheet No	Overall Plan	Sheet Size	
ENTERSHEETNO	1	A3	
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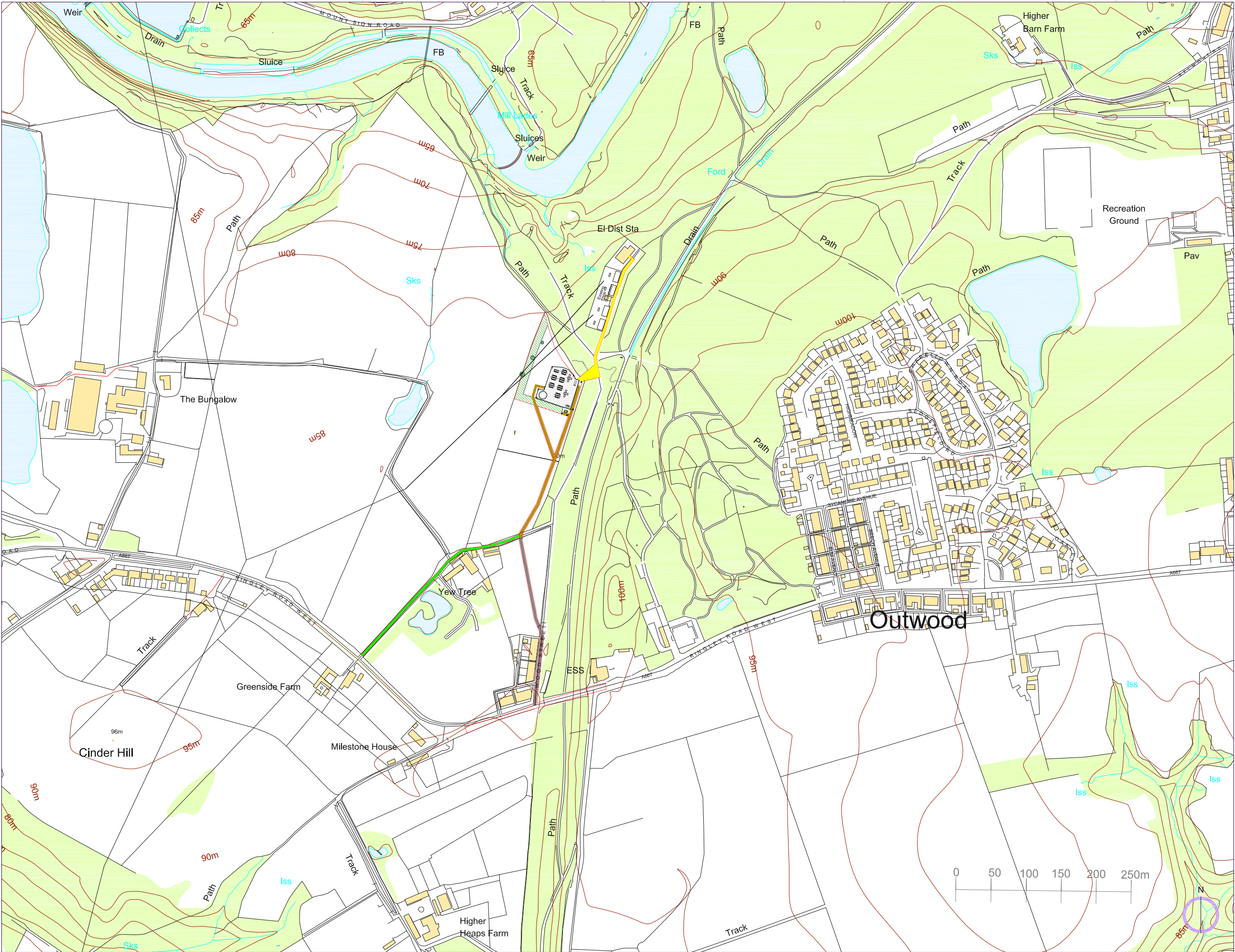
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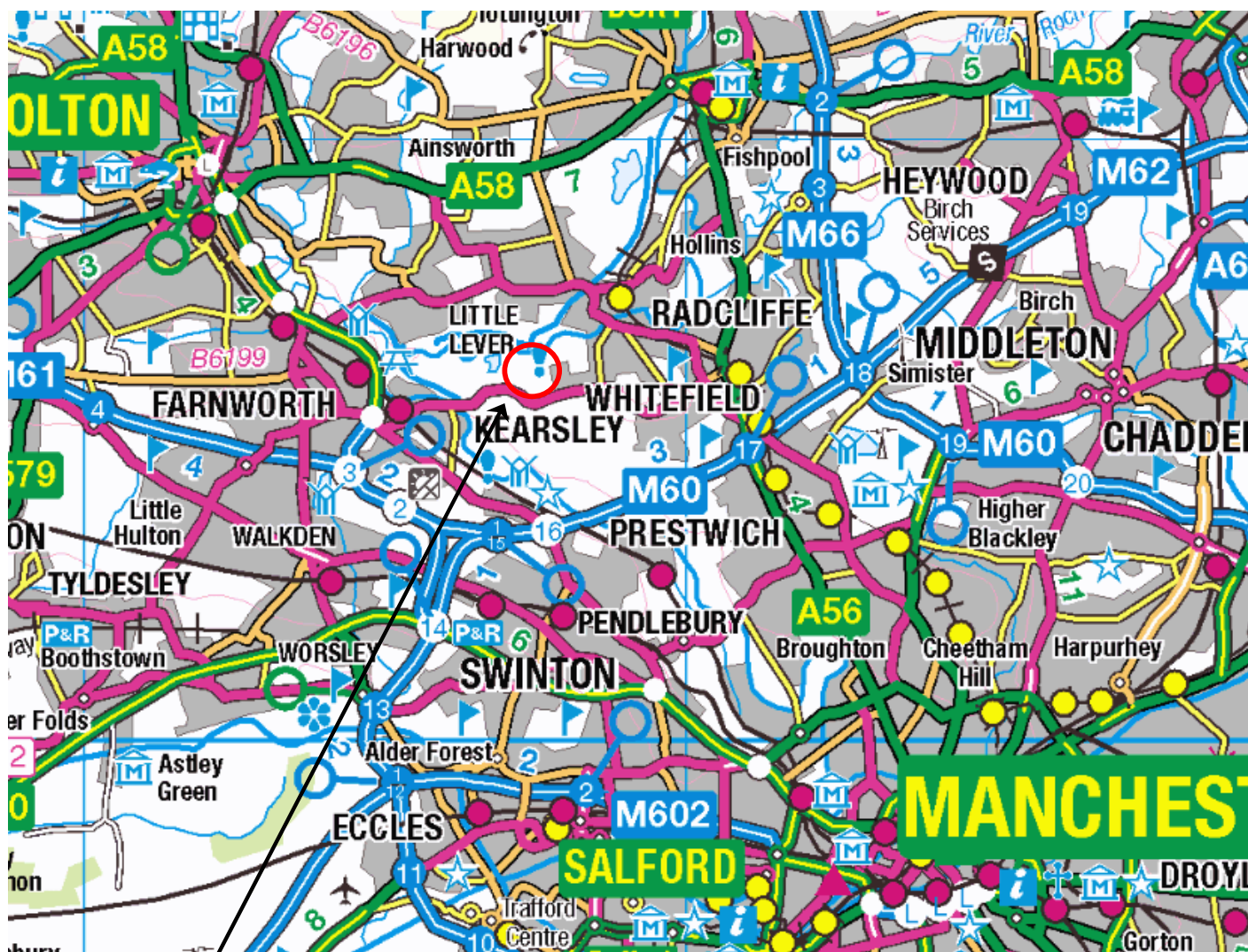
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- Security Fence
- Cable Route/ Corridor
- Access Track
- Temporary Access Track
- Maintenance Access
- Overhead Line
- Compound Area Hardcore
- Landscape Buffer
- Tree
- Battery Container
- Transformer/ Inverters
- Storage
- Customer Substation
- DNO Substation
- CCTV
- Gate
- Water Tank

