

A photograph of a landscape with a stream, rocks, and green vegetation. The text "Remediation Strategy" is overlaid in white.

Remediation Strategy

Land at Heaton Grange, Batley For Jack Lunn

Report no: 5773/1

Date: April 2026



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Appendix A : Drawings

Drawing	Revision	Title
5773/1	-	Site Location Plan
5773/2	-	Proposed Site Layout
5773/3	-	Site Features
5773/4	-	Third Party Exploratory Hole Location Plan
5773/5	-	Revised Conceptual Site Mode
5773/6	-	Hotspot Remediation Areas

Appendix B : Protocol for Placement of Non-Engineered General Fill

Appendix C : Protocol for Importation & Use of Soil Cover (Capping)

REMEDIATION STRATEGY for land at HEATON GRANGE, BATLEY

1 INTRODUCTION

1.1 The commission and brief

- 1.1.1 Lithos Consulting Limited has been commissioned by Jack Lunn (JL) to prepare a Remediation Strategy for land off Heaton Grange, Batley.
- 1.1.2 Haigh Huddleston has previously issued the following reports relating to this site:
- Geoenvironmental Appraisal: Heaton Grange, Batley, Report E20/7738/R001A, dated September 2020
 - Supplementary Investigation Letter: Heaton Grange, Batley, Report E20/7738/MD/003, dated November 2022
- 1.1.3 Solmek has previously issued the following reports:
- Phase 1: Desk Study: Mill Lane, Batley, Report S240106, dated February 2024
 - Phase 2: Site Investigation: Mill Lane, Batley, Report S240106/SI, dated February 2024
 - Ground Gas Risk Assessment letter report No. S240106/GAS, dated 17th May 2024
- 1.1.4 The appointed Remediation Contractor will need to familiarise themselves with the above Reports and comply with all relevant recommendations contained therein.
- 1.1.5 This document outlines the remediation objectives necessary to protect environmental receptors and render the site suitable for the proposed development. A Method Statement should be prepared in order to detail how the objectives will be achieved.
- 1.1.6 The Method Statement should be accompanied by a Designer's Risk Assessment in accordance with the CDM Regulations, 2015. The Method Statement and Risk Assessment should be submitted to and approved by JL's Site Manager.

1.2 The proposed development

- 1.2.1 The proposed residential development comprises 21 dwellings with associated gardens, POS, roads and sewers, as shown on Drawing 5773/2 presented in Appendix A.
- 1.2.2 The houses will be founded on traditional strip footing, local deepening due to made ground.
- 1.2.3 Access to the development will be from Heaton Grange.
- 1.2.4 The Local Planning Authority has agreed outline planning permission for redevelopment of this site (Ref. 2020/60/93777/E). There are several Conditions associated with remediation, most notably:
- **Condition 12:** Submission of a Remediation Strategy
 - **Condition 13:** Unexpected contamination (notification to the Local Authority and update of the Remediation Strategy if encountered)
 - **Condition 14:** Verification Report
- 1.2.5 This report has been prepared to support the discharge of Condition 12.

2 BACKGROUND

2.1 Site description

2.1.1 Site details are summarised below.

Detail	Remarks
Location	1.4 km southeast of Batley town centre
NGR	SE 251 235
Area	0.84 ha (2.15 acres)
Known live services	Underground water & sewer

2.1.2 The site location and current salient features are shown on Drawings 5773/1 and 5773/3 in Appendix A.

2.2 Site walkover

2.2.1 The site is accessible from the south via Heaton Grange.

2.2.2 The site comprises a single irregular parcel that is relatively flat plateau with steep slopes down to the north and west boundaries.

2.2.3 Access restricted due to becoming overgrown with self-seeded saplings and brambles with an area of more mature trees in the east and southwest. A singular loop with spurs has been cleared in the west to allow some access for intrusive investigation works and the Heras fencing to be installed.

2.2.4 A public footpath runs along the site's eastern boundary from Bromley Road along a narrow unmetalled path which connects to the industrial estate to the north.

2.2.5 Fly tipping is present adjacent to existing residential most noticeably adjacent to No. 17 Heaton Grange where waste includes but not limited to a mattress, settee and other household waste.

2.3 Ground investigation

2.3.1 Haigh Huddleston's (HH) ground investigation works comprised 8 trial pits and 10 window sample boreholes which were monitored for ground gas on two occasions between August and September 2020 and six occasions between July 2022 and October 2022.

2.3.2 Solmek completed a desk study which included reference to an earlier HH ground investigation and culminated in a preliminary conceptual site model. Further ground investigation fieldwork was supervised by Solmek in January 2024 comprising 7 trial pits & 6 cable percussive boreholes. Boreholes were installed to facilitate groundwater and gas monitoring on six occasions between Jan to May 2024.

Made Ground

2.3.3 Made Gound Topsoil was typically dark brown slightly sandy gravelly Clay. Gravel is sandstone, brick and concrete. Made ground topsoil was encountered across the whole site to an average depth of 0.5m bgl (maximum 0.9m).

2.3.4 Made Ground was encountered in the east (maximum depth 2.1m) which generally comprised firm dark brown locally light orangish brown slightly sandy gravelly clay. Gravel is fine to coarse, angular to subangular of sandstone, brick and concrete.

Obstructions

- 2.3.5 Historical plans and previous reports show that a single building has been present which is only a small percentage (c.0.5%) of the site area. Drawing 5773/3 shows the footprint of the former building.
- 2.3.6 Bedrock was encountered in all of the exploratory holes from relatively shallow depth (from 0.8m). Any deep excavations such as those that may be required for drainage etc may encounter hard rock. In essence, the need for bedrock excavation will be predominantly dictated by two factors: the depth of cut required, and the nature of the bedrock encountered in that cut.
- 2.3.7 It would therefore be prudent to allow for use of powerful excavators (probably at least a 25-tonne excavator) with some rock ripping teeth and a breaker. However, it is worth noting that it is often easier to dig in large open excavations, as once the excavator gets its teeth under bedding/fractures it can rip, which is not really possible in small narrow excavations such as trial pits.
- 2.3.8 Clearly, hard rock has implications for drainage infrastructure and, where possible, a design strategy of keeping excavations relatively shallow would be prudent.

Natural ground

- 2.3.9 Natural ground comprised firm to stiff slightly sandy gravelly Clay.
- 2.3.10 Bedrock was encountered in all exploratory holes with the majority (22 of 35) likely Birstall Rock Formation.

Groundwater

- 2.3.11 Shallow groundwater (0.25m to 0.88m) was encountered during Solmek's gas monitoring but not evident in the trial pits. This is likely to be perched water and not the actual groundwater level based on the lack of evidence of water in the trial pits.

Mining

- 2.3.12 The Mining Remediation Authority¹ indicate that there are no mine entries within, or within 20m of, the site boundary.
- 2.3.13 This site is located within a Coal Mining Development **Low Risk Area**, however, there may still be unrecorded mining features.

Hazardous gas

- 2.3.14 The HSA website radon map indicates that the site is in an area where **5% to 10%** of homes are estimated to be above the action level, and **basic** radon protection measures are required in new dwellings.
- 2.3.15 Potential gas sources identified by Solmek- made ground, backfilled features, natural sources, filling station (VOCs), landfill & coal measures
- 2.3.16 The results of the monitoring completed to date are summarised below.

¹ On 28th November 2024, the Coal Authority changed their name to the Mining Remediation Authority.

Well	Response zone	Range of methane concentrations (% v/v)	Range of carbon dioxide concentrations (% v/v)	Range of steady flow rates (litre/hour)
WS01	Made ground (1.0m - 1.4m) Weathered coal measures (1.4m - 2.8m)	N.D.	0.5 – 0.6	N.D.
WS02	Weathered coal measures (1.0m - 2.0m)	N.D.	9.0	N.D.
WS05	Weathered coal measures (1.0m - 2.0m)	N.D.	2.0 - 2.2	N.D.
WS12	Made ground (1.0m - 2.5m) Weathered coal measures (2.5m - 3.9m)	N.D.	6.7 - 8.2	N.D.
WS13	Made ground (1.0m - 2.1m) Weathered coal measures (2.1m - 5.0m)	N.D.	3.9 - 4.8	N.D.
BH01	Weathered coal measures (1.0m - 1.4m)	N.D.	0.8- 4.6	0.1
BH03	Weathered coal measures (0.6m - 2.0m)	N.D.	0.3 - 0.9	0.1-1.0
BH04	Made ground (0.4m - 1.4m)	N.D.	N.D. - 0.2	0.1
BH06	Made ground (0.6m - 1.0m)	N.D.	0.1 – 4.8	0.1

- 2.3.17 There are some discrepancies between HH's and Solmek's risk assessments, specifically the recommendation by HH for CS₂ ground gas protection and the lack of recognition of this in the Solmek Gas Risk Assessment. Therefore, in Lithos opinion, **CS₂** gas measures should be installed which will be sufficient for the radon protection measures already required.

Contamination

- 2.3.18 Inorganic contamination was identified in both HH and Solmek's investigations as follows:
- Arsenic was elevated in BH04 at 0.2m (43mg/kg)
 - Lead was only elevated in WS11 at 1.2m 310mg/kg c.f. 200mg/kg.
 - Asbestos identified in HH's TP02 at 0.7m (Amosite fibres not quantified), WS11 at 1.2m & WS12 at 0.5m (chrysotile fibres 0.005% and 0.003%).
- 2.3.19 Refer to the 3rd Party Exploratory Location Plan (Ref. 5773/4) in Appendix A for locations of the ground investigation positions.
- 2.3.20 No organic contamination recorded. The Benzo(a)pyrene encountered in WS11 at 4mg/kg is not considered elevated when compared to Lithos' tier 1 values.
- 2.3.21 Assessment of the site investigation data enabled formulation of a conceptual model, which is presented as Drawing 5773/5 in Appendix A.
- 2.3.22 In terms of the proposed redevelopment plausible contaminant linkages, and feasible remediation options, are summarised below:

Receptors	Pathways	Contaminant source	Remediation options
Human health (Future residents) ◇	Consumption of contaminated vegetables	Metals & asbestos in the made ground	Excavation, treatment e.g. disposal or placement at depth of hotspots arising with validation of excavation extents.
	Ingestion		
	Inhalation (dust)		
	Migration & accumulation of hazardous gas	Carbon dioxide and radon in natural ground	CS ₂ Gas protection measures
Buildings	Contact with "aggressive" soil and/or groundwater	Sulphate in the made ground	Design Sulphate Class DS-1 ACEC Classification of AC-1 for sub-surface concrete.

