

ALDI STORES LTD

Hostmoor Avenue, March

Geo-Environmental Assessment Report

AT/C4324/9589

November 2020



	EXECUTIVE SUMMARY			
Location and Brief Site Description	The site is located off Hostmoor Avenue, March, PE15 0AX. The subject site comprises two separate commercial/ light industrial premises. An above ground waste oil tank, diesel generators and an electrical sub-station were identified as potential sources of contamination on the site. The site is set within a small industrial/retail estate featuring retail and light industrial premises, which in turn is surrounded by agricultural land comprising fields.			
Ground Conditions	Generalised ground conditions from the ground investigation comprise (top down): Made ground (generally granular) encountered from ground level to between 0.20m and 1.45m bgl. Natural strata predominantly of firm to stiff clay, with a layer of sand of variable depth and thickness identified at shallow depth. No visual or olfactory evidence of contamination. Groundwater (perched) between 0.51m and 4.90m bgl.			
Human Health - Soils Contamination	Based on the field observations, testing and assessment undertaken, there are no determinands above the relevant screening criteria for the proposed commercial end-use, the risks to human health from the identified source are considered to be low and remediation will not be necessary.			
Controlled Waters	The overall risk to controlled waters is considered to be low and no further action is required.			
Ground Gas	Based on the monitoring to date, the site is classified as CS1. Ground gas monitoring is ongoing, and a full assessment will be undertaken on completion of the scheduled monitoring.			
Outline Remedial Strategy	No specific remedial measures are considered necessary at the site.			
Waste	Waste classification on a selection of made ground and natural soils has revealed them to be non-hazardous and inert.			
Foundations and Floor Slabs	The most suitable foundations for the proposed commercial development are considered to be pads and strips bearing in the loose to medium dense sand at a minimum depth of 0.8m bgl, or in the underlying firm to stiff (medium strength) clay at a minimum depth of 1.5m bgl. Preliminary foundations indicate foundations in the sand would provide an allowable bearing capacity of 120kN/m², whilst foundations in the clay at 1.5m bgl would provide 110kN/m². Ground bearing floor slabs may be adopted subject to appropriate design and preparation of the formation.			
Concrete Classification	DS1 AC1s conditions prevail in both natural and made ground.			
Highways Design	Made Ground estimated CBR – 2% Superficial Strata estimated CBR – cohesive/fine soils– 4% Superficial Strata estimated CBR – granular/coarse soils– 5% The above should be confirmed by in-situ testing at formation level by a specialist geotechnical engineer during construction.			
Sustainable Drainage Systems (SUDS)	Drainage to soakaways is considered unsuitable for this site. Indicative soil infiltration rates range from 2.22x10-6m/s to 2.36x10-6m/s.			
Further Work	The following further works will be required to progress to the construction phase: Completion of ground gas monitoring programme. Issue gas assessment / update gas assessment within this report. Demolition Asbestos survey. Tree survey by qualified arboriculturist. Detailed foundation design by a structural engineer, including foundation zonation plan and depth schedule. Production of Materials Management Plan (MMP) under the CL:AIRE DoWCoP, if required.			

This executive summary should be read in conjunction with the full report, reference AT/C4324/9589 and not as a standalone document.



PROJECT QUALITY CONTROL DATA SHEET

Site Name:	Hostmoor Avenue, March				
Document Name:	Geo-Environmental Assessment Report				
Reference:	AT/C4324/9589				
	- 6 Nov 2020 Interim (awaiting completed gas monitoring).				
Status:					

Issued By:	Client:	Engineer:
Brownfield Solutions Ltd Unit 5 Alfred Court Saxon Business Park Stoke Prior Bromsgrove Worcestershire B60 4AD Tel: 01215 729014 brownfield-solutions.com	Aldi Stores Ltd 1 Sheepcotes Chelmsford CM2 5AE	Stirling Maynard Stirling House Rightwell Bretton Peterborough PE3 8DJ
	Contact:N/A	Contact: Mr T. Hubble

Written by:



A Thornes BSc (Hons) MSc FGS Graduate Project Engineer Checked by:



W Griffiths BSc (Hons) CEnv MIEnvSc Principal Project Engineer



Approved by:



M Holland BSc (Hons) MSc FGS Senior Project Engineer



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Drawing Number	Rev	Title	
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APPENDICIES			
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1.0 INTRODUCTION

1.1 Context

This report describes a Geo-Environmental Assessment carried out by Brownfield Solutions Limited (BSL) for Aldi Stores Ltd as instructed by Stirling Maynard on a site off Hostmoor Avenue, March and has been completed in general accordance with the following guidance:

Environment Agency guidance - Land Contamination: Risk Management (LCRM).

BS 10175:2011+A2:2017 Investigation of Potentially Contaminated Sites.

BS5930: 2015+A1:2020 Code of Practice for Ground Investigations.

BS EN 1997-1:2004+A1:2013 Eurocode 7. Geotechnical design. General rules plus UK National Annex.

BS EN 1997-2:2007 Eurocode 7 Geotechnical design. Ground investigation and testing plus UK National Annex.

Definitions of terms and acronyms used within this report is presented in Section 11.0.

1.2 Proposed Development

The proposed development is for a commercial end use comprising a steel framed retail building and associated car park areas as shown on the proposed development plan, drawing No. 2909-CHE-015B provided to BSL by the client.

1.3 Previous Reports

This report should be read in conjunction with BSL Phase 1 Desk Study Assessment Report (8816) issued in October 2019.

1.4 Objectives and Scope

The objectives of this report are to determine the geo-environmental setting and ground conditions of the site, highlighting potential risks and areas of concern that may govern the development under the current planning regime. This assessment is also intended to fulfil the requirements of a Ground Investigation Report (GIR) as detailed in BS EN 1997-2:2007.

Following the Phase I Desk Study referenced above, an exploratory intrusive investigation was undertaken to confirm the findings of the preliminary CSM and risk assessment and meet any objectives that had not been satisfied. The exploratory investigation was undertaken using trial pitting, window sampling, cable percussive drilling, gas and groundwater monitoring, laboratory chemical and geotechnical testing, with reporting on the findings.

1.5 Limitations

This assessment has been prepared in accordance with the relevant current legislative framework, guidance and risk assessment methodology as outlined in Appendix A. BSL is not liable for any subsequent changes in the guidance and legislation.

The findings and opinions conveyed via this report are based on information obtained from a number of sources as detailed within this report, BSL have assumed this information is correct and reliable. Nevertheless, BSL cannot and does not guarantee the authenticity or reliability of the information it has relied upon.



BSL have used reasonable skill, care and diligence for the investigation of the site and the production of this report. There may be other conditions prevailing on the site which are outside the scope of work and have not been highlighted by this assessment and therefore have not been considered by this report. Responsibility cannot be accepted for such site conditions not revealed by the assessment.

This report has been prepared for the sole use and reliance of the Client, Aldi Stores Ltd. No other third parties may rely upon or reproduce the contents of this report without the written permission of Brownfield Solutions Ltd (BSL). If any unauthorised third party comes into possession of this report, they rely on it at their own risk and BSL do not owe them any Duty of Care.

The investigation carried out on the site has been conducted to provide the best information on the ground conditions within site access and budgetary constraints. The inherent variation of ground conditions allows only for definition of the actual conditions at the locations and depths of exploratory locations at the time of the investigation. Different ground conditions may exist that have not been identified within this investigation.

The recommendations in this report assume that ground levels will remain as existing, unless stated otherwise within the report. If there is to be any re-profiling (e.g. to create development platforms or flood defences) then the recommendations may not apply.

The groundwater results described are only representative of the dates on which they were recorded, and levels may vary seasonally (e.g. due to changes in weather).

This assessment has been based on the proposed planning layouts provided. Any subsequent change to the planning layout may have an impact on the validity of recommendations made within this report. Furthermore, new information, changed practices or new legislation may necessitate revised interpretation of the report after the date of its submission.

Although every effort has been made to position exploratory holes in the least sensitive areas of the site, exploratory hole positions were located approximately as part of this investigation and no guarantee can be given as to their accuracy. Consideration should be given to the possibility that exploratory holes excavated as part of this investigation and indeed any previous ground investigation work by others may be encountered beneath or within the influence of individual foundations. BSL cannot be held responsible for structural failures caused by the location of foundations of any form of structure within the influence of exploratory holes.

Where it has not been possible to reasonably use an EC7 compliant investigation technique, a practical alternative has been adopted to obtain indicative soil parameters and any interpretation is based upon engineering experience, local precedent where applicable and relevant published information.

The chemical testing carried out for this report was not scoped to comply with the requirements of the water supply company and further work may be required, unless otherwise stated.

Notwithstanding site observations concerning the presence or otherwise of archaeological issues, asbestos-containing materials (ACM) or invasive weeds (e.g. Japanese Knotweed), this report does not constitute a formal survey of these potential issues.

The site plans enclosed in this report should not be scaled off. Any site boundary line depicted on plans does not imply legal ownership of land.

Any recommendations made in this report should be confirmed with the Regulatory Authorities prior to implementation to ensure compliance.



2.0 THE SITE

2.1 Location

The site is located off Hostmoor Avenue, March, PE15 0AX. It is situated approximately 2 Km north-west of March Town Centre, centred on National Grid Reference 540183, 298125 as shown on the Site Location Plan, Drawing No. C4324/01.

2.2 Site Description

The main site features and potential issues identified are detailed below and are shown on the Site Features Plan, Drawing No. C4324/02.

Feature	Description
Site Area	Approximately 1.25 hectares.
Site Access	Access to the site can be gained off either Hostmoor Avenue to the south or Martin Avenue to the east.
Current Land Use and Site Features	The subject site comprises two separate commercial plots. In the south accessed from Hostmoor Avenue, is Brimur Packaging Ltd, whilst the north is occupied by Stormport Ltd which is accessed from Martin Avenue. The majority of the Stormport site was external and used for storage of highways / construction materials, such as fencing, cones, ducting etc. In total across the two sites are three buildings, all of which appear to be of the same steel frame, metal clad construction. Numerous manhole covers are present across both areas denoting possible drainage /sewers. There are several overheard services (telecoms and power) crossing the northern part of the site. In the centre of the site is an area of grass soft landscaping which appears to be unused
Potential Sources of Gross Contamination	To the north of the Brimur Packaging Ltd building a bunded above ground waste oil storage tank was identified, no oil staining was noted surrounding the tank. Next to this attached to the building was what appeared to be a vent for a boiler. The ground surfacing near the above ground waste oil storage tank was raised relative to its surroundings, comprised gravel and appeared to contain some ash. Two external storage sheds were identified on the south side of the Stormport building, possibly housing a generator, evidenced from the 'electrical danger of death' sign externally. An outdoor electrical substation is present on the eastern boundary of the site with a separate boundary and access from Martin Avenue.
Vegetation	There are numerous deciduous trees across the south, east and western border, generally circa 8m to 12m high. The southern border is also defined by a low hedgerow generally of hawthorn.
Topography	The site is generally flat and level. However, a mound/ soil stockpile is situated to the north-west corner of the southern portion of the site.
Site Boundaries	The southern portion of the site is bordered by hedgerows and trees to the east, south and west, the entrance off Hostmoor Avenue to the south is protected by a single chain. The northern boundary is defined by the chainlink fence of the other property. The northern portion of the site (Stormport Ltd) is protected by chainlink fence around all borders, and the entrance off Martin Avenue is also gated. Trees are present along the western boundary, just outside of the fenced area. The electrical substation is bordered by wooden fencing, held in place with concrete posts.
Surrounding Area	The site is set within a small industrial/retail estate featuring retail and light industrial premises, which in turn is surrounded by agricultural land comprising fields. A railway line is located approximately 275m south of the site.



3.0 SUMMARY OF PREVIOUS REPORTS

3.1 BSL Desk Study

A summary of the relevant points from the Desk Study completed by BSL (reference 8816) is presented below:

The site had remained as agricultural land until 1970 where commercial development of two large units and an electricity substation was constructed as part of March Trading Park. Between 1994 and 2003 a third commercial building was constructed in the northern portion of the site and has remained unchanged until the present day.

Geology comprises Oadby Member (Glacial Diamicton, a Secondary Undifferentiated Aquifer) over mudstone of West Walton Formation and Ampthill Clay Formation (Undifferentiated), which is an Unproductive Aquifer.

No faults are within an influencing distance of the site.

Whilst the site is not within an area of recorded mining, there is a possible former sand and gravel pit located approximately 800m north-east of the site.

There are no records of shallow mines in and around the site.

The nearest watercourses to the site are a series of unnamed inland rivers, possibly drainage channels, the closest of which is indicated to be located 3m west of the site.

The risk to human health is considered to be low to moderate.

The risk from ground gas is considered to be low and the site is not located in an area requiring radon protection measures.

The risk to controlled waters is low.

The site is located in a UXO low risk zone.

Recommendations were for an appropriate Phase II ground investigation to be carried out to confirm the identified risks and obtain information for preliminary design.



4.0 METHOD OF INVESTIGATION

4.1 Objectives

To confirm the risks to the identified receptors and confirm the ground conditions in respect to the identified geotechnical and geo-environmental risks, an appropriate intrusive investigation was undertaken as per the recommendations of the Phase I Desk Study Assessment.

The aim of the fieldwork was to:

Investigate ground conditions on the site and the potential need for detailed investigation. Install standpipes to allow future monitoring.

Assess the potential contamination on the site and obtain samples for contamination screening.

Assess the potential impact of any contamination on controlled waters.

Obtain geotechnical information on the ground conditions at the site for preliminary foundation design and preliminary pavement design purposes.

Give an assessment of the geo-environmental risks associated with redevelopment of the site.

4.2 Site Works

The following site works have been undertaken as part of the intrusive investigation between the dates of 14th and 17th September 2020.

Method	No.	Range Depths (m bgl)	Purpose
Hand excavated trial pit	1	0.60	Obtain shallow samples for contamination testing.
Trial pits – JCB 3CX	3	1.50– 1.80	Establish general ground conditions and undertake soil infiltration tests to assist with drainage design.
Window sample boreholes – Tracked WS rig	9	2.80 – 5.00	Establish general ground conditions on site. Allow Standard Penetration Tests (SPTs) to be carried out and obtain samples for contamination and geotechnical testing. Installation of ground gas and water monitoring wells.
Cable percussive boreholes	2	10.00	Assess deeper ground conditions, carry out SPTs and obtain samples for contamination and geotechnical testing. Installation of ground gas and water monitoring wells.

The site was operational at the time of the ground investigation which lead to some restrictions on the locations of exploratory holes. The approximate locations of the exploratory holes are indicated on the Exploratory Hole Location Plan, Drawing No C4324/03. The exploratory hole logs are presented in Appendix B.

HP01 was originally proposed to be a window sample location. However, due to the close proximity to services and the CAT and Genny picking up a signal with minimal gain, it was not possible to maintain an appropriate standoff from the suspected location of the signal. Therefore, a hand excavated pit was dug to obtain environmental samples, log the soils and measure the thickness of the made ground in that location.

The exploratory holes were logged by an experienced geo-environmental engineer in general accordance with the following guidance:

BS 5930:2015+A1:2020 Code of Practice for Site Investigations.

BS EN 14688-1:2018 Geotechnical Investigation and Testing – Identification and classification of soil.



4.3 Sampling

During the drilling and excavation of the exploratory holes, representative samples were taken at regular intervals to assist in the identification of the soils and to allow subsequent laboratory testing. They were stored and transported in general accordance with BS 10175:2011+A2:2017.

The type of sample was dependent upon the stratum and the purpose of analysis in accordance with current environmental and geotechnical guidance.

The distribution of samples taken across the site is recorded on the exploratory logs and a summary of the samples taken is presented in the table below:

Туре	Number
Environmental (ES)	51
Disturbed (D)	43
U100 (U)	5

4.4 Laboratory Testing

As part of the initial assessment for potential contamination of the site, selected samples were taken for the purpose of chemical contamination testing.

In the absence of particularly contaminative processes on site and the lack of visual evidence of potential hydrocarbon impaction, fourteen representative soil samples were screened for the following general suite of determinands at a UKAS approved laboratory:

Determinand	No of Samples
BSL Default Soil Suite: Arsenic, Cadmium, Chromium (III), Chromium (VI), Copper, Nickel, Mercury, Lead, Zinc, Selenium, speciated polycyclic hydrocarbons (PAH 16), water soluble sulphate (2:1 Extract), soil organic matter (SOM) and pH.	8
Petroleum Hydrocarbons (TPH CWG) inc BTEX and MTBE.	6
Asbestos Screen.	8
PCB Compounds (7 Congeners).	1
Total Organic Carbon (TOC).	10
Combined Herbicide / Pesticide Screen.	5

The Chemical Laboratory Testing Results are presented in Appendix C.

Representative disturbed samples were obtained for all soil types encountered. Selected samples were scheduled for testing at an approved laboratory in accordance with BS 1377 'Method of Test for Soils for Civil Engineering Purposes' and BS EN ISO 17892- Parts 1-12:2018 'Geotechnical investigation and testing. Laboratory testing of soil'.

The following tests were scheduled for geotechnical purposes:

Description	No of Samples
Natural Water Content.	6
Plasticity Index Analysis.	6
pH Value.	6
Water Soluble Sulphate Contents.	6
Determination of One-Dimensional Consolidation properties.	2
Undrained Triaxial Compression Test with Measurement of Pore Pressure.	3



The Geotechnical Laboratory Testing Results are presented in Appendix D.

4.5 Monitoring

Ground gas monitoring standpipes were installed in 3 boreholes and subsequently 2No. monitoring visits have been undertaken out of 4No proposed as part of the current scope, in line with the recommendations of CIRIA C665. Two visits are scheduled to be undertaken to complete the ground gas monitoring. All gas monitoring was undertaken using GFM436 infrared gas meter with integral electronic flow analyser.

Flow measurements on each standpipe (I/hr) were taken. Measurements of the percentage volume in air (%v/v) of oxygen (O_2), carbon dioxide (CO_2) and methane (CH_4) were recorded in addition to the percentage Lower Explosive Limit (%LEL) of methane (Note: 100% LEL equates to 5% by volume), the atmospheric pressure (mb) and average temperature during the visit ($^\circ$ C).

