

Phase 3 Remediation Options Appraisal

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Concept Design Architects

Edgegate Farm, Huddersfield Road, Milnrow, OL16 3TJ

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1. Introduction

The following document is a Phase 3 Remediation Options Appraisal carried out by Oakshire Environmental, and includes details of the site and previous investigations an assessment of feasible remediation options.

1.1 Project Overview

The client's proposed project involves prior approval for change of use from agricultural building to 4 no. dwellinghouses (Use Class C3) including installation of new windows and doors at Edgegate Farm, Huddersfield Road, Milnrow, OL16 3TJ. Following the identification of contaminant linkages at the site, remediation has been recommended. Oakshire Environmental have carried out a Phase 3 Remediation Options Appraisal & Strategy, as described below.

1.2 Purpose of Investigation

The objectives of the Phase 3 Remediation Options Appraisal were to:

- Assess the nature and extent of contamination risk at the site.
- Identify suitable remediation option(s).
- Outline a strategy for the implementation of suitable remediation option(s).
- Determine the requirement or scope of further investigations.

1.3 Scope of Work

- Brief introductory information will be noted to provide context to the report and will include an Introduction, Project Overview, Scope of Work and Limitations.
- Assess the nature and extent of contamination risk, identified as part of previous investigations.
- Identify initial feasible options for remediation at the site, including assessment of potential constraints and generic remediation objectives, based on the costs involved and the practicality of their application. Remediation methods to be considered include civil engineering, biological, chemical, physical and thermal methods.
- Conduct a detailed evaluation of remediation options, including development of site-specific remediation objectives, in order to determine which option(s) are most appropriate for the site.
- Outline a strategy for the implementation of suitable remediation option(s).
- Recommended remediation option(s) will be assessed to determine the requirement or scope of further investigations at the site.
- Supporting appendix to include photographs, maps and plans of the site.

1.4 Limitations

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This report excludes consideration of potential hazards arising from any activities at the site other than normal use and occupancy for the intended land uses. Hazards associated with any other activities have not been assessed and must be subject to a specific risk assessment by the parties responsible for those activities. Oakshire Environmental does not warrant or guarantee that the site is free of hazardous or potentially hazardous materials or conditions. It should be noted that this report has been produced for environmental purposes only.

2. Site

The following section provides a description of the site, location and previous investigations, utilising information obtained from the client and publicly available sources.

2.1 Site Description and Location

The site is located at Edgegate Farm off Huddersfield Road to the north east of Oldham and is approximately 0.07ha. The site is comprised of a detached barn constructed of block work and corrugated steel. At time of sampling, there were numerous vehicles and agricultural machinery parked on the adjacent yard area to the barn building, in addition to areas of assorted storage associated with the operation of the site.

The site is bordered by yard areas to the north west, north east and south east including parked caravans to the north west, waste materials in skips and agricultural equipment, machinery and vehicles to the south east. To the south west there are stable buildings, residential dwellings and shipping containers within the wider farm complex. The surrounding area is predominantly agricultural with some isolated residential dwellings and villages.

National Grid Reference: SD 96588 11428

2.2 Proposed Development

The proposed development involves the change of use of the existing agricultural building to four dwellings including the development of lawn areas at the south east and parking at the north west.

2.3 Previous Investigations

A Phase 1 Preliminary Risk Assessment was carried out by Oakshire Environmental in November 2023. This assessment considered the risk to residential end users and controlled waters to be low to moderate and, therefore, recommended that a Phase 2 Intrusive Site Investigation should be undertaken, including sampling of shallow soil in areas of proposed soft landscaping to be tested for a suite of contaminants including heavy metals and hydrocarbons.

Following the Phase 1 Preliminary Risk Assessment, Oakshire Environmental carried out sampling of soil and made ground at the site in areas of proposed soft landscaping at the southeast and southwest. Samples were tested for a comprehensive suite of contaminants including Metals (As, Be, Cd, Cu, Pb, Hg, Ni, Se, V, Zn), Chromium (III & VI), Phenols, Polycyclic Aromatic Hydrocarbons (PAHs), BTEX & MTBE, Total Petroleum Hydrocarbons (TPHs) CWG (Aliphatic/ Aromatic), pH, Organic Matter and Asbestos (Qualitative).