◇ Transient risks to construction workers will be addressed by the adoption of appropriate health and safety measures in accordance with the Health and Safety at Work Act 1974, and regulations made under the Act including for example the COSHH Regulations.

3 RISK ASSESSMENT & TARGET CONCENTRATIONS

- 3.1 Clean-up criteria relevant to the limited contamination encountered at this site are not driven by risks to controlled waters, therefore in the absence of a site-specific Quantitative Risk Assessment, it is conservatively proposed that Lithos' soil screening values within our Protocol for Importation & Use of Soil Cover (Capping) be adopted as remedial targets for contamination in soils on this site. The Protocol is included in Appendix C. Any imported soils should be subject to the same screening criteria.
- 3.2 In the unlikely event hydrocarbon contamination is encountered this should be subject to removal/ treatment of soils that contain significant free product at all depths.
- 3.3 In this context, significant free product is readily identifiable by the naked eye, and pervasive throughout the soil mass, probably with noticeable seepages. Traces of free product in fissures or localised, cobble-sized pockets would not normally be considered significant.

4 EARTHWORKS LEVELS, REGRADE & ANTICIPATED FOUNDATIONS

- 4.1 Solmek's Geoenvironmental Appraisal Report (Ref. S240106/SI, dated February 2024), indicates that strip foundations deepened through made ground are likely to be most appropriate.
- 4.2 The foundation solutions outlined above assumed that ground levels would not change significantly from those existing at the time. However, final site levels will be determined by JL, in conjunction with their Earthworks Contractor and Engineering Designer.
- 4.3 Revision of the foundation solutions outlined above may be necessary on completion of the site preparatory and remediation earthworks, especially where deeper excavation is necessary to remove relict obstructions.
- 4.4 Any digital terrain modelling undertaken by the Earthworks Contractor should be designed with a view to enabling a "materials balance" (i.e. volume of cut to broadly equals the volume of fill), and be made available to JL's Engineering Designer. The digital terrain modeller should consider:
- Volume reduction caused by turnover (compaction of loose made ground; removal of obstructions/tanks etc)
 - Whether or not processed arisings/treated soils are retained on site
 - The thickness of the soil cover required in garden areas
 - Implications for foundations (i.e. those indicated in the previous ground investigation reports may no longer be the most appropriate)
- 4.5 Final site levels should then be issued by the Engineering Designer, via an External Works Drawing, which should show:
- Proposed finished floor levels
 - Proposed finished road levels
 - Garden & driveway levels and gradients

Geological fault

- 4.6 Drawing 5773/3 shows the approximate line of the fault superimposed on the proposed housing layout; the fault crosses the north-east corner site.
- 4.7 It should be noted that the line of a fault on a geological map is often very approximate, and it may be inaccurate by 10m or more. Furthermore, the presence of a fault is usually 'masked' by overlying drift or residual soils; they can only be seen where long trenches are excavated into bedrock.
- 4.8 At this site, no movement associated with past, present or future mining is anticipated and the fault is not within the vicinity proposed dwellings, therefore there is no need to specifically search for the fault. However, the warranty provider may like to see reinforcement of footings with one layer of B385 mesh placed 75mm above the base of the footing. Given the uncertainty regarding the precise line of the fault, it would be prudent to reinforce the footings of all plots within 25m of its assumed line, i.e. Plots 20/21.
- 4.9 Further advice should be sought if a significant weak zone is encountered (e.g. ground comprising loose, broken or soft 'gouge' material) during the excavation of footings. If associated with a fault, the weak zone is likely to form a fairly continuous "linear belt", rather than a localised "pocket", and be anything from a few centimetres to a few metres in width.

5 REMEDIATION STRATEGY (GENERAL)

5.1 Aims

5.1.1 Remediation aims are to:

- Resolve contamination issues in order to protect environmental receptors, and render the site suitable for the proposed development
- Provide a stable development platform (to agreed levels and gradients) for subsequent construction of the proposed development and associated infrastructure
- Satisfy requirements of the Local Planning Authority and warranty provider

5.2 Overview

5.2.1 The following remediation works are required:

- General site clearance of surface materials and vegetation
- Excavation of hotspots and either offsite disposal of arisings or placement at depth within the proposed POS
- Validation of the hotspot excavations
- Stripping of Topsoil in areas of proposed road/dwellings for potential reuse
- Provision of a minimum 300mm thick layer of 'clean' imported or site won soils in all garden areas (only soil quality required to be validated)

5.3 Site set-up, organisation and safety

5.3.1 Site cabins and welfare facilities are to be established at a location to be agreed with the Engineer. All welfare facilities must be established in accordance with the relevant health & safety statutory requirements. Provision should be provided on site for car parking for all site employees.

5.3.2 All site personnel should undergo a site-specific health and safety induction prior to commencement of work on site.

5.3.3 JL's Site Manager should be informed prior to any proposed entry of a confined space or deep excavation. Entry must be restricted to suitably qualified and equipped personnel.

5.3.4 Access into excavations etc. must be controlled and undertaken in accordance with the CDM Regulations 2015, most notably Regulation 22, to mitigate risk of collapse or asphyxiation.

5.3.5 During the remediation works, all personnel on site will comply with guidance provided in the Health and Safety Executive (HSE) document "Protection of Workers and the General Public during the Redevelopment of Contaminated Land". In summary, the following should be provided:

- Protective clothing, footwear and gloves. (Personnel should be instructed in why and how they are to be used)
- Hand-washing and boot-washing facilities
- Designated smoking areas

5.3.6 If at any time during the works personnel begin to feel unwell, they are to inform the Engineer, who will determine appropriate action.

5.3.7 All visitors to site must enter and register at the main Site Office.

5.4 Contractor's responsibilities

- 5.4.1 Prior to the commencement of any works the Contractor, in agreement with the Engineer, should:
- Comply with any requirements of JL's contract documentation
 - Establish the boundaries of the site and the working areas
 - Undertake a dilapidation survey of site boundaries, adjacent properties and highways, via dated photographs or video footage
 - Liaise with the Local Authority regarding working hours, noise/dust/odour control, and protected trees
 - Complete a full services search and liaise with all relevant utility companies regarding work in close proximity to their apparatus
 - Prepare a detailed Method Statement outlining how the objectives of this Remediation Strategy will be achieved (and obtain approvals)
 - Inform the Engineer of any risk, identified and assessed, which could impact upon the Engineer's activities
 - Prepare the necessary COSHH statements and Health & Safety Plan in accordance with CDM regulations
- 5.4.2 The Contractor should satisfy the Health & Safety Executive with regard to all matters concerning the health, safety and welfare of persons on the site.
- 5.4.3 The Contractor should ensure that:
- Personnel, plant, materials and other equipment related to the contract are confined within the boundaries of the site.
 - Any live services lying within the site boundary are marked and protected, or appropriate arrangements made to truncate them.
 - Good practices relating to personal hygiene are adopted.
 - Suitable precautions are implemented at all times to prevent off-site migration of contaminants via airborne dust and vapours.
 - Suitable precautions are taken to prevent the spread of mud and debris on public highways.
 - Refuelling of mobile plant is undertaken in a designated area. Above ground oil storage tanks should comply with the requirements of Pollution Prevention Guideline PPG2. A spill kit should be kept on site, adjacent to the designated refuelling area. (Lithos are aware that some of the EA PPG documents have been withdrawn from the gov.uk website. However, whilst some references to UK legislation and guidance are now outdated; the PPGs still set out key principles and provide a useful, concise overview).

5.5 Materials Management Plan

- 5.5.1 This project will involve the re-use of both natural and made ground soils on site and potentially the import of natural soils from another development site(s). The Contractor could prepare a Materials Management Plan (MMP) in accordance with the CL:AIRE Code of Practice (v2, March 2011).
- 5.5.2 The MMP would document how all of the materials to be excavated during the proposed site preparatory and remediation earthworks are to be dealt with. In summary the MMP would provide:
- Details of the parties that will be involved with the implementation of the MMP
 - A description of the materials in terms of potential use and relative quantities of each category

- The specification for use of materials against which proposed materials will be assessed, underpinned by an appropriate risk assessment related to the place where they are to be used
- Details of where and, if appropriate, how these materials will be stored
- Details of the intended final destination and use of these materials
- Details of how these materials are to be tracked
- Contingency arrangements that must be put in place prior to movement of these materials
- Verification Plan

5.5.3 The MMP should include consideration of the following factors:

- Any risks posed by the excavated materials to both human health and the environment
- Suitability for use
- Certainty of use
- Anticipated quantities of materials

5.5.4 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. The tracking system must include:

- Annotated plans of the site(s) identifying different excavation areas, stockpile locations, treatment areas (if applicable) and placement locations
- Inspection procedures
- Registered waste carrier and non-waste haulier
- Tracking form / control sheets
- Treatment results (if applicable)
- Delivery tickets for non-waste materials (if moving from one site to another)
- Acceptance procedures for non-waste materials

5.5.5 Finally, the MMP would 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.

5.5.6 Once completed, the MMP would need to be reviewed by a Qualified Person (QP), who will submit an online Declaration to CL:AIRE and send a copy to JL. It should be noted that in accordance with the Code of Practice, Lithos cannot act as the Qualified Person because we have prepared this Remediation Strategy.

5.6 Engineering supervision and verification

5.6.1 Site works should be supervised throughout by a suitably qualified Engineer, who will report to a Project Manager. Supervision may be part-time for certain activities, but must be full-time during the removal of any grossly contaminated soil/fill (including the identified hot-spots) and any placement of fill to an engineering specification.

5.6.2 The Engineer will ensure that the requirements of this Remediation Strategy are complied with in a safe and orderly manner.

5.6.3 The responsibilities of the Engineer should include, but not be limited to, the following:

- Ensuring that all site personnel are suitably qualified and given an appropriate induction at the beginning of their first day
- Supervision of the remediation and ground preparatory works
- Provision of advice on the correct handling of materials and conditions encountered

- Provision of guidance on the appropriate protective clothing and safety equipment that is to be made available and used
- Ensuring that personal hygiene arrangements are adequate
- Retrieval of soil and water samples and the subsequent scheduling of appropriate laboratory analysis to enable verification of various aspects of the works, and to advise the Project Manager of progress
- Liaison with statutory authorities as required

5.6.4 The Engineer will maintain records of the works to include the following:

- Daily record sheets to include a summary of the day's activities
- Date and weather conditions
- Plant, personnel and visitors present
- Aspects relating to Health and Safety, Environmental Control, or non-compliance with either this Remediation Strategy or the Contractor's Method Statement
- Site surveys as necessary to record the locations of demolition, excavation and filling activity
- Test results

5.6.5 On satisfactory completion of all the works the Engineer, with input from the geoenvironmental engineer as necessary, will prepare a Verification Report, in accordance with the Environment Agency's online guidance "Land Contamination Risk Management" which replaced CLR11 in October 2020. Copies of the Verification Report will be issued to JL.

