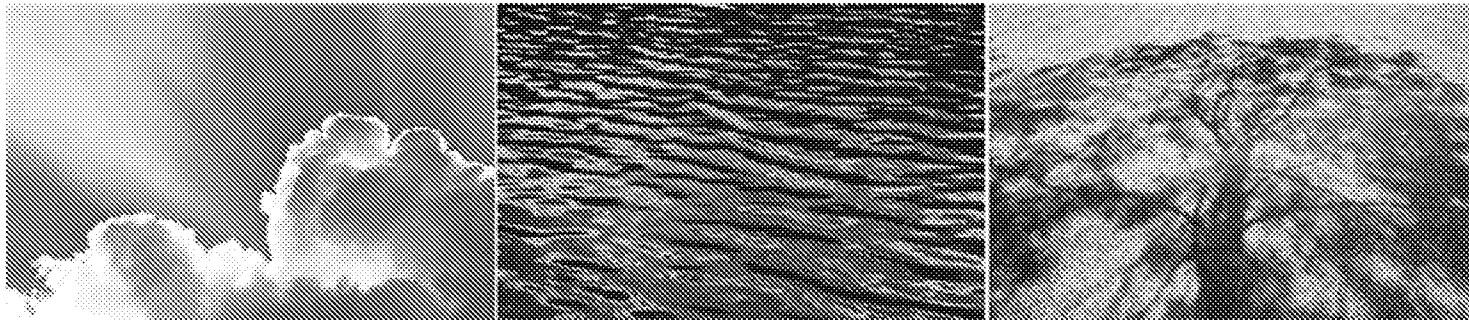


Remediation Strategy and Verification Plan



Desk Studies | Risk Assessments | Site Investigations | Geotechnical | Contamination Investigations | Remediation Design and Validation

Site: Land South of Mayflower Way, Angmering, West Sussex

Client: Angmering Community Land Trust

Report Date: 3 June 2020

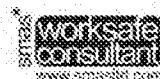
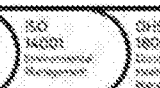
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PL 29200

ENIS 506775

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SUMMARY

The site in Angmering, West Sussex, which extends to about 0.43 ha, comprises an open plot of agricultural land, which at the time of our investigation was not in use. It is proposed to redevelop the site with two to three storey residential properties with associated private gardens, soft landscaping, an orchard and areas of parking.

The desk study indicates that the site has a history of agricultural use and, based on anecdotal evidence, may have also been allotments for a short period of time. The site is set within a predominantly rural / residential area.

Two phases of intrusive investigation were carried out. The first being a Desk Study, Site Investigation & Risk Assessment Report (Aug 2017 – ref J13227); the second a supplemental Investigation for Asbestos in Soil (May 2020 – ref J14366).

Relevant Pollutant Linkages have been identified in respect of loose asbestos fibres and fragments of asbestos cement sheet.

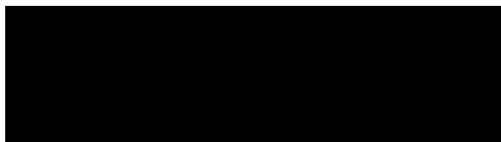
A Remediation Strategy comprising selective excavation of contaminated soils, and replacement with suitable clean soils is proposed, within areas of private gardens, soft landscaping and the orchard, subject to approval by regulatory authorities.

A Verification Plan and Discovery Strategy are also included.

The contamination screening values used are valid at the time of writing but may be subject to change and any such changes will have implications for the assessments based upon them. Their validity should be confirmed at the time of site development.

This report has been prepared for the sole internal use and reliance of Angmering Community Land Trust and their appointed Engineers. This report shall not be relied upon or transferred to any other parties without the express written authorization of Southern Testing Laboratories Limited. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

The findings and opinions conveyed via this report are based on information obtained from a variety of sources as detailed within this report, and which Southern Testing Laboratories Ltd believes are reliable. Nevertheless, Southern Testing Laboratories Ltd cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.