Made ground was identified across the site comprising gravelly sandy clay with road planings, gravel, brick and concrete to a maximum depth of 2m. PAH concentrations exceeded the residential with homegrown produce screening values in samples taken from shallow made ground at the southwest and deeper made ground at the southeast and Chrysotile asbestos was also identified in shallow made ground at the southeast, therefore, it was concluded that the risk to residential end users is high.

TPH concentrations were also elevated and exceeded UK Water Industry Research (UKWIR) thresholds for PE water pipes, therefore, the risk to residential end users through permeation into drinking water pipes was considered to be moderate and barrier pipes were considered necessary.

Due to the moderate to high organic matter content and depth of made ground identified at the site, there was also considered to be a low to moderate risk to residential end users from ground gas permeation into the building.

Based on laboratory testing of soil samples from the site, the updated conceptual site model and the currently proposed development plan, the risk to residential end users and construction workers was considered to be high, therefore, it was recommended that a Phase 3 Remediation Options Appraisal & Strategy is produced, to include analysis of feasible remediation options to address contamination risk at the site.

3. Remediation Options

The Environment Agency’s Land Contamination: Risk Management guidance for the development of an options appraisal requires the initial identification of feasible options for remediation at a site, based on the costs involved and the practicality of their application. There are a number of remediation methods available including civil engineering, biological, chemical, physical and thermal methods. Some methods may not be appropriate to a particular site as some can only be used on certain types of media and some may not be cost effective. Other site-specific constraints such as time and access can also determine the feasibility of a particular remediation option. The following section outlines the generic remediation objectives for the site, taking into account potential constraints, and includes a selection of feasible remediation options.

3.1 Site Context and Objectives

The proposed development involves the change of use of the existing agricultural building to four dwellings including the development of lawn areas at the south east and parking at the north west, therefore, this report considers the feasibility of redeveloping the site for residential use.

3.2 Potential Constraints

Given the size of the site, there is not considered to be limitations with regards to space for machinery required to carry out remediation work. There are no sensitive human receptors bordering the site and the building is not currently occupied so there are no sensitive receptors on site. In addition, the on-site contamination is not expected to be ongoing so there are no specific time constraints with regards the implementation of remediation.

3.3 Generic Remediation Objectives

The following table outlines the generic objectives of remediation at the site.

Table 1: Summary of Generic Objectives

Remediation Objective	Objective Type
Enable the site to be redeveloped for residential end use	General
Enable development of a remediation strategy that meets regulatory requirements	Management
Enable development of a remediation strategy that meets the developers' requirements	Management
Avoid unacceptable environmental impacts from implementation of remediation strategy	Management
Avoid long term monitoring requirements	Management

3.4 Feasible Remediation Options

Contamination risk from organic contaminants and ground gases has been identified in made ground, therefore, a number of remediation options have been discounted as they are inappropriate for the site and the identified contamination risk.

Soil flushing, soil washing, and hydraulic binders are likely to be too costly and unnecessarily extensive for the site given the relatively localised contamination and minimal material expected to require remediation. Contamination is not likely to have impacted groundwater or surface water, so remediation will only need to consider soil contamination and vapour ingress into the proposed building.

PAHs identified above the residential with homegrown produce screening values are not considered to be volatile and VPH concentrations were very low or below the laboratory limit of detection, therefore, there is not considered to be a risk of vapour ingress into the building, however, the depth of made ground suggests that ground gas production may pose a risk to the proposed development. Based on the maximum depth of made ground identified (2m) and the identified organic matter content (average Total Organic Carbon value of 5.09%), the site is likely to be classified as Characteristic Situation 3 (Amber 2 – NHBC) in terms of ground gas risk.

The following remediation options are considered appropriate for the site and will be subject to a more detailed evaluation in the following section.

Table 2: Summary of Feasible Remediation Options

Remediation Option	Method	Linkage Element Addressed
Excavation and Disposal	Civil Engineering	Source Management
Containment - Cover System	Civil Engineering	Pathway Interruption
Membrane	Barriers (in buildings)	Pathway Interruption
Passive Venting	Dilution and Dispersion	Pathway Interruption

4. Evaluation of Remediation Options

Following the identification of feasible remediation options, a detailed evaluation of options, including development of site-specific remediation objectives, is required to determine which option(s) are most appropriate for the site.

