Geotechnical and Geo-environmental Consultants

REMEDIATION METHOD STATEMENT

LOWER BARN FARM
BAYLHAM
SUFFOLK
IP6 8JP

Reference Number 2938/Rpt 1v1
September 2021

Prepared for

Simmons Building Services (South-East) Ltd
Priory House
Boxted Straight Road
Colchester
CO4 5RB

By

Brown 2 Green Associates Ltd
Suite 1, Wenden Court
Station Road
Wendens Ambo
Saffron Walden
Essex, CB11 4LB

Tel: 01799 542473
Web address: www.brown2green.co.uk

Client	Simmons Building Services (South-East) Ltd
	Priory House, Boxted Straight Road, Colchester, CO4 5RB
Report Title	Remediation Method Statement: Lower Barn Farm, Baylham, Suffolk, IP6 8JP
Reference Number	2938/Rpt 1v1
Date	September 2021

Prepared By	Radu-Mihai Ilie MSc, PhD, FGS (Geo-environmental Consultant)	
Reviewed and Approved By	Philip Miles BSc, MSc, C Geol (Director)	

TABLE OF CONTENTS

1 INTRODUCTION 1

1.1 Background 1
1.2 Proposed Development 1
1.3 Objectives 1
1.4 Sources of Information 1
1.5 Limitations and Constraints of the Study 2

2 SUMMARY OF RESULTS OF INVESTIGATION 3

2.1 Ground Conditions 3
2.2 Contamination Assessment 3

3 REMEDIATION STRATEGY 5

3.1 Verification 6
3.2 Gas Protection Measures 6
3.3 Water Supply Pipework 6
3.4 Reporting 6
3.5 Unforeseen Contamination 6
3.6 Post Development Maintenance/Monitoring 7

FIGURES

Figure 1 Site Location Plan
Figure 2 Proposed Development Layout
Figure 3 Remediation Areas

APPENDICES

Appendix I Verification Criteria for Base of Excavation
Appendix II Chemical Specification and Versification Criteria for Top and Subsoil

1 INTRODUCTION

1.1 Background

Brown 2 Green Associates Ltd have been commissioned by Simmons Building Services (South-East) Ltd to prepare a Remediation Method Statement for the redevelopment of Lower Barn Farm, Baylham, Suffolk, IP6 8JP to residential. The site is located at National Grid Reference 611040, 252160. The site location is presented in Figure 1.

A Phase 1 Desk Study was previously completed by Rossi Long Consulting. Based on the findings of the Desk Study, a Phase 2 Geo-environmental Site Investigation was undertaken by Murray Rix (Northern) Ltd. The site investigation consisted of the drilling of six boreholes (BH1 to BH6). Soil samples were obtained and gas monitoring was carried out. Made ground was encountered in three boreholes (BH4 to BH6). Maximum made ground thickness was recorded in BH 5 (0.4m). The made ground is underlain by sand and gravel deposits of Lowestoft Formation, which in turn are underlain by chalk. Concentrations of individual PAHs were recorded in BH5 (0.2-0.4m and 0.4-0.9m) and also long chain aromatic hydrocarbons (EC16-EC21). No elevated concentrations of methane or carbon dioxide were recorded during the monitoring of ground gas. The report recommended that an additional site investigation should be carried out in order to determine the extent of the contamination hotspot identified in BH5 and a remediation strategy should be put in place.

A supplemental site investigation was also completed by Murray Rix (Northern) Ltd. The investigation identified up to 0.9m of made ground consisting of brick rubble fill, concrete rubble fill, clay fill and mixed soil and clay fill. Elevated lead concentrations were identified in borehole C2. Asbestos fibres were identified in boreholes C1 and C2 in concentrations of less than 0.001%. The reports stated that the presence of asbestos was limited to the yard area and that a remediation strategy is required.

This report presents the remediation strategy to be adopted at the site.

