PROPOSED CADET HUT
2 HUDDERSFIELD ROAD
MIRFIELD
WF14 9DQ

REMEDIATION AND ENABLING WORKS STRATEGY
REPORT REFERECE: MRN-25312-RMS-REV.02

PREPARED FOR:

CWT BUILDING CONSULTANTS LTD
MEDLOCK FARM
MEDLOCK LANE
LITTLE NELSON
WORRAL
CHESHIRE
CH64 4BW

UKAS TESTING
1580

Andrew House, Hadfield Street, Dukinfield, Cheshire SK16 4QX Tel: 0161 475 0870
Email: enquiries@murrayrix.com Website: www.murrayrix.com

Also at: London: 020 8523 1999

EXECUTIVE SUMMARY OF REMEDIAL PROPOSALS

Objectives	The objectives of this report are to: Prepare overview of contaminated land remediation requirements; Evaluate feasible remediation technologies; Define validation criteria to demonstrate the successful implementation of a site remediation and enabling works plan; and Ensure the safe, cost effective and regulatory compliant redevelopment of the site.
Remedial Requirements	The most appropriate remedial option would be the installation of a clean cover system with a warning geo-membrane or break layer in the area of asbestos contamination. However, MRN have been advised by the client that it is not possible to raise the site levels by the required 600mm of clean cover and that excavation to lower the site levels to allow installation of the clean cover system is also not possible due to the presence of the many large trees within the site and thus the tree protection requirements. We further understand that the Arboriculturist acting for the site can only authorise the excavation of approximately 100mm of material to ensure the tress are adequately protected. Therefore, based on the advised site constraints, the above remedial options appraisal has been reevaluated, the most appropriate approaches to the residual risks are listed below: • Undertake a water supplier pipeline Risk Assessment for water feed and install barrier pipe and/or clean service corridors if necessary. • Utilise a non-standard cover system utilising a suitable protective geo-membrane, with approximately 100mm of clean cover. The options selected have been chosen because they are considered to be effective, can be carried out practically within the available time periods and are commercially viable. Furthermore, the options selected seek to promote sustainability and address the issue of tree protection and site levels. Therefore, the most appropriate remedial option would be the installation of a nonstandard clean cover system utilising a suitable protective geo-membrane with a warning geo-membrane or break layer in the area of asbestos contamination. The type of membrane required would need to be agreed with/specified by the Arboriculturist and Regulatory Authorities. Elsewhere hardstanding will break the pathway to site end users/ human health.

	For areas of proposed trees, a tree pit will need to be excavated, and additional subsoil provided above the hard dig layer / membrane. The above is subject to agreement with the local authority, and requirements should be confirmed at the earliest opportunity. On completion of the above follow the final verification reporting requirements.
Cover system and Verification	In line with YALPAG guidance (2021), all cover systems will be subject to verification to ensure that soils are suitable for use, free from contamination, and installed to the agreed depth. Verification will include chemical testing of imported soils, inspection of material quality, validation of cover depth (including demarcation layers where specified), and supporting photographic and documentary evidence. A Verification Report will be provided to the Local Authority to demonstrate that the site is suitable for its intended use and to enable discharge of planning conditions.

This executive summary should be read in conjunction with the full report, reference MRN 25312 Rev 2, and not as a standalone document.

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Context

Murray Rix has been instructed by CWT Building Consultants, (The Client) to develop a remediation strategy for the Proposed new Cadet Hut, 2 Huddersfield Rd, Mirfield WF14 9DQ 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.

1.2 Background and Scope

This Remedial Strategy is to set out how the remediation of the site will be undertaken and how the works will be validated. The document explains how the works will be permitted under current regulatory regimes and has been produced to address conditions set out in Kirklees Council Planning Permissions reference 2023/93737.

The scope of works for this document comprises a summary of the ground model, summaries of the risk assessments carried out, a remedial options appraisal (LCRM Stage 2), Remedial Strategy (LCRM stage 3) implementation details and any validation requirements.

Note that geotechnical aspects are not specifically addressed within this document as it seeks to meet the requirements set out within LCRM. Geotechnical aspects should be considered within a Geotechnical Design Report in accordance with Eurocode 7 or a suitable site-specific Earthworks Strategy.

1.3 Proposed Development

The proposed development involves the construction of a one-storey modular cadet hut with associated hardstanding and landscaped areas as shown on the site : layout : proposed drawing no. 230711-015.04 provided to MRN by CWT building Consultants Ltd and the demolition of two number existing structures.

1.4 Available Information

The following reports have been produced for the site and should be read in conjunction with this assessment (in date order):

- G&M Consulting Geo-Environmental Appraisal Report ref: C541 – November 2022
- PWA Geo-Environmental Ltd: Phase 2 Geo-Environmental Assessment. Report ref: 23109-PWAG-00-XX-RP-G-2000-P01 – March 2024

1.5 Limitations

This report has been prepared for the sole use and reliance of the Client, CWT Building Consultants Ltd. This report shall not be relied upon or transferred to any other parties without the express written authorisation of MRN. If an unauthorised third party comes into possession of this report, they rely on it at their risk, and the authors owe them no duty of care or skill.

Current UK guidance and legislation have been used in the environmental assessment of the site, MRN is not liable for any subsequent changes in the guidance and legislation.

MRN have used reasonable skill, care, and diligence in the production of this report. The findings and opinions conveyed via this report are based on information obtained from a number of sources as detailed within this report, MRN have assumed this information is correct and reliable. Nevertheless, MRN cannot and does not guarantee the authenticity or reliability of the information upon which it has relied upon.

The recommendations within this report are based upon the proposed site end use provided to MRN at the time of writing. If the end use or development layout changes from the proposal, then the recommendations may change or become invalid.

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.

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

2.0 GROUND MODEL SUMMARY

2.1 Description of Site

The site is located off Huddersfield Road, Mirfield, WF14 9DQ, on the west of Mirfield and can be located by national grid reference SE 19365 20286, as shown on the site location plan below.

The main site features and potential issues identified during the time of the intrusive investigation are detailed below.

Feature	Description
Site Area	0.2 Hectares
Site Access	Access to the site is gained off Huddersfield Road to the North.
Current Land Use And Site Features	The site is currently used as a Cadet Building. The site currently comprises of an area of hardstanding with two single story modular buildings and a shed. Theres a steep landscaped banking along the south and eastern of site with building rubble along the base of the southern bank. Numerous large trees run along the northeast and west of site. Metal palisade fencing borders the site on all sides with an access gate to Huddersfield Road on the northern side.
Potential Sources Of Gross Contamination	Historical evidence of landfilling associated with the site (possibly to form the site level profile). OS maps record 'unspecified ground workings' and 'unspecified heap' on the site. EA records landfilling with inert, commercial waste, dated 1944. Considering the historical uses of the site, generation of ground gas associated with landfilling possible. However, given the age of the infill, first recorded as an 'unspecified heap) on the OS map dated 1938, and the fact that the site appears to have been licenced for 'inert, commercial' there is a likelihood that the materials are unlikely to be continuing to generate gas. Historical and current industrial/commercial activity recorded/identified, particularly adjacent to the southern boundary of the site
Vegetation	Grassed areas, rough vegetation, shrubs, and trees
Topography	Access to the rear of the site is between these two buildings onto an area of rough well-kept grass, which forms the brow of a slope. This slope drops towards the southern boundary of the site, by approximately 4m on to what is presumed to be the flood plain of the River Calder. Between the toe of the slope and the southern boundary of the site, is a strip of relatively flat ground, comprising rough vegetation and gravel, and approximately 3m wide. This strip of flat ground extends around the southeastern portion of the site, the levels then climb back up to the height of the main part of the site, through a series of 'steps' cut into the existing ground surface.
Site Boundaries	The site is secured to all boundaries by a tall palisade fence. The site is bounded to the south by light industrial units and to the west by a set of private garages and east by residential properties. The ground levels adjacent to the western boundary were noted to be similar to the main part of the site, whereas the levels on the eastern boundary were noted to be similar to the levels at the toe of the slope.
Surrounding Area	Not noted in either of the previous reports.

2.2 Environmental Setting

Site History
Full details of historical site developments, including mapping and aerial photographs can be found in the Phase 1 Desk study (G&M Consulting: C541 – November 2022).

The earliest available maps from 1855 depict the site as undeveloped. Between 1888 and 1977, a number of residential buildings were constructed to the east of the site. The site itself remained vacant until 1990, when a building labelled as 'Club' was first noted. A second building appeared on the site in 2010.

Published Geology and Hydrology
The 1:50,000 Scale British Geological Survey map of the area shows the site to be located on bedrock strata of Clifton Rock.

Clifton Rock - Sandstone. Sedimentary bedrock formed between 319 and 318 million years ago during the Carboniferous period.

The PWA Geo-Environmental Ltd: Phase 2 Geo-Environmental Assessment. Report ref: 23109-PWAG-00-XX-RP-G-2000-P01 – March 2024 indicates the following sequence of strata (top down):

- Made Ground; over
- Clifton Rock.

Hydrogeology
According to the Phase 1 report, information provided by the EA indicates that the underlying bedrock (Pennine Lower Coal Measures) is classified as a 'Secondary A,' aquifer which is defined as having;

'Permeable layers capable of supporting water supplies at a local level rather than strategic scale, and in some cases forming an important source to base flow to rivers. These are generally aquifers formerly classified as minor aquifers.'

The site is not shown to be within a Source Protection Zone.

Hydrology
According to the Phase 1 report, the risk posed to the site by groundwater flooding is 'Low', (within 50m)'.

The highest risk posed to the site from 'Surface Water Flooding' according to the Phase 1 Report is highlighted to be '1 in 30 years, 0.1m-0.3m (within 50m)'.

According to the Phase 1 report, the closest identified surface water feature is 111m to the southwest and shown as the River Calder.

The site is identified to lie within the catchment of 'Calder from River Colne to River Chald' in the operational catchment of 'Calder Lower.'

The southern boundary of the site is shown to lie within a Flood Zone 3 area.

The site is not shown to be within a "Nitrate Sensitive Area" or a "Nitrate Vulnerable Zone."

Surface water features
No surface water features are noted within 50m of site.

Food Risk
The southern boundary of the site is shown to lie within a Flood Zone 3 area.

Radon
The Groundsure report contains information on Radon Affected Areas as defined by the Health Protection Agency (HPA) and indicates that the site is within an area where less than 1% of properties are affected by Radon, and therefore:

- "No radon protection measures are necessary."

UXO Risk
According to the desk study the site area is shown to be within a low-risk zone.

2.3 Ground Conditions

Observed Geology and Groundwater
From the previous investigations carried out, the ground conditions can be summarised as below:

Made ground was encountered in all locations and typically comprised a layer of tarmacadam over sometimes yellowish brown or grey clayey silty sandy GRAVEL, silty sandy gravelly CLAY or clayey silty gravely SAND with medium to high cobble content and rare brick, coal and or pottery. This was underlain by superficial deposits of mostly yellowish or orangish brown, occasional sandy gravelly CLAY or occasionally clayey sandy GRAVEL with a medium to high cobble content. Grey mudstone bedrock was encountered at 13.50 m bgl in CP02.

Made ground was encountered from ground level to between 4.30 and 5.30 m bgl, in all locations and was typically comprised of a layer of tarmacadam over sometimes yellowish brown or grey clayey silty sandy GRAVEL, silty sandy gravelly CLAY or clayey silty gravely SAND with medium to high cobble content and rare brick, coal and or pottery. The Gravel typically constituted of angular to subrounded fine to coarse sandstone and mudstone.

Superficial deposits were encountered from 4.30 – 5.30 m bgl to between 9.20 to 10.30 m bgl, in all locations. Mostly yellowish or orangish brown, occasional sandy gravelly CLAY, or occasionally clayey sandy GRAVEL with a medium to high cobble content. CP01 encountered a yellowish brown, gravelly SAND layer with a high cobble content 6.50 – 8.20 m bgl. Gravel was typically angular to sub rounded fine to coarse sandstone and mudstone

Presumed mudstone bedrock was encountered at a depth of 13.50 m bgl (Unknown thickness) in CP02 at 13.5 m bgl as grey mudstone, recovered as grey angular coarse GRAVEL.

Groundwater was encountered during the intrusive ground investigation works at exploratory locations CP01 and BH1A. Ground water levels ranged between 9.10 and 9.60 m bgl.

Post site works monitoring levels showed the boreholes to be dry at the times of monitoring.

Observations
During the works undertaken by G&M Consulting Ltd, no olfactory evidence of any contamination was noted during the fieldwork. And there was no visual or olfactory evidence of contamination within any cable percussive, or hand pit position noted during the PWA investigation works.

3.0 SUMMARY OF RISK ASSESSMENTS

3.1 General

The previous ground investigations have confirmed the following:

- Asbestos, heavy metal and PAH contamination within the Made Ground

3.2 Human Health Risks

Made ground or made ground topsoil underlies the whole site, with heavy metal contamination (arsenic and lead) encountered above residential with and without homegrown produce screening levels in multiple locations across the site and is considered pervasive throughout the made ground.

PAH contamination is also present within soil samples located across the site and is also considered to be pervasive throughout the made ground.

In addition, asbestos has also been detected at trace (<0.001% w/w) within two samples, at 0.001% within one sample and at 0.003% within one sample of made ground, all taken from the vicinity of TP02

Based on the above, mitigation measures will be required.

3.3 Permanent Ground Gases and Vapours

A summary of the ground gas monitoring carried out by G&M Consulting Ltd is presented below:

G&M Consulting conducted six rounds of gas monitoring in 2022. At the time of authoring their report only two rounds of gas monitoring had been conducted. From the limited data they had, they gave these results a preliminary characteristic situation of CS1.

A review of the complete gas monitoring data carried out by PWA Geo-Environmental Ltd which they state indicates a maximum concentration of 0.3% v/v carbon dioxide, non-detect methane,

17.4% v/v oxygen concentration as the minimum and non-detect flow. All positions were monitored over the course of the six visits.

PWA Geo-Environmental Ltd further state. A site characteristic gas screening value (GSV) is calculated based on the borehole hazardous gas flow rate – Qhg. This is calculated for methane and carbon dioxide in accordance with BS:8485:2015+A1:2019 based on the measured gas flows, gas concentrations, or a limit of detection (taken as 0.1 l/hr for flow and 0.1% for gas concentration), whichever is higher. The derived GSV is used to determine a characteristic gas situation (CS).

The GSV for carbon dioxide was calculated using the maximum steady state flow and maximum steady gas concentrations. A GSV of 0.0003 l/hr was derived that equates to CS1.

PWA Geo-Environmental Ltd state The possibility of risk from shallow coal mine workings to the proposed development was assessed as **low** and no further assessment is considered necessary.

As such, no special precautions are required in regard to a ground gas risk.

3.4 Risk to Controlled Waters

Chemical testing of groundwater was not carried out in either of the previous intrusive investigations.

The G&M Consulting report states:
Considering the fact that the made ground soils will be either removed or capped with hard stand or clean soils in any areas of soft landscaping (thereby effectively eliminating surface water infiltration and leachate generation), it is considered that the soils are considered to pose a **negligible/low** risk to controlled waters and that no further remediation is considered necessary, outside of that described. Furthermore, no groundwater was encountered during the fieldwork, or in the subsequent monitoring visits.

The conceptual model contained within Table 11 of the PWA Geo-Environmental Ltd report indicates the risk to controlled waters to be Low and Very Low

3.5 Summary

A summary of the findings of the previous investigations and assessments where a risk is present (i.e. an unacceptable source-pathway-receptor linkage) which requires mitigation is presented in the table below.

Source	Receptor
Elevated concentrations of heavy metals (arsenic and lead), PAHs, and localised asbestos present within the made ground	Human health / construction workers (Residential without homegrown produce screening criteria adopted)

Based on the above, it was recommended that a Remedial Strategy was prepared that identifies the specific remediation requirements for the site.

4.0 REMEDIAL OPTIONS APPRAISAL

4.1 Remediation Options

The Investigations and risk assessment have concluded that the site will require remediation is the action required to prevent, minimise, remedy, or mitigate the effects of the identified unacceptable risks listed in the section above.

The remediation of the site will need to ensure that upon completion of the development, the ground conditions at the site can be shown to be appropriate for the intended use and that they will not pose unacceptable contamination risks to the identified receptors.

For the options appraisal, there are 3 steps to follow:

1) Identify feasible remediation options.
2) Do a detailed evaluation of options.
3) Select the final remediation option.

The objectives of the remediation will be to sever one or more of the linkages within the source-pathway-receptor (S-P-R) model. There are three broad approaches which can be adopted:

- Remove or treat the source of pollutants.
- Remove or modify the migration pathway.
- Remove or modify the behaviour of the receptor.

The options appraisal process considers the available remedial techniques to achieve the above based on following key criteria:

- Effectiveness.
- Practicality.
- Durability.
- Relative Cost.
- Relative Operational Time (in terms of installation or the activity).
- Sustainability.

The feasibility of each of the listed remedial option is assessed in terms of effectiveness at treating the contamination, which is broken down into; effective (Yes), partially effective (Partially) or not effective (No).

The listed techniques are also assessed in terms of relative cost ranging from negligible cost (£) through moderately expensive (££) to prohibitively expensive (£££).

Timescales over which the remediation technique is operational has been relatively assessed as weeks, months, years, and decades. If a given technique is only effective over a period in the order of years to decades, then its overall feasibility is diminished

A sustainable approach can help to ensure that the benefit of doing the remediation is greater than its impact.

The table below summarises the possible remedial options and assesses each against the six key criteria listed above:

Remedial Activity	Effective	Relative Cost	Operational Time	Comments (Practicality / Sustainability / Durability	Feasible
Cover System	Yes	£	Weeks	Will prevent contact between site end users and shallow contaminated soils, breaking the S-P-R linkage.	Yes - considered a suitable remediation option to mitigate the risk to human health. No - See comments below regarding excavation and tree protection
Excavation and Disposal (may also require pre-treatment by screening & sorting).	Yes	£££	Weeks	This will effectively remove the source of the contamination, but is much less sustainable compared to other feasible options (excessive cost, take up of landfill space, transport issues, need to replace with clean material)	No – gross contamination not encountered and given the made ground is widespread over a large site excavation and disposal would be disproportionately costly and unsustainable. See comments below regarding excavation and tree protection
Materials Management (Excavation and Re-Use of Suitable Materials)	Yes	££	Weeks to months	Excavation and re-use of any suitable materials and potential reuse of treated materials at a suitable depth. Would need to be undertaken in association with a Materials Management Plan (MMP) prepared in accordance with the CLAIRE Definition of Waste Code of Practice and signed off by a Qualified Person.	No - See comments below regarding excavation and tree protection
Stabilisation and Solidification	Yes	££	Weeks	Mixing of cement/lime into soils to effectively bind contamination to minimise migration from soil to vapour and dissolved phases and reduce the mobility of contaminants in soils. Bench trials would be required to determine the most suitable binder formulation and to prove that solidification/stabilisation will be effective in reducing leachate concentrations. Option would still require a cover system to mitigate human health risks.	Yes - but discounted as it is considered there is no need for such an aggressive remediation technique and would be disproportionate to the level of risk. No - See comments below regarding excavation and tree protection

New water supply pipeline	Yes	£	Weeks	A pipeline risk assessment will be required to determine the most suitable pipe materials for potable water supply.	Yes – in conjunction with other options.
Biological Methods					
Not considered to be relevant to the subject site.					

Remedial Activity	Effective	Relative Cost	Operational Time	Comments (Practicality / Sustainability / Durability	Feasible
Chemical Methods					
Not Considered to be relevant to the subject site.					
Physical Methods					
Soil Washing	Yes (for PAH but not on Lead)	£££	Months	Large scale plant and equipment in a limited space; need to treat process streams (water, sediment) and route to appropriate offsite disposal, as required. Will potentially result in a significant proportion of soils, which are geotechnically unsuitable without extensive treatment.	No – discounted due to disproportionate cost, timing, and unsustainability creating geotechnically unsuitable material that would require replacement / further treatment/remedial measures. See comments below regarding excavation and tree protection
Passive Methods					
Not Considered to be relevant to the subject site.					

Remedial Activity	Effective	Relative Cost	Operational Time	Comments (Practicality / Sustainability / Durability	Feasible
Non-Standard Cover System Utilising a suitable protective geo-membrane, with approximately 100mm of clean cover (See comments below)	Yes	£	Weeks	Will prevent contact between site end users and shallow contaminated soils, breaking the S-P-R linkage.	Yes - considered a suitable remediation option to mitigate the risk to human health. The type of membrane required would need to be agreed with/specified by the Arboriculturist and Regulatory Authorities.

4.2 Selected Remedial Options

The most appropriate remedial option would be the installation of a clean cover system with a warning geo-membrane or break layer in the area of asbestos contamination. However, MRN have been advised by the client that it is not possible to raise the site levels by the required 600mm of clean cover and that excavation to lower the site levels to allow installation of the clean cover system is also not possible due to the presence of the many large trees within the site and thus the tree protection requirements.

We further understand that the Arboriculturist acting for the site can only authorise the excavation of approximately 100mm of material to ensure the tress are adequately protected.

Therefore, based on the advised site constraints, the above remedial options appraisal has been reevaluated, the most appropriate approaches to the residual risks are listed below:

Based on the above remedial options appraisal, the most appropriate approaches to the residual risks are listed below:

• Undertake a water supplier pipeline Risk Assessment for water feed, and install barrier pipe and/or clean service corridors if necessary.
• Utilise a non-standard cover system utilising a suitable protective geo-membrane, with approximately 100mm of clean cover.

The options selected have been chosen because they are considered to be effective, can be carried out practically within the available time periods and are commercially viable. Furthermore, the options selected seek to promote sustainability and address the issue of tree protection and site levels.

Therefore, the most appropriate remedial option would be the installation of a nonstandard clean cover system utilising a suitable protective geo-membrane with a warning geo-membrane or break layer in the area of asbestos contamination.

• • Utilise a non-standard cover system utilising a suitable protective geo-membrane, with approximately 100mm of clean cover. The type of membrane required would need to be agreed with/specified by the Arboriculturist and Regulatory Authorities.

4.3 Site Remediation Requirements

The key requirements are summarised in the table below:

Source	Contaminants of Concern	Remediation Method	Further Details / Remedial Requirements
Made Ground	Arsenic, Lead, PAHs, Asbestos	Installation of protective geo-membrane and clean cover	In the area of asbestos contamination, the protective geomembrane will also need to act as a warning geo-membrane
Made Ground	VOC's, SVOC' s PAH's, TPH's	Undertake a water supplier pipeline Risk Assessment for water feed, and install barrier pipe and/or clean service corridors if necessary	Whilst the CSM shows the potential risk as very low, appropriate testing and risk assessment does not seem to have been carried out

In addition to the specific remedial requirements detailed in the table above which are intended to mitigate the risks from known sources, it is recommended that a watching brief be maintained during the groundworks and construction for any evidence of contamination and MRN consulted for advice.

Detailed requirements are discussed in section 5.0 below. Note where the word "clean" is used from here on, the definition of this shall mean chemically suitable for the intended use.

5.0 DETAILED REMEDIAL REQUIREMENTS AND OTHER CONSTRAINTS

5.1 General

This section is intended to fulfil the requirements of LCRM Stage 3: Remediation and Verification. All remedial works are to be overseen by suitably experienced and qualified site staff and a site watching brief will be in place alongside regular visits by a suitably qualified person to undertake the necessary verification works described.

The table below provides a summary of requirements in terms of the approximate order of works. It should be noted that the precise sequencing has not yet been confirmed by an appointed Contractor. This Remedial Strategy may also be subject to revision, dependant on the requirements of the regulators.

Task	Description
1.	**Pre-Commencement** Approval of this Remedial Strategy with the Local Authority, Warranty Provider (e.g. NHBC) and Environment Agency (EA) prior to site works commencing. Appointment of contractor for the works, who is to obtain appropriate permits, licences, and approvals. Other appointments as per CDM requirements. Production and declaration of a Materials Management Plan (MMP) under the DoWCoP prior to any works commencing or confirmation of waste exceptions (U1) to be in place.
2.	**Site Clearance and Demolition Works**

Task	Description
	Subject to all necessary ecological and Arboricultural surveys being undertaken and appropriate mitigation measures in place, the site should be cleared and any vegetation below areas of proposed development should be stripped in accordance with Series 200 of the Specification for Highway Works. Demolition of buildings, removal of hardstanding, floor slabs, drainage runs etc – A watching brief should be maintained during demolition and clearance/soils strip for any previously unidentified contamination
3.	**Excavation and Re-use of Site Won Material and Importation of Soils (Earthworks)** Excavation, screening, treatment (if required) for disposal off site. Site won materials not to be reused on this site
4.	**Installation of a Clean Cover System** Installation of "clean" validated cover system in soft landscaping areas where required to provide growing medium. Imported soils to be used as part of the cover layer should meet the chemical criteria outlined in appendix A
5.	**Verification and Reporting of Remedial Work** The landscaped areas where a cover system has been placed will require depth validation. Collation of information relating to site clearance, chemical testing, any remedial works, remedial verification, material movements, and waste transfer documentation where appropriate. A closure Verification Report will be required to close out the declared Materials Management Plan and submitted to CL:AIRE. Complete remedial validation report in line with regulatory guidance and warranty provider requirements. The report should be submitted to the Local Authority and warranty provider for approval following completion.

5.2 Demolition Works

Issues surrounding demolition of above ground buildings is outside the scope of this report, it is assumed that all existing above ground buildings and structures will be removed to ground level prior to remedial works commencing, following completion of any enabling works such as asbestos removal where present.

The excavation of all hardstanding areas, slabs, basement structures, relict foundations and similar below ground obstructions, will be undertaken with materials stockpiled and tested to determine their fate (off-site disposal) in accordance with a Materials Tracking System.

All excavations should be suitably benched or otherwise supported for the duration of the works in accordance with relevant industry guidance.

Redundant drainage associated with the previous development will require chasing out. Existing connections to be located and capped to prevent contaminated groundwater entering the off-site drainage. The contractor should locate and record connection points and maintain off site connection pipework to allow for future connection if required.

A watching brief should be maintained during demolition and clearance/soils strip for any previously unidentified contamination and MRN consulted for advice in the event any evidence of contamination is identified.

5.3 Utilities

Given the presence of heavy metals and elevated levels of within the shallow made ground, a United Utilities Pipeline Risk Assessment will be required to ensure the correct material is selected for the potable water supply pipe.

Further advice is contained in UKWIR Report 10/WM/03/21 – 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites'.

5.4 Earthworks

General Considerations
Work procedures should be designed to minimise the risk of dust becoming airborne by suitable means, such as keeping the exposed soils damp or covered at all times. It is important that the control measures in place are sufficiently robust to prevent release of contaminated dust into the surrounding environment.

Geotechnical Considerations
Whilst geotechnical aspects are not specifically considered within this Remedial Strategy, all earthworks should be undertaken in accordance with an appropriate Earthworks' Specification.

Materials classification testing is detailed alongside full requirements in a standalone Earthworks Specification.

If present, unsuitable materials (e.g. timber, metals, and plastics) removed during screening should be segregated and stored in a suitable location prior to off-site disposal to a suitable licence facility. Where practicable materials should be re-used or recycled.

The contractor should be responsible for controlling groundwater entry into excavations.

Materials Management
Any works involving the movement of soils within the site boundary shall be done in accordance with a Materials Management Plan (MMP) under the CL:AIRE Definition of Waste Code of Practice (CoP). Further guidance is presented in Appendix B.

Imported Materials and Materials for Re-use
Any soils or materials imported as part of the works should be tested for chemical compliance and suitability in line with the guidance stipulated in Appendix A and the proposed end use.

Based on the chemical testing completed to date, site-won made ground should not be considered for reuse within the cover system.

Any imported material should be approved by MRN and the Local Authority prior to being imported onto site.

Where feasible, imported topsoil should conform to the requirements of BS 3882:2015 (Specification for Topsoil and requirements for use), or as agreed with the client. Imported subsoil should also conform to the requirements of BS 38601:2013 (Specification for subsoil and requirements for use), or as agreed with the client.

In addition, all materials must be free from aggressive / invasive weeds (such as Japanese Knotweed and Giant Hogweed) and bulk vegetative growth.

Well Decommissioning
Existing monitoring wells to be decommissioned to remove potential pathways. Covers and pipe shall be removed, and the resultant annulus filled with bentonite, grout, or concrete in accordance with EA guidance.

Organic Soils
None Identified

5.5 Cover Layer
A cover system comprising a suitable protective Geo-Membrane and "clean" validated topsoil/subsoil should be placed in proposed soft landscaped areas.

Elsewhere, areas of building and hardstanding, are considered sufficient to break the pathway to end users.

Imported soils to be used as part of the cover layer should meet the chemical criteria outlined in Appendix A.

It should be noted that the screening criteria and scenarios adopted within Appendix A are conservative, thus an exceedance of a contaminant will not necessarily deem the material to be unsuitable. Any exceedances detected and overall material suitability should be assessed on a case-by-case basis, with the results included and discussed in the Validation Report.

The installation of a clean cover system will break the pathway to human health from the heavy metal, PAH and localised asbestos contamination within the made ground and act as a growing medium.

The cover layer in soft landscaping areas should comprise (top down):

• Approximately 100mm "clean" validated topsoil/subsoil.
• Suitable protective geo-membrane, which should also act as a warning barrier membrane in the area of asbestos contamination.

The type of membrane required would need to be agreed with/specified by the Arboriculturist and Regulatory Authorities.

Site drainage should be taken into consideration with the implementation of the clean cover layer. It is also essential to provide a structured, uncompacted, and well-aerated soil profile for the successful
establishment and subsequent growth of plants and grass. However, where heavy machinery and large volumes of soil are excavated and stored, soil structure can easily be destroyed by over-compaction, leading to poor drainage and failed garden planting. This can often be mitigated by careful site planning or rotavating the soils as required.

The above is subject to agreement with the Local Authority and any warranty provider, and requirements should be confirmed at the earliest opportunity.

5.6 Records

Accurate records and as-built drawings will need to be kept, updated and provided for all aspects of the remedial works as they progress.

The construction works should be devised in a way to allow the maximum re-use of site won materials adhering to current waste regulations. To allow this and demonstrate compliance with Waste Management Licensing Regulations the Contractor should maintain an accurate Materials Management Plan (MMP). These shall show the source, description, classification, and placement location of all fills used on the site. The plans shall be revised regularly with archive versions maintained for future reporting purposes. The MMP should show the extent of any excavations undertaken on site.

However, it is assumed at the time of this report that due to on-site contamination levels being above that of the allowable limits of the proposed end usage, site won soils will not be used in this development.

5.7 Stockpile Management

Segregation of materials and stockpiles should be maintained, and accurate records kept avoiding the
potential for cross contamination. Good site practice for stockpile management includes, but is not limited to:

• Damping down of the site surface, excavations, and stockpiles to prevent the generation of dust (windblown asbestos fibres can contaminate “clean” topsoil stockpiles potentially resulting in expensive disposal costs).
• Stockpiles sizes should be kept to a minimum to reduce ‘wind whip’ causing potentially hazardous material to be blown from the pile.
• Once at the intended size, stockpiles should be “sealed” to ensure no excess materials are placed and mixed into the stockpiled to prevent cross contamination.
• Clean, validated material proposed for re-use as part of the cover system should ideally be placed on a suitable polythene membrane or clean concrete hardstanding to prevent any cross contamination.
• Appropriate loading of plant to prevent spillages.

• Appropriate signage should be displayed so that site workers/visitors are aware of the intended use and are alerted to the potential hazards associated with the material to be stored on site.

Examples of good site practice for stockpile management are presented below:

Stockpile sealed and cordoned off with a warning sign

Sheeting of contaminated materials

5.8 Testing

Prior to commencing any works, the Contractor will submit to the Clients Representative (Suitably qualified Geo-environmental Engineers) details for the testing laboratories to be used together with their UKAS and MCERTS accreditations (as appropriate). The Clients Representative will approve the laboratories subject to them holding the relevant certifications. Alternatively, providing the Client's Representative is a suitably qualified Engineer, then they may attend site to obtain samples for appropriate testing.

Tests carried out by a laboratory without the approval of the Client's Representative will be rejected.

All samples will be taken in accordance with relevant guidance (e.g. BS 10175:2011+A2:2017).

The contractor is responsible for the testing of the physical properties of any imported material to be used in the engineering works. This applies to both sites won and any imported materials.

However, it is assumed at the time of this report that due to on-site contamination levels being above that of the allowable limits of the proposed end usage, site won soils will not be used in this development.

5.9 Permits

The appointed contractor will need to hold or obtain relevant waste permits or exemptions (were applicable) in accordance with the Environmental Permitting Regulations 2016 to carry out waste recovery, treatment, and re-use activities on site. Alternatively, waste recovery and re-use operations shall be in accordance with the CL:AIRE Definition of Waste Code of Practice (DoWCoP), 2011 and an approved Materials Management Plan (MMP) declared under the DoWCoP by a Qualified Person (QP).

A crusher/screener will also require a waste permit or exemption. Aggregates should be processed in accordance with relevant WRAP Quality Protocol to produce a non-waste product.
It is the contractor's duty of care to ensure that any waste to be treated or disposed off-site is transported by a licenced waste carrier and that the waste facility is licenced, permitted, or holds an appropriate exemption.

Evidence of the above should be maintained and provided on request along with any waste transfer or consignment notes for materials removed off-site.

5.10 Surface Water Runoff

The contractor should provide and maintain means to intercept surface run off in accordance with good site practice. Run-off from the site shall not be allowed to enter adjacent waterways or drainage gullies without the permission of the Drainage and Highway Authorities.

Surface waters from the site shall be discharged to the mains sewer under consent from the local Water Authority.

It should be noted that groundwater impacted by PAH's or hydrocarbons may require some form of treatment prior to discharge, alternatively if only small amounts of water are encountered, this could be stored and removed to a suitable waste disposal facility.

5.11 Unexpected Contamination

If any unexpected, contaminated materials are encountered by the contractor, then works should cease in that area and the contractor should consult MRN for advice prior to any irrevocable action at the site.

6.0 STAKEHOLDERS AND RESPONSIBILITIES

6.1 Key Stakeholders

A summary of the key project stakeholders is presented below (not exhaustive):

Function/interest	Name of Party
Local Planning Authority	Kirklees Council
Developer	Integra Buildings Ltd
Geo-Environmental Consultant	PWA/Murray Rix
Remediation/Enabling Works Contractor	Integra Buildings Ltd
Human Health Regulator	Kirklees Council
Controlled Waters and Waste Regulator	Environment Agency/Canals Trust
Highways Adoption Authority	Kirklees Council

6.2 Client

The remediation works will come under the umbrella of CDM 2015 Regulations. The Client is responsible for formally appointing a Principal Designer and Principal Contractor, otherwise the Client assumes the role of Principal Designer. All pre-construction information will need to be made available to the appointed duty holders and sufficient time and resources allowed.

6.3 Consultant/Engineer (Client's Representative)

A suitably qualified Geo-Environmental Engineer/consultant should be appointed as the client's representative to oversee the works, who will have a visiting role throughout and provide advice when required.

They should be responsible for:

• Providing appropriate supervision of the remedial works (either part time or full time).
• Monitoring the works to ensure compliance with this strategy and specification.
• Audit testing of materials. (However, it is the responsibility of the contractors to demonstrate the suitability/acceptability and the compliance of the material with the specification).
• Approval of test results.
• Validation of the works.

They will maintain records of the works to include the following:

• Record sheets to include a summary of the activities.
• Aspects relating to Environmental Control or non-compliance with this strategy.
• Test Results.

Liaison will be carried out with relevant regulators prior to commencing on site. The design of the Remedial Strategy can be adapted to avoid unnecessary delays at a later date.

Validation information will be supplied to the Local Authority for approval in a Verification Report. The report will include relevant site records and stand as certification that the remedial works have been carried out in accordance with this strategy.

6.4 Contractor

The contractor appointed to oversee the development construction works should comply with the following regulations, guidance and legislation relating to the works:

• Environmental Protection Act 1990.
• Health and Safety Executive "Protection of Workers and the General Public during the Redevelopment of Contaminated Land," HS(G)66, HMSO 1991.
• Duty of Care Regulations 1991.
• Water Resources Act 1991.
• Water Industry Act 1991.
• Environment Act 1995.
• The Control of Substances Hazardous to Health Regulations 2002.
• Hazardous Waste Regulations.
• Control of Asbestos Regulations (CAR) 2012.
• Control of Asbestos Regulations 2012: Interpretation for Managing and Working with Asbestos in Soil and Construction & Demolition materials: Industry Guidance (shortened name CAR-SOILTM)".
• The Construction, Design and Management Regulations 2015.

The contractor should provide adequate supervision for all the site works. This shall include a suitably experienced Remediation Engineer or Site Manager who will validate the work and maintain records allowing preparation of a validation report for the works.

The appointed contractors will be responsible for maintaining all records in connection with the works.

Records shall include details of:

• All the material imported to the site (including volume, source, and chemical composition).
• All the material exported from the site (including volume, destination, and chemical composition).
• The size and extent of the remedial excavations (lateral extent and depth plotted on suitable plans).
• Any treatment undertaken.
• Details of the contractor's waste exemptions, if applicable.
• Discharge of any groundwater.

6.5 CDM Stakeholders - Health & Safety

The appointed Principal Contractor (PC) will need to produce a Construction Phase Plan for the work, prepare risk assessments and method statements. The PC will be responsible for the coordination of welfare and H&S matters on-site including sub-contractors.

The Principal Designer/Client will review the Construction Phase Plan and notify the local office of the Health and Safety Executive (HSE) of the works prior to commencing (via form F10). Unless otherwise agreed with the client, the table below provides a broad outline of the overall project team.

All works should be carried out in a manner that will safeguard all site employees. This should include but not be limited to; site induction for all staff and visitors, training/safety awareness training, issue of Personal Protective Equipment (PPE) and the provision of suitable welfare facilities. Further advice is provided within HSE publication 'HSG 66 Protection of Workers and the General Public during Redevelopment of Contaminated Land'.