Drawn By	Checked By	REV	
MSTP	PC		013
Date	Approved By		
28.02.2025	PC		

PROJECT	Shore Top Farm BESS
TITLE	Proposed Site Layout
CLIENT	Taiyo Power & Storage Ltd.

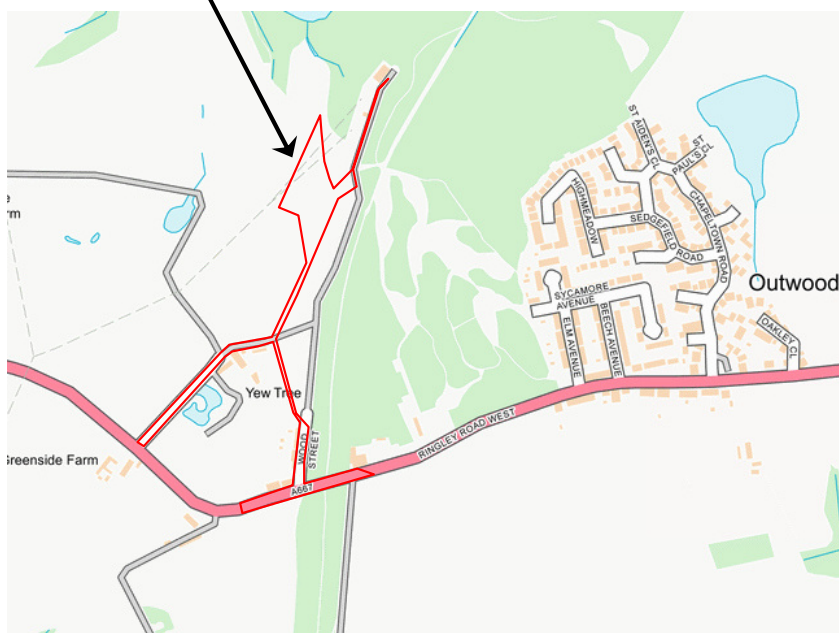
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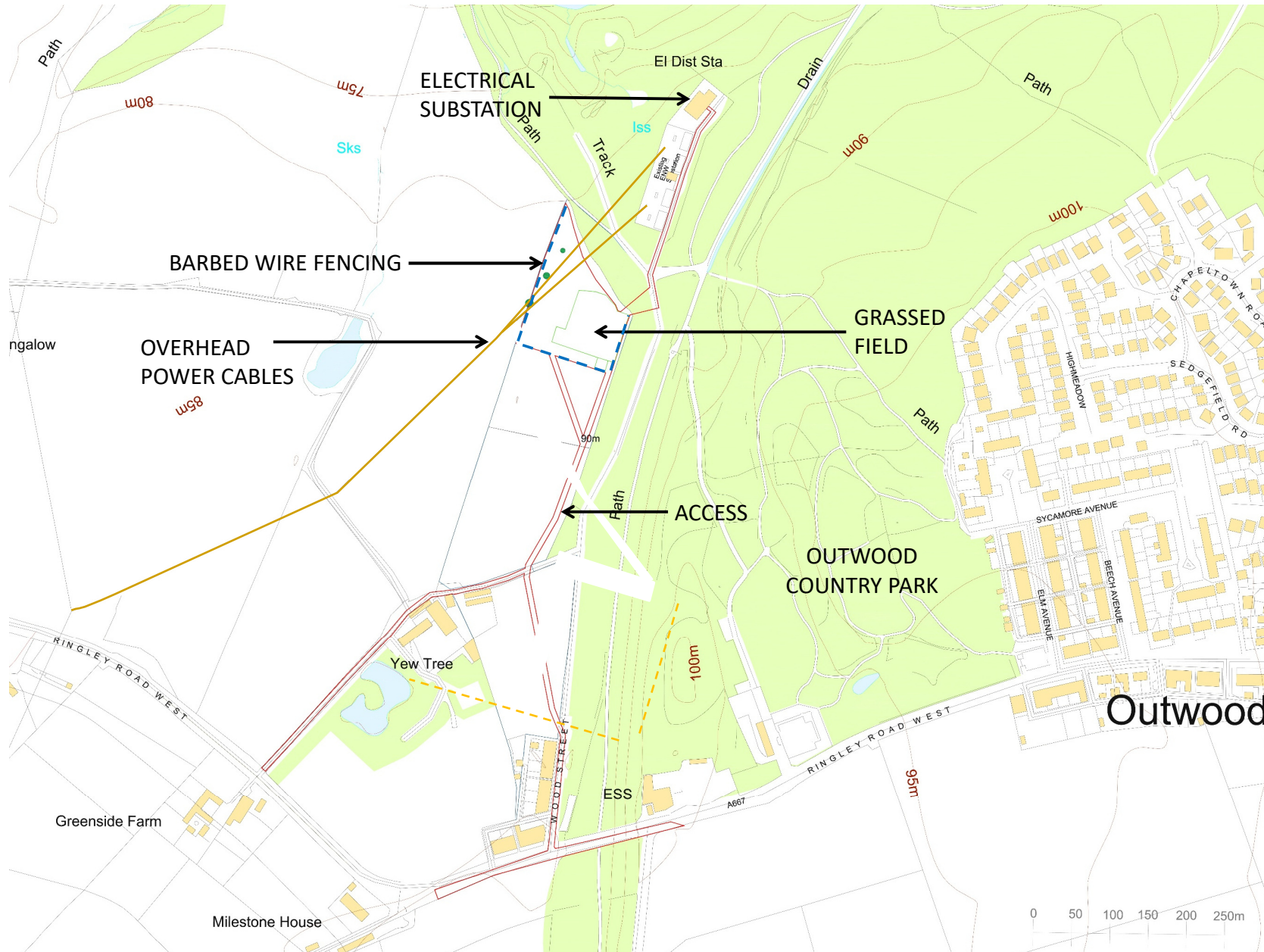
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PROJECT TITLE
KEARSLEY ROAD, RADCLIFFE
DRAWING TITLE
SITE LOCATION PLAN