Standpipes were constructed in general accordance with the relevant guidance. A summary of the installation construction is presented in the table below:

Location	Internal Diameter Pipe	Response Zone (m bgl)	Targeted Strata	Purpose
WS03	35mm PVC	0.70 - 5.00	Natural Strata	Ground Gas
WS06	35mm PVC	1.00 - 4.00	Natural Strata	Ground Gas
BH01	50mm HDPE	1.00-10.00	Natural Strata	Ground Gas

The gas monitoring visits recorded peak and steady state conditions. Peak results are those that occur on opening the valve on the borehole tap. Steady state conditions are those that occur a period of time afterwards when the initial (accumulated) gases have been purged from the borehole.

Interim ground gas monitoring results are presented in Appendix E of this report.



5.0 GROUND CONDITIONS

5.1 Summary

A brief summary of the ground conditions encountered is presented in the table below:

Stratum	Range Depths - Top (m bgl)	Range Depths - Base (m bgl)	Range Thickness' (m)	Brief Description
Made Ground	00.00	00.20 - 01.45	00.20 - 01.45	Gravelly Sand
Natural Granular Strata	00.20-1.45	0-1.45 00.70-01.90 00.10-01.30 Gi		Gravelly Sand
Natural Cohesive Strata	00.30-01.90		Slightly gravelly CLAY.	
Solid Geology	N/A	N/A	N/A	Not encountered

^{*}Base depths not proven.

Details are provided in the logs in Appendix B and the individual strata are described in the sections below.

5.2 Made Ground

Made Ground - Topsoil

Made Ground Topsoil was encountered in 6 locations across the site from ground level to between 0.10m and 0.20m bgl, generally comprising dark brown slightly gravelly sand with occasional rootlets and anthropogenic inclusions of gravel sized brick and concrete alongside quartzite.

Made Ground - General

Made ground was encountered within all the exploratory holes across the site and was observed from ground level to depths between 0.20m and 1.45m bgl.

Hardstanding surfacing of concrete was present in BH01 and WS01 between 0.20m and 0.30m thick. Gravel hardcore was observed in locations within the northern area of the site.

The composition of the made ground was fairly consistent across the site and comprised gravelly sand. Gravel was predominantly brick and concrete and quartzite with small amounts of clinker in WS05. Cobbles of brick and concrete ranged from low to medium content.

5.3 Natural Superficial Strata

The natural strata underlying the site was generally firm to stiff slightly gravelly or gravelly clay, locally slightly sandy or sandy, particularly at shallow depth. A layer of gravelly sand was present above or within the clay at shallow depth across the site, the depths are shown in the table below.

Sand Layers

Location	Depth Top	Depth Base	Thickness	Brief Description	
BH01	0.60	1.40	0.80	Light brown Gravelly Sand	
BH02	0.70	1.90	1.20	Loose reddish brown Gravelly Sand	
DHUZ	5.40 5.70		0.30	Brown slightly clayey Sand	
HP01	0.20	0.60+	0.40+	Brown gravelly Sand	
TP101	0.70	1.10	0.40	Orange brown slightly gravelly Sand	
TP103	1.00	1.30	0.30	Orange brown slightly gravelly Sand	
WS01	1.40	1.65	0.25	Loose orange brown gravelly Sand	



Location	Depth Top	Depth Base	Thickness	Brief Description
WS02	0.50	1.55	1.05	Brown slightly clayey slightly gravelly Sand (to 1.2m) over medium dense reddish brown gravelly Sand.
WS03	0.70	160 090		Medium dense reddish brown gravelly Sand.
WS04	0.30	0.70	0.40	Dark brown slightly gravelly clayey Sand.
WS05	1.45	1.55	0.10*	Reddish brown gravelly Sand.
WS06	0.60	1.40	0.80	Reddish brown slightly gravelly clayey Sand (to 1.3m) over reddish brown slightly gravelly Sand.
WS07	0.50	1.30	0.80	Reddish brown gravelly Sand.
WS08	0.20	1.50	1.30	Brown slightly clayey slightly gravelly Sand (to 0.8m) over medium dense reddish brown slightly gravelly clayey Sand.
WS09	0.70	1.00	0.30	Brown gravelly Sand.

^{*} Reduced natural sand thickness in WS05 due to thicker made ground present to 1.45m bgl.

In BH02 between 6.5m and 8.0m bgl a layer of very soft white and light grey chalky clay was encountered. The SPT value within this layer at 7.0m bgl was 24, which indicates a higher in-situ strength.

In WS01, the sand layer was deeper and thinner than most other locations and was present below a thicker layer of soft gravelly clay between 0.6m and 1.4m bgl.

A firm grey organic clay was encountered within WS08 from 1.50m to 2.00m.

Shear vane readings in the cohesive soils indicate the clays are generally medium and high strength.

The recorded superficial deposits underlying the site are Oadby Member, described by the BGS as Diamicton (meaning an unsorted or poorly sorted soil with a range of particle sizes), grey, weathering brown, characterised by Cretaceous and Jurassic rock fragments; subordinate lenses of sand and gravel, clay and silt. Clay, brown to grey, and silty clay, with chalk and flint fragments.

The natural ground is considered to be representative of the Oadby Member.

5.4 Solid Geology

The solid geology of the undifferentiated West Walton Formation or the Ampthill Clay Formation was not encountered in this investigation.

5.5 Groundwater

The depths to groundwater and locations present are shown in the table below:

Location	Depth During Site Works	Depth During Monitoring Period
	(m)	(range) (m)
BH01	1.15	1.00-1.10
BH02	4.90	N/A
WS01	1.20	N/A
WS02	1.20	N/A
WS03	NGW	0.51-0.84
WS06	NGW	1.04-1.21
TP101	1.80	N/A
TP102	1.10	N/A



5.6 Observations

Contamination

During the works undertaken by BSL, observations for both visual and olfactory evidence of contamination were undertaken.

With the exception of clinker observed as a minor constituent in WS05, WS08 and WS09 within the made ground soils and slight hydrocarbon odour within the made ground of WS05, no other evidence of contamination was observed at the site.

Stability of Excavations/Boreholes

The sides of the trial pits were generally stable.

The stiff nature of the clay across the site proved difficult to excavate at depth.

Casing was required within boreholes to prevent collapse with the granular made ground and natural soils during drilling of the window sample boreholes and cable percussive boreholes.



6.0 TEST RESULTS

6.1 Geotechnical Laboratory Testing

Plasticity Index Analysis

Plasticity index results ranged between 18% and 25% indicating the cohesive soils to be of medium plasticity. Associated water contents ranged between 7.1% and 22%.

After modification of particle size in accordance with BRE 240 the modified plasticity indices are in the range 7.92% to 23.75% indicating the cohesive soils to be of low to medium volume change potential.

Undrained Shear Strength

Undrained shear strength in triaxial compression ranged from 97 to 214kPa indicating the cohesive soils to be of high to very high strength. The results of the tests are shown in the table below:

Location	Depth (m)	Shear Strength (kPa)	Undrained Shear Strength to EC7
BH01	2.10	112	High
BH02	2.10	97	High
BH02	3.10	214	Very High

One Dimensional Consolidation Properties

The one-dimensional consolidation properties were as follows:

Location	Depth (m)	Mv Range (m²/MN)	Cv Range t50, log (m²/yr)	Compressibility at Approx. Over- Burden Pressure
BH01	2.10	0.12-0.31	5.2-19	Medium
BH02	3.10	0.17-0.24	8.6-17	Medium

6.2 Aggressive Ground Conditions – Geotechnical Chemical Testing

The test results for the assessment of aggressive ground conditions are presented in Appendix C. The results are summarised and assessed within Section 8.0 of this report.

6.3 In Situ Geotechnical Testing

In Situ Hand Shear Vane Tests

Nine hand shear vane tests were carried out on suitable cohesive soils recovered from the trial pits. Each shear vane result recorded represents the mean value of three tests undertaken at the specified depth.

The results and distribution of the hand shear vane tests are recorded in kPa on the Exploratory Hole Logs which are presented in Appendix B.

In Situ Standard Penetration Tests

Standard Penetration Tests (SPTs) were carried out within the window sample and cable percussive boreholes at regular 1.0m intervals. The results of the individual blows and the N-values are recorded on the Exploratory Hole Logs in Appendix B.

All SPT N values are uncorrected. Density and strength descriptors are reported in accordance with the guidelines stated in BS 5930:2015+A1:2020, incorporating requirements of BS EN ISO 14688-1:2002, BS EN ISO 14688-2:2004 and BS EN ISO 14689-1:2003.



Soil Infiltration Test Results

Soil infiltration tests were undertaken within trial pits at 3No. locations across site, a summary of the results is presented in the table below. These were carried out in general accordance with BRE Digest 365 (BRE 2016) where infiltration rates allow three test runs during a working day (or where there is no infiltration), but where low infiltration rates were encountered the available time may not have been sufficient to fully comply with the BRE test method.

Where less than three tests were possible in a particular location the results provided should be considered as indicative only. Further discussion concerning the suitability of infiltration testing at the site is provided in Section 7.0.

Location	Stratum Type	Depth (m)	Infiltration Rate (m/sec)		
			Test 1	Test 2	Test 3
TP101/SA01	Sandy CLAY	1.80	2.36x10 ⁻⁶	N/A	N/A
TP102/SA02	Sandy CLAY	1.55	2.22x10 ⁻⁶	N/A	N/A
TP103/SA03	Sandy CLAY	1.50	2.33x10 ⁻⁶	N/A	N/A

The full test results are presented in Appendix E.

6.4 Geo-Environmental Testing

Chemical Laboratory Testing

The chemical test results for soils are presented in Appendix C. The results are summarised and assessed within Section 8.0 of this report.

Photo-Ionisation Detection (PID) Monitoring - Soils

PID head space monitoring was undertaken on all environmental soil samples taken during the ground investigation at the site, the results are recorded on the exploratory hole logs.

All of the samples tested recorded PID results of between 0.0ppm and 1.7ppm, indicating that no significant volatile vapour contamination was present.

Ground Gas Monitoring

Ground gas monitoring installations have been monitored on two occasions to date out of four visits scheduled. The results are presented in Appendix E and are summarised and assessed within Section 8.0 of this report.



7.0 GEOTECHNICAL ASSESSMENT

7.1 Ground Model Summary

The site is currently occupied with several large industrial units with associated hardstanding. An electricity substation is located on site.

The ground conditions can be summarised as below (top down):

Made ground generally comprising gravelly sand with gravel of brick, concrete and quartzite from ground level to between 0.20m and 1.45m bgl.

Natural superficial deposits comprising gravelly sand proven to depths between 0.70m and 1.90m bgl.

Natural superficial deposits comprising stiff clay proven to depths of 10.45m bgl.

Groundwater levels ranging between 1.15m and 4.90m bgl during site works.

Post site works groundwater monitoring levels ranging between 0.51m and 1.21m bgl.

The groundwater encountered is not a continuous body, but is likely to be perched within the clay at variable depths.

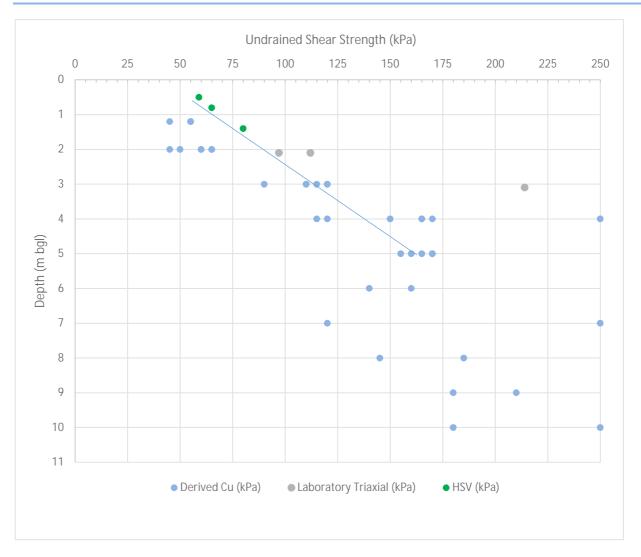
7.2 Design Soil Parameters

The relevant test results from the prior section have been evaluated to derive geotechnical soil parameters for the site in the following section.

For cohesive (fine) soils, the equivalent approximate undrained shear strengths (Cu) and equivalent approximate coefficients of volume compressibility (mv) have been calculated from the recorded SPT N values, adopting f1 and f2 values respectively, based on the correlation of Stroud (1975) and the 'average' plasticity.

A depth (m bgl) vs derived shear strength (Cu) graph is provided below to provide a profile of the cohesive soils underlying the site.





The above graph shows a general increase in soils strengths as depth increases. The shear strength obtained through direct laboratory testing and hand shear vanes generally indicates higher shear strength than the SPT derived data, and is considered more reliable, therefore the line of fit on the above graph has been weighted towards the HSV and laboratory triaxial data, where available.

Data obtained from exploratory holes remote from the proposed building footprint (TP101, TP102, WS04, WS05 and WS09) has been omitted from the above graph, so that the characteristic values are not influenced by data that are potentially unrepresentative of the soils underlying the proposed structure.

Gravelly sand was present above or within the clay at shallow depth across the site. The shallow sand strata recorded in the exploratory holes in and surrounding the proposed building are summarised in the table below.

Location	Depth Top	Depth Base	Thickness	Brief Description	SPT N-value (depth)
BH01	0.60	1.40	0.80	Light brown Gravelly Sand	NA
BH02	0.70	1.90	1.20	1.20 Loose to medium dense reddish brown Gravelly Sand	
WS01	1.40	1.65	0.25	0.25 Loose to medium dense orange brown gravelly Sand	
WS02	0.50	1.55	1.05	Brown slightly clayey slightly gravelly Sand (to 1.2m) over medium dense reddish brown gravelly Sand.	14 (1.2m)*



Location	Depth Top	Depth Base	Thickness	Brief Description	SPT N-value (depth)
WS03	0.70	1.60	0.90	Medium dense reddish brown gravelly Sand.	23 (1.2m)*
WS06	0.60	1.40	0.80	Reddish brown slightly gravelly clayey 0.80 Sand (to 1.3m) over reddish brown slightly gravelly Sand.	
WS07	0.50	1.30	0.80	Reddish brown gravelly Sand.	NA
WS08	0.20	1.50	1.30	Brown slightly clayey slightly gravelly Sand (to 0.8m) over medium dense reddish brown slightly gravelly clayey Sand.	18 (1.2m)*

^{*} These values are indicative only and should be used with caution as the SPT started in the sand but progressed into the underlying clay towards the bottom of the SPT.

Characteristic Values

Characterisation of the geotechnical parameters above has been undertaken to obtain characteristic values, which are a cautious estimate of the values affecting the occurrence of the limit state.

The characteristic value for undrained shear strength (Cu) in cohesive deposits at 1.0m bgl is interpreted to be 60kN/m², increasing to 90kN/m² at 2.0mbgl.

The angle of shearing resistance (ϕ ') of the granular (coarse) soils has been derived from the uncorrected SPT N value data and the correlation of Peck (1967). A characteristic angle of internal friction of 30° has been derived based on a conservative characteristic N-value of 10.

The thickness of the sand varies typically between circa. 0.8m and 1.3m thick and is generally present at minimum foundation depth for the medium volume change potential clay (0.9m bgl). This was not the case in WS01, where the sand was only 0.25m thick and was encountered at greater depth (1.4-1.65m bgl) below a layer of soft sandy clay. The sand was generally present to depths of between 1.3m and 1.9m bgl.

A characteristic coefficient of volume compressibility (m_v) value of 0.2 m^2 /MN has been adopted for the clay between 1m and 4m bgl based on the laboratory consolidation test results.

A characteristic coefficient of volume compressibility (m_v) of 0.0625 m^2 /MN has been derived from the insitu SPT testing within the cohesive materials below 4m bgl.

7.3 Foundations

The development will comprise a single storey food store with a steel frame and is considered to be classed as Geotechnical Category 2 in accordance with Eurocode 7.

Preliminary design by calculation has been undertaken to determine the design resistance of the bearing strata in the following section. No proposed structural loads were available at the time of writing, therefore the following recommendations are provisional and should be reviewed at the detailed design stage.

Pads and Strips

The most suitable foundation solution for the proposed development is considered to be pad foundations for the structural columns and strip foundations for the masonry walls, taken to the underside of any made ground to found on undisturbed natural loose to medium dense sand.

The sand is typically present from depths of between 0.5m and 0.7m bgl to maximum depths of between 1.3m and 1.6m bgl. Preliminary calculations indicate that a 1m square pad or 0.6m wide strip bearing in the loose to medium dense sand at 0.8m bgl would provide an allowable bearing capacity of 120 kN/m².



This assumes the sand is present to 1.3m bgl (0.5m below the pad/strip) and that perched groundwater is present below the base. This adopts a factor of safety of 3. Preliminary calculations indicate that total settlements would be less than 25mm.

In WS01, the sand was thin and present at greater depth (1.4m bgl), and the overlying sandy clay was described as soft. Foundations in this area would need to be deepened. We would recommend the foundations are deepened below the soft clay and thin sand to bear on the underlying firm grey slightly gravelly clay at 1.65m bgl. A 1m square pad or 0.6m wide strip at this depth would provide an allowable bearing capacity of 110kN/m² to limit settlements to less than 25mm. The extent of the soft shallow clay is unknown and it would be prudent to delineate this following demolition of the site.

Foundations spanning between cohesive and granular strata will need to be appropriately reinforced to mitigate differential settlements.

Alternatively all foundations could be deepened below the sand to bear on medium to high strength clay between depths of 1.5-1.9m bgl, adopting a characteristic Cu value of 60kN/m², an allowable bearing capacity of 110kN/m² has been calculated for the clay at a minimum depth of 1.5m bgl (1m square pad or 0.6m wide strip) limiting settlements to less than 25mm. This assumes groundwater is present below the base of the foundation.

The minimum depth of any foundations bearing in the clay would be 0.90mbgl bgl due to the medium volume change potential of the clays, and deeper near trees and hedges in accordance with current quidance.

Trees are noted within and close to the area of the site proposed for development. Depending on their size, type and maturity, the required depth of founding based on the recommendations of BRE 298 may exceed 2.5m. Should this prove to be the case, then piled foundations should be considered as a potentially more economical solution, unless it can be proven that the soils are not desiccated.