The works should be carried out in a manner to protect against damage to property or nuisance to property or persons on the site or within its immediate vicinity. Noise and dust issues should be considered. Members of the public should be excluded from the works areas, and the contractor should maintain suitable security to ensure unauthorised persons cannot access the works. Appropriate temporary protection and warning signs should be erected to warn of hazards that may result as a consequence of the works.

6.6 Regulators

Implement the regulations and environmental standards set by government. The contents of this report will need to be agreed in advance of works with the regulators.

7.0 VERIFICATION PLAN

7.1 Clean Cover System

Verification should be carried out in accordance with YALPAG Technical Guidance on Verification Requirements for Cover Systems (Version 4.1, June 2021), verification will form an essential component of the remediation process to demonstrate that the agreed cover system has been correctly installed and is suitable for its intended purpose. The verification process must be agreed with the Local Authority at an early stage and should include defensible measurements, observations, and records to ensure compliance with the approved remediation strategy.

Key requirements include:

- Source and Characterisation of Material

  All imported soils must be verified as suitable for use. Evidence of source, quality, and chemical testing must be provided in line with Appendix 1a of the YALPAG guidance. Soils must meet appropriate UK human health assessment criteria (e.g. LQM S4ULs or Defra C4SLs). Documentary evidence such as supplier certificates, laboratory analysis, and delivery records will be included in the Verification Report.

- Suitability and Quarantine

  Only materials deemed suitable following testing and inspection will be used. Imported soils will be stockpiled in designated quarantine areas prior to placement to prevent cross-contamination. Visual and olfactory inspections will be undertaken to confirm absence of obvious contamination or deleterious materials.

- Verification of Depth

  The agreed cover depth will be validated by a combination of trial pit depth checks and/or topographical survey, in accordance with Local Authority requirements. Where demarcation or no-dig layers (e.g. geotextile membranes) are specified, their installation, thickness and quality will also be verified at the time of placement.

- Reporting

  A Verification Report will be prepared to demonstrate compliance with the remediation objectives. This will include:

  - Description of the works and rationale for remediation;
  - Material tracking records (e.g. delivery tickets, certificates, stockpile logs);
  - Laboratory testing results;
  - Photographic evidence of material placement, depth checks, and demarcation layers;
  - Confirmation that the works render the site suitable for its intended use in accordance with the National Planning Policy Framework (NPPF).

This Verification Report will be submitted to the Local Authority to enable discharge of the relevant planning conditions and will also provide a permanent record confirming the site's suitability for future use.

7.2 Well Decommissioning

Wells should be decommissioned in accordance with EA guidance and backfilled with a low permeability material (i.e. concrete or bentonite). For decommissioned wells, photographic evidence should be provided of their removal and infilling.

7.3 Contingency Planning

Should significantly contaminated material be encountered during the development (e.g. gross hydrocarbon impaction) then a suitably qualified geo-environmental engineer should be consulted for advice. Measures may include the excavation of the material which should be stockpiled on 2000-gauge polythene sheeting, sampled and tested for an appropriate range of contaminants.

Once the laboratory analysis of the material is available, an assessment will be undertaken to determine whether it will need to be disposed off-site to a suitable facility or if the materials could be retained on site re-used with or without some form of treatment within regulatory requirements.

Depending on the nature of any such impact it may be necessary to undertake validation testing of the excavation faces in order to demonstrate that no such materials are left in-situ.

Should gross asbestos contamination be identified, then all works should cease until an Asbestos Management Plan is put into place (if not done so already) and remedial requirements are confirmed by a suitably qualified geo-environmental engineer. Note remedial works under such instances may

be classified as either licenced or non-licenced and may be notifiable to the Health and Safety Executive (HSE). Works would need to comply with CAR 2012 and CARSOILS™.

7.4 Reporting

On receipt of all information, the appointed Geo-Environmental Engineer will compile a Verification Report(s). The report will be a concise document that provides records and collected evidence of the remediation carried out at the site. The final report should contain:

- Introduction, including description of the project and background to the works.
- Summary references to site investigation data, risk assessments, and the Remedial Strategy.
- A description of the works undertaken and any treatment records.
- Details of chemical validation testing.
- Reference to the MMP (if utilised), records of where material was moved from/imported from/to and final destinations, including volumes, suitable for use criteria, QP declaration references etc.
- The size and extent of the remedial excavations (lateral extent and depth plotted on suitable plans).
- Details of how any out of specification materials were dealt with and final destination, including waste transfer notes.
- Appropriate site plans and photographic record.
- Conclusions, detailing any additional works that may be required.
- Details of any long-term monitoring requirements, if any.

This should then be submitted to the regulators and warranty providers for approval, which should close out the requirements of this Remedial Strategy.

8.0 REFERENCES

Association of Ground Investigation Specialists. 'Guidelines for Good Practice in Site Investigation.' Issue 2, March 2006.

BS 3882: 'Specification for topsoil'. 2015.
BS 5930+A1:2020: 'Code of Practice for Site Investigations'. 2020.
BS 6031: 'Code of practice for earthworks. 2009.
BS 8485+A1: 'Code of practise for the design of protective measures for methane and carbon dioxide ground gases for new buildings. 2019.
BS 8576 'Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)'. 2013.
BS 10175:2011+A2 'Investigation of Potentially Contaminated sites - code of practice'. 2017.
BRE Report BR211, Scivyer, C. 'Radon – Guidance on protective measures for new buildings' 2015 Edition.
BRE Report 414. 'Protective measures for housing on gas contaminated land. Building Research Establishment Report.' 2011.
BRE Report 465 'Cover Systems for Land Regeneration'. 2004.
CIRIA Special Publications 101-112, 'Remedial Treatment for Contaminated Land'. 1998.
CIRIA Special Publication 124, 'Barriers, liners and cover systems for containment and control of land contamination'. 1996.
CIRIA 149 'Protecting Development from Methane'. 1995.
CIRIA 150 'Methane Investigation Strategies'. 1995.
CIRIA 151 'Interpreting Measurements of Gas in the Ground'. 1995.
CIRIA 152 'Risk assessment for Methane and Other Gases from the Ground'. 1995.
CIRIA 552 'Contaminated Land Risk Assessment – A guide to good practice'. 2001.
CIRIA C659 'Assessing risks posed by hazardous ground gases to buildings.' 2006.
CIRIA C665 'Assessing Risks Posed by Hazardous Ground Gases to Buildings'. 2007.
CIRIA C681 'Unexploded Ordnance (UXO) A guide for the construction industry'. 2009.
CIRIA C716 'Remediating and mitigating risks from volatile organic compound (VOC) vapours from land affected by contamination'. 2012.
CIRIA C733 'Asbestos In Soil And Made Ground: A Guide To Understanding And Managing Risks'. 2014.
CIRIA C735 'Good Practice on The Testing and Verification of Protection Systems for Buildings Against Hazardous Ground Gases'. 2014.
CIRIA C748 'Guidance on the Use of Plastic Membranes as VOC Vapour Barriers'. 2014.
CL:AIRE and CIEH. 'Guidance on Comparing Soil Contamination Data with a Critical Concentration.' May 2008.
CL:AIRE 'The Definition of Waste: Development Industry Code of Practice.' Version 2. March 2011.
CL:AIRE RB17 'A Pragmatic Approach to Ground Gas Risk Assessment'. 2012.
CL:AIRE SP1010 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination'. Rev 2 2014.
CL:AIRE 'Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials – CAR-SOILTM.' 2016.

CL:AIRE ‘Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies’ Version 1. March 2017.
DEFRA and the Environment Agency, CLR10 ‘Soil Guideline Value Reports for Individual Soil Contaminants.’ 2002-2004.
DEFRA and the Environment Agency, CLR Report No 11 ‘Model Procedures for the Management of Contaminated Land’. 2004.
Department of the Environment, CLR Report No 1 ‘A framework for assessing the impact of contaminated land on groundwater and surface water’. 1994.
Department of the Environment, CLR Report No 2 ‘Guidance on Preliminary Site Inspection of Contaminated Land.’ 1994.
Department of the Environment, CLR Report No 3 ‘Documentary research on Industrial Sites’. 1994.
Department of the Environment, CLR Report No 4 ‘Sampling Strategies for Contaminated Land’. 1994.
Department of the Environment Waste Management Paper No. 27. ‘Landfill Gas: Technical Memorandum Providing Guidance on the Monitoring and Control of Landfill Gas.’ 1992.
Department of the Environment. ‘Industry Profiles’ - 48 separate publications available from The Stationery Office, London. 1995.
DETR. Circular: Contaminated Land. 2006.
EC Regulation 1272/2008 ‘The Classification, labelling and packaging of substances and mixtures (CLP)’ 2008.
Environment Agency ‘Using Soil Guideline Values.’ 2009.
Environment Agency, ‘Updated Technical Background to the CLEA model.’ 2009.
Environment Agency, ‘Human health toxicological assessment of contaminants in soil.’ 2009.
Environment Agency Hazardous Waste: ‘Guidance on the classification and assessment of waste’ WM3 ver 1.1 May 2018.
Environment Agency. ‘Remedial Targets Methodology. Hydrogeological Risk Assessment for Land Contamination.’ 2006.
Environment Agency & NHBC. R&D Publication 66. ‘Guidance for the Safe Development of Housing on Land Affected by Contamination.’ 2008.
Environment Agency. R&D Publication 20. ‘Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources.’ 1999.
Environment Agency Technical Guidance Note 01. Hydrogeological Risk Assessment for Landfills. [Withdrawn Feb 2016. Replaced with below].
Environment Agency and DEFRA ‘Landfill developments: groundwater risk assessment for leachate.’ 2016.
Environment Agency Petroleum Hydrocarbons in Groundwater ‘Supplementary Guidance for Hydrogeological Risk Assessment.’ 2009.
YALPAG Technical Guidance on Verification Requirements for Cover Systems (Version 4.1, June 2021)

END OF REPORT

APPENDIX A
LIMITATIONS

1. This report and its finding should be considered in relation to the terms of reference and objectives agreed between Murray Rix and the client as indicated in Section 1.3.

2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information, it has been assumed it is correct. No attempt has been made to verify the information.

3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.

4. During the site walkover, reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover, no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.

5. Access considerations, the presence of services and the activities being carried out on the site limited the locations where sampling locations could be installed and the techniques that could be used.

6. Site sensitivity assessments have been made based on available information at the time of writing and are ultimately for the decision of the regulatory authorities.

7. 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 do not constitute or replace full and proper surveys.

8. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.

9. Murray Rix cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by Murray Rix is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by Murray Rix In this connection without their explicit written agreement there to by Murray Rix

10. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

APPENDIX B
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	Charted 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
p	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 C
PREVIOUS REPORTS

Geo-Environmental Ltd

Consulting Geo-Environmental Engineers

Phase 2 Geo-Environmental Assessment

CRFCA
YH08 – Mirfield Air Training Corps

Report Ref:
23109-PWAG-00-XX-RP-G-2000-P01

Prepared for:
Integra Buildings Ltd

Date:
March 2024

Summit House
Riparian Way
The Crossing
Cross Hills
BD20 7BW

Tel: 01535 633350
E-mail: info@pwaite.co.uk

www.pwaite.co.uk

DOCUMENT CONTROL SHEET

Issued by: PWA Geo-Environmental Ltd

Summit House
Riparian Way
The Crossings
Cross Hills
Keighley
West Yorkshire
BD20 7BW

Tel: 01535 633350
E-mail:info@pwaite.co.uk

Client: Integra Buildings Ltd

Report Ref: 23109-PWAG-00-XX-RP-G-2000-P01

Project: Mirfield Air Training Corps

Report: Phase 2 Geo-Environmental Assessment

Proposed Development: cadet building

Status: Preliminary

Date: March 2024

Document Production Record

Issue Details	Name	Signature
Prepared By:	Charlie Kelly	
Checked By:	Ian Parkinson	
Approved By:	Ian Parkinson	

Document Revision Record

Issue No	Date	Revision Details
P01	08/03/2024	Original Issue

Executive Summary

PWA Geo-Environmental Ltd (PWAG) was commissioned by Integra Buildings Ltd to undertake a Phase 2 Geo-Environmental Assessment for a proposed cadet hut located at Mirfield Air Training Corps. A summary of salient geo-environmental issues is provided below. However, the full report must be read in its entirety.

Key Details	
Site Description	The site is approximately 0.2 hectares, is located on the west of Mirfield and can be located by national grid reference SE 19365 20286. The site currently comprises of an area of hardstanding with two single story modular buildings and a shed. Theres a steep landscaped banking along the south and eastern of site with building rubble along the base of the southern bank. Numerous large trees run along the north east and west of site. Metal palisade fencing borders the site on all sides with an access gate to Huddersfield Road on the northern side.
Site History	The earliest maps show in 1855 the site as an undeveloped. There are a number of residential buildings on the east of site between 1888 - 1977. The site remains empty till a building labelled club appears in 1990, with the second building appearing in 2010.
Mapped Geology	The BGS 1:10,000 SE12SE (1999) indicates that the site is comprised of made ground overlying bedrock of Clifton Rock.
Radon	The property is not within a Radon Affected Area. The site is identified as an area where between less than 1% of properties are above the action level. No radon protection measures are required for developments undertaken in these areas. The requirement for radon protection measures for any proposed development should be confirmed with local building control.
Potential Contamination	The preliminary environmental risk assessment for the site identified potential sources of contamination associated with the made ground.

Geo-Environmental Findings	
Site Works	Fieldwork undertaken in December 2023 comprised 2 cable percussive boreholes drilled to depths of between 14.50 to 15.60 m bgl.
Summary of Ground Conditions	Made ground was encountered in all locations and was typically comprised of a layer of tarmacadam over sometimes yellowish brown or grey clayey silty sandy GRAVEL, silty sandy gravelly CLAY or clayey silty gravely SAND with medium to high cobble content and rare brick, coal and or pottery. Underlain by superficial deposits of Mostly yellowish or orangish brown, occasional sandy gravelly CLAY or occasionally clayey sandy GRAVEL with a medium to high cobble content. Below which a grey mudstone bedrock was encountered at 13.50 m bgl in CP02.
Contamination	Contamination on site is considered wide spread, with PWA-Geoenvironmental and G&M Consulting identifying elevated levels above the GAC's for a residential land use for lead, arsenic, and speciated PAH's. G&M Consulting also identified asbestos within the made ground at 1.00 m and 3.00 m bgl.
Foundations and Floor Slabs	Given the depths to suitable founding strata it would be prudent to consider the use of deep foundations such as piles or ground improvement techniques. The unit that is proposed on site is a prefabricated modular unit and therefore will arrive on site with the floor slab already constructed. These floor slabs are suspended.
Road and Paved Areas	The made ground present at shallow depth are likely to provide a CBR value of at least 4%.
Sulphate Class	Sulphate class DS-3, AC-3 within the made ground and DS-1, AC-1 in the underlying natural deposits have been allocated based upon chemical testing of soils done by G&M Consulting.

Contaminated Land Risk Assessment

Based on the information contained in this report, and with due regard to the proposed residential development, the site represents a moderate/low risk with respect to contaminated land liability issues in its current condition. Following remediation the site is expected to represent a low risk.

Recommendations

We recommend that copies of this report should be provided to:

- a structural engineer so that appropriate building foundations, floors and structures can be designed; and
- the appropriate regulator for review and comment before undertaking any additional work; and
- the implementation of 600mm clean cover system.

Contents

Appendices

Appendix A – Drawings

Drawing No.	Title
230711-015.03	Site : layout : proposed
23109-PWA-00-XX-DR-G-2001	Exploratory Hole Plan
23109-PWA-00-XX-DR-G-2002	Ground Model

Appendix B – Exploratory Hole Logs

Appendix C – Geotechnical Laboratory Results

Appendix D – Geochemical Testing Results

Appendix E – Historic Borehole Logs

Appendix F – Dynamic Cone Penetrometer Results

Appendix G – Risk Evaluation

1 FOREWORD

This report has been prepared for the sole use and reliance of Integra Buildings Ltd (the Client) and cannot be relied upon by any other parties without the express written authorisation of PWA Geo-Environmental Ltd. Any unauthorised third party relies on this report at their own risk and the authors owe them no duty of care.

The report presents observations and factual data obtained during our site walkover, along with information reviewed during the desk study and intrusive works and provides an assessment of geo-environmental issues with respect to information provided by the Client regarding the site. There may be other conditions on site not encountered during this investigation and which have not been examined. We cannot accept responsibility for any conditions not revealed by this investigation and confirmation of ground conditions between exploratory locations should be undertaken if considered necessary. Any spatial inference of ground conditions between investigation locations are for guidance only and no liability can be accepted for their accuracy.

The groundwater conditions encountered on site and recorded on exploratory records are those observed at the time of investigation. The normal rate of investigation does not enable the recording of an equilibrium water level. Furthermore, groundwater levels are subject to seasonal variation, changes in weather and changes in local drainage conditions. Therefore, this information is provided for guidance only and no liability can be accepted for their accuracy.

The report should be read in its entirety, including all associated drawings and appendices. PWA Geo-Environmental Ltd cannot be held responsible for any misinterpretations arising from the use of extracts that are taken out of context.

The findings and opinions conveyed in this report (including review of any third-party reports) are based on information obtained from the sources listed, which PWA Geo-Environmental Ltd understands are reliable. All reasonable skill, care and diligence has been applied in examining the information obtained. However, PWA Geo-Environmental Ltd accepts no responsibility for inaccuracies in the data supplied or for opinions based on any such inaccurate data.

Where the report refers to the potential presence of invasive weeds such as Japanese Knotweed, or the presence of asbestos containing materials, it should be noted that the observations are for information only and should be verified by a suitably qualified expert.

PWA Geo-Environmental Ltd reserves the right to amend their conclusions and recommendations in the light of further information that may become available.

2 INTRODUCTION

2.1 The Commission and Brief

PWA Geo-Environmental Ltd (PWAG) was commissioned by Integra Buildings Ltd to undertake a Phase 2 Geo-Environmental Assessment for a proposed cadet building development located at Mirfield Air Training Corps. The overall objectives were to:

- Investigate ground conditions to confirm the depth and characteristics of possible made ground, natural superficial deposits and underlying bedrock;
- Provide preliminary geotechnical and geo-environmental recommendations for developing the site; and
- Provide recommendations for further work where necessary.

This report presents the factual information collected during this assessment, interpretation of the data obtained and recommendations relevant to the commission and brief. General notes and limitations relevant to all PWA Geo-Environmental Ltd investigations are described in the Foreword. These should be read in conjunction with this report. Should this report not address particular questions relevant to your requirements then this must be brought to our attention in advance of any works commencing so we can determine what additional work is needed.

2.2 The Proposed Development

The development proposal for the site comprises a one-storey modular cadet hut with associated hardstanding and landscaped areas. A site location plan is shown on Drawing No. 230711-015.03 and is included in **Appendix A**. It is assumed that levels will not be significantly different to those existing. Any changes to the proposed layout, site levels and/ or end use will require amendments to this report.

2.3 Geo-Environmental Assessment Methodology

Key aspects of this Phase 2 are summarised as follows:

- Undertake three days cable percussive drilling to undertake in-situ tests to obtain strength data, and collect geotechnical and geoenvironmental samples;
- Assessment of potential contamination;
- Assessment of anticipated ground conditions;
- Assessment of geotechnical properties of the near surface deposits to enable provision of foundation and highway recommendations;
- Preparation of a conceptual site model and preliminary risk assessment including recommendations for further investigation, if required.

This review relied on published information and information provided by the client and other parties, including anecdotal information, during the given time. PWAG cannot accept responsibility for the reliability and authenticity of information or reports prepared by third parties.

3 SITE DETAILS

3.1 Site Location and Description

Table 1. Site Location and Description	
Address	2 Huddersfield Rd, Mirfield WF14 9DQ
National Grid Reference	SE 19365 20286
Area	0.2 Hectares
Site Description	The site is approximately 0.2 hectares, is located on the west of Mirfield and can be located by national grid reference SE 19365 20286. The site currently comprises of an area of hardstanding with two single story modular buildings and a shed. Theres a steep landscaped banking along the south and eastern of site with building rubble along the base of the southern bank. Numerous large trees run along the north east and west of site. Metal palisade fencing borders the site on all sides with an access gate to Huddersfield Road on the northern side.
Location	

Table 1. Site Location and Description		
	Figure 1. Site location	
Ground Cover	**Ground Cover**	**Estimated percentage**
	Buildings and sheds	35%
	Hardstanding	25%
	Gardens and landscaped areas	40%
Known Services	Known services on site include electricity running from the eastern cadet hut to Huddersfield road, and drainage running from the east from that building, marked by thee man holes.	
Current Use	Cadet building	
Proposed Use[1]	cadet building	

3.2 Geology

The geology of the site has been obtained from publicly available information, the British Geological Survey (BGS) published geological map covering the site and the BGS GeoIndex Onshore viewer. These indicate that the geology comprises made ground overlying bedrock of Clifton Rock.

Figure 2: Geological Setting (reproduced from 1:10,000 SE12SE 1999)

1. Different site uses may introduce changes to pollutant linkages that are not considered in this report.

The BGS GeoIndex identifies two borehole records located 250 m north of the site and the historical borehole logs are included in **Appendix E**. These identified 0.3-0.5 m of topsoil over 0.5m of firm silty sandy gravelly CLAY underlain by sandstone bedrock, proven to 1.15m bgl.

4 PREVIOUS REPORTS

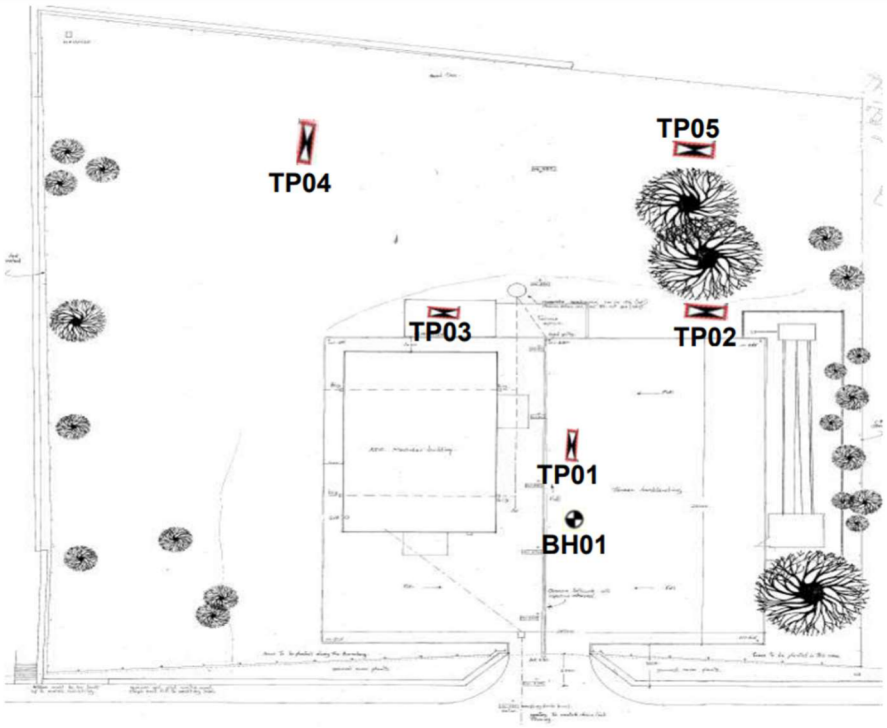
Previous reports include:

- G&M Consulting Ltd (November 2022). Geoenvironmental Appraisal of land at Mirfield Air Training Corps, Huddersfield Road, Mirfield, West Yorkshire.

Key findings of this are summarised below:

Table 2. Summary of Previous Findings

Site History	The earliest maps show in 1855 the site as an undeveloped. There are a number of residential buildings on the east of site between 1888 - 1977. The site remains empty till a building labelled club appears in 1990, with the second building appearing in 2010.
Published Geology	Area of land fill shown on site with no superficial deposits. Bedrock is the Pennine Lower Coal Measures Formation with the Clifton Rock Within.
Mining and Quarrying	According to the Coal Authority interactive map the site is not positioned within a 'development high risk area'. Inspection of the OS Plans does not indicate evidence of quarrying on site, or in the immediate vicinity.
Hydrogeology	Information provided by the EA indicates that the underlying bedrock (Pennine Lower Coal Measures) is classified as a 'Secondary A'
Hydrology	According to the GroundSure report, the closest identified surface water feature is 111m to the south west and shown as the River Calder.The southern boundary of the site is shown to lie within a Flood Zone 3 area.
Radon	The GroundSure report contains information on Radon Affected Areas as defined by the Health Protection Agency (HPA) and indicates that the site is within an area where less than 1% of properties are affected by Radon.
Scope of Works	Five trial pits were excavated to a maximum depth of 3.90 m bgl and one cable percussive borehole was drilled to 11.45 m bgl. Chemical testing was carried out on nine samples for heavy metals, five for water soluble sulphate and pH, six for phenol, ten samples for speciated PAHs and six for asbestos identification. Geotechnical testing included eight moisture contents, four Atterberg Limits and four water soluble sulphate.
Ground Conditions	Made ground was encountered in all exploratory holes, with proven depths of 1.6-4.3 m bgl and typically consisted of dark brown gravelly clayey fine to coarse SAND with becoming slightly clayey and very gravelly in places, with some cobbles and boulders. The gravel content comprised of brick, concrete, limestone, clinker, slate, and mudstone. Superficial deposits comprised of a soft / firm light brown slightly to very sandy sometimes gravelly CLAY underlain by slightly clayey gravelly SAND and light brown subangular to rounded fine to coarse gravel. Topsoil was not encountered.

Table 2. Summary of Previous Findings	
Exploration Location Plan	
Visual and Olfactory Evidence of Contamination	Probable ACMs were encountered in TP02. No other visual or olfactory evidence of contamination was noted.
Ground Gases	BH1 Installed with gas monitoring equipment, six rounds of monitoring were conducted. The has been characterized as CS1.
Chemical Testing	When compared to LQM/CIEH and DEFRA C4SL's Generic Assessment Criteria for Human Health Risk Assessment, elevated levels of arsenic, lead and PAH speciates were recorded in samples of the made ground along with asbestos (Chrysotile, amosite, and crocidolite), that was identified in two samples. Ground conditions regarding concrete classification have been calculated at DS-3 in the made ground and DS-1 in the underlying natural soils.
Geotechnical Findings	Made ground was deemed unsuitable for constructing foundations in and was too deep to extend shallow footings through. As such, a pied solution was recommended. An alternate solution of ground improvement was also suggested, utilising a raft foundation on top of the treated made ground.
Recommendations	Recommendations given by G&M are; • Implementation of a clean cover system to deal with the limited contamination identified on site. • Raft foundation solution if the made ground is treated by ground improvement, or a piled foundation solution if not.

5 FIELDWORK

5.1 Scope of Fieldworks

Fieldwork was supervised by PWA Geo-Environmental Ltd and comprised:

Table 3. Scope of Fieldworks			
Start date:	19/12/2023	**End date:**	21/12/2023
Site Works Summary Fieldwork undertaken in December 2023 comprised two cable percussive boreholes drilled to depths of between 14.50 to 15.60 m bgl.			

Table 3. Scope of Fieldworks			
Technique	**Exploratory Holes**	**Depths**	**Comments**
Cable percussive	CP01-CP02	14.50 – 15.60 m	To characterize shallow ground conditions, undertake in-situ testing to obtain strength data (standard penetration tests (SPTs)), and collect representative samples for laboratory testing. Evaluate potential depth to bedrock. The objective was to determine the suitability of the ground for constructing foundations for the proposed structures.
Hand pits	HP01-HP08	0.1 – 0.2 m	To sample shallow made ground for chemical testing.

Descriptions of strata and groundwater observations made during investigation works, together with samples recovered and the results of all in situ field testing, are presented on the exploratory hole logs in **Appendix B.** Exploratory hole locations are shown on Drawing No 23109-PWAG-00-XX-DR-G-2001-P01 in **Appendix A**.

5.2 Sampling Strategy

The principal objectives were to understand the sub-surface conditions and how they will influence bearing capacity and concrete classification, investigate possible contamination identified in the geoenvironmental appraisal, and provide recommendations for the proposed development. The site investigation was designed to investigate the location of the proposed development and provide general site coverage where access could be gained.

5.3 Geotechnical Laboratory Testing

Geotechnical laboratory testing on selected samples was carried out under subcontract with a UKAS-accredited laboratory. Geotechnical test results are presented in **Appendix C**.

Table 4. Geotechnical Laboratory Testing		
Type of sample	**Particle Size Distribution**	**Water Soluble Sulphate and pH**
Superficial deposits	3	3

5.4 Chemical Laboratory Testing

Selected samples of the topsoil and made ground were tested for a range of potential contaminants under subcontract with a UKAS and MCERTS accredited laboratory. Chemical test reports, as received from the laboratory, are presented in **Appendix D.** The testing was designed to supplement the contamination findings discussed in the report by G&M Consulting (November 2022).

Table 5. Chemical Laboratory Testing		
Type of sample	**No. of samples**	**Determinands**
Made ground	8	Heavy metals, total petroleum hydrocarbons (TPH), poly aromatic hydrocarbons (PAHs), and asbestos identification

6 GROUND CONDITIONS

6.1 Ground Conditions Encountered

A summary of ground conditions encountered is presented in the Conceptual Ground Model presented as Drawing No. 23109-PWAG-00-XX-G-DR-2002-P01 in **Appendix A**. **Table 6** provides a summary of the strata encountered:

Table 6. Summary of Ground Conditions Encountered		
Summary of Ground Conditions Made ground was encountered in all locations and typically comprised a layer of tarmacadam over sometimes yellowish brown or grey clayey silty sandy GRAVEL, silty sandy gravelly CLAY or clayey silty gravely SAND with medium to high cobble content and rare brick, coal and or pottery. This was underlain by superficial deposits of mostly yellowish or orangish brown, occasional sandy gravelly CLAY or occasionally clayey sandy GRAVEL with a medium to high cobble content. Grey mudstone bedrock was encountered at 13.50 m bgl in CP02.		
Strata	**Depth Encountered (Thickness)**	**Description and Distribution**
Made ground	Ground level (4.30 to 5.30 m)	Made ground was encountered in all locations and was typically comprised of a layer of tarmacadam over sometimes yellowish brown or grey clayey

Table 6. Summary of Ground Conditions Encountered		
		silty sandy GRAVEL, silty sandy gravelly CLAY or clayey silty gravely SAND with medium to high cobble content and rare brick, coal and or pottery. The Gravel typically constituted of angular to subrounded fine to coarse sandstone and mudstone.
Superficial deposits	4.30 – 5.30 m bgl (9.20 to 10.30 m)	Mostly yellowish or orangish brown, occasional sandy gravelly CLAY or occasionally clayey sandy GRAVEL with a medium to high cobble content. CP01 encountered a yellowish brown, gravelly SAND layer with a high cobble content 6.50 – 8.20 m bgl. Gravel was typically angular to sub-rounded fine to coarse sandstone and mudstone.
Presumed mudstone bedrock	13.50 m (Unknown thickness)	Bedrock was encountered in CP02 at 13.5 m bgl as grey mudstone, recovered as grey angular coarse GRAVEL.

6.2 Stability

No borehole instability was observed during the investigation.

6.3 Obstructions

No obstructions were encountered within superficial strata.

6.4 Visual and Olfactory Evidence of Contamination

There was no visual or olfactory evidence of contamination within any cable percussive or hand pit position.

6.5 Groundwater

Groundwater was encountered in both cable percussive position during this investigation.

Below is a table showing where and at what depth water strikes were encountered during the investigation.

Table 6. Groundwater Observations.		
Location	**Depth (bgl)**	**Comment**
CP01	9.60 m	Encountered within gravel.
CP02	9.10 m	Encountered within gravel.

However, water levels are likely to fluctuate with the seasons/rainfall and therefore may be substantially higher at wetter periods of the year, compared to those recorded during this investigation.

6.6 Classification Tests (Particle Size Distribution)

Three particle size distribution (PSD) tests were completed at depths between 6.00 – 10.50 m bgl. The testing has confirmed that the geological logging of the soil at the time of the investigation was generally correct.

The material was classified in accordance with Table 6/1 of the Specification for Highways Works (SHW) Series 600 Earthworks revealing:

Table 7. Material Classification Summary						
Sample & Depth	**Description**	**Cobbles (%)**	**Gravel (%)**	**Sand (%)**	**Silt/Clay (%)**	**Material Classification**
CP01: 9.00 m	Brown sandy clayey GRAVEL	0	72	17	11	Class 1A Well graded granular material
CP01: 10.50 m	Brown sandy slightly silty GRAVEL	0	83	15	2	Class 1A Well graded granular material
CP02: 5.10 m	Brown very sandy very clayey GRAVEL	0	42	28	30	2C Stony cohesive material

6.7 Standard Penetration Tests (SPT) – Fine Grained soils

Three SPTs were undertaken in fine grained soils. At 13.50 m bgl in CP01, and at 5.00 m and 12.00 m bgl in CP02. The corrected N60 value at 13.50 m bgl in CP01 was 143, and was presumed to be weathered bedrock. At CP02 it was 27 at 5.00 m and at 12.00 m it was 55.

The SPT 'N' value within the cohesive material ranged between 27 to 143 blows, the results are indicative of stiff to very stiff deposits, and the results indicate an increase in penetration resistance with depth. Where refusals were observed, engineering judgement was applied regarding whether refusal was due to an obstruction or strength of the material. If the SPT results were considered valid then this was extrapolated using a simple linear extrapolation to determine the estimated N-value per 300 mm.

Indicative undrained shear strengths of cohesive soils can be derived by applying a correlation to SPT 'N' values according to the material's plasticity after Stroud. Based on the average recorded plasticity index of 25% a correlation factor of approximately 5 can be applied. Using Stroud's correlation, the SPT 'N' values indicate undrained shear strengths of:

- Cu = 137 kPa @ 5 m bgl in CP02
- Cu = 274 kPa @ 12 m bgl in CP02

These values indicate that the material is high strength.

The result from CP01 has been removed as this is presumed to have encountered weathered bedrock.

6.8 Standard Penetration Tests (SPT) - Coarse Grained Soils

Seven standard penetration tests (SPTs) were undertaken in coarse grained soils, at 1.20 m bgl, and metre intervals following that, until 7.50 m bgl, at which point the intervals became 1.50 m intervals until 12.00 m in CP01, and 10.50 m in CP02. The corrected N60 values range between 14 – 117 blows, with three being >50 blows. The remaining values range between 14 – 27 indicating them to be medium dense gravels. The areas where > 50 blows were need was believed to have been areas of very dense gravel, that required chiseling.

The SPT results have been used to derive a conservative characteristic friction angle, of 36°.

6.9 Field Determination of California Bearing Ratio

One Dynamic Cone Penetrometer Tests (DCP) were undertaken within the existing car parking area to determine California Bearing Ratio (CBR) values to inform car park design. The testing was undertaken in accordance with Transport Research Laboratory (TRL) methodology. The results of the testing are presented as **Appendix F.**

Before testing began a small area of tarmac was excavated and the DCP was carried out on the underling soils. The DCP tests showed a CBR value in the top 100-250mm around 40-50% which sharply increased for the next 50mm returning values in the hundreds with a peak of 431%. Below which the CBR stabilized out to an average CBR value of 15-20%. The average overall CBR value was 74.5% with the minimum being 4%.

The peak values likely correlate to the obstruction within the soil, likely a cobble. As such the average CBR given Is likely greater than reality. Taking that into consideration, a typical CBR value of 3% is considered suitable for pavement design purposes in the made ground although this must be confirmed by plate load testing.

6.10 Soluble Sulphate and pH

The Aggressive Chemical Environment for Concrete classifications for the soil types identified at the site have been determined in general accordance with BRE Special Digest 1:2005 (SD1). SD1 requires that sites are first identified as being in one of four categories based on natural ground / 'Brownfield' conditions and pyrite content. The site has been categorized as: Brownfield - Non-pyrite with a mobile groundwater regime.

The Water-Soluble Sulphate Values (mg/l SO4) of natural soils at the site based on the testing carried out varied from 100 to 510 mg/l and the pH value ranged from 7.1 to 8.1. As the characteristic value of sulphate is less than 3,000 mg/l and the characteristic pH is greater than 5.5, the concentrations of magnesium, nitrate and chloride are not considered significant in determining the design sulphate class.

G&M Consulting carried out testing on three samples from the made ground and recorded Water-Soluble Sulphate Values of 41 to 1900 mg/l and pH values of 7.8 to 9.5. Testing was also conducted on two samples of natural soil which returned values of 60 mg/l and 120 mg/l and pH of 7.7 and 8.0.

Given the values the design sulphate class for the made ground is DS-3 and the underlying natural soil is DS-2.

7 RESULTS OF CHEMICAL TESTING

7.1 Assessment Criteria

All laboratory test data were reviewed for completeness and consistency. Those determinants that indicate potential contamination were subject to further evaluation. In this instance the dataset was considered representative of conditions encountered in those samples analysed.

For each potential contaminant of concern, analytical data for soil samples were compared to the relevant Generic Assessment Criteria (GAC) taken from the LQM/CIEH Suitable for Use Levels (S4ULs)[2]. Taking into consideration the proposed land use we have used values derived for a residential with homegrown produce end use. For those potential contaminants of concern where the selected GAC is dependent on Soil Organic Matter (SOM) content we have assumed 1% SOM unless otherwise indicated.

Where there are no applicable generic assessment criteria (GAC) for a given contaminant / parameter, it has been excluded from the table. Where analysis returned a concentration in excess of the GAC, the relevant sample is highlighted orange. In the cases where all the samples tested for a given substance were below the GAC, no further consideration is necessary for that substance.

Usually, statistical analysis of the results is undertaken in accordance with CL:AIRE statistics guidance. The purpose is to determine whether there is enough evidence that the true mean concentration of each determinant is less than the relevant GAC for that substance. On this occasion, statistical analysis has not been carried out due to the small data set.

7.2 Chemical Analysis - Soils

The chemical analysis certificates as received from the laboratory are presented in **Appendix D.** The information is summarised in **Table 8** and the samples analysed have the high total shown.

Table 8. Summary of Soils Analysis.