DRAWING No. M5678/01	REVISION A	SCALE NTS	DATE 07/04/25
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KEY

— APPROXIMATE SITE BOUNDARY

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PROJECT TITLE
KEARSLEY ROAD, RADCLIFFE

DRAWING TITLE
SITE FEATURES PLAN

DRAWING No.	REVISION	SCALE	DATE
M5678/02	A	NTS	07/04/25
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APPENDIX A

BSL Methodology and Guidance



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

Background

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

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

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

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

From the geo-environmental perspective, the hazard Identification process uses professional judgement to evaluate all the hazards in terms of possible contaminant linkages (of source-pathway-receptor). Possible contaminant linkages are potentially unacceptable risks in terms of the current contaminated land regime legal framework and require either remediation or further assessment. These are normally addressed via intrusive ground investigation and generic risk assessment as part of Phase II investigations and reports.

The second stage is the Ground Investigation, Generic Risk Assessment and Geotechnical Interpretation. This represents the further assessment mentioned above. The Ground Investigation comprises field work and laboratory testing based on the findings of the Preliminary Risk Assessment, to reduce uncertainty in the geotechnical and geo-environmental hazard identification. This may include an exploratory, a detailed or/and supplementary Investigations as described in BS 10175:2011+A2:2017. Phase II Assessments are produced in general accordance with the recommendations for a Tier 2 Generic Quantitative Risk Assessment as described in LCRM guidance and are also intended to fulfil the requirements of a Ground Investigation Report (GIR) as detailed in BS EN 1997-2:2007.

Contaminated Land - Legislative Background

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

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

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

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

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

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

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

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

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

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

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



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

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

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

Relevant Guidance Documents

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

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

Relevant Legislative Documents

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

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

Contaminated Land Risk Assessment Approach

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



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

Further information can be found at the below site:

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

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

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

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

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

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

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

High likelihood: There is a pollution linkage and an event appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Ground Gas Risk Assessment

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

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

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

Legislative Framework

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

Generation Potential of Sources

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

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

Frequency and Duration of Monitoring

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

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

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

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

Typical/idealised periods of monitoring

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

Typical/idealised frequency of monitoring/Number of Visits Required

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

Notes

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

RB17 Approach

CL:AIRE RB17 (Card et al 2012) is a pragmatic approach to ground gas risk assessment and was developed because gas concentration, pressure and flow rate measured in a well headspace may not be representative of the conditions in the surrounding formation.

In these low-risk situations, the approach is to use the conceptual site model and the estimation of the likely gas generation from a source to identify where or if gas monitoring is required to better define the risks.

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

Radon

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

Areas of the country can be categorised according to the percentage of existing homes where radon is present above the Action Level:

-  0-1% lower probability.
-  1-3% and 3-10% intermediate probability.
-  >10% higher probability.

Basic radon protection measures are required in new buildings and extensions in areas of England and Wales where 3-10% of properties exceed the Action Level and full radon protection measures where >10% exceed the Action Level.

Unexploded Ordnance (UXO) Guidance

Clients have a legal duty under the CDM 2015 Regulations to provide designers and contractors with project-specific health and safety information needed to identify hazards and risks. This includes the possibility of unexploded ordnance (UXO) being encountered on the site. Further details are given in CIRIA report C681.

