



Land at Cranborne, Clifton Avenue, Holmfirth For England & Co

Report no: 4604/3

Date: March 2025



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APPENDICES

Appendix A : Drawings

Drawing	Revision	Title
4604/1	-	Site Location Plan
4604/2	-	Proposed Site Layout
4604/3	-	Site Features
4604/7	-	Revised Conceptual Site Model

Appendix B : Lithos Tier 1 Screening Values

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

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

REMEDIATION STRATEGY for land at CRANBORNE, CLIFTON AVENUE, HOLMFIRTH

1 INTRODUCTION

1.1 The commission and brief

1.1.1 Lithos Consulting Limited has been commissioned by England & Co to prepare a Remediation Strategy for land at Cranborne, Clifton Avenue, Holmfirth.

1.1.2 Lithos has already issued the following reports:

- Preliminary Geoenvironmental Appraisal: Land at Clifton Avenue, Holmfirth. Report No. 4604/1, dated November 2022.
- Geoenvironmental Appraisal: Land at Cranborne, Clifton Avenue, Holmfirth . Report No. 4604/2, dated January 2023.
- Letter Report: Cranborne, Clifton Avenue, Holmfirth – Additional testing (sulphates). Ref. 017/4604/GLM, dated 29th June 2023.

1.1.3 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.

1.1.4 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 England & Co's Site Manager.

1.2 The proposed development

1.2.1 The proposed residential development comprises three residential dwellings, with associated gardens, POS, access roads and sewers, as shown on Drawing 4604/2 presented in Appendix A.

1.2.2 The houses will be founded on 'traditional' strip foundations seated in Residual Soils or entirely on bedrock.

1.2.3 Access to the development will be from Clifton Avenue to the northeast.

1.2.4 The Local Planning Authority has agreed planning permission for redevelopment of this site. There are several Conditions associated with remediation, most notably:

- Condition 10: Where site remediation is recommended in the Phase II Intrusive Site Investigation Report approved pursuant to condition (9) further groundworks shall not commence until a Remediation Strategy by a suitably competent person has been submitted to and approved in writing by the Local Planning Authority.
- Condition 11: Remediation of the site shall be carried out and completed in accordance with the Remediation Strategy approved pursuant to condition (10).
- Condition 12: Following completion of any measures identified in the approved Remediation Strategy or any approved revised Remediation Strategy a Validation Report by a suitably competent person shall be submitted to the Local Planning Authority.

1.2.5 This report has been prepared to satisfy the requirements of Condition 10.

2 BACKGROUND

2.1 Site description & history

2.1.1 Site details are summarised below.

Detail	Remarks
Location	7.5 km south of Huddersfield town centre
NGR	SE 148 088
Area	0.18 ha
Known live services	Underground electric

2.1.2 The site is located on a terrace across the edge of the Holme Valley which runs roughly north to south; the River Holme flows north about 250m to the west. Levels across the wider area fall moderately steeply to the west. Land to the east of the site slopes up with gradients of up to around 1v:6h, whilst land beyond the western boundary slopes steeply down with a gradient of around 1v:4h.

2.1.3 The site is accessed off Clifton Avenue which makes up the northern-most area of the site and opens out onto Town End Road which runs north to south beyond the western boundary.

2.1.4 The centre and southwest are occupied by sheds which are used for storage of general construction equipment and materials. The central shed is of sheet metal construction and housed a 3-tonne tracked 360° excavator at the time of the walkover. The southwestern shed is of prefabricated concrete construction, with a sheet metal roof, and housed a small dump-truck.

2.1.5 The site boundary in the centre-east cuts through the garden of the adjacent residential dwelling (Cranborne). The parcel of garden included in the site's boundary is occupied by a summer house and animal hutch (empty at the time of the walkover) along with mown grass. The garden is separated from the wider site by a dry-stone wall, a mature conifer and leylandii hedgerow which has a height of about 3.5m.

2.1.6 The south is occupied by mown grass, but was otherwise empty at the time of the walkover.

2.1.7 Mature trees and shrubs, including conifers, grow along the southern and eastern boundaries.

2.1.8 The site has remained largely undeveloped throughout its history with the exception of small building crossing the access road in the late 1890s early 1900s and the more recent storage sheds in the southwest.

2.1.9 The site location and current salient features are shown on Drawings 4604/1 and 4604/3 in Appendix A. A full site description is provided in Lithos Report 4604/2, with only brief details below.

2.2 Ground investigation

2.2.1 Following completion of a desk study which culminated in a preliminary conceptual site model, ground investigation fieldwork was supervised by Lithos in November 2022 and comprised 9 trial pits and 2 sample pits. An additional 6 trial pits were excavated in June 2023.

2.2.2 In November 2022, a total of 3 made ground samples and 9 samples of topsoil were sent to an accredited laboratory for chemical testing. During this investigation, no geotechnical testing was undertaken.

2.2.3 In June 2023, 6 samples of Cohesive Residual Soil were tested for pH & sulphates.

Made Ground

2.2.4 Made ground was identified in external storage areas across external storage areas and typically comprised Granular Made Ground to between 0.05m and 0.3m depth. Made Ground Topsoil was encountered beneath Granular Made Ground in two trial pits.

Obstructions

2.2.5 Constraints associated with existing buildings and ongoing operations (storage areas) prevented trenching to identify and assess the nature/extent of buried obstructions. However, the existing buildings are likely to have shallow foundations and concrete floor slabs, and consequently some below ground structures should be anticipated during demolition/construction works.

Natural ground

2.2.6 Natural ground comprised Topsoil, typically 300mm thick, underlain by Cohesive Residual Soils (a firm light orangish brown mottled grey slightly sandy slightly gravelly Clay).

Groundwater

2.2.7 No significant inflows of groundwater were encountered during the investigation.

2.3 Summary of contamination

2.3.1 No visual or olfactory evidence of organic contamination was noted during site work. In addition, no significantly elevated concentrations of contaminants have been identified within the topsoil and made ground.

3 REMEDIATION STRATEGY (GENERAL)

3.1 Aims

3.1.1 Remediation aims are to:

- Resolve contamination issues in order to protect environmental receptors, and render the site suitable for the proposed development
- Satisfy requirements of the Local Planning Authority and warranty provider

3.2 Overview

3.2.1 The following remediation works are required:

- Demolition of the existing buildings
- General site clearance of surface materials and vegetation
- Topsoil strip & stockpile
- Break-up of slabs and hardstand (within the southwest of site)
- Provision of 300mm thickness of topsoil in all garden and landscaped areas where made ground is present.

3.3 Site set-up, organisation and safety

3.3.1 Site cabins and welfare facilities are to be established at a location to be agreed with England & Co's Site Manager. All welfare facilities must be established in accordance with the relevant health & safety statutory requirements.