1.2 Proposed Development

The development consists of the demolition of the existing buildings and erection of eight dwellings with associated parking and private gardens. The proposed layout is presented in a drawing prepared by Iceni Consulting, drawing number 20-001/CE/001 rev P7. The proposed development layout is presented in Figure 2.

1.3 Objectives

This document provides details of the requirements for remediation. The objectives of the remediation are to:

- Break the pollutant linkages that were identified as being active during the site investigation works.
- Render the site suitable for the intended end use as a residential development with private gardens.
- Render the site incapable of determination as contaminated land under Part 2A.

1.4 Sources of Information

Background information relating to the site was acquired and referenced from the following sources:

- Phase 1 Geo-Environmental Assessment – Lower Barn Farm, Baylham, Suffolk; prepared by Rossi Long Consulting;

- Geo-environmental Investigation and Risk Assessment – Residential Development – Lower Barn Farm, Baylham, Suffolk, prepared by Murray Rix (Northern) Ltd.

- Phase II Geo-environmental (Supplemental) Investigation and Risk Assessment – Residential Development – Lower Barn Farm, Baylham, Suffolk, prepared by Murray Rix (Northern) Ltd.

During the preparation of this report consideration has been made with regard to the findings of the previous work. These reports should be read in conjunction with this report.

1.5 Limitations and Constraints of the Study

Brown 2 Green Associates Ltd cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The client cannot place reliance on the report until full payment has been made. The copyright in this report and other plans and documents prepared by Brown 2 Green Associates Ltd is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of the report may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by Brown 2 Green Associates Ltd in this connection without their explicit written agreement thereto by Brown 2 Green Associates Ltd.

2 SUMMARY OF RESULTS OF INVESTIGATION

2.1 Ground Conditions

Made Ground

The boreholes indicate that the hardstanding is underlain by up to 0.9m of made ground. The made ground generally consists of made ground consisting of brick rubble fill, concrete rubble fill, clay fill and mixed soil and clay fill.

Natural Strata

The made ground is underlain by sand and sand and gravel. Chalk was also identified below 0.8m in C3 and slightly deeper in the other boreholes (e. g. 1.6m in C1, 2.0m in C2).

Visual and Olfactory Evidence of Contamination

No visual or olfactory evidence of contamination was noted during the site investigation phase.

Groundwater Conditions

No groundwater was identified during the drilling of boreholes.

It should be noted that groundwater levels can fluctuate seasonally and therefore, may be encountered at higher or lower elevations than those recorded in this site investigation.

2.2 Contamination Assessment

The Phase 2 Site Investigation identified:

Concentrations of polycyclic aromatic hydrocarbons (PAHs) were identified within BH5 (0.2-0.4m and 0.4-0.9m) and also long chain aromatic hydrocarbons (EC16-EC21) at levels that were above the adopted generic assessment criteria for the assessment of risk to human health. The additional site investigation identified elevated lead concentrations were identified in borehole C2. Asbestos fibres (chrysotile and amosite) were identified in boreholes C1 and C2 in concentrations of less than 0.001%. The reports stated that the presence of asbestos was limited to the yard area and that a remediation strategy is required.

The Tier I Controlled Water Risk Assessment has determined that there are no unacceptable concentrations of potential contaminants within the underlying soils that would pose a potential risk to controlled waters.

No elevated concentrations of methane or carbon dioxide were recorded during the monitoring of ground gas. The risk assessment for bio-genic ground gas concluded that there is no risk from ground gas.

The risk assessment in respect to the future planting and towards sensitive ecological receptors identified that the determinants at the site would pose a potential risk.

The risk assessment in respect to water supply infrastructure identified that hydrocarbon concentrations associated with the made ground from BH5 may potentially pose a risk to the integrity of water supply pipework.

In light of the results of the site investigation, and the results of the chemical analysis and the risk screening assessment presented in the previous reports, a Conceptual Model showing the identified pollution linkages was developed. The Conceptual Model is presented below.