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

Geotechnical Guidance

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

APPENDIX B

Historical Maps

Site Details:

RADCLIFFE, BURY, M26 1EB

Client Ref: M5678-5247-SD
Report Ref: GS-Q2B-KYH-5LO-R9U
Grid Ref: 377518, 406062

Map Name: County Series

Map date: 1893

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1893
 Revised 1893
 Edition N/A
 Copyright N/A
 Levelled N/A

Surveyed 1893
 Revised 1893
 Edition N/A
 Copyright N/A
 Levelled N/A

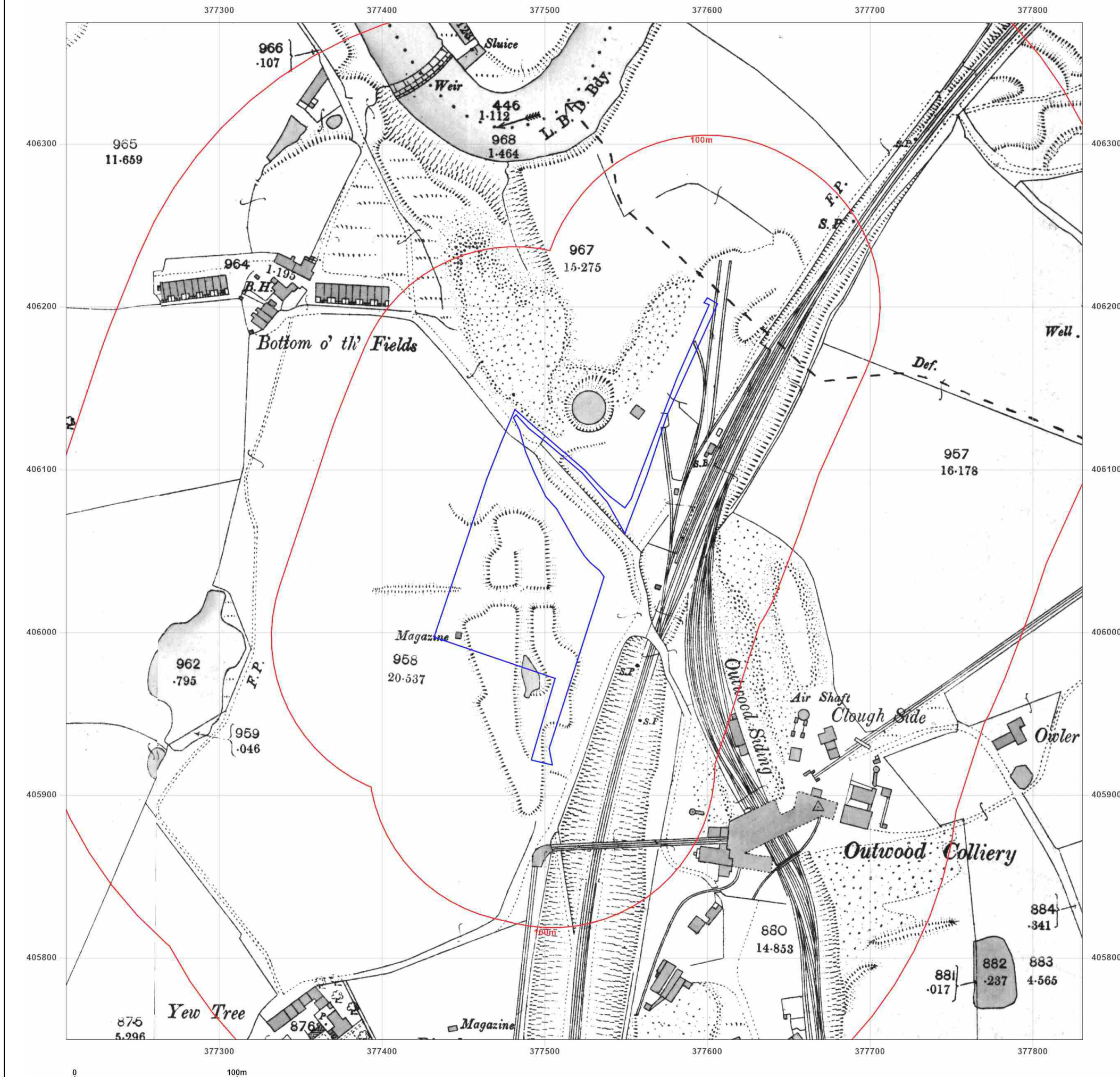


Produced by
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Production date: 25 April 2024

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



Site Details:

RADCLIFFE, BURY, M26 1EB

Client Ref: M5678-5247-SD
Report Ref: GS-Q2B-KYH-5LO-R9U
Grid Ref: 377518, 406062