- 3.3.2 All site personnel should undergo a site-specific health and safety induction prior to commencement of work on site.
- 3.3.3 England & Co'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.
- 3.3.4 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.
- 3.3.5 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
- 3.3.6 If at any time during the works personnel begin to feel unwell, they are to inform England & Co's Site Manager, who will determine appropriate action.
- 3.3.7 All visitors to site must enter and register at the main Site Office.

3.4 Contractor's responsibilities

- 3.4.1 Prior to the commencement of any works the Contractor, in agreement with England & Co's Site Manager, should:
- Comply with any requirements of England & Co'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
 - Obtain a pre-demolition (formerly Type 3) asbestos survey report for all buildings to be demolished
 - Prepare a detailed Method Statement outlining how the objectives of this Remediation Strategy will be achieved (and obtain approvals)
 - Inform England & Co's Site Manager of any risk, identified and assessed, which could impact upon England & Co's Site Manager activities
 - Prepare the necessary COSHH statements and Health & Safety Plan in accordance with CDM regulations
- 3.4.2 The Contractor should satisfy the Health & Safety Executive with regard to all matters concerning the health, safety and welfare of persons on the site.
- 3.4.3 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).

3.5 Materials Management Plan

3.5.1 This project will involve the re-use of both natural and made ground soils on site. Therefore, the Contractor may choose to prepare a Materials Management Plan (MMP) in accordance with the CL:AIRE Code of Practice (v2, March 2011).

3.5.2 The MMP will 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 should 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

3.5.3 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

3.5.4 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

3.5.5 Finally, the MMP will have to set out a Verification Plan that identifies how the placement of materials is to be recorded and the quantities of material to be used. It will contain a statement on how the use of the materials relate to the remediation or design objectives.

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

3.6 Engineering supervision and verification

3.6.1 England & Co's Site Manager, supported as/where necessary by a suitably qualified Geoenvironmental Engineer, will ensure that the requirements of this Remediation Strategy are complied with in a safe and orderly manner.

3.6.2 The responsibilities of England & Co's Site Manager 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

3.6.3 England & Co's Site Manager 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

3.6.4 On satisfactory completion of all the works England & Co's Site Manager, 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 the England & Co, the Local Authority and warranty provider.

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

3.6.6 The Verification Report will include:

- A summary of the preparatory & remediation works undertaken, including any works associated with unforeseen ground conditions.
- Copies of any correspondence with Regulators relating to specific aspects of the remediation works.
- Reference to the MMP and associated tracking system, including alterations made and why (if applicable).
- Record of quantity of materials used.
- A receipted copy of the Qualified Person's Declaration (if applicable).

3.6.7 The Verification Report will also provide recommendations with respect to:

- Foundation Solution(s)
- Placement of Soil Cover

3.6.8 The above recommendations will take account of the actual remediation works undertaken, and may differ significantly from recommendations originally presented in the site investigation report.

4 REMEDIATION STRATEGY (SPECIFIC OBJECTIVES)

4.1 Contingency for unknowns

4.1.1 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.

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

4.1.3 In accordance with the requirements of Condition 11 of the planning permission all works (apart from investigation works) should cease immediately and the Local Planning Authority should be notified in writing within 2 working days. Condition 11 also prohibits the recommencement of works until a revised Remediation Strategy is submitted to, and approved in writing, by the Local Planning Authority.

4.1.4 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.

4.1.5 Analysis of at least 6 samples, for an appropriate range of determinands should be undertaken. On receipt of the results, the Engineer will liaise with the Contractor regarding the most appropriate remediation option.

4.1.6 The Contractor might consider it appropriate to commission a supplementary post-vacation (or possibly post-demolition) ground investigation in order to obtain a better picture of ground conditions in advance of the proposed remediation / construction works. A simple 1 day trial pit dig could yield useful data.

4.2 Site clearance

- 4.2.1 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.
- 4.2.2 The site should then be cleared of all residual debris, any vegetation, shrubs, bushes and unprotected trees as instructed by England & Co.
- 4.2.3 Topsoil, typically 300mm thick is present across much of the site (beyond the access track and storage areas). Testing suggests this material should be chemically suitable for re-use on site. Given the nature of the topsoil present on this site it would be expected to be suitable to support plant growth. However, no testing in accordance with BS3882:2015 Specification for Topsoil (N-P-K, clay content etc) has been undertaken to date.
- 4.2.4 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.

4.3 Asbestos

- 4.3.1 Current legislation (as outlined in HSG 264) requires a pre-demolition (formerly Type 3) asbestos survey to be undertaken, immediately prior to demolition of any building. The Contractor should request a copy of the survey report from England & Co. If no survey report is available, the Contractor will instruct an asbestos survey.
- 4.3.2 If notifiable asbestos materials are identified then, prior to demolition of the buildings, all such materials should be removed by a licensed contractor, and disposed of as hazardous waste.
- 4.3.3 The licensed contractor should submit a Method Statement detailing how the works will be carried out in accordance with the Control of Asbestos Regulations 2012.
- 4.3.4 Localised fragments of asbestos cement sheeting may be encountered during the site remediation and preparatory 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).

4.4 Demolition

- 4.4.1 Existing buildings should be demolished in a safe and controlled manner.
- 4.4.2 All demolition operations should conform to BS 6187:2011 Code of Practice for Demolition. All personnel working on these operations should be fully qualified to do so.
- 4.4.3 A detailed Method Statement specific to the project must be prepared by the Contractor and submitted to England & Co. The Method Statement should also be submitted to, and approved by, England & Co's Site Manager and the Local Authority.
- 4.4.4 Once buildings have been demolished, all surface hardstand and floor slabs could be grubbed-up and stored in a location on site, to be agreed with England & Co's Site Manager, prior to crushing (see Section 4.9). Alternatively, given the limited volume of such material likely to be generated, this could be sent for processing off-site.
- 4.4.5 Any unsuitable materials should be removed to a suitably licensed landfill site (see Section 4.6).

4.5 General excavation

- 4.5.1 Excavation of made ground will be undertaken in a controlled manner, working from a line agreed with England & Co's Site Manager in linear panels.
- 4.5.2 Excavated material should be removed from each panel and screened to remove oversize (> 200mm) and other unsuitable (e.g. anthropogenic or biodegradable materials), prior to replacement.
- 4.5.3 Any stockpile of made ground should be assumed to contain elevated concentrations of inorganic contaminants, and it should be ensured that such materials are not allowed to cross-contaminate any clean soils or controlled waters.
- 4.5.4 Any significant excavation should be inspected by England & Co's Site Manager, and have its depth and extent recorded by survey, prior to backfilling (see Section 4.12).
- 4.5.5 Any excavated and screened material that needs to be stockpiled temporarily should be placed in areas designated by the England & Co's Site Manager.