Note where foundations require deepening to greater than 2.5m below ground level, they must be designed by an engineer, as specified in NHBC Technical Requirement R5.

General Advice for Shallow Foundations

The bearing stratum should be inspected for 'soft spots' within the natural clay strata, resulting for instance from localised groundwater perched within the overlying fill materials. If soft soils are encountered, then foundations will need to be deepened to found on suitable strata. The stratum should also be inspected for 'hard spots' which may require removal.

If the ground conditions encountered during the construction phase differ significantly to the conditions encountered during construction, work should cease and BSL contacted for further advice.

During the construction phase supervision should be on a continuous basis to check the design assumptions are correct and construction conforms to design. Supervision should include inspections, Control Ground Investigations and monitoring.

7.4 Building Near Trees

The clay soils on site are of low to medium volume change potential. Where foundation excavations (or piles if adopted) encounter cohesive strata in the vicinity of existing, proposed or recently removed trees, foundations should be adjusted in full accordance with BRE 298. All foundations should be deepened below roots of greater than 5mm diameter during excavations for footings.

A survey of all trees and hedges on the site and within influencing distance of the site boundary should be undertaken to identify tree species and heights by a qualified arboriculturist in accordance with



BS 5837:2012 and NHBC Standards. This information will be required in order to assess the effects of trees on the cohesive strata.

Where foundation depths due to trees already present or recently removed exceeds 1.50m, there is a possibility for heave to occur on removal of the tree and guidance states that compressible material or void former is required against the inside face of the foundation, unless it can be satisfied that the soil is not desiccated.

7.5 Floor Slabs

Ground bearing slabs may be adopted providing the following criteria are satisfied:

Any compressible or unsuitable materials (made ground in excess of 600mm, topsoil containing vegetation and organic matter, including tree roots, are excavated and either improved or removed and replaced with suitable materials.

The foundation depth (such as due to the influence of trees) is less than 1.5m.

It is demonstrated that desiccation in cohesive soils is not present.

Any fill beneath the slab is suitable, well-compacted granular material placed in an appropriate thickness in accordance with a suitable specification (e.g. SHW Series 600) designed and supervised by an appropriately qualified engineer, with the end performance validated.

The slab is adequately reinforced.

Regular construction joints and ties are provided to allow for differential settlement.

The final floor slab design should be of sufficient thickness and sufficiently reinforced to accept the envisaged applied loads, without unacceptable total or differential movement.

Vertical elements within the structure, such as columns and walls will need to be isolated from the ground bearing slab in order to allow for the slab to expand against them without resulting in cracking.

Prior to the placement of the founding materials and the construction of a ground bearing floor slab, the sub-formation and formation will need to be inspected and checked by a geotechnical engineer to ensure the ground conditions are as expected. If soft spots or hard spots are identified at the formation level, they should be reported to the Geotechnical Engineer immediately and remedial actions agreed.

Incorporation of geogrid reinforcement at formation level, before granular material is placed and compacted, will likely minimise required excavation depths and help provide a suitable foundation for the ground bearing slab.

Ground floor slabs should also be designed to incorporate any ground gas protections measures, although results to date do not indicate these will be required at present, subject to ongoing monitoring and regulatory confirmation.

Suspended floor slabs may be also be adopted however alternative foundation options may need to be considered to support the load of a suspended slab.

7.6 Site Preparation and Construction

Topsoil and subsoil should be removed from beneath all buildings and hardstanding areas.

If organic soils or peat is encountered below the proposed building these will need to be removed.

There are a number of services crossing the site. To allow construction, all services will need to be disconnected and any suspected dead services are confirmed as dead by testing.



Instability of excavations through natural soils is not anticipated provided they are not exposed to adverse weather conditions for any substantial period of time. Instability of the made ground should be allowed for. All excavations should be carried out in accordance with CIRIA Report 97 'Trenching Practice'.

Excavation depths should generally be readily achieved using conventional plant (JCB or similar) although high specification plant (tracked 360° or similar) is recommended to maintain the build programme. Breaking equipment may also be required locally to penetrate old foundations associated with former construction.

To protect against the effects of heave, new drainage should be designed to take account of potential ground movement, including where pipes and services which pass through substructure walls or foundations. The volume change potential on this site is low to medium and the potential ground movements that need to be considered for design are 50mm to 100mm.

Recorded post site works groundwater levels ranged between 0.51m and 1.21m bgl and therefore are likely to be encountered within likely excavation depths. Based on the exploratory holes logs and monitoring, it is considered that methods such as sump pumping are likely to be sufficient to deal with anticipated flows Further guidance is provided in CIRIA C750 "Groundwater Control: Design and Practice". It should be noted that groundwater levels will vary seasonally and the timing of construction may influence requirements.

7.7 Concrete Classification

The soluble sulphate and pH test results have been assessed in accordance with BRE Special Digest 1 "Concrete in aggressive ground" 2005. The Design Sulphate (DS) classification and the Aggressive Chemical Environment for Concrete (ACEC) classification are presented in the table below.

For the purposes of this assessment, the groundwater has been classified as static given the site is underlain by low permeability deposits.

Stratum	No. Samples	Characteristic SO4 (g/I)	Characteristic pH	DS Class	ACEC Class
Made Ground	6	111	7.6	DS1	AC-1s
Natural Superficial Strata	8	147	8.3	DS1	AC-1s

Based on the above, the results of laboratory pH and sulphate content, indicate that sulphate class DS-1 and ACEC Class AC-1s conditions prevail in accordance with BRE Special Digest 1 "Concrete in aggressive ground" 2005.

The specific concrete mixes (the Design Concrete Class) to be used on site will be determined by the site-specific concrete requirements in terms of the durability and structural performance. These are assessed in terms of the Structural Performance Level (SPL) and any need for Additional Protective Measures (APM) detailed in Part D of BRE Special Digest 1 with further guidance in Pt E and F.

7.8 Highways

Based on Table 5.1 from DMRB IAN 73/06 Rev 1 equilibrium CBR values of 5% are likely to be achieved in undisturbed natural granular soils and 4% for natural clays soils for pavement design purposes, unless proven otherwise by in-situ testing at formation level by a specialist geotechnical engineer. Equilibrium CBR values are likely to be 2% within the made ground.

Where the CBR is found to be less than 2%, the sub-grade is unlikely to be suitable for both the trafficking of site plant and as a permanent highway foundation without improvement of the soils.



To achieve the required design CBR value, improvement works should be carried out in accordance with DMRB IAN 73/06 Rev 1 Chapter 5 and may include proof rolling, excavation and re-engineering / replacement of weaker soils, the inclusion of a geogrid or use of stabilisation techniques such as the addition of hydraulic binders (e.g. cement/lime).

Based on the fines content of the soils, they are considered to be frost susceptible, therefore highway construction should be a minimum thickness of 450mm to mitigate against the risk.

Care should be taken to ensure the stratum at formation level is protected against inclement weather, as this is likely to lead to surface deterioration and a decrease in soils strengths.

7.9 Sustainable Drainage Systems (SUDS)

The use of soakaways within the natural ground is not considered to be feasible at the site due to the low infiltration rates obtained (in the order of 10⁻⁶ m/s) and the limited thickness of and shallow, variable distribution of granular strata underlying the site.



8.0 GFO-FNVIRONMENTAL RISK ASSESSMENT

8.1 Introduction

The samples were tested for an assessment of the chemical contamination that may pose a risk to human health. The results were examined with reference to a selection of guidance documents as detailed in Appendix A. In this case the LQM/CIEH S4ULs and DEFRA C4SLs for commercial end use have been adopted as Tier 1 generic screening values.

The apparent exceedance of the relevant screening value is taken as indicating further detailed assessment or remedial action is required.

A summary assessment sheet is presented in Appendix C alongside the chemical test results. Results are discussed in detail in the sections below.

8.2 Soils Test Results and Risk Assessment – Human Health

Metals

No metals have been detected above the adopted screening criteria.

Ashestos

No asbestos fibres have been detected in any of the 7No. samples screened.

No visual evidence of asbestos contamination was noted during the investigation, which was undertaken by an engineer with asbestos awareness and Non-Licenced Work qualifications.

Poly Aromatic Hydrocarbons (PAHs)

No PAHs have been detected above the adopted screening criteria. All concentrations were below laboratory detection limits.

Total Petroleum Hydrocarbons (TPH CWG)

No petroleum hydrocarbons have been identified above the adopted screening criteria. All concentrations were below laboratory detection limits, including a sample from WS05 in the vicinity of the above ground bunded waste oil tank.

BTEX and MTBE

No BTEX or MTBE compounds have been identified above the adopted screening criteria.

In addition to the above, PID head space monitoring was undertaken on all environmental soil samples taken during the ground investigation at the site, the results are recorded on the exploratory hole logs.

The samples recorded PID results of between 0.0ppm and 1.7ppm, indicating that no significant volatile vapour contamination was present.

PCBs

One sample from WS06 at 0.10m bgl in the vicinity of the on site electrical sub-station was tested for PCBs (7 congener suite) and all concentrations were below laboratory testing limits (<0.001mg/kg).

Total Organic Carbon (TOC)

The TOC results on the samples of Made Ground (7 samples) range between 1.0% and 3.1% (arithmetic mean 1.74%).

The TOC results on the samples of natural ground (3 samples) range between 0.8% and 2.0% (arithmetic mean 1.33%).



8.3 Summary – Human Health Risk Assessment

Based on the testing and assessment undertaken, there are no determinands above the relevant assessment criteria and mitigation measures will not be required in respect to soils.

8.4 Permanent Ground Gas and Vapours Results

Two ground gas monitoring visits have been carried out between the dates of 30th September and 7th October 2020. A further two visits are scheduled. Results are summarised in the table below:

	CH ₄	(%)	CO	2 (%)	O ₂	(%)	CO (ppm)	H ₂ S ((ppm)	TVOC	(ppm)	Flow	(l/hr)
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Peak	0.0	0.0	0.8	4.0	17.7	19.2	0.0	0.0 0.0	0.0	0.0 0.0	0.0	0.0	0.0	0.9
Steady	0.0	0.0	0.1	2.3	18.6	20.6	0.0		0.0		0.0	0.0	0.0	0.7

Notes: CH_4 = Methane; CO_2 = Carbon dioxide; O_2 = Oxygen; CO= Carbon Monoxide; H_2S = Hydrogen Sulphide; TVOC (PID)= Total Volatile Organic Compounds (as measured with Photo Ionisation Detector); ppm= Parts Per Million.

The highest carbon dioxide concentrations were recorded in WS03 (4.0% v/v) on the second visit. The maximum flow of 0.9 l/hr was also recorded in WS03 on the second visit.

The atmospheric pressure ranged between 1003mb and 1008mb over the monitoring period, during periods of falling and steady pressure trends.

Groundwater levels were recorded above the response zone in WS03 on 1 out of 2 visits.

8.5 Ground Gas Risk Assessment

In order to assess the ground gas situation and the requirement for ground gas precautionary measures at the site, guidance was taken from CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings' and BS8485:2015+A1:2019 'Code of Practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'.

As the proposed end-use is a commercial development, guidance dictates that the gas monitoring results should be assessed in accordance with the Wilson and Card methodology.

The Wilson and Card methodology uses the concept of a Gas Screening Value (GSV) which is derived using the following equation: (max gas concentration / 100) x maximum flow.

In the absence of any detectable gas concentrations (for methane), the detection limit of 0.1% has been used to calculate the GSV.

A maximum positive steady state flow rate of 0.7l/hr has been used to derive the GSVs. The GSV's for the site are presented below.

Gas	GSV (I/h)	Typical Threshold Concentration Exceeded	Classification
Methane	0.0007	No	CS-1
Carbon Dioxide	0.028	No	CS-1

The GSVs for carbon dioxide and Methane place the site the site into Characteristic Situation 1 (CS1).

Confirmation of the Characterisation Situation will be made following completion of the current monitoring period.



8.6 Potable Water Supply

The level of protection for the clean potable water supply pipes should be determined using the local water company risk assessment criteria in accordance with UKWIR.

As the site is brownfield, there is the assumption that barrier pipe would be utilised, although requirements should be confirmed by risk assessment and with the water supply company.

8.7 Qualitative Risk Assessment

The CSM has been revised based on the findings of the site investigation and laboratory testing results and these are presented overleaf. Unless stated otherwise, in respect to off-site sources, only risks that are assessed as moderate and above within the preliminary CSM have been carried forward to this section, or where a previously unidentified potential source, pathway and / or receptor has been identified from the recent site works.



Human Health						
Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity		Justification
On site Electricity Substation PCBs, oil	Root uptake, ingestion, direct contact, inhalation of dusts	End-users	Unlikely	Medium	Low	The substation present on site was built prior to the nationwide ban of PCBs in 1981 (polychlorinated biphenyls), these are persistent but relatively immobile contaminants. Oils can be used as a coolant within electrical substations, however the risk associated with leaks is considered low, due to the ongoing maintenance and periodic inspection by the power network operator, furthermore the suspected underlying cohesive geology will reduce migration out of their asset boundary. The substation will remain post-development, but the area will be inaccessible to site end-users. The risk is considered to be low.
On site Made ground Metals, PAHs, asbestos, TPH	Root uptake, ingestion, direct contact, inhalation of dusts	End-users	Unlikely	Medium	Low	The made ground is thin and there was no evidence of contamination identified and no exceedances of chemical screening criteria were recorded for commercial end use. Indeed, contaminants were generally below laboratory detection limits. The presence of hardstanding across the commercial development will break the pathway to site end users. The risk is considered to be low.
On Site — Waste Oil Storage Tank	Ingestion, direct contact, inhalation of vapours	End-users	Unlikely	Medium	Low	The steel tank appeared to be in relatively good condition, i.e. no holes identified and was relatively full suggesting it didn't have any leaks. Furthermore, the tank was bunded which would contain any minor spillages or leaks and prevent contamination of the underlying soils. There was no visual or olfactory evidence of any leaks on the surface surrounding the tank. No hydrocarbons were detected on the site. No contamination was identified in WS05 in the vicinity. Post-development the location of the tank will be covered in hardstanding associated with the car park and the risk to end-users is considered to be low.
On Site - Possible Electrical Substations/ Generators	Ingestion, direct contact, inhalation of vapours	End-users	Unlikely	Medium	Low	These buildings appear to be substation buildings, this type of building is typically lowered onto small substations. These are therefore likely to be empty and a source of contamination is unlikely. No contamination was identified in WS01 in the vicinity. The risk to end-users is considered to be low.
On site Made Ground Metals and organic contamination	Migration into/chemical attack of water supply pipelines	Water Pipelines / End users	Unlikely	Mild	Very Low	Contaminants within the soil/groundwater could potentially attack the clean potable water supply pipe. No evidence of contamination has been identified through on site observations or chemical testing. The risk is considered to be very low. Contaminants should be assessed to determine the correct pipe material and level of precautions required.



	Human Health					
Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity		Justification
Made ground Ground Gas (carbon dioxide and methane)	Migration into confined spaces, inhalation and asphyxiation/ explosion	End-users / property / structures	Unlikely	Severe	CS1	Based on the site history and exploratory investigations, significant thickness of made ground is not present and has been in place for over 20 years, therefore the gas generation potential is considered very low. The ongoing gas monitoring classifies the site as CS1 (very low risk) therefore indicating no gas precautions are necessary. This will be confirmed once the gas monitoring is completed.



	Controlled Waters					
Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity		Justification
	Overland flow, migration through saturated zone	Unnamed drainage channel 3m west (Surface waters)	Unlikely	Medium	Low	No contamination was identified within the made ground. Therefore, a low risk is posed to surface waters from the made ground.
Made Ground PAHs, Metals, TPH	Leaching through unsaturated zone / Migration through saturated zone	Secondary (undifferentiated) Superficial Aquifer	Unlikely	Medium	Low	The underlying aquifers are not considered to be sensitive due to the ground conditions (low sensitivity and potential for transmission of contaminants) and absence of groundwater abstractions within 2km. Furthermore, the lack of particularly contaminative historic uses, along with the absence of identified contamination observed on site or any exceedances within the testing, indicate the risk is low. In addition, the site is underlain by thick deposits of clay below the thin layer of unsaturated sand, which will inhibit any vertical migration of groundwater.
On Site Waste Oil Tank and Electrical Generators TPH	Overland flow, migration through saturated zone	Unnamed drainage channel 3m west (Surface waters)	Unlikely	Medium	Low	The waste oil storage tank was bunded and there was no sign of spillage surrounding the bund. Similarly, there was no sign of staining on the hardstanding surrounding the suspected generators/substations, and no elevated TPH levels were recorded within the testing results. The risk to the controlled surface waters is considered to be low.
	Leaching through unsaturated zone / Migration through saturated zone	Secondary (undifferentiated) Superficial Aquifer	Unlikely	Medium	Low	The underlying aquifers are not considered to be sensitive due to the ground conditions (low sensitivity and potential for transmission of contaminants) and absence of groundwater abstractions within 2km. No obvious signs of spillages were identified during the site works and no contamination was observed within the surrounding soils through laboratory testing. Therefore, the risk to Secondary Aquifer is considered low.



	Controlled Waters					
Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk	Justification
Electricity Substation PCBs, oils	Overland flow, migration through saturated zone	Unnamed drainage channel 3m west (Surface waters)	Unlikely	Medium	Low	PCBs are persistent but relatively immobile contaminants. No evidence of PCBs or other contaminants was observed or identified by testing of the shallow soils near to the substation. In addition, the substation is within a covered structure on hardstanding and the site is underlain by relatively impermeable deposits therefore it is unlikely any pathway will exist. The risk is considered to be low.
	Leaching through unsaturated zone / Migration through saturated zone	Secondary (undifferentiated) Superficial Aquifer & Unproductive Bedrock)	Unlikely	Medium	Low	The underlying aquifers are not considered to be sensitive due to the ground conditions (low sensitivity and potential for transmission of contaminants) and absence of groundwater abstractions within 2km. PCBs are persistent but relatively immobile contaminants. No evidence of PCBs or other contaminants was observed or identified by testing of the shallow soils near to the substation. In addition, the substation is within a covered structure on hardstanding and the site is underlain by relatively impermeable deposits therefore it is unlikely any pathway will exist. The risk is considered to be low.



8.8 Outline Remedial Measures

The level of protection for the clean potable water supply pipes should be determined using the local water company risk assessment criteria in accordance with UKWIR.