Source	***Potential migration pathway***	***Potential Receptors***	***Discussion, Remedial or Precautionary Measures and Mitigating Factors***
Individual PAHs, aromatic hydrocarbons (EC16-EC21) and lead	Ingestion of contaminated soils and dust by direct contact and soil attached to home grown vegetables. Inhalation of dust (indoor and outdoor).	Residents and ground workers	The removal of made ground and replacement with clean soils in landscaped areas is required.
Hydrocarbon concentrations	Contact with drinking water supply pipework	Water supply pipework	Removal of hydrocarbon hotspot (BH5).
Loose asbestos fibres	Inhalation of fibres.	Residents and construction workers	The removal of made ground containing loose asbestos fibres (defined by the area where BH5, C1 and C2 were drilled)

3 REMEDIATION STRATEGY

The results of the site investigation have confirmed that the level of contamination at the site has the potential to pose a risk to end users and the environment and that there are active pollution linkages present. Remediation will be required to render the site suitable for the intended end use. The aim of the remediation is to break pollutant linkages that are present and thus mitigate the identified risks to acceptable levels. An appraisal of the remediation options concludes that source removal and pathway interruption are the most appropriate techniques to be adopted.

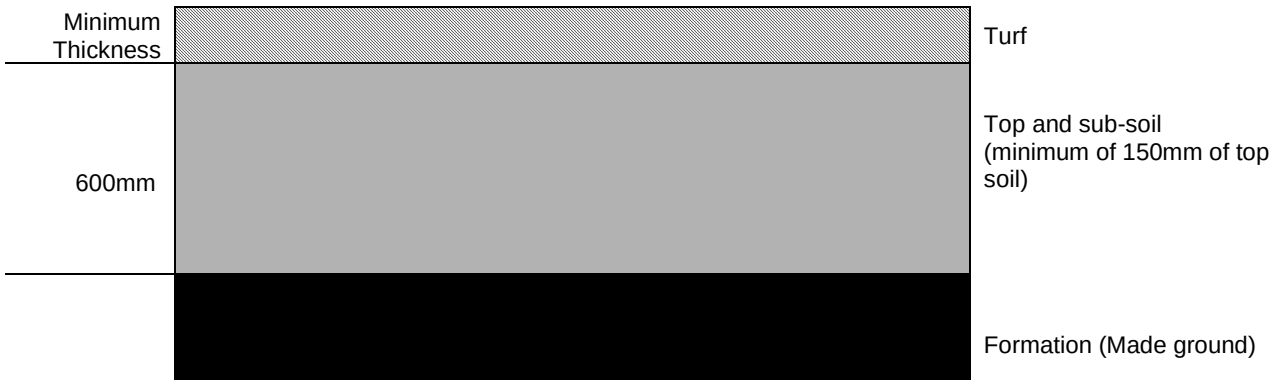
The site investigation identified that the made ground beneath the drive located to the east of the former barn contained concentrations of PAHs, long chain aromatic hydrocarbons, lead and loose asbestos fibres at levels that would pose a significant risk to human health. The thickness of the made ground varies between 400mm and 900mm. This area (where BH5, C1 and C2 were drilled), will become soft landscaping of the gardens of Plots 7 and 8. To create the required garden levels, the existing ground levels will need to be reduced by between 500mm and 700mm, resulting in the removal of the made ground.

To mitigate the risk from the concentrations of PAHs, long chain aromatic hydrocarbons, lead and loose asbestos fibres, the depth of excavation will be extended to the base of the made ground as the residual made ground will be less than 600mm below finished garden level. The extent of the area that requires excavation is presented in Figure 3.

All excavated soil generated by the remediation will be classified as waste. The soil will be disposed of to a suitable waste disposal facility, treatment facility or other suitable route to enable the soil to be re-used.

Following the completion of the excavation verification sampling will be undertaken to confirm all contaminated land ground has been removed.