S K Toms BSc (Hons) MSc MEnvSc PIEMA
(Countersigned)

For and on behalf of Southern Testing Laboratories Limited



J Kelly BSc PhD DIC
(Signed)

STL: J14366
3 June 2020

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APPENDIX A

Site Plans

APPENDIX B

Assessment Criteria

A INTRODUCTION

1 Authority

Our authority for carrying out this work is contained in a letter dated 24th February 2020 from Bruce Howse of The Howse Wallis Partnership, acting as Agent for Angmering Community Land Trust.

2 Location

The site, which comprises an existing field, is located to the south of Mayflower Way, approximately 500m to the north-east of Angmering Railway Station, Littlehampton, BN16 4AY, see Figure 1 in Appendix A. The approximate National Grid Reference of the site is TQ 07262 03273.

3 Proposed Construction

It is proposed to construct a residential housing, with private gardens, landscaped areas and an orchard / area of public open space. The proposed layout is shown in Figure 2 in Appendix A.

For the purposes of the contamination risk assessment, the proposed development land use is classified as Residential with home-grown produce consumption (CLEA model¹/C4SL report²).

4 Scope

This report presents our Remediation Options Appraisal, Remediation Strategy, and Verification Plan for the proposed remedial works at the site.

As with any site there may be differences in soil conditions between exploratory hole positions.

The findings and opinions conveyed via this report are based on information obtained from a variety of sources as detailed within this report, and which Southern Testing Laboratories Limited believes are reliable. Nevertheless, Southern Testing Laboratories Limited cannot and does not guarantee the authenticity or reliability of the information it has obtained from others.

This report has been prepared for the sole internal use and reliance of Angmering Community Land Trust and their appointed Engineers. This report shall not be relied upon or transferred to any other parties without the express written authorization of Southern Testing Laboratories Limited. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

The recommendations contained in this report may not be appropriate to alternative development schemes.

The contamination screening values used are valid at the time of writing but may be subject to change and any such changes will have implications for the assessments based upon them. Their validity should be confirmed at the time of site development.

¹ Environment Agency Publication SC050021/SR3 'Updated technical background to the CLEA Model' (2009).

² SP1010 Development of Category 4 Screening Levels DEFRA (2014)

B BACKGROUND INFORMATION

5 Site Investigation Works

The site has been the subject of two main site investigation reports, in terms of contamination assessment, as listed below

Ref	Date	Author	Title/Ref No.	Subject
1	Aug 2017	Southern Testing	Desk Study & Preliminary Site Assessment Report J13227	Whole site
2	May 2020	Southern Testing	Supplementary Investigation & Laboratory Analysis for Asbestos in Soil J14366	Whole site

These reports provide good coverage and characterisation of the site. Information derived from the reports is discussed below. The reader is referred to the original reports for supporting detail if needed. These reports are referred to below by the number given in the left hand column of the above table.

6 Site History

The desk study, detailed in report 1 above, indicates that the site has a history of agricultural use and, based on anecdotal evidence, may have also been used as allotments for a short period of time. The site is set within a predominantly rural / residential area.

7 Relevant Pollutant Linkages

The site investigation and risk assessments carried out as part of reports 1 & 2, have identified occasional contamination from asbestos within made ground soils in places, with no obvious or definable pattern to the contamination. The made ground analysed was free from significant levels of heavy metals, PAHs, TPH and pesticides / herbicides, which were included within the original conceptual site model.

Although a single sample of topsoil has been screened previously and found to be free from significant contamination, due to the risk from mixing this with the underlying made ground during the site strip, we do not recommend the re-use of the onsite topsoil within the proposed development, but importing certified clean material from a reputable reliable source. If potential re-use is to be pursued, then supervision during the strip and significant further testing once stripped, would be necessary to confirm the suitability for reuse. This is, however, not recommended at this stage.

No land gas or vapour risks were identified, nor any credible risk to controlled waters.