Sources of contamination have been identified on site, however, the risks have been demonstrated to be low. Therefore, no specific remedial measures are required for soils in respect to human health for the proposed end use.

Ground Gas Protection Systems

Based on the ground gas monitoring results to date, no mitigation measures are required, subject to ongoing monitoring and no radon protection is required for new buildings at this location.

8.9 Health and Safety Issues

During the reclamation and construction phases of the site development it will be necessary to protect the health and safety of site personnel. The risk to construction and ground workers is assessed in the table below:

Potential Source	Potential Pathway	Potential Receptor	Likelihood	Severity	Level of Risk
Made Ground (heavy metals, PAHs, petroleum hydrocarbons)	Ingestion, direct contact, inhalation of dusts.	Construction Workers	Unlikely	Medium	Low
Asbestos	Ingestion, direct contact, inhalation of dusts.	Construction Workers	Unlikely	Medium	Low
Ground gas	Inhalation in confined spaces/trenches	Construction Workers	Unlikely	Severe	Moderate/ Low

The risk from made ground will be mitigated by standard PPE including gloves. Welfare facilities should be made available to wash before hand to mouth activities.

It is noted that concentrations of carbon dioxide (an asphyxiant) in the soil exceed HSE Workplace Exposure Limits for personnel in the working environment of 1.5% for short term (15 minutes) exposure and/or 0.5% for long term exposure.

Soil gas concentrations are not necessarily reflected by those in the breathing zone, all contractors and maintenance workers should be made aware of the possible presence of carbon dioxide and should take all necessary health and safety precautions when working in trenches or confined spaces.

General guidance on these matters is given 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 measures are suggested to provide a minimum level of protection:



All ground workers should be issued with the relevant protective clothing, footwear and gloves. These protective items should not be removed from the site and personnel should be instructed as to why and how they are to be used.

Hand-washing and boot-washing facilities should be provided.

Care should be taken to minimise the potential for off-site migration of contamination by the provision of dust suppression control and wheel cleaning equipment during the construction works.

Good practices relating to personal hygiene should be adopted on the site.

The contractor shall satisfy the Health and Safety Executive with regard to any other matters concerning the health, safety and welfare of persons on the site.

8.10 Asbestos

The investigation of asbestos issues within structures was beyond the scope of this report. However, guidance from UK Government indicates that asbestos should be assumed to be present in buildings unless proven otherwise.

Any asbestos within structures will require removal prior to re-development. This will need to be done by a suitably qualified experienced and licensed contractor, who ensures that adequate PPE is provided to operatives, and that all the relevant legislation is adhered to.

Excavations in soils containing asbestos should comply with the CL:AIRE publication 'Interpretation for Managing and working with Asbestos in Soil and Construction and Demolition Materials' (CARSOIL) and CAR 2012. All such works will need to be agreed with the regulatory bodies (HSE and/or LA).

Additional guidance is provided within the BSL methodology Guidance Note in Appendix A.

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9.0 WASTE SOIL CLASSIFICATION & ASSESSMENT

9.1 Summary

BSL have undertaken a preliminary assessment of potential excavation waste to arise from the site during redevelopment to:

Classify the excavation waste to arise as either hazardous or non-hazardous.

Identify the most sustainable options for the wastes to arise in accordance with the waste hierarchy.

Provide a written description of the waste required as part of the Duty of Care.

Provide details of "hazardous properties" to complete hazardous waste consignment note (where applicable).

Be able to provide a basic classification report to a landfill operator (where waste is destined for landfill disposal).

9.2 Waste Classification Procedure

As described in the 'Waste Duty of Care Code of Practice (2016)' any substance or object that the holder discards, intends to discard or is required to discard is a waste. It is the responsibility of the waste producer to classify this waste. The classification process is described in the 'Guidance on the classification and assessment of waste' WM3 and aims to determine whether the waste is Hazardous or Non-Hazardous to human health and the environment.

Hazardous wastes are signified by entries where the code is followed by an asterisk, where some wastes are deemed hazardous without further assessment, which are termed "Absolute Entries" e.g. most waste oils. Alternatively, waste entries are termed "Mirror" entries that require further assessment of hazardous properties, in order to determine whether they are hazardous waste or not (e.g. soil and stones). The EWC codes relevant to excavation wastes are:

17 05 03* - soil and stones containing dangerous substances.

17 05 04 – soil and stones other than those mentioned in 17 05 03.

The Landfill Directive (Directive 1999/31/EC on the landfilling of waste, Decision 2003/33/EC and Landfill Regulations 2005) led to the establishment of a methodology for classifying wastes.

Wastes first need to be classified based on their total concentrations and classified as either hazardous or non-hazardous waste. WAC testing is only required if the end disposal route is a landfill and WAC analysis must not be used for waste classification.

Wastes can only be accepted at a landfill if they meet the relevant Waste Acceptance Criteria (WAC) for that type of landfill. A waste must comply with the WAC limits for the relevant landfill, otherwise the soil will need to be pre-treated. There are three different WAC criteria, these are:

Inert waste.

Stable Non-Reactive Hazardous Waste (SNRHW).

Hazardous waste.

There are no standard set of WAC limits for non-hazardous landfill sites and each non-hazardous landfill will have its own set of criteria under which it is licenced to accept non-hazardous waste. These will need to be determined through the selected waste receiver prior to disposal.

Hostmoor Avenue, March



A non-hazardous waste should not be compared with WAC limits for hazardous or SNRHW waste sites and the WAC test should only be used to determine if the waste is suitable for disposal at an inert waste landfill site. Likewise, wastes classified as hazardous based on their total concentrations should not be compared with WAC limits for inert waste landfill sites, as these will not be accepted.

Details of how material should be classified for waste disposal are presented in the BSL Methodology and Guidance in Appendix A and are summarised in the table below:

	PRIOR TO LEAVING SITE						
Classification based on Total Concentrations ¹	Non-Haza	rdous Waste	Hazardous Waste				
	IF SOILS CANNOT BE RE-USED ELSEWHERE AND MUST GO TO LANDFILL						
WAC testing	Below inert WAC limit values	Above inert WAC limit values	Below hazardous WAC limit values ⁴	> WAC limit values			
Landfill requirements	INERT landfill	NON-HAZARDOUS landfill ²	HAZARDOUS landfill	PRE-TREATMENT ³			

- 1 Total concentrations are defined as tests results on solids as opposed to leachate (i.e. a liquid).
- 2 Individual sites may have certain limit values pre-determined in their licence.
- 3 After pre-treatment the material characteristics may have changed to an extent that allow the soil to be re-classified.
- 4 Possibility that wastes could be classified as stable Nonreactive HAZARDOUS waste in non-hazardous Landfill (e.g. soils containing low concentrations of asbestos, gypsum or sulphate bearing soils).

Waste classified as non-hazardous can be accepted into a non-hazardous landfill without having to pass any numerical WAC.

Soils above hazardous WAC limit values require pre-treatment prior to disposal. The effective pre-treatment, typically involving separation, sorting and screening, can offer cost savings through reducing the hazardous nature and volumes of soil. Costs for disposal of non-hazardous/hazardous soils are significant compared to the disposal of inert material.

Inert Waste

The possibility of automatic inert classification of the naturally occurring "clean" soils should be explored in accordance with Section 4.3 of the EA guidance document. The Council Decision includes a list of wastes in Section 2.1.1 of the document that are assumed to be inert and therefore acceptable at a landfill for inert waste without testing. This is the case if:

They are single stream waste of a single waste type (although different waste types from the list may be accepted together if they are from a single source); and

There is no suspicion of material or substances such as metals, asbestos, plastics, chemicals, etc to an extent which increases the risk associated with the waste sufficiently to justify contamination and they do not contain other classes of landfill.

9.3 Waste Classification and Waste Acceptance Criteria (WAC)

We have reviewed the testing results and assessed them through a waste classification database which allows users to code and classify waste as defined in the EWC (European Waste Catalogue) based on EC Regulation 1272/2008 on the Classification, Labelling and Packaging of Substances and Mixtures (CLP) and latest Environment Agency guidance (WM3 "Guidance on the classification and assessment of waste - Technical Guidance").



Eight samples were tested for a comprehensive suite of analytes to assess whether they contained any contaminants in the hazardous range when screened against assessment criteria within WM3 using the HazWasteOnline tool.

The Waste Classification Report and WAC testing results are presented in Appendix F The results of the waste assessment based on total concentrations is presented in the table below.

Location	Depth (m)	Stratum	Waste Classification	WAC Analysis	Landfill
WS01	0.30	MADE GROUND: Slightly gravelly clayey sand	Non-hazardous	NA	
WS04	0.70	Gravelly CLAY	Non-hazardous	Inert	INERT landfill
WS05	1.20	MADE GROUND: Slightly gravelly slightly clayey sand	Non-hazardous	Inert	INERT landfill
WS07	0.40	MADE GROUND: Gravelly sand	Non-hazardous	NA	
HP01	0.10	MADE GROUND: Slightly gravelly sand	Non-hazardous	NA	
BH01	0.40	MADE GROUND: slightly gravelly sand	Non-hazardous	NA	
BH02	0.40	MADE GROUND: Slightly gravelly clayey sand	Non-hazardous	Inert	INERT landfill
BH02	0.90	Gravelly SAND	Non-hazardous	Inert	INERT landfill

Based on the waste classification database assessment, the made ground and natural soils have been classified as non-hazardous. The WAC analysis indicates that if a landfill disposal route is required, then the tested materials are likely to be suitable for disposal as inert waste, including soils in BH02 in the vicinity of the proposed loading ramp.

Waste Containing Asbestos

Should soils contain asbestos, the concentration and type of asbestos identified, in addition to the chemical composition (i.e. hazardous or non-hazardous detailed above), will determine which waste code is applicable to the soils and which landfill will accept it.

Waste	Conc. by Weight (%)	EWC 2002 Catalogue Entry Code	Waste Disposal Route
Non-hazardous containing asbestos fibres	<0.001 - <0.1%	17 05 04 (soil and stones other than those mentioned in 17 05 03*)	Non-hazardous landfill subject to achieving Waste Acceptance Criteria (WAC) for a stable non-reactive hazardous landfill site.
Hazardous containing asbestos fibres	<0.001 - <0.1%	17 05 03* (soil and stones containing hazardous substances)	Hazardous landfill subject to achieving Waste Acceptance Criteria (WAC) for a hazardous landfill site.
Non-hazardous soils containing asbestos fibres	>0.1%	17 05 03* (soil and stones containing hazardous substances)	Hazardous landfill authorised to receive asbestos, or in a stable non-reactive hazardous waste cell at a non-hazardous landfill authorised to receive asbestos.
Non-hazardous Soils containing ACM (Mechanically separable)	>0.1%	17 06 05 (construction material containing asbestos) 17 05 04 (soil and stones other than those mentioned in 17 05 03*)	ACMs disposed of at a hazardous landfill authorised to receive asbestos, or in a stable non-reactive hazardous waste cell at a non-hazardous landfill authorised to receive asbestos. Soils should be disposed of at a non-hazardous landfill subject to achieving Waste Acceptance Criteria (WAC) for a stable non-reactive hazardous landfill site.



Waste	Conc. by Weight (%)	EWC 2002 Catalogue Entry Code	Waste Disposal Route
Hazardous soils containing ACM	>0.1%	17 05 03* (soil and stones containing dangerous substances)	Hazardous landfill subject to achieving Waste Acceptance Criteria (WAC) for a hazardous landfill site.

Testing for total contaminant concentrations on natural soils was not undertaken and they are assumed to be non-hazardous.

9.4 Options Assessment

Following the classification of waste materials, the options available for the waste can be considered in the context of the waste hierarchy as below:

Onsite re-use (with or without prior treatment) under suitable exceptions/permits.

Offsite processing for recycling or recovery e.g. screening.

Offsite disposal (with or without prior treatment) i.e. landfill.

Where feasible, efforts should be made to retain soils for onsite re-use to minimise costs and maximise the sustainability of projects.

Based on the above, the possible options for the generation of waste soils at the site are described in the table below:

Waste Generation Source	Comments					
Crush	The crushed concrete is site derived from structures which had not been used for potentially contaminative activities. These should be subject to an asbestos survey and removal of asbestos as required, prior to demolition and crushing of structures. Assuming the above criteria are met, with materials containing no asbestos or ACM, crushed concrete is considered to be inert without testing. Where samples of crushed concrete have been subject to totals testing this is likely to hazardous due to pH, and where subject to WAC testing, the sulphate and TDS limits are breached, this is to be expected due to the presence of concrete.					
Made Ground from site levelling/foundations excavations/services excavations	Samples of made ground from across the site have been classified as non-hazardous for off-site disposal purposes, although should be suitable for re-use on site if required under suitable exemptions/permits.					
Natural ground from site levelling/foundations excavations/services excavations	The Diamicton may be considered suitable for re-use onsite as fill where the criteria of the WFD exception for re-use of naturally occurring soils can be met. Naturally occurring clean materials could also be exported to another site under the direct transfer scenario of the DoWCoP. Classified as non-hazardous and below inert WAC testing criteria for off-site disposal purposes.					

General

If any gross hydrocarbon contaminated material is encountered during the construction phase, it is possible that this may be classified as hazardous and testing should be undertaken at that time.

Where it is necessary to dispose material off site it is recommended that materials are segregated and sufficient time is allowed to further classify the actual soil arisings that constitute the waste, including discussion with landfill sites and waste transfer stations to find the best disposal route. It is illegal to dilute and mix soils without a suitable permit.



As a significant proportion of the soils likely to be generated on site are clean it is recommended that where possible that the soils could be recycled at a suitable local waste treatment plant or transfer station rather than a landfill disposal route.

9.5 Re-use of Soils

By definition in law, any material excavated from the ground becomes waste at the moment of excavation. If that soil (now a "waste") is then placed on another part of the development site (or used on another development site) without an appropriate materials management plan, permit or exemption being in place, by law this material is defined as "illegally deposited waste".

Landfill tax rules allow HM Revenue & Customs (HMRC) to recover landfill tax on illegally deposited waste on construction sites. This could lead to excessive costs without the correct documentation in place. In addition, a person who makes, knowingly causes or knowingly facilitates a disposal to be made at an unauthorised site is also liable to pay Landfill Tax.

In order to comply with UK legislation and avoid excessive costs, if the re-use of soils is proposed on site, this should be done in accordance with the relevant exemptions or permits in place.

Soils Re-use Under DoWCoP

One of the main industry mechanisms for allowing the re-use of soils in construction is the CL:AIRE "Development Industry Code of Practice for the Definition of Waste" (CL:AIRE DoWCoP) also known as a Materials Management Plan (MMP). Further guidance is provided in the BSL Methodology and Guidance in Appendix A.

To implement the DoWCoP (for Route A), there is a requirement to notify the Environment Agency and Local Authority of the intention to use the code of practice in principal, after which there is a 21-day notice period for their response.

In order to re-use soils under the DoWCoP, there are four key criteria that need to be met:

The aims and objectives of the project meet the requirements of the Waste Framework Directive (does not harm human health or the environment).

The soils can be demonstrated to be suitable for use (backed up by chemical/geotechnical testing and assessment).

There is certainty of use (planning consents are in place alongside materials tracking, which should be in place as part of good site practice in any case).

Quantity (the quantity of materials used should be known).

Information on existing site levels, proposed levels, volumes generated (e.g. foundation / drainage excavation arisings) would need to be known in order to complete the MMP.

If the DoWCoP is the chosen route, the MMP should be in place and declared by a Qualified Persons (QP) before works commence, otherwise excavated soils could constitute an illegal deposit of waste and enforcement action could be taken by the EA and HMRC.

The declared MMP should be amended as new import sources are added.

Once the project is complete, a verification report detailing soils re-use/import will need to be produced and submitted to CL:AIRE, which may be subject to a random audit process. Sites found to be non-complaint with the CoP can be referred to the EA for further investigation.



Regardless of implementing re-use under the code of practice or not, all sites should have some form of materials tracking in place in compliance with current legislation. Any re-use scheme should also be designed to minimise disposal costs.

Re-use of soils containing asbestos should comply with the CL:AIRE publication 'Interpretation for Managing and working with Asbestos in Soil and Construction and Demolition Materials' (CAR-SOILTM) and CAR 2012.

In terms of the re-use of brick/concrete crush materials, the DoWCoP does cover aggregates, but only on the site of origin, and the EA WRAP aggregate Quality Protocol might best apply to ensure quality standards, which are discussed further below.

Soils Re-use under Exemptions and Permits

Other potentially suitable options to allow the re-use and/or import of soils and aggregates on site are provided in the table below:

Re-use Mechanism	Description
U1 Exemption	Can be applied to re-use/import of soils and stones, but only up to 1000 tonnes or for brick and concrete up to 5000 tonnes. This is usually an efficient way to re-use small volumes of waste materials. However, only one U1 can be filled in per site in any 3-year period. Quick and free via online registration.
WRAP Quality Protocols	Describes how processed demolition arisings can be removed from regulatory waste regime. Requires a demonstration of appropriateness by: Factory Production Control Manual. Facility Permit (or Exemption). Grading Analysis.
Waste Framework Directive (WFD) exclusion	In regard to "clean" naturally occurring soils only that are to be re-used on their site of origin, these are covered by a Waste Framework Directive (WFD) exclusion which is an EA regulatory position statement. So long as the project can prove the four criteria listed above for the DoWCoP, then permits or the DoWCoP are not required. However, many projects still use the CoP to ensure compliance.
T5 Screening and blending of waste	The T5 exemption allows you to temporarily treat waste on a small scale to produce aggregate or soil at a particular location, such as a construction or demolition site. The limit is 5,000 tonnes. This applies to: Screening soil on a demolition site to remove wood and rubble. Blending soil and compost that has been produced under an exemption on a construction site to produce better soil for landscaping on that site (e.g. peaty deposits). Crushing waste (except bricks, tiles and concrete) before screening or blending
	Grading waste concrete after it has been crushed to produce a certain type of aggregate.
T7 Exemption	The T7 allows treatment of waste bricks, tiles and concrete by crushing, grinding or reducing in size. This needs to be registered with the Local Authority.
Other Permitting Routes	Other options include use under an Environmental Permit (Standard or Bespoke Rules), however these may be a time consuming and costly route, where use of the other above options (if applicable) are likely to be more feasible in construction.