Following the verification sampling, the area will be reinstated to create the required finished garden level. As all the contaminated made ground has been removed a minimum of 150mm of clean suitable top soil will be required. However, if contaminated made ground is still present a cover system will be placed. Details of the cover system are presented below:



The soils used to reinstate the gardens or within the cover system must be of a standard suitable for a residential end use. The soils must be physically suitable for the intended use and be free from deleterious materials such as glass, plastic, wood, paper etc. It is recommended that topsoil should generally comply with the requirements of the specification for multigrade topsoil as given in BS 3882: 2015 or to the satisfaction of the landscape architect. All top and sub-soil that is used must conform to the chemical specification detailed in Appendix I. A sustainable approach would be testing

the site won top soil present on site in the western and eastern areas and reuse it in the garden and soft landscaping areas should the chemical results reveal that it is suitable for the above-mentioned purpose.

3.1 Verification

Within the area that required remediation the following verification will be undertaken:

- Following the removal of the contaminated made ground/top soil and prior to the reinstatement of the excavated area, samples will be obtained from the base of the excavated area. A minimum of one sample per plot will be obtained. Samples will be submitted to a UKAS/MCERT accredited laboratory and analysed for lead, TPH (CWG), PAHs and asbestos. The verification criteria are presented in Appendix II.

- If contaminated made ground is still present, as determined by the validation of each plot and a capping layer is required and has been placed within the rear garden of each of the Plots 7 and 8, a trial pit will be excavated to the base of the capping layer. The following verification criteria will be adopted: Minimum capping layer thickness of 600mm.

- Validation samples of any imported top soil and sub soil that is used within gardens and within 600mm of finished garden level will be obtained for laboratory analysis. A minimum of one sample per plot will be obtained, assuming all the soil is obtained from the same source. Should top and sub-soil be placed a sample will be obtained from each type of material. No verification sampling will be undertaken if site won natural soil or top soil from the field outside of the remediation areas is used to reinstate garden or within the capping layer. If samples are obtained, samples will be submitted to a UKAS accredited laboratory and analysed for the suite detailed in Appendix II. The results of all samples must conform the verification criteria detailed in Appendix II.

3.2 Gas Protection Measures

No gas protection measures are required.

3.3 Water Supply Pipework

All drinking water supply pipework should be placed within a clean corridor.

3.4 Reporting

On completion of the remediation a validation report will be prepared. The validation report will present the following information:

- Site observations and photographs, including plan showing the location of all photographs.

- Chemical analysis of validation samples and imported soils.

- Waste transfer notes.