The Relevant Pollutant Linkages for the site are as follows:

Contaminant/Source	Pathways	Receptors
Asbestos fibres/fragments in Made Ground	Dust/particulate inhalation	Site/ Construction Workers Future residents Maintenance workers

C REMEDIAL OBJECTIVES AND OPTIONS

8 Remedial Objectives

The site is to be developed for a residential end-use. In the absence of significant off-site risk, the principal objective of the remediation is to remove or reduce to an acceptable level the risks associated with the presence of the identified contamination. Additional objectives are to achieve the remediation goal in a cost effective and timely manner, whilst minimising impact from associated traffic movements, landfill and resource consumption.

9 Options Appraisal

The proposed development comprises a very high proportion of hard cover, with small areas of soft landscaping/garden etc. The identified Pollutant Linkages are mostly associated with exposed soils; this includes the potential risk from the maintenance of buried services. The remedial options are considered in the context of the specific development proposals.

Asbestos Fibres in the Made Ground

The risks to human health receptors from asbestos fibres/fragments in the Made Ground could be dealt with by several methods.

In respect of construction and maintenance workers, the use of PPE and safe working practices (minimising disturbance of the soil, creation of dust and the extent and duration of contact with soils) can reduce risk by helping to break the exposure pathways. However, while use of these measures should be considered as part of good practice in construction and maintenance, they typically are looked upon as a measure of last resort and need to be used in combination with other measures. Neither are such measures appropriate for future site users (residents).

Breaking the exposure pathway prior to construction by emplacement of imported clean material and/or impermeable cover over the made ground could reduce risks to human health receptors including future site users and landscaping maintenance workers. Buildings, access roads and car parking spaces constitute impermeable cover and therefore imported soils would only be needed for areas of the site proposed as soft landscaping.

Removing the source by careful selective excavation of affected soils and subsequent off-site disposal to an appropriately licensed facility is also capable of reducing/eliminating the risk to human health receptors. As with emplacement of a barrier of clean material, this would be required for gardens, soft landscaping areas and the public open space/orchard, as buildings, access roads and car parking spaces will break the pathway. However, maintenance of buried utilities could be required in the future, and associated excavations could expose residual contaminated soil. Therefore, removal of soils for a margin beyond the full width and depth of services trenches would be required to manage the risk. The placement of suitable clean soils would create a 'clean corridor' for services.

Off-site disposal of contaminated soils and importation of clean materials place additional demands on aggregate resources and waste disposal capacity, and both require significant road haulage. Use of these remediation methods therefore requires that the quantities involved be minimised to ensure the approach remains sustainable in respect of resources, energy and traffic impacts.

An approach combining source removal and replacement with clean material to limited areas of the site, with carefully considered safe working methods for construction, is considered most likely to be effective and sustainable in respect of asbestos fibres/fragments in the Made Ground.

D REMEDIATION STRATEGY

11 Remediation Methods

The Remediation Strategy will comprise the following:

Location	Details
Soft landscaping areas (including orchard)	Where Made Ground soils are in excess of 600mm thick, these soils should be stripped down to 600mm below finished levels and a deter to dig layer installed (a geotextile marker layer – rhino alert or similar) with levels made up with site-won or imported certified clean natural soils and imported certified clean topsoil (to include a minimum 150mm of topsoil). Where made ground thicknesses are less than this, the reduce dig can stop at the top of the natural soils. A greater depth of excavation will be required if large shrubs or trees are to be planted (such as the orchard), to accommodate the cultivation requirements – see specialist horticultural advice in this regard.
Private Gardens	Where Made Ground soils are in excess of 600mm thick, these soils should be stripped down to 600mm below finished levels to allow the placement of a deter to dig layer installed (a geotextile marker layer – rhino alert or similar) with levels made up with site-won or imported certified clean natural soils and imported certified clean topsoil, (to include a minimum 150mm of topsoil). Where made ground thicknesses are less than this, the reduce dig can stop at the top of the natural soils.