4.6 Export to landfill

- 4.6.1 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.
- 4.6.2 Given the proximity of existing housing, and in order to avoid any potential odour nuisance, stockpiles of material should be exported from site as soon as practically possible.
- 4.6.3 Any material exported from site to landfill 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.
- 4.6.4 A transfer note should be completed, signed and retained by the parties involved. The transfer note 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.
- 4.6.5 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

- 4.6.6 Sampling and characterisation of stockpiled materials generated during the site preparatory works is likely to be required if off-site disposal is proposed.
- 4.6.7 It should be noted that the classification and assessment of waste soils under the Environment Agency's Technical Guidance WM3¹, is a complex process.
- 4.6.8 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.

¹ Technical Guidance WM3 – Guidance on the classification and assessment of waste. Environment Agency 2015

- 4.6.9 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%).
- 4.6.10 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.

4.7 Control of water

- 4.7.1 Groundwater should be controlled in accordance with CIRIA report 113 "Control of Groundwater for Temporary Works".
- 4.7.2 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.
- 4.7.3 Pumping from over-excavated sumps may be required to maintain satisfactory working conditions.
- 4.7.4 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).
- 4.7.5 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.
- 4.7.6 It is quite likely that perched waters will be encountered during the remediation earthworks; most commonly associated with redundant drains and buried structures.
- 4.7.7 Any potentially contaminated water 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.

4.8 Removal of below ground obstructions

- 4.8.1 All foundations associated with existing buildings and other relict structures should be chased out and grubbed-up, in order to remove potential obstructions to new foundations and infrastructure.
- 4.8.2 Where relict structures are found to retain fluid contaminants, they should be drained first. The drained fluids should be stored in appropriate, sealed tanks/containers and analysed for a range of determinands to be agreed with the Engineer. Fluids may then be tankered off-site, or be discharged to sewer, subject to analytical results and local water treatment company consent.
- 4.8.3 Deep excavations for the removal of structures etc may be unstable in the short term and continuous side support may be necessary.

- 4.8.4 Suitable materials derived from grubbing-up should be stored in a location on site, to be agreed with England & Co's Site Manager, prior to crushing (see Section 4.9). Alternatively, given the limited volume of such material likely to be generated, this could be sent for processing off-site.
- 4.8.5 Any unsuitable materials should be removed to a suitably licensed landfill site (see Section 4.6).

4.9 Crushing

- 4.9.1 Production of a selected granular fill should be possible if suitable materials (generated by demolition operations and grubbing-up of floor slabs, foundations and other relict structures) are crushed.
- 4.9.2 The crushed product should be screened to remove any unsuitable elements and stockpiled for re-use during the subsequent construction works. Generation of a Class 6 material as defined in the Highways Agency Specification (Series 600) should be possible.
- 4.9.3 The Engineer should check the suitability of crushed product for re-use, instruct the removal of any unsuitable material and schedule appropriate confirmatory geotechnical or chemical testing.
- 4.9.4 A minimum of 3 samples (or 1 sample per 500m³, whichever is the greater) should be taken from any stockpile of specific crushed product and sent to a UKAS accredited laboratory for analysis to assess whether the material conforms to requirements as defined in Series 600 of the Highways Agency Specification for Highway Works.
- 4.9.5 A minimum of 3 samples (or 1 sample per 500m³, whichever is the greater) should be taken from any stockpile of specific crushed product and sent to a UKAS accredited laboratory for asbestos analysis. Any samples in which asbestos is positively identified should be subject to asbestos quantification analysis.

4.10 Backfill of excavations

- 4.10.1 Excavations (to remove relict structures 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 C.
- 4.10.2 However, where an excavation conflicts with the footprint of proposed driveways, compaction in accordance with the Specification for Highway Works is recommended. The Geoenvironmental Engineer should be consulted for further advice.
- 4.10.3 The anticipated backfill materials were adequately characterised by the site investigation (see Lithos Report 4604/2, dated January 2023). Consequently, further testing of backfill materials is not anticipated.
- 4.10.4 Nonetheless, excavated arisings will be inspected by England & Co's Site Manager, 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.
- 4.10.5 Any material considered unsuitable for use as backfill will be exported from site (see Section 4.6).

4.11 Boundary issues

- 4.11.1 England & Co'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).
- 4.11.2 Advice should be sought from the Engineer if mobile contamination or redundant drains/utilities are encountered close to the site's boundaries.

4.12 Surveying

- 4.12.1 The Contractor should arrange for the following survey work as directed by England & Co's Site Manager:
- 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 left in-situ
 - Recording of natural ground levels, where natural ground encountered during the earthworks
 - Recording the locations and volumes of all stockpiles of suitable materials left on site for England & Co 's use during the development works
 - As-built survey of the finished surface on completion of the remediation contract
- 4.12.2 The Contractor should supply the results of this survey work to England & Co's Site Manager for inclusion in the Verification Report.