Table 3: Summary of Site-Specific Objectives

Remediation Objective	Objective Type	Evaluation Criteria
Enable the site to be redeveloped for residential end use without risk to human health	General/Technical	PAH concentrations in shallow soils on site to be below relevant screening values after remediation Ground gas protection measures to be installed as required to prevent permeation into the proposed dwelling
Enable development of a remediation strategy that meets regulatory requirements	Management	Remediation strategy to be agreed with Local Authority and carried out in accordance with relevant regulations
Enable development of a remediation strategy that meets the developers' requirements	Management	Remediation strategy to be agreed with developer
Avoid unacceptable environmental impacts from implementation of remediation strategy	Management	Compliance with regulations on the control of noise, dust odour, traffic and generation of waste
Utilise remediation option with a proven track record	Management	Selected option to have proven success on sites with similar contamination issues
Avoid long term monitoring requirements	Management	No site-specific evaluation criteria

4.1 Excavation and Off-Site Disposal and Containment

Excavation and off-site disposal of contaminated made ground in proposed garden areas could be carried out to remove the source of contamination. Containment would then be required, through placement of imported clean material, to interrupt the contamination pathway, protect against residual contamination risk and re-instate site levels.

Excavation would need to be carried out to a depth that would allow the required clean cover to be placed, to a minimum depth of 600mm in the proposed garden areas. This clean cover depth would allow an adequate depth for growth of plants, in addition to, removing contaminant linkages, to enable the site to be redeveloped for residential use without risk to human health.

As an additional measure, a hi-vis non-woven geotextile membrane should be installed below the clean cover system, to warn future developers and site users and ensure that the separation layer is maintained. It should also be permeable to water to ensure that surface water drainage at the site is not negatively affected.

Results of soil testing from the Intrusive Site Investigation suggest that, due to the elevated hydrocarbon concentrations in shallow and deeper made ground at the southeast and shallow made ground at the south west, material from these areas should be classified as Hazardous, with an EWC code of 17 05 03*, for off-site disposal to landfill or treatment facility.

This remediation option meets all the relevant objectives outlined in this report and is appropriate for the site. Excavation and off-site disposal and containment is likely to be the most cost-effective feasible remediation option and would be most cost effective if conducted alongside the proposed development at the site. There are not likely to be excessive environmental nuisances, such as noise and dust, assuming groundwork best practices are followed, in addition, excavation and containment are very common remediation techniques, successfully used on multiple sites with similar contamination issues, and is not likely to need extensive post-remediation verification work.

4.2 Membrane and Passive Venting

Due to the depth and extent of made ground identified across the site, gas mitigation measures are required. The depth (maximum: 2mbgl) and Total Organic Carbon content (average: 5.09%) of made ground at the site suggests that the site can be categorised as Characteristic Situation 3 (Amber 2) in accordance with the CL:AIRE Research Bulletin 17 'A Pragmatic Approach to Ground Gas Risk Assessment' and the proposed development includes private dwellings (Type A building), therefore, in order to protect the development from the ingress of ground gases 4.5 points of protection measures must be achieved. This can be provided with a suitable sub floor ventilation layer along with the installation of a sufficiently impervious membrane.

The ventilation layer must achieve 'very good' performance, in accordance with BS 8485, and when designed and constructed correctly it will dilute any gas being emitted from the ground to acceptable levels and will provide 2.5 points of protection.

The membrane must be sufficiently impervious to the transmission of gas and durable enough to withstand the installation process and, if installed appropriately, it will provide a further 2 points of protection which will provide the required score of 4.5.

The floor and substructure design can also provide protection from the ingress of ground gases (e.g. a cast in situ ground-bearing floor slab with only nominal mesh reinforcement would provide a score of 0.5), however, this will not provide an essential element of the gas protection design.

Given that the proposed development involves the change of use of an existing building with an existing floor slab, the ventilation layer should be provided above the floor slab using a ventilation mat or geocomposite vent layer. The membrane would then be installed above the ventilation layer.

It should be noted that, regardless of any other remediation options selected, gas mitigation measures will need to be incorporated into the development.

5. Recommendations

Based on the detailed evaluation of feasible remediation options in this report, the most appropriate remediation option is considered to be via source management and pathway interruption by way of excavation and off-site disposal of contaminated soil and made ground and containment through the placement of a clean cover layer. The details regarding this remediation are outlined below.