12 Assessment Criteria

The following assessment criteria values will be used in the verification process:

All imported soils shall be free from deleterious materials, weeds and contamination.

The topsoil material to be used for soft landscaping will comply with the appropriate BS Specification for Topsoil (BS 3882:2015) and the analysis shall also comply with the values given for a residential land use without home-grown produce consumption in the table in Appendix B. Subsoil may be any suitable material recommended by the landscaping company, but shall be certified in respect of contamination in the same way as the topsoil.

Material to be used for creating the clean services corridors shall be suitable for its engineering purpose and also be certified free from contamination.

The criteria values given in Appendix B are valid at the time of writing but may be subject to change and any such changes will have implications for the assessments based on them. Their validity should be confirmed at the time of site development.

E VERIFICATION PLAN

13 Data Collection

Location	Data	Responsible party
Private Gardens /Soft Landscaping areas and public open space/orchard	Removal of Made Ground down to 600mm below finished level/natural soils (or in accordance with specialist horticultural advice in the orchard area).	Main Contractor
	Post strip inspection of reduced surface.	Southern Testing
	Post placement check of reinstatement thicknesses, including verification of the placement of a deter-to-dig membrane where required.	Southern Testing
	Transfer/consignment notes for the material removed from site/imported to site, along with supplier certificates for the imported soils.	Main contractor/ groundworker

The presence of asbestos in the shallow made ground soils will have to be carefully managed during the groundworks phases of the development, in order to prevent the release of fibre from the affected soils when these are exposed at the surface. Whilst the concentrations of fibre measured during the investigations are low, and the risk of airborne fibre similarly low, precautions are necessary to ensure that people using neighbouring sites, including residential properties, are protected.

A robust discovery strategy must also be in force for the groundworks phases, see below.

14 Analytical Framework

Provided that adequate certification can be provided by the supplier of soils imported for the remedial works, no testing should be necessary, unless required by the local authority or warranty provider.

If testing is required, the results of the analyses will be compared with the assessment criteria given above.

15 Reporting

At the end of the remediation, a verification report will be produced by Southern Testing.

16 Discovery Strategy

As with any site, areas of contamination not identified during site investigation works may come to light in the course of redevelopment. This is particularly true for the areas covered by the existing buildings, where investigation has not been possible to date, and particularly important in relation to the presence of asbestos. Accordingly, a discovery strategy will be adopted and rigorously applied, to ensure that any hitherto unknown contamination is identified and dealt with in an appropriate manner, as follows:

- A close watch will be maintained during all groundworks and other excavation works. It is essential that the personnel responsible for the watching of works have suitable training in respect of asbestos hazards in the ground, and experience of working with contamination.
- In the event that suspected asbestos containing materials, or unexpected or malodorous soils or liquids are encountered, excavation work shall cease in the affected area.
- The affected area shall be made safe, covered if necessary, and fenced off to prevent unauthorised access.
- The Site Manager shall notify Southern Testing of the discovery, who will attend site to inspect the suspect materials, provide advice and take samples as necessary. Within Southern Testing, Dr Lawrence Mockett shall be the first point of contact.
- The Site Manager shall notify Arun District Council of the discovery. Within ADC, the Contaminated Land Officer shall be the first point of contact.

Any suspect excavated soil will be stockpiled separately on polythene sheeting, covered, and tested as necessary, before being dealt with.

17 General Guidance

In general terms, the workforce and general public should be protected from contact with contaminated material. There is a range of relevant documents published by the Health and Safety Executive, and organisations such as CIRIA, and the BRE.