5.6.6 The Verification Report will stand as certification that the remediation and ground preparatory works have been carried out in accordance with this Remediation Strategy.

5.6.7 The Verification Report will include:

- A summary of the preparatory & remediation works undertaken, including any works associated with unforeseen ground conditions
- Verification test results associated with "hot-spot" treatment, including plans showing sample locations & levels, and the extent of any "hot-spot" excavations
- Details of the fate of any arisings excavated from "hot-spot"
- Verification test results associated with proposed source materials for imported clean soils or site won soils
- Verification of the 600mm soil cover system (where hotspot arisings are placed in POS areas).
- Copies of any correspondence with Regulators relating to specific aspects of the remediation works

6 REMEDIATION STRATEGY (SPECIFIC OBJECTIVES)

6.1 Contingency for unknowns

6.1.1 Even after an appropriate preliminary investigation and ground investigation, with exploratory holes on a closely spaced grid (say trial pits at 30m centres), a geoenvironmental appraisal is typically based on inspection of the ground underlying less than 0.5% of the total site area (and much less at depths in excess of about 3.5m). Consequently, there is always a possibility that unanticipated ground conditions will be encountered during the remediation works.

6.1.2 If unanticipated ground is encountered during the remediation works, the Contractor should immediately seek further advice from the Engineer.

- 6.1.3 In accordance with the requirements of Conditions 12 & 13 of the planning permission, in the event that remediation works are unable to proceed in accordance with this Strategy or contamination not previously considered is encountered, all works (apart from investigation works) should cease immediately and the Local Planning Authority should be notified in writing within 2 working days.
- 6.1.4 In order to assess the nature of any unanticipated grossly contaminated soil/fill, and (if necessary) allow revision of this Strategy document, it should be placed in temporary stockpiles on hardstand or an impermeable membrane, suitably covered and bunded.
- 6.1.5 Analysis of at least 6 samples, for an appropriate range of determinands should be undertaken on any such grossly contaminated/fill material. On receipt of the results, the Engineer will liaise with the Contractor regarding the most appropriate remediation option.

6.2 Well decommissioning

- 6.2.1 Monitoring well WS05 (installed by HH) should be decommissioned in order to prevent the possibility of gas migration into sub-floor voids. Decommissioning could be achieved by filling the well with gravel and then bentonite pellets (uppermost 2m; to be wetted after placement). The headworks (raised helmet or stop-cock type cover) should then be removed and the surface made good.
- 6.2.2 Ideally the upper length of HDPE well pipe should be back-screwed and removed from the borehole, with the resultant 'hole' to be filled with bentonite pellets (to be wetted during and after placement).

6.3 Site clearance

- 6.3.1 Any trees currently under a preservation order should be identified and agreed with relevant authorities prior to the commencement of the works. All trees subject to a TPO should be clearly identified and protected by fencing in accordance with BS5837: 2012.
- 6.3.2 The site should then be cleared of all residual debris, any vegetation, shrubs, bushes and unprotected trees as instructed by JL.
- 6.3.3 In the areas of the dwellings and road Topsoil should be stripped and placed in a temporary stockpile. The Engineer may instruct analysis (pH, metals, asbestos ID and speciated PAH) of further samples from the topsoil stockpile in order to confirm its suitability for re-use.
- 6.3.4 Where hot-spots interact with trees that are being retained only a shallow scrape of surface soils will be undertaken given the low risk of contamination and that these areas will be POS (subject to approval from the arboriculturist). The scraped soils should be considered as hot-spot arisings and treated accordingly i.e. removal or placement at depth. The shallow scrape around trees should be replaced by clean tested soils (See Section 6.17).

6.4 Asbestos

- 6.4.1 Localised fragments of asbestos cement sheeting may be encountered during site preparation works. All suspected asbestos-containing material should be recovered by hand and placed in double sealed bags, within a sealed skip for off-site disposal at a suitably licensed landfill site. Personnel involved in this activity should be equipped with appropriate personal protective equipment, including dust masks (minimum FFP3).
- 6.4.2 An asbestos ID (screen) was scheduled on 20 samples of made ground, with asbestos identified in 4 samples. Two of these samples yielded amounts of asbestos above the limit of measurement (<0.001%).

- 6.4.3 Provided soils are kept damp the risk of airborne fibre release, even during disturbance associated with excavation, should be negligible, and certainly below the control limit (as set by the Control of Asbestos Regulations 2012) of 0.1 f/cm³ airborne fibres averaged over a 4-hour period.
- 6.4.4 Any made ground soils where asbestos is or has been positively identified and considered representative of near-surface soils, must be isolated beneath a minimum 600mm thick surface cover of "clean" soil plus a high-visibility marker barrier, (garden/landscaped areas), or hardstand (parking areas), or floor slabs (buildings). In line with the principles of sustainable development, there should be no need to export any soil from site however, JL can still consider off-site management of these materials.

6.5 Site regrade

- 6.5.1 Regrade of site is anticipated to facilitate the proposed housing layout. It is understood that JL will require the appointed earthworks contractor to undertake digital terrain modelling, with a view to:
- Achieving a materials balance (thereby avoiding the need for any significant import or export of soils)
 - Confirming final levels, including Plot FFLs
 - Achieving acceptable highway and drive gradients
 - Minimising foundation abnormalities
- 6.5.2 The earthworks modelling should consider the possibility of using site-won subsoil as cover material (subject to the Engineer's approval), and how excess foundation and drainage arisings will be accommodated.

6.6 Excavation of contaminated soil/fill

- 6.6.1 Hot-spots relating to elevated arsenic, lead, PAHs and asbestos have been encountered and will require excavation and either exported offsite for appropriate management or placed at depth below a 600mm clean soil cover system (with high visibility marker layer at the base).
- 6.6.2 The hotspot areas are delineated in the Hotspot Remediation Areas Drawing (Ref. 5773/6); included in Appendix A and should be treated as follows:

Hotspot Ref.	Contaminant	Depth and extent of excavation	Validation
HS (BH04)	Arsenic	0.2m deep 5m radius (E: 425010, N: 423487)	Arsenic at base (No. 1) and sidewalls (No. 4)
HS (HH TP02)	Asbestos (not quantified and assumed >0.001%)	0.8m deep 5m radius (E: 425080 N: 423490)	Asbestos ID at base (No. 1) and sidewalls (No. 4)
HS (WS11 & 12)	Asbestos (>0.001%) & lead	0.3 across the full area deepened to 0.6m (WS12 E: 425175 N: 423504 and to 1.3m (WS11 E: 425189 N: 423519)	Asbestos ID and lead at base (No. 3) and sides (No. 8)

- 6.6.3 No hydrocarbon contamination of concern has been recorded to date. However, the possibility that localised 'hot-spots' will be encountered during the site preparatory works cannot be discounted.

- 6.6.4 Each excavated 'hot-spot' of soil should be placed in a separate stockpile on hardstand or an impermeable membrane, suitably covered and bunded.
- 6.6.5 Following excavation of the hot-spots, the Engineer will inspect and sample the resultant excavations.
- 6.6.6 The Engineer will instruct continued removal of soil/fill if verification samples yield concentrations in excess of the clean-up criteria outlined in Section 3.
- 6.6.7 Excavations should not be left open for longer than is necessary and should be securely cordoned-off using 2m high Heras-type fencing, with appropriate warning signs whenever excavation works are suspended.
- 6.6.8 Excavated contaminated soils should either be treated or disposed of off-site; see Sections 6.7 and 6.8 respectively.
- 6.6.9 On completion of soil removal, excavations are to be backfilled in line with the Protocol for Placement of Non-Engineered General Fill in Appendix B.

6.7 On-site treatment of contamination

- 6.7.1 Given the limited anticipated volume of hot-spot soil arisings anticipated, export to landfill (see Section 6.8) may prove to be the most efficient and economical option. However, the Contractor could also consider placement of the material below a 600mm clean soil cover system (with high visibility marker layer at the base) in the POS area. This would need to be supervised by the Engineer.
- 6.7.2 Whichever option is undertaken this will need to be included in the Verification Report.

6.8 Export to landfill

- 6.8.1 Excavation arisings that are unsuitable for retention and re-use on site should be placed in temporary stockpiles on hardstand or polythene sheeting and be suitably covered to minimise the potential for dust/odour nuisance and prevent surface water run-off.
- 6.8.2 Given the proximity of existing housing, stockpiles of hot-spot arisings or other potentially contaminated material should be exported from site as soon as practically possible.
- 6.8.3 Any material exported from site to landfill or soil treatment facility should be hauled by a registered waste carrier in accordance with the requirements of the Waste Regulations 2011 and the Landfill (England & Wales) Regulations 2002.
- 6.8.4 Waste duty of care documentation should be completed, signed and retained by the parties involved. The documentation should include the volume of waste, the nature of the material and a statement of its chemical composition, details of the source and destination sites, and details of the haulier.
- 6.8.5 In order to protect the general public from dust and vapour emissions, wagons that are to be used for the haulage of the contaminated material from the site must be sheeted. In addition, the Contractor must ensure that no fluids seep from the wagons.
- 6.8.6 In order to provide the landfill facility with information regarding chemical composition of the waste, further analysis of any material that requires removal from site may be required.

Waste classification

- 6.8.7 Sampling and characterisation of stockpiled materials generated during the site preparatory works is likely to be required if off-site disposal is proposed.

- 6.8.8 It should be noted that the classification and assessment of waste soils under the Environment Agency's Technical Guidance WM3², is a complex process.
- 6.8.9 It is critical if material is to be exported from site that this is allocated an appropriate waste code, following the steps within WM3. Waste carriers transporting, and sites accepting, this material should have a corresponding code within their permits. It is the responsibility of those generating the waste (i.e. the site), to ensure that the waste is handled and disposed of appropriately.
- 6.8.10 With respect to **asbestos**, waste soils will be classed hazardous if the soil mass contains more than 0.1% asbestos fibres that are free and dispersed. However, WM3 states that where the waste contains identifiable pieces of asbestos (i.e. any particle of a size that can be identified as potentially being asbestos by a competent person if examined by the naked eye), then the waste is hazardous if the concentration of asbestos in the pieces alone is 0.1%. If a stockpile of soil contained rare fragments of broken asbestos-cement sheeting, the whole stockpile would be classed as hazardous unless all the fragments could be picked-out (even though the concentration of asbestos in the soil mass might be orders of magnitude less than 0.1%).
- 6.8.11 Contractors exporting waste from the site should review the site investigation data and make their own assessment. Alternatively, Lithos could undertake this assessment once exported waste streams have been identified.