4.13 Placement of soil cover

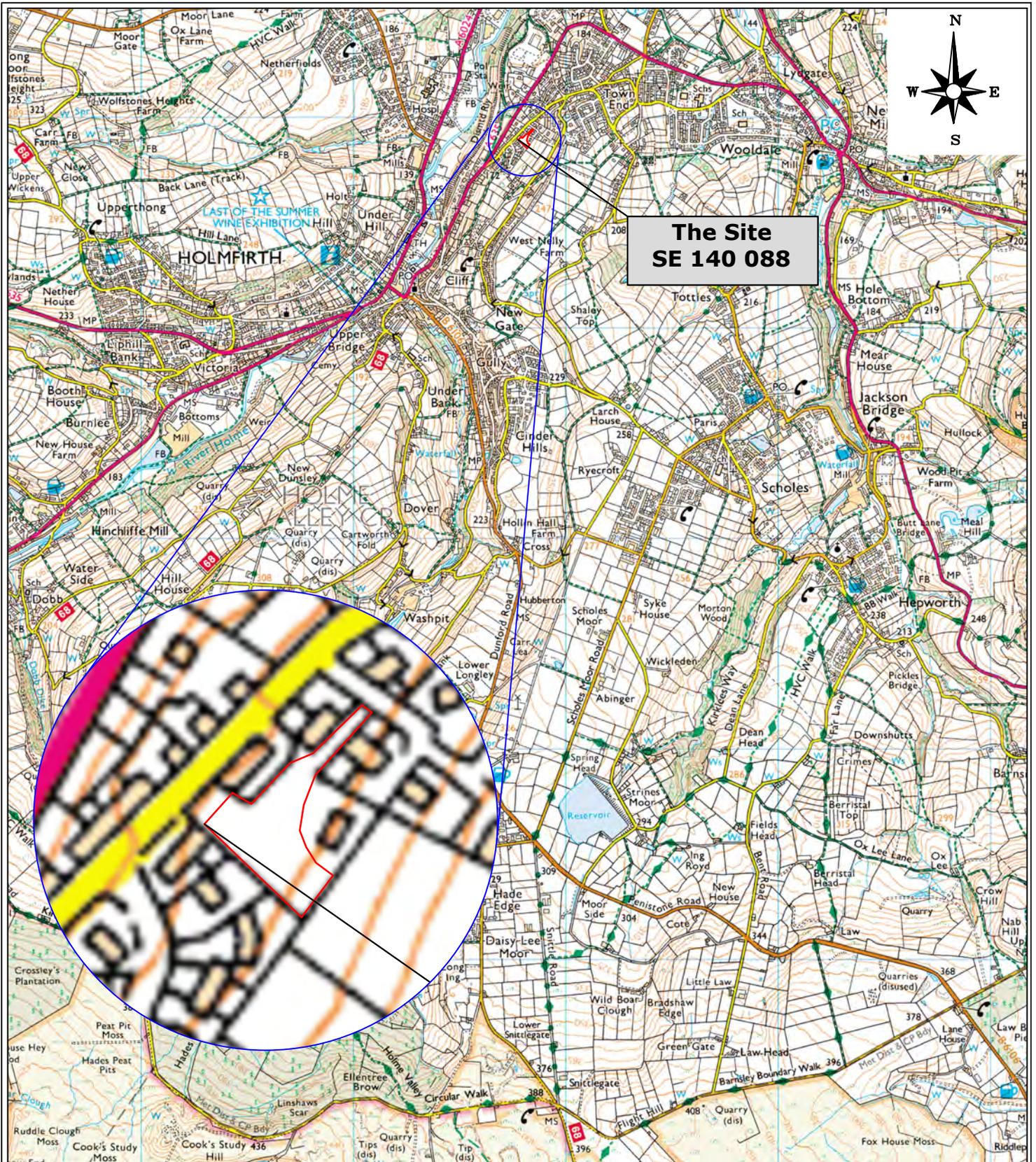
- 4.13.1 Clean inert soil will be placed over the made ground in proposed garden and landscaped areas (but not beneath hardstanding). This cover layer is to comprise 300mm of "clean" subsoil and topsoil
- 4.13.2 Some gardens may be underlain by natural soils only, and where this is the case placement of 150mm of topsoil will suffice.
- 4.13.3 Sufficient suitable topsoil (&, if necessary, subsoil) is likely to be generated on site.
- 4.13.4 Topsoil and subsoil quality should be assessed in accordance with Lithos' Protocol for Importation & Use of Soil Cover (Capping), copied in Appendix D. This Protocol includes chemical assessment criteria which should not be exceeded.
- 4.13.5 Any material imported for use as cover should be validated in accordance with Lithos' Protocol for Importation & Use of Soil Cover (Capping), copied in Appendix D. This Protocol includes chemical assessment criteria which should not be exceeded.

4.14 Topsoil placement

- 4.14.1 NHBC Conditions require garden areas to be provided with topsoil to a thickness of not less than 100mm. Topsoil thicknesses in excess of 400mm should generally be avoided.
- 4.14.2 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.
- 4.14.3 For the loosening to be most effective, it should be undertaken when the subsoil is dry to the full depth of working.

- 4.14.4 Subsequent trafficking over the loosened subsoil should be minimised.
- 4.14.5 Topsoil should not be placed during or immediately after heavy rain.
- 4.14.6 An excavator with a toothed bucket should be used to load the topsoil from stockpile into dumpers, to prevent excessive smearing.
- 4.14.7 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.
- 4.14.8 After re-spreading topsoil, any large compacted lumps should be broken down to produce a fine tilth suitable for planting, turving and seeding (< 10mm maximum aggregate size).

APPENDIX A
DRAWINGS



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CLIENT

ENGLAND & CO

JOB TITLE

CLIFTON
AVENUE,
HOLMFIRTH

DRAWING TITLE

SITE LOCATION
PLAN

DRAWN

GLM

DATE

01/11/2022

CHECKED

REG

DATE

01/11/2022

STATUS

FOR COMMENT

DRAFT

FOR APPROVAL

FINAL

SCALE

1:25,000

SHEET

A4

DRAWING NO.

4604/1

REVISION



NOTES

— APPROXIMATE SITE BOUNDARY

REPRODUCED FROM HINCHCLIFFE ARCHITECTURE & DESIGN'S DRAWING 'CRANBOURNE, CLIFTON AVENUE, WOOLDALE, HD9 1AL - PROPOSED SITE PLAN' REF. 064-21-PL01 REV. H, DATED 27/08/2021