Some soils will require removal from site and disposal to suitably licensed landfills. Different guidelines and charges will apply to different waste classifications. As waste producers, the Developer holds responsibilities under the various governing regulations, including:-

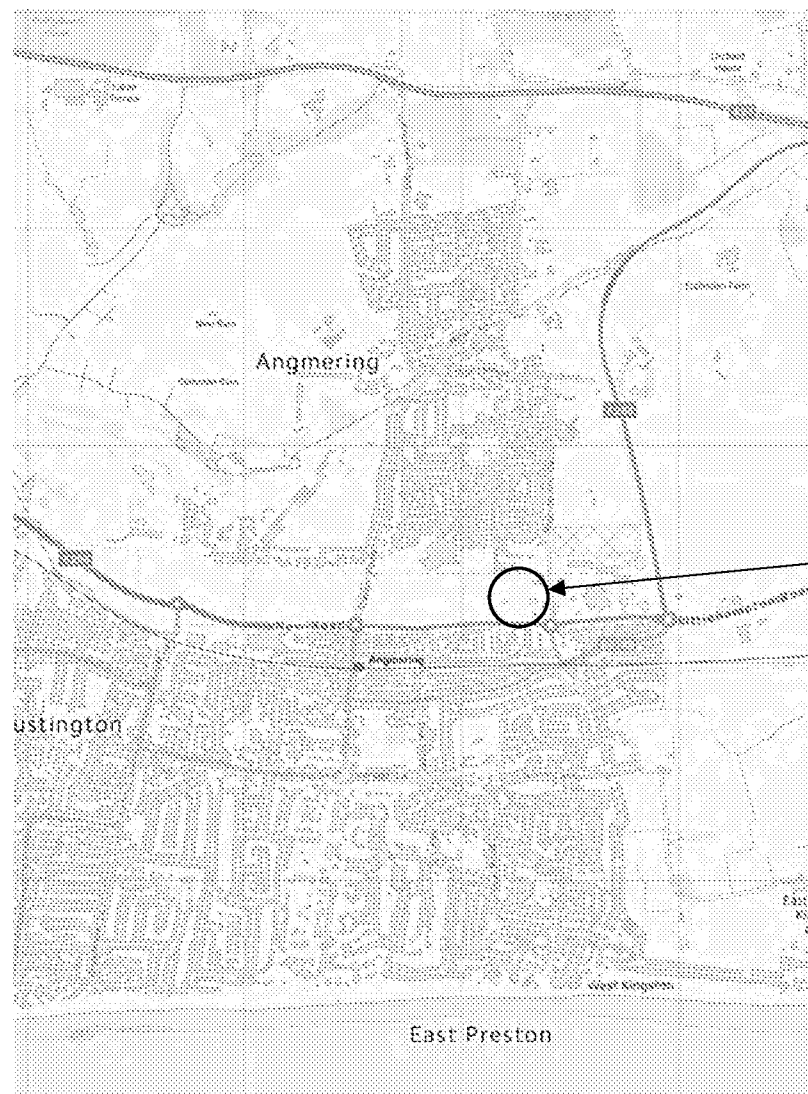
- Ensuring that waste is characterised in accordance with current Technical Guidance.
- Ensuring that waste is disposed of at a facility appropriately licensed to receive the waste as classified.
- Keeping accurate records of all waste classification, transfer and a disposal log including information such as:
 - Date, Waste Classification, Carrier's Registration Number, Transfer Note Number, Ultimate Destination.
- Submitting full copies of those records for inclusion in validation/closure reports.
- Maintaining those records for potential future regulatory inspection.

It is noted particularly that asbestos fibre is present in the made ground over at least part of the site. The concentrations recorded in the site investigation are below the hazardous waste threshold of 0.1%, but its presence may, nonetheless, limit the available options for disposal. Further testing will be required for waste disposal purposes.

In the event that identifiable fragments of asbestos containing materials come to light in the course of redevelopment, any waste soils containing such fragments are automatically classified as Hazardous Waste.