3.5 Unforeseen Contamination

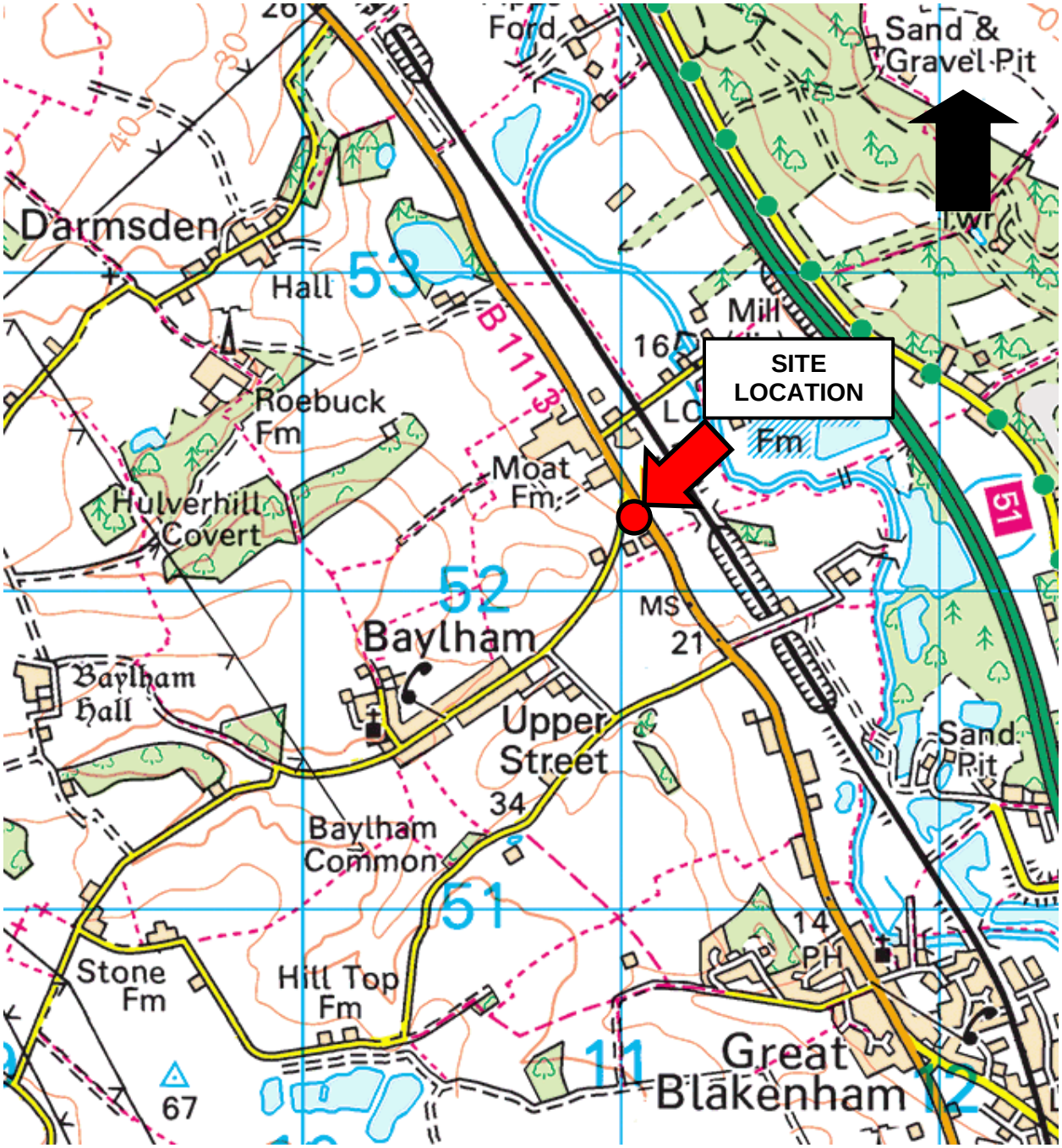
During the construction works, should any evidence of unforeseen visual or olfactory contamination not revealed during the site investigation, underground storage tanks or other underground structures be identified, contact should be made with a suitable qualified Geo-environmental

Consultant. Following inspection, suitable action will be taken to assess any risk from contamination. This may include additional investigation or sampling. If contamination is identified contact will be made with the Contaminated Land Officer at the local council and all relevant information submitted.

3.6 Post Development Maintenance/Monitoring

No post development maintenance or monitoring of the remediation measures are required.

FIGURES



Project Number: 2938	Project: Lower Barn Farm, Baylham, Suffolk	Scale: NTS
Figure 1	**Site Location Plan**	Brown 2 Green

FIGURE 2

PROPOSED DEVELOPMENT LAYOUT

0 5 10
1:200 Scale

Notes

No dimensions to be scales from this drawing.

Revisions

P1	Preliminary Issue.	18/11/2020
P2	Site layout amended for planning.	16/12/2020
P3	Paths added to plot 7 and 8's garden. Survey cleared within site boundary for clarity.	05/01/2021
P4	Plots 1 and 2 positions adjusted.	01/02/2021
P5	Scale Bar added.	01/04/2021
P6	Application boundary added and layout adjusted to suit.	08/04/2021
P7	Plots 7,8 and 9 updated to suit Architects plans. Boundaries to plots 1, 2, 3, 4, 7 and 9 amended.	28/06/2021

Project
BAYLHAM
IPSWICH

Client

simmons building services
Simmons Building Services (South East) Ltd.
Priory House | Boxted Straight Road | Colchester CO4 5RB
e. info@simmonsbuildingservices.co.uk
w. www.simmonsbuildingservices.co.uk
t. 01206 273375