REV.	DESCRIPTION	DATE



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CLIENT

ENGLAND & CO

JOB TITLE

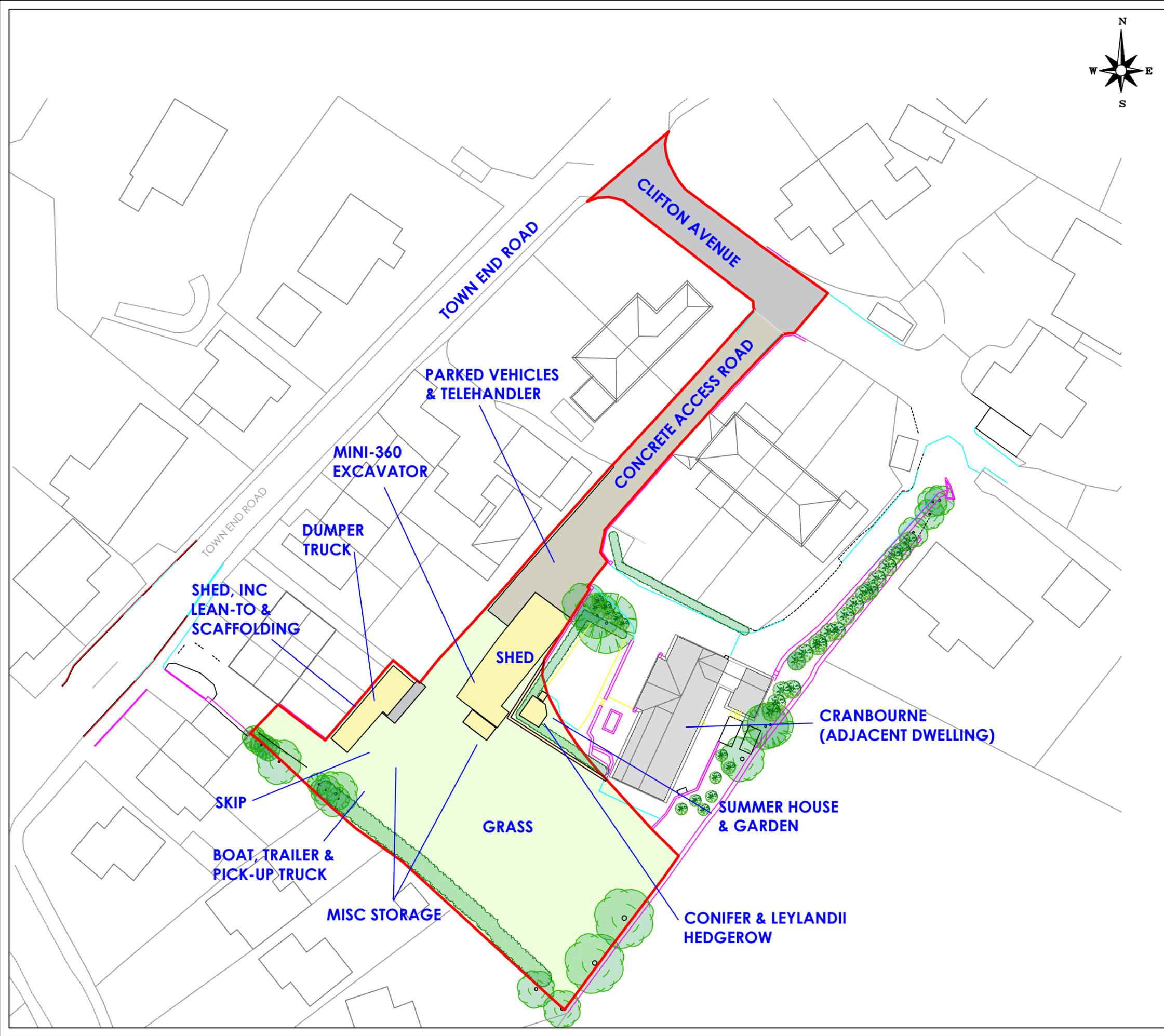
CLIFTON AVENUE, HOLMFIRTH

DRAWING TITLE

PROPOSED SITE LAYOUT

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				FINAL	<input checked="" type="checkbox"/>

SCALE	1:500	SHEET	A3	DRAWING NO.	4604/2	REVISION	
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NOTES

	GRASS & OVERGROWN AREAS
	BUILDING
	CONCRETE HARDSTAND
	TARMAC HARDSTAND
	APPROXIMATE SITE BOUNDARY

REV.	DESCRIPTION	DATE



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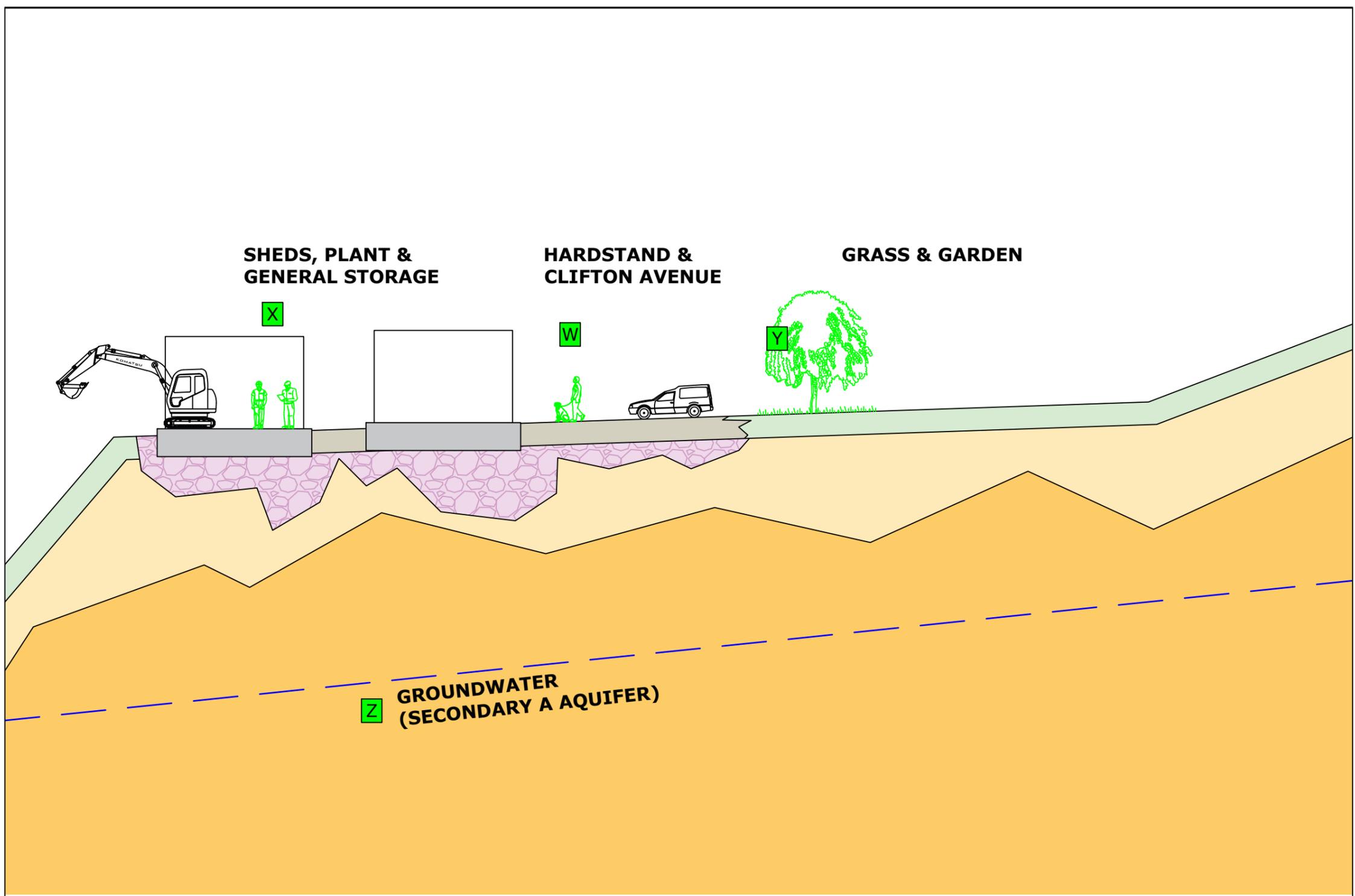
CLIENT
ENGLAND & CO

JOB TITLE
CLIFTON AVENUE, HOLMFIRTH

DRAWING TITLE
SITE FEATURES

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CHECKED REG	DATE 01/11/2022	

SCALE 1:500	SHEET A3	DRAWING NO. 4604/3	REVISION
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NOTES

REV.	DESCRIPTION	DATE



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Tel 01937 545330

CLIENT
ENGLAND & CO

JOB TITLE
CLIFTON AVENUE, HOLMFIRTH

DRAWING TITLE
REVISED CONCEPTUAL SITE MODEL

KEY	
	TOPSOIL
	MADE GROUND
	HARDSTAND
	RESIDUAL SOIL
	HUDDERSFIELD WHITE ROCK SANDSTONE

SOURCES
NONE OF SIGNIFICANCE

PATHWAYS
NONE OF SIGNIFICANCE

RECEPTORS
END USERS (RESIDENTS)
SITE WORKERS
VEGETATION
SURFACE WATERS
GROUNDWATER

DRAWN CC	DATE 04 01 2023	STATUS FOR COMMENT <input type="checkbox"/>
CHECKED GLM	DATE 04 01 2023	FOR APPROVAL <input type="checkbox"/>
		DRAFT <input type="checkbox"/>
		FINAL <input checked="" type="checkbox"/>