Map Name: County Series

Map date: 1909

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1909
 Revised 1909
 Edition N/A
 Copyright N/A
 Levelled N/A

Surveyed 1909
 Revised 1909
 Edition N/A
 Copyright N/A
 Levelled N/A

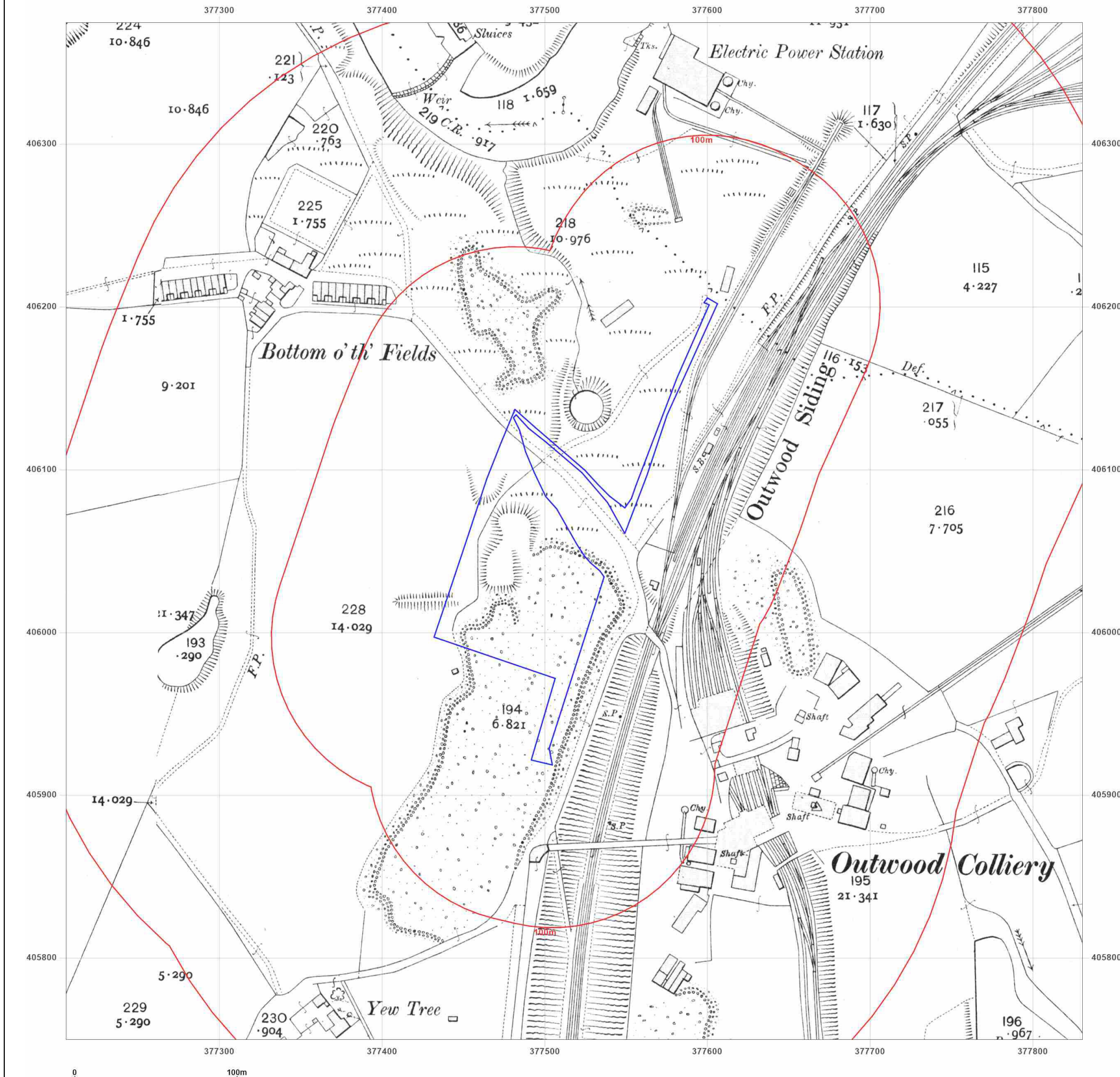


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Site Details:

RADCLIFFE, BURY, M26 1EB

Client Ref: M5678-5247-SD
Report Ref: GS-Q2B-KYH-5LO-R9U
Grid Ref: 377518, 406062

Map Name: County Series

Map date: 1929

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1929
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Edition N/A
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