Determinand	GAC for residential with homegrown produce	Made Ground (Max)	Made Ground (Min)	Number of exceedances
Arsenic	37	42.3	14.2	1
Cadmium	11	1.8	0.4	0
Chromium	910	119	26.4	0
Copper	2400	93.7	44.2	0
Lead	200	884.8	124.6	4
Mercury, inorganic	40	0.6	<0.5	0
Nickel	180	54.5	22.9	0
Selenium	250	1	<0.5	0
Zinc	3700	796.1	246.5	0
Acenaphthene	210	0.47	<0.11	0
Acenaphthylene	170	0.28	<0.11	0
Anthracene	2400	0.84	0.4	0
Benzo[a]anthracene	7.2	3.31	0.9	0
Benzo[a]pyrene	2.2	3.28	1.02	3
Benzo[b]fluoranthene	2.6	3.86	1.2	3
Benzo[g,h,i]perylene	320	2.01	0.51	0
Benzo[k]fluoranthene	77	1.57	0.64	0
Chrysene	15	2.59	0.94	0
Dibenzo[a,h]anthracene	0.24	0.53	0.16	7
Fluoranthene	280	5.74	2.53	0

2. Nathanail, C. P., McCaffrey, C., Gillet, A. G., Ogden, R. C. and Nathanail, J. F. 2015. The LQM/CIEH <0.11S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham.0.5

Table 8. Summary of Soils Analysis.				
Determinand	**GAC for residential with homegrown produce**	**Made Ground (Max)**	**Made Ground (Min)**	**Number of exceedances**
Fluorene	170	0.35	<0.11	0
Indeno[1,2,3-cd]pyrene	27	2.06	0.5	0
Naphthalene	2.3	0.69	0.15	0
Phenanthrene	95	3.38	0.91	0
Pyrene	620	5.05	2.13	0
Total PAH 16	NA	5.05	12.6	0
Asbestos	NA	NAIIS	NAIIS	0

*Note: All units mg/kg unless otherwise stated. GAC = LQM/CIEH S4ULs. NA = Not applicable.

7.2.1 Made Ground

Eight samples were taken from the made ground from depths between 0.10 – 0.20 m bgl. A key objective was to evaluate the contamination findings from the G&M Consulting (November 2022) report. In summary, our findings were similar regarding arsenic, lead and PAHs. However, we did not identify asbestos in any of the samples tested.

Metals and inorganic analytes

One sample (from HP05) exceeded the GAC for arsenic of 37 mg/kg with a value of 42.3 mg/kg. This exceedance was considered quite minor although G&M (November 2022) reported 4 out of 9 samples tested above the GAC with results ranging from 37 to 140 mg/kg.

Four samples (from HP01, HP02, HP03, and HP05) exceeded the GAC for lead of 200 mg/kg with values in exceedance ranging between 252.8 - 884.8 mg/kg. G&M (November 2022) reported 4 out of 9 samples tested above the GAC with results ranging from 200 to 740 mg/kg.

All other samples were found to be below the GAC for metals and inorganic analytes.

Organics

Three samples (from HP03, HP05, and HP08) exceeded the GAC for benzo[a]pyrene of 2.2 mg/kg with values in exceedance ranging between 2.77 - 3.28 mg/kg. G&M (November 2022) reported 2 out of 10 samples tested above the GAC with results ranging from 11 to 20 mg/kg. It should be noted that G&M are using a less stringent GAC of 5 mg/kg.

Three samples (from HP03, HP05, and HP08) exceeded the GAC for benzo[b]fluoranthene of 2.6 mg/kg with values in exceedance ranging between 3.33 - 3.86 mg/kg. G&M (November 2022) reported 4 out of 10 samples tested above the GAC with results ranging from 2.8 to 17 mg/kg.

Seven samples (from HP01, HP02, HP03, HP04, HP05, HP06, and HP08) exceeded the GAC for Dibenzo[a,h]anthracene of 0.24 mg/kg with values in exceedance ranging between 0.26 – 0.47 mg/kg. G&M (November 2022) reported 4 out of 10 samples tested above the GAC with results ranging from 0.49 to 2.9 mg/kg.

While PWAG identified no samples in exceedance of the Benzo[a]anthracene GAC of 7.2 mg/kg, G&M (November 2022) reported 2 out of 10 samples tested above the GAC with results ranging from 10 to 18 mg/kg.

Asbestos

No asbestos was identified in any of the shallow PWAG samples. G&M (November 2022) reported 2 out of 6 samples tested had positive asbestos identification. Loose fibrous debris of amosite was identified in TP2 at 3.00 m bgl and loose fibrous debris of chrysotile, amosite, and crocidolite was identified in TP2 at 1.00 m bgl.

7.2.2 Phytotoxicity

Chemical testing results were compared with phytotoxicity criteria to determine if the soils could be harmful to plant life. The results are summarised in **Table 9**.

Table 9. Summary of Soils Analysis.				
Determinand	**Unit**	**Assessment criteria**	**Source Reference**	**Made ground (Max)**
Arsenic	mg/kg	250	MAFF 1998	42.3
Chromium	mg/kg	25	ICRCL 70/90 1990	119
Copper	mg/kg	<100	BS3882:2015	93.7
Nickel	mg/kg	<60	BS3882:2015	54.5
Zinc	mg/kg	<200	BS3882:2015	796.1

Based on the above results the soils tested at this site are potentially phytotoxic to plants, however current vegetation on site showed no sign of hardship.

8 RISK ASSESSMENT AND REVISED CONCEPTUAL SITE MODEL

8.1 Introduction

The preliminary conceptual site model given by G&M Consulting (November 2022) has been revised in light of the ground investigation and associated chemical analysis results, updating our understanding of surface and sub-surface features and contaminant sources.

Potential risks associated with asbestos containing materials in the fabric of the building are not considered in this assessment. We assume that these risks are identified on the facility's asbestos register and managed appropriately. At some time in the future, when the buildings require renovation/ demolition, we recommend that a further and more detailed pre-demolition asbestos survey is undertaken. Before renovation/demolition, all asbestos containing material must be removed from site by a suitably qualified contractor and supported by a detailed verification report.

Contaminated materials and their sources identified on site present concern on the condition that a potential impermissible risk exists. The possibility for harm to occur on site requires the fulfilment of three conditions:

- Source: The presence of substances (potential contaminants/pollutants), that may cause harm or pollution.
- Receptor: The existence of an entity that may become harmed from the Source.
- Pathway: A route that the Source takes to reach the Receptor.

Potential sources of contamination considered in the conceptual site model included the made ground. Generally, the potential risks were considered moderate/low. This was on the basis that the contamination is wide spread across the site including the landscaped areas. Given the buildings use as a cadet training hut it is likely that people will come into contact with the contaminated soil.

These finding have been used to update our understanding of surface and sub-surface features, the potential contaminant sources, transport pathways and receptors.

Table 10. Source, Pathway and Receptors		
Potential Sources of Contamination	**Potential Transport Pathways and Pollutant Linkages**	**Potential Receptors**
On-site sources Made ground.	• Direct exposure to potentially contaminated soils (direct contact, ingestion and dust inhalation). • Potential leaching of contaminants from made ground and the risk of infiltration into underlying groundwater. • Direct contact with conditions potentially aggressive to building materials and underground services.	**Controlled waters** • Underlying groundwater. • Surface water **Human Health** • Current site users. • Future site users. • Construction workers during redevelopment works. **Construction Materials** • Future buildings and services. • Underground services.

8.2 Qualitative Risk Assessment and Revised Conceptual Site Model

A qualitative risk assessment is undertaken of potential pollutant linkages following the guidance presented in **Appendix G**, and is based on consideration of both:

- The likelihood of an event (probability – considers both the presence of the hazard and receptor and the integrity of the pathway);
- The severity of the potential consequence (considers both the potential severity of the hazard and the sensitivity of the receptor).

Potential risks related to these plausible linkages are based on redevelopment of the site with a proposed residential end use assuming no mitigation is implemented. These are summarised in **Table 11**.

Table 11. Preliminary Environmental Risk Assessment

Source	Pathways to Receptor	Receptors	Associated Hazard [Potential severity]	Likelihood / Potential Mitigation	Potential Risk
Made ground	Direct contact, ingestion and dust inhalation	Current site users. Future site users.	Effect on human health [medium]	Low likelihood: Given the sites intended use, there is a chance that the cadets will come into direct contact with the surface material. No asbestos was identified in the surface samples collected. Potential mitigation measures include separating site users from the made ground. This could be achieved through a combination of the hardcover of the development and a clean cover system in landscaped areas.	Moderate/ low
		Construction workers.		Unlikely: Any risks can be mitigated by appropriate site management and use of suitable PPE during construction stage.	Low
	Leaching and infiltration	Controlled waters - groundwater	Leaching and infiltration into groundwater [Minor]	Low likelihood: Bedrock is secondary A aquifer and is of medium vulnerability.	Very low
		Controlled waters – surface water	Surface water runoff entering the river Calder. [Minor]	Likely: The site is in close proximity of the river Calder.	Low
	Direct contact	New in ground services and construction materials	Degradation [Mild]	Unlikely: Use of appropriate construction materials, chemical resistant supply pipes and use of oversized service trenches with clean fill can mitigate the risk	Very low

9 ENVIRONMENTAL RISK ASSESSMENT AND RECOMMENDATIONS

9.1 Human Health

G&M Consulting identified elevated levels above the GAC for a residential with plant uptake end land use for lead, arsenic, and speciated PAHs and identified asbestos within the soil. PWAGs following investigation identified elevated levels above the GAC for a residential with home grown vegetables end land use for lead, arsenic, and speciated PAHs. While residential with home grown vegetables end land is quite stringent land use for the site, we consider that a commercial end land use would not have been stringent enough for the end land use case.

Given the depth to the asbestos contamination it is unlikely that end users of the site will come into contact and the metal and organic contamination is not server, it is considered prudent that remediation measures are taken to protect the end user.

Where possible, the ground works on-site should be designed and planned to minimise the exposure of workers to contaminated soil. This should be considered in the Health and Safety plan under the CDM Regulations. Where risks cannot be removed entirely at the planning stage, mitigation measures should include the use of personal protective clothing (PPE) including gloves. Dust suppression measures should also be incorporated into the works to reduce ingestion and inhalation of contaminated dust.

9.2 Plant Life

Whilst there are large mature trees on site, the risk assessment indicates that the natural soils on site are considered potentially harmful to plant life. This should be reviewed by a suitably qualified landscape architect.

9.3 Radon

The site is within an area where no radon protection measures are required. This should be confirmed with local building control.

9.4 New Utilities and Water Supply Pipes

Given the contamination of the site we recommend that the use of barrier water supply pipes (such as Protecta-Line) may be acceptable. In addition, we recommend that the pipes are laid in trenches backfilled with clean granular material. However, we recommend that this is discussed with the water supply company before development starts to ensure they agree.

9.5 Outline Remediation Requirements

The made ground contamination is widespread across the site and as such it is recommended to implement a clean cover system. This should include 450 mm of clean topsoil and subsoil in gardens and landscaped areas, or hardstanding to act as a barrier between the contamination and future end users. Alternatively, the contaminated soil could be removed from site, but due to the extent of the contamination this is likely to be uneconomical.

Potential risks associated with asbestos containing materials in the fabric of the building are not considered in this assessment. We assume that these risks are identified on the facility's asbestos register and managed appropriately. At some time in the future, when the buildings require renovation/ demolition, we recommend that a further and more detailed pre-demolition asbestos survey is undertaken. Before renovation/demolition, all asbestos containing material must be removed from site by a suitably qualified contractor and supported by a detailed verification report.

9.6 Waste Management

The handling, re-use or disposal of waste is regulated by the Environment Agency. Any material excavated on-site may be classified as waste and it is the responsibility of the holder of a material to form their own view on whether or not it is waste. One of the ways this can be achieved is set out in the Definition of Waste: Development Industry Code of Practice (DoWCoP). This builds on the Environment Agency guidance document Definition of waste: developing greenfield and brownfield sites (2006). The Agency will consider the use of the DoWCoP in deciding whether to regulate materials as waste. If materials are dealt with in accordance with the DoWCoP, the Agency considers that those materials are unlikely to be waste at the point when they are to be used for the purpose of land development.

Good practice has three basic elements:

- Ensuring that an adequate Materials Management Plan (MMP) is in place, covering the use of materials on a specific site.
- Ensuring that the MMP is based on an appropriate risk assessment, concluding that the objectives of preventing harm to human health and pollution of the environment will be met if materials are used in the proposed manner.
- Ensuring that the requirements of the MMP are met.

All material proposed for off-site disposal (e.g. during future construction works) should be given a proper description and waste classification as required by the Environmental Protection Duty of Care Regulations, and in accordance with WM3 and the Environment Agency Technical Guidance on the assessment and classification of Hazardous Waste. Advice on the classification of wastes containing asbestos is provided in Chapter 3 of Environment Agency document 'Guidance on the classification and assessment of waste Technical Guidance WM3'.

9.7 Reuse of Site Won Material

This project may require the reuse of natural soils on site. Therefore, the contractor may need to prepare a Materials Management Plan (MMP) in accordance with the CL:AIRE Code of Practice (v2, March 2011). Alternatively, where quantities are small, a suitable exemption may be more appropriate.

The MMP will document how all of the materials to be excavated during the proposed site preparatory earthworks are to be dealt with. The MMP should also detail how materials will be tracked throughout the earthworks in order that the subsequent Verification Report can provide an auditable trail. Finally, the MMP will have to set out a Verification Plan that identifies how the placement of materials is to be recorded and the quantities of material to be used. It will contain a statement on how the use of the materials relate to the remediation or design objectives.

In the event that materials from this site are required to be transferred to other locations, or material is imported for landscaping, the MMP will assist with verification for regulatory authorities.

Once completed, the MMP will need to be reviewed by a Qualified Person (QP), who will sign a Declaration for submission to CL:AIRE and send a copy to the Client.

9.8 Unexpected finding protocol

If unexpected potentially contaminated materials (such as those with an unusual colour, odour or containing drums, chemicals or asbestos, etc) are encountered at any time during redevelopment then work should stop, and a suitably qualified environmental consultant contacted to provide advice on the appropriate course of action. This could be associated with former hydrocarbon storage equipment such as disused steel tanks and dispensing pumps.

10 GEOTECHNICAL CONCLUSIONS AND RECOMMENDATIONS

10.1 Proposed Development

This assessment has been prepared on the understanding that the development proposal for the site comprises a one-storey modular cadet hut with associated hardstanding and landscaped areas. A site location plan is shown on Drawing No. 230711-015.03 and is included in **Appendix A**. Finished floor levels have not been provided, therefore we have also assumed that the proposed levels will not be significantly different to those existing. If any of these assumptions are incorrect then the conclusions in this report will require reassessment.

10.2 Geotechnical Categorisation of the Proposed Development

Eurocode 7, Section 2 advocates the use of geotechnical categorisation of the proposed structure(s) to establish the design requirements. Initial categorisation can be made before site investigation and can be used to define the scope and extent of geotechnical investigation required. For the purposes of this investigation, the proposed structures have been classed as Geotechnical Category 2.

10.3 Mining

The possibility of risk from shallow coal mine workings to the proposed development was assessed as **low** and no further assessment is considered necessary.

10.4 Gas Risk

G&M Consulting conducted six rounds of gas monitoring in 2022. At the time of writing their report only two rounds of gas monitoring had been conducted. From the limited data they had, they gave these results a preliminary characteristic situation of CS1.

A review of the complete gas monitoring data indicates a maximum concentration of 0.3% v/v carbon dioxide, non-detect methane, 17.4% v/v oxygen concentration as the minimum and non detect flow. All positions were monitored over the course of the six visits.

A site characteristic gas screening value (GSV) is calculated based on the borehole hazardous gas flow rate – Q_{hg}. This is calculated for methane and carbon dioxide in accordance with BS:8485:2015+A1:2019 based on the measured gas flows, gas concentrations or a limit of detection (taken as 0.1 l/hr for flow and 0.1% for gas concentration), whichever is higher. The derived GSV is used to determine a characteristic gas situation (CS).

The GSV for carbon dioxide was calculated using the maximum steady state flow and maximum steady gas concentrations. A GSV of 0.0003 l/hr was derived that equates to CS1.

As such, no special precautions are required in regard to a ground gas risk.

10.5 Site Preparation and Stability of Excavations

Comments relating to the stability of excavations (i.e. trial pits) and groundwater seepages are included in the logs in **Appendix B**.

Based on observations made during fieldwork, shallow (<1.0 m) excavations should not require shoring to maintain stability in the short term. However, for deeper excavations further advice should be sought from the temporary works designer. The following factors should be considered:

- No ground can be relied upon to stand unsupported in all circumstances. Therefore, man entry into any excavation should only be undertaken where a suitable risk assessment has been carried out by a competent person.
- All trenches should be excavated in accordance with CIRIA Report 97 (1983) 'Trenching Practice';
- Trench shoring should be keyed into basal materials beneath the base of the trench. The embedment depth may be significantly deeper than the depth of the excavation being supported; and
- Consideration should be given to the re-use of arisings from foundation trenches / drainage runs etc. Where contamination has been encountered, it may be possible to reuse foundation arisings subject to risk assessment; however, certainty of use and volume should be confirmed in accordance with the requirements of CLAIRE guidance.

In line with BS6031, all excavations should be examined daily by a competent person to ensure that they remain safe. Where the sides cannot be sloped back to a safe angle, as approved by a competent and experienced person, their continued stability should not be taken for granted. Vertical or steep faces should be provided with support unless instructed otherwise by a competent person. No work should take place until the excavation is safe.

Groundwater was encountered below 9.00 m bgl in both exploratory positions. As such, it is envisaged that at shallow depths (<2.00 m) any groundwater seepages should be minor and may be controlled by sump pumping methods. However, at greater depth, significant groundwater ingress may be encountered and if present, a specialist dewatering contractor may be required. Groundwater should be controlled in accordance with CIRIA report 113 Control of Groundwater for Temporary Works.

It should be noted that groundwater levels may vary from those at the time of the investigation, for example in response to seasonal fluctuations.

Presumed bedrock was encountered in the form of mudstone at depth of 13.50 m bgl. Further obstructions, not encountered during the investigation, could be present such as unknown services. Based on observed ground conditions, shallow excavations in superficial deposits should be suitable for standard plant.

10.6 Preliminary Foundation Recommendations

Made ground was encountered in all three boreholes drilled on site and was present to depths of between 4.3 and 5.3 m bgl. As such, shallow foundations have been discounted.

Given the depths to suitable founding strata it would be prudent to consider the use of deep foundations such as piles or ground improvement techniques such as vibro stone columns to support structural loads. Both piling and vibro replacement contractors have their own proprietary methods of installation. Therefore, we recommend that discussions with specialist contractors take place at an early stage in the development. Settlement of superficial deposits and made ground could give risk to negative skin friction on driven piles. Due allowance should be made for down drag forces in the design of piles.

All foundations should be designed by a suitably qualified Structural Engineer.

10.7 Floor Slabs

The unit that is proposed on site is a prefabricated modular unit and therefore will arrive on site with the floor slab already constructed. These floor slabs are suspended.

10.8 Roads and Pavements

If the current tarmacadam is removed from site made ground is expected to be present across the site. Based on DCP results, the made ground is expected to be able to achieve a CBR design value of >3% over much of the site and can be used for preliminary design subject to insitu testing during construction.

Once design levels have been constructed, proof rolling of the formation will be required and any loose or soft spots must be removed and replaced with an engineered fill, in accordance with a suitable specification. Fine grained soils are susceptible to change during inclement weather and the formation level must be protected from deterioration. In addition, good practice shall be followed whereby all slopes are trimmed to falls to shed rain water and the surface sealed to limit infiltration.

Prior to the placement of the founding materials and the construction of the road pavement, the sub-formation and formation will need to be inspected and checked in accordance with a suitable specification, to ensure the ground conditions are as expected. All testing should be carried out in accordance with DMRB IAN 73/06 and confirm that the ground conditions at the time of construction are consistent with the previous design parameters.

Whilst the CBRs estimated above should be achievable, significant deterioration during/after periods of significant rainfall is likely and/or site trafficking. Consequently, it would be prudent to consider flexibility in the groundworks programme to enable highway construction during prolonged dry\warm weather when formation will be least vulnerable to deterioration. Alternatively, a minimum 200 mm thickness of suitable granular fill (ie a "blanket" of 6F2) could be placed along the line of proposed highways to protect formation during the construction phase.

All road designs should be discussed with the relevant local authority if highways are to be subject to a Section 38 agreement.

10.9 Buried Concrete

Based on the samples tested by PWAG and G&M Consulting, and in accordance with BRE Special Digest 1 (2005), a Design Sulphate (DS) Class of DS-3, AC3 within the made ground and DS-2, AC-2 within the natural underlaying strata.

RECOMMENDATIONS FOR FUTURE WORKS

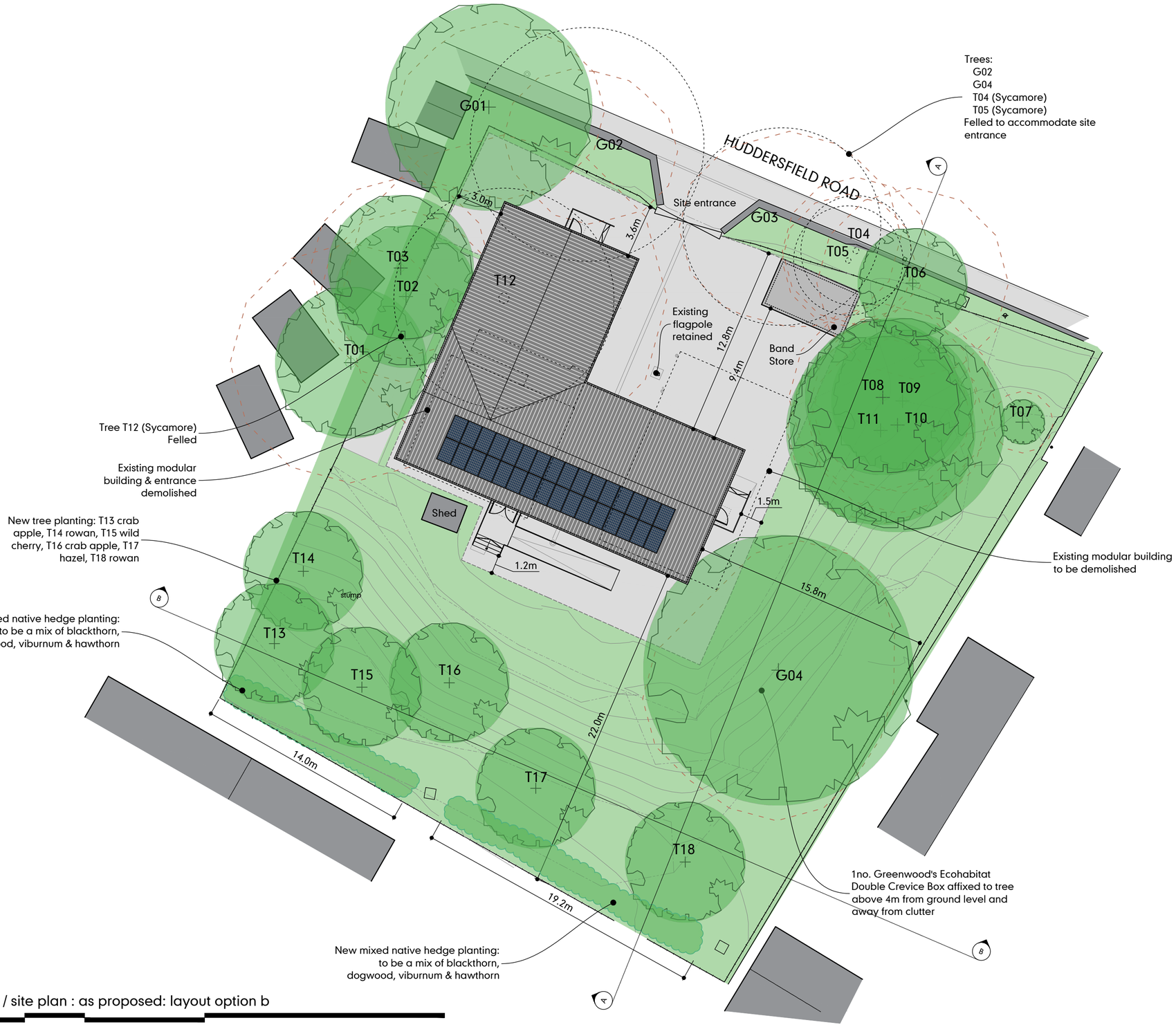
It is recommended that:

- copies of this report should be provided to a structural engineer so that appropriate building foundations, floors and structures can be designed;
- all ground investigation information is passed over to a suitable specialist piling contractor to advise on foundation design for the proposed development; and
- a remediation strategy is written for the site to set out how the minor concentrations of contamination should be dealt with.

11 REGULATORY APPROVALS

The conclusions and recommendations presented in this report are considered reasonable based on the information that was available. However, these are not guaranteed to gain approval from regulatory authorities or warranty providers. Therefore, we recommend that copies of this report are passed to the appropriate regulator or warranty provider for review and comment before undertaking any additional work.

Appendix A
Drawings



block / site plan : as proposed: layout option b

g:\shared drives\data store\001 active jobs\230711 integra crfca mirfield\2-00 docs-out (in-progress)\2-01 titled-drawings\230711 plng-drwgs 002-020.dwg : 11-Dec-23 . 15:20:37 : © Williams-Architects Ltd

drawing N° 230711-015.03 | status Planning

notes

~~Do not scale from this drawing - use stated levels and dimensions only. If in doubt, contact Williams Architects Ltd.~~

ver	notes	date
.03	*Northern steps reversed, additional planting information, site section lines added.*	11dec23
.02	*Stairs and ramps amended to new dimensions.*	29nov23

integra buildings

williamsarchitects

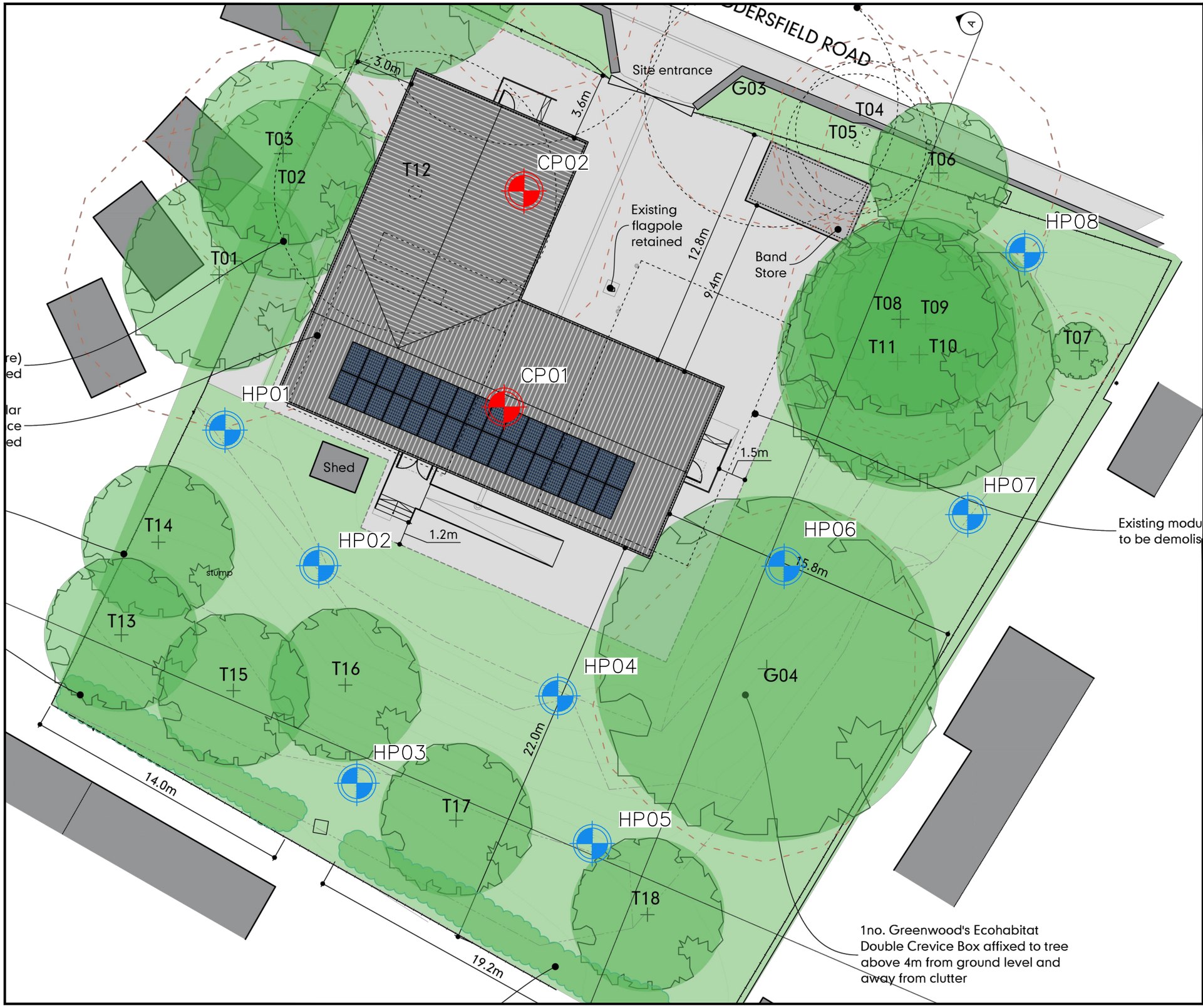
Williams-Architects Ltd
Studio 8, The Garage Studios
41-45 St Mary's Gate
The Lace Market
Nottingham NG1 1PU

t 0115 945 5691
enquiries@williams-architects.co.uk
www.williams-architects.co.uk

Registered in England & Wales. N° 5096848

client	Integra Buildings Ltd
created	01nov23
project	CRFCA Mirfield
job N°	230711
title	site : layout : proposed
scale	1:200 @ A2

drawing N° 230711-015.03 | status Planning



NOTES:

1. COPYRIGHT IN THIS DOCUMENT BELONGS TO PAUL WAITE ASSOCIATES LIMITED & ALL RIGHTS IN IT ARE RESERVED BY THE OWNER.
2. NO PART OF THIS DRAWING MAY BE COPIED, TRANSFERRED, OR MADE AVAILABLE TO USERS OTHER THAN THE ORIGINAL RECIPIENT, INCLUDING ELECTRONICALLY, WITHOUT PRIOR PERMISSION FROM PAUL WAITE ASSOCIATES LIMITED.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS & ENGINEERS DRAWINGS & SPECIFICATIONS.
4. ALL DIMENSIONS ARE SHOWN IN MILLIMETRES.
5. NO DIMENSIONS TO BE SCALED FROM THIS DRAWING.
6. ONLY PDF/HARD COPIES OF DRAWINGS SHOULD BE REFERRED TO FOR CONSTRUCTION USE, THE USE OF AUTOCAD DRAWINGS/DWG'S IS UNDERTAKEN ENTIRELY AT THE DEVELOPERS RISK AND ALL DIMENSIONS AND SETTING OUT MUST BE CHECKED IN CONJUNCTION WITH THE ARCHITECT AND ENGINEERS CONSTRUCTION DRAWINGS. ALL DRAWINGS SHOULD BE CONFIRMED AS LATEST ISSUE ON THE DOCUMENT ISSUE SHEET PRIOR TO COMMENCEMENT OF WORKS AND SHOULD BE USED ONLY FOR THEIR DEFINED DRAWING STATUS. ANY DISCREPANCIES BETWEEN THE ARCHITECT AND ENGINEERS DRAWINGS ARE TO BE IMMEDIATELY NOTIFIED TO ALL PARTIES.

KEY:

CABLE PERCUSSIVE BORE HOLE

HAND PIT

Rev	Date	Remarks	Drawn	Chk'd

PWA / GROUP

CIVIL — SUMMIT HOUSE, RIPARIAN WAY, — 01535 633350
STRUCTURAL — THE CROSSINGS, CROSSHILLS, — info@pwagroup.co.uk
GEO-ENVIRONMENTAL — KEIGHLEY, BD20 7BW — www.pwagroup.co.uk

Client: INTEGRA BUILDINGS LTD

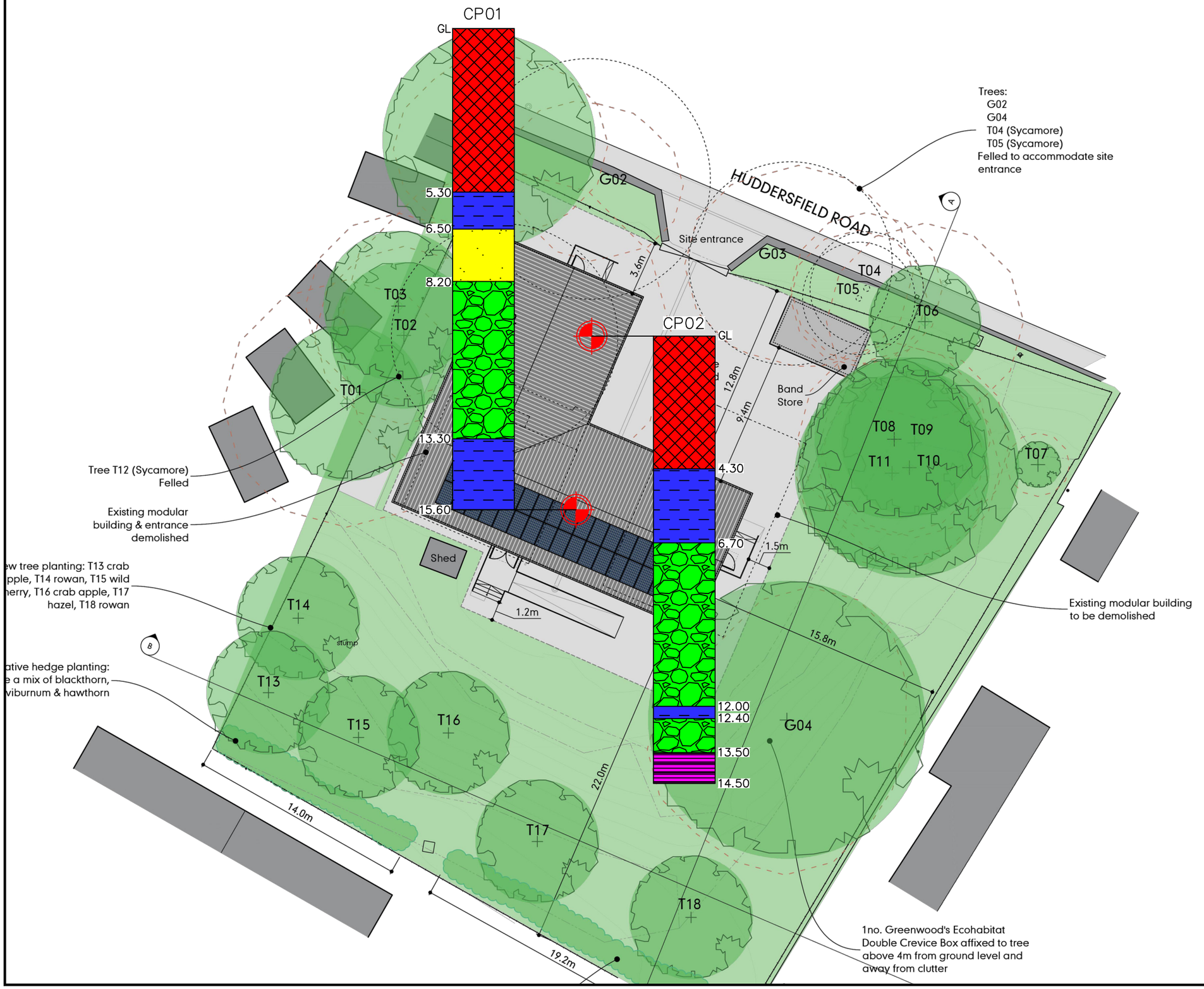
Project: MIRFIELD AIR TRAINING CORPS

Title: EXPLORATORY HOLE PLAN

Size	Scale	Designed	Checked	Date
A3	NTS	CK	TW	MAR 24

Drawing Status: PRELIMINARY

Job Number	Originator	Zone	Level	Type	Role	Drawing No.	Rev
23109	PWA	00	XX	DR	G	2001	P01



NOTES:

1. COPYRIGHT IN THIS DOCUMENT BELONGS TO PAUL WAITE ASSOCIATES LIMITED & ALL RIGHTS IN IT ARE RESERVED BY THE OWNER.
2. NO PART OF THIS DRAWING MAY BE COPIED, TRANSFERRED, OR MADE AVAILABLE TO USERS OTHER THAN THE ORIGINAL RECIPIENT, INCLUDING ELECTRONICALLY, WITHOUT PRIOR PERMISSION FROM PAUL WAITE ASSOCIATES LIMITED.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS & ENGINEERS DRAWINGS & SPECIFICATIONS.
4. ALL DIMENSIONS ARE SHOWN IN MILLIMETRES.
5. NO DIMENSIONS TO BE SCALED FROM THIS DRAWING.
6. ONLY PDF/HARD COPIES OF DRAWINGS SHOULD BE REFERRED TO FOR CONSTRUCTION USE, THE USE OF AUTOCAD DRAWINGS/DWG'S IS UNDERTAKEN ENTIRELY AT THE DEVELOPERS RISK AND ALL DIMENSIONS AND SETTING OUT MUST BE CHECKED IN CONJUNCTION WITH THE ARCHITECT AND ENGINEERS CONSTRUCTION DRAWINGS. ALL DRAWINGS SHOULD BE CONFIRMED AS LATEST ISSUE ON THE DOCUMENT ISSUE SHEET PRIOR TO COMMENCEMENT OF WORKS AND SHOULD BE USED ONLY FOR THEIR DEFINED DRAWING STATUS. ANY DISCREPANCIES BETWEEN THE ARCHITECT AND ENGINEERS DRAWINGS ARE TO BE IMMEDIATELY NOTIFIED TO ALL PARTIES.