SCALE Not to scale	SHEET A3	DRAWING NO. 4604/7	REVISION
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APPENDIX B
LITHOS TIER 1 VALUES

Soil screening values used by Lithos

In March 2002 DEFRA and the Environment Agency published a series of technical papers (R&D Publications CLR 7, 8, 9 and 10) outlining the UK approach to the assessment of risk to human health from land contamination. In 2008 CLR 7, 9 and 10 and all corresponding SGV and Tox reports were withdrawn and superseded by new guidance including:

- Guidance on Comparing Soil Contamination Data with a Critical Concentration - CL:AIRE and CIEH, May 2008
- Evaluation of models for predicting plant uptake of chemicals from soil - Science Report – SC050021/SR
- Human health toxicological assessment of contaminants in soil - Science Report: SC050021/SR2
- Updated technical background to the CLEA model - Science Report: SC050021/SR3
- CLEA Software Handbook, Science report: SC050021/SR4
- Compilation of data for priority organic pollutants for derivation of Soil Guideline Values - Science Report: SC050021/SR7

In December 2013 Defra published the results of research project SP1010 – Development of Category 4 Screening Levels (C4SLs) for Assessment of Land Affected by Contamination. The objective of this project was to provide technical guidance in support of Defra's revised Statutory Guidance for Part 2 A of the Environmental Protection Act 1990 (Part 2A). The revised Statutory Guidance, published in April 2012, introduced a new four-category system for classifying land under Part 2A where Category 1 includes land where the level of risk is clearly unacceptable, and Category 4 includes land where the level of risk posed is acceptably low. Project SP1010 aimed to deliver:

- A methodology for deriving C4SLs for four generic land-uses comprising residential, commercial, allotments and public open space; and
- Demonstration of the methodology, via derivation of C4SLs for 6 substances – arsenic, cadmium, chromium IV, lead, benzene & benzo(a)pyrene.

The methodology for deriving both the previous Soil Guideline Values and the Category 4 Screening Levels is based on the Environment Agency's Contaminated Land Exposure Assessment (CLEA) methodology. Development of C4SLs has been achieved by modifying the toxicological and/or exposure parameters used within CLEA (while maintaining current exposure parameters).

The Part 2A Statutory Guidance was developed on the basis that C4SLs could be used under the planning regime. Defra anticipate that, where they exist, C4SLs will be used as generic screening criteria, and Lithos consider C4SLs to be suitable for use as Tier 1 Screening Values. Lithos have discussed this matter with both NHBC and YALPAG (collection of Yorkshire & Lincolnshire local authorities) and received confirmation that they are satisfied with this approach.

The CLEA conceptual site model assumes a source located in a sandy loam, with 6% soil organic matter (SOM) - equivalent to 3.5% total organic carbon (TOC). However, many organic contaminants are more mobile when the SOM is lower, and consequently comparison of soil results with revised, lower screening values may be required. Other CLEA default characteristics adopted by Lithos are:

Sandy Loam characteristics (source)	Default values adopted
Total porosity (fraction)	0.53
Water filled porosity (fraction)	0.33
Air filled porosity (fraction)	0.2

Lithos have derived Screening Values for five different CSMs (scenarios); these are:

- A - Residential with gardens, but no cover (or only up to 300mm)
- B - Residential with gardens and 600mm 'clean' cover
- C - Residential apartments with landscaping (i.e. no home grown produce)
- D - Commercial/industrial with landscaping
- E - Importation of soil cover

The **exposure** pathways considered for each scenario are detailed in the table below.

Scenario	Land use	Pathways	Justification
A	Residential with garden, but no cover (or only up to 300mm)	<ul style="list-style-type: none"> • Direct ingestion of soil • Dermal contact • Consumption of vegetables & soil attached to vegetables • Inhalation of indoor vapours and dust • Inhalation of outdoor vapours and dust 	Minimal cover – insufficient to break any pathways therefore all exposure pathways are relevant.
B	Residential with garden minimum 600mm cover	<ul style="list-style-type: none"> • Inhalation of indoor vapours • Inhalation of outdoor vapours 	The 600mm cover removes the risk from all pathways other than inhalation.
C	Residential apartments with landscaped areas and minimum 300mm cover	<ul style="list-style-type: none"> • Direct ingestion of soil • Dermal contact • Inhalation of indoor vapours and dust • Inhalation of outdoor vapours and dust 	All pathways applicable due to possible exposure from landscaped areas. However consumption of home grown produce not included as unlikely to be grown in landscaped areas. Where vegetables are to be grown site specific QRA may be required.
D	Commercial/ industrial with landscaped areas no cover	<ul style="list-style-type: none"> • Direct ingestion of soil • Dermal contact • Inhalation of indoor vapours and dust • Inhalation of outdoor vapours and dust 	All pathways applicable due to possible exposure from landscaped areas. Assumed the commercial development consists of offices to provide a conservative assessment.
E	Importation of soil for cover in garden and landscaped areas	<ul style="list-style-type: none"> • Direct ingestion of soil • Dermal contact • Consumption of vegetables & soil attached to vegetables • Inhalation of outdoor vapours and dust 	Material used as cover to break existing pathways therefore all direct and indirect pathways relevant; however cover is not placed below plots therefore indoor inhalation is not relevant.

Lithos have assumed the source of contamination is directly below the building foundations; i.e. a depth to source of 0.15m as opposed to the CLEA default of 0.65m. This assumption provides for a more conservative approach than the UK default.

Lithos have derived Tier 1 values for a number of inorganic and organic determinands in the context of the five Scenarios A to E. The Tier 1 values are **not** intended to be used when considering potential risks associated with:

- Existing land uses in the context of Part 2A of the Environment Protection Act 1990;
- End uses such as allotments, sports fields, children's playgrounds, care homes, hospitals etc; and
- Controlled waters

Inorganic Tier 1 values for scenarios A to E

Inorganic contaminant	Tier 1 assessment criteria (mg/kg) for Scenarios A to E							Comments/notes
	SGV*	C4SL*	A	B	C	D	E	
As	32	37	37	Use (A) in SI Report for initial "screen" If >5 x A, then consider increase of cover to 1,000mm	40	640	37	C4SL adopted
Cd	10	26	26		149	410	26	C4SL adopted
Cr			4,000		4,000	28,767	4,000	Assumes Cr is CrIII
Pb	450	200	200		314	2,330	200	C4SL adopted
Ni	130		109		123	892	109	Assessment of health risk only
Se	350		434		596	13,018	434	
Hg	170		199		244	3,603	199	Assumes in an inorganic compound
Vn			584		586	4,994	584	
B			5		5	5	5	
Cu			100		100	100	100	Based on phytotoxic risks as plants are the more sensitive receptor (Cu is pH dependant)
Zn			200		200	200	200	