APPENDIX A

Site Plans



Site Location

NB: Contains Ordnance Survey data © Crown copyright and database right 2020

Site: Land South of Mayflower Way, Angmering

STL: J14366

Fig No: 1

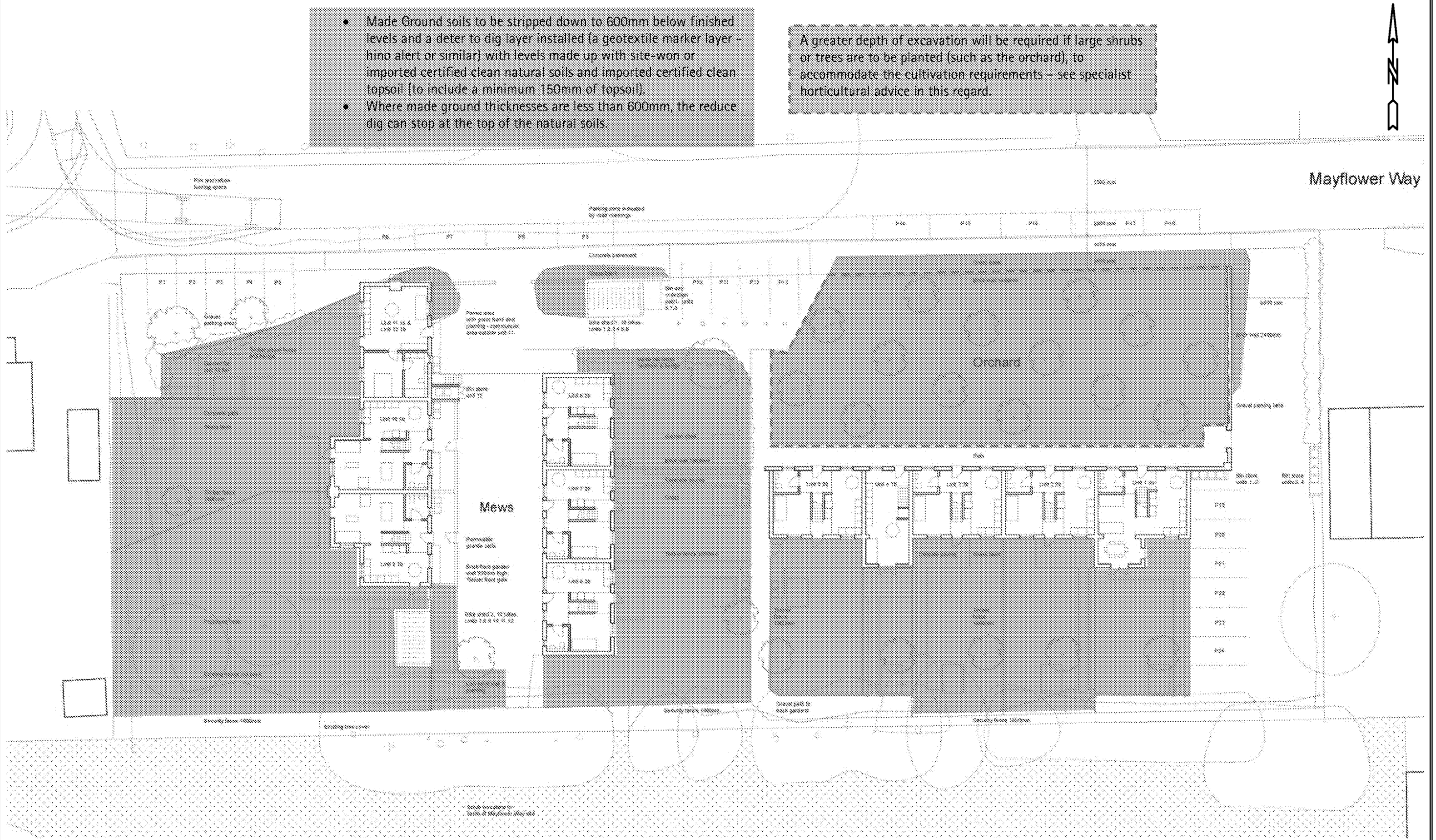
Date: 23 March 2020

Site Location Plan

 Southern Testing

Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4QA
ST Consult: Twigden Barns, Brixworth Road, Creton, Northampton NN6 8NN