KEY:

- CABLE PERCUSSIVE BORE HOLE
- MADE GROUND
- CLAY
- SAND
- GRAVEL
- MUDSTONE

Rev	Date	Remarks	Drawn	Chk'd

PWA / GROUP

CIVIL — SUMMIT HOUSE, RIPARIAN WAY, — 01535 633350
STRUCTURAL — THE CROSSINGS, CROSSHILLS, — info@pwagroup.co.uk
GEO-ENVIRONMENTAL — KEIGHLEY, BD20 7BW — www.pwagroup.co.uk

Client: INTEGRA BUILDINGS LTD

Project: MIRFIELD AIR TRAINING CORPS

Title: GROUND MODLE

Size	Scale	Designed	Checked	Date
A3	NTS	CK	TW	MAR 24

Drawing Status: PRELIMINARY

Job Number	Originator	Zone	Level	Type	Role	Drawing No.	Rev
23109	PWA	00	XX	DR	G	2002	P01

Appendix B
Exploratory Hole Logs

PWA Geo-environmental Summit House, Riparian Way BD20 7BW	**BOREHOLE LOG**	Borehole ID: **CP01** Sheet 1 of 2

Project Name:	Mirfield Air Cadets	Project Number: 23109	Elevation:	Hole Type: CP
Project Location:	2 Huddersfield Rd, Mirfield WF14 9DQ	Coordinates: E419364, N420281		Scale: 1:50
Client Name:	Integra Buildings Ltd	Dates: 19/12/2023 - 20/12/2023		Logged By: AE

Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description	Scale
		Depth (m)	Type	Results				
					0.12		Tarmacadam. MADE GROUND	
		0.60	B		0.49		Light greyish yellow slightly sandy gravelly angular to sub angular COBBLES of sandstone. Gravel is angular to sub rounded fine to coarse sandstone. MADE GROUND	1
		0.60	ES					
		1.20	SPT(C)	N=4 (1,1/1,1,1,1)				
		2.00	SPT(C)	N=7 (2,1/2,2,3,0)			Dark greyish brown silty gravelly CLAY with rare brick and medium cobble content of angular to rounded sandstone and mudstone. Gravel is angular to rounded fine to coarse sandstone and mudstone. MADE GROUND	2
					2.40			
		3.00	SPT(C)	N=4 (1,1/1,1,1,1)			Greyish brown gravelly medium to coarse SAND with rare brick and medium cobble content of angular to rounded sandstone and mudstone. Gravel is angular to sub rounded fine to coarse sandstone and mudstone. MADE GROUND	3
		4.00	SPT(C)	N=4 (1,0/1,1,1,1)	4.10		Very dark greyish brown clayey sandy gravelly SILT with rare brick. Gravel is angular to sub angular fine to coarse sandstone and slate. MADE GROUND	4
		5.00	SPT(C)	N=10 (2,2/3,2,2,3)	5.00		*Fabric encountered @ 4.65 m bgl.*	5
		5.40	D		5.30		Orangish brown with dark brown mottling slightly silty slightly sandy gravelly CLAY with rare brick glass and coal. Gravel is angular to sub rounded fine to coarse mudstone and sandstone. MADE GROUND	
		6.00	U					6
		6.30	D					
		6.50	B		6.50		Firm orangish brown slightly silty gravelly CLAY. Gravel is angular to rounded fine to coarse mudstone and sandstone.	7
		7.30	D		7.30		Very dense yellowish brown gravelly fine to coarse SAND with high cobble content. Gravel is angular to round fine to coarse sandstone and mudstone.	
		7.50	SPT(S)	N=69 (7,12/15,16,19,19)				
		7.50	D					8
		8.20	B		8.20		Very dense yellowish brown gravelly fine to coarse SAND with high cobble content. Gravel is angular to round fine to coarse sandstone and mudstone.	
		9.00	SPT(C)	N=17 (2,3/4,4,5,4)			Medium dense becoming very dense yellowish brown sandy angular to rounded fine to coarse GRAVEL of sandstone and mudstone with high cobble content.	9
		9.00	B				*Gravel content increases with depth.*	
	▼							10

Remarks: No olfactory evidence of contamination.
Cable Percussion was refused at 15.6m bgl on presumed bedrock.
Groundwater was encountered at 9.6m depth.
Upon completion cable percussion hole was backfilled with arisings.

Key:
ES - Environmental sample
B - Bulk sample
D - Disturbed sample
SPT - Std. Penetration Test

pwa Geo Environmental	PWA Geo-environmental Summit House, Riparian Way BD20 7BW	**BOREHOLE LOG**	Borehole ID: **CP01** Sheet 2 of 2

Project Name:	Mirfield Air Cadets	Project Number: 23109	Elevation:	Hole Type: CP
Project Location:	2 Huddersfield Rd, Mirfield WF14 9DQ	Coordinates: E419364, N420281		Scale: 1:50
Client Name:	Integra Buildings Ltd	Dates: 19/12/2023 - 20/12/2023		Logged By: AE

Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description	Scale
		Depth (m)	Type	Results				
		10.50	SPT(C)	N=90			Medium dense becoming very dense yellowish brown sandy angular to rounded fine to coarse GRAVEL of sandstone and mudstone with high cobble content.	11
		10.50	B	(14,11/20,50,20,0)				
		12.00	SPT(C)	N=98				12
		12.00	B	(15,10/20,41,9,28)				
		13.00	SPT(S)	N=14 (2,3/4,3,4,3)				13
		13.00	D					
					13.30			
		13.50	SPT(C)	N=120			Stiff dark yellowish brown slightly silty gravelly CLAY with medium cobble content. Gravel is angular to sub rounded fine to coarse sandstone and mudstone.	
		13.50	D	(17,8/50,50,20,0)				14
		14.00	B					
		14.80	B		14.80		Firm yellowish grey silty gravelly CLAY with low cobble content. Gravel is angular to sub rounded fine to coarse mudstone.	
		15.00	SPT(S)	N=84				15
		15.00	D	(50,14/14,50,20,0)				
					15.60			16
								17
								18
								19
								20

Remarks: No olfactory evidence of contamination.
Cable Percussion was refused at 15.6m bgl on presumed bedrock.
Groundwater was encountered at 9.6m depth.
Upon completion cable percussion hole was backfilled with arisings.

Key:
ES - Environmental sample
B - Bulk sample
D - Disturbed sample
SPT - Std. Penetration Test

PWA Geo-environmental Summit House, Riparian Way BD20 7BW	**BOREHOLE LOG**	Borehole ID: **CP02** Sheet 1 of 2

Project Name:	Mirfield Air Cadets	Project Number: 23109	Elevation:	Hole Type: CP
Project Location:	2 Huddersfield Rd, Mirfield WF14 9DQ	Coordinates: E419363, N420297		Scale: 1:50
Client Name:	Integra Buildings Ltd	Dates: 20/12/2023 - 21/12/2023		Logged By: AE

Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description	Scale
		Depth (m)	Type	Results				
					0.12		Tarmacadam. MADE GROUND	
		0.40	B		0.46		Light yellowish brown slightly silty sandy gravelly CLAY with rare brick and pottery and high cobble content. Gravel is angular to sub rounded fine to coarse mudstone and sandstone. MADE GROUND	
		0.65	D					
		1.20	SPT(C)	N=4 (1,1/1,1,1,1)	0.90			1
		2.00	SPT(C)	N=4 (1,1/1,1,1,1)	1.70		Light yellowish brown with cream mottling slightly clayey silty sandy GRAVEL with rare brick and coal and high cobble content. Gravel is angular to sub rounded fine to coarse mudstone and sandstone. MADE GROUND	2
		3.00	SPT(C)	N=4 (1,1/1,1,1,1)	2.80		Dark yellowish brown slightly silty sandy gravelly CLAY with rare brick and high cobble content. Gravel is angular to sub rounded fine to coarse mudstone and sandstone. MADE GROUND	3
		3.00	D					
		4.00	SPT(C)	N=8 (1,1/1,2,2,3)			Yellowish brown slightly silty sandy gravelly CLAY with rare brick and medium cobble content. Gravel is angular fine to coarse sandstone and mudstone. MADE GROUND	4
		4.50	D		4.30			
		5.00	SPT(S)	N=27 (4,5/6,6,7,8)	4.80		Orangish brown slightly sandy gravelly CLAY with rare brick and high cobble content. Gravel is angular to sub rounded fine to coarse sandstone and mudstone. MADE GROUND	5
		5.00	B					
		5.10	B					
		6.00	U				*Gravel and cobble content increase with depth.*	6
					6.70		Firm dark orangish brown slightly silty sandy gravelly CLAY with high cobble content. Gravel is angular to rounded fine to coarse mudstone and sandstone	
		7.50	SPT(C)	N=19 (3,3/4,4,5,6)			Firm light brown sandy gravelly CLAY with medium cobble content. Gravel is angular to rounded fine to coarse sandstone and mudstone.	7
		7.50	B					
		7.50	B				Medium dense brown slightly clayey sandy angular to sub rounded medium to coarse GRAVEL of sandstone and mudstone with medium cobble content.	8
	▼	9.00	SPT(C)	N=12 (7,8/2,3,4,3)				9
		9.00	B					
					10.00			10

Remarks: No olfactory evidence of contamination.
Cable Percussion was refused at 14.5m bgl on bedrock.
Groundwater was encountered at 9.1m depth.
Upon completion the cable percussion hole was backfilled with arisings.

Key:
ES - Environmental sample
B - Bulk sample
D - Disturbed sample
SPT - Std. Penetration Test

pwa Geo Environmental	PWA Geo-environmental Summit House, Riparian Way BD20 7BW	**BOREHOLE LOG**	Borehole ID: **CP02** Sheet 2 of 2

Project Name:	Mirfield Air Cadets	Project Number: 23109	Elevation:	Hole Type: CP
Project Location:	2 Huddersfield Rd, Mirfield WF14 9DQ	Coordinates: E419363, N420297		Scale: 1:50
Client Name:	Integra Buildings Ltd	Dates: 20/12/2023 - 21/12/2023		Logged By: AE

Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description	Scale
		Depth (m)	Type	Results				
		10.50	SPT(C)	N=23 (4,4/5,5,6,7)			Dense brown sandy angular to rounded fine to coarse GRAVEL sandstone and mudstone with medium cobble content.	11
		10.50	B					
		11.50	B					
		12.00	SPT(S)	N=46	12.00			12
		12.00	B	(7,8/10,11,12,13)			Stiff dark brown slightly gravelly CLAY with low cobble content. Gravel is angular to rounded fine to medium sandstone and mudstone.	
		12.00	D		12.40			
		12.50	B				Very dense brown sandy angular to rounded fine to coarse GRAVEL of sandstone and mudstone with medium cobble content.	13
		13.50	SPT(S)	N=100	13.50			
		13.50	D	(11,14/50,30,20,0)			Presumed bedrock recovered as angular coarse GRAVEL of mudstone. MUDSTONE	14
		14.00	B					
					14.50			15
								16
								17
								18
								19
								20

Remarks: No olfactory evidence of contamination.
Cable Percussion was refused at 14.5m bgl on bedrock.
Groundwater was encountered at 9.1m depth.
Upon completion the cable percussion hole was backfilled with arisings.

Key:
ES - Environmental sample
B - Bulk sample
D - Disturbed sample
SPT - Std. Penetration Test

Appendix C
Geotechnical Laboratory Results

LABORATORY REPORT

Contract Number: PSL24/0062

Report Date: 22 January 2024

Client's Reference: 23109

Client Name: PWA Geo-Environmental
Summit House
Riparian Way
Cross Hills
Keighley
BD20 7BW

For the attention of: Charlie Kelly

Contract Title: Mirfiled ATC

Date Received: 3/1/2024
Date Commenced: 3/1/2024
Date Completed: 22/1/2024

Notes: Opinions and Interpretations are outside the UKAS Accreditation

Checked and Approved Signatories:

A Watkins (Managing Director)
R Berriman (Associate Director)
S Royle (Laboratory Manager)
L Knight (Assistant Laboratory Manager)
S Eyre (Senior Technical Coordinator)
T Watkins (Senior Technician)

5 – 7 Hexthorpe Road,
Hexthorpe,
Doncaster,
DN4 0AR
Tel: 01302 768098
Email: rberriman@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
CP01	2	U	6.00		Brown slightly gravelly CLAY.
CP01	7	B	9.00		Brown sandy clayey GRAVEL (Class 1A)
CP01	11	B	10.50		Brown sandy slightly silty GRAVEL (Class 1A)
CP02	2	B	5.10		Brown very sandy very clayey GRAVEL (Class 2C)

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Mirfiled ATC

Contract No:
PSL24/0062
Client Ref:
23109

SUMMARY OF LABORATORY HAND VANES

(BS1377 : PART 7 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content %	Peak Shear Strength kPa	Residual Shear Strength kPa	Remarks
CP01	2	U	6.00		32	38		

* This test is out of our UKAS scope

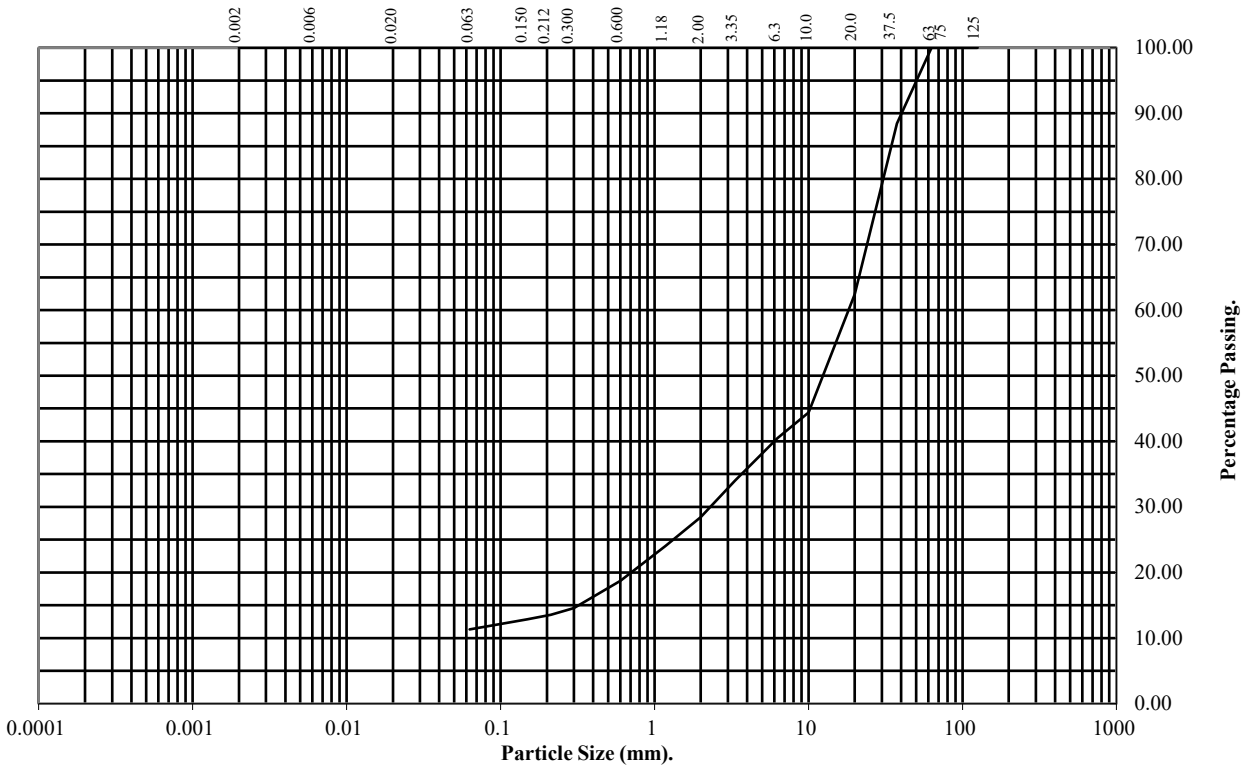
PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY	**Mirfiled ATC**	**Contract No:**
		PSL24/0062
		Client Ref:
		23109

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**CP01**	**Top Depth (m):**	**9.00**
Sample Number:	**7**	**Base Depth(m):**	
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	88
20	62
10	44
6.3	40
3.35	34
2	28
1.18	24
0.6	19
0.3	15
0.212	14
0.15	13
0.063	11

Soil Fraction	Total Percentage
Cobbles	0
Gravel	72
Sand	17
Silt/Clay	11

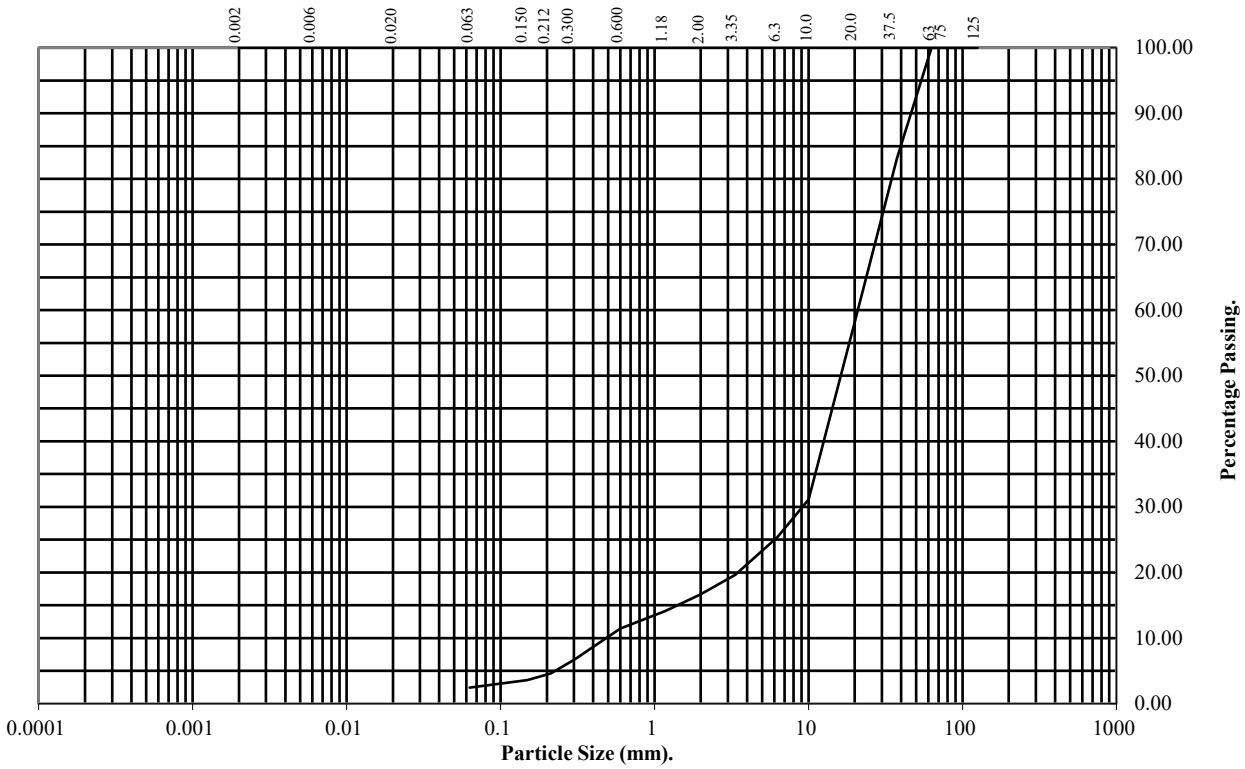
Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**CP01**	**Top Depth (m):**	**10.50**
Sample Number:	**11**	**Base Depth(m):**	
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	83
20	58
10	31
6.3	25
3.35	20
2	17
1.18	14
0.6	11
0.3	7
0.212	5
0.15	4
0.063	2

Soil Fraction	Total Percentage
Cobbles	0
Gravel	83
Sand	15
Silt/Clay	2

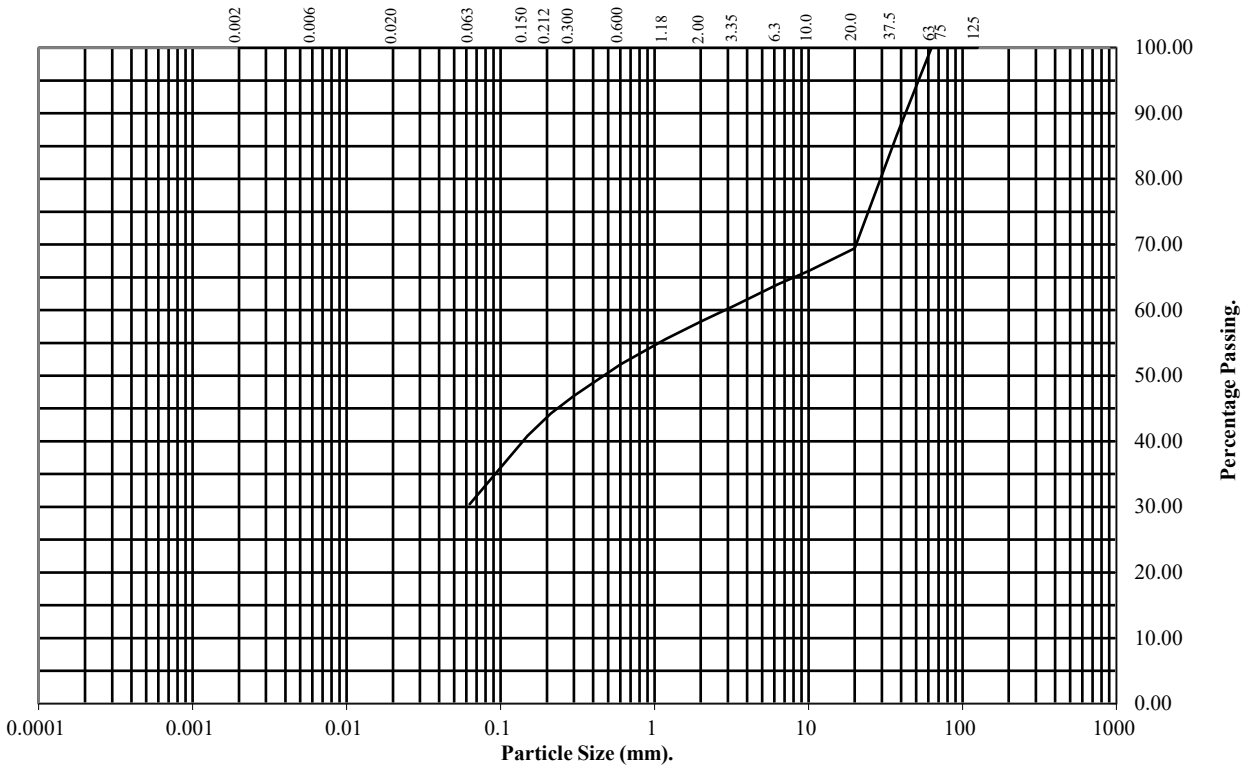
Remarks:
See Summary of Soil Descriptions

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number:	**CP02**	**Top Depth (m):**	**5.10**
Sample Number:	**2**	**Base Depth(m):**	
Sample Type:	**B**		



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	87
20	69
10	66
6.3	64
3.35	61
2	58
1.18	56
0.6	52
0.3	47
0.212	44
0.15	41
0.063	30

Soil Fraction	Total Percentage
Cobbles	0
Gravel	42
Sand	28
Silt/Clay	30

Remarks:
See Summary of Soil Descriptions

4161

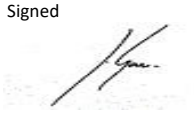
CTS Group
7 - 11 Harding Street
Leicester
LE1 4DH

Professional Soils Laboratory
5/7 Hexthorpe Road
Hexthorpe
Doncaster
DN4 0AR

Analytical Test Report: L24/00462/PSL - 24-40897

Your Project Reference:	**PSL24/0062 Mirfiled ATC**		
Your Order Number:	PSL24/0062	Samples Received / Instructed:	19/01/2024 / 19/01/2024
Report Issue Number:	1	Sample Tested:	19/01 to 25/01/2024
Samples Analysed:	3 soil samples	Report issued:	25/01/2024

Signed



James Gane
Analytical Services Manager
CTS Group

Notes:

General

Please refer to Methodologies page for details pertaining to the analytical methods undertaken.

Samples will be retained for 14 days after issue of this report unless otherwise requested.

Moisture Content was determined in accordance with CTS method statement MS - CL - Sample Prep, oven dried at <30˚C.

Moisture Content is reported as a percentage of the dry mass of soil, this calculation is in accordance with BS1377, Part 2, 1990, Clause 3.2

Where specification limits are included these are for guidance only. Where a measured value has been highlighted this is not implying acceptance or failure and certainty of measurement values have not been taken into account.

Uncertainty of measurement values are available on request.

Samples were supplied by customer, results apply to the samples as received.

Deviating Samples

On receipt samples are compared against our sample holding and handling protocols, where any deviations have been noted these are reported on our deviating sample page (if present)

Accreditation Key

UKAS = UKAS Accreditation, MCERTS = MCERTS Accreditation, u = Unaccredited

MCERTS Accreditation only covers the SAND, CLAY and LOAM matrices

Date of Issue: 30.10.2023

Issued by: J. Gane

Issue No: 4

Rev No: 5

CTS Group
7 - 11 Harding Street
Leicester
LE1 4DH

L24/00462/PSL - 24-40897

Project Reference - PSL24/0062 Mirfiled ATC

Analytical Test Results - Chemical Analysis

Lab Reference			336650	336651	336652
Client Sample ID			-	-	-
Client Sample Location			CP01	CP02	CP02
Client Sample Type			B	B	U
Client Sample Number			11	2	4
Depth - Top (m)			10.50	5.10	6.00
Depth - Bottom (m)			10.50	5.10	6.00
Date of Sampling			-	-	-
Time of Sampling			-	-	-
Sample Matrix			Sand	Clay	Clay
Determinant	**Units**	**Accreditation**			
Water soluble sulphate (as SO_4)	(mg/l)	u	510	100	180
pH Value	pH Units	MCERTS	8.1	8.0	7.7

7 - 11 Harding Street
Leicester
LE1 4DH

L24/00462/PSL - 24-40897

Project Reference - PSL24/0062 Mirfiled ATC

Sample Descriptions

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Description	Moisture Content (%)	Stone Content (%)	Passing 2mm test sieve (%)
336650	-	CP01	B	11	Brown very gravelly silty sand	-	-	100
336651	-	CP02	B	2	Brown gravelly sandy clay	-	-	100
336652	-	CP02	U	4	Brown gravelly sandy clay	-	-	100

4161

CTS Group
7 - 11 Harding Street
Leicester
LE1 4DH

L24/00462/PSL - 24-40897

Project Reference - PSL24/0062 Mirfiled ATC

Sample Comments

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Comments
336650	-	CP01	B	11	
336651	-	CP02	B	2	
336652	-	CP02	U	4	

7 - 11 Harding Street
Leicester
LE1 4DH

L24/00462/PSL - 24-40897

Project Reference - PSL24/0062 Mirfiled ATC

Analysis Methodologies

Test Code	Test Name / Reference	Sample condition for analysis	Sample Preperation	Test Details
ANIONSS	MS - CL - Anions by Aquakem (2:1Extract)	Oven dried	Passing 2mm test sieve	Determination of Anions (inc Sulphate, chloride etc.) in soils by Aquakem. Analysis is based on a 2:1 water to soil extraction ratio
PHS	MS - CL - pH in Soils	As received	Passing 10mm test sieve	Determination of pH in soils using a pH probe (using a 1:3 soil to water extraction)
SAMPLEPREP	MS - CL - Sample Preparation	-	-	Preparation of samples (including determination of moisture content) to allow for subsequent analysis

7 - 11 Harding Street
Leicester
LE1 4DH

L24/00462/PSL - 24-40897

Project Reference - PSL24/0062 Mirfiled ATC

Sample Deviations

Deviations are listed below against each sample and associated test method, where deviation(s) are noted it means data may not be representative of the sample at the time of sampling and it is possible that results provided may be compromised.

Observations on receipt

A - No date of sampling provided
C - Received in inappropriate container
H - Contains headspace
T - Temperature on receipt exceeds storage temperature
R - Sample(s) received with less than 96 hours for testing to commence/complete, any result formally classed as deviating will be marked with an X against the applicable test (i.e. RX)

Observations whilst in laboratory

X - Exceeds sampling to extraction or analysis timescales

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Test	Deviations
336650	-	CP01	B	11		A
336651	-	CP02	B	2		A
336652	-	CP02	U	4		A

Appendix D
Geochemical Testing Results

SOCOTEC

Environmental Chemistry

Certificate of Analysis

Client: PWA Geo-Environmental

Project: 23122705

Quote: BEC230228988 V2.1

Project Ref: 23109

Site: Mirfield ATC

Contact: Theo Wood

Address: Summit House
Riparian Way, The Crossings Cross Hills
Keighley
West Yorkshire
BD20 7BW

E-Mail: TheoW@pwageo.co.uk

Phone: 07889 569357

No. Samples Received: 8

Date Received: 23/12/2023

Analysis Date: 10/01/2024

Date Issued: 10/01/2024

Report Type: Final Version 01

This report supersedes any versions previously issued by the laboratory

Reported by Customer Service Co-Ordinator
Julie Dickinson
01283 554496

Client: PWA Geo-Environmental
Project Name: 23109-Mirfield ATC
Project No: 23122705
Date Issued: 10/01/2024

Samples Analysed

Text ID	Sample Reference	Sampling Date	Sample Type	Sample Description
23122705-001	HP01-7-ES-0.10	21/12/2023 00:00:00	SOLID	Soil Sample
23122705-002	HP02-6-ES-0.20	20/12/2023 00:00:00	SOLID	Soil Sample
23122705-003	HP03-8-ES-0.20	20/12/2023 00:00:00	SOLID	Soil Sample
23122705-004	HP04-4-ES-0.10	19/12/2023 00:00:00	SOLID	Soil Sample
23122705-005	HP05-5-ES-0.15	20/12/2023 00:00:00	SOLID	Soil Sample
23122705-006	HP06-3-ES-0.10	19/12/2023 00:00:00	SOLID	Soil Sample
23122705-007	HP07-2-ES-0.10	19/12/2023 00:00:00	SOLID	Soil Sample
23122705-008	HP08-1-ES-0.10	19/12/2023 00:00:00	SOLID	Soil Sample

Client: PWA Geo-Environmental
Project Name: 23109-Mirfield ATC
Project No: 23122705
Date Issued: 10/01/2024

1252

Analysis Results

Analysis	Method Code	MDL	Units	Accred.	001	002	003	004	005	006	007
Sample ID					001	002	003	004	005	006	007
Customer ID					HP01-7-ES-0.10	HP02-6-ES-0.20	HP03-8-ES-0.20	HP04-4-ES-0.10	HP05-5-ES-0.15	HP06-3-ES-0.10	HP07-2-ES-0.10
Sample Type					SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Sampling Date					21/12/2023	20/12/2023	20/12/2023	19/12/2023	20/12/2023	19/12/2023	19/12/2023
Arsenic as As	ICPMSS	0.3	mg/kg^	UM	14.2	26.2	36.7	26.0	42.3	25.3	18.9
Cadmium as Cd	ICPMSS	0.2	mg/kg^	UM	0.9	0.8	0.8	0.6	1.1	1.8	0.4
Copper as Cu	ICPMSS	1.6	mg/kg^	UM	50.2	75.7	91.4	58.0	93.7	86.4	46.4
Lead as Pb	ICPMSS	0.7	mg/kg^	UM	884.8	271.7	252.8	168.5	533.9	124.6	150.9
Mercury as Hg	ICPMSS	0.5	mg/kg^	UM	<0.5	<0.5	<0.5	<0.5	0.6	0.5	<0.5
Nickel as Ni	ICPMSS	2	mg/kg^	UM	22.9	30.4	29.0	32.4	54.5	35.5	33.7
Selenium as Se	ICPMSS	0.5	mg/kg^	UM	<0.5	<0.5	<0.5	<0.5	1.0	<0.5	<0.5
Total Chromium as Cr	ICPMSS	1.2	mg/kg^	UM	33.9	48.2	42.9	30.6	66.1	119.4	27.8
Zinc as Zn	ICPMSS	16	mg/kg^	UM	796.1	442.7	596.9	246.5	659.3	532.2	303.8
Acenaphthene	PAHMSUS	0.08	mg/kg^	UM	<0.13	0.11	0.11	<0.11	0.20	0.19	0.13
Acenaphthylene	PAHMSUS	0.08	mg/kg^	U	<0.13	0.11	0.11	<0.11	0.18	0.20	0.12
Anthracene	PAHMSUS	0.08	mg/kg^	U	0.48	0.64	0.69	0.40	0.72	0.60	0.42
Benzo[a]anthracene	PAHMSUS	0.08	mg/kg^	UM	1.44	1.69	2.17	1.20	2.45	1.44	0.90
Benzo[a]pyrene	PAHMSUS	0.08	mg/kg^	UM	1.86	2.04	2.99	1.58	2.77	1.97	1.02
Benzo[b]fluoranthene	PAHMSUS	0.08	mg/kg^	UM	2.26	2.49	3.76	1.83	3.33	2.30	1.20
Benzo[g,h,i]perylene	PAHMSUS	0.08	mg/kg^	UM	1.15	1.12	2.01	0.89	1.52	1.18	0.51
Benzo[k]fluoranthene	PAHMSUS	0.08	mg/kg^	UM	1.03	1.15	1.52	0.95	1.57	1.10	0.64
Chrysene	PAHMSUS	0.08	mg/kg^	UM	1.43	1.63	2.13	1.25	2.41	1.50	0.94
Dibenzo[a,h]anthracene	PAHMSUS	0.08	mg/kg^	UM	0.31	0.35	0.53	0.26	0.45	0.33	0.16

Client: PWA Geo-Environmental
Project Name: 23109-Mirfield ATC
Project No: 23122705
Date Issued: 10/01/2024

Analysis Results

				Sample ID	008
				Customer ID	HP08-1-ES-0.10
				Sample Type	SOLID
				Sampling Date	19/12/2023
Analysis	Method Code	MDL	Units	Accred.	
Arsenic as As	ICPMSS	0.3	mg/kg^	UM	18.0
Cadmium as Cd	ICPMSS	0.2	mg/kg^	UM	0.4
Copper as Cu	ICPMSS	1.6	mg/kg^	UM	44.2
Lead as Pb	ICPMSS	0.7	mg/kg^	UM	142.3
Mercury as Hg	ICPMSS	0.5	mg/kg^	UM	<0.5
Nickel as Ni	ICPMSS	2	mg/kg^	UM	32.1
Selenium as Se	ICPMSS	0.5	mg/kg^	UM	<0.5
Total Chromium as Cr	ICPMSS	1.2	mg/kg^	UM	26.4
Zinc as Zn	ICPMSS	16	mg/kg^	UM	287.4
Acenaphthene	PAHMSUS	0.08	mg/kg^	UM	0.47
Acenaphthylene	PAHMSUS	0.08	mg/kg^	U	0.28
Anthracene	PAHMSUS	0.08	mg/kg^	U	0.84
Benzo[a]anthracene	PAHMSUS	0.08	mg/kg^	UM	3.31* B
Benzo[a]pyrene	PAHMSUS	0.08	mg/kg^	UM	3.28
Benzo[b]fluoranthene	PAHMSUS	0.08	mg/kg^	UM	3.86
Benzo[g,h,i]perylene	PAHMSUS	0.08	mg/kg^	UM	1.96
Benzo[k]fluoranthene	PAHMSUS	0.08	mg/kg^	UM	1.37
Chrysene	PAHMSUS	0.08	mg/kg^	UM	2.59
Dibenzo[a,h]anthracene	PAHMSUS	0.08	mg/kg^	UM	0.47

Client: PWA Geo-Environmental
Project Name: 23109-Mirfield ATC
Project No: 23122705
Date Issued: 10/01/2024

UKAS TESTING 1252

Analysis Results

Analysis	Method Code	MDL	Units	Accred.	Sample ID	001	002	003	004	005	006	007
					Customer ID	HP01-7-ES-0.10	HP02-6-ES-0.20	HP03-8-ES-0.20	HP04-4-ES-0.10	HP05-5-ES-0.15	HP06-3-ES-0.10	HP07-2-ES-0.10
					Sample Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
					Sampling Date	21/12/2023	20/12/2023	20/12/2023	19/12/2023	20/12/2023	19/12/2023	19/12/2023
Fluoranthene	PAHMSUS	0.08	mg/kg^	UM		3.71	4.21	5.07	3.13	5.74	3.76	2.53
Fluorene	PAHMSUS	0.08	mg/kg^	UM		<0.13	0.14	0.12	<0.11	0.15	0.17	0.12
Indeno[1,2,3-cd]pyrene	PAHMSUS	0.08	mg/kg^	UM		1.11	1.15	1.69	0.89	1.48	1.12	0.50
Naphthalene	PAHMSUS	0.08	mg/kg^	UM		0.17	0.17	0.21	0.15	0.32	0.30	0.16
Phenanthrene	PAHMSUS	0.08	mg/kg^	UM		1.08	1.50	1.53	0.91	1.78	1.49	1.08
Pyrene	PAHMSUS	0.08	mg/kg^	UM		3.27	3.60	4.46	2.80	5.05	3.22	2.13
Total PAH 16	PAHMSUS	1.28	mg/kg^	U		19.7	22.1	29.1	16.6	30.1	20.9	12.6
Total Moisture at 35°C	CLANDPREP	0.1	%	N		35.9	23.3	26.1	26.7	27.1	33.8	30.5
Colour of Material	CLANDPREP		-	N		Black	Brown	Black	Brown	Brown	Brown	Brown
Major Constituents	CLANDPREP		-	N		SILT	SILT	SILT	SILT	SILT	SILT	SILT
Minor Constituents	CLANDPREP		-	N		Gravel	Gravel	Gravel	Gravel	Gravel	Gravel	Gravel
Miscellaneous Constituents	CLANDPREP		-	N		Organic Matter	Organic Matter	Wood	Organic Matter	Organic Matter	Organic Matter	Organic Matter
Asbestos Identification	SUB020		-	N		NAIIS	NAIIS	NAIIS	NAIIS	NAIIS	NAIIS	NAIIS

Client: PWA Geo-Environmental
Project Name: 23109-Mirfield ATC
Project No: 23122705
Date Issued: 10/01/2024

UKAS TESTING 1252

mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

Analysis Results

Analysis	Method Code	MDL	Units	Accred.	Sample ID: 008
					Customer ID: HP08-1-ES-0.10
					Sample Type: SOLID
					Sampling Date: 19/12/2023
Fluoranthene	PAHMSUS	0.08	mg/kg^	UM	5.69
Fluorene	PAHMSUS	0.08	mg/kg^	UM	0.35
Indeno[1,2,3-cd]pyrene	PAHMSUS	0.08	mg/kg^	UM	2.06
Naphthalene	PAHMSUS	0.08	mg/kg^	UM	0.69
Phenanthrene	PAHMSUS	0.08	mg/kg^	UM	3.38
Pyrene	PAHMSUS	0.08	mg/kg^	UM	4.93
Total PAH 16	PAHMSUS	1.28	mg/kg^	U	35.5
Total Moisture at 35°C	CLANDPREP	0.1	%	N	28.9
Colour of Material	CLANDPREP		-	N	Brown
Major Constituents	CLANDPREP		-	N	SILT
Minor Constituents	CLANDPREP		-	N	Gravel
Miscellaneous Constituents	CLANDPREP		-	N	Organic Matter
Asbestos Identification	SUB020		-	N	NAIIS

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: SOCOTEC UK Ltd
Environmental Chemistry
PO Box 100
Burton upon Trent
Staffordshire
DE15 0XD

CONTRACT NO: S38061-20

DATE OF ISSUE: 10.01.24

DATE SAMPLES RECEIVED: 03.01.24

DATE ANALYSIS COMPLETED: 10.01.24

DESCRIPTION: Eight soil/loose aggregate samples.