6.9 Control of water

- 6.9.1 Groundwater should be controlled in accordance with CIRIA report 113 "Control of Groundwater for Temporary Works".
- 6.9.2 Arrangements should be made to prevent ponding in any excavation "hollows"; the Contractor should ensure that ground levels are of sufficient gradient to enable the collection of surface water run-off in sumps or grips.
- 6.9.3 Pumping from over-excavated sumps may be required to maintain satisfactory working conditions.
- 6.9.4 The Contractor should make all necessary arrangements to prevent off-site migration of contaminated sediment via surface water run-off. This will necessitate the installation of surface water grips, and removal, sealing-off, or diversion of all redundant former site drains (and any land drains).
- 6.9.5 A Surface Water Management Plan should be prepared by the Contractor, describing the mitigation measures that will be put in place to intercept direct run-off from any disturbed areas, stockpiles etc, thereby preventing any potential impact of adjacent land and nearby watercourses. Surface water run-off will probably require treatment (as a minimum to allow settlement of fines) prior to consented discharge.
- 6.9.6 Any potentially contaminated water (not anticipated on this site) should not be allowed to escape to other areas until the results of the analysis are available and, if required, a suitable means of water treatment has been agreed.
- 6.9.7 Water collected in sumps should be passed through a series of oil/water separators to remove any oily contamination. Oils trapped in the absorbent medium should be disposed of to a suitably licensed landfill site.
- 6.9.8 Treated water should then be tankered off-site, or be discharged to sewer, subject to analytical results and local water treatment company consent.

² Technical Guidance WM3 – Guidance on the classification and assessment of waste. Environment Agency 2015

6.10 Removal of below ground obstructions

- 6.10.1 All foundations associated with relict structures should be chased out and grubbed-up, in order to remove potential obstructions to new foundations and infrastructure.
- 6.10.2 Drawing 5773/3 shows the location of the single building recorded on historical OS plans although there may be other unrecorded former buildings.

6.11 General Fill

- 6.11.1 Excavations (to remove tanks, relict structures, contamination etc) should be backfilled as necessary to achieve the desired levels, with suitable materials and compacted in accordance with Lithos' Protocol for Placement of Non-Engineered General Fill; copy included in Appendix B.
- 6.11.2 However, where an excavation conflicts with the footprint of a proposed highway, compaction in accordance with the Specification for Highway Works will be required (see Section 6.12).
- 6.11.3 The site surface should be initially left 300mm below proposed finished garden levels to allow for placement of soils. In areas of highways the ground surface will be left approximately 600mm below finished road level.
- 6.11.4 The anticipated backfill materials should be adequately characterised by further testing of backfill materials is not anticipated.
- 6.11.5 Nonetheless, excavated arisings will be inspected by the Engineer, and any suspicious material or material yielding evidence of significant contamination (based on visual/olfactory observations), will be placed in temporary stockpiles from which an adequate number of samples will be taken (typically a minimum of 6 samples). The samples will be scheduled for an appropriate suite of contaminants in order to characterise the material and decide its fate.
- 6.11.6 Any material considered unsuitable for use as backfill will be exported from site (see Section 6.8).

6.12 Highways

- 6.12.1 The Contractor should consult the adopting authority regarding preparation of the ground beneath new highways (as outlined below, or in any proposed alternative specification) in advance of the works. The Contractor should also agree acceptable performance criteria, with the Engineer and the adopting authority.
- 6.12.2 However, it is considered that the following options would be suitable to enable the construction of the highways.
- 6.12.3 The natural soils present at shallow depth (anticipated formation) are predominantly cohesive. Based on visual inspection of the natural materials and the recorded plasticity indices at the site, published tables³ indicate that the shallow deposits would be expected to provide a CBR value of at least 2% (based on the Solmek report). This value should be verified prior to or during construction.

³ The Structural Design of Bituminous Road, TRRL Laboratory Report 1132 (Table C1, page 36)

- 6.12.4 Whilst the CBR estimated above should be achievable, significant deterioration during/after periods of significant rainfall and/or site trafficking is likely. Consequently, it would be prudent to consider flexibility in the groundworks programme to enable highway construction during prolonged dry/warm weather (typically between April & September) when formation will be least vulnerable to deterioration. Alternatively, a minimum 200mm thickness of suitable granular fill (i.e. a "blanket" of 6F2) could be placed along the line of proposed highways to protect formation during the construction phase.
- 6.12.5 Made ground should be excavated from beneath new highway footprints to a maximum of depth of 2.0m from existing ground level or proposed highway formation, whichever is the lower in terms of levels. Highways should then be raised to formation level, either with:
- Suitable aggregate placed & compacted in accordance with The Highways Agency Specification for Highway Works (SHW) Series 600, or
 - Suitable screened & selected site-won material, placed & compacted in accordance with SHW Series 600. Unsuitable materials include any soft or wet materials, biodegradables including topsoil, wood, scrap metal, frozen & oversize material.
- 6.12.6 Some refinement of the above advice might be possible after highways design (with consideration of the proposed formation level cf existing ground level), and via inspection (and usually CBR testing) of the proposed formation during site preparatory groundworks.
- 6.12.7 Any residual made ground materials in the base of the excavation (i.e. in areas where the thickness of made ground exceeds 2m) should be inspected and (where necessary) any soft spots removed and replaced with suitable engineered fill.
- 6.12.8 The suitability of site-won material for placement as engineered fill should be confirmed by field trials and geotechnical laboratory testing, which will yield the following information:
- Number of passes with the compaction plant (to be used during subsequent earthworks)
 - Maximum layer thickness (plant dependent)
 - Acceptance criteria: minimum dry density & moisture content range
- 6.12.9 The engineered fill should achieve at least 95% maximum dry density, with air voids comprising less than 10%, as determined by 2.5kg laboratory compaction tests.
- 6.12.10 Where the made ground is re-engineered in accordance with the above specification, it is considered that a CBR value of 5% should be achievable; however, this should be verified by field trials.
- 6.12.11 The Contractor should ensure that only suitable granular fill is placed within 450mm of estate road formation in order to protect cohesive sub-grade materials (including natural cohesive soils). Such fill should be placed in accordance with the Specification for Highway Works.
- 6.12.12 The Contractor will arrange for the necessary compliance testing to be undertaken at formation level on road alignments, as required by the adopting authority and Engineer. As a minimum this should comprise plate load tests, carried out to determine the CBR at formation level, at approximate 25m intervals. Test locations should be staggered across the width of the highway to ensure the whole highway area is assessed.

6.13 Boundary issues

- 6.13.1 JL's Designer should ensure that proposed levels tie in with the surrounding infrastructure, and ground levels of adjacent properties (after allowance for the placement of any required soil cover).

- 6.13.2 Advice should be sought from the Engineer if mobile contamination or redundant drains/utilities are encountered close to the site's boundaries.

6.14 Surveying

- 6.14.1 The Contractor should arrange for the following survey work as directed by the Engineer:
- All setting out necessary to allow the works to proceed
 - Recording of the depth and lateral extent of excavations to remove obstructions, contaminated soils etc
 - Recording of the positions of any relict obstructions (i.e. former build foundations) left in-situ
 - Recording the final location of hot-spot arisings (if retained on site)
 - Recording the locations and volumes of all stockpiles of suitable materials left on site for JL 's use during the development works
 - As-built survey of the finished surface
- 6.14.2 The Contractor should supply the results of this survey work to the Engineer for inclusion in the Verification Report.

6.15 Placement of soil cover

- 6.15.1 Where hot-spot arisings remain beneath proposed POS areas, it will require isolation beneath a clean soil cover system. However, given the compressible nature and gas generating potential of this topsoil it must be overlain by no more than 1m of soil.
- 6.15.2 This cover layer is to comprise 600mm of "clean" subsoil and topsoil plus a 150mm 'hard dig' layer, or a high-visibility contaminated ground warning / marker barrier, such as Lotrak Alarm18.
- 6.15.3 Where no placement of hotspot arisings is undertaken, provision of clean soils (min. 300mm) is required. The chemical/physical quality of the soil needs to be assessed and included in the Verification Report; however, **soil depth checks would not be necessary** in this scenario.
- 6.15.4 Post hotspot excavation in the proposed POS areas the Contractor should use either clean imported soils or site won tested soils to finish off the landscaping to provide an adequate growing medium.
- 6.15.5 Some soils suitable for use in gardens/POS may be sourced on site, subject to the Engineer's approval. The Engineer will assess accessibility, suitability, the conceptual site model (most notably the creation of new pathways by which mobile contaminants could impact controlled waters), and engineering implications (for example, increased foundation depth) before allowing any excavation of in-situ natural soils for re-use as clean cover. However, there may also be a need for soil import.
- 6.15.6 Topsoil and subsoil quality (site won and imported) should be assessed in accordance with Lithos' Protocol for Importation & Use of Soil Cover (Capping), copied in Appendix C.
- 6.15.7 This Protocol includes chemical assessment criteria which should not be exceeded.
- 6.15.8 This work may be undertaken as part of the contract for the preparatory & remediation works, in which case imported soils should be stockpiled in a location agreed with the Engineer. Alternatively, the developer may choose to import soil at a later stage in the development.

6.16 Topsoil placement

- 6.16.1 Garden/landscaped areas to be provided with topsoil to a thickness of not less than 100mm. Topsoil thicknesses in excess of 400mm should generally be avoided.
- 6.16.2 Prior to placement of topsoil, the underlying subsoil should be loosened by ripping or rotovating. Stones and other objects greater than 50mm should be removed from the prepared surface, and the loosened subsoil should be roughly levelled so that an even depth of topsoil can be achieved.
- 6.16.3 For the loosening to be most effective, it should be undertaken when the subsoil is dry to the full depth of working.
- 6.16.4 Subsequent trafficking over the loosened subsoil should be minimised.
- 6.16.5 Topsoil should not be placed during or immediately after heavy rain.
- 6.16.6 An excavator with a toothed bucket should be used to load the topsoil from stockpile into dumpers, to prevent excessive smearing.
- 6.16.7 The dumper should tip the topsoil onto the receiving surface, and topsoil should then be spread to the required depth by an excavator. Both the dumper and excavator should avoid tracking over the placed topsoil.
- 6.16.8 After re-spreading topsoil, any large compacted lumps should be broken down to produce a fine tilth suitable for planting, turfing and seeding (< 10mm maximum aggregate size).