 ST Consult



NB: Positions of Boreholes and/or Trial Pits are only indicative unless dimensioned

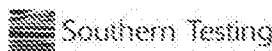
Site: Mayflower Way, Angmering

STL: J14366

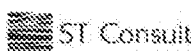
Fig No: 2

Date: 3rd June 2020

Site Plan - Remediation Plan



Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4QA
ST Consult: Twigden Barns, Brixworth Road, Creaton, Northampton NN6 8NN



APPENDIX B

Verification Criteria

Contaminant Screening Values for Imported Soils

Contaminant	Units	Proposed Land Use					
		Residential with home-grown produce consumption	Residential without home-grown produce consumption	Open Space* (Residential)	Open Space* (Park)	Allotments	Commercial / Industrial
Arsenic (As) [2]	mg/kg	37	40	79	170	43	640
Cadmium (Cd) [2]	mg/kg	11	85	120	555	1.9	190
Trivalent Chromium (CrIII) [2]	mg/kg	910	910	1,500	33,000	18,000	8600
Hexavalent Chromium (CrVI) [2]	mg/kg	6	6	7.7	220	1.8	33
Lead (Pb) [3]	mg/kg	200	310	630	1300	80	2330
Mercury (Hg) [1,2,7]	mg/kg	7.6-11	9.2-15	40	68-71	6.0	29-320
Selenium (Se) [2]	mg/kg	250	430	1,100	1,800	88	12,000
Nickel (Ni) [1,4]	mg/kg	pH<6.0 60 pH 6.0-7.0 75 pH>7.0 110					
Copper (Cu) [1,4]	mg/kg	pH<6.0 100 pH 6.0-7.0 135 pH>7.0 200					
Zinc (Zn) [1,4]	mg/kg	pH<6.0 200 pH 6.0-7.0 200 pH>7.0 300					
Phenol [1,2]	mg/kg	120-380	440-1200	440-1300	440-1300	23-83	440-1300
Benzo[a]pyrene [1,5]	mg/kg	1.7-2.4	2.6	4.9	10	0.67-2.7	36
Naphthalene [1,2]	mg/kg	2.3-13	2.3-13	77-430 ⁺	77-430 ⁺	4.1-24	77-430 ⁺
Total Cyanide (CN) [6]	mg/kg	/	/			/	/
Free Cyanide [6]	mg/kg	/	/			/	/
Complex Cyanides [6]	mg/kg	/	/			/	/
Thiocyanate [6]	mg/kg	/	/			/	/

Notes:

* Open Space levels calculated on the basis of the exposure modelling developed in the C4SL research.

+ Screening values constrained to saturation limit. Higher values may be acceptable on a site specific basis.

[1] Where ranges of values are given for organic contaminants, the screening value is dependent on the Soil Organic Matter. Where ranges are given for inorganic contaminants, the screening value is dependent on the pH.

[2] LQM/CIEH S4UL (2014). Copyright Land Quality Management Ltd reproduced with permission; Publication Number S4UL 3116. All rights reserved.

[3] C4SL (DEFRA 2014).

[4] Copper Zinc and Nickel may have phototoxic effects at the GAC or SGV concentrations and alternative criteria are given for importation of Topsoil or other soils for cultivation, based on BS3882:2015 (Topsoil) and BS8601:2013 (Subsoil).

[5] Based on the Surrogate Marker approach and modelled using the modified exposure parameters of C4SL but retaining 'minimal risk' HCV.

[6] Usually Non-Detect concentrations. Screening criteria to be derived on a site specific basis if test results indicate.

[7] SGV/GAC for Methyl Mercury, higher concentrations may be tolerable if inorganic mercury is the only species present. Lower concentrations apply for elemental mercury.

**These screening values are valid at the time of writing but may be subject to change.
Their validity should be confirmed at the time of site development.**