ANALYSIS REQUESTED: Qualitative analysis of samples for determination of presence/type of asbestos.

METHODS:

Our method involves initial examination of the samples followed by detailed analysis of representative sub-samples. Each sub-sample was analysed qualitatively for asbestos by polarised light and dispersion staining as described by the Health and Safety Executive in HSG 248.

RESULTS:

Initial Screening

No asbestos was detected in any of the soil samples by stereo-binocular and polarised light microscopy.

A summary of the results is given in Table 1.

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

CONTRACT NO: S38061-20
DATE OF ISSUE: 10.01.24

RESULTS: (cont.)

Table 1: Qualitative Results

SOCOTEC Job I.D: 23122705

IOM sample number	SOCOTEC Sample ID	Client Sample ID	ACM type detected	PLM result
S38061-66	23122705-001	HP01-7-ES-0.10	-	No Asbestos Detected
S38061-67	23122705-002	HP02-6-ES-0.20	-	No Asbestos Detected
S38061-68	23122705-003	HP03-8-ES-0.20	-	No Asbestos Detected
S38061-69	23122705-004	HP04-4-ES-0.10	-	No Asbestos Detected
S38061-70	23122705-005	HP05-5-ES-0.15	-	No Asbestos Detected
S38061-71	23122705-006	HP06-3-ES-0.10	-	No Asbestos Detected
S38061-72	23122705-007	HP07-2-ES-0.10	-	No Asbestos Detected
S38061-73	23122705-008	HP08-1-ES-0.10	-	No Asbestos Detected

Our detection limit for this method is 0.001%.

COMMENTS:

IOM Consulting cannot accept responsibility for samples that have been incorrectly collected or despatched by external clients.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

AUTHORISED BY: .....
D Third
Laboratory Analyst

Client:	PWA Geo-Environmental
Project Name:	23109-Mirfield ATC
Project No:	23122705
Date Issued:	10/01/2024

Deviating Sample Report

All samples received in an appropriate condition with no deviancies noted with the samples.

Analysis Method

Method Code	Method Description	Analysis Method
CLANDPREP	DW35 - CLand Prep and Dry Weight Correction to 35°C	As Received
CLANDPREP	Solid Material Description	As Received
ICPMSS	Arsenic in Solids by ICPMS	Air Dried & Ground
ICPMSS	Cadmium in Solids by ICPMS	Air Dried & Ground
ICPMSS	Chromium in Solids by ICPMS	Air Dried & Ground
ICPMSS	Copper in Solids by ICPMS	Air Dried & Ground
ICPMSS	Lead in Solids by ICPMS	Air Dried & Ground
ICPMSS	Mercury in Solids by ICPMS	Air Dried & Ground
ICPMSS	Nickel in Solids by ICPMS	Air Dried & Ground
ICPMSS	Selenium in Solids by ICPMS	Air Dried & Ground
ICPMSS	Zinc in Solids by ICPMS	Air Dried & Ground
PAHMSUS	16 PAHs by GCMS	As Received
SUB020	Asbestos Stage 1: Screen & ID	

Result Report Notes

Letters alongside results signify that the result has associated report notes.
The report notes are as follows:

Letter	Note
A	Due to the matrix of the sample the laboratory has had to deviate from our standard protocols to be able to process the sample and provide a result. Where applicable the accreditation has been removed and this should be taken into consideration when utilising the data.
B	The QC associated with this result has not wholly met the QMS requirements, the accreditation has therefore been removed. However, the Laboratory has confidence in the performance of the method as a whole and that the integrity of the data has not been significantly compromised.
C	Due to matrix interference, the internal standard and/or surrogate has not met the QMS requirements. This should be taken into consideration when utilising the data.
D	A non-standard volume or mass has been used for this test which has resulted in a raised detection limit.
E	Due to the parameter value being beyond our calibration range (and following the maximum size of dilution allowed, where applicable), the result cannot be quantified and as such the result will appear as a greater than symbol (>) with the accreditation removed. This data should be used for indicative purposes only.
F	Based on the sample history, appearance and smell a dilution was applied prior to testing. Unfortunately, the result is either above (>) or below (<) our calibration range. Results above our calibration range have accreditation removed. The data should be used for indicative purposes only.
G	The day 5 oxygen reading was below the capability of the instrument to detect, and therefore the calculated BOD has been reported unaccredited for guidance purposes only.

Client:	PWA Geo-Environmental
Project Name:	23109-Mirfield ATC
Project No:	23122705
Date Issued:	10/01/2024

HWOL Acronym Key

Acronym	Description
HS	Headspace Analysis
EH	Extractable Hydrocarbons - i.e everything extracted by the solvent(s)
CU	Clean up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
+	Operator to indicate cumulative e.g. EH_CU+HS_1D_Total

Additional Information

This report refers to samples as received. SOCOTEC UK Ltd takes no responsibility for accuracy or competence of sampling by others.

Results within this report relate only to the samples tested.

The accreditation codes are as follows:

U = UKAS accredited analysis
M = MCERT accredited analysis
N = Unaccredited analysis

Any units marked with ^ signify results are reported on a dry weight basis of 35°C.

All Air Dried and Ground Samples (ADG) are oven dried at less than 35°C.

This report shall not be reproduced except in full, without written approval of the laboratory.

Opinions and interpretations given are outside the scope of our UKAS accreditation.

Any samples marked with * are not covered by our scope of UKAS accreditation. If applicable, further report notes have been added.

Any solid samples where the Major Constituents are not one of the following (Sand, Silt, Clay, Made Ground) are not one of our accredited matrix types.

Any samples marked with ‡ have had MCERTS accreditation removed for this result

Any samples marked with a tick in the deviant table is deviant for the specific reason.

Any samples reported as IS, NA, ND mean the following:

IS = Insufficient Sample to complete analysis
NA = Sample is not amenable for the required analysis
ND = Results cannot be determined

Items listed with a 'SUB' method code prefix have been carried out by an external subcontracted laboratory.

Our deviating sample report does not include deviancy information for Subcontracted analysis. Please see the report from the subcontracted lab for information regarding any deviancies for this analysis.

Summaries of analysis methods are available upon request.

End of Certificate of Analysis

Appendix E
Historic Bore Holes

Borehole Record

BH No	CP1		
Contract No	C541		
Method:	Cable percussive drilling using a Dando 150 - 150mm diameter	Site	Mirfield ATC
Date	28/10/22		
Scale	1:50		
Client	John Hill Associates		
Logged By	AS		

Sample Details			Description	Depth (m)	Level (mAOD)	Legend
Type	Depth To-from (m)	Records				
			MADE GROUND: Tarmacadam	0.10		
			MADE GROUND: Yellowish cream clayey sandy subangular fine to coarse GRAVEL sized fragments of limestone and sandstone (Type 1 Fill)	0.60		
SPT D	1.0-1.45	N=1 (1,1/0,0,0,1)	MADE GROUND: Dark brown localy black slightly clayey very gravelly fine to coarse SAND of ash locally a very sandy gravel with a low cobble content. Gravel is subangular fine to coarse of clinker, brick, sandstone and limestone. Cobbles are subangular fine to coarse of brick and sandstone.			
SPT D	2.0-2.45	N=3 (0,1/2,0,1,0)	From 1.80m: becoming clayey			
SPT D	3.0-3.45	N=5 (2,2/1,1,1,2)				
SPT D	4.0-4.45	N=6 (16,6/1,2,1,2)		4.30		
SPT D	5.0-5.45	N=23 (2,5/7,6,5,5)	Firm, yellowish brown gravelly very sandy CLAY with a low cobble content. Sand is fine to coarse, gravel is subangular to rounded fine to coarse of quartzite and sandstone. Cobbles are subangular of sandstone.			
SPT D	6.0-6.45	N=27 (16,9/8,6,6,7)				
B	6.0-7.0					
SPT D	7.0-7.45	N=16 (5,4/4,5,4,3)				
SPT D	8.0-8.45	N=21 (5,5/6,5,5,5)		8.30		
SPT D	9.0-9.45	N=16 (6,6/6,4,3,3)	Medium dense, light brown sandy subangular to rounded fine to coarse GRAVEL of quartzite and sandstone with a low cobble content. Sand is fine to coarse. Cobbles are subrounded to rounded of quartzite			
B	9.0-10.0					

Remarks

Monitoring well installed to 4m bgl. Borehole backfilled with arisings and bentonite below well
Failed U100 - 5.00-5.45m - High granular content
No groundwater encountered

Sample Types

D - Disturbed
U - Undisturbed
W - Water

G&M CONSULTING

Borehole Record

				BH No	CP1
				Contract No	C541
Method:	As Sheet 1	Site	Mirfield ATC	Date	28/10/22
				Scale	1:50
		Client	John Hill Associates	Logged By	AS

Sample Details					
Type	Depth To-from (m)	Records	Description	Depth (m)	Level (mAOD)	Legend
CPT	10.0-10.45	N=14 (2,4/3,3,4,4)				
B	10.0-11.0		Medium dense, light brown sandy subangular to rounded fine to coarse of quartzite and sandstone with a low cobble content. Sand is fine to coarse, cobbles are subrounded to rounded of quartzite			
CPT	11.0-11.45	N=23 (8,11/7,6,5,5)				
			Borehole complete at 11.45m			

Remarks

Sample Types
D - Disturbed
U - Undisturbed
W - Water

G&M CONSULTING

Appendix F

Dynamic Cone Penetrometer Results

Appendix G
Risk Evaluation

Risk Evaluation

To ensure consistency in our qualitative method for risk evaluation we have used the classification scheme presented CIRIA C552 Contaminated Land Risk Assessment – A Guide to Good Practice, 2001. The overall risk rating for any potential contaminant linkage is set out in **Table I** and based upon a combination of the:

- Magnitude of the potential consequence (severity) of risk occurring (defined in **Table II**); and
- Magnitude of the probability (likelihood) of the risk occurring (defined in **Table III**).

The definition of the overall risk rating and likely action required is defined in **Table IV**.

Table I: Comparison of consequence against likelihood

		Consequence (severity)			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**High likelihood**	Very high risk	High risk	Moderate risk	Moderate/ low risk
	Likely	High risk	Moderate risk	Moderate/ low risk	Low risk
	Low likelihood	Moderate risk	Moderate/ low risk	Low risk	Very low risk
	Unlikely	Moderate/ low risk	Low risk	Very low risk	Very low risk

Table II: Classification of Consequence (Severity)

Class[n]	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in significant harm. Short term risk of pollution of sensitive water resource. Catastrophic damage to buildings/property. A short term risk to a particular ecosystem, or organism forming part of such ecosystem.	• High concentrations of cyanide on the surface of an informal recreation area. • Major spillage of contaminants into controlled water. • Explosion, causing building collapse (can also equate to a short term human health risk if buildings are occupied).
Medium	Chronic damage to human health. Pollution of sensitive water resources. A significant change in a particular ecosystem, or organism forming part of such an ecosystem.	• Concentrations of a contaminant from site exceed the generic, or site specific assessment criteria. • Leaching of contaminants from site to an aquifer. • Death of a species within a designated nature reserve.
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services. Damage to sensitive buildings/ structures/ services or the environment.	• Pollution of non-classified groundwater. • Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by PPE). Easily repairable effects of damage to buildings, structures and services.	• The presence of contaminants at such concentrations that PPE is required during site works. • The loss of plants in a landscaping scheme. • Discoloration of concrete.

Table III: Classification of Likelihood (Probability)

Class[n]	Definition
High likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are in the right place, which means that it is probable that an event will occur.
Low likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over longer period such event would take place and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

Table IV: Classification of risks and likely action required

Class[n]	Definition
Very high risk	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 to a designated receptor is currently happening. This risk, if realized, is likely to result in a substantial liability. Urgent investigation and remediation works are likely to be required.
High risk	Harm is likely to arise to a 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 risk	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 is more likely that the harm would be relatively mild. Investigation is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Low risk	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realized, would at worst normally be mild.
Very low risk	There is a low possibility that harm could arise to a receptor. In the vent of such harm being realized it is not likely to be severe.

PWA Geo-Environmental Ltd
Summit House, Riparian Way,
Cross Hills, Keighley,
West Yorkshire, BD20 7BW

Registered in England 6939651

t: 01535 633350
e: info@pwaite.co.uk
w: www.pwaite.co.uk

Report No: C541
Date: November 2022

GEOENVIRONMENTAL APPRAISAL
of land at
MIRFIELD AIR TRAINING CORPS, HUDDERSFIELD ROAD, MIRFIELD, WEST YORKSHIRE

Prepared for

John Hill Associates

Prepared by
G&M Consulting Ltd, The Chestnuts, Brackenhill Road, Haxey, Doncaster DN9 2LR

REPORT NUMBER:	C541	**REPORT STATUS:**	Final
REPORT TYPE:	Geoenvironmental Appraisal		
REPORT DATE:	November 2022		
SITE:	Land at Mirfield Air Training Corps, Huddersfield Road, Mirfield, West Yorkshire		
PREPARED FOR:	John Hill Associates		
PREPARED BY:	A Swinbourne BSc. (Hons) FGS, MIEnvSc, ACIEH.		
REVIEWED BY:	G Swinbourne BSc. (Hons) MSc. DIC, FGS		

Contents

APPENDICES

GEOENVIRONMENTAL APPRAISAL
of land at
MIRFIELD AIR TRAINING CORPS, HUDDERSFIELD ROAD, MIRFIELD, WEST YORKSHIRE

1.0 INTRODUCTION.

G&M Consulting Ltd (G&M) was commissioned by John Hill Associates to undertake a geoenvironmental appraisal, for land at Mirfield Air Training Corps, Huddersfield Road, Mirfield, West Yorkshire.

It is understood that it is proposed to redevelop the existing facilities at the site, and that this report has been prepared in support of the planning and costing submissions.

At the time of writing of this report, no development layout is available for inspection. It is however understood that any proposed buildings will be of modular construction and single story. It is unclear at this at this stage whether any areas of proposed soft landscaping are proposed.

The aims of this investigation are as follows;

- To determine the land use history of the site from an inspection of available historical Ordnance Survey (OS) plans;
- To determine the environmental setting of the site, including the details of the geology, hydrogeology and hydrology;
- To determine the shallow ground conditions beneath the site;
- To establish if shallow mine workings are likely present beneath the site;
- To determine the nature and degree of any possible near surface ground and groundwater contamination; and,
- To provide recommendations on measures to deal with any contamination present on site, if encountered.
- To provide geotechnical data, for foundation design.

The investigation has been undertaken in phases, the initial phase is a desk study and the second phase is an intrusive ground investigation which is based on the findings of the desk study element of the work.

The desk-based part of the investigation, included the review and assessment of information provided by GroundSure Limited (GroundSure), British Geological Survey (BGS), The Coal Authority (CA), Building Research Establishment (BRE) and The Environment Agency (EA) and Zetica UXO.

The fieldwork for the intrusive investigation was undertaken on the 13th and 28th October 2022 and comprised the excavation of five trial pits and the drilling of one cable percussive borehole with the installation of a combined gas and groundwater monitoring well. Following completion of the fieldwork selected soil samples were scheduled for a range of chemical and geotechnical laboratory tests. At the time of writing of this report, monitoring of the ground gas installation is underway.

1.1 Limitations.

This investigation report, which is designed to meet the requirements of all relevant current guidance, presents the factual information available during this appraisal, interpretation of the data obtained and recommendations relevant to the defined objectives.

The comments and opinions presented in this report are based on the findings of a review of available information and ground conditions encountered during the intrusive investigation work. There may be other conditions prevailing on the site which have not been disclosed by this investigation and which

have not been taken into account by this report. Responsibility cannot be accepted for conditions not revealed by the investigation. Any diagram or opinion of the possible configuration of ground conditions between exploratory holes is conjectural and given for guidance only and confirmation of intermediate ground conditions should be considered if deemed necessary.

This report is intended for the sole use of John Hill Associates or their client. No other third party may rely upon or reproduce the contents of this report without the written authorisation of the report author. If any unauthorised third party comes into possession of this report they rely on it at their own risk and the author does not owe them any Duty of Care or Skill.

2.0 SITE DESCRIPTION.

2.1 Site Location.

The site lies on the northern side of the Calder valley and is located to the south of the A644 Huddersfield Road, approximately 5 km, south west of Dewsbury town centre West Yorkshire, at National Grid Reference SE 193 202. A site location plan is shown on Drawing No. C541/1, presented in Appendix A of this report.

2.2 Site Features.

The site is accessed directly off Huddersfield Road, which runs to the north of the site, through a set of double palisade gates. The central part of the site, once through the gates, is a flat lying area comprising an area of tarmac, with two single story buildings (presumed to be used by the ATC). Access to the rear of the site is between these two buildings onto an area of rough well kept grass, which forms the brow of a slope. This slope drops towards the southern boundary of the site, by approximately 4m on to what is presumed to be the flood plain of the River Calder. Between the toe of the slope and the southern boundary of the site, is a strip of relatively flat ground, comprising rough vegetation and gravel, and approximately 3m wide. This strip of flat ground extends around the south eastern portion of the site, the levels then climb back upto to the height of the main part of the site, through a series of ‘steps’ cut into the existing ground surface.

The slope was covered in rough vegetation with evidence of blocks of concrete and brickwork. Inspection of the composition of the slope indicated its make-up to include a significant amount of made ground

The site is secured to all boundaries by a tall palisade fence. The site is bounded to the south by light industrial units and to the west by a set of private garages and east by residential properties. The ground levels adjacent to the western boundary were noted to be similar to the main part of the site, whereas the levels on the eastern boundary were noted to be similar to the levels at the toe of the slope.

A set of photographs taken as part of the walk-over survey are available for inspection, from G&M if required.

3.0 SITE HISTORY.

In order to investigate the history of the site, extracts of OS plans dated from 1855 have been examined. These were obtained as part of the GroundSure Report, a copy of which is presented in Appendix B of this report. It is not the intention of this report to describe, in detail, all the changes that have occurred on or adjacent to the site, only those pertinent to the proposed development. This approach is intended to reduce uncertainty in the desk study review process to an acceptable level in line with BS10175:2011+A2:2017.

Date (Scale)	Site Usage	Surrounding Area Usage
1855 (1:10,560) County Series	• Site shown to be undeveloped	• Huddersfield Road shown adjacent to northern boundary • Sandstone quarry shown approximately 100m to the north • Calder & Hebble Navigation River shown approximately 100m to the south
1892 (1:10,560) & 1888 (1:2,500) County Series	• Site shown to be developed with a number of unlabelled buildings in the eastern part of the site	• Sands Mill (Woollen) shown approximately 70m to the south west • Railway line shown approximately 250m to the south
1907 (1:2,500) & 1905 (1:10,560) County Series	• Earthworks shown to the west of the site shown extending onto the western boundary of the site	• Earthworks structures shown adjacent to western boundary of the site (areas of bunding) • Railway line shown approximately 60m to the south
1931 (1:10,560) & 1922 & 1933 (1:2,500) County Series	• No significant change	• Further earthworks shown to the west of the site
1938 & 1948 (1:10,560) County Series	• No significant change.	• No significant change
1957 & 1958 (National Grid) (County Series) & 1951-1956 (1:10,560) Provisional	• Buildings on site appear to be residential	• Further earthworks shown approximately 20m to the south east (appears to be bunding). Area labelled 'Battyeford' • Small unlabeled buildings shown adjacent to western boundary of the site
1965-1967 (1:10,560) Provisional	• No significant change	• No significant change
1974-1975 (1:10,000) National Grid	• No significant change	• Railway approximately 60m to the south, now shown as 'dismantled' •
1977-1982 (1:2,500) & 1981-1985 (1:10,000) National Grid	• Buildings no longer shown on site	• Probable industrial units shown approximately 50m to the south west • Garage shown approximately 60m to the east of the site
1990-1993 & 1993-1994 (1:1,250) National Grid	• Building labelled 'club' shown to the centre of the site	• Garage to the east no longer shown • Scrap yard shown approximately 50m to the south of the site
2001 (1:10,000) National Grid 2003 (1:1,250) LandLine	• No significant change	• No significant change
2010 & 2022 (1:10,000) National Grid	• 2nd building shown on site (map dated 2022)	• No significant change

4.0 ENVIRONMENTAL SETTING.

4.1 Published Geology

Information on the geology of the site was obtained from the following sources published by the British Geological Survey (BGS):

- BGS maps (England & Wales 1:50,000 Scale, Sheet 77 – Huddersfield – Solid and Drift Editions 2003).

- BGS online Geoindex - http://mapapps2.bgs.ac.uk/geoindex/home.html
- The BGS Lexicon of Named Rock Units, which provides typical descriptions for most geological units (www.bgs.ac.uk/lexicon).

The site is shown to be underlain by the following descending sequence of strata:

SUMMARY OF EXPECTED SITE GEOLOGY	
Geological Unit Name	**Description**
Made Ground	
Filled area shown on the BGS map within the GroundSure report	Area of landfill shown on site
Superficial Deposits	
None	
Alluvium immediately to the south associated with the River Calder	Clay, silt, sand and gravel
Bedrock	
Pennine Lower Coal Measures Formation	Sandstone, siltstone and mudstone with subordinate beds of coal, ironstone and seatearth. Clifton Rock, named sandstone unit within the PLCM directly underlying the site.

4.2 GroundSure GeoInsight

The GroundSure report contains a GeoInsight report, this presents the published geology, as detailed above together with a risk assessment on potential geological hazards. All risks identified as less than moderate are not discussed further. All identified natural hazard risks at the site are deemed to be low, very low or negligible, with the exception of Compressible Deposits, which are deemed to be moderate.

4.3 Hydrology

According to the GroundSure report, the risk posed to the site by groundwater flooding is '*Low*', *(within 50m)'.*

The highest risk posed to the site from *'Surface Water Flooding'* according to the GroundSure Report is highlighted to be *'1 in 30 year, 0.1m-0.3m (within 50m)'.*

According to the GroundSure report, the closest identified surface water feature is 111m to the south west and shown as the River Calder.

The site is identified to lie within the catchment of '*Calder from River Colne to River Chald'* in the operational catchment of '*Calder Lower'.*

The southern boundary of the site is shown to lie within a Flood Zone 3 area.

The site is not shown to be within a *"Nitrate Sensitive Area"* or a *"Nitrate Vulnerable Zone".*

4.4 Hydrogeology

Information provided by the EA indicates that the underlying bedrock (Pennine Lower Coal Measures) is classified as a 'Secondary A', aquifer which is defined as having;

'Permeable layers capable of supporting water supplies at a local level rather than strategic scale, and in some cases forming an important source to base flow to rivers. These are generally aquifers formerly classified as minor aquifers'.

The site is not shown to be within a Source Protection Zone.

4.5 Mining and Quarrying

According to the CA interactive map (http:/mapaps2.bgs.co.uk/coalauthority/home.html) the site is not positioned within a 'development high risk area'.

Inspection of the OS Plans does not indicate evidence of quarrying on site, or in the immediate vicinity of the site.

4.6 Radon

The GroundSure report contains information on Radon Affected Areas as defined by the Health Protection Agency (HPA) and indicates that the site is within an area where less than 1% of properties are affected by Radon, and therefore:

- **"No** radon protection measures are necessary**".**

5.0 REGULATORY REVIEW

A GroundSure report was commissioned in order to review the environmental regulatory information for the site and the immediate surrounding area, a copy of which is presented in Appendix B of this report.

5.1 Discharge Consents to Controlled Waters

The GroundSure report shows that there are no discharge consents within 250 m of the site.

5.2 Water Abstractions

There are no groundwater or surface water abstractions within 250 m of the site.

5.3 Waste Disposal and Landfill Sites.

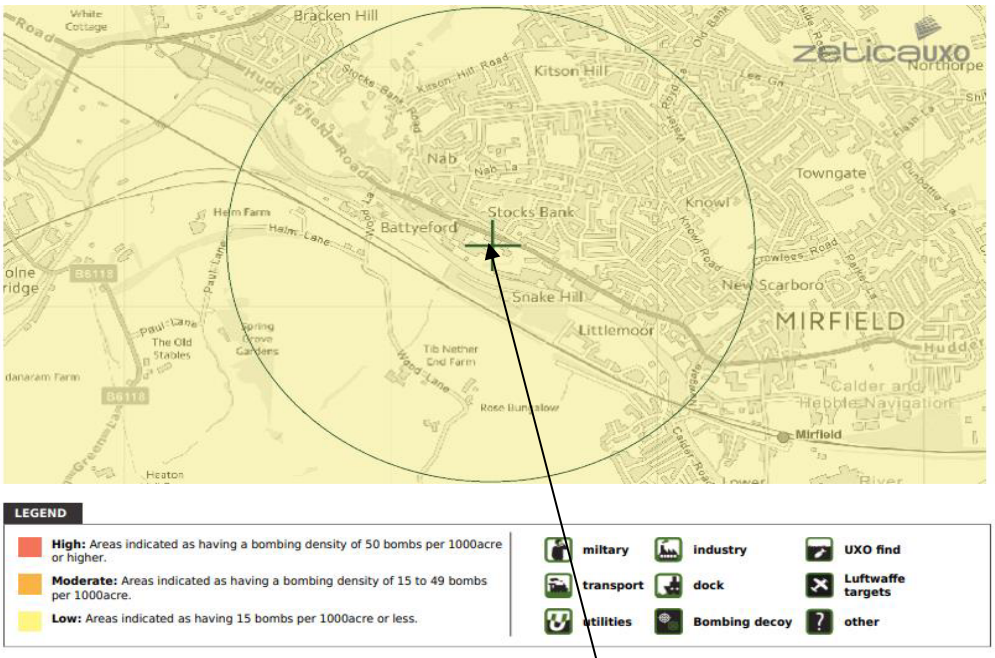
Historical Land Uses	• Various records, noted as 'unspecified heap' on OS maps dated 1938, 1966-1975 and 1985. Noted as 'unspecified ground workings' on OS map dated 1951
Local Authority Landfill	• None recorded within 250m of the site
Environment Agency Registered Landfill Sites:	• None recorded within 250m of the site
Operational Landfill Sites:	• None recorded within 250m of the site
Environment Agency Historic Landfill Sites:	• One shown on the site. Site Ref 4700/0181. License Holder shown as Messers J W Blackburn. Waste type is shown as inert, commercial. 1st recorded 01.01.1944
BGS/DoE Landfill	• None recorded within 250m of the site.
Registered Waste Treatment/Transfer or Disposal Sites:	• Scrap yard shown on site on the OS plan dated 1994. (This is considered to be a mapping error, and the scrap yard was located adjacent to the southern boundary of the site) • SS Motor Spares (metal recycling site shown 30m east of the site)

5.4 Miscellaneous

Integrated Pollution Controls (IPC) and Integrated Pollution and Prevention Controls (IPPC)	• There are no IPC authorisations within 500m of the site. • There are no IPPC authorisations within 500m of the site.
Licensed Industrial Activities (Part A(1))	• None shown within 250m of the site
Pollution Incidents	• 1No recorded within 250m of the site. Shown 179m to the south east; incident date is given as 13/08/01. Pollutant type is given as 'biodegradable Materials & Wastes'. Shown as a Land impact and Air impact – Category 3 (Minor)
Petrol and Fuel Sites	• 2No recorded within 250m of the site, shown 38m to the east on the OS plan dated 1982 and 129m east on the OS plans dated 1972-1983. Both site are now no longer shown
Historical Tanks	• 5No recorded within 250m of the site. The closest is shown 14m to the south as an 'unspecified tank' on the OS plan dated 1933.
Current Industrial Sites Data	• The GroundSure report states that there are 19 recent industrial sites within 250m, the closest of which is shown 19m south west of the site and is noted to be a 'vehicle parts & Accessories'
Other	• There is not in an area of Special Scientific Interest (SSSI). • There are no Special Areas of Conservation (SAC) or Special Protection Areas (SPA) within 250m of the site.

5.5 Unexploded Ordnance

Area shown to be within a low-risk zone. The risk map taken from available information provided by Zetica Ltd, is shown below.



The Site

6.0 PRELIMINARY CONCEPTUAL SITE MODEL.

6.1 Introduction

The findings of the desk study have been used to identify and assess potential sources of contamination and to develop a preliminary conceptual model of the site in order to investigate potential pollution linkages and identify complete pollutant linkages that may require further investigation or analysis and/or remediation. This approach is in line with the principals of Land Contamination Risk Management (LCRM) - Environment Agency October 2020.

The scope of the model is intended primarily to identify potential impacts to human health and

environmental receptors from potential on-site and off-site contamination sources.

Source-Pathway-Receptor elements within the model are defined as follows:

Contaminant Source	Is a hazardous substance or agent, present at levels that have the potential to cause harm or damage a receptor.
Receptor	Is an entity (human, aquatic environment, flora and fauna etc) that is vulnerable to the adverse effects of the contaminant.
Pathway	Is the means by or through which a contaminant comes into contact with or otherwise effects, the receptor.

This relationship is termed a 'pollution linkage'. It should be recognised that for a health or environmental risk to exist, all three elements of the relationship or linkage must be present, for example;

- If there is no contaminant, or contaminants present at levels below those considered to be harmful or damaging to a receptor then there can be no adverse effect on a receptor.
- If there is no receptor present that can be adversely affected by a contaminant, no harm or damage can arise.
- Even where both a contaminant and a receptor are present, no harm or damage will occur if there is no pathway by or through which a linkage between the two can be established.

The findings in the desk study have been assessed below to determine the potential linkage(s) existing on the site, and the likelihood of the linkage being present and determining a consequent level of risk.

In assessing risk, the categorisation shown below has been developed. The table is intended to be an aid to assessing the degree of risk. It should be noted that in terms of the Environmental Protection Act 1990 there is no differing degree of risk. It is either 'significant' or not.

Term	Description
Very High Risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without appropriate remedial action
High Risk	Harm is likely to arise to a designated receptor from an identified hazard at the site without appropriate remedial action
Moderate Risk	It is possible that without appropriate remedial action harm could arise to a designated receptor. It is relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely that such harm would be relatively mild.
Low Risk	It is possible that harm could arise to a designated receptor from an identified hazard. It is likely that, at worst, if any harm was realised any effects would be mild.
Negligible Risk	The presence of an identified hazard does not give rise to the potential to cause harm to a designated receptor.

6.2 Assessment of Potential Sources of Contamination

Potential sources of contamination have been assessed which include both current and historical on site sources together with those originating from off-site locations which may migrate onto the site through one of the recognised pathways.

An assessment has been made as follows;

Feature	Details	Discussion	Risk	Does Source Warrant further Assessment
On-Site	Made Ground/materials associated with former site uses	Historical evidence of landfilling associated with the site (possibly to form the site level profile). OS maps record 'unspecified ground workings' and 'unspecified heap' on the site. EA records landfilling with inert, commercial waste, dated 1944.	Moderate	Yes
On-Site	Ground Gas	Considering the historical uses of the site,	Low	Yes

		generation of ground gas associated with landfilling possible. However, given the age of the infill, first recorded as an 'unspecified heap) on the OS map dated 1938, and the fact that the site appears to have been licenced for 'inert, commercial' there is a likelihood that the materials are unlikely to be continuing to generate gas.		
Off- site	Made Ground/materials associated with former site uses	Historical and current industrial/commercial activity recorded/identified, particularly adjacent to the southern boundary of the site	Low	Yes

6.3 Potential Receptors

The following potential receptors have been identified for the site;

Receptor	Details
Human Receptors	Future site occupiers
	Construction workers
Controlled Waters	The site is underlain by Pennine Lower Coal Measures (Secondary A Aquifer)
Built Development	Building foundations/substructures and utility connects.

6.4 Potential Pathways

Taking into account the intended use of the site, the following potential pathways by which the above receptors and sources may be linked as follows;

Receptor	Pathway
Human (Future site users, construction workers)	Ingestion of soil/soil dust Dermal contact with soil/soil dust Indoor/outdoor inhalation of fugitive dust Indoor/outdoor inhalation of soil vapour
Controlled Waters	Percolation and mobilisation of contaminants within the soil into the groundwater through to the Secondary A aquifer River Calder approximately 100m to the south of the site
Built Development	Direct contact with aggressive ground conditions

6.5 Qualitative Risk Assessment

A preliminary qualitative risk assessment has been undertaken and involves assessing the likely probability and consequence of a pollutant linkage and determining a consequent level of risk. The purpose of this assessment is to develop the preliminary conceptual site model, as follows;

Preliminary Conceptual Site Model

Source	Risk	Potential Contaminants	Likely Exposure Pathway/s	Receptor/s	Probability Assessment**
Made Ground (On-site)	Moderate	Inorganic and organic contaminants	Skin contact Ingestion	End users (residential) and construction workers	**Likely –** historical records indicate landfill has taken place on site (possibly to form the site level profile of the site). Historical OS maps indicate 'unspecified heal' and 'unspecified ground workings' Records shown landfilling of 'inert, commercial', first recorded in 1944
			Leaching/migration of contaminants through soil	Controlled waters	
	Low	Ground Gas	Inhalation / explosions risk in confined spaces.	End users (residential	**Low Likelihood –** Rationale as above. However, landfilling first recorded on site on OS map dated 1938 and EA records

					show the deposition of 'inert, commercial' waste, first recorded in 1944. there is a likelihood that the materials are unlikely to be continuing to generate gas. Radon gas protection measures not required.
Made Ground (off site).	Low	Mobile inorganic/ organic contaminants associated with former off-site uses	Skin contact Ingestion Inhalation	End users (residential) and built Development	**Low Likelihood** – Historical and current industrial/commercial activity recorded/identified, particularly adjacent to the southern boundary of the site

** Definitions and Classifications of Risk Assessment Terminology presented in Appendix H of this report

The preliminary conceptual site model does indicate a number of potential complete pollutant linkages, associated with the former site uses, that require further investigation, analysis and risk assessment.

7.0 GROUND INVESTIGATION.

7.1 Design and Strategy.

The desk-based part of this investigation was used as the basis for the design of an appropriate intrusive ground investigation

The aim and purpose of the ground investigation was to verify the nature and depth of the shallow made ground, natural soils and groundwater and ground gas regimes across the site, to allow informed decisions on potential remediation options that might be required in order to break the direct contact exposure pathways.

7.2 Scope of Works.

The scope of the intrusive investigation is detailed below;

Exploratory Hole Type	Purpose
Trial Pits	To determine the general nature of shallow soils underlying the site, including the; • Nature, distribution and thickness of any potential made ground. • Nature, degree and extent of ground contamination. • Determination of the presence of shallow underlying natural ground • To help identify and inform suitable remedial options
Cable percussive borehole	• Determine the deeper geology beneath the site • To allow the installation of monitoring wells to determine of the presence of ground gas beneath the site • Assist in the determination of foundation options for the site

Fieldwork was undertaken on the 13th and 28th October 2022 and comprised;

- Excavation of five trial pits, referenced TP1 to TP5 inclusive, to depths of between 1.6 m to 3.9 m below ground level (bgl).
- Drilling of a single cable percussive borehole, referenced CP1, to a depth of 11.45 m bgl

The exploratory hole positions were set out and the fieldwork supervised by a G&M engineering geologist. The locations of the exploratory holes are shown on Drawing No C541/2, presented in Appendix A of this report.

The investigation was scoped using guidance presented in BS 10175:2011+A2:2017, CIRIA C665:2007,

the principals of Land Contamination Risk Management (LCRM) - Environment Agency October 2020 and BS EN 1997:2004 and 2007.

Prior to the commencement of any exploratory hole a scan was carried out for buried services using a combination of cable avoidance tool (CAT) and signal generator ('Genny').

The trial pits were excavated using a 6-tonne rated 360^{o} tracked machine.

A photographic record of the trial pits is presented in Appendix G of this report.

The cable percussive borehole was drilled using a Dando 2000 rig, utilising 150mm diameter drop tools and temporary casing. SPTs were carried out in the borehole using a separate hammer.

The hammer has been calibrated for efficiency. The calibration certificates are included in Appendix E of this report. The SPT 'N' values shown on the borehole logs and discussed in this report have not been corrected for hammer efficiency.

The combined gas and groundwater monitoring installation comprised 50 mm diameter HDPE pipe, consisting of a lower slotted section of casing surrounded by single size non-calcareous gravel. The well was installed to a depth of 4.0m m bgl. The upper section of the well was constructed from plain casing sealed with a bentonite/cement seal. A flush lockable security cover was concreted into place to complete the well installation at the ground surface.