5.1 Remediation Strategy

Contaminated soil in proposed soft landscaped areas, as shown on plan in the appendix, should be excavated and disposed of off-site, to partially remove the source of contamination. Following excavation a cover layer of clean soil should then be placed to a minimum depth of 600mm, to interrupt the contamination pathway, protect against residual contamination risk and re-instate site levels, as an additional measure, a hi-vis non-woven geotextile membrane should be installed below the clean cover layer to warn future developers and site users. This clean cover depth would allow an adequate depth for growth of plants, in addition to, removing contaminant linkages, to enable the site to be redeveloped for residential use without risk to human health. There is no minimum requirement for excavations provided that they allow for the placement of the required thickness of clean cover.

Results of soil testing from the Phase 2 Intrusive Site Investigation suggest that sampled made ground from the site would be classified as Hazardous, with an EWC code of 17 05 03*, for off-site disposal to landfill or treatment facility.

Soil to be utilised as the cover system should be imported and must be shown to be uncontaminated and of a suitable quality to provide a growing medium, e.g. compliant with British Standard 3882:2015 for topsoil. If cover soil is to be stockpiled prior to placement, it should be appropriately quarantined on a polythene sheet or similar protective membrane to avoid contamination prior to placement. Cover soil may be delivered in bags and these are considered to be an appropriate means of quarantine. Alternatively, cover soil can be placed immediately upon arrival at the site.

If unforeseen visible or olfactory evidence of contamination is identified during excavations at the site, work should cease in order to allow further investigation to be carried out.

To mitigate the risk to the proposed dwellings from ground gas production, a passive sub floor ventilation layer should be provided by installing a geocomposite/vent mat (typically 20–40 mm overall profile) across the full floor area to form an uninterrupted ventilation zone. Sheets or rolls should be laid in accordance with the manufacturer's recommendations and where multiple bays are required, overlap and tape joints using system tapes to prevent fines ingress while keeping the air pathways connected. Ensure the mat passes beneath internal walls or is bridged via vent strips or duct links so no area is left unvented. The ventilation must provide effective cross-flow across the entire footprint and demonstrate sufficient dilution capacity, in accordance with BS 8485. Outlets should be provided on two opposite sides of the building to provide adequate dilution of gas and these should comprise periscope vents and/or straight through vents in the external walls with airbricks positioned at 2m maximum centres and not more than 450mm from the corners.

In order to further mitigate the risk of ground gas ingress into the dwellings, a gas resistant membrane should be installed. The membrane must be made from a virgin polymer such as polyethylene, LDPE or modified bitumen/LDPE and must have a methane transmission rate of less than 40ml/day/m²/atm (average). The membrane should have lapped and taped joints and 'top hats' around service penetrations in accordance with the manufacturer's specification (typically 150mm laps with double sided tape). The membrane must also be sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions as well as being sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools, etc) and to withstand in-service stresses (e.g. settlement if placed below a floor slab). Any screed and insulation should then be laid on top of the membrane.

5.2 Verification

Following the implementation of remediation, a Phase 4 Verification Report should be produced, to ensure remediation has been appropriately implemented and the site is safe for its proposed use.

Excavations should be carried out by a suitably qualified groundworks contractor and a photographic record of the excavation works should be kept, including the base and faces of each excavation. The Phase 4 Verification Report should include a supporting appendix, including photographic evidence of the hi-vis membrane and depth of clean cover using a tape measure or staff, to verify that the required depth of cover has been implemented and the hi-vis non-woven geotextile membrane has been appropriately installed, in addition to, copies of waste transfer notes and certificates for any imported material.

In order to confirm that imported or site-won cover soil presents a low contamination risk, samples should be taken and analysed for Metals (As,Cd,Cr,Cu,Pb,Hg,Ni,Se,Zn), Chromium (III & VI), PAHs (16 USEPA speciation), pH, Organic Matter and Asbestos in a UKAS accredited laboratory, as per the recommendations in YALPAG Technical Guidance. Samples can be collected from stockpiled soil prior to placement or in-situ cover soil after placement. Ground conditions encountered at the site during the sampling process should be noted, with photographic evidence taken throughout. This information will be used to inform recommendations and conclusions. Results of laboratory testing should be assessed with reference to LQM/CIEH Suitable 4 Use Levels (S4ULs) and CL:AIRE Category 4 Screening Levels (C4SLs), to assess the risk to human health and the environment.