6.17 Trees & root protection zones

- 6.17.1 JL will need to appoint an Arboriculturist to provide a Method Statement that sets out measures to avoid tree damage whilst undertaking the works outlined in this Remediation Strategy. The Arboriculturist will also need to provide a Tree Protection Plan and attend site as\when necessary.
- 6.17.2 The following general comments relating to tree and root protection are provided for general guidance and further advice should be sought from an Arboriculturist.
- 6.17.3 Any trees currently under a preservation order should be identified and agreed with relevant authorities prior to the commencement of the works. All trees subject to a TPO should be clearly identified and protected by fencing in accordance with BS5837:2012⁴.
- 6.17.4 Before work of any kind begins, the Site Manager and Arboriculturist should meet on site to discuss the construction methodology, identify and resolve any difficulties relating to tree protection requirements, and mark out fence lines and ground protection areas.

Tree works

- 6.17.5 Before tree works commence, the Arboriculturist should mark any trees to be removed with paint and provide the Council with written notice at least 7 days before felling commences.
- 6.17.6 Any necessary tree work should be completed out by an appropriately trained and equipped Tree Surgeon, holding the relevant certificates of competence and insurance for all operatives employed on the site. All works should be carried out carefully, safely and in a workmanlike manner in accordance with BS3998:2010⁵.

⁴ BS5837 (2012) - *Trees in relation to design, demolition and construction – Recommendations.*

⁵ BS3998:2010 - *Tree work. Recommendations.*

6.17.7 Care should be taken with machine operations to avoid damage inside root protection areas.

6.17.8 The Arboriculturist may need to maintain a watching brief during the tree works.

Tree protection

6.17.9 Trees including the ground containing their roots require protection against impact, significant soil stripping, soil compaction and other forms of damage arising from remediation and construction activity. To avoid damage, adequate tree protection is essential.

6.17.10 After tree works are complete, and before any other work begins, 2m high metal weld mesh fencing should be erected in locations shown on a Tree Protection Plan to be provided by the Arboriculturist.

6.17.11 It is essential to ensure that the tree protection fencing is installed exactly as shown on the Tree Protection Plan, to avoid conflict with subsequent remediation and/or construction works.

6.17.12 Feet should be firmly pegged to the ground and panels bolted together. Fencing should be fully braced with scaffolding on the tree side to prevent movement in accordance with BS5837:2012.

6.17.13 Pre-printed laminated A4 notices are to be attached to the site side of each panel stating "**CONSTRUCTION EXCLUSION ZONE – NO ACCESS**".

6.17.14 The Arboriculturist should inspect the fencing after erection, to check location and adequacy of protection.

6.17.15 The Arboriculturist should provide the Council with written notice of the completion of tree protection fencing at least 7 days before site works recommence.

6.17.16 For the avoidance of doubt, fencing should remain in situ and be maintained in an effective condition, until all building works are complete.

6.17.17 The Site Manager should undertake daily checks of the tree protection fencing to ensure that it is maintained in an effective and serviceable condition, and to ensure that any defects are immediately rectified.

Removal of Tree Protection fencing

6.17.18 Once satisfied that the site is free from construction activity, the Arboriculturist should issue written instructions for the removal (by hand) of the tree protection fencing.

Marrying of soil levels

6.17.19 The edges of soil spread outside root protection areas should be married-in by hand, under arboricultural supervision using landscaper rakes, with existing ground level inside root protection areas, ensuring that the levels inside the latter are not raised or lowered.

Cultivation

6.17.20 Cultivation for seeding, turf laying and planting inside root protection areas should be carried out by hand under arboricultural supervision using a pedestrian rotovator to a maximum depth of 100 mm taking care to avoid root damage.

6.18 Hazardous gas protection

6.18.1 Based on the site characterisation discussed above, the proposed foundation solution, and with reference to the gas protection “scoring” system outlined in BS8485:2015+A1:2019, Lithos consider that the following protective measures should be incorporated in all new buildings:

Charac. situation (Wilson & Card, '99)	Gas “Score” req'd by BS8485	Protective measures (Residential) (See footnote for definition of Building Type A)		
		Floor slab (BS8485 “score”)	Sub-floor ventilation (BS8485 “score”)	Membrane
				Type (BS8485 score [∞])
CS2	3.5	Select one from: Block & Beam – (0.5). Reinforced ground bearing slab – (0.5). Reinforced, cast in-situ suspended slab (with minimal and suitably sealed service penetrations & joints) – (1.5). Reinforced ground bearing raft (with limited service penetrations cast into slab). Note: the venting area through any downstand beam should be 3 times greater than that provided by the side ventilation (air bricks) – (1.5).	Select one from: Passive sub-floor ventilation; venting layer could be: A min. 150mm clear void (2.5), or A proprietary void former providing an equivalent clear void depth of 60mm; see Section B7 in BS8485 (2.5), or Min. 300mm thick blanket of min. 20mm single size rounded or sub-angular gravel (1.0). Min. ventilation = 1,500 mm²/m run of external wall (via air bricks on each of 2 opposite sides), with 100mm pipes at 1.75m centres or honeycombing of any sub-floor sleeper walls.	Gas resistant membrane meeting all of the following criteria: • sufficiently impervious to gases with a methane gas transmission rate <40.0 ml/day/m²/atm (average) for sheet and joints (tested in accordance with BS ISO 15105-1 manometric method); • sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions; • sufficiently strong to withstand in-service stresses (e.g. settlement if placed below a floor slab); • 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); • capable, after installation, of providing a complete barrier to the entry of the relevant gas; • a minimum 0.4 mm thickness (1600g polyethylene) reinforced membrane (virgin polymer); and • verified in accordance with CIRIA C735[∞] (2.0)

Footnotes:

- [∞] In accordance with CIRIA C735, a Verification Plan should be prepared which outlines the activities (inspection and testing), the relevant personnel, and the type of records to be collected. Gas membranes need to be visually inspected to establish possible damage. For CS3 sites inspection & verification should be carried out by an independent third party. However, whilst conflicts of interest in verification should be avoided, the Developer's staff on site could undertake inspection & verification on CS2 sites. In all circumstances, the verifier should be competent, experienced and suitably trained.
1. Building Type A is defined in Table 3 and Section 7 of BS8485:2015+A1:2019 as: private ownership with no building management controls on alterations to the internal structure, the use of rooms, the ventilation of rooms or the structural fabric of the building. Examples include private housing and some retail premises
 2. A combination of two or more of the three types of protection measures (slab, ventilation & membrane) should be used to achieve the BS8485 score.
 3. The membrane should always be lapped and sealed in accordance with BRE\Environment Agency Report BR 414 (2001) – “Protective Measures for housing on gas-contaminated land”. The membrane should be continuous across internal walls & the cavity, and there should be a cavity tray in external walls.
 4. In all cases there should be minimum penetration of floor slab by services; any penetrations should be suitably sealed.

6.18.2 In order to ensure the effectiveness of gas protective measures, workmanship should be carried out by appropriately trained and qualified personnel.

6.18.3 Independent third-party verification (i.e. not by the installer or any associated company) of gas protection measures is required in accordance with the guidance, which as a minimum should include visual inspection. In all cases the verifier should be competent, experienced and suitably trained. As stipulated in the CIRIA guidance the frequency of verification will be dictated by the experience of the installer.

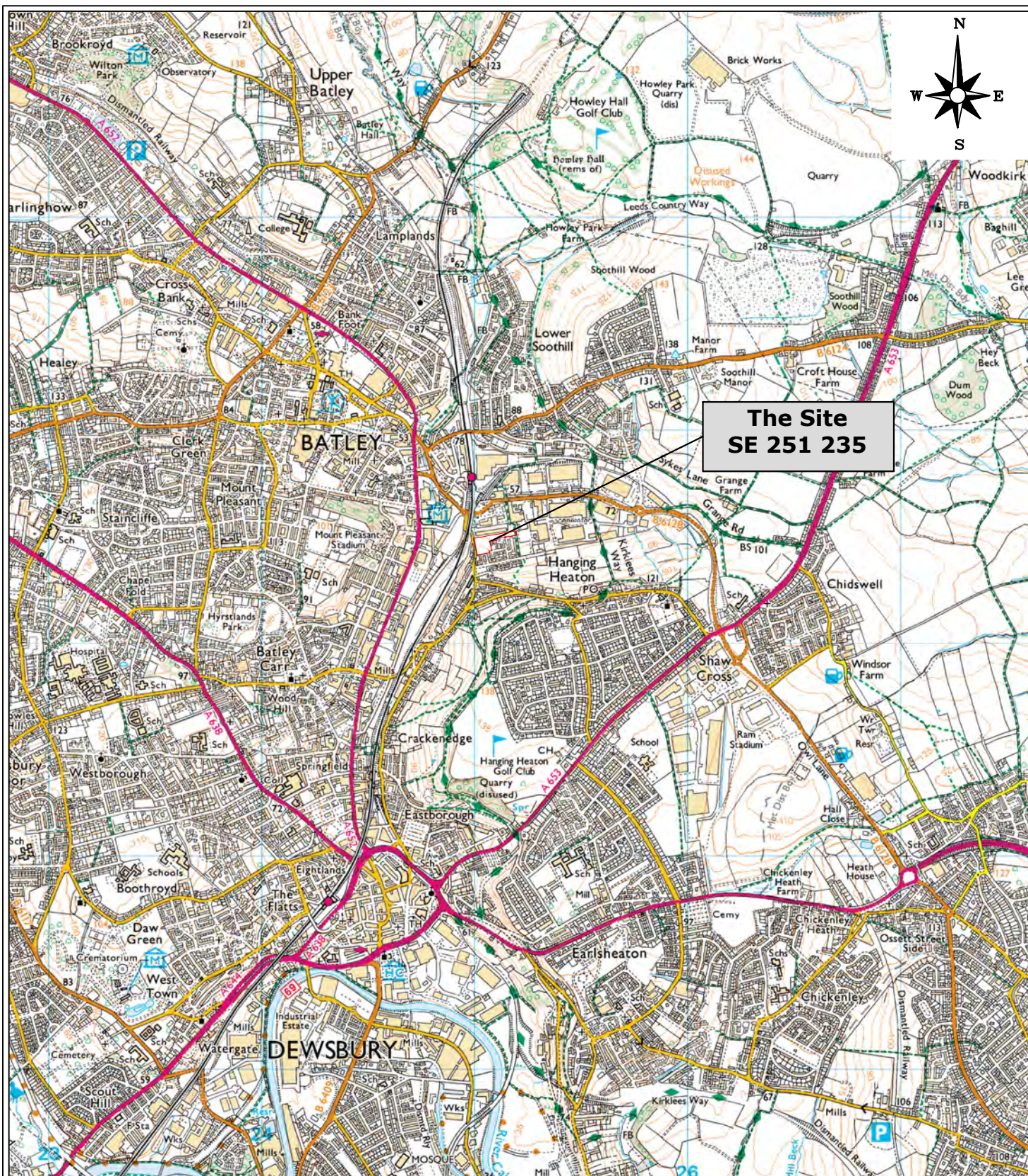
- 6.18.4 In general accordance with CIRIA⁶, YALPAG guidance⁷ and NHBC guidance⁸ a **Gas Protection Strategy and Verification Plan** (Design Report and Construction Drawings) should be prepared which detail site specific requirements for the gas protection system with respect to the development.
- 6.18.5 BRE/Environment Agency Report BR 414 (2001) – “Protective Measures for housing on gas-contaminated land” provides a practical guide to good practice for the detailing and construction of passive soil gas protection measures for new residential development. Of particular relevance are a list of ‘Watchpoints’, which offer practical information for installation and buildability.
- 6.18.6 Designers/Architects should be made aware of the importance of gas protection measures, and their house designs should take account of potential constraints associated with Building Regulations (most notably those relating to access thresholds, noise and insulation), flood mitigation measures, and utility providers (external meter boxes may have to be located away from air bricks) etc.