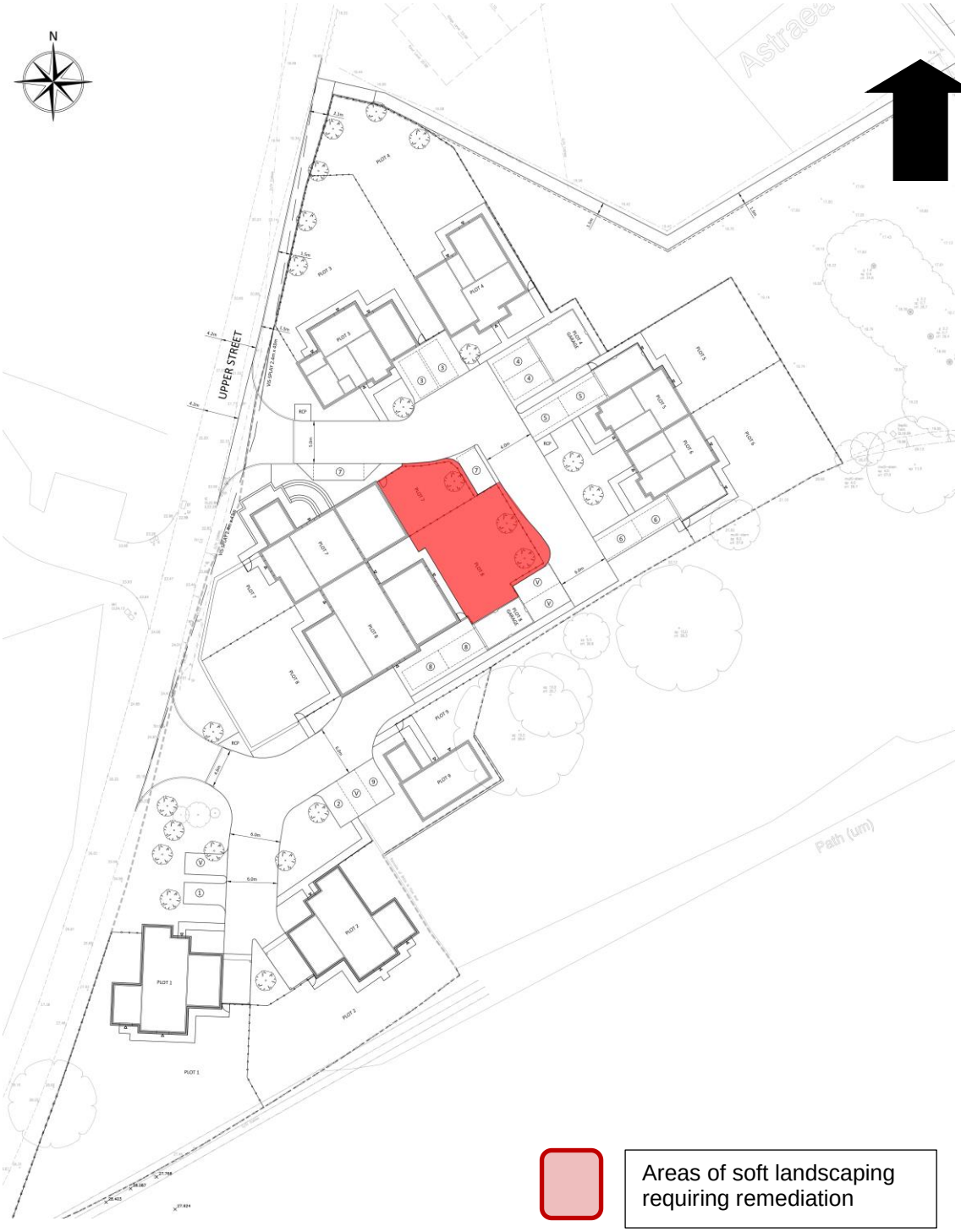
Title
SITE LAYOUT

ICENI CONSULTING
Iceni Consulting Anglia Limited
14 Strickmere
Stratford St. Mary
Colchester
Suffolk, CO7 6NZ
www.iceniconsulting.co.uk
Tel: 07742 508235
Email: info@iceniconsulting.co.uk