10.0 CONCLUSIONS

10.1 Geo-Environmental

Geo-Environmental – Human Health

The proposed development is for commercial end-use comprising an Aldi retail store.

Testing of the made ground and natural soils at the site did not reveal any exceedances of heavy metals, PAHs, petroleum hydrocarbons, BTEX or MTBE compounds.

No asbestos has been detected in any of the 7 samples that were tested.

No PCBs were identified in the vicinity of the sub-station.

The risks to human health from the identified sources of contamination are considered to be low.

Ground gas monitoring has revealed a maximum peak carbon dioxide concentration of 4.0%v/v and methane concentrations of 0.0%v/v. Based on the gas monitoring the site is classified as Characteristic Situation 1, therefore ground gas protection measures are not required. However, this will be confirmed once all the scheduled gas monitoring rounds have been completed.

Geo-Environmental – Controlled Waters

The overall risk to controlled waters is considered to be low and no further action is required.

Waste

Waste classification on a selection of made ground and natural soils has revealed them to be non-hazardous and inert.

10.2 Geotechnical

Foundations

The most suitable foundations for the proposed commercial development are considered to be pads and strips bearing in the loose to medium dense sand at a minimum depth of 0.8m bgl, or in the underlying firm to stiff (medium strength) clay at a minimum depth of 1.5m bgl. Preliminary foundations indicate foundations in the sand would provide an allowable bearing capacity of 120kN/m², whilst foundations in the clay at 1.5m bgl would provide 110kN/m².

Floor slabs

Ground bearing floor slabs may be adopted subject to appropriate design and preparation of the formation. Suspended floor slabs may also be adopted however alternative foundation options may need to be considered to support the load of a suspended slab.

Concrete classification

Both made ground soils and natural superficial strata are classified as DS1 AC-1s. Static groundwater has been assumed due to the presence of low permeability clays.

Highways

CBR values of 5% are likely to be achieved in undisturbed natural granular soils and 4% for natural clays soils for pavement design purposes, unless proven otherwise by in-situ testing at formation level by a specialist geotechnical engineer. Equilibrium CBR values are likely to be 2% within the made ground.

Drainage (SUDS)

The use of soakaways within the natural ground is not considered to be feasible at the site.



10.3 Further Work

The following further work is considered necessary to progress the site to construction phase:

Completion of ground gas monitoring programme.

Issue gas assessment / update gas assessment within this report.

Demolition Asbestos survey.

Tree survey by qualified arboriculturist.

Detailed foundation design by a structural engineer.

Production of Materials Management Plan (MMP) under the CL:AIRE DoWCoP, if required.

Watching Brief following removal of floor slabs; BSL representative or other competent person should attend site to inspect the soils exposed from beneath the buildings for evidence of any potential contamination.

Watching brief during the removal of former oil tank by a BSL representative or other competent person to inspect the soils exposed from beneath the tank for evidence of any potential contamination and sample if evidence of contamination is observed.



11.0 ABBREVIATIONS AND DEFINITIONS

	GLOSSARY
Term / Abbreviation	Definition
AST	Above Ground Storage Tank.
B(a)P	Benzo (a) Pyrene.
BGS	British Geological Survey.
BRE	Building Research Establishment.
BS	British Standard.
BSL	Brownfield Solutions Ltd.
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes.
CBR	California Bearing Ratio (used in pavement/highways design).
CAR 2012	Control of Asbestos Regulations (2012).
CBCB	Cheshire Brine Compensation Board.
CBCD	Cheshire Brine Compensation District.
CBR	California Bearing Ratio.
CIEH	Chartered Institute of Environmental Health.
CIRIA	Construction Industry Research Association.
CL:AIRE	Contaminated Land: Applications in Real Environments.
CLEA	Contaminated Land Exposure Assessment.
CLO	Contaminated Land Officer.
COMAH	Control of Major Accident Hazards.
Contamination	Presence of a substance which is in, on or under land, and which has the potential to cause significant harm or to cause significant pollution of controlled water. There is no assumption in this definition that harm results from the presence of the contamination. Naturally enhanced concentrations of harmful substances can fall within this definition of contamination. Contamination may relate to soils, surface water, groundwater or ground gas.
Controlled Waters	Inland freshwater (any lake, pond or watercourse above the freshwater limit), water contained in underground strata and any coastal water between the limit of highest tide or the freshwater line to the three-mile limit of territorial waters.
CPT	Cone Penetration Test.
CSM	Conceptual Site Model. A schematic hypothesis of the nature and sources of contamination, potential migration pathways (including description of the ground and groundwater) and potential receptors, developed on the basis of the information from the preliminary investigation and refined during subsequent phases of investigation and which is an essential part of the risk assessment process. The conceptual site model is initially derived from the information obtained by the preliminary investigation (i.e. the Phase I Desk Study). This conceptual model is used to focus subsequent investigations, where these are considered to be necessary, in order to meet the objectives of the investigations and the risk assessment. The results of intrusive investigations can provide additional data that can be used to further refine the conceptual site model.
DCP	Dynamic Cone Penetrometer.
DNAPL	Dense Non-Aqueous Phase Liquid.
DoWCoP	Definition of Waste Code of Practice.
DWS	Drinking Water Standard.
EA	Environment Agency.
EHO	Environmental health Officer.
EQS	Environmental Quality Standard.
GAC	Generic Assessment Criteria.



	GLOSSARY
Term / Abbreviation	Definition
GDR	Geotechnical Design Report.
GFR	Geotechnical Feedback Report.
GIR	Ground Investigation Report.
GSV	Gas Screening Value.
Harm	Adverse effect on the health of living organisms, or other interference with ecological systems of which they form part, and, in the case of human health, including property/structures and water supply pipelines.
Hazard	Inherently dangerous quality of a substance, procedure or event.
HDPE	High Density Polyethylene.
HSV	Hand Shear Vane.
K	Modulus of Subgrade Reaction.
LCRM	Land Contamination: Risk Management (EA guidance).
LNAPL	Light Non-Aqueous Phase Liquid (petrol, diesel, kerosene).
LOD	Limit of Detection (for particular method adopted).
MMP	Materials Management Plan.
Mv	Modulus of Volume of Compressibility.
ND	Not Detected.
NHBC	National House Building Council.
NR	Not Recorded.
OS	Ordnance Survey.
PAH	Polycyclic Aromatic Hydrocarbon.
Pathway	Mechanism or route by which a contaminant comes into contact with, or otherwise affects, a receptor.
PCB	Poly-Chlorinated Biphenyl.
PCSM	Preliminary Conceptual Site Model.
рН	Scale used to specify how acidic or basic a water-based solution is.
PHC	Petroleum Hydrocarbons.
PID	Photo Ionisation Detector.
PNEC	Predicted No-Effect Concentration.
Precision	Level of agreement within a series of measurements of a parameter.
PSD	Particle Size Distribution.
PVC	Polyvinyl Chloride.
Receptor	Human health, living organisms, ecological systems, controlled waters (surface waters and groundwater within aquifers), atmosphere, structures and utilities that could potentially be adversely affected by contaminant(s).
Risk	Probability of the occurrence, magnitude and consequences of an unwanted adverse effect on a receptor.
Risk Assessment	Process of establishing, to the extent possible, the existence, nature and significance of risk.
Sampling	Methods and techniques used to obtain a representative sample of the material under investigation.
SOM	Soil Organic Matter.
Source	Location from which contamination is, or was, derived. This could possibly be the location of the highest soil, groundwater or gas concentration of the contaminant(s).
SPT	Standard Penetration Test.
SVOCs	Semi Volatile Organic Compounds.
TOC	Total Organic Carbon.
TPH CWG	Total Petroleum Hydrocarbon (Criteria Working Group).



	GLOSSARY
Term / Abbreviation	Definition
TVOCs	Total volatile organic compounds.
UCS	Unconfined Compressive Strength.
Uncertainty	Parameter, associated with the result of a measurement that characterises the dispersion of the values that could reasonably be attributed to the measurement.
UST	Underground Storage Tank.
UXO	Unexploded Ordnance.
VCCs	Vibro Concrete Columns.
VSCs	Vibro Stone Columns
VOCs	Volatile Organic Compounds.
WAC	Waste Assessment Criteria.
WFD (in waste context)	Waste Framework Directive.
WFD (in water context)	Water Framework Directive.
Units	Definition
0	Degrees
Φ	Phi angle (in degrees)
g/l	Grams per Litre
Km	Kilometres
kPa	Kilo Pascal (Equivalent to kN/m²)
KN/m ² /mm	Kilo Newton per metered squared per millimeter
kN/m ²	Kilo Newtons per metre squared
kPa	Kilo Pascal (Equivalent to kN/m²)
l/hr	Litres per hour
MJ/kg	Mega joule per kilogram
MN	Mega Newton
M^2/MN	Mega Newton per metre squared
M	Metres
m bgl	Metres Below Ground Level
m OD	Metres Ordnance Datum (sea level)
μg/I	Micrograms per Litre (parts per billion)
μm	Micrometre
mb	Millibars (atmospheric pressure)
mg/kg	Milligrams per kilogram (parts per million)
mg/m ³	Milligram per metre cubed
mm	Millimetre
ppb	Parts Per Billion
Ppm	Parts Per Million



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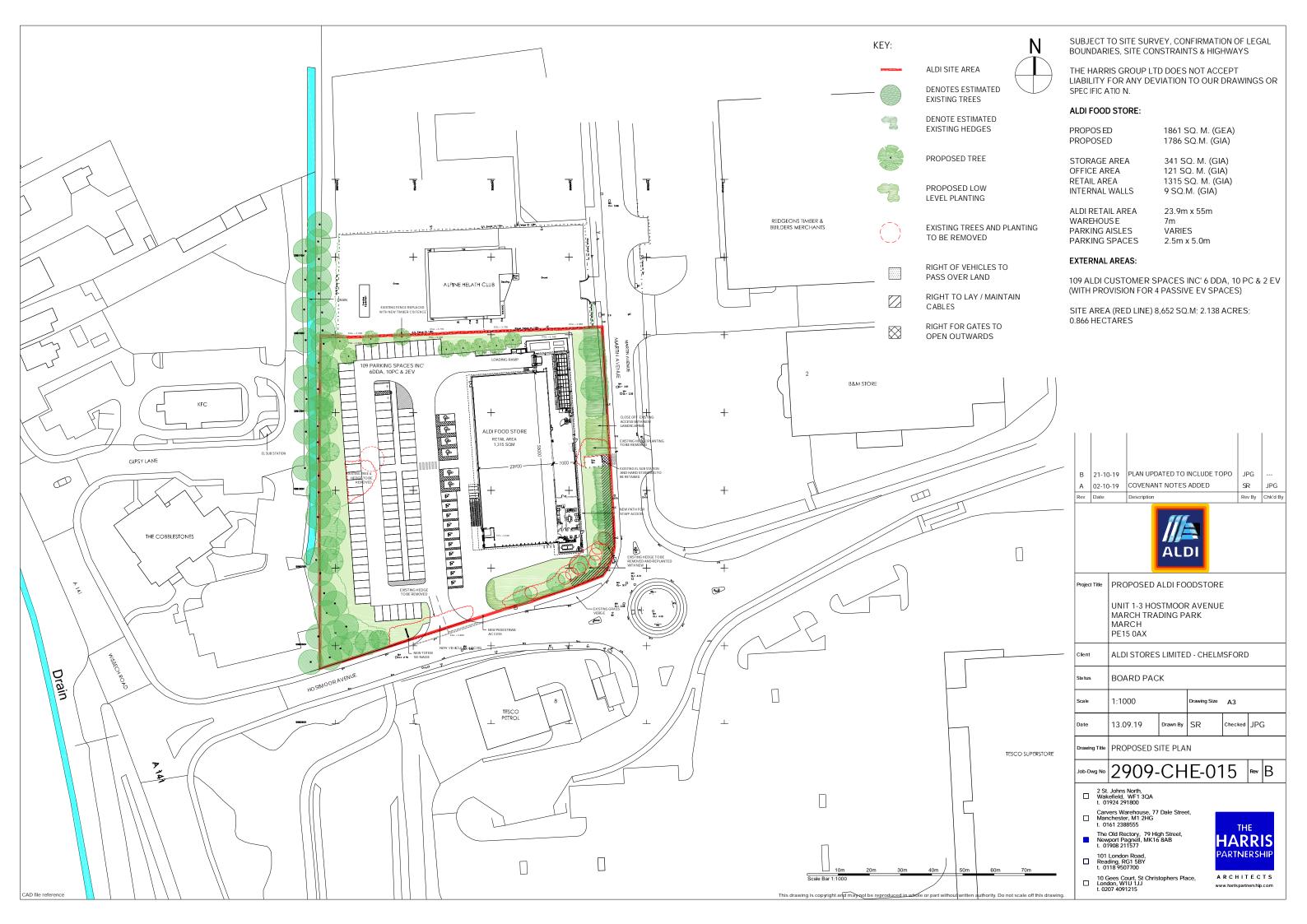
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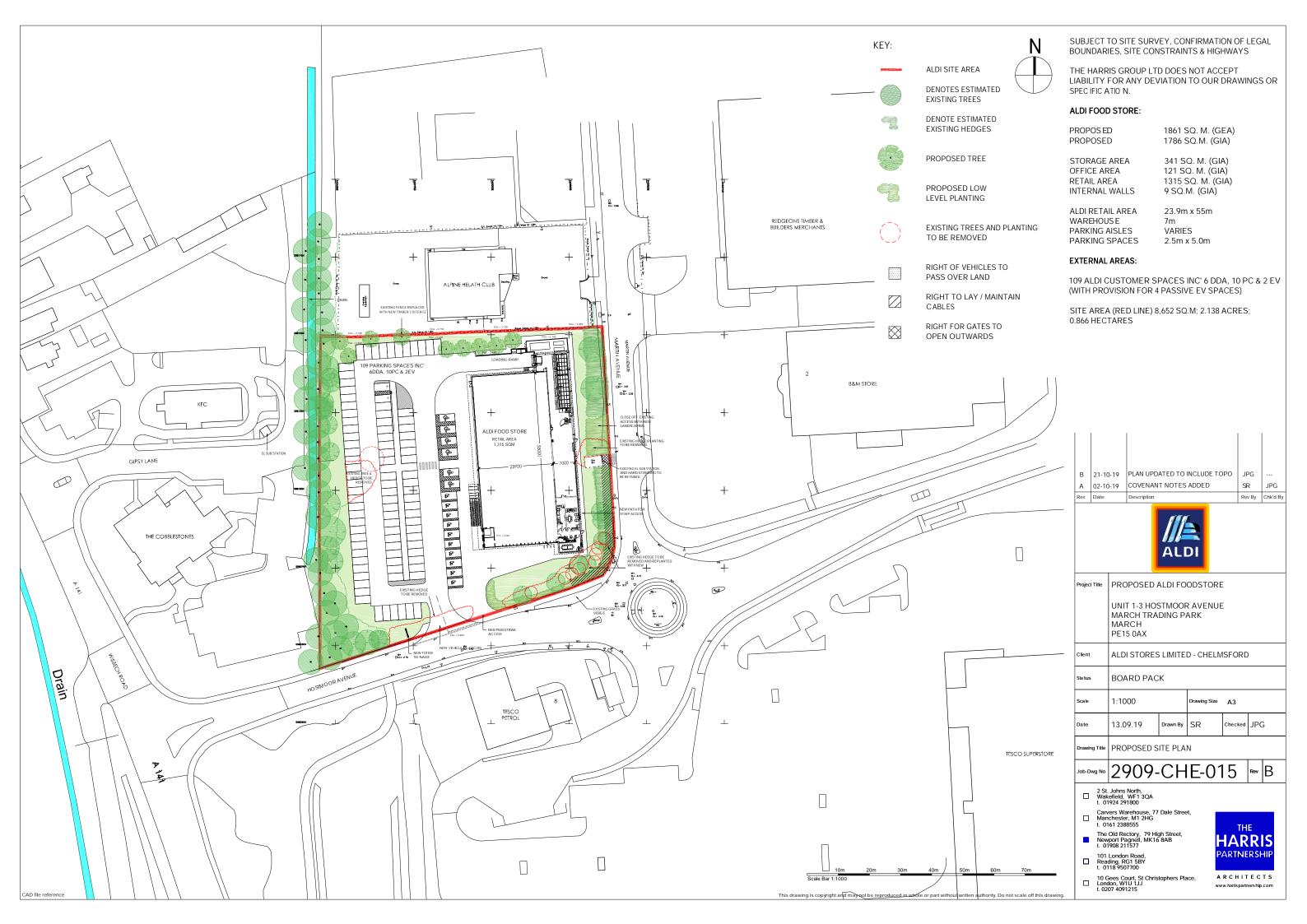
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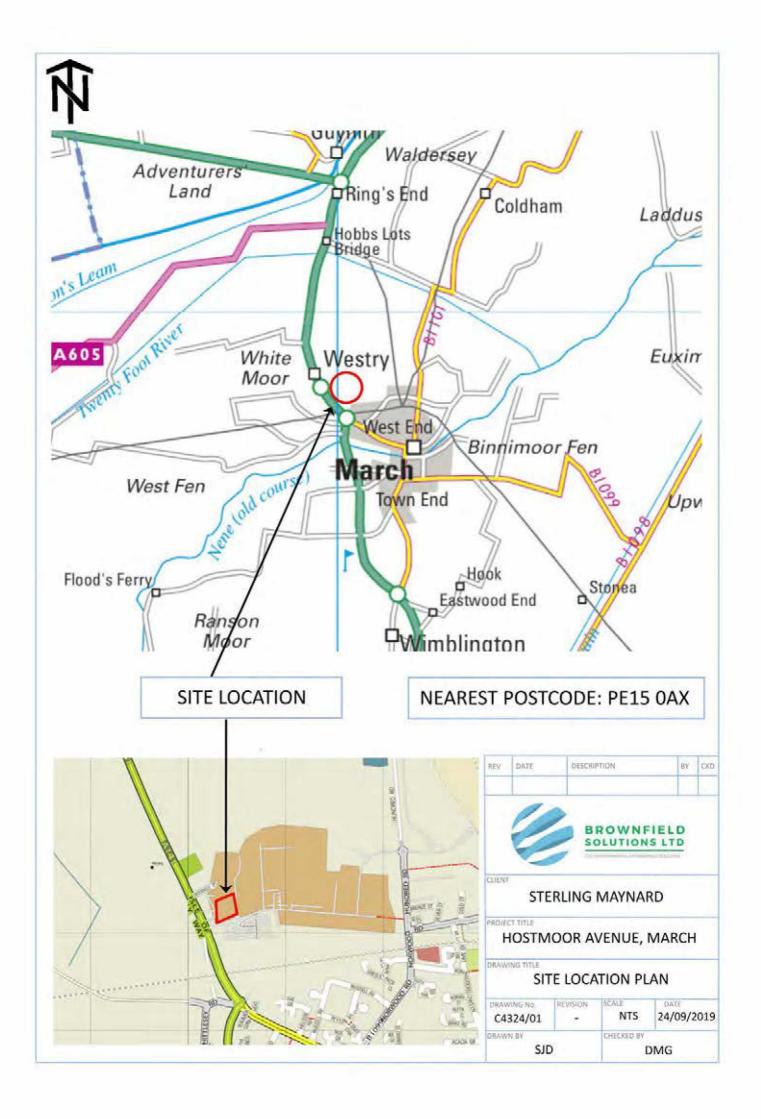


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APPROXIMATE LOCATION OF PROPOSED FOODSTORE



KEY

APPROXIMATE SITE BOUNDARY



TRIAL PIT/ SOAKAWAY



WINDOW SAMPLE BOREHOLE



CABLE PERCUSSIVE BOREHOLE



HPXX HAND EXCAVATED PIT



SOAKAWAY TEST LOCATION



BOREHOLE INSTALLATION

NOTES

- 1. ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE COMMENCING WORKS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ARCHITECT & ENGINEER FOR VERIFICATION. FIGURED DIMENSIONS ONLY ARE TO BE TAKEN FROM THIS DRAWING.
- 2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS REPORTS. THIS DRAWING IS COPYRIGHT OF BSL.
- 3. DRAWING NOT FOR CONSTRUCTION PURPOSES.