The installation of the subfloor void and ground gas membrane should be verified in accordance with CIRIA C735.

The findings of this validation assessment should be used to update the Conceptual Site Model, produced as part of the Phase 2 Intrusive Site Investigation, to identify contaminant linkages at the site, in order to determine the efficacy of remediation and the requirement for any further investigations or remediation work.

6. References

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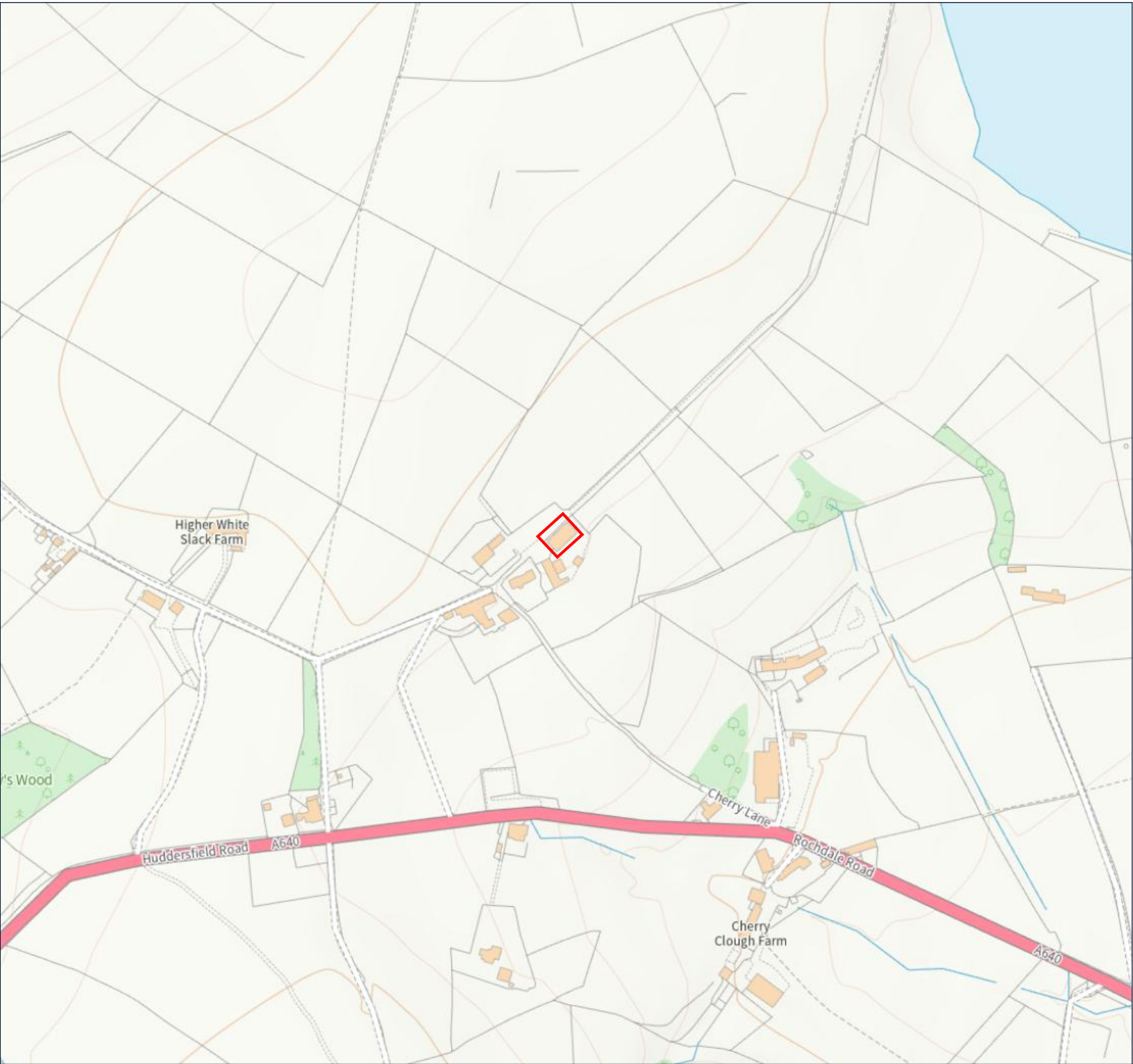
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Appendix - Site Maps & Plans