Organic Tier 1 values for scenarios A to E

Organic contaminant (all sourced via CLEA)	Tier 1 assessment criteria (mg/kg) for Scenarios A to E							Comments/notes
	SGV*	C4SL*	A	B	C	D	E	
Benzene	0.33	0.87	0.7	<1^	<1^	63	<1	<1 based on professional judgement and lower than calculated value.
Toluene	610		836	2,048	1,912	5,000	<1	Scenario D based on professional judgement and lower than calculated value.
Ethyl Benzene	350		379	592	566	5,000	<10	Scenario E based on professional judgement and lower than calculated value.
Xylenes	240		535	590	585	5,000	<10	
Phenol	420		1,434	3,360	2,264	5,000	<10	
PCBs			2	8	2	38	N/A	Based on toxicity of EC7
Benzo(a)pyrene		5	5	25	5	76	5	C4SL adopted. Scenario B 5 times scenario A
Naphthalene			6	6	6	619	<10	Scenario E based on professional judgement and lower than calculated value
Gasoline Range Organics			22	23	23	2,178	626	See 3-step assessment of TPH below ^Based on professional judgement and lower than calculated value
Diesel Range Organics			215	218	215	^5,000	1429	
Lubricating Range Org			3,299	5,000	3,829	^5,000	3,299	

* For a residential end use

The significance of PAHs can be determined by considering indicator compounds. In most cases benzo(a)pyrene (BaP) is adopted as an indicator due to the amount of toxicological data available and has been used by various authoritative bodies to assess the carcinogenic risk of PAHs in food. A surrogate marker approach can be used to estimate the toxicity of a mixture of PAHs in soil using toxicity data for individual indicator compounds within that mixture. Exposure to the surrogate marker is assumed to represent exposure to all PAHs in that matrix. The surrogate marker approach relies on a number of assumptions:

- Surrogate marker (BaP) must be present in all soil samples
- Profile of the different PAH relative to BaP should be similar in all samples
- PAH profile in the soil samples should be similar to that used in the pivotal toxicity study¹

To assess the PAH profile in a soil sample, the ratio of the seven genotoxic PAHs (benz[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, chrysene, dibenz[a,h]anthracene and indeno[1,2,3-c,d]pyrene), relative to BaP, should be calculated. The ratio relative to BaP should lie within an order of magnitude above and below the mean ratio to BaP.

Naphthalene should also be considered separately against its generic screen. Whilst classed as a PAH, naphthalene is more volatile and mobile in the environment than most other PAHs. As such the significance of naphthalene cannot be considered within the surrogate marker approach.

Similarly, TPH cannot be assessed as a single "total" value, and reference has been made to the Environment Agency's document P5-080/TR3, "The UK approach for evaluating human health risks from petroleum hydrocarbons in soils". This document supports the assumptions and recommendations made by the US Total Petroleum Hydrocarbons Criteria Working Group (TPHCWG). The TPHCWG have broken down "TPH" into representative constituent fractions or "EC Bandings". The TPHCWG have derived a series of physiochemical and toxicological parameters for each of the bandings.

¹ SP1010 Appendix E, Provisional C4SLs for benzo(a)pyrene as a surrogate marker for PAHs, CL:AIRE 2013

The significance of speciated TPH results can be assessed by following the 3 steps outlined in the tables below.

Step	Result	Action
1. Consider indicator compounds: Are BTEX, naphthalene, benzo(a)pyrene above their respective Tier 1 values?	Yes	Remediation or dQRA required
	No	Proceed to Step 2
2. Consider individual TPH fractions: are they above respective screening values?	Yes	Remediation or dQRA required
	No	Proceed to Step 3
3. Assess Cumulative effects: Is the calculated Hazard Index for each source >1	Yes	Remediation or dQRA required
	No	TPH compounds pose no significant risk

The equation used to assess cumulative effects in step 3 is shown below.

$$HI = \sum_{F_i=1}^{16} HQ F_i = \frac{\text{Measured concentration } F_i \text{ (mg kg}^{-1}\text{)}}{SGV F_i \text{ (mg kg}^{-1}\text{)}}$$

where HI = Hazard Index
 HQ = Hazard Quotient
 F_i = Fraction i
 SGV = Soil Guideline Value

Statistical Assessment

Current UK guidance is provided by CL:AIRE², and uses two-way confidence intervals and graphical summaries, to assist assessors when determining whether or not a dataset is adequate to answer the question posed; e.g. "is existing site topsoil suitable for retention & re-use?". To answer such a question, it is necessary to recover and test a large number of samples (a minimum of 10; ideally 20+) in order to undertake meaningful statistical analysis.

However, in the context of site investigation to assess the significance of contamination on brownfield sites which are typically underlain by **heterogenous made ground**, some remediation is almost always required (placement of soil cover, excavation of gross contamination etc). Consequently, in such circumstances, it is not necessary to demonstrate that made ground soils are "clean" and therefore there is no need to test large numbers of samples and undertake statistical analysis. Sample results can simply be compared directly with appropriate screening values (e.g. Lithos Tier 1 values).

The CL:AIRE (2020) guidance replaces the withdrawn "Guidance on Comparing Soil Contamination Data with a Critical Concentration" (2008).

The old approach to statistical analysis was based on a definitive yes/no answer which required limited consideration of the dataset and Conceptual Site Model, it was widely accepted that this did not allow sites or risk to be adequately assessed. The updated approach requires a comprehensive understanding of the datasets within the context of the Conceptual Site Model.

The current guidance requires that:

- A robust CSM is in place which identifies source areas, averaging areas and averaging zones
- Sampling locations are relatively evenly spread across the site and were selected using simple or stratified random sampling with no targeting being undertaken
- The field data and CSM do not suggest the presence of a hotspot of contamination which should be treated as a separate zone
- The samples are all taken from a similar same depth and within the same material type across the zone being assessed
- A minimum of 10 samples have been taken. It should be appreciated that confidence in a dataset increases as the number of samples obtained and tested from a zone increases.

The statistical analysis assumes a homogenous distribution of strata and contamination and therefore the dataset will be normally distributed (symmetric, log symmetric or fat tailed).

The normally distributed dataset is assessed using a number of statistical tools to generate a Dot and Box Plot which includes summary statistics and confidence intervals. The review of statistical data enables the assessor to make a decision, with an associated level of confidence, where the true mean of the sample population lies in relation to the critical concentration.

It is essential when using statistics to assess sample data that all decisions relate back to the conceptual site model. Statistics cannot indicate if contamination on a site is likely to present a risk to the end user, this is the role of the 'competent person' i.e. Lithos.

However, broadly speaking the following applies:

- Mean and UCL below the critical concentration – no further assessment required.
- Mean below the critical concentration, but UCL above – consider the CSM and likely sources.
- Mean and UCL above the critical concentration – further assessment required, remediation likely depending on the CSM.
- LCL, Mean & UCL above the critical concentration – further assessment required, remediation likely.

² CL:AIRE, 2020. Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration.