REV	DATE	DESCRIPTION	BY	CKD



CLIENT

STIRLING MAYNARD

PROJECT TITLE

HOSTMOOR AVENUE, MARCH

EXPLORATORY HOLE LOCATION PLAN

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                s@ N\&AK\%)^* 860^* \%LQLMMMS6+'./,)'/.-3\%l' 3\%Q:Q,-'./.)+'\%778/*.\%QE\%775-\%k'()^*+',-'./GB^*+.-8.)+'\%68.\%l' 3\%Q:Q,-'./.)+'%778/*.%QE%775-%k'()^*+',-'./GB^*+.-8.)+'%68.%l' 3%Q:Q,-'./.)+'%778/*.%QE%775-%k'()^*+',-'./GB^*+.-8.)+'%68.%l' 3%Q:Q,-'./.)+'%678/*.%QE%775-%k'()^*+',-'./GB^*+.-8.)+'%68.%l' 3%Q:Q,-'./.)+'%678/*.%QE%775-%k'()^*+',-'./GB^*+.-8.)+'%68.%l' 3%Q:Q,-'./.)+'%678/*.%QE%775-%k'()^*+',-'./GB^*+.-8.)+'%68.%l' 3%Q:Q,-'./.)+'%678/*.%QE%775-%k'()^*+',-'./GB^*+.-8.)+'%68.%l' 3%Q:Q,-'./.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QB^*+.-8.)+'%678/*.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*+'.%QE%775-%k'()^*-'.%QE%775-%k'()^*-'.%QE%775-%k'()^*-'.%QE%775-%k'()^*-'.%QE%775-%k'()
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               s@ G+'./,)'/.)+'% 3% ()*+', -'./% /..-*299%5-)*%:0,8/.)+'2%+*P8*+:-*.<\P8*+7.22)+'/02%.'3%3).)+'%07%+(%
                                  LMM-JR%
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A5- %-40%+ )' = 12/28%+ ' 9 ] 5/62.)(- 90/2% 760 =) 20/.)(- %f/, -; +*4%+86, -' .2%5/.5%2 %--' 96+' 2)3- *- 3% %5- %*+368.)+' %7%
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               , @ \quad \mathsf{A5-86'} \ ()^*+' \ , \quad -' \ ./ \ \mathsf{GB}^*+.-8.) + ' \ \mathsf{G8.36CCM} \ \mathsf{SR}/^* \ .\%E \ \mathsf{G6+'} \ ./ \ , \ )' \ / \ .-3 \ \mathsf{H6}' \ \ 3\%. / .6. + ^* < \% 6) \ 3/' \ 8- \ \mathsf{H6.MBLJF\%} 
                ,@ A5- %%'()*+', -'.%P*+.-8.)+'%E8.%BCCMJP%
                ,@ A5-%/.-*%-2+6*8-2%8.%BCCBJR%
                ,@ A5- %%'()*+', -'.%68.%BCCDJF%
                , @ A5-96+'./, )'/.-3961' 3988' = 0 31988.91 MMMJP8
                , @ A5-98+006.)+'98*-(-'.)+'98*36+'.*+0982'=0/396'396'/0-2196-600.)+'296MMMJ986'
                , @ A5-961' 37) (01% -= 60'.) + '24% 24 = 0' 3\% 3\% /0-2 J 1% = 60'.) + '24 L MMLJ 18%
               \% A5-9/d' 37) CDM&' = 0 3% 3% /0-2J9%, -'3, -'.J%K-=60.)+'29% LMMJR%
               (@ G+' ./, )'/.-3\%1' 3\%2' = 0 3J\%K-=60.)+' 2\%LMBLJR%
               ,@ "-/0.5% 3%/7.<%.%+*4%8.R%
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ļ #, - DD"\$4&C)%*."&2*"56' (*8 \$6/"&\$": *"5\$CC\$8 *+"5\$6"6)./""...*.. (*%&")%"&2*"E F;"<2*"56' (*8 \$6/")."+".)9%*+"&\$": *"1\$%.).&*%&" $8\ \ |\&2\ "E\ F"C^*9).\ C'\&)\$\ \%"\ \%+"G\$\ C)1)^*.\ "]\%1C4+)\%9"GC'\ \%\%)\%9,""<2*".\&'\ 6\&)\%9"G\$)\%8"\$\$5"\&2*"6).\ /\ "'\ .\ .^*.\ .\ (\ ^*\%\&")+\ ^*\%\&)5H"\&2*"1\$\%\&^*1\&"\$5"$ $\&2^{*}"G6\$: C^{*}(""\%+"\&2*"\$:J^{*}1\&)B^{*}."\$5"\&2*"G6\$1^{*}...;""E\%+^{*}6"\#,-DD7"\&26^{*}*"\&)^{*}6."\$5"6)./""...^{*}...(*\%\&"^{*}1).\&"K"L6^{*}C)(")\%+(6H7"M^{*}\%^{*}6)1"...$

N 4' %&)&' &)B* "' %+"O * &')C* + "N 4' %&)&' &)B* ;""" P\$ 6(4 C' 8)%9" %+"+* B* C\$G)%9" "1\$ %1* G&4 ' C'(\$ + * C'\$\$ 6'82 * ".)&* "). " %")(G\$ 68' %8"6* 3 4)6* (* *&8"\$ 5'6). / " . . * . . (* *&7"82). ". 4 GG\$ 68. " 82*")+ * %8|5|1' &}\$ %"" %+"" . . * . . (* %&"\$ 5"G\$ Cl4 &' %&"C|%/ ' 9* . ;"O * B* C\$G(* %&"\$ 5"&2 * "1\$ %1* G&4 ' C'(\$ + * C*5\$ 6(. "&2 * "(')%"G' 6&"\$ 5" G6* C)()% 6H*6). / " . . * . . (* %87" %+ *82 * "(\$ + * C"). ". 4 : . * 3 4 * %8CH*6* 5)% * + "\$ 6"6* B). * + " . "(\$ 6* ")%5\$ 6(' &)\$ %" %+ "4 %+ * 6. & * %+)%9"). "

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-)./")."" "1\$(:)%' &)\$%"\$5"&2*"C)/*C)2\$\$+"\$5"" %"*B*%&"\$11466)%9" %+"&2*"(' 9%)&4+*"\$5")&."1\$%. *34*%1*.;"<2*6*5\$6*7": \$&2"&2*"

<2*"6)./"' . . * . (*%&"G6\$1* . "%**+ . "&\$"&' . 11\$4%&"&2*"+*96**"\$5"1\$%5)+*%1*"6*34)6*+")%"+*1).)\$%,;""@'%&)5)1' &)\$%"\$5" 4 %1* 6&')%&)* . "). "' %"* . . * %&)' C". &* G")%"6). / "' . . * . . (* %&;"

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- ST UVWX XW=""<2*6*").""G\$CC4&)\$%"C)%/'9*"'%+""%**B*%&"'GG*'6."B*6H"C)/*CH")%"&2*".2\$6&"&*6(""%+"'C(\$.8")%*B)&::C*" \$B*6"&2 *"C\$ %9"&*6(7"\$ 6"&2 *6*"). "*B)+ *%1*"' &"&2 *"6*1*G&\$ 6"\$ 5"2 ' 6("\$ 6"G\$ CC4 &)\$ %Y"
- ST XZ="<2*6*").""G\$CC4&)\$%"C)%/'9*"%+"CC"&2*"*C*(*%&,"'6*"G6*.*%&""%+")%"&2*"6)92&"GC'1*7"82)12"(*'%.")&")."G6\$:':C*" &2' &" %" 8" %\8" (C'\$ 1146;""#)614 (. &' %1* ." 6* ". 4 12 "&2' &"&2 * "* B* %&"). "%\$ &")%* B)&' : C*7": 4 &"G\$...); C*")%"&2 * ". 2 \$6&"&* 6("" %+" C)/ * CH"\$ B* 6"&2 * "C\$ %9 "&* 6(Y"
- ST [X XW="<2*6*").""G\$CC4&)\$%"C)%/'9*"%+"1)614(.&'%1*."'6*"G\$..);C*"4%+*6"82)12"%"*B*%&"1\$4C+"\$1146;"" > \$8 *B*67")&").": H"%\$"(*' %."1*6&')%"*B*%"\$B*6"" "C\$%9*6"G*6)\$+".412"*B*%&"8 \$4C+"&'/*"GC' 1*7"" %+")."C*.."C)/*CH")%"&2*" . 2 \$ 6&"&*6(Y"
- ST \X XZ="<2*6*")."""G\$CC4&)\$%"C)%/"9*".4&"1)614(.&' %1*."'6*".412"&2'&")&").")(G6\$:':C*"&2*"*B*%&"8\$4C+"\$1146"*B*%")%" &2 * "C\$ %9"&* 6(;"
- <2*". *B*6)&H"). "' C.\$"1C' . .)5)*+"4.)%9"' ". H. &*(": ' . *+"\$%"#@@"#QQR;"<2*"&*6(. "' %+"+*5)%)&)\$%. "' 6*="
- ST] ^_=" 2\$6&" &*6("a' 14&*b"6)./"&\$"24(' %" 2*'C&2"C) /"CH" &\$"6*.4C&")%.)9%)5) 1'%"2'6(d"' ."+*5) %'+" : H"&2*"A%B) 6\$7%'%&" L6% & 18)\$ %"0 18"Deef 7"L '68"@9;"" 2 \$68K& 6("6). / "\$ 5"G\$ COL8)\$ %"\$ 5". * %.)&)B* "8 ' & 6"6*. \$ 461*.;"# ' & '. & 6\$ G2)1"+ ' (' 9* "8\$" : 4 | C+ |)%9. "\$ 6"G6\$ G* 6&H;""0 ". 2 \$ 6&K&* 6("6). / "&\$ "" "G' 6&)14 C'6"* 1\$. H. &* ("\$ 6"\$ 69' %). ("5\$ 6()%9"G' 6&"\$ 5"&2 ' &** 1\$. H. &* ("a%\$ &* " +*5)%)&)\$ %"\$ 5"*1\$. H. &*(")%"cO6' 5&"#)614 C'6"\$ %"# \$ %&' ()%' &*+ ", ' %+d7"OA<- "Rf f f bY""
 - nrxm orvxvouvvxyvIlm ~ oi xngn onthklvnrvwoui (nrw sof (rl~rw soxvouvIII knm • o
- ST, f = "#2 68%) 1" + '('9*" &\$"24('%' 2 *' &22" ac.) 9%5) 1'9\$2' 6(d"'. "‡5)%' +') % Qx-" Fiffb; ""L\$Q3 &) \$%\$5".*9\$&) B"8 &6" 6*. \$461*.;"0".)9%}\$1' 9&12' 99*")% "G 6&14C 6*"1\$. H &("\$6\$69' %).("5\$6()%'G 6&\$5&2' &"1\$. H &("26\$6"+*5)%\$\$%" \$5*1\$.H&(')%O65&#)614C6'\$%#\$%&()%&+",' %+d**T**OA:-"Pfffb**Y**
 - ghij klm nço vwunnavyi xrvwnozouvwxij rwi wanothum m-oxt mosmvnyruci mmnj mwozuyxnyri |ohni utrvisovzouvwxij rwi wanozyj oʻo $\text{nrxmox} \text{ of of yrverki lavyof meav} \text{w-i y of this frzm y o-nin xt or zonkmem no-nt swith o-nn rswith xm-oxit x (y nognamny model)} \text{ or zonkmem no-nt swith xm-oxit x (y nognamn$
- ST, X="L\$OC4\\$\$%\$5" %8%. *%) &\B'8' & *6'6*.\$461*.; "`)9%5)1%\"+'('9 *"&\$"16\$G7":4\)C\}99 7".&64846*."'%". *6\B1*." ac)9%\$1' %&2' 6(d'."+*5)%+")%@65&#)614C6'\$%#\$%&()%&+",' %-dOA<-"Rfffb"O' ('9*"&\$".*%)&B":4)\(\)9\%.7 . 8641846*. 7. *6B)1*. "\$6'82*'* %B)6\$% *%8Y"
- ST,_="26(7"%\$&%1"..'6)CH.)9%5) 1%32'6(7"8 212"('H 6*.40&')%5 %%5)' C'C\$."\$6"*IG%) &46" &\$"6*.\$DB*;"• \$%6. G'6('%%&'2*'\&2"*\\$51&"\\$\$"24('%'2*'\&2"a*'.)\&T\G6B*\&4+": H'4.*"\\$5G*6.\\$%\C6\\$&1\&B"1\\$\&)\%"*\&|b"A'.)\&T 6*G)6: C"*55*1&"\$5"+'('9*"\$\$":4)G)%9.7.8641846*. " %+".*6B)1*.;"



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× × × × × × × × × × × × × × × × × × ×	dHf FVT_KVTHHSF	b 892≓ 32.	b 892≓ 3 c B D.	e8D.	`2⇒.58D.				
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 $j = 2 \times 60 \times 600$; $8k \times 342 = 67.1$; $32 \times 6029 \cdot k = 60.342$; $8k \times 24.2$; $8k \times 24.2$; $8k \times 34.2$; 8k

no pKQFTJ ^mq42=2.6, :. .46B4.r =8?: ?655>.34: 3;2<2=2.4: =@.18C59.: =62.38:: .92;650: 329.=212r 38=k8@.: 0.692036629.4: s: =9. 8=342=2.6, .2<692012.34: 3;2<2=2.4: =@.6, .1C==2035>.4: r r 2060BEq46, -6,7 Adx =2: 5629A18C59.=2;C53.60.; C?;3: 036556;?656>E t =B203.60<2;36B 3680.: 09.=2@296360.: =2.56725>.38.?2.=21 C629u

no \ \P ^ma: =@.6.55/25-.83.: =62.33.: .92; 650: 329.=212r 33=k=8@.: 0.692036629.4: s: =9Ev2: 55: 3680.8k 342.=67.6.56/25-.38. r=2;203: .; C?; 3 036.556?655-Et =E203.60<2; 368.3680.6.=2I C629.: 09.=2@296.5D8=7;.@: >.?2.0212; ;: \Rightarrow .60.342.; 48=3 32=@.: 09.: =2.55/25-.8<2=.342.50B2=32=@u

no R HSkCYZkmw&6.r 8;; &f5.34; 34: =@.18C59.; =6.2.38.; .92; &60: 329.=212r 38=k=8@.; 0.69203&629.4; s:=9E.a8D2<2=A66.6. 2642==253&25.C056725.34; 3:0>.; C14.4; =@.D8C59.?2.; 2<2=2A8=&c:0>.4; =@.D2=2.38.811C=6cD8C59.?2.@8=2.56725.38. ?2.=253&25.@659Exv0<2; 36B 3680.6.08=@:55.=21 C6=29.38.15=&c.342.=67.; 09.9232=@62.342.56? 6665>Ex8@2.=2@296.5 D8=7; @:>.?2.=21 C6=29.60.342.80B 2=32=@u

no dH mw3.6.r8;; 65.34: 34: =0.18C59.: =62.38.: .92; 650: 329.=212r 38==k=80.: 0.692036629.4: s: =9A?C3.63.6.56725-.34: 3.346. 4: =0.48k=2: 56.29AD8C59.: 3D8==308==0:55-.22.0659 u.

no pKQFdH mq42=2.6.:.35D.r8;; & 653>.34:34:=@.18C59.:=62.38.:.=212r38=E.w0.342.2<203.8k; C14.4:=@.?260B=2:5629A&6.083.56725.38.?2.; 2<2=2E

x8@2.567; B2; @:>.?2. 692036629. D4614. 180; 363C32; . : . 3428=2361:51800213680. ?23D220. : .; 8C=12. : 09. : . =212r 38=A?C3 r=8L2;; 680: 5yC9B2@203; 48D; .342@.083.38.?2.r 8;; 6752.k8=; 8@2.=2:; 80E..q42; 2.: =2.5 ?25529.208.5607: B2{.60.342.; C@@: \Rightarrow . 3 ?52.: 09.08.kC=342=: 13680.6.=21 C6=29E.



i Wef^Xc`fj WK[cb W U[mY

$k[WM] \ WM \ VVCdVVK] \ [c`fUdVU_YF \ Udf`U[fdeY] \ VVCdVVK] \ [c`fUdVU_YF \ Udf`U[fdeY] \ VVCdVVK] \ VVCdVVK] \ VVCdVVK \ VVCdVVV \ VVCdVV \ VVCdVVVV \ VVCdVVV \ VVCdVVV \ VVCdVV \ VVCdVVV \ VVCdVVV \ VVCdVVV \ VV$

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 $7 \#\$, 0+) \&0(+.1 /)(50(),.##)0.!).')! (+\&.'.'2)0')0\%\% + \$\% +.0('3\&^* +)\$ -)20/)\&\$'.(\$+.'2)"./.(/)0'!)(5) \# '2(5)\$ -)\&\$'.(\$+.'2)\% +.\$!6)$

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-& ./D2	C	0 120	895	895	895	895	895	895	795	795	795	; 35	; 35	; 35	3.55	3. 55	3.55
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- . / 012 34 56 7 8 24 09/: 2 / 6 71:5 < 8/ 42 158= /0 0>< :192 ?/ 012 192 : /4 2 345 678 > @AB
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 - CD 15 x62 @1 x: 1 928 5 @4 5 = 01 9/1/3 3 =: 15 1 92 H5: 2H2 @15 < 1 9 2 ? / 012 G
 - CD 15 85H3 = 212?/0 1 265 87H2@1 0 / @42 8 5 460 G
 - CD 15 >62 @1 ><;07>1 /E=; /7195 4> 0 26?/ 0 12 H/@/ A2 H2 @15 3 1 > 5@0 G
 - CD 15342:2@19/4H15 3253=2/@61922@:>45@H2@1G

- K GD L > 0.3 5 O / = 15 / 32 4H > 11 26? / 0.12 4 2.8; 8=> @A < /8> = >1; G
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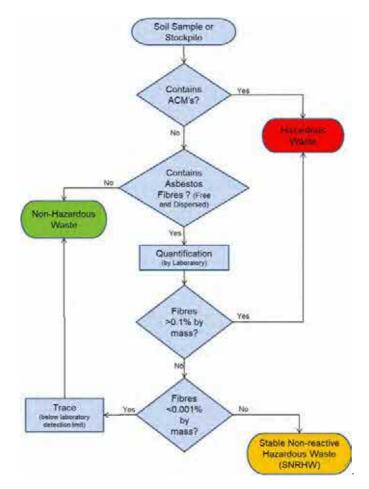
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+, -.>00-00A - 6157.>0G-0150.?561>**646**I.B>0I-.403-J-63-6156.B, -1, -K1, -.>0G-0150.40.JK 0-61>0L MN QGK0.1, >1>K-.7K-.>63.340J-K0-3D5K..