7.3 Strata Description.

Depths and descriptions of strata encountered together with details of the samples recovered are presented on the exploratory hole record sheets presented in Appendix C of this report. Procedures and principles contained in BS EN ISO 14688-1 (2002), as amplified by BS 5930 (2015), were followed. The depths of strata on the record sheets are recorded from current ground levels at each location.

7.4 Sampling/In-situ Testing

Small disturbed samples of soil, for chemical analysis, were placed in amber glass jars as appropriate. Between boreholes, equipment was thoroughly cleaned and dried.

In accordance with best practice (BS10175:2013) samples were collected in appropriate containers, kept in a chilled cool box whilst on site, retained in a fridge (below 2^{o}C) until the day of collection, packed in a chilled cool box on the day of collection and transported in this to the laboratory.

Small disturbed samples of soil were taken for geotechnical testing and placed in plastic tubs, bulk samples of soil were also taken for geotechnical testing and placed into large plastic bags.

Standard Penetration Tests (SPT) were carried out in the borehole, in accordance with BS EN ISO 22476-3. Seating drives have been recorded in increments of 75 mm in accordance with recommended UK practice. The SPT results are shown on the borehole logs in Appendix C and on a summary plot in Appendix E of this report, where they have been converted to an undrained shear strength, refer to Section 8.3 of this report.

The undrained strength of the soils was measured during the fieldwork, where possible, using a hand shear vane.

7.5 Laboratory Testing

Selected soil samples were tested for a range of potential contaminants, under a sub-contract with i2 Analytical Ltd (i2), a UKAS/MCERTS accredited laboratory. The analytes tested are listed in Section 9.2 of this report. The results of soil analysis, as received from the laboratory, are presented in Appendix

D of this report.

Selected soil samples for geotechnical testing were delivered to Professional Soils Laboratory (PSL) an external accredited geotechnical laboratory. The results of soil analysis, as received from the laboratory, are presented in Appendix D of this report.

SUMMARY OF GEOTECHNICAL LABORATORY TESTING			
Number of tests	**Test**	**Test Method**	**Notes**
Classification Tests			
8	Moisture content	BS1377: Part 2.	-
4	Liquid and plastic (Atterberg) limits.	BS1377: Part 2.	-
Chemical Tests: Soil			
4	Water soluble sulphate and pH value.	In-house Method	-

8.0 GROUND CONDITIONS AND MATERIAL PROPERTIES

A complete record of all the strata encountered is given on the attached trial pit and borehole logs. From these it can be seen that the site is underlain by a variable thickness of made ground, which increases in thickness to the south, overlying superficial deposits, initially comprising soft and firm clay.

8.1 Made Ground

Made ground was encountered in all the exploratory holes. The base of the made ground was proven in TP4 and TP5 at a depth of 1.6 m bgl and in CP1 at a depth 4.3 m bgl. The base of the made ground was not proven in TP1, TP2 and TP3 which were terminated within the made ground at depths of between 1.6 m and 3.2 m bgl. The made ground generally comprises dark brown gravelly clayey fine to coarse sand which becomes slightly clayey and very gravelly in places, with some cobbles and boulders. The gravel content comprises fragments of brick, concrete, limestone, clinker, slate, and mudstone in various proportions across the site. The cobble and boulder size fragments comprise brick, concrete, and sandstone. In TP2 the made ground comprises very clayey gravel and in TP1 from 0.5 m to 1.0 m bgl slightly clayey gravel.

In TP2 fragments of metal, plastic and fiberglass were noted and at 2.5 m bgl possible fragments of asbestos. Fragments of plastic were also noted in TP3.

The made ground is presumed to be the landfill identified in the GroundSure report.

8.2 Superficial Deposits

TP4, TP5 and CP1 proved the base of the made ground and encountered the underlying superficial deposits.

In TP4 and TP5 the underlying superficial deposits comprised soft / firm light brown slightly sandy clay, which in TP5 was proved to a completion depth of 3.3 m bgl. In TP4 the clay is underlain at a depth of 3.7 m bgl by slightly clayey gravelly sand, the gravel comprising weakly cemented sub angular fragments of sandstone, which was proved to the completion depth of 3.9 m bgl.

In CP1 firm gravelly very sandy clay was proved to a depth of 8.3 m bgl, underlain by light brown sub

angular to rounded fine to coarse gravel, which was proved to completion depth of 11.45 m bgl.

Based on the results of the Atterberg limit tests discussed below the clay encountered in TP4 and TP5 is different to that encountered in CP1. It is assumed that the clay in the trial pits is derived locally from weathering of the underlying coal measure strata and that in the borehole is an alluvial deposit.

8.3 Geotechnical Properties

Atterberg limits were determined for the various clay samples recovered. These show the clays, from TP4 and TP5, assumed to be derived from the underlying coal measure rocks, to be generally of high plasticity with a liquid limit (LL) in the range, 55% to 60%, plastic limit (PL) in the range 25% to 26% and a plasticity index (PI) in the range 30% to 34%. The sample, taken from CP1 and presumed to be alluvium is shown to be of low plasticity with results of LL 31%, PL 17% and PI 14%, a second sample from the borehole proved to be non-plastic.

The modified plasticity index, which takes into account the percentage passing the 425um sieve, indicates the shallower clays, in the trial pits, to be of medium volume change potential.

The undrained shear strength (Cu) of the clays encountered in the TP4 and TP5 has been measured directly by hand shear vanes. The Cu has also been determined indirectly from the SPT N values in CP1 using the correlation proposed by Stroud where the undrained shear strength Cu = f x SPT N value, where f is a factor based on the plasticity index of the clay. For this site a value of f = 4.5 has been assumed.

Hand vanes undertaken within the clays exposed in TP4 and TP5 recorded undrained shear strengths within the range 22 kPa and 48 kPa, indicating low to medium strength. For design purposes it is suggested that an undrained shear strength of 25 kPa be assumed for this shallow clay.

SPTs in BH1 within the made ground returned N values of between 1 and 8, generally increasing with depth. The SPTs in the underlying clay were in the range 18 to 27 and in the deeper gravel 14 to 23 indicating medium dense conditions. A plot of SPT N values with depth is included in Appendix E.

Using Stroud's correlation, the SPTs indicate the clay encountered in CP1 to have an undrained shear strength of between 81 kPa and 120 kPa, high strength. This is based on a correlation and is not a direct measurement and should therefore be used as a guide only.

Water soluble sulphate (SO_4) and pH tests were carried out on three samples of made ground and two samples of the natural soils. These recorded concentrations of SO_4 of between 0.041 g/l and 1.9 g/l (41 mg/l and 1,900 mg/l), together with a pH of between 7.8 and 9.5 for the samples of made ground, and for the two natural soil samples a water soluble sulphate content of 0.06 g/l and 0.12 g/l (60 mg/l and 120 mg/l) and pH of 7.7 and 8.0.

8.4 Groundwater

Groundwater was not encountered in the trial pits whilst they were being excavated. Similarly groundwater was not encountered in the borehole whilst drilling.

Monitoring of the well installed in the borehole has been carried out as part of a number of return visits. No standing water has been recorded to date.

It should be borne in mind that water levels are likely to fluctuate with seasonal rainfall and may therefore be substantially higher at wetter times of year than those found during this investigation.

8.5 Visual / Olfactory Evidence of Contamination

The made ground was found to include varying proportions of brick, concrete, tile, slate and plastic,

which can produce elevated concentrations of certain toxic and phytotoxic contaminants.

No olfactory evidence of any contamination was noted during the fieldwork.

8.6 Ground Gas and Vapours

Ground gas monitoring has been carried out on two occasions to date, and the result are summarised below. Full details of the ground gas monitoring are presented in Appendix F of this report.

Well	Methane (range) % v/v	Methane (range) %LEL	Carbon Dioxide (range) %v/v*	Oxygen (range) %v/v	VOC (ppm)	Flow (range) l/hr*
CP1	ND	-	0.0-0.3	17.4-17.7	0	0

ND - Not Detected. * Peak reading

Barometric air pressure for the visits varied between 991 mb and 1006 mb

The scheduled programme of monitoring comprises six visits over a three month period. It is proposed to undertake four further monitoring visits, as far as possible/practicable, to coincide with worst case weather/environmental conditions identified in CIRIA C665. On completion of the monitoring, a full set of results will be issued in an addendum report.

9.0 RESULTS OF CHEMICAL TESTING

9.1 General

For this site, measured values were compared to Generic Assessment Criteria (GAC) derived for a residential with plant up take end use. (Considered the most conservative values)

Chemical analysis was undertaken on representative soil samples recovered from across the site. The determinands were selected to provide information on the distribution of potential contaminants. The general analytical suite was supplemented with additional analysis where former land usage, as determined from the desk study, or visual or olfactory observations suggested the presence of additional contaminants.

The majority of initial screening levels (GAC's) used in the production of this assessment have been taken from the guidelines introduced by:

- DEFRA C4SL's, DEFRA 2015.
- Joint Land Quality Management Ltd (LQM) and Chartered Institute of Environmental Health (CIEH), Generic Assessment Criteria for Human Health Risk Assessment, S4UL's, Land Quality Press 2015.

Usually statistical testing is undertaken for the Planning Scenario by the methods described in CL:AIRE "Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration", September 2020. This statistical testing is undertaken to determine whether there was sufficient evidence that the true mean concentration of each determinand was less than the relevant critical concentration for that component. However, given the fact that a proportion of the sampling was carried out on a targeted basis, detailed statistical assessment of the data has not been conducted, instead individual contaminant concentrations have been compared to their relevant assessment criteria.

9.2 Testing Schedule

Following completion of the fieldwork samples were selected for testing as follows;

Laboratory Analysis	Topsoil/Made Ground	Natural Soils
Total concentrations of arsenic, cadmium, chromium (Hexavalent), copper, lead, nickel, selenium, zinc, mercury	7	2
Water soluble sulphate, Ph	3	2
Phenol	5	1
Speciated PAH	9	1
Asbestos	6	-

9.3 Soil Analysis

The chemical analysis results and screening criteria are summarised below. The results for the natural soils have been combined for an initial assessment.

Summary of Total Soil Concentrations

Determinand	GAC (1% SOM) (mg/kg, unless otherwise stated)	No. of samples above screening value	No. of samples tested	Maximum concentration above GAC (mg/kg, unless otherwise stated)
Metals/Metalloids				
Arsenic	37 (2)	4	9	140 (TP1-0.4m)
Cadmium	11(1)	0	9	
Chromium (IV)	21 (2)	0	9	
Lead	200 (2)	4	9	740 (TP5-0.5m)
Mercury	40 (1)	0	9	
Selenium	250 (1)	0	9	
Copper	2400 (1)	0	9	
Nickel	180 (1)	0	9	
Zinc	3700 (1)	0	9	
Inorganics				
pH	<5	0	5	
Water Soluble Sulphate	0.5 g/l (3)	1	5	1.9g/l (TP2-1.0m)
Organics				
PAHs				
Acenaphthene	210(1)	0	10	
Anthracene	2400(1)	0	10	
Acenaphthylene	170(1)	0	10	
Benzo(a)anthracene	7.2(1)	2	10	18 (TP2-2.0m)
Benzo(b)fluoranthene	2.6(1)	4	10	17 (TP2-2.0m)
Benzo(k)fluoranthene	77(1)	0	10	
Benzo(g,h,i)perylene	320(1)	0	10	
Benzo(a)pyrene	5.0(2)	2	10	20 (TP2-2.0m)
Chrysene	15(1)	0	10	
Dibenz(a,h)anthracene	0.24(1)	4	10	2.9 (TP2-2.0m)
Fluoranthene	280(1)	0	10	
Fluorene	170(1)	0	10	
Indeno(1,2,3-cd)pyrene	27(1)	0	10	
Naphthalene	2.3(1)	0	10	
Pyrene	620(1)	0	10	
Phenanthrene	95(1)	0	10	
Other				
Monohydric Phenol	120(1)	0	6	
Asbestos	Fibres present	2	6	TP2-1.0m; Chrysotile,

Determinand	GAC (1% SOM) (mg/kg, unless otherwise stated)	No. of samples above screening value	No. of samples tested	Maximum concentration above GAC (mg/kg, unless otherwise stated)
				Amosite, Crocidolite TP2-3.0m; Amosite

[1] LQM/CIEH (2015) Generic Assessment Criteria for Human Health Risk Assessment. 2nd Ed. (for a sandy soil with 1% SOM and pH 7.0)
[2] DEFRA C4SL's, DEFRA 2015
[3] BRE (2005) Special Digest 1, 3rd Edition, Concrete in aggressive ground. Upper limits for DS-1 Design Sulphate Class concrete.

Elevated concentrations of Arsenic, Lead and PAH speciates were recorded in samples of the made ground soils.

Two of the samples submitted for asbestos screening recorded asbestos fibres. TP2 at 1.0m recorded Chrysotile, Amosite and Crocidolite and TP2 at 3.0m recorded Amosite

No samples of the natural soils were shown to be elevated above respective GAC levels

10.0 QUALITATIVE RISK ASSESSMENTAND REVISED CONCEPTUAL MODEL

Following the ground investigation and results of the chemical testing presented above, the preliminary conceptual site model presented in the Phase 1 desk study has been revised. The revised model has been developed for the proposed future land use (redevelopment of the site for use by the Air Training Corps).

Identified Contaminants of Concern

- Elevated levels of Arsenic and Lead within the made ground soils.
- Elevated levels of PAH speciates, within the made ground soils.
- Elevated levels of water soluble sulphate within the made ground soils.
- Occurrences of asbestos fibres within the made ground soils.
- Currently no elevated hazardous ground gas encountered across the site. (Four further visits planned to complete six visits over a nominal three month period).

Summary of Identified Pollutant Linkages

In summary, the revised conceptual site model has identified the following potential pollutant which could result in an unacceptable risk to the proposed end-use, denoted as a moderate or higher potential of significant pollutant linkage on the conceptual site model.

Source	Risk	Potential Contaminants	Exposure Pathway	Primary Receptor/s	Complete Pollutant Linkage
Made ground (on site)	Moderate/High	Inorganic/organic contaminants	Skin contact Ingestion	End users of site; Construction workers	**Yes**: made ground soils present on site recorded elevated levels of Arsenic, Lead and PAH Speciates. Asbestos fibres also recorded in made ground soils.
		Asbestos	Inhalation		
	Low	Ground gas	Migration (lateral and vertical) Inhalation,	Built development; End users of site	Further assessment required; monitoring ongoing (4 further visits to complete 6 visits over a three month period). Currently a complete

			explosion		pollutant linkage assumed until monitoring period completed and reported.
Made Ground (on site)	Moderate	Water Soluble Sulphate	Soil contact	Built Development	**Yes**: elevated water soluble sulphate in made ground. Appropriate concrete design required.

11.0 CONCLUSIONS AND RECOMMENDATIONS.

11.1 General

G&M Consulting Ltd (G&M) was commissioned by John Hill Associates to undertake a geoenvironmental appraisal, for land at Mirfield Air Training Corps, Huddersfield Road, Mirfield, West Yorkshire.

It is understood that it is proposed to redevelop the existing facilities at the site, and that this report has been prepared in support of the planning and costing submissions.

At the time of writing of this report, no development layout is available for inspection. It is however understood that any proposed buildings will be of modular construction and single story. It is unclear at this at this stage whether any areas of proposed soft landscaping are proposed, however, it is assumed the majority of the external area to the site will comprise hardstanding.

It has been assumed that ground levels will not change significantly from those described in this report, or that the proposed end use of the site will not change from that detailed above. If this is not the case, then amendments to the interpretation and conclusions in this report may be required.

11.2 Geotechnical Considerations

Introduction

At the time of writing detailed loads for the foundations are not known. It is understood that the proposed buildings are single storey and of the modular type and therefore considered likely to have low bearing pressure. The following assessment is therefore based on a line load of 30 kN per metre run.

It is also assumed that proposed finished development levels do not vary significantly from those at the time of the fieldwork, on site. If either of these assumptions are not the case significant alteration to these recommendations may be required.

Any proposed foundation option should be discussed with a structural engineer responsible for the design.

Foundations.

Given the assumed relatively likely light loading of the structure, there are a number of options for foundations which can be considered which would primarily be determined by cost and physical limitations of the site.

Made ground in general is not considered suitable for foundations, without first pretreatment, due to the potential for variability of content and strength and, on this site the variation in depth across the site from 1.6 m to 4.3 m bgl. The made ground is identifiable as landfill material, presumed to be inert, but containing some unsuitable materials including possible asbestos encountered at depth.

Generally, foundations taken to below made ground, would normally be done by trench fill or piled foundations. Given the thickness of made ground on this site trench fill would be unsuitable and therefore piled foundations would be the preferred option.

Shallow foundations, either pads or a raft, maybe feasible if the made ground is treated. This could be

done by excavating, sorting and removal of any deleterious materials and then recompacting suitable material to an agreed depth, with the inclusion of geotextile reinforcement, this option would require sufficient space for earthwork plant to operate and also the consideration of the possible presence of asbestos. Alternatively, the made ground could be treated using vibro techniques, which has the advantage that disturbed soils would not be brought to the surface. Again, sufficient space would be required for the plant to operate. The bearing capacity of treated made ground would be dependent on the treatment method used and subsequent validation.

If piled foundations are considered, then they should be taken into the underlying superficial deposits. Driven piles would be the preferred option, as these would not bring any surplus material to the surface. However, the vibration from these techniques should be considered with regard to any adjacent properties. Screw piles could also be considered as these would also minimise the amount of material brought to the surface.

The load capacity of piles is dependent on the type and method of installation and as such the advice of a specialist piling company should be sought with regard to the most suitable type of pile for the site and likely achievable loads.

The bearing capacity of soil below a foundation is a function of the undrained shear strength of the soil, together with the type of foundation, including its depth and width. The bearing capacity should therefore be checked once foundation designs are finalised.

Floor Slabs.
If a raft foundation is used this would also form the floor slab. If traditional deep or piled foundations are used then a suspended floor slab would be required to avoid any differential settlement between the slab and foundations.

All formation level soils should be proof-rolled, and all loose, soft, organic or otherwise unsuitable materials should be removed and replaced with a suitable, well-compacted granular fill. Hard spots such as old foundations should also be removed.

Excavations.
The shallow soils encountered at the site are considered suitable for excavation by standard mechanical plant such as a wheeled backhoe excavator to depths indicated by the termination depth of the exploratory holes.

The use of hydraulic or pneumatic breakers, may be required if obstructions or old foundations associated with former structures, are encountered.

Whilst ground water was not encountered in the trial pits, surface water run-off from rainfall may enter excavations, particularly given the location of the site adjacent to the valley side. Some dewatering may therefore be required within excavations.

It should be noted that groundwater levels may change due to seasonal or other variations. Advice on suitable dewatering techniques is given in CIRIA Report C515 *Groundwater Control – design and practice*.

All excavations should be planned and due consideration should be given to providing temporary support or suitable battering. Excavations should be regularly inspected by a competent person to ensure continued safety. Further advice on the safety of excavations is given in *Health and Safety in Construction*.

Buried Concrete.
This assessment of the potential for chemical attack on buried concrete is based on current guidance contained in BRE Special Digest 1 ('SD1', 2005) *Concrete in Aggressive Ground Part 1: Assessing the aggressive chemical environment.* Third Edition.

Water soluble sulphate (SO_4) and pH tests were carried out on three samples of made ground and two samples of the natural soils. These recorded concentrations of SO_4 of between 41 mg/l and 1,900 mg/l, together with a pH of between 7.8 and 9.5 for the samples of made ground and for the two samples of natural soils a water soluble sulphate content of 60 mg/l and 120 mg/l and pH of 7.7 and 8.0.

Based on the guidance in SD1, where there are less than five samples tested (on each type of material/soil/water present on site), the characteristic value for the pH is taken as the lowest value and that of the water soluble sulphate, the highest value.

Therefore, a characteristic value for pH of 7.8 is determined for the made ground and 7.7 for the natural soils. A characteristic value for water soluble sulphate of 1,900 mg/l is determined for the made ground and 120 mg/l for the natural soils.

Based on these characteristic values and Table C2 (SD1) for brownfield sites, a Design Sulphate Class for the made ground of DS-3 is indicated and for the natural soils DS-1.

11.3 Contamination Constraints to Development

Risk Evaluation for Proposed Land Use

The development proposals indicate the future end use of the site to be the redevelopment of the site by the Air Training Corps, for the same end use that the site is currently being used for. This is considered to represent a **medium/low** sensitivity end use.

Based on the source>pathway>receptor philosophy, and the chemical results obtained as part of this investigation, it is considered that the made ground tested generally pose a **moderate/high** risk to end users through ingestion, dermal contact or inhalation and that remedial action will be required to break this linkage.

If made ground is left beneath areas of proposed hardstand (building footprints, parade areas and car parking etc), it is considered to pose a **negligible** risk to end users, as pathways are severed due to capping by the hardstanding.

Due to the presence of contamination in the made ground and because of its unsuitability as a growing medium, if made ground is left on site in areas of proposed soft landscaping, there will be a need to be an import of clean cover soils. This is to provide a healthy medium for plant growth and to remove any remaining pathways for exposure of end users to residual contaminants. It is recommended that a minimum of 600mm of clean capping soils (including 150mm of topsoil) are placed. This thickness is subject to regulatory approval.

Controlled waters

Considering the fact that the made ground soils will be either removed or capped with hard stand or clean soils in any areas of soft landscaping (thereby effectively eliminating surface water infiltration and leachate generation), it is considered that the soils are considered to pose a **negligible/low** risk to controlled waters and that no further remediation is considered necessary, outside of that described.

Furthermore, no groundwater was encountered during the fieldwork, or in the subsequent monitoring visits.

Construction and Maintenance Workers

Contamination may pose a short-term (acute) or long-term (chronic) risk to workers during construction and maintenance. The potential risks must be specifically assessed as part of the health and safety evaluation for the works to be performed in accordance with prevailing legislation. Site practices must conform to the specific legislation requirements and follow appropriate guidance (e.g. HSE, 1991; CIRIA 1996).

On the basis of the results obtained, the revised conceptual model confirms potential moderate/high risks to construction workers from PAH speciates and asbestos fibres in the made ground soils. However, risks can be adequately mitigated by appropriate PPE and hygiene precautions and good working and soil management practices, including dampening down of soils. It is recommended that procedures outlined in the HSE document 'Protection of Workers and the General Public during Remediation of Contaminated Land' be followed.

Where necessary, groundworks will need to comply with Control of Asbestos Regulations 2012.

This report should be forwarded to any organisation undertaking ground works in order for them to assess the risk to their own personnel.

Adjacent Site Users
Provided that any soils are carefully excavated and standard dust control measures are adopted, including dampening down of soils, during the development works, then it is considered that there is a **low/negligible** short-term risk to adjacent site users.

Utilities
It is recommended that the results of the chemical testing and details of the proposed enabling works are provided to the appropriate utility companies to determine the necessity for service protection.

11.4 Ground Gas (Interim Results)

Gas monitoring has only been undertaken on two occasions to date, therefore the following comments are only a preliminary assessment. A full assessment will be made once monitoring is complete and an addendum report will be issued.

Guidance on the assessment of ground gas is given in CIRIA C665 (2007) *'Assessing Risks Posed by Hazardous Ground Gases to Buildings'* and BS8485:2015+A1:2019 *'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'*.

The gas monitoring carried out to date has recorded no methane and a peak carbon dioxide concentration of 0.3 % (CP1) and using the limit of detection of the monitoring equipment issued, a gas flow rate of 0.1l/hr (as no flows were recorded in any of the boreholes during the monitoring), derives a site GSV of 0.003 l/hr.

Based on the above GSV, the ground gas regime for the site would initially be assessed as Characteristic Situation CS1 – No special precautions.

A further assessment of the ground gas regime beneath the site, and the need, or otherwise for gas protection measures to the building, will be undertaken on completion of the monitoring period, following which an addendum assessment report will be issued.

According to the desk study basic radon protection measures are **not** required for the protection of the proposed buildings at this location.

11.5 Watching Brief during Development Works

It is possible that areas of contamination or made ground may be encountered during the development works, which have not been identified by this report. If any areas of noxious, odorous, fibrous or liquid etc. contamination are encountered, then works should stop immediately, the local authority informed and further advice sought from a suitably experienced and qualified consultant. It is recommended that a watching brief be maintained during the development work for this purpose.

11.6 Disposal of Unsuitable Soils.

Any unsuitable materials which are to be exported from site, should be despatched to a suitably licensed landfill facility, in accordance with the requirements of the Duty of Care (DoC) Regulations, April 2006 and where appropriate, the HWR, 2005 or any superseding legislation.

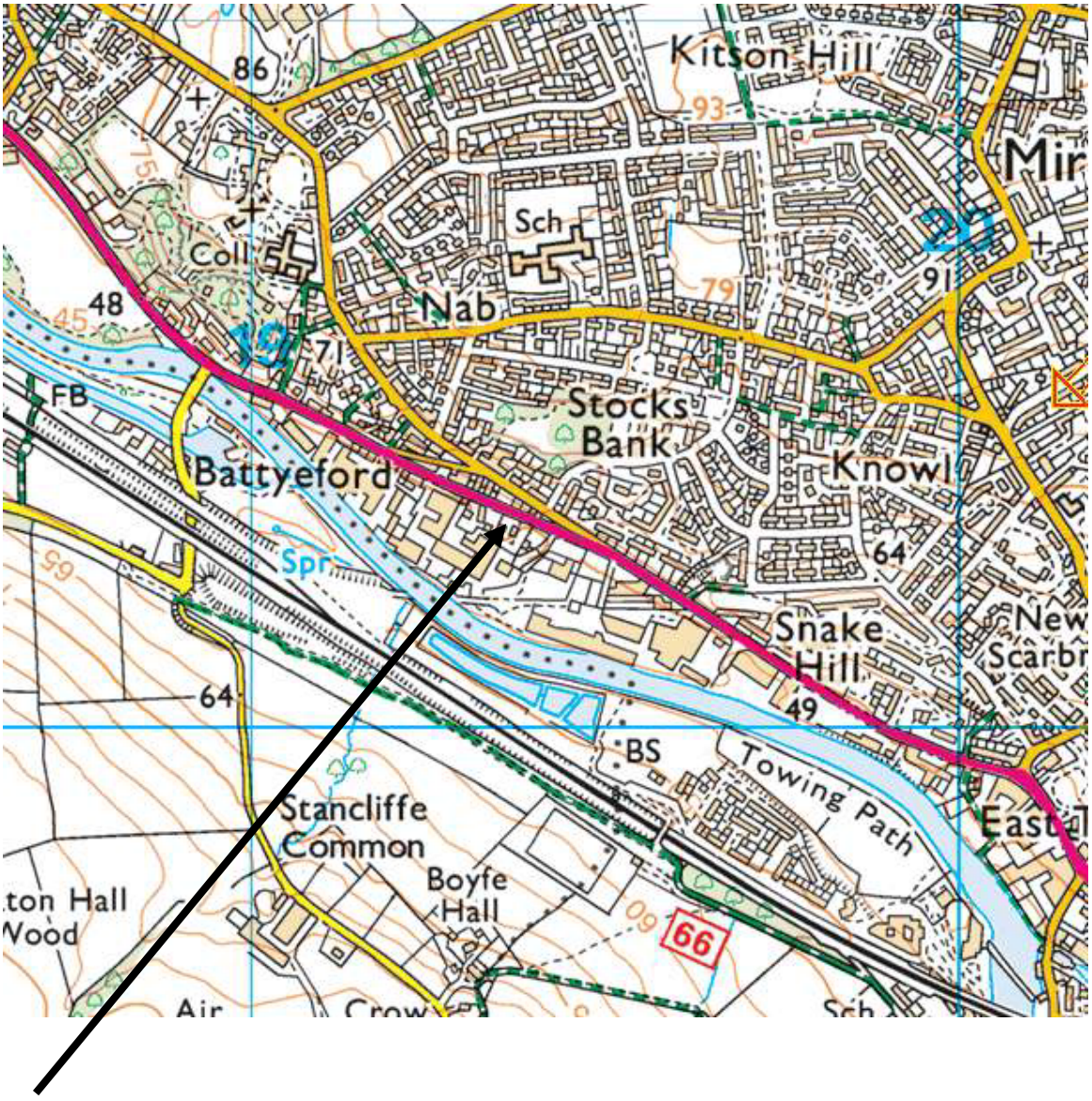
11.7 Regulatory Approval

The conclusions and recommendations presented above are considered practical based on the findings of this investigation, however, they cannot be guaranteed to gain regulatory approval, and therefore this report should be submitted to the regulators for their approval as part of any planning process.

The above recommendations comprise a general outline of possible or likely works. A remediation strategy report may be required by the regulatory authorities prior to development.

APPENDIX A

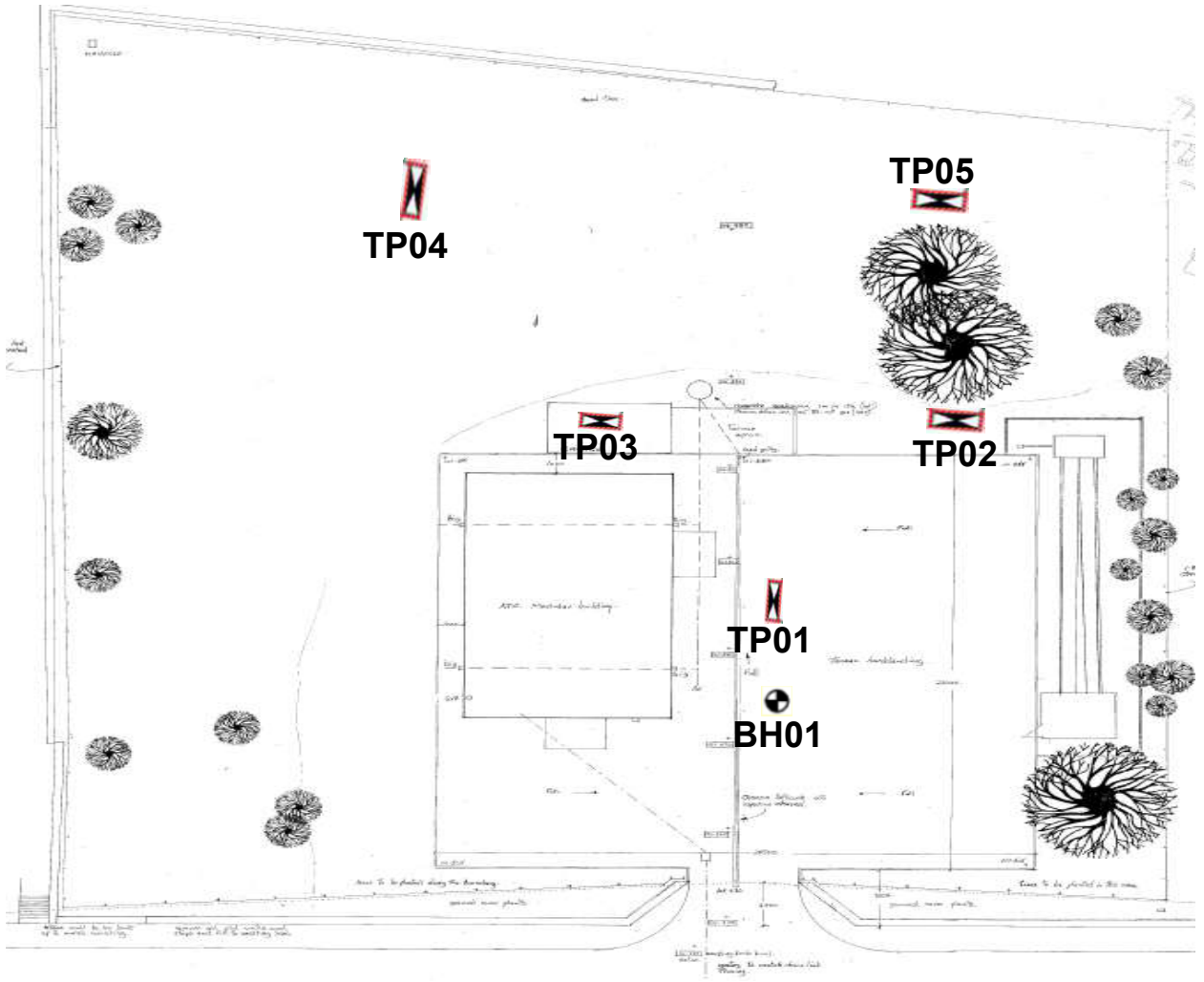
DRAWINGS



The Site

Site Location Plan **Drawing No C541/1**

G&M CONSULTING



Drawing: C541/1/2		Scale NTS	
Contract	C541 – Mirfield ATC	Drawn AS	Approved GS
		Drawing Name – Exploratory Hole Location Plan	
Client: John Hill Associates			

G&M CONSULTING

APPENDIX B

GROUNDSURE DOCUMENTS

Groundsure
LOCATION INTELLIGENCE

Enviro+Geo Insight

MIRFIELD AIR CADET CENTRE, HUDDERSFIELD ROAD, MIRFIELD, WF14 9DQ

Order Details

Date: 27/10/2022

Your ref: C541

Our Ref: GS-9159942

Site Details

Location: 419369 420275

Area: 0.18 ha

Authority: Kirklees Council

Contact us with any questions at:
info@groundsure.com
08444 159 000

Summary of findings

Page	Section	Past land use	On site	0-50m	50-250m	250-500m	500-2000m
13	1.1	Historical industrial land uses	4	6	46	71	-
18	1.2	Historical tanks	0	1	3	10	-
19	1.3	Historical energy features	0	0	4	6	-
20	1.4	Historical petrol stations	0	0	0	0	-
20	1.5	Historical garages	0	1	1	0	-
20	1.6	Historical military land	0	0	0	0	-
Page	Section	Past land use - un-grouped	On site	0-50m	50-250m	250-500m	500-2000m
21	2.1	Historical industrial land uses	6	7	72	102	-
28	2.2	Historical tanks	0	1	4	14	-
29	2.3	Historical energy features	0	0	6	12	-
30	2.4	Historical petrol stations	0	0	0	0	-
30	2.5	Historical garages	0	1	2	0	-
Page	Section	Waste and landfill	On site	0-50m	50-250m	250-500m	500-2000m
32	3.1	Active or recent landfill	0	0	0	1	-
33	3.2	Historical landfill (BGS records)	0	0	0	0	-
33	3.3	Historical landfill (LA/mapping records)	0	0	0	0	-
33	3.4	Historical landfill (EA/NRW records)	1	0	0	0	-
33	3.5	Historical waste sites	0	1	0	0	-
34	3.6	Licensed waste sites	0	1	3	1	-
35	3.7	Waste exemptions	0	0	0	3	-
Page	Section	Current industrial land use	On site	0-50m	50-250m	250-500m	500-2000m
37	4.1	Recent industrial land uses	0	2	17	-	-
39	4.2	Current or recent petrol stations	0	0	0	0	-
39	4.3	Electricity cables	0	0	0	0	-
39	4.4	Gas pipelines	0	0	0	0	-
39	4.5	Sites determined as Contaminated Land	0	0	0	0	-

40	4.6	Control of Major Accident Hazards (COMAH)	0	0	0	0	-
40	4.7	Regulated explosive sites	0	0	0	0	-
40	4.8	Hazardous substance storage/usage	0	0	0	0	-
40	4.9	Historical licensed industrial activities (IPC)	0	0	0	0	-
40	4.10	Licensed industrial activities (Part A(1))	0	0	0	0	-
41	**4.11**	**Licensed pollutant release (Part A(2)/B)**	0	0	1	0	-
41	4.12	Radioactive Substance Authorisations	0	0	0	0	-
41	**4.13**	**Licensed Discharges to controlled waters**	0	0	0	4	-
42	4.14	Pollutant release to surface waters (Red List)	0	0	0	0	-
42	4.15	Pollutant release to public sewer	0	0	0	0	-
43	4.16	List 1 Dangerous Substances	0	0	0	0	-
43	**4.17**	**List 2 Dangerous Substances**	0	0	0	1	-
43	**4.18**	**Pollution Incidents (EA/NRW)**	0	0	1	5	-
44	4.19	Pollution inventory substances	0	0	0	0	-
44	4.20	Pollution inventory waste transfers	0	0	0	0	-
45	4.21	Pollution inventory radioactive waste	0	0	0	0	-

Page	Section	Hydrogeology	On site	0-50m	50-250m	250-500m	500-2000m
46	**5.1**	**Superficial aquifer**	Identified (within 500m)				
48	**5.2**	**Bedrock aquifer**	Identified (within 500m)				
50	**5.3**	**Groundwater vulnerability**	Identified (within 50m)				
51	5.4	Groundwater vulnerability- soluble rock risk	None (within 0m)				
51	5.5	Groundwater vulnerability- local information	None (within 0m)				
52	**5.6**	**Groundwater abstractions**	0	0	0	0	4
53	**5.7**	**Surface water abstractions**	0	0	0	0	11
56	5.8	Potable abstractions	0	0	0	0	0
57	5.9	Source Protection Zones	0	0	0	0	-
57	5.10	Source Protection Zones (confined aquifer)	0	0	0	0	-

Page	Section	Hydrology	On site	0-50m	50-250m	250-500m	500-2000m
58	**6.1**	**Water Network (OS MasterMap)**	0	0	5	-	-