⁶ Good practice on the testing and verification of protection systems for buildings against hazardous ground gases. CIRIA C735, 2014.

⁷ Verification Requirements for Gas Protection Systems - Technical Guidance for Developers, Landowners and Consultants. Yorkshire and Lincolnshire Pollution Advisory Group, December 2016.

⁸ Hazardous ground gas – as essential guide for housebuilders. NHBC Foundation, April 2023

APPENDIX A
DRAWINGS



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CLIENT

JACK LUNN

JOB TITLE

HEATON
GRANGE, BATLEY

DRAWING TITLE

SITE LOCATION
PLAN

DRAWN

ET

DATE

19 03 2026

CHECKED

DJ

DATE

19 03 2026

STATUS

FOR COMMENT ☐

DRAFT ☐

FOR APPROVAL ☐

FINAL ☒

SCALE

1:25,000

SHEET

A4

DRAWING NO.

5773/1

REVISION

House Type	Amount	Sq.ft	Sq. m	Total sq. ft	Total sq. m
 2B3P Ellerdale	11	761	70,7	8,371	777,7
 2B4P Dovedale	03	907,4	84,3	2,722	252,9
 2B4P House	01	1058	98,3	1058	98,3
 3B4P Loxley	06	943,9	87,7	5,663	526,2
Total houses:		21	Total area:	17,814	1,655



NOTES		
— APPROXIMATE SITE BOUNDARY		
REPRODUCED FROM JACK LUNN DRAWING REFERENCE 1260-81-010, REV. P14 DATED 9th APRIL 2026		
REV.	DESCRIPTION	DATE



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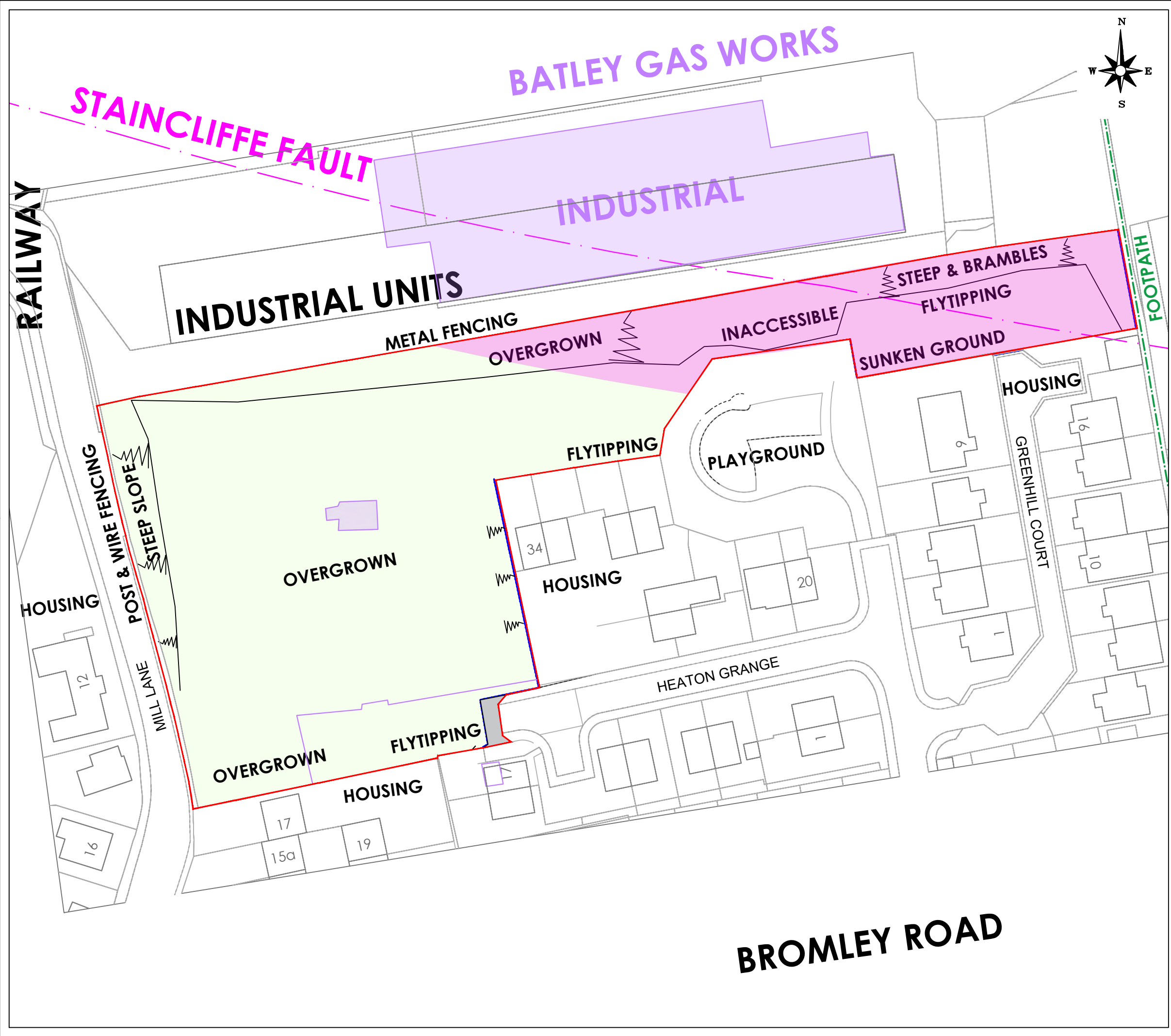
CLIENT	JACK LUNN
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JOB TITLE	HEATON GRANGE, BATLEY
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DRAWING TITLE	PROPOSED SITE LAYOUT
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DRAWN	ET	DATE	14 04 2026	STATUS	FOR COMMENT ☐
CHECKED	DJ	DATE	14 04 2026		FOR APPROVAL ☐
					DRAFT ☐
					FINAL ☒

SCALE	1:750	SHEET	A3	DRAWING NO.	5773/2	REVISION	
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NOTES

- GRASS & OVERGROWN AREAS
- HISTORIC BUILDING
- FOOTPATH
- HERA FENCING
- WITHIN 25M OF MAPPED FAULT
- GEOLOGICAL FAULT (FROM BGS PLANS)
- APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE

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CLIENT

JACK LUNN

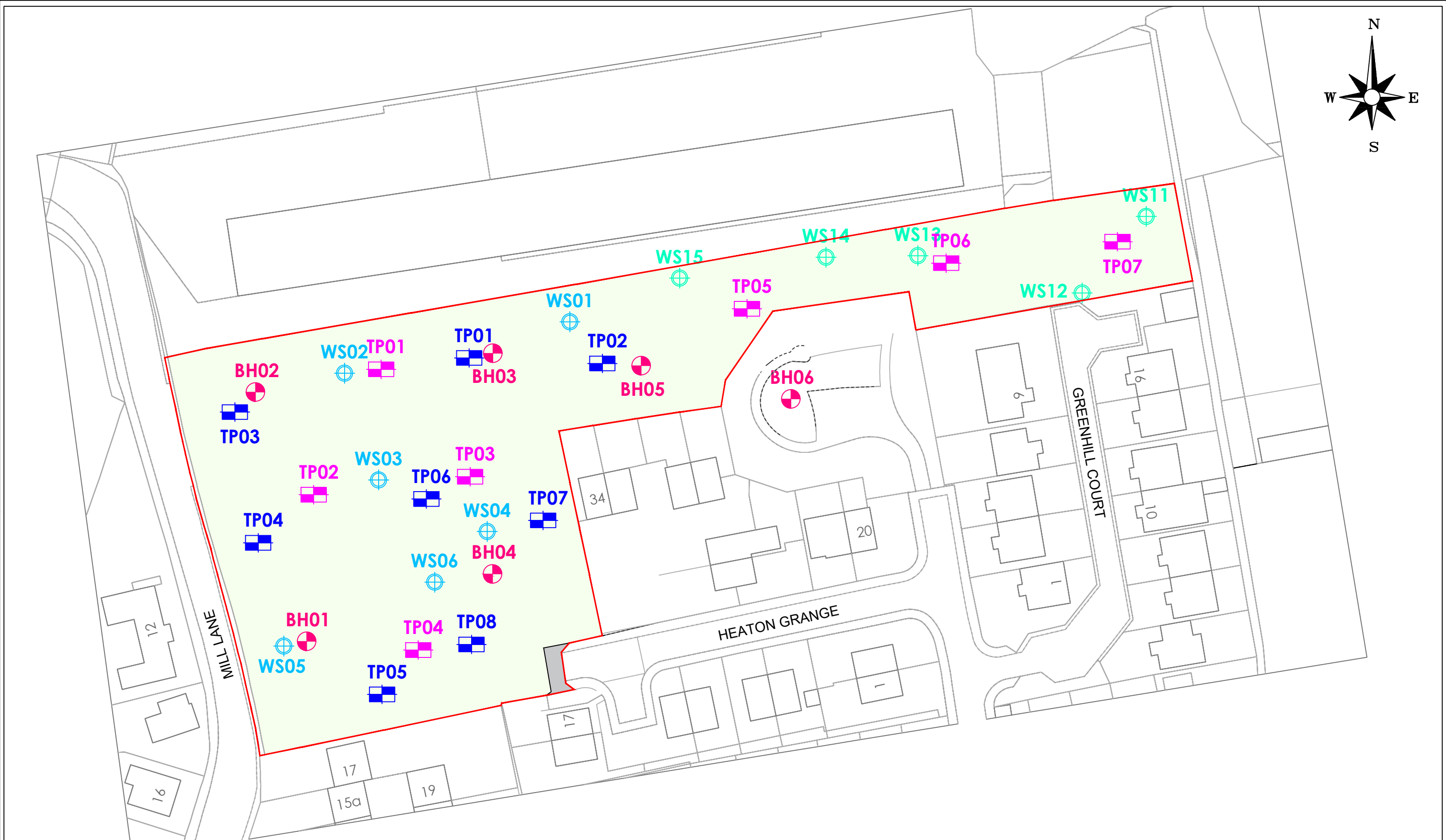
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HEATON GRANGE, BATLEY