MN B-61474 G@.J4?-0.57.>0 G-0150?561 > **646** I.A > 1 K4> **Q Q R** 9 **S**)T.



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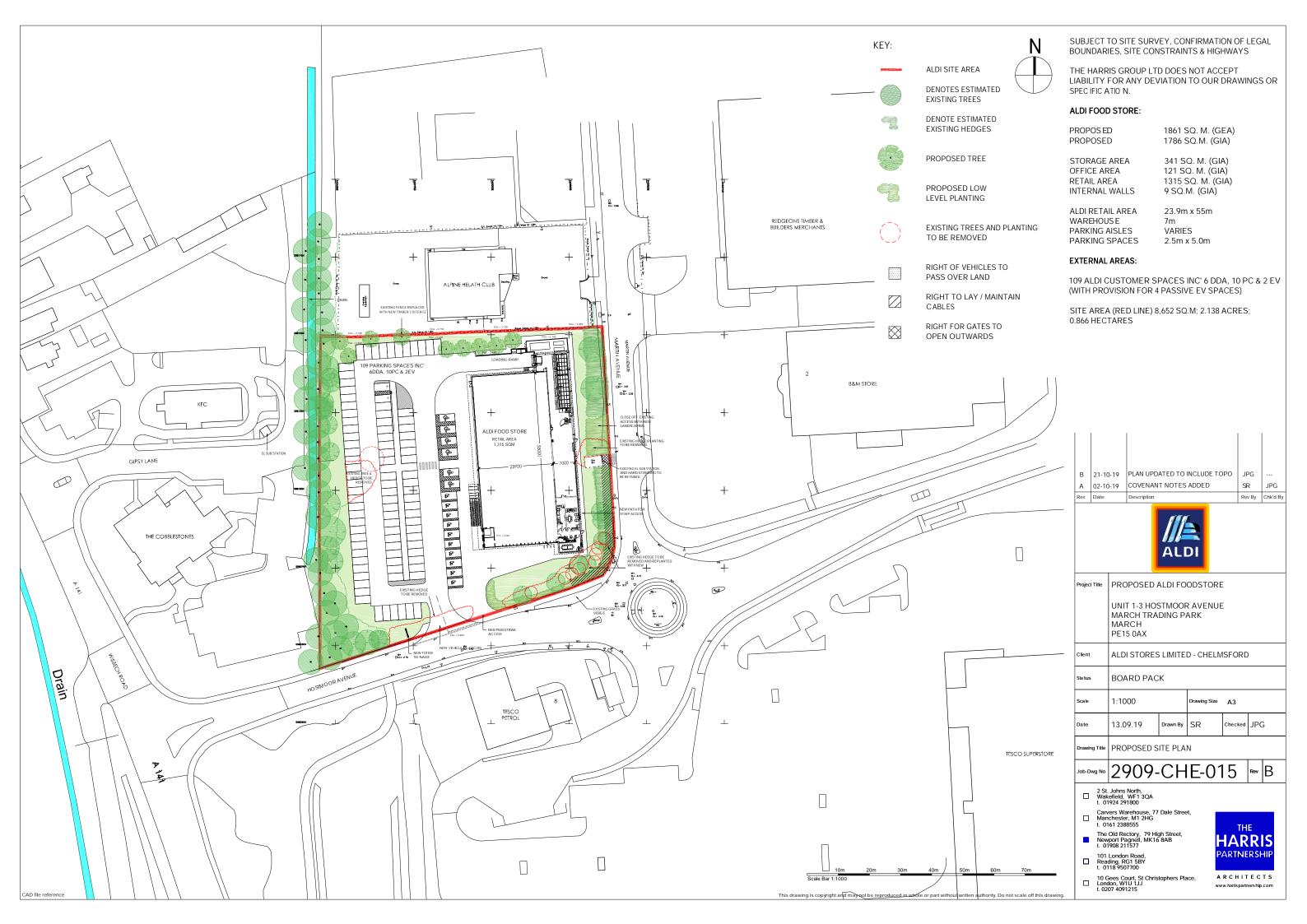
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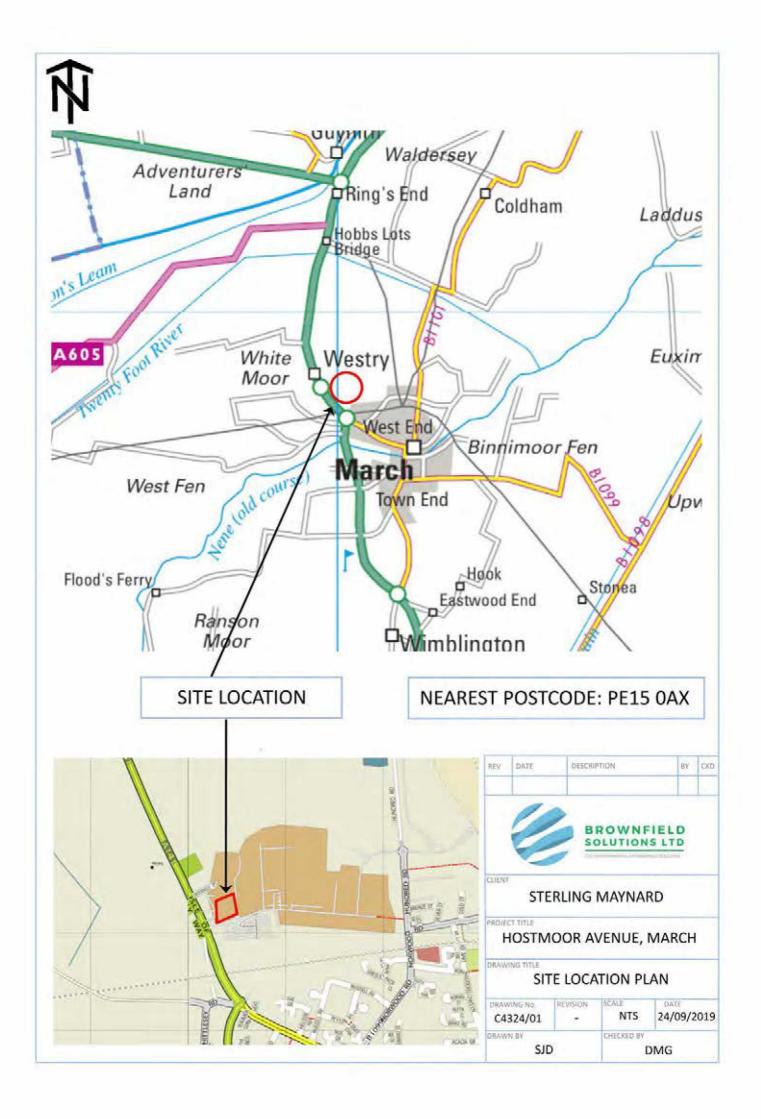


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APPROXIMATE LOCATION OF PROPOSED FOODSTORE



KEY

APPROXIMATE SITE BOUNDARY



TRIAL PIT/ SOAKAWAY



WINDOW SAMPLE BOREHOLE



CABLE PERCUSSIVE BOREHOLE



HPXX HAND EXCAVATED PIT



SOAKAWAY TEST LOCATION



BOREHOLE INSTALLATION

NOTES

- 1. ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE COMMENCING WORKS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ARCHITECT & ENGINEER FOR VERIFICATION. FIGURED DIMENSIONS ONLY ARE TO BE TAKEN FROM THIS DRAWING.
- 2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS REPORTS. THIS DRAWING IS COPYRIGHT OF BSL.
- 3. DRAWING NOT FOR CONSTRUCTION PURPOSES.