73	10.13	Possible Special Areas of Conservation (pSAC)	0	0	0	0	0
73	10.14	Potential Special Protection Areas (pSPA)	0	0	0	0	0
73	10.15	Nitrate Sensitive Areas	0	0	0	0	0
73	**10.16**	**Nitrate Vulnerable Zones**	0	0	0	0	1
75	**10.17**	**SSSI Impact Risk Zones**	1	-	-	-	-
76	10.18	SSSI Units	0	0	0	0	0
Page	Section	Visual and cultural designations	On site	0-50m	50-250m	250-500m	500-2000m
77	11.1	World Heritage Sites	0	0	0	-	-
77	11.2	Area of Outstanding Natural Beauty	0	0	0	-	-
77	11.3	National Parks	0	0	0	-	-
77	11.4	Listed Buildings	0	0	0	-	-
78	11.5	Conservation Areas	0	0	0	-	-
78	11.6	Scheduled Ancient Monuments	0	0	0	-	-
78	11.7	Registered Parks and Gardens	0	0	0	-	-
Page	Section	Agricultural designations	On site	0-50m	50-250m	250-500m	500-2000m
79	**12.1**	**Agricultural Land Classification**	Grade 3 (within 250m)				
80	12.2	Open Access Land	0	0	0	-	-
80	12.3	Tree Felling Licences	0	0	0	-	-
80	12.4	Environmental Stewardship Schemes	0	0	0	-	-
80	12.5	Countryside Stewardship Schemes	0	0	0	-	-
Page	Section	Habitat designations	On site	0-50m	50-250m	250-500m	500-2000m
81	**13.1**	**Priority Habitat Inventory**	0	0	6	-	-
82	13.2	Habitat Networks	0	0	0	-	-
82	13.3	Open Mosaic Habitat	0	0	0	-	-
82	13.4	Limestone Pavement Orders	0	0	0	-	-
Page	Section	Geology 1:10,000 scale	On site	0-50m	50-250m	250-500m	500-2000m
83	**14.1**	**10k Availability**	Identified (within 500m)				
84	**14.2**	**Artificial and made ground (10k)**	1	2	8	13	-
86	**14.3**	**Superficial geology (10k)**	0	1	0	2	-

87	14.4	Landslip (10k)	0	0	0	0	-
88	14.5	Bedrock geology (10k)	1	1	3	14	-
89	14.6	Bedrock faults and other linear features (10k)	0	0	1	7	-
Page	Section	Geology 1:50,000 scale	On site	0-50m	50-250m	250-500m	500-2000m
91	15.1	50k Availability	Identified (within 500m)				
92	15.2	Artificial and made ground (50k)	0	1	2	1	-
93	15.3	Artificial ground permeability (50k)	0	1	-	-	-
94	15.4	Superficial geology (50k)	0	1	0	1	-
95	15.5	Superficial permeability (50k)	Identified (within 50m)				
95	15.6	Landslip (50k)	0	0	0	0	-
95	15.7	Landslip permeability (50k)	None (within 50m)				
96	15.8	Bedrock geology (50k)	1	1	3	11	-
97	15.9	Bedrock permeability (50k)	Identified (within 50m)				
98	15.10	Bedrock faults and other linear features (50k)	0	0	1	6	-
Page	Section	Boreholes	On site	0-50m	50-250m	250-500m	500-2000m
99	16.1	BGS Boreholes	0	0	5	-	-
Page	Section	Natural ground subsidence					
101	17.1	Shrink swell clays	Very low (within 50m)				
102	17.2	Running sands	Low (within 50m)				
104	17.3	Compressible deposits	Moderate (within 50m)				
106	17.4	Collapsible deposits	Very low (within 50m)				
107	17.5	Landslides	Very low (within 50m)				
108	17.6	Ground dissolution of soluble rocks	Negligible (within 50m)				
Page	Section	Mining, ground workings and natural cavities	On site	0-50m	50-250m	250-500m	500-2000m
110	18.1	Natural cavities	0	0	0	0	-
111	18.2	BritPits	0	0	2	2	-
112	18.3	Surface ground workings	6	0	41	-	-
114	18.4	Underground workings	0	0	0	2	13
114	18.5	Historical Mineral Planning Areas	0	0	0	0	-

115	18.6	Non-coal mining	0	0	0	0	0
115	18.7	Mining cavities	0	0	0	0	0
115	18.8	JPB mining areas	None (within 0m)				
115	**18.9**	**Coal mining**	Identified (within 0m)				
116	18.10	Brine areas	None (within 0m)				
116	18.11	Gypsum areas	None (within 0m)				
116	18.12	Tin mining	None (within 0m)				
116	18.13	Clay mining	None (within 0m)				

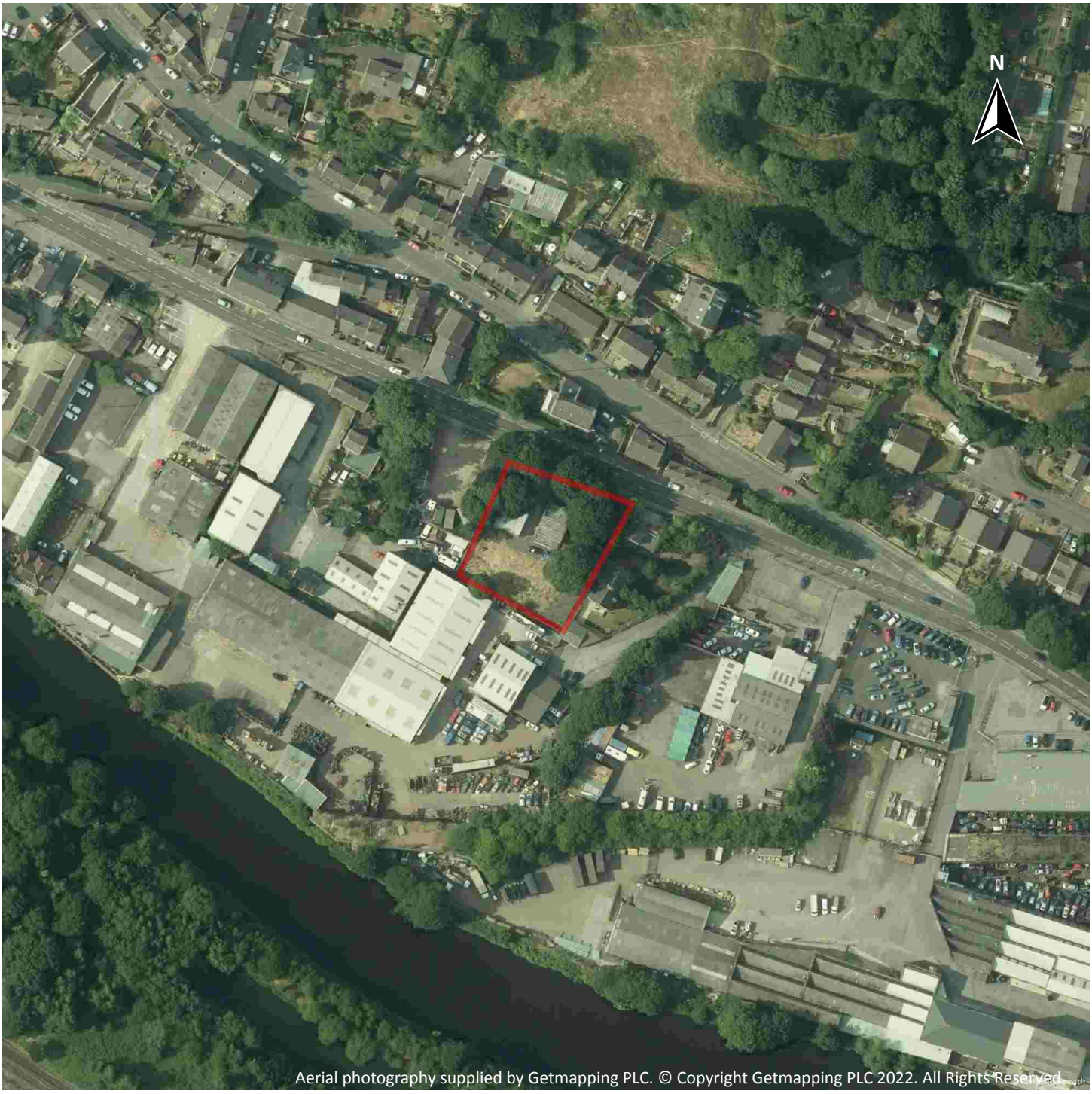
Page	Section	Radon					
117	**19.1**	**Radon**	Less than 1% (within 0m)				
Page	Section	Soil chemistry	On site	0-50m	50-250m	250-500m	500-2000m
118	**20.1**	**BGS Estimated Background Soil Chemistry**	1	2	-	-	-
118	20.2	BGS Estimated Urban Soil Chemistry	0	0	-	-	-
118	20.3	BGS Measured Urban Soil Chemistry	0	0	-	-	-
Page	Section	Railway infrastructure and projects	On site	0-50m	50-250m	250-500m	500-2000m
119	21.1	Underground railways (London)	0	0	0	-	-
119	21.2	Underground railways (Non-London)	0	0	0	-	-
120	21.3	Railway tunnels	0	0	0	-	-
120	21.4	Historical railway and tunnel features	0	0	0	-	-
120	21.5	Royal Mail tunnels	0	0	0	-	-
120	**21.6**	**Historical railways**	0	0	1	-	-
121	**21.7**	**Railways**	0	0	8	-	-
121	21.8	Crossrail 1	0	0	0	0	-
121	21.9	Crossrail 2	0	0	0	0	-
122	21.10	HS2	0	0	0	0	-

Recent aerial photograph

Capture Date: 30/05/2021

Site Area: 0.18ha

Recent site history - 2018 aerial photograph



Capture Date: 01/07/2018

Site Area: 0.18ha

Recent site history - 2012 aerial photograph

Capture Date: 26/03/2012

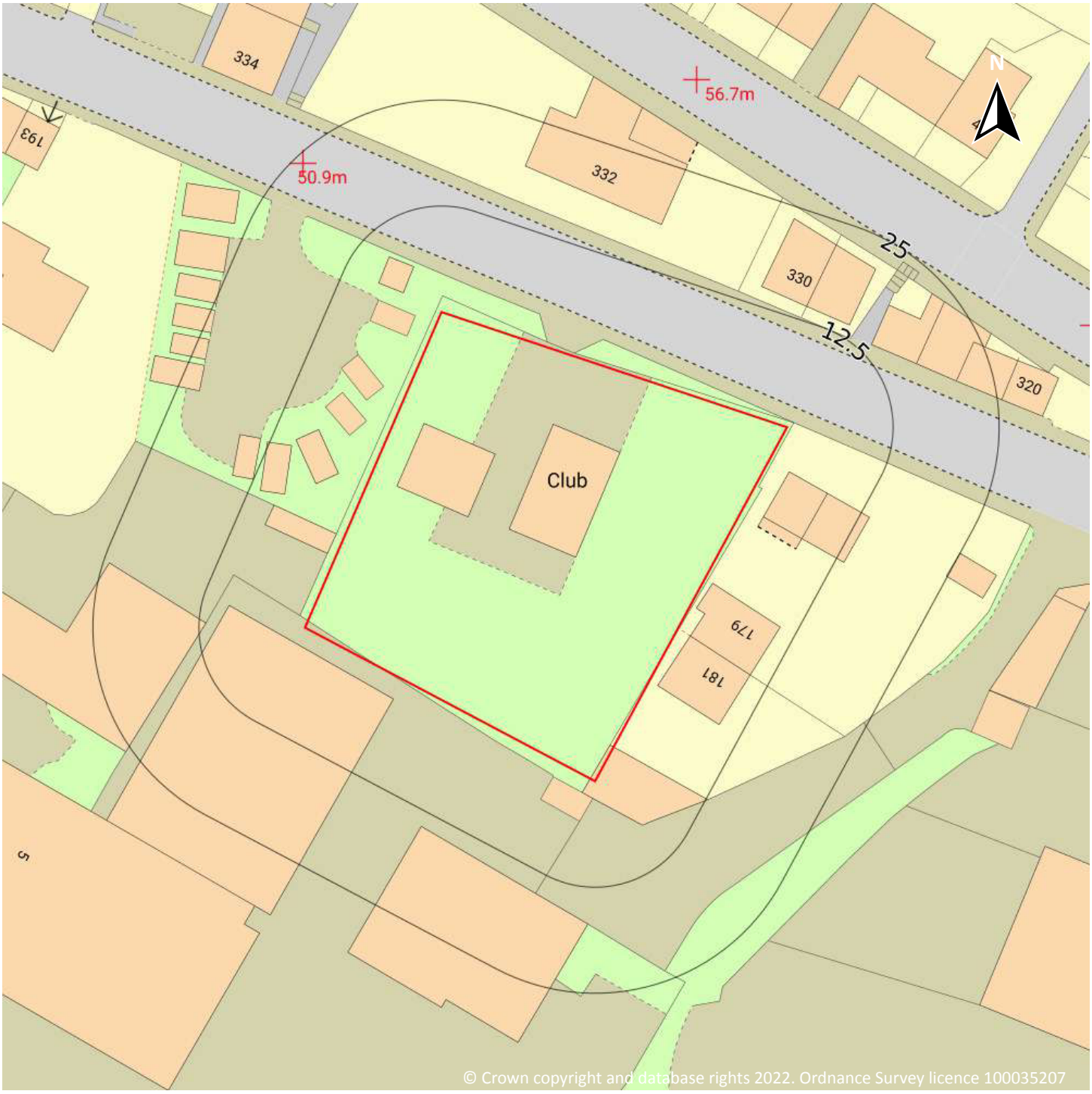
Site Area: 0.18ha

Recent site history - 1999 aerial photograph

Capture Date: 10/07/1999

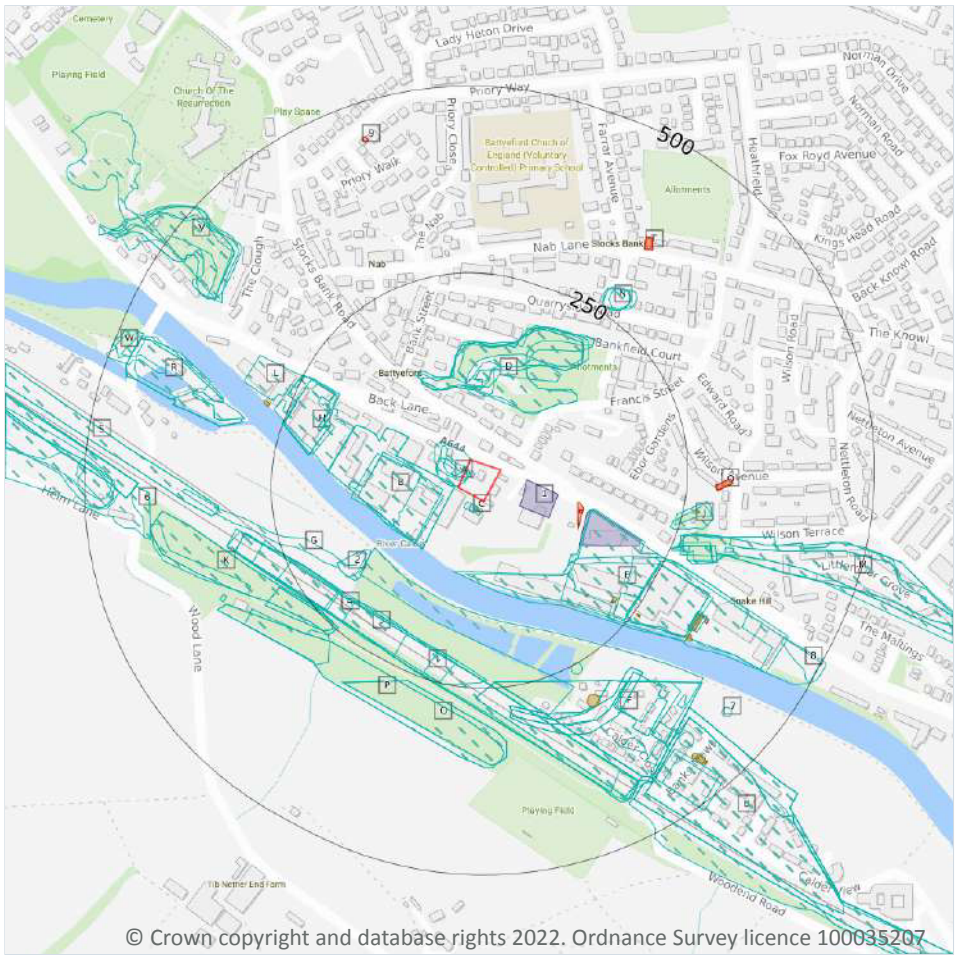
Site Area: 0.18ha

OS MasterMap site plan



Site Area: 0.18ha

1 Past land use



Site Outline

Search buffers in metres (m)

Historical industrial land uses

Historical tanks

Historical energy features

Historical garages

1.1 Historical industrial land uses

Records within 500m	127

Potentially contaminative land use features digitised from historical Ordnance Survey mapping at 1:10,000 and 1:10,560 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use map on **page 13**

ID	Location	Land use	Dates present	Group ID
A	**On site**	**Unspecified Ground Workings**	**1951**	**1412323**

ID	Location	Land use	Dates present	Group ID
A	**On site**	**Unspecified Heap**	**1938**	**1485519**
A	**On site**	**Unspecified Heap**	**1966 - 1975**	**1510118**
A	**On site**	**Unspecified Heap**	**1985**	**1512861**
B	5m W	Sands Mill	1948	1477489
B	5m W	Unspecified Mills	1892 - 1905	1484182
C	11m S	Unspecified Tank	1951	1515359
C	11m SW	Unspecified Tank	1938	1519479
B	21m W	Sands Mill	1931 - 1938	1499397
B	22m SW	Unspecified Mill	1966 - 1975	1478899
B	52m W	Sands Mill	1951	1511112
D	83m NE	Unspecified Quarry	1985	1531605
D	83m NE	Unspecified Disused Quarry	1966 - 1975	1551208
D	85m N	Refuse Heap	1892	1436665
D	95m N	Unspecified Quarry	1948	1468206
D	95m N	Unspecified Quarry	1905 - 1931	1476204
E	95m S	Unspecified Mills	1975 - 1985	1550698
D	98m N	Unspecified Quarry	1938	1540415
E	98m S	Unspecified Mill	1951	1421641
D	99m N	Unspecified Ground Workings	1951	1412324
D	104m N	Unspecified Quarry	1951	1522259
E	132m E	Unspecified Mills	1892 - 1948	1502249
F	136m SW	Unspecified Commercial/Industrial	1938	1493012
E	142m SE	Unspecified Mills	1966	1509495
G	144m SW	Unspecified Ground Workings	1951	1412268
2	151m SW	Unspecified Heap	1975 - 1985	1541442
H	160m NW	Unspecified Mill	1966 - 1985	1480920
H	184m W	Unspecified Mill	1948 - 1951	1460174
H	190m W	Unspecified Mill	1938	1471631

ID	Location	Land use	Dates present	Group ID
H	190m W	Unspecified Mill	1931	1477885
3	196m SW	Cuttings	1966 - 1985	1468941
4	200m SW	Cuttings	1951	1515646
I	201m SW	Cuttings	1938	1507090
I	204m SW	Cuttings	1905 - 1931	1474232
I	204m SW	Cuttings	1948	1524299
I	204m SW	Cuttings	1892	1525174
I	208m S	Cuttings	1966 - 1985	1537804
E	211m SE	Unspecified Mills	1951	1462939
G	211m SW	Cuttings	1975 - 1985	1510968
G	211m SW	Cuttings	1966	1533561
J	240m E	Unspecified Quarry	1966 - 1985	1546731
F	242m S	Unspecified Kiln	1956	1435438
F	242m S	Unspecified Commercial/Industrial	1988	1464025
F	242m S	Unspecified Commercial/Industrial	1975	1474238
F	242m S	Cuttings	1956 - 1965	1482386
F	242m S	Cuttings	1975 - 1988	1556393
E	242m SE	Unspecified Mills	1938	1493915
J	243m E	Unspecified Quarry	1951	1489611
E	244m SE	Unspecified Mills	1948	1472013
E	244m SE	Unspecified Mills	1905 - 1931	1538082
G	246m SW	Unspecified Heap	1966	1505772
G	246m SW	Unspecified Heap	1951	1528706
K	246m SW	Unspecified Heap	1985	1493535
K	246m SW	Unspecified Heap	1975	1540517
L	248m NW	Unspecified Mill	1966 - 1985	1533308
F	249m SE	Malt Kiln	1938	1423565
J	252m E	Railway Station	1948	1459891

ID	Location	Land use	Dates present	Group ID
J	252m E	Railway Station	1905 - 1931	1463671
M	257m E	Railway Sidings	1938	1461996
M	258m E	Railway Sidings	1966	1545531
M	258m E	Railway Sidings	1951	1555392
N	258m NE	Unspecified Pit	1931	1510463
N	258m NE	Unspecified Pit	1948	1520153
M	259m E	Railway Sidings	1905 - 1931	1480561
M	259m E	Railway Sidings	1948	1548100
N	259m NE	Unspecified Heap	1938	1530731
O	261m S	Unspecified Heap	1975 - 1988	1464949
O	261m S	Unspecified Heap	1956 - 1965	1478316
G	263m SW	Unspecified Heap	1966 - 1985	1495972
J	264m E	Railway Station	1938	1554891
N	264m NE	Unspecified Pit	1951	1478018
P	264m SW	Unspecified Heap	1948	1490867
P	264m SW	Unspecified Heap	1931	1517186
J	272m E	Railway Station	1951	1479300
F	276m S	Railway Sidings	1975	1463162
F	276m S	Railway Sidings	1956	1503376
F	276m S	Railway Sidings	1965	1541762
F	281m S	Railway Sidings	1948	1474518
F	281m S	Railway Sidings	1892 - 1931	1498539
R	300m W	Boat Building Yard	1931 - 1938	1539730
R	301m W	Unspecified Yard	1905	1458410
R	301m W	Unspecified Yard	1948	1517270
F	304m SE	Malt Kiln	1948	1505396
F	304m SE	Malt Kiln	1905 - 1931	1513894
K	307m SW	Unspecified Ground Workings	1951 - 1966	1479969

ID	Location	Land use	Dates present	Group ID
F	312m SE	Unspecified Works	1965	1438241
J	318m E	Railway Building	1951	1429020
E	322m SE	Unspecified Tanks	1948	1542479
E	322m SE	Unspecified Tanks	1931	1542722
S	322m W	Unspecified Pit	1966	1493132
S	322m W	Unspecified Pit	1975 - 1985	1544852
E	322m SE	Unspecified Tanks	1938	1476849
E	329m SE	Unspecified Tanks	1951	1425836
K	342m SW	Railway Building	1938	1429019
R	360m W	Boat Building Yard	1951	1505878
F	371m SE	Unspecified Heap	1988	1415196
F	373m SE	Unspecified Kiln	1956	1435440
F	377m SE	Malt Kiln	1948	1493949
F	377m SE	Malt Kiln	1905 - 1931	1529336
U	389m SE	Railway Sidings	1966	1458282
U	389m SE	Railway Sidings	1965	1458283
U	389m SE	Railway Sidings	1956	1459391
V	393m NW	Unspecified Ground Workings	1892	1412325
U	399m SE	Railway Sidings	1905	1485729
U	399m SE	Railway Sidings	1892	1508854
U	399m SE	Railway Sidings	1938 - 1948	1530666
U	399m SE	Railway Sidings	1931	1536916
5	400m NW	Unspecified Quarry	1951 - 1975	1530518
V	404m NW	Unspecified Quarry	1985	1493824
V	404m NW	Unspecified Quarry	1931 - 1948	1499997
V	404m NW	Unspecified Quarry	1905	1515516
F	409m SE	Unspecified Tank	1975	1433470
6	413m W	Refuse Heap	1892	1436664

ID	Location	Land use	Dates present	Group ID
S	413m W	Colliery	1892 - 1905	1461420
F	418m SE	Engine Shed	1905 - 1965	1526492
W	419m W	Unspecified Mill	1892	1421640
7	424m SE	Malt Kiln	1938	1423564
S	428m W	Railway Sidings	1948	1478929
S	428m W	Railway Sidings	1931	1517758
S	428m W	Railway Sidings	1892 - 1905	1526217
F	430m SE	Railway Building	1892	1429021
8	439m SE	Refuse Heap	1966	1436663
S	455m W	Unspecified Heap	1951	1495908
S	459m W	Refuse Heap	1892 - 1905	1496738
S	462m W	Unspecified Heap	1931 - 1948	1491614
S	463m W	Unspecified Heaps	1966 - 1985	1475129
W	468m NW	Cuttings	1966	1409837

This data is sourced from Ordnance Survey / Groundsure.

1.2 Historical tanks

Records within 500m	**14**

Tank features digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use map on **page 13**

ID	Location	Land use	Dates present	Group ID
C	14m S	Unspecified Tank	1933	223709
E	215m SE	Tanks	1922 - 1933	249611
E	217m SE	Unspecified Tank	1957	238887
E	218m SE	Unspecified Tank	1957	234220

ID	Location	Land use	Dates present	Group ID
E	254m SE	Unspecified Tank	1893 - 1907	243655
E	257m SE	Unspecified Tank	1957	237415
J	268m E	Unspecified Tank	1907	223707
L	275m W	Tanks	1933	230754
F	296m SE	Unspecified Tank	1989	223708
E	326m SE	Tanks	1922 - 1933	234254
E	327m SE	Tanks	1922 - 1933	238159
F	439m SE	Unspecified Tank	1989	223706
F	446m SE	Tanks	1957	239069
F	456m SE	Tanks	1957	240190

This data is sourced from Ordnance Survey / Groundsure.

1.3 Historical energy features

Records within 500m	**10**

Energy features digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use map on **page 13**

ID	Location	Land use	Dates present	Group ID
E	112m E	Electricity Substation	1996	135550
E	118m E	Electricity Substation	1983	132595
E	119m E	Electricity Substation	1972	145803
E	184m SE	Electricity Substation	1972 - 1996	141371
Q	288m E	Electricity Substation	1972 - 1983	145727
Q	289m E	Electricity Substation	1996	140972
E	337m SE	Electricity Substation	1996	129136
T	352m NE	Electricity Substation	1970	146455

ID	Location	Land use	Dates present	Group ID
T	353m NE	Electricity Substation	1981 - 1996	136051
9	447m N	Electricity Substation	1970 - 1994	144158

This data is sourced from Ordnance Survey / Groundsure.

1.4 Historical petrol stations

Records within 500m	0

Petrol stations digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

This data is sourced from Ordnance Survey / Groundsure.

1.5 Historical garages

Records within 500m	2

Garages digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale, intelligently grouped into contiguous features. To prevent misrepresentation of the size of historical features at any given time, features are only grouped if they have similar geometries within immediately preceding or succeeding map editions. See section 2 for a breakdown of grouping if required. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use map on **page 13**

ID	Location	Land use	Dates present	Group ID
1	38m E	Garage	1982	41106
E	129m E	Garage	1972 - 1983	44898

This data is sourced from Ordnance Survey / Groundsure.

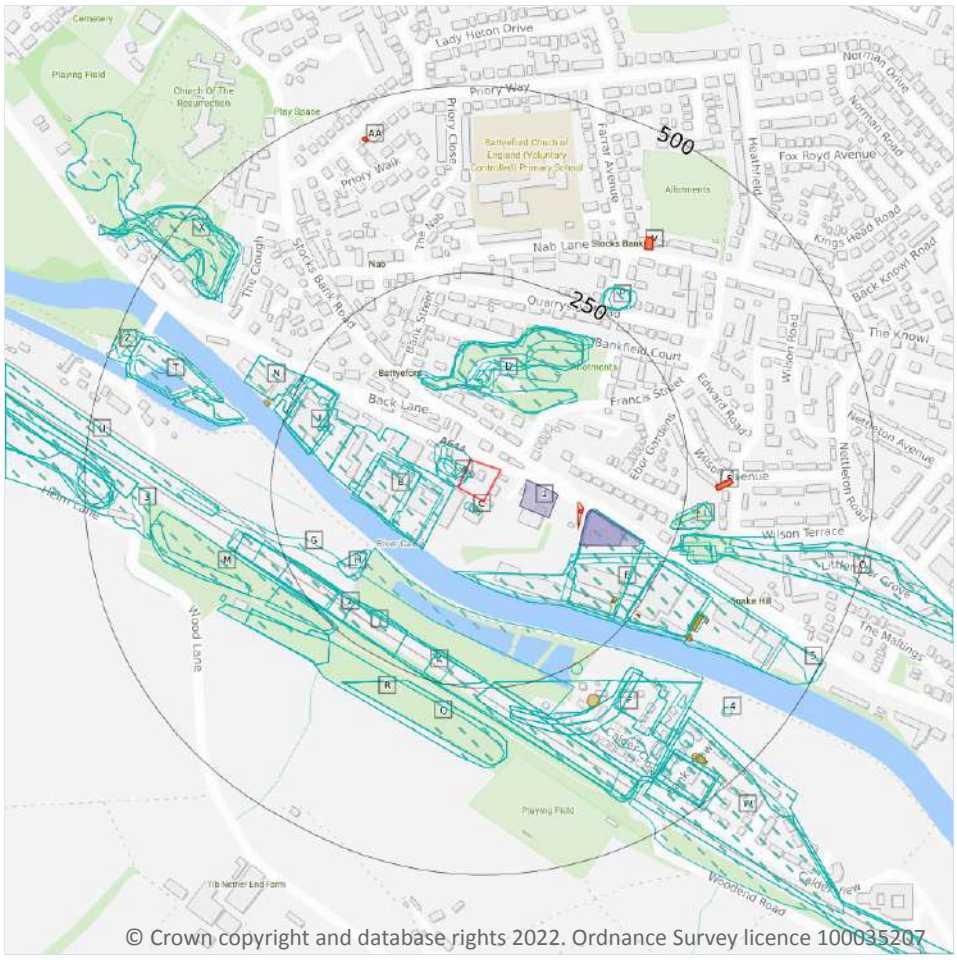
1.6 Historical military land

Records within 500m	0

Areas of military land digitised from multiple sources including the National Archives, local records, MOD records and verified other sources, intelligently grouped into contiguous features.

This data is sourced from Ordnance Survey / Groundsure / other sources.

2 Past land use - un-grouped



Site Outline

Search buffers in metres (m)

Historical industrial land uses

Historical tanks

Historical energy features

Historical garages

2.1 Historical industrial land uses

Records within 500m	187

Potentially contaminative land use features digitised from historical Ordnance Survey mapping at 1:10,000 and 10,560 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use - un-grouped map on **page 21**

ID	Location	Land Use	Date	Group ID
A	**On site**	**Unspecified Ground Workings**	**1951**	**1412323**
A	**On site**	**Unspecified Heap**	**1966**	**1510118**
A	**On site**	**Unspecified Heap**	**1985**	**1512861**

ID	Location	Land Use	Date	Group ID
A	**On site**	**Unspecified Heap**	**1975**	**1510118**
A	**On site**	**Unspecified Heap**	**1938**	**1485519**
A	**On site**	**Unspecified Heap**	**1938**	**1485519**
B	5m W	Sands Mill	1948	1477489
B	5m W	Unspecified Mills	1905	1484182
B	5m W	Unspecified Mills	1892	1484182
C	11m S	Unspecified Tank	1951	1515359
C	11m SW	Unspecified Tank	1938	1519479
B	21m W	Sands Mill	1938	1499397
B	22m SW	Unspecified Mill	1975	1478899
B	52m W	Sands Mill	1951	1511112
B	53m W	Unspecified Mill	1966	1478899
B	60m W	Sands Mill	1931	1499397
D	83m NE	Unspecified Quarry	1985	1531605
D	83m NE	Unspecified Disused Quarry	1975	1551208
D	85m NE	Unspecified Disused Quarry	1966	1551208
D	85m N	Refuse Heap	1892	1436665
D	95m N	Unspecified Quarry	1948	1468206
D	95m N	Unspecified Quarry	1905	1476204
D	95m N	Unspecified Quarry	1931	1476204
E	95m S	Unspecified Mills	1985	1550698
E	95m S	Unspecified Mills	1975	1550698
D	98m N	Unspecified Quarry	1938	1540415
E	98m S	Unspecified Mill	1951	1421641
D	99m N	Unspecified Ground Workings	1951	1412324
D	104m N	Unspecified Quarry	1951	1522259
E	132m E	Unspecified Mills	1948	1502249
E	132m E	Unspecified Mills	1905	1502249

ID	Location	Land Use	Date	Group ID
E	132m E	Unspecified Mills	1892	1502249
E	132m E	Unspecified Mills	1931	1502249
F	136m SW	Unspecified Commercial/Industrial	1938	1493012
E	136m SE	Unspecified Mills	1938	1502249
E	142m SE	Unspecified Mills	1966	1509495
G	144m SW	Unspecified Ground Workings	1951	1412268
H	151m SW	Unspecified Heap	1985	1541442
H	151m SW	Unspecified Heap	1975	1541442
I	160m NW	Unspecified Mill	1966	1480920
I	160m NW	Unspecified Mill	1985	1480920
I	160m NW	Unspecified Mill	1975	1480920
I	184m W	Unspecified Mill	1951	1460174
I	190m W	Unspecified Mill	1938	1471631
I	190m W	Unspecified Mill	1948	1460174
I	190m W	Unspecified Mill	1931	1477885
J	196m SW	Cuttings	1966	1468941
J	196m SW	Cuttings	1985	1468941
J	196m SW	Cuttings	1975	1468941
2	200m SW	Cuttings	1951	1515646
K	201m SW	Cuttings	1938	1507090
K	204m SW	Cuttings	1948	1524299
K	204m SW	Cuttings	1905	1474232
K	204m SW	Cuttings	1892	1525174
K	204m SW	Cuttings	1931	1474232
K	208m S	Cuttings	1966	1537804
K	208m S	Cuttings	1985	1537804
K	208m S	Cuttings	1975	1537804
E	211m SE	Unspecified Mills	1951	1462939

ID	Location	Land Use	Date	Group ID
G	211m SW	Cuttings	1985	1510968
G	211m SW	Cuttings	1975	1510968
G	211m SW	Cuttings	1966	1533561
L	240m E	Unspecified Quarry	1966	1546731
L	240m E	Unspecified Quarry	1985	1546731
L	240m E	Unspecified Quarry	1975	1546731
F	242m S	Unspecified Commercial/Industrial	1988	1464025
F	242m S	Cuttings	1988	1556393
F	242m S	Cuttings	1965	1482386
F	242m S	Cuttings	1956	1482386
F	242m S	Cuttings	1975	1556393
F	242m S	Unspecified Kiln	1956	1435438
F	242m S	Unspecified Commercial/Industrial	1975	1474238
E	242m SE	Unspecified Mills	1938	1493915
L	243m E	Unspecified Quarry	1951	1489611
E	244m SE	Unspecified Mills	1948	1472013
E	244m SE	Unspecified Mills	1905	1538082
E	244m SE	Unspecified Mills	1931	1538082
G	246m SW	Unspecified Heap	1951	1528706
G	246m SW	Unspecified Heap	1966	1505772
M	246m SW	Unspecified Heap	1985	1493535
M	246m SW	Unspecified Heap	1975	1540517
N	248m NW	Unspecified Mill	1966	1533308
N	248m NW	Unspecified Mill	1985	1533308
N	248m NW	Unspecified Mill	1975	1533308
F	249m SE	Malt Kiln	1938	1423565
L	252m E	Railway Station	1948	1459891
L	252m E	Railway Station	1905	1463671

ID	Location	Land Use	Date	Group ID
L	252m E	Railway Station	1931	1463671
O	257m E	Railway Sidings	1938	1461996
O	258m E	Railway Sidings	1951	1555392
O	258m E	Railway Sidings	1966	1545531
P	258m NE	Unspecified Pit	1948	1520153
P	258m NE	Unspecified Pit	1931	1510463
O	259m E	Railway Sidings	1948	1548100
O	259m E	Railway Sidings	1905	1480561
O	259m E	Railway Sidings	1931	1480561
P	259m NE	Unspecified Heap	1938	1530731
P	259m NE	Unspecified Heap	1938	1530731
Q	261m S	Unspecified Heap	1988	1464949
Q	261m S	Unspecified Heap	1965	1478316
Q	261m S	Unspecified Heap	1956	1478316
Q	261m S	Unspecified Heap	1975	1464949
G	263m SW	Unspecified Heap	1966	1495972
G	263m SW	Unspecified Heap	1985	1495972
G	263m SW	Unspecified Heap	1975	1495972
L	264m E	Railway Station	1938	1554891
P	264m NE	Unspecified Pit	1951	1478018
R	264m SW	Unspecified Heap	1948	1490867
R	264m SW	Unspecified Heap	1931	1517186
L	272m E	Railway Station	1951	1479300
F	276m S	Railway Sidings	1965	1541762
F	276m S	Railway Sidings	1956	1503376
F	276m S	Railway Sidings	1975	1463162
F	281m S	Railway Sidings	1948	1474518
F	281m S	Railway Sidings	1905	1498539

ID	Location	Land Use	Date	Group ID
F	281m S	Railway Sidings	1892	1498539
F	281m S	Railway Sidings	1931	1498539
T	300m W	Boat Building Yard	1938	1539730
T	301m W	Unspecified Yard	1948	1517270
T	301m W	Unspecified Yard	1905	1458410
T	301m W	Boat Building Yard	1931	1539730
F	304m SE	Malt Kiln	1948	1505396
F	304m SE	Malt Kiln	1905	1513894
F	304m SE	Malt Kiln	1931	1513894
M	307m SW	Unspecified Ground Workings	1951	1479969
M	307m SW	Unspecified Ground Workings	1966	1479969
F	312m SE	Unspecified Works	1965	1438241
L	318m E	Railway Building	1951	1429020
E	322m SE	Unspecified Tanks	1948	1542479
E	322m SE	Unspecified Tanks	1931	1542722
U	322m W	Unspecified Pit	1966	1493132
U	322m W	Unspecified Pit	1985	1544852
U	322m W	Unspecified Pit	1975	1544852
E	322m SE	Unspecified Tanks	1938	1476849
E	329m SE	Unspecified Tanks	1951	1425836
M	342m SW	Railway Building	1938	1429019
T	360m W	Boat Building Yard	1951	1505878
F	371m SE	Unspecified Heap	1988	1415196
F	373m SE	Unspecified Kiln	1956	1435440
F	377m SE	Malt Kiln	1948	1493949
F	377m SE	Malt Kiln	1905	1529336
F	377m SE	Malt Kiln	1931	1529336
W	389m SE	Railway Sidings	1965	1458283

ID	Location	Land Use	Date	Group ID
W	389m SE	Railway Sidings	1956	1459391
X	393m NW	Unspecified Ground Workings	1892	1412325
W	399m SE	Railway Sidings	1948	1530666
W	399m SE	Railway Sidings	1905	1485729
W	399m SE	Railway Sidings	1892	1508854
W	399m SE	Railway Sidings	1931	1536916
Y	400m NW	Unspecified Quarry	1951	1530518
Y	400m NW	Unspecified Quarry	1966	1530518
Y	400m NW	Unspecified Quarry	1975	1530518
W	401m SE	Railway Sidings	1938	1530666
X	404m NW	Unspecified Quarry	1985	1493824
X	404m NW	Unspecified Quarry	1948	1499997
X	404m NW	Unspecified Quarry	1905	1515516
X	404m NW	Unspecified Quarry	1931	1499997
F	409m SE	Unspecified Tank	1975	1433470
X	409m NW	Unspecified Quarry	1938	1499997
3	413m W	Refuse Heap	1892	1436664
U	413m W	Colliery	1905	1461420
U	413m W	Colliery	1892	1461420
F	418m SE	Engine Shed	1965	1526492
F	418m SE	Engine Shed	1956	1526492
Z	419m W	Unspecified Mill	1892	1421640
F	420m SE	Engine Shed	1938	1526492
F	422m SE	Engine Shed	1948	1526492
F	422m SE	Engine Shed	1905	1526492
F	422m SE	Engine Shed	1931	1526492
4	424m SE	Malt Kiln	1938	1423564
U	428m W	Railway Sidings	1948	1478929

ID	Location	Land Use	Date	Group ID
U	428m W	Railway Sidings	1905	1526217
U	428m W	Railway Sidings	1892	1526217
U	428m W	Railway Sidings	1931	1517758
F	430m SE	Railway Building	1892	1429021
5	439m SE	Refuse Heap	1966	1436663
U	455m W	Unspecified Heap	1951	1495908
U	459m W	Refuse Heap	1905	1496738
U	459m W	Refuse Heap	1892	1496738
U	462m W	Unspecified Heap	1948	1491614
U	462m W	Unspecified Heap	1931	1491614
U	463m W	Unspecified Heaps	1966	1475129
U	463m W	Unspecified Heaps	1985	1475129
U	463m W	Unspecified Heaps	1975	1475129
U	466m W	Unspecified Heap	1938	1491614
U	466m W	Unspecified Heap	1938	1491614
Z	468m NW	Cuttings	1966	1409837

This data is sourced from Ordnance Survey / Groundsure.