DRAWING TITLE

SITE FEATURES

DRAWN	ET	DATE	19 03 2026	STATUS	FOR COMMENT ☐
CHECKED	DJ	DATE	19 03 2026	FOR APPROVAL	☐
				DRAFT	☐
				FINAL	☒
SCALE	1:750	SHEET	A3	DRAWING NO.	5773/3
				REVISION	



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CLIENT

JACK LUNN

JOB TITLE

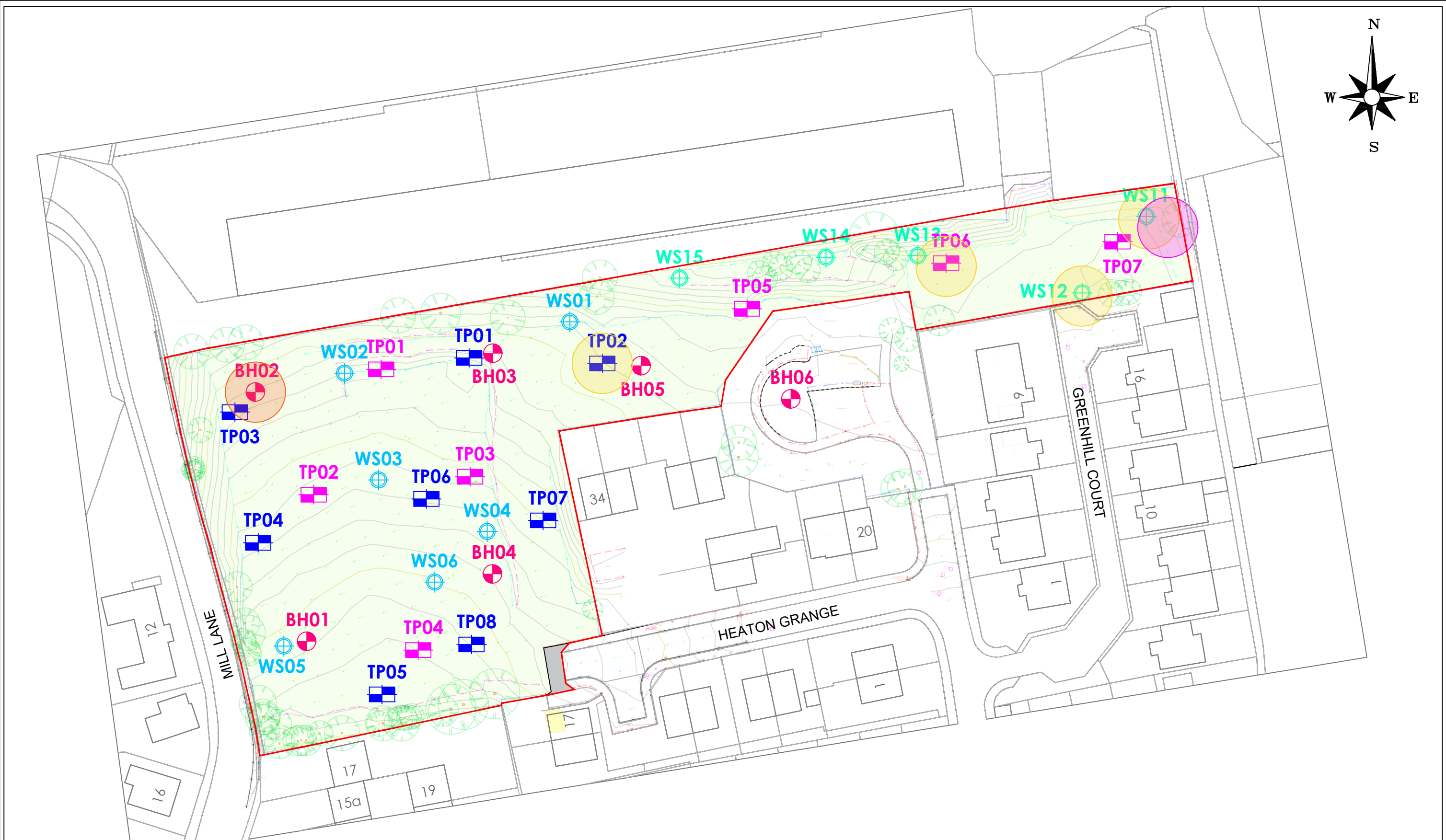
HEATON
GRANGE, BATLEY

DRAWING TITLE

3rd PARTY EXPLORATORY HOLE
LOCATION PLAN

NOTES		
	HH TRIAL PIT LOCATION - JULY 2020	
	HH WINDOW SAMPLE LOCATION - JULY '20	
	HH WINDOW SAMPLE LOCATION - JULY '22	
	SOLMEK TRIAL PIT LOCATION - JAN '24	
	SOLMEK BOREHOLE LOCATION - JAN '24	
	APPROXIMATE SITE BOUNDARY	
REV.	DESCRIPTION	DATE

STATUS	
FOR COMMENT ☐	FOR APPROVAL ☐
DRAFT ☐	FINAL ☒
DRAWN ET	DATE 25 03 2026
APPROVED DJ	DATE 25 03 2026
SCALE 1:750	SHEET A3
DRAWING NO. 5773/4	REVISION



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CLIENT

JACK LUNN

JOB TITLE

HEATON
GRANGE, BATLEY

DRAWING TITLE

3rd PARTY EXPLORATORY HOLE
LOCATION PLAN &
CONTAMINATION

NOTES		
ELEVATED ASBESTOS ELEVATED ARSENIC ELEVATED LEAD		
REV.	DESCRIPTION	DATE

STATUS	
FOR COMMENT ☐ FOR APPROVAL ☐ DRAFT ☐ FINAL ☒	
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APPENDIX B
LITHOS PROTOCOL FOR THE PLACEMENT OF NON-ENGINEERED FILL

1 INTRODUCTION

- 1.1 This protocol is aimed at providing general guidance to contractors in the placement of general earthworks fill materials in areas of a site that do not require high quality, controlled engineering eg Public Open Space. No guarantee can be made as to the degree of settlement that may occur in such fill masses; however, the protocol should mitigate significant differential settlements.
- 1.2 General fill will be either inert soil or contaminated soil that is deemed chemically suitable for reuse in certain specific site areas or beneath a specified 'clean' soil cover layer. All soft and compressible soils or existing fill shall, if comprising unsuitable fill be removed from site. Suitable fill materials may be compacted on site.
- 1.3 Unsuitable fill shall comprise:
 - Cohesive soils having a liquid limit in excess of 90% or Plasticity Index in excess of 65%
 - Chalk having a fine fraction (<400µm) in excess of 10% at the borrow pit
 - Any material containing topsoil, wood, peat or lignite
 - Any material containing biodegradables
 - Any material containing scrap metal
 - Frozen or waterlogged substances
 - Material defined as unsuitable by the Engineer because of its type or level of contamination
 - Material which, by virtue of its particle size or shape, cannot be properly and effectively compacted (eg oversize material, gravels which are tabular and some slate wastes)
 - Expansive steel slag
 - Non-inert or contaminated material
 - Putrescible waste
 - Materials containing minerals hostile to the built environment such as pyritic shales, gypsiferous clays, burnt colliery discard, pulverised fuel ash, spent oil shale or incinerator waste
- 1.4 The base of the area to be filled shall be proof rolled with a dead weight roller and all soft materials removed and replaced with compacted fill. Where unsuitable material has been excavated, the underlying ground shall be compacted to the same specification as adopted for subsequent compaction works.
- 1.5 Fill shall be placed and compacted in near-horizontal layers of maximum 200mm thicknesses and be brought up at a uniform rate so that all parts of the site or particular sections of the site reach finished (formation) level at the same time. Each layer will be subjected to nominal compaction, comprising at least two passes with a towed vibratory roller of at least 2,900 kg per metre width (or equivalent). If the compacted fill demonstrates excessive rutting, excessive roller 'bow-waving' or other soft behaviour then it shall be deemed unsuitable.
- 1.6 Cobbles, boulders, rock or waste fragments, the largest dimension of which is greater than two-thirds of the compacted layer thickness (or greater than 250mm in any dimension), shall not be incorporated into the fill.
- 1.7 When compacting fill in the vicinity of existing trenches, excavations, retaining walls or other structures all work shall be performed in such a way as to ensure that their existing stability is not impaired; this will require careful selection of both compaction plant and compaction method.

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- 1.8 When placing fill against structures the Contractor must only use only the following types of compaction plant for fill within 2m of a structure:
- Vibratory roller, mass per metre width of roll not exceeding 1300 kg and total mass not exceeding 1000 kg
 - Vibrating plate compactor, mass not exceeding 1000 kg
 - Vibro-tamper, mass not exceeding 75 kg
- 1.9 If weather conditions are such that the fill is adversely affected, the Contractor shall cease work until such time as the fill can be placed and compacted to meet the protocol requirements. No fill shall be placed and left uncompacted at the end of the working day. Compacted fill shall be graded to falls to ensure free run-off of rainwater without ponding.
- 1.10 Drainage grips or trenches shall be excavated, as necessary, uphill of the area to be filled to prevent the area becoming flooded. Drainage shall be affected without causing siltation or erosion and water shall be disposed of. The area to be filled shall be graded to falls, and sump pumping or other suitable dewatering facilities shall be provided as necessary by the Contractor to keep the base of the excavation dry at all times.