Scale @ A1	Date	Drawn By	Checked by
1:200	Nov 2020	IC	MKP

Status
PRELIMINARY

Drg. No.	Revision
20-001/CE/001	P7



Project Number: 2938	Project: Lower Barn Farm, Baylham, Suffolk	Scale: NTS
Figure 3	**Remediation Plan**	Brown 2 Green

APPENDICES

APPENDIX I

VERIFICATION CRITERIA FOR REMEDIATION (BASE OF EXCAVATION)

Determinant	Maximum Concentration (mg/kg)		
Lead	200		
Asbestos	None detected (<0.001%)		
pH	5 - 10		
	1% Soil Organic Matter	2.5% Soil Organic Matter	6% Soil Organic Matter
Polycyclic Aromatic Hydrocarbons			
Benz(a)anthracene	7.2	11	13
Chrysene	15	22	27
Benzo(b)fluoranthene	2.6	3.3	3.7
Benzo(a)pyrene	2.2	2.7	3.0
Dibenzo(a,h)anthracene	0.24	0.28	0.3
Total Petroleum Hydrocarbons Aromatic			
TPH C_{16}-C_{21}	260	540	930

APPENDIX II

CHEMICAL SPECIFICATION AND VERIFICATION CRITERIA FOR TOP AND SUB SOIL

Determinant	Maximum Concentration (mg/kg)		
Arsenic **	37		
Cadmium**	11		
Chromium**	910		
Lead***	200		
Mercury**	40		
Nickel****	75		
Selenium**	250		
Vanadium**	410		
Copper ****	200		
Zinc ****	300		
Asbestos	None detected		
pH	5 - 10		
	1% Soil Organic Matter	2.5% Soil Organic Matter	6% Soil Organic Matter
Polycyclic Aromatic Hydrocarbons			
Naphthalene**	2.3	5.6	13
Acenaphthylene **	170	420	920
Acenaphthene **	210	510	1100
Fluorene **	170	400	860
Phenanthrene **	95	220	440
Anthracene**	2400	5400	11000
Fluoranthene**	280	560	890
Pyrene**	620	1200	2000
Benz(a)anthracene**	7.2	11	13
Chrysene**	15	22	27
Benzo(b)fluoranthene**	2.6	3.3	3.7
Benzo(k)fluoranthene**	77	93	100
Benzo(a)pyrene**	2.2	2.7	3.0
Indeno(123-cd)pyrene**	27	36	41
Dibenzo(a,h)anthracene**	0.24	0.28	0.3
Benzo(ghi)perylene**	320	340	350
Total Petroleum Hydrocarbons Aliphatic			
TPH C_5-C_6 **	42	78	160
TPH C_6-C_8 **	100	230	530
TPH C_8-C_{10} **	27	65	150
TPH C_{10}-C_{12} **	130	330	760
TPH C_{12}-C_{16} **	1100	2400	4300
TPH C_{16}-C_{35} **	65000	92000	110000
Total Petroleum Hydrocarbons Aromatic			
TPH C_5-C_6 **	70	140	300
TPH C_6-C_8 **	130	290	660
TPH C_8-C_{10} **	34	83	190
TPH C_{10}-C_{12} **	74	180	380
TPH C_{12}-C_{16} **	140	330	660
TPH C_{16}-C_{21} **	260	540	930
TPH C_{21}-C_{35} **	1100	1500	1700
	No visual or olfactory evidence of hydrocarbons		

Source of Values

* - Soil guideline value, DEFRA/Environment Agency

** - Tier 1 GAC are based on Nathanail, C. P., McCaffrey, C., Gillett, A. G., Ogden, R. C. and Nathanail, J. F. 2015. The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham. **Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3086.**

*** - Category 4 Screening Level.

**** - BS 3882 British Standards Specification for Top Soil.

***** - B2G level to ensure no visible or olfactory evidence.