2.2 Historical tanks

Records within 500m	**19**

Tank features digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use - un-grouped map on **page 21**

ID	Location	Land Use	Date	Group ID
C	14m S	Unspecified Tank	1933	223709
E	215m SE	Tanks	1922	249611
E	215m SE	Tanks	1933	249611
E	217m SE	Unspecified Tank	1957	238887

ID	Location	Land Use	Date	Group ID
E	218m SE	Unspecified Tank	1957	234220
E	254m SE	Unspecified Tank	1893	243655
E	254m SE	Unspecified Tank	1907	243655
E	257m SE	Unspecified Tank	1957	237415
E	257m SE	Unspecified Tank	1957	237415
L	268m E	Unspecified Tank	1907	223707
N	275m W	Tanks	1933	230754
F	296m SE	Unspecified Tank	1989	223708
E	326m SE	Tanks	1922	234254
E	326m SE	Tanks	1933	234254
E	327m SE	Tanks	1922	238159
E	327m SE	Tanks	1933	238159
F	439m SE	Unspecified Tank	1989	223706
F	446m SE	Tanks	1957	239069
F	456m SE	Tanks	1957	240190

This data is sourced from Ordnance Survey / Groundsure.

2.3 Historical energy features

Records within 500m	**18**

Energy features digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use - un-grouped map on **page 21**

ID	Location	Land Use	Date	Group ID
E	112m E	Electricity Substation	1996	135550
E	118m E	Electricity Substation	1983	132595
E	119m E	Electricity Substation	1972	145803
E	184m SE	Electricity Substation	1972	141371
E	184m SE	Electricity Substation	1983	141371

ID	Location	Land Use	Date	Group ID
E	184m SE	Electricity Substation	1996	141371
S	288m E	Electricity Substation	1983	145727
S	289m E	Electricity Substation	1996	140972
S	289m E	Electricity Substation	1972	145727
E	337m SE	Electricity Substation	1996	129136
V	352m NE	Electricity Substation	1970	146455
V	353m NE	Electricity Substation	1996	136051
V	353m NE	Electricity Substation	1981	136051
V	353m NE	Electricity Substation	1984	136051
V	353m NE	Electricity Substation	1990	136051
AA	447m N	Electricity Substation	1994	144158
AA	447m N	Electricity Substation	1970	144158
AA	449m N	Electricity Substation	1984	144158

This data is sourced from Ordnance Survey / Groundsure.

2.4 Historical petrol stations

Records within 500m	0

Petrol stations digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

This data is sourced from Ordnance Survey / Groundsure.

2.5 Historical garages

Records within 500m	3

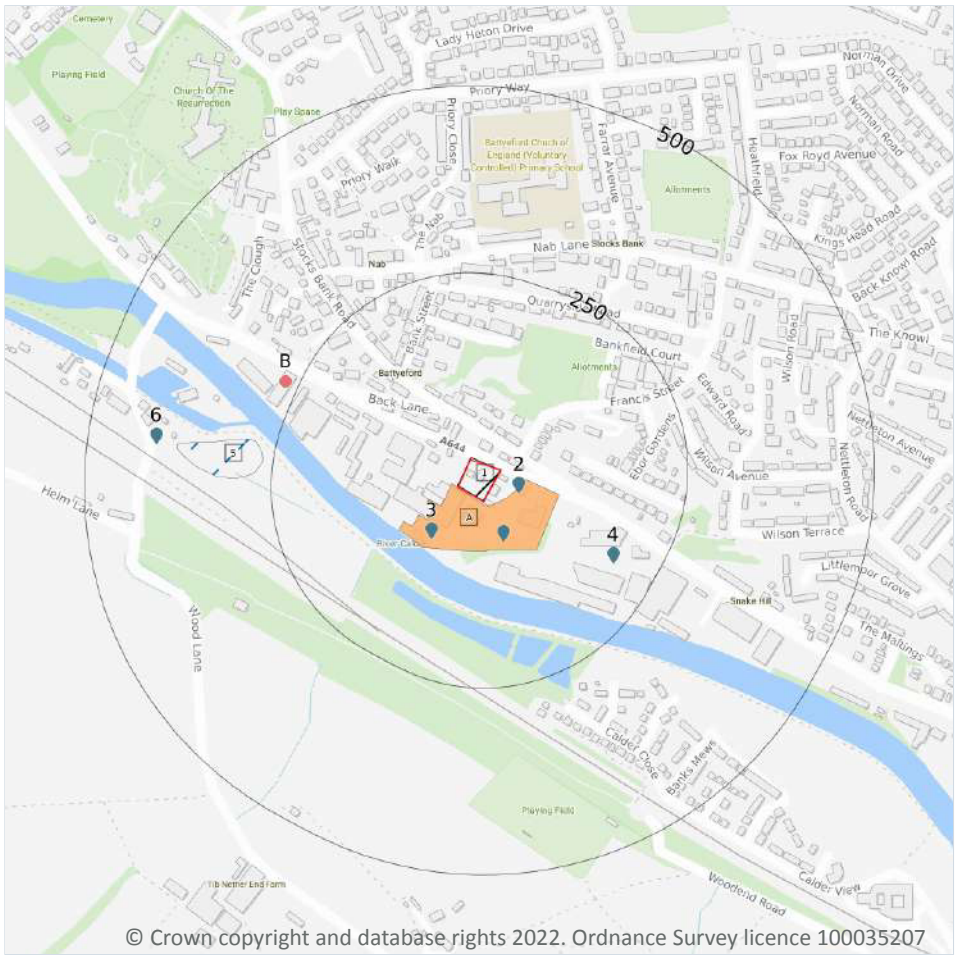
Garages digitised from historical Ordnance Survey mapping at high-detail 1:1,250 and 1:2,500 scale. Any records shown are available intelligently grouped in section 1. Grouped and the original un-grouped features can be cross-referenced across sections 1 and 2 using the 'Group ID'.

Features are displayed on the Past land use - un-grouped map on **page 21**

ID	Location	Land Use	Date	Group ID
1	38m E	Garage	1982	41106
E	129m E	Garage	1983	44898
E	131m E	Garage	1972	44898

This data is sourced from Ordnance Survey / Groundsure.

3 Waste and landfill



Site Outline

Search buffers in metres (m)

Active or recent landfill

Historical landfill (EA/NRW)

Historical waste sites

Licensed waste sites

Waste exemptions

3.1 Active or recent landfill

Records within 500m	1

Active or recently closed landfill sites under Environment Agency/Natural Resources Wales regulation.

Features are displayed on the Waste and landfill map on **page 32**

ID	Location	Details	
5	264m W	Operator: British Waterways Board Site Address: Land/premises At, Wood Lane, Battyeford, Mirfield, Dewsbury, West Yorkshire, WF14 0ED	WML Number: 61005 EPR Reference: BRI013 Landfill type: A06: Landfill taking other wastes Status: Closure IPPC Reference: - EPR Number: EA/EPR/XP3195ZS/A001

This data is sourced from the Environment Agency and Natural Resources Wales.

3.2 Historical landfill (BGS records)

Records within 500m	0

Landfill sites identified on a survey carried out on behalf of the DoE in 1973. These sites may have been closed or operational at this time.

This data is sourced from the British Geological Survey.

3.3 Historical landfill (LA/mapping records)

Records within 500m	0

Landfill sites identified from Local Authority records and high detail historical mapping.

This data is sourced from the Ordnance Survey/Groundsure and Local Authority records.

3.4 Historical landfill (EA/NRW records)

Records within 500m	1

Known historical (closed) landfill sites (e.g. sites where there is no PPC permit or waste management licence currently in force). This includes sites that existed before the waste licensing regime and sites that have been licensed in the past but where a licence has been revoked, ceased to exist or surrendered and a certificate of completion has been issued.

Features are displayed on the Waste and landfill map on **page 32**

ID	Location	Details		
1	**On site**	**Site Address: Sandsfield, Huddersfield Road, Battyeford Licence Holder Address: Meadow Bank, Mirfield**	**Waste Licence: - Site Reference: 4700/0181 Waste Type: Inert, Commercial Environmental Permitting Regulations (Waste) Reference: - Licence Issue: - Licence Surrender: -**	**Operator: - Licence Holder: Messrs J W Blackburn First Recorded 01/01/1944 Last Recorded: -**

This data is sourced from the Environment Agency and Natural Resources Wales.

3.5 Historical waste sites

Records within 500m	1

Waste site records derived from Local Authority planning records and high detail historical mapping.

Features are displayed on the Waste and landfill map on **page 32**

ID	Location	Address	Further Details	Date
A	**On site**	**Site Address: N/A**	**Type of Site: Scrap Yard** **Planning application reference: N/A** **Description: N/A** **Data source: Historic Mapping** **Data Type: Polygon**	**1994**

This data is sourced from Ordnance Survey/Groundsure and Local Authority records.

3.6 Licensed waste sites

Records within 500m	**5**

Active or recently closed waste sites under Environment Agency/Natural Resources Wales regulation.

Features are displayed on the Waste and landfill map on **page 32**

ID	Location	Details		
2	30m E	Site Name: S S Motor Spares Site Address: Land/premises At, Huddersfield Road, Mirfield, Dewsbury, West Yorkshire, WF14 9DQ Correspondence Address: -	Type of Site: Metal Recycling Site (Vehicle Dismantler) Size: 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: SSM001 EPR reference: EA/EPR/XP3795ZN/A001 Operator: Charles W J Saunders Waste Management licence No: 61006 Annual Tonnage: 2500	Issue Date: 10/01/1991 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Expired
A	50m SE	Site Name: Ss Components Ltd Site Address: Land/premises At, Huddersfield Road, Mirfield, Mirfield, West Yorkshire, WF14 9DQ Correspondence Address: -	Type of Site: ELV Facility Size: 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: 000219 EPR reference: EA/EPR/EP3192ZB/A001 Operator: Ss Components Ltd Waste Management licence No: 65414 Annual Tonnage: 2500	Issue Date: 16/03/2005 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued

ID	Location	Details		
3	68m SW	Site Name: Ss Components Ltd Site Address: Land/premises At, Huddersfield Road, Mirfield, Mirfield, West Yorkshire, WF14 9DQ Correspondence Address: -	Type of Site: ELV Facility Size: 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: 000219 EPR reference: EA/EPR/EP3192ZB/A001 Operator: S S Components Ltd Waste Management licence No: 65414 Annual Tonnage: 2500	Issue Date: 16/03/2005 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued
4	186m SE	Site Name: Mirfield Motor Spares Ltd Site Address: 157, Huddersfield Road, Mirfield, West Yorkshire, WF14 9DQ Correspondence Address: -	Type of Site: ELV Facility Size: 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: 000169 EPR reference: EA/EPR/ZP3592ZX/A001 Operator: Mirfield Motor Spares Ltd Waste Management licence No: 65376 Annual Tonnage: 2500	Issue Date: 23/06/2004 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Issued
6	410m W	Site Name: Battyeford Lock Site Address: Land/premises At, Wood Lane, Battyeford, Mirfield, Dewsbury, West Yorkshire, WF14 0ED Correspondence Address: -	Type of Site: Landfill taking other wastes Size: 25000 tonnes Environmental Permitting Regulations (Waste) Licence Number: BRI013 EPR reference: EA/EPR/XP3195ZS/A001 Operator: British Waterways Board Waste Management licence No: 61005 Annual Tonnage: 5000	Issue Date: 22/07/1991 Effective Date: - Modified: - Surrendered Date: - Expiry Date: - Cancelled Date: - Status: Closure

This data is sourced from the Environment Agency and Natural Resources Wales.

3.7 Waste exemptions

Records within 500m	**3**

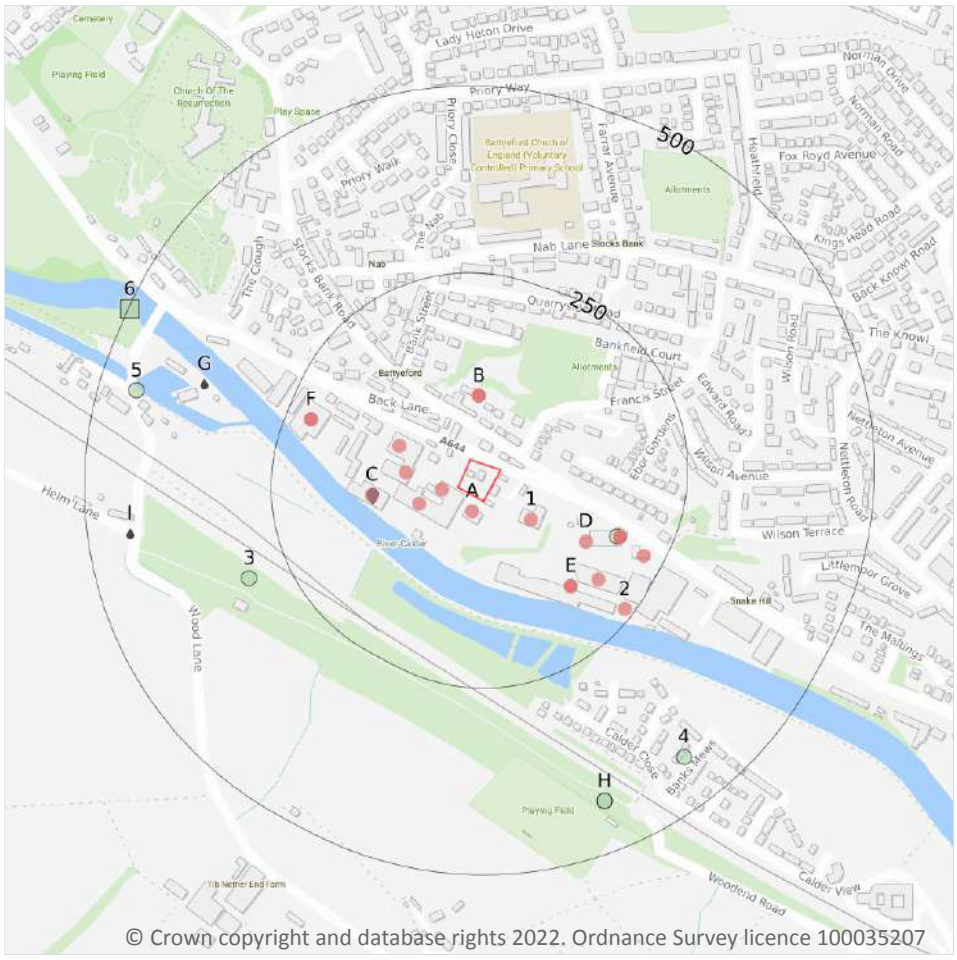
Activities involving the storage, treatment, use or disposal of waste that are exempt from needing a permit. Exemptions have specific limits and conditions that must be adhered to.

Features are displayed on the Waste and landfill map on **page 32**

ID	Location	Site	Reference	Category	Sub-Category	Description
B	269m NW	PERSEVERANCE MILLS, HUDDERSFIELD ROAD, MIRFIELD, WF14 9DL	WEX086606	Using waste exemption	Not on a farm	Use of waste in construction
B	269m NW	PERSEVERANCE MILLS, HUDDERSFIELD ROAD, MIRFIELD, WF14 9DL	WEX086606	Using waste exemption	Not on a farm	Incorporation of ash into soil
B	269m NW	PERSEVERANCE MILLS, HUDDERSFIELD ROAD, MIRFIELD, WF14 9DL	WEX086606	Using waste exemption	Not on a farm	Use of waste to manufacture finished goods

This data is sourced from the Environment Agency and Natural Resources Wales.

4 Current industrial land use



© Crown copyright and database rights 2022. Ordnance Survey licence 100035207

Site Outline

Search buffers in metres (m)

Recent industrial land uses

Licensed pollutant release (Part A(2)/B)

Licensed Discharges to controlled waters

List 2 Dangerous Substances

Pollution Incidents (EA/NRW)

4.1 Recent industrial land uses

Records within 250m	19

Current potentially contaminative industrial sites.

Features are displayed on the Current industrial land use map on **page 37**

ID	Location	Company	Address	Activity	Category
A	19m SW	S S Components Ltd	Huddersfield Road, Mirfield, West Yorkshire, WF14 9DQ	Vehicle Parts and Accessories	Motoring
A	22m W	A & D Accident Repair Centre Ltd	Liversedge Mills, Huddersfield Road, Mirfield, West Yorkshire, WF14 9DQ	Vehicle Repair, Testing and Servicing	Repair and Servicing

ID	Location	Company	Address	Activity	Category
A	57m W	J T F Fabrications	Unit 4 Sands Industrial Estate, Huddersfield Road, Mirfield, West Yorkshire, WF14 9DQ	General Construction Supplies	Industrial Products
1	67m SE	Karwan Autos Ltd	189, Huddersfield Road, Mirfield, West Yorkshire, WF14 9DQ	Secondhand Vehicles	Motoring
A	73m W	R K Fabrications UK Ltd	Unit 1, Liversedge Mills, Huddersfield Road, Mirfield, West Yorkshire, WF14 9DQ	Metals Manufacturers, Fabricators and Stockholders	Industrial Products
B	86m N	Works	West Yorkshire, WF14	Unspecified Works Or Factories	Industrial Features
B	87m N	Sando's Ice Cream	Sandos Ice Cream 56, Stocks Bank Road, Mirfield, West Yorkshire, WF14 9PZ	Food and Beverage Industry Machinery	Industrial Products
A	94m NW	Hypergraph Laboratory Supplies	Sands Mill, Huddersfield Road, Mirfield, West Yorkshire, WF14 9DQ	Medical Equipment, Supplies and Pharmaceuticals	Industrial Products
C	116m W	Caldercote Ltd	Unit 1 and 2 Sands Industrial Estate, Huddersfield Road, Mirfield, West Yorkshire, WF14 9DQ	Industrial Coatings and Finishings	Industrial Products
D	146m SE	Visual Conservatories	159, Huddersfield Road, Mirfield, West Yorkshire, WF14 9DQ	Conservatories	Consumer Products
E	163m SE	R T Cnc Services	Unit 7 Bankfield Business Park, Huddersfield Road, Mirfield, West Yorkshire, WF14 9DQ	Cutting, Drilling and Welding Services	Construction Services
E	163m SE	Calder Gates	Unit 6 Bankfield Business Park, Huddersfield Road, Mirfield, West Yorkshire, WF14 9DQ	Fences, Gates and Railings	Industrial Products
D	184m SE	Icarus Computers	159, Huddersfield Road, Mirfield, West Yorkshire, WF14 9DQ	Electrical Equipment Repair and Servicing	Repair and Servicing
D	184m SE	Healthy Options Pet Food	159, Huddersfield Road, Mirfield, West Yorkshire, WF14 9DQ	Animal Feeds, Pet Foods, Hay and Straw	Foodstuffs
E	185m SE	Pakprint Tapes Ltd	Unit 19 Bankfield Business Park, Huddersfield Road, Mirfield, West Yorkshire, WF14 9DQ	Packaging	Industrial Products
F	217m NW	Kelcol Bedding Company Ltd	Wellington Mills, Huddersfield Road, Mirfield, West Yorkshire, WF14 9DL	Beds and Bedding	Consumer Products
F	217m NW	D S M Group	Dsm Ropes and Twines, Wellington Mills, Huddersfield Road, Mirfield, West Yorkshire, WF14 9DL	Ropes, Nets and Cordage	Industrial Products

ID	Location	Company	Address	Activity	Category
D	224m SE	Mirfield Motor Spares Ltd	157, Huddersfield Road, Mirfield, West Yorkshire, WF14 9DQ	Scrap Metal Merchants	Recycling Services
2	238m SE	Business Park	West Yorkshire, WF14	Business Parks and Industrial Estates	Industrial Features

This data is sourced from Ordnance Survey.

4.2 Current or recent petrol stations

Records within 500m	0

Open, closed, under development and obsolete petrol stations.

This data is sourced from Experian.

4.3 Electricity cables

Records within 500m	0

High voltage underground electricity transmission cables.

This data is sourced from National Grid.

4.4 Gas pipelines

Records within 500m	0

High pressure underground gas transmission pipelines.

This data is sourced from National Grid.

4.5 Sites determined as Contaminated Land

Records within 500m	0

Contaminated Land Register of sites designated under Part 2a of the Environmental Protection Act 1990.

This data is sourced from Local Authority records.

4.6 Control of Major Accident Hazards (COMAH)

Records within 500m	0

Control of Major Accident Hazards (COMAH) sites. This data includes upper and lower tier sites, and includes a historical archive of COMAH sites and Notification of Installations Handling Hazardous Substances (NIHHS) records.

This data is sourced from the Health and Safety Executive.

4.7 Regulated explosive sites

Records within 500m	0

Sites registered and licensed by the Health and Safety Executive under the Manufacture and Storage of Explosives Regulations 2005 (MSER). The last update to this data was in April 2011.

This data is sourced from the Health and Safety Executive.

4.8 Hazardous substance storage/usage

Records within 500m	0

Consents granted for a site to hold certain quantities of hazardous substances at or above defined limits in accordance with the Planning (Hazardous Substances) Regulations 2015.

This data is sourced from Local Authority records.

4.9 Historical licensed industrial activities (IPC)

Records within 500m	0

Integrated Pollution Control (IPC) records of substance releases to air, land and water. This data represents a historical archive as the IPC regime has been superseded.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.10 Licensed industrial activities (Part A(1))

Records within 500m	0

Records of Part A(1) installations regulated under the Environmental Permitting (England and Wales) Regulations 2016 for the release of substances to the environment.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.11 Licensed pollutant release (Part A(2)/B)

Records within 500m	1

Records of Part A(2) and Part B installations regulated under the Environmental Permitting (England and Wales) Regulations 2016 for the release of substances to the environment.

Features are displayed on the Current industrial land use map on **page 37**

ID	Location	Address	Details	
C	116m W	Caldercote Ltd, Unit 2, Sands Industrial Estate, Huddersfield Road, Mirfield, WF14 9DQ	Process: Coating Processes Status: Current Permit Permit Type: Part B	Enforcement: No Enforcements Notified Date of enforcement: No Enforcements Notified Comment: No Enforcements Notified

This data is sourced from Local Authority records.

4.12 Radioactive Substance Authorisations

Records within 500m	0

Records of the storage, use, accumulation and disposal of radioactive substances regulated under the Radioactive Substances Act 1993.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.13 Licensed Discharges to controlled waters

Records within 500m	4

Discharges of treated or untreated effluent to controlled waters under the Water Resources Act 1991.

Features are displayed on the Current industrial land use map on **page 37**

ID	Location	Address	Details	
G	366m W	BATTYE CUT, WOOD LANE, BATTYEFORD, MIRFIELD	Effluent Type: SEWAGE DISCHARGES - FINAL/TREATED EFFLUENT - NOT WATER COMPANY Permit Number: C5171 Permit Version: 1 Receiving Water: LAND ADJACENT TO BATTYE CUT	Status: TRANSFERRED FROM COPA 1974 Issue date: 26/07/1988 Effective Date: 26/07/1988 Revocation Date: 25/07/2012

ID	Location	Address	Details	
G	366m W	BATTYE CUT, WOOD LANE, BATTYEFORD, MIRFIELD	Effluent Type: SEWAGE DISCHARGES - FINAL/TREATED EFFLUENT - NOT WATER COMPANY Permit Number: C5171 Permit Version: 2 Receiving Water: LAND ADJACENT TO BATTYE CUT	Status: TRANSFERRED FROM COPA 1974 Issue date: 26/07/2012 Effective Date: 26/07/2012 Revocation Date: -
I	443m W	THE OLD SMITHY, HELME LANE, MIRFIELD	Effluent Type: SEWAGE DISCHARGES - FINAL/TREATED EFFLUENT - NOT WATER COMPANY Permit Number: C5195 Permit Version: 1 Receiving Water: LAND ADJ TO PROPOSED DWELLING	Status: TRANSFERRED FROM COPA 1974 Issue date: 05/08/1988 Effective Date: 05/08/1988 Revocation Date: 25/07/2012
I	443m W	THE OLD SMITHY, HELME LANE, MIRFIELD	Effluent Type: SEWAGE DISCHARGES - FINAL/TREATED EFFLUENT - NOT WATER COMPANY Permit Number: C5195 Permit Version: 2 Receiving Water: LAND ADJ TO PROPOSED DWELLING	Status: TRANSFERRED FROM COPA 1974 Issue date: 26/07/2012 Effective Date: 26/07/2012 Revocation Date: -

This data is sourced from the Environment Agency and Natural Resources Wales.

4.14 Pollutant release to surface waters (Red List)

Records within 500m	0

Discharges of specified substances under the Environmental Protection (Prescribed Processes and Substances) Regulations 1991.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.15 Pollutant release to public sewer

Records within 500m	0

Discharges of Special Category Effluents to the public sewer.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.16 List 1 Dangerous Substances

Records within 500m	0

Discharges of substances identified on List I of European Directive E 2006/11/EC, and regulated under the Environmental Damage (Prevention and Remediation) Regulations 2015.

This data is sourced from the Environment Agency and Natural Resources Wales.

4.17 List 2 Dangerous Substances

Records within 500m	1

Discharges of substances identified on List II of European Directive E 2006/11/EC, and regulated under the Environmental Damage (Prevention and Remediation) Regulations 2015.

Features are displayed on the Current industrial land use map on **page 37**

ID	Location	Name	Status	Receiving Water	Authorised Substances
6	498m NW	New List 2 Water Site 12	Active	River Calder	Tributyltin

This data is sourced from the Environment Agency and Natural Resources Wales.

4.18 Pollution Incidents (EA/NRW)

Records within 500m	6

Records of substantiated pollution incidents. Since 2006 this data has only included category 1 (major) and 2 (significant) pollution incidents.

Features are displayed on the Current industrial land use map on **page 37**

ID	Location	Details	
D	179m SE	Incident Date: 13/08/2001 Incident Identification: 23883 Pollutant: General Biodegradable Materials and Wastes Pollutant Description: Other General Biodegradable Material or Waste	Water Impact: Category 4 (No Impact) Land Impact: Category 3 (Minor) Air Impact: Category 3 (Minor)
3	304m SW	Incident Date: 14/08/2001 Incident Identification: 24009 Pollutant: Inert Materials and Wastes Pollutant Description: Construction and Demolition Materials and Wastes	Water Impact: Category 3 (Minor) Land Impact: Category 2 (Significant) Air Impact: Category 4 (No Impact)

ID	Location	Details	
H	432m S	Incident Date: 15/06/2001 Incident Identification: 9554 Pollutant: Inert Materials and Wastes Pollutant Description: Construction and Demolition Materials and Wastes	Water Impact: Category 4 (No Impact) Land Impact: Category 3 (Minor) Air Impact: Category 4 (No Impact)
H	432m S	Incident Date: 15/06/2001 Incident Identification: 9554 Pollutant: Inert Materials and Wastes Pollutant Description: Construction and Demolition Materials and Wastes	Water Impact: Category 4 (No Impact) Land Impact: Category 3 (Minor) Air Impact: Category 4 (No Impact)
4	434m SE	Incident Date: 18/06/2002 Incident Identification: 85776 Pollutant: Atmospheric Pollutants and Effects Pollutant Description: Smoke	Water Impact: Category 4 (No Impact) Land Impact: Category 4 (No Impact) Air Impact: Category 3 (Minor)
5	449m W	Incident Date: 06/09/2002 Incident Identification: 105873 Pollutant: Atmospheric Pollutants and Effects Pollutant Description: Other Atmospheric Pollutant or Effect	Water Impact: Category 4 (No Impact) Land Impact: Category 4 (No Impact) Air Impact: Category 3 (Minor)

This data is sourced from the Environment Agency and Natural Resources Wales.

4.19 Pollution inventory substances

Records within 500m	**0**

The pollution inventory (substances) includes reporting on annual emissions of certain regulated substances to air, controlled waters and land. A reporting threshold for each substance is also included. Where emissions fall below the reporting threshold, no value will be given. The data is given for the most recent complete year available.

This data is sourced from the Environment Agency and the Scottish Environment Protection Agency.

4.20 Pollution inventory waste transfers

Records within 500m	**0**

The pollution inventory (waste transfers) includes reporting on annual transfers and recovery/disposal of controlled wastes from a site. A reporting threshold for each waste type is also included. Where releases fall below the reporting threshold, no value will be given. The data is given for the most recent complete year available.

This data is sourced from the Environment Agency and the Scottish Environment Protection Agency.

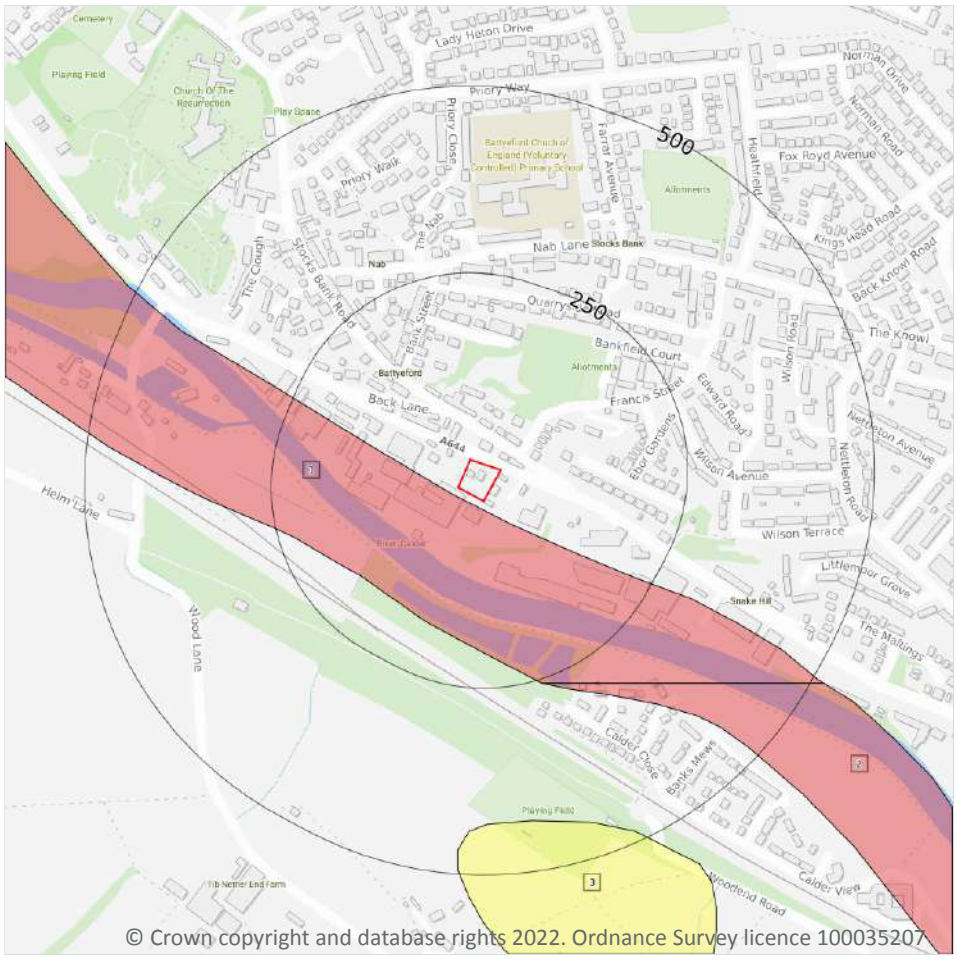
4.21 Pollution inventory radioactive waste

Records within 500m	0

The pollution inventory (radioactive wastes) includes reporting on annual releases of radioactive substances from a site, including the means of release. Where releases fall below the reporting threshold, no value will be given. The data is given for the most recent complete year available.

This data is sourced from the Environment Agency and the Scottish Environment Protection Agency.

5 Hydrogeology - Superficial aquifer



Site Outline

Search buffers in metres (m)

- Principal
- Secondary A
- Secondary B
- Secondary Undifferentiated
- Unproductive
- Unknown

5.1 Superficial aquifer

Records within 500m	3

Aquifer status of groundwater held within superficial geology.

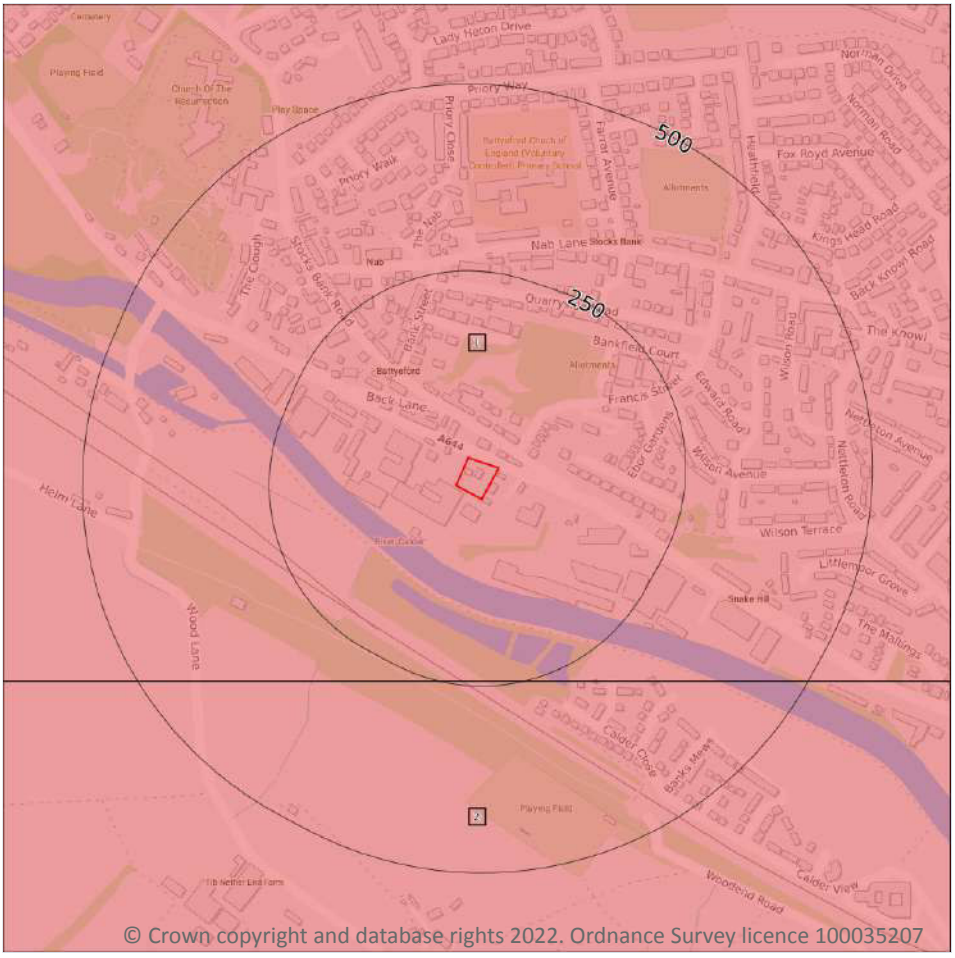
Features are displayed on the Hydrogeology map on **page 46**

ID	Location	Designation	Description
1	11m S	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers
2	255m S	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers

ID	Location	Designation	Description
3	431m S	Secondary Undifferentiated	Assigned where it is not possible to attribute either category A or B to a rock type. In general these layers have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type

This data is sourced from the British Geological Survey, the Environment Agency and Natural Resources Wales.

Bedrock aquifer



Site Outline

Search buffers in metres (m)

- Principal
- Secondary A
- Secondary B
- Secondary Undifferentiated
- Unproductive

5.2 Bedrock aquifer

Records within 500m **2**

Aquifer status of groundwater held within bedrock geology.

Features are displayed on the Bedrock aquifer map on **page 48**

ID	Location	Designation	Description
1	**On site**	**Secondary A**	**Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers**
2	243m S	Secondary A	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers

This data is sourced from the British Geological Survey, the Environment Agency and Natural Resources Wales.