Other screening values used by Lithos

Tier 1 risk assessment of **hazardous gas** is undertaken through reference to the following documents (and further information is presented in Generic Note No. 5 – Hazardous Gas):

- Approved Document C, Building Regulations 2000
- Boyle & Witherington (2007) – Guidance on evaluation on development proposals on sites where methane and carbon dioxide are present, incorporating "traffic lights". Report Ref. 10627-R01-(02), for NHBC
- CIRIA C665 (2007) – Assessing risks posed by hazardous ground gases to buildings
- BS 8485:2015 – Code of Practice for the characterisation & remediation from ground gas in affected developments

With respect to the assessment of potential **phytotoxic effects** of contaminants, Lithos refer to The Sewage Sludge in Agriculture: Code of Practice 2018 for copper and zinc (at pH 5.5 to 6.0). The CLEA derived Tier 1 value is adopted for nickel due to its human health effects.

The potential risk to **building materials** is considered through reference to relevant BRE Digests, with particular emphasis on BRE Special Digest 1, 'Concrete in aggressive ground', 2005.

With respect to the interpretation of the **calorific values**, at present there are no accepted methods to assess whether a sample is combustible and under what circumstances it might smoulder. Some guidance is given in ICRCCL Note 61/84 "Notes on the fire hazards of contaminated land" which states that: "In general ... it seems likely that materials whose CV's exceed 10MJ/kg are almost certainly combustible, while those with values below 2MJ/kg are unlikely to burn".

Tier 1 **groundwater risk assessments** are always site specific and compare leachate or groundwater concentrations with the appropriate water quality standard based on the CSM and consideration of relevant water quality impacts and assessments.

Waste classification & WAC

In the context of waste soils generated by remediation and/or groundworks activities on brownfield sites, the following definitions (from the Landfill Regulations 2002) apply:

- Inert (e.g. uncontaminated 'natural' soil, bricks, concrete, tiles & ceramics)
- Non-Hazardous (e.g. soil excavated from a contaminated site which contains dangerous substances, but at concentrations below prescribed thresholds)
- Hazardous (e.g. soil excavated from a contaminated site which contains dangerous substances at concentrations above prescribed thresholds)

Dangerous substances include compounds containing a variety of determinants commonly found in contaminated soils on brownfield sites, for example arsenic, lead, chromium, benzene etc.

Landfill operators require Waste Acceptance Criteria (WAC) laboratory data, if soil waste is classified as **hazardous**. However, subject to WAC testing it may be possible to classify it as stable, non-reactive hazardous waste, which can be placed within a dedicated cell within the non-hazardous landfill.

Lithos typically only include WAC analysis in site investigation proposals and reports, if significant off-site disposal (of soil classified as hazardous waste) is anticipated, for example where redevelopment proposals include basement construction etc. If off-site disposal of soils classified as hazardous waste during redevelopment is anticipated, then WAC analysis should be scheduled at an early stage in the remediation programme. However, organic compounds (BTEX, TPH, PAH etc) are the most common contaminants that result in soils being classed as hazardous, and these contaminants can often be dealt with by alternative technologies (e.g. by bioremediation or stabilisation) and consequently retention on site is often possible.

It should be noted that **non-hazardous** soil waste can go to a non-hazardous landfill facility; no further testing (e.g. WAC) is required.

APPENDIX C
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
 - Putresible 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.

-
- 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 D
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 residential developments; most notably when the made ground contains inorganic (and non-volatile organic) contaminants at concentrations above 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 nature and degree of contamination (and sometimes the Local Authority whose area the site lies within), but typically between 600mm and 1,000mm is required. 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 If the made ground is essentially "clean", but contains materials generally considered undesirable as near-surface material in garden areas (e.g. oversize materials such as construction/demolition rubble) then, in accordance with NHBC Standards Chapter 9.2, a 300mm thick soil cover should be adequate. If the made ground is essentially "clean" and comprises reworked natural soil, the only cover likely to be required is topsoil.
- 1.4 The "clean" soil cover blocks potential linkages between the contaminated made ground and future residents. Soil cover is not required beneath drives, garages or houses.
- 1.5 The **CML initiative**, which came into force on 1st April 2003, requires housebuilders to submit to NHBC (or other warranty provider) 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 finishing date.
- 1.7 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 without compromising the DPC and any sub-floor ventilation.
- 1.9 Ideally soil **quality** should be determined by sampling of the **source** at least 7 working days before importation to the development site. Samples could be obtained from stockpiles on site, which may on occasion comprise surplus natural ground development arisings. Soil samples could be obtained from gardens after placement, but this is not recommended.
- 1.10 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.
- 1.11 Where soils have been tested at source 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.

1.12 Soil **thickness** can only be checked after placement; this should be done before turfing / landscaping, but ideally after scaffolding has been dismantled.

1.13 *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 1,000m ³	Per additional 1,000m ³
Greenfield	At least 3, with at least 1 sample per 250m ³	2
Brownfield	At least 6, with at least 1 sample per 100m ³	2
Crushed product	At least 3, with at least 1 sample per 500m ³	2

1.14 On a typical development with gardens comprising 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.

1.15 **Inspection Frequency (to check Soil Thickness):** The number of inspection pits excavated to check cover thickness (and collect samples, if testing at source has not been undertaken), should be dependent on the number of plots associated with the given development. The following frequencies are recommended:

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

1.16 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

1.17 **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 Verification Requirements for Cover Systems: Technical Guidance for Developers, Landowners & Consultants; Version 3.4, November 2017.

- 1.18 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 150mm 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)
- 1.19 **Laboratory Analysis:** Whether samples are taken at source, from stockpiles on site, or from gardens after placement, they should be forwarded to an analytical laboratory for testing in accordance with one of the Schedules detailed in Table 1.
- 1.20 Imported topsoil should be subject to such 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.

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. 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.

- 1.21 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 in gardens.

1.22 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 revised toxicological value has been published the former CLEA value has been adopted.

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)	C4SL	3,000	
Cr (VI)	C4SL	21	
Pb	C4SL	200	
Ni	C4SL	127	Assessment of human health risk only.
Se	C4SL	434	
Hg	C4SL	199	Assumes mercury present as an inorganic compound (cf elemental metal or within organic compound). See Science Report SC050021/Mercury SGV.
B	Lithos	5	
Cu	DoE	80 to 200	Based on phytotoxic risks as plants are the more sensitive receptor (Cu is pH dependent).
Zn	DoE	200	
Benzo(a)pyrene	C4SL	5	
Naphthalene	C4SL	12	
GRO	C4SL	45	Conservative value based on value for aromatic fraction C7 to C8 range, but assuming indoor inhalation pathway still relevant (it shouldn't be).
DRO	C4SL	219	Conservative value based on value for aliphatic fraction C10 to C12 range, but assuming indoor inhalation pathway still relevant (it shouldn't be).
LRO	C4SL	1,000	Calculated value above hazardous waste screen in WM3, there 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 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.