Description

Site location plan

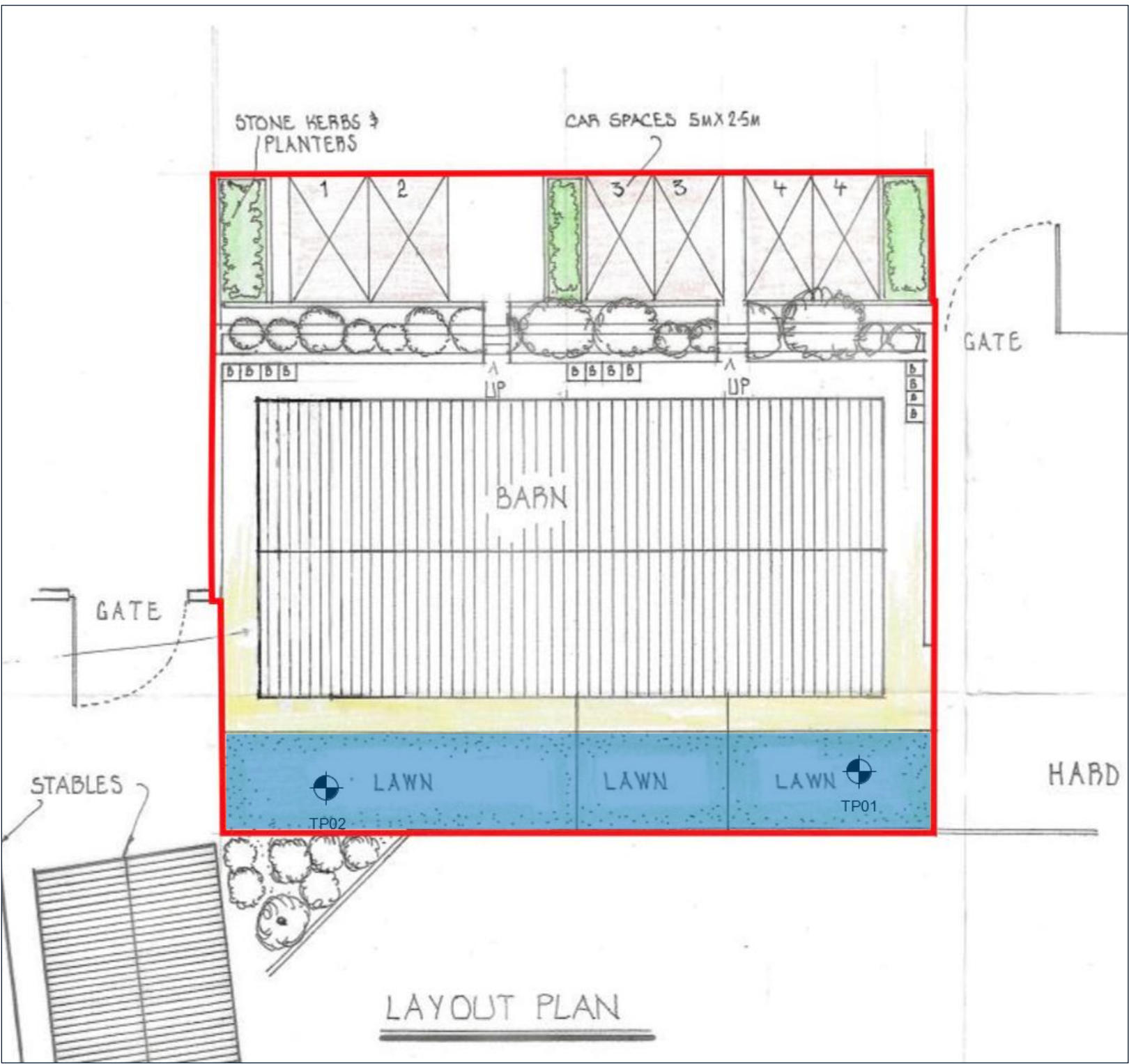
Sources

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Key

Site boundary

North



Appendix - Site Maps & Plans

Description

Proposed site plan showing trial pit locations and extent of recommended clean cover system

Sources

S. Ingram & Associates

Key

- Site boundary
- Trial pit location
- Clean cover system