APPENDIX C
LITHOS PROTOCOL FOR IMPORTATION & USE OF SOIL COVER (CAPPING)

1 INTRODUCTION

- 1.1 Isolation of made ground in garden and landscaped areas beneath a cover of "clean" subsoil, and topsoil is often recommended on new developments; most notably when the made ground contains inorganic (and non-volatile organic) contaminants at concentrations above relevant guidance threshold values. A cover solution is not appropriate for volatile or semi-volatile organic contaminants (fuels, solvents etc); removal or treatment will usually be required.
- 1.2 The thickness of cover is dependent on the end use of the development, nature and degree of contamination (and sometimes the Local Authority whose area the site lies within), Typically for a commercial development between 300mm and 1,000mm thickness is required and for a residential development between 600mm and 1,000mm thickness is required. Regardless of the type of development, where contamination is more significant a granular hard-dig layer or geotextile marker membrane may also be required at the base of the cover.
- 1.3 The "clean" soil cover blocks potential linkages between the contaminated made ground and future site users. Soil cover is not required beneath areas of hardcover including buildings, private drives, carparking and roads.
- 1.4 If the made ground is essentially "clean", but contains materials generally considered undesirable as near-surface material in garden and landscaped areas (e.g. oversize materials such as construction/demolition rubble) then placement of cover is also required. In private gardens, in accordance with NHBC Standards Chapter 10.2, a 450mm thick soil cover should be adequate. In landscaped areas a 300mm thick soil cover should be adequate. For both gardens and landscaped areas if the made ground is essentially "clean" and comprises reworked natural soil, the only cover likely to be required is 100mm topsoil.
- 1.5 The **CML initiative** came into force in April 2003 and relates specifically to residential developments. It requires housebuilders to submit to NHBC (or other warranty providers) a validation report confirming the thickness and quality (i.e. contaminant-free) of the placed soil cover. Validation reports should normally be prepared by independent geoenvironmental consultants.
- 1.6 Failure to submit cover validation reports promptly will delay issue of the cover note by the warranty provider, which will subsequently delay the release of mortgage funds and hence legal completion; i.e. the financial implications are significant. Consequently, it is essential that cover validation is requested at least 2 weeks prior to the anticipated finalling date.
- 1.7 For all land uses soil cover is usually placed many weeks after completion of the preparatory/remediation works, and issue of the associated Verification Report, typically at a relatively late stage in the construction programme.
- 1.8 Prior to placement of soil cover, the appointed remediation contractor and/or groundworker should ensure that ground levels are low enough to accommodate the required cover thickness, taking account of any boundary issues, and, where relevant, without compromising the DPC and any sub-floor ventilation.
- 1.9 Ideally soil quality should initially be determined by sampling of the source (at least 7 working days before importation to the development site) to demonstrate suitability for use. Further sampling of the material at the site may also be required to demonstrate cross contamination did not occur during the importation process. Samples could also be obtained from stockpiles of site won material on site; there may comprise surplus natural ground development arisings. Soil samples could be obtained after placement of the cover layer, but this is not recommended.

- 1.10 Imported topsoil should be subject to testing, unless it is being sourced from a reputable commercial supplier able to provide robust certification (certificate date less than 2 months prior to import date). In addition, some analysis in accordance with BS3882 may occasionally be appropriate.
- 1.11 Where sampling of the source has been carried out, and on receipt of the laboratory results, Lithos will issue a confirmation of soil suitability for importation to the client, who will in turn instruct his contractor to commence importation.
- 1.12 Clearly, if soil cover is imported and placed before confirmation of its suitability, no guarantee can be given that validation work will yield the desired results. It may therefore be necessary to excavate and export the placed soil cover and/or import further "clean" soil.
- 1.13 It is likely that it will be necessary to stockpile imported soil cover material at the site. Where soils have been confirmed as suitable for use and temporarily stockpiled on site, stockpiles should be fenced-off and marked as containing certified topsoil/subsoil. The soil should be inspected prior to placement to confirm that it is the same material as previously tested, and that it has not been cross-contaminated with miscellaneous arisings generated during the construction works. Where material has been stockpiled on site for an extensive period of time further sampling may be required at the development site to demonstrate cross contamination has not taken place.
- 1.14 Soil **thickness** can only be checked after placement; this should be done before turfing / landscaping, but ideally after scaffolding has been dismantled.
- 1.15 **Sampling Frequency (to check Soil Quality):** The number of samples tested will be dependent on the nature of the source, and the quantity of material to be imported. However, in accordance with current YALPAG (Yorkshire & Lincolnshire Pollution Advisory Group) guidance¹, the testing frequency should be as follows:

Nature of source	Number of samples (from any single source material)	
	Up to 500m ³	Per additional 500m ³
Greenfield	At least 3 [#]	1 [*]
Brownfield	At least 6 [#]	1 [*]
Crushed product	At least 3	1 [*]

* To be agreed with the relevant Local Authority

But could be up to 10 samples (if 500m³), depending on the Local Authority area within which the site is located.

- 1.16 On a typical residential development where gardens comprise a total area of 100m² (front and rear), and a soil cover thickness of 600mm including 100mm topsoil, for a brownfield source this testing frequency equates to approximately one topsoil sample per ten plots and one subsoil sample per two plots. Given the requirement to test a minimum number of samples from any one source, the testing frequency effectively increases for sites with only a small number of plots.

¹ Verification Requirements for Cover Systems: Technical Guidance for Developers, Landowners & Consultants; Version 4.1, June 2021.

1.17 **Inspection Frequency (to check soil thickness):** The number of inspection pits excavated to check cover thickness (and collect samples, if required) should be dependent on the end use of the development.

1.18 For **residential developments** the number of plots associated with a given site will dictate the number of inspection pits. The following frequencies are recommended for residential plots.

No. plots within development	Frequency of inspection pits	Remarks
1 to 5	1 pit per plot	e.g. for 3 plots, dig 3 inspection pits
6 to 20	1 pit per 2 plots	e.g. for 9 plots, dig 5 inspection pits
21 to 30	1 pit per 3 plots	e.g. for 23 plots, dig 8 inspection pits
≥ 30	1 pit per 4 plots	e.g. for 39 plots, dig 10 inspection pits

1.19 For **areas of landscaping**, regardless of development type, a minimum of 3 pits per area of soft landscaping are recommended where the landscaped area is greater than 25m². In individual landscaped areas smaller than 25m² inspection pits are not required.

1.20 Photographs should be taken of each inspection pit to show:

- The thickness of cover material present
- The presence of any geotextile marker or granular hard-dig layer (if required)
- The position of each inspection pit in relation to the plot/area of landscaping

1.21 **Soil Material Suitability:** Inspection pits should be excavated through the entire thickness of any proposed in-situ source material, or cover material (if inspection is post-placement). Stockpiles should be assessed from both the surface and by digging into the "core", to ensure the material is reasonably homogenous.

1.22 The soil material should comply with the following requirements:

- Be clean and free of foreign debris, building waste materials, glass sharps, and contaminants
- Topsoil should not have a gravel content of greater than 30% by dry weight and should generally have a maximum stone size of 50mm in any one direction
- Subsoil should generally have a maximum stone size of 75mm in any one direction
- Not have been sourced from an area within 7m laterally, or 3m vertically, of Japanese Knotweed plants, and not contain any Japanese Knotweed fragments (rhizomes, leaves, stems etc)

1.23 **Laboratory Analysis:** Whether samples are taken at source, from stockpiles on site, or from gardens and landscaped areas after placement, they should be forwarded to an analytical laboratory for testing in accordance with one of the Schedules detailed in Table 1 overleaf.

1.24 Additional determinands may be scheduled dependent on the history of the source site, although if this is considered necessary it may suggest the material is unlikely to be suitable for use as clean cover.

Table 1 – Test schedule

Source	Test schedule
Greenfield & Manufactured topsoil	pH, total metals (Cu, Ni, Zn, Cr III, Cr VI, As, Hg, Se, Cd & Pb), water soluble boron. TOC & speciated PAH Asbestos ID
Brownfield & Soil transfer stations	pH, total metals (Cu, Ni, Zn, Cr III, Cr VI, As, Hg, Se, Cd & Pb), water soluble boron. TOC, Speciated PAH & banded TPH* Asbestos ID
Crushed product	pH, total metals (Cu, Ni, Zn, Cr III, Cr VI, As, Hg, Se, Cd & Pb), water soluble boron. TOC & Speciated PAH Asbestos ID

Note: The schedules detailed above have been prepared in accordance with the Secondary Model Procedures and Land Contamination Risk Management, 2020. This document states that analysis should be relevant to potential sources and not merely a set list of parameters applied to each site.

* The YALPAG guidance recommends speciated TPH (TPH CWG) analysis for brownfield sources, but this should not be necessary unless the banded TPH analysis fails the assessment criteria detailed in Table 2 below.

Where crushed product is used at least 600mm below finished garden level, only asbestos analysis will be required.

- 1.25 Chemical assessment (Tier 1) criteria for imported soils are provided in Table 2, these reflect exposure and toxicological amendments proposed within the C4SL report. Where no C4SL value has been published generic assessment criteria have been derived based on the C4SL assumptions using the CLEA model (version 1.701).

Table 2 - Chemical assessment criteria for imported soils

Contaminant	Source	Tier 1 assessment criteria (mg/kg)	Comments/notes
pH	CLEA		
As	C4SL	37	
Cd	C4SL	26	
Cr (III)	CLEA	4000	
Cr (VI)	C4SL	21	
Pb	C4SL	200	
Ni	CLEA	109	Assessment of human health risk only.
Se	CLEA	434	
Hg	CLEA	199	Assumes mercury present as an inorganic compound (cf elemental metal or within organic compound). See Science Report SC050021/Mercury SGV.
Vn	CLEA	584	
B	Lithos	5	Based on phytotoxic risks as plants are the more sensitive receptor (Cu is pH dependent).
Cu	DoE	100	
Zn	DoE	200	
Benzo(a)pyrene	C4SL	5	
Naphthalene	CLEA	6	
GRO	CLEA	22	Conservative value based on value for aromatic fraction C7 to C8 range, but assuming indoor inhalation pathway still relevant (it shouldn't be).
DRO	CLEA	215	Conservative value based on value for aliphatic fraction C10 to C12 range, but assuming indoor inhalation pathway still relevant (it shouldn't be).
LRO	CLEA	1,000	Calculated value above hazardous waste screen in WM3, therefore 1,000mg/kg adopted. This may be reviewed on a site specific basis depending on the source and nature of transfer.

2 VALIDATION REPORTS

- 2.1 The analytical testing will usually be undertaken on a 3 or 5-day turnaround and the Client/Contractor will be notified of the soil's suitability (or otherwise) immediately after receipt of the results.
- 2.2 Interim plot validation certificates for residential plots should be issued to warranty providers on a plot by plot (or block by block) basis as development proceeds. Once the full development has been completed these should be pulled together into a final verification report, for submission to the Local Authority to satisfy planning conditions.
- 2.3 Interim validation certificates will be issued by Lithos for each landscaped area or set of landscaped areas once completed. After Lithos have been able to confirm placement of agreed thicknesses of suitable soil cover in all landscaped areas across the site, and where required to satisfy a Local Authority planning condition, we will prepare and submit a final validation letter report.