REV	DATE	DESCRIPTION	BY	CKD



CLIENT

STIRLING MAYNARD

PROJECT TITLE

HOSTMOOR AVENUE, MARCH

EXPLORATORY HOLE LOCATION PLAN

DRAWN BY	T	CHECKED BY X	X
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DRAWING No.	REVISION	SCALE	DATE



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                          U@ WXY%9%%-'.)/0%6-%1<%5)85%6+'./,)'/'.2%6%,+(-%7*+%5-26+68-%+%6-%-8:.+*F%6
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^ 5-*- %24-6*8-$%/.5; /<% 3%*=-.%*- %60%*-2-' .%%+006./' .%\ 4/=- %\)22% 3%5-*- %2%+.-' .)/Ø4**$6/*, %4%- %4/62-31%
A5- %*- 2-' 8-%7/92+6*8-%+- 2%+. \(\)(.) + \(.) 8/0\): \(\)(: \(\)(: \)(5/. \)%6+ \(./, \)'.)+' \(\)(*+10, \(\)() \(.) \)(2\)\(\)(**+10, \(\)() \(./, \)'.)+' \(\)(*62\)%-\(\)(**+10, \(\)() \(./, \)'.)+' \(\)(**+10, \(\)() \(./, \)'.)+' \(\)(**+10, \(\)() \(./, \)'.)+' \(\)(**+10, \(\)() \(./, \)'.)+' \(\)(**+10, \(\)() \(./, \)'.)+' \(\)(**+10, \(\)() \(./, \)'.)+' \(\)(**+10, \(\)() \(./, \)'.)+' \(./, \)(**+10, \(\)() \(./, \)'.)+' \(./, \)(**+10, \(\)() \(./, \)'.)+' \(./, \)(**+10, \(\)() \(./, \)'.)+' \(./, \)(**+10, \(\)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./, \)() \(./
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                  s@ N\&AK\%)^* 860^* \%LQLMM\956+' ./, )'/.-3\%l' 3\%Q : Q, -' ./.)+' \%7\%/^*.\%QE\%7\%5-\%l()\*+', -' ./\GP\*+.-8.)+' \%68.\% 
                                       BCCMR%
                 s@ GH1BB% 946 + 3- OTP2*+8- 36* - 2P%
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                                       &PEBCCM5966 /<96/MMLF966
                 s@ G+'./,)'/.)+'% 3% ()*+', -'./% /..-*299%5-)*%:0,8/.)+'2%+*P8*+:-*.<\P8*+7.22)+'/02%.'3%3).)+'%07%+(%
                                      LMM-JR%
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A5- %-40%+ )' = 12/28%+ ' 9 ] 5/62.)(- 90/2% 760 =) 20/.)(- %f/, -; +*4%+86, -' .2%5/.%2 %--' 86+' 2)3- *- 3% %5- %*+368.)+' %7%
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                 , @ \quad \mathsf{A5-86'} \ ()^{*+'} \ , \quad \mathsf{-'} \ ./ \ \mathsf{GB}^{*+} \ .- \ 8.) + ' \ \mathsf{GS-36CCM} \ \mathsf{FB}/^{*} \ .\% \ \mathsf{E} \ \mathsf{G6+'} \ ./ \ , \ )^{'} \ / \ .- \ \mathsf{3} \ \mathsf{Hd}' \ \ \mathsf{3} \ \mathsf{7} \ ./ \ ./ \ ./ \ .- \ \mathsf{4} \ \mathsf{1} \ \mathsf{
                  ,@ A5- %%'()*+', -'.%P*+.-8.)+'%E8.%BCCMJP%
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                  , @ A5-96+'./, )'/.-3961' 3988' = 0 31988.91 MMMJP8
                  , @ A5-98+006.)+'98*-(-'.)+'98*36+'.*+0982'=0/396'396'/0-2196-600.)+'296MMMJ986'
                  , @ A5-961' 37) (01% -= 60'.) + '24% 24 = 0' 3\% 3\% /0-2 J 1% = 60'.) + '24 L MMLJ 18%
                 , @ A5-961' 37) CDM&' = 0' 3\% 3\% /0-2 J9%E, -'3, -'. J9%E-=60'.) +' 29%EMM/JR%
                 (@ G+' ./, )'/.-3\%1' 3\%2' = 0 3J\%K-=60.)+' 2\%LMBLJR%
                 ,@ "-/0.5% 3%/7.<%.%+*4%8.R%
```



ļ #, - DD"\$4&C)%*."&2*"56' (*8 \$6/"&\$": *"5\$CC\$8 *+"5\$6"6)./""...*.. (*%&")%"&2*"E F;"<2*"56' (*8 \$6/")."+".)9%*+"&\$": *"1\$%.).&*%&" $8\ \ |\&2\ "E\ F"C^*9).\ C'\&)\$\ \%"\ \%+"G\$\ C)1)^*.\ "]\%1C4+)\%9"GC'\ \%\%)\%9,""<2*".\&'\ 6\&)\%9"G\$)\%8"\$\$5"\&2*"6).\ /\ "'\ .\ .^*.\ .\ (\ ^*\%&")+*%&)5H"&2*"1\$\%&*1\&"\$5"$ $\&2^{*}"G6\$: C^{*}(""\%+"\&2*"\$:J^{*}1\&)B^{*}."\$5"\&2*"G6\$1^{*}...;""E\%+^{*}6"\#,-DD7"\&26^{*}*"\&)^{*}6."\$5"6)./""...^{*}...(*\%\&"^{*}1).\&"K"L6^{*}C)("\%'6H7"M^{*}\%^{*}6)1"...$

N 4' %&)&' &)B* "' %+"O * &')C* + "N 4' %&)&' &)B* ;""" P\$ 6(4 C' 8)%9" %+"+* B* C\$G)%9" "1\$ %1* G&4 ' C'(\$ + * C'\$\$ 6'82 * ".)&* "). " %")(G\$ 68' %8"6* 3 4)6* (* *%8"\$ 5'6). / " . . * . . (* *%87"82). ". 4 GG\$ 68. " 82*")+ * %8|5|1' &}\$ %"" %+"" . . * . . (* %&"\$ 5"G\$ Cl4 &' %&"C|%/ ' 9* . ;"O * B* C\$G(* %&"\$ 5"&2 * "1\$ %1* G&4 ' C'(\$ + * C*5\$ 6(. "&2 * "(')%"G' 6&"\$ 5" G6* C)()% 6H*6). / " . . * . . (* %87" %+ *82 * "(\$ + * C"). ". 4 : . * 3 4 * %8CH*6* 5)% * + "\$ 6"6* B). * + " . "(\$ 6* ")%5\$ 6(' &)\$ %" %+ "4 %+ * 6. & * %+)%9"). "

\$: &')%* + "&2 6\$ 4 92 "&2 * "6). / "' . . * . . (* %&"G6\$ 1* . . ;""

-)./")."" "1\$(:)%' &)\$%"\$5"&2*"C)/*C)2\$\$+"\$5"" %"*B*%&"\$11466)%9" %+"&2*"(' 9%)&4+*"\$5")&."1\$%. *34*%1*.;"<2*6*5\$6*7": \$&2"&2*"

<2*"6)./"' . . * . (*%&"G6\$1* . "%**+ . "&\$"&',*")%&\$"' 11\$4%&"&2*"+*96**"\$5"1\$%5)+*%1*"6*34)6*+")%"+*1).)\$%,;""@'%&)5)1' &)\$%"\$5" 4 %1* 6&')%&)* . "). "' %"* . . * %&)' C". &* G")%"6). / "' . . * . . (* %&;"

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- ST UVWX XW=""<2*6*").""G\$CC4&)\$%"C)%/'9*"'%+""%**B*%&"'GG*'6."B*6H"C)/*CH")%"&2*".2\$6&"&*6("%+"'C(\$.8")%*B)&::C*" \$B*6"&2 *"C\$ %9"&*6(7"\$ 6"&2 *6*"). "*B)+ *%1*"' &"&2 *"6*1*G&\$ 6"\$ 5"2 ' 6("\$ 6"G\$ CC4 &)\$ %Y"
- ST XZ="<2*6*").""G\$CC4&)\$%"C)%/'9*"%+"CC"&2*"*C*(*%&,"'6*"G6*.*%&""%+")%"&2*"6)92&"GC'1*7"82)12"(*'%.")&")."G6\$:':C*" &2' &" %" 8" %\8" (C'\$ 1146;""#)614 (. &' %1* ." 6* ". 4 12 "&2' &"&2 * "* B* %&"). "%\$ &")%* B)&' : C*7": 4 &"G\$...); C*")%"&2 * ". 2 \$6&"&* 6("" %+" C)/ * CH"\$ B* 6"&2 * "C\$ %9 "&* 6(Y"
- ST [X XW="<2*6*").""G\$CC4&)\$%"C)%/'9*"%+"1)614(.&'%1*."'6*"G\$..);C*"4%+*6"82)12"%"*B*%&"1\$4C+"\$1146;"" > \$8 *B*67")&").": H"%\$"(*' %."1*6&')%"*B*%"\$B*6"" "C\$%9*6"G*6)\$+".412"*B*%&"8 \$4C+"&'/*"GC' 1*7"" %+")."C*.."C)/*CH")%"&2*" . 2 \$ 6&"&*6(Y"
- ST \X XZ="<2*6*")."""G\$CC4&)\$%"C)%/"9*".4&"1)614(.&' %1*."'6*".412"&2'&")&").")(G6\$:':C*"&2*"*B*%&"8\$4C+"\$1146"*B*%")%" &2 * "C\$ %9"&* 6(;"
- <2*". *B*6)&H"). "' C\$"1C' . .)5)*+"4.)%9" ". H. &*(": ' . *+"\$%"#@@"#QQR;"<2*"&*6(. "' %+"+*5)%)&)\$%. "' 6*="
- ST] ^_=" 2\$6&" &*6("a' 14&*b"6)./"&\$"24(' %" 2*'C&2"C) /"CH" &\$"6*.4C&")%.)9%)5) 1'%"2'6(d"' ."+*5) %'+" : H"&2*"A%B) 6\$7%'%&" L6% & 18)\$ %"0 18"De ef 7"L '68"@9;"" 2 \$68K& 6("6). / "\$ 5"G\$ COL8)\$ %"\$ 5". * %.)&)B* "8 ' & 6"6*. \$ 461*.;"# ' &'. & 6\$ G2)1"+ ' (' 9* "8\$" : 4 | C+ |)%9. "\$ 6"G6\$ G* 6&H;""0 ". 2 \$ 6&K&* 6("6). / "&\$ "" "G' 6&)14 C'6"* 1\$. H. &* ("\$ 6"\$ 69' %). ("5\$ 6()%9"G' 6&"\$ 5"&2 ' &** 1\$. H. &* ("a%\$ &* " +*5)%)&)\$ %"\$ 5"*1\$. H. &*(")%"cO6' 5&"#)614 C'6"\$ %"# \$ %&' ()%' &*+ ", ' %+d7"OA<- "Rf f f bY""
 - ghij klm napoajrst ouvwunnuxyi xrvwnovzouvwxij rwi wuovwon(yzi unovzoynuymi xrvwoi ymi |oj i)vyonkrlli smovzouvwxij rwi wuovwon(yzi unovzoynuymi xrvwoi ymi |oj i)vyonkrlli smovzouvwxij rwi wuovwon(yzi unovzoynuymi xrvwoi ymi |oj i)vyonkrlli smovzouvwxij rwi wuovwon(yzi unovzoynuymi xrvwoi ymi |oj i)vyonkrlli smovzouvwxij rwi wuovwon(yzi unovzoynuymi xrvwoi ymi |oj i)vyonkrlli smovzouvwxij rwi wuovwon(yzi unovzoynuymi xrvwoi ymi |oj i)vyonkrlli smovzouvwxij rwi wuovwon(yzi unovzoynuymi xrvwoi ymi |oj i)vyonkrlli smovzouvwxij rwi wuovwon(yzi unovzoynuymi xrvwoi ymi |oj i)vyonkrlli smovzouvwxij rwi wuovwon(yzi unovzoynuymi xrvwoi ymi |oj i)vyonkrlli smovzouvwxij rwi wuovwon(yzi unovzoynuymi xrvwoi ymi |oj i)vyonkrlli smovzouvwxij rwi wuovwon(yzi unovzoynuymi xrvwoi ymi |oj i)vyonkrlli smovzouvwxij rwi wuovwon(yzi unovzoynuymi xrvwoi ymi |oj i)vyonkrlli smovzouvwxij rwi wuovwon(yzi unovzoynuymi xrvwoi ymi |oj i)vyonkrlli smovzouvwxij rwi wuovwon(yzi unovzoynuymi xrvwoi ymi |oj i)vyonkrlli smovzouvxii rwi wuovwon(yzi unovzoynuymi xrvwoi ymi |oj i)vyonkrlli smovzouvxii rwi wuovwon(yzi unovzoynuymi xrvwoi ymi |oj i)vyonkrlli smovzouvxii |oj i nrxm orvxvouvvxyvIlm ~ oi xnyn onthklvnrvwoui (nrw sof (rl~rw soxvouvIII knm • o
- ST, f = "#2 68%) 1" + '('9*" &\$"24('%' 2 *' &22" ac.) 9%5) 1'9\$2' 6(d"'. "‡5)%' +') % Qx-" Fiffb; ""L\$Q3 &) \$%\$5".*9\$&) B"8 &%" 6*. \$461*.;"0".)9%}\$1' 9&12' 99*")% "G 6&14C 6*"1\$. H &("\$6\$69' %).("5\$6()%'G 6&\$5&2' &"1\$. H &("26\$6"+*5)%\$\$%" \$5*1\$. H&(')%O65&#)614C6'\$%#\$%&()%&+",' %+d**T**OA:-"Pfffb**Y**
 - ghij klm nço vwunnavyi xrvwnozouvwxij rwi wanothum m-oxt mosmvnyruci mmnj mwozuyxnyri |ohni utrvisovzouvwxij rwi wanozyj oʻo $\text{nrxmox} \text{ of of yrverki lavyof meav} \text{w-i y of this frzm y o-nin xt or zonkmem no-nt swith o-nn rswith xm-oxit x (y nognamny model)} \text{ or zonkmem no-nt swith xm-oxit x (y nognamn$
- ST, X="L\$OC4\\$\$%\$5" %8%. *%) &\B'8' & *6'6*.\$461*.; "`)9%5)1%\"+'('9 *"&\$"16\$G7":4\)C\}99 7".&64846*."'%". *6\B1*." ac)9%\$1' %&2' 6(d'."+*5)%+")%@65&#)614C6'\$%#\$%&()%&+",' %-dOA<-"Rfffb"O' ('9*"&\$".*%)&B":4)\(\)9\%.7 . 8641846*. 7. *6B)1*. "\$6'82*'* %B)6\$% *%8Y"
- ST,_="26(7"%\$&%1"..'6)CH.)9%5) 1%32'6(7"8 212"('H 6*.40&')%5 %%5)' C'C\$."\$6"*IG%) &46" &\$"6*.\$DB*;"• \$%6. G'6('%%&'2*'\&2"*\\$51&"\\$\$"24('%'2*'\&2"a*'.)\&T\G6B*\&4+": H'4.*"\\$5G*6.\\$%\C6\$&1\&B"1\\$\&)\%"*&I\\$A'.)\&T 6*G)6: C"*55*1&"\$5"+'('9*"\$\$":4)G)%9.7.8641846*. " %+".*6B)1*.;"



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× × × × × × × × × × × × × × × × × × ×	dHf FVT_KVTHHSF	b 892≓ 32.	b 892≓ 3 c B D.	e8D.	`2⇒.\BD.					
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 $j = 2 \times 60 \times 600$; $.8k \times 342 = 67.1$; $.22 \times 6029$, $.873 \cdot 6029$, $k = 8 \cdot 60.342$; $.78 < 2.3 \cdot 75$.; $.=2.1 \cdot 1.1$; $.185 \times 100$; $.38 \times 100$;

no pKQFTJ ^mq42=2.6, :. .46B4.r =8?: ?655>.34: 3;2<2=2.4: =@.18C59.: =62.38:: .92;650: 329.=212r 38=k8@.: 0.692036629.4: s: =9. 8=342=2.6, .2<692012.34: 3;2<2=2.4: =@.6, .1C==2035>.4: r r 2060BEq46, -6,7 Adx =2: 5629A18C59.=2;C53.60.; C?;3: 036556;?656>E t =B203.60<2;36B 3680.: 09.=2@296360.: =2.56725>.38.?2.=21 C629u

no \ \P ^ma: =@.6.55/25-.83.: =62.33.: .92; 650: 329.=212r 33=k=8@.: 0.692036629.4: s: =9Ev2: 55: 3680.8k 342.=67.6.56/25-.38. r=2;203: .; C?; 3 036.556?655 Et =E203.60<2; 368.3680.6.=2I C629.: 09.=2@296.5D8=7;.@: >.?2.0212; ;: \Rightarrow .60.342.; 48=3 32=@.: 09.: =2.55/25-.8<2=.342.50B2=32=@u

no R HSkCYZkmw&6.r 8;; &f5.34; 34: =@.18C59.; =6.2.38.; .92; &60: 329.=212r 38=k=8@.; 0.69203&629.4; s:=9E.a8D2<2=A66.6. 2642==253&25.C056725.34; 3:0>.; C14.4; =@.D8C59.?2.; 2<2=2A8=&c:0>.4; =@.D2=2.38.811C=6cD8C59.?2.@8=2.56725.38. ?2.=253&25.@659Exv0<2; 36B 3680.6.08=@:55.=21 C6=29.38.15=&c.342.=67.; 09.9232=@62.342.56? 6665>Ex8@2.=2@296.5 D8=7; @:>.?2.=21 C6=29.60.342.80B 2=32=@u

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x8@2.567; B2; @:>.?2. 692036629. D4614. 180; 363C32; . : . 3428=2361:51800213680. ?23D220. : .; 8C=12. : 09. : . =212r 38=A?C3 r=8L2;; 680: 5yC9B2@203; 48D; .342@.083.38.?2.r 8;; 6752.k8=; 8@2.=2:; 80E..q42; 2.: =2.5 ?25529.208.5607: B2{.60.342.; C@@: \Rightarrow . 3 ?52.: 09.08.kC=342=: 13680.6.=21 C6=29E.



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-& ./F<		0 120	; 95	::5	8855	4: 5	8355	; 355	465	8: 55	3; 55	465	8: 55	3; 55	465	8: 55	3; 55
-& ./@	<	0 120	; 85	: 85	8855	3555	. 455	6555	9. 555	74555	855555	8: 555	8: 555	8: 555	; 7555	35555	35555
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88ms q 8Ap 4= AA3 AA; 3 6 <A 4<: 4B 3; : 6 A <9D <3 4<2 D <4<2 3 4A8<3 4B: 3 A46: <4V 93 A3 6 <4D 645 67 89: 6; 3 6 <D R4! D D D 9B III4
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87ms n D <3 98D RA4n D 6 D > 3; 3 6 <4| RD6 4ln n j m4C 2 872 4B3 < D 8RA4; D <3 98D R4> 3 6 3 9D <3 B 4A<: ?pV 8R3 A 4D 6 B 4<2 3 43 6 B 4 S A 3 114
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 - CD E 2<5 42>1>085==2 8126F6 > 035 026 5 < 54 4285: 2426G
 - CD 15 x62 @1 x: 1 928 5 @4 5 = 01 9/1/3 3 =: 15 1 92 H5: 2H2 @15 < 1 9 2 ? / 012 G
 - CD 15 85H3 = 212?/0 1 265 87H2@1 0 / @42 8 5 460 G
 - CD 15 >62 @1 ><;07>1 /E=; /7195 4> 0 26?/ 0 12 H/@/ A2 H2 @15 3 1 > 5@0 G
 - CD 15342:2@19/4H15 3253=2/@61922@:>45@H2@1G

- K GD L >0.3 5 0 / =15 / 32 4H > 11 26? / 0 12 4 28; 8=> @A < /8> = >1; G
- RGD L >03 5 0/ =15/ =/ @6x > = =0>12G

1926>0350/=15/324H>112 6</8>=>1;?>==E20 7EP28115192S T US"V"U TWTXY/@6

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- CD n/@6<>==0/428=/00><>26/88546>@A15?921924192;8/@88231Ut"TXF uUt"TX54 "?/0120G
- CD . /01208/@5@; E/8823126/ 1/=/@>><1921521192?/01 2/88231/@8284\$124>/ OqnQ2549718=/00 5< \$406<\text{\$\sigma\$}
- CD v 5017 0120H0 1E2142/126E2<542; 578@02@6192H5=/ @>>= =G
- CD | 19242/42 < 5H/= 3 5B 20020 < 54 × 62 @> <; > @A@B 928 w> @P/012019 | 1 H701E2 < 5 = 5 ? 26E2 < 542 701 208 @P2 /8823126/1/#@> > = 070E5

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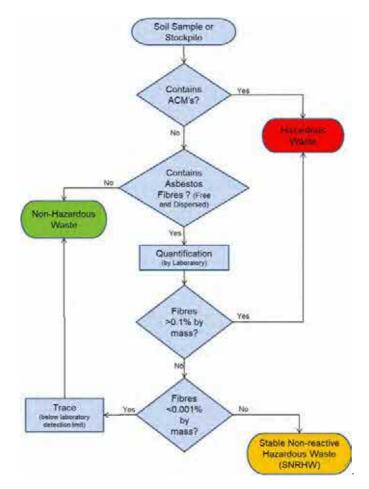
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+, -./01.234456.57.8 9:.; < = 4\$>6?-.56.1, -.?@00474>1456.>63.>00-00A-61.57.B>01-003-1>4021, -.B>E.46.B, 42, .F0G-0150.40.>00-00-3.B41.46.054021.

+, -.>00-00A - 6157.>0G-0150.?561>**646**I.B>0I-.**4**03-J-63-6156.B, -1, - K1, -.>0G-0150.**4**0.JK 0-61>0 L MN OGK0.1, >1>K-.7K-.>63.340J-K0-3D5K..

MN B-61474 G@.J4?-0.57.>0 G-0150?561 > **646** I.A > 1 K4> **Q Q R** 9 **S**)T.



 $\begin{array}{l} \textbf{P3-61474G@.J4?-057.} 0 & \textbf{G-01500.} \text{K-.} \cdot \text{SE.J} > \textbf{N4.2.} @57. > 0.4 \textbf{J.1} > 1? \cdot \text{S6.G-.48-61474} & 3. > 0. \textbf{J51-614-} @G-.461. > 0.6 -0.150 \text{GE.>} \cdot ?5A \ \textbf{J-1-61.} \\ \textbf{J-N056.47.-V>A.46-3.GE.1, -.6>W-3.-E-H.+, -.K-0= @40.1, > 1? 5A \ A 56 @0 5 4 @B 41, .X40 G @FR9 $0. \text{K-.05 K1-3.>} 63.1, -.FR9 $0. K A 5X-3.GE., > 63. \textbf{J4.2.} & 4. 3. 4 \ 0.5 \ 0.5 \ 0.7 \ 0.8 \ 0.7 \ 0.8 \ 0.7 \ 0.8 \ 0.7 \ 0.8 \ 0.8 \ 0.8 \ 0.7 \ 0.8 \ 0$

 $FOG-0150?56?-61\colored{C} 1860.G- \colored{G} B.YHYY/Z.GE.A > 00 > K-.G- \colored{G} B.01 > 63 > K 3. @35K > 15 KE.3-1-?1566. \colored{G} 40 > 63. > K-.651.?=K K 61@ K-1 > 16. - 16.$

 $\begin{array}{l} FOG-0150?56?-61\&-1660.G-1B--6.YHYY/Z.>63.YHZ.>K-.01>G@.656[K->?14X-.,>U-k35=0.B>01-.0], \\ ^2 FHB>01-.1&60.F, \\ 01>1660.B,-&k.054@k?F?@6I.1>W0.J@?-.A>E.G-.>G@.15.1>W.\] \\ ^2 BDG=1.>K-.=6@W @.15.1>W.054@2?561>646I.>0G-0150>G5X-.1&?-.?56?-61&-1660.H. \\ \end{array}$

+, -.75 @B 461.?53-0.0, 5= @G-.>004 6-3.15.1, -.>0 G-0150 B>01-.>0.>J J K5 J K4>1 L.

<u>• </u>	
`aloc.	d efg!h!f !ef.
/i .Yj .Y/.	P60=@166.A>1 K4>@?561>6461.>0 G-0150
/i .Yj .Y: .	k 1, - K 460=@1456.A > 1 K4> @2?560 401461 .575K .?561> 46461 ., > U+185=0 .0+G0 1>6?- 0.
/i .Yj .Yl .	P60=@166.A > 1 K4 @51, - K1, >6.1, 50 .A - 61456- 3.46./i .Yj .Y/.>63./i .Yj .Y:
/i .Yj .Ym.	R5601K=?1456.A > 1 K4>@561> 461.>0G-0150.

89:. 434 > 1-0.1 > 1/i.Yj.Ym.B5 = @65KA > @G-.: 0-3.46.JK7K6?-.15./i.Yj.Y/.75K1-.> 0G-0150.4.> 0G-0150.7561 > A46 > 1-3.054 @63.0156-0H



!"#\$%&'()*+,- &./0(*1.&()-.0+23" #4 # #4 4567# 8#8669#4 :;86!<

=6686 367#"46""#>#4 #4 45 67#8> #4 6 3>"8#6" <=69#4 :;?6" 5;67#86 "#>#86"#!#" 8@4A> ! B66 #8B>><<C#68>#86 DAEE<

F%+8), H&%**
I 6#J43KA; KC!#"# 3 # #646!#4
6; 4"4" #! <=6;6!!6 4D"L! MNOMC<
I8;868P; P 3; C86"6DLMNOMPP
#!86668P #4" 5 #8P#3?D"Q!
R <SP"4" 4##66 #"A##<
T84 #4? 36; 6"#6>4"###86
6A4B> 3!#8P<=6A>4#64A;#
>; #6>" 344""!"<I8;!#>
!##> 3#>> !# 46>4"<
=6! 4"N<04U;46>#<=6 V+.W(X;#
A>48P;;;!""##4" 86 >" <
366!666 6!> 644"" #B68;EYQ
>" =QUZZUO[\$6 4#>#"4"4" 20\ZZ#6]

- ^_ QA4"#3 86" 8N<NNO`>#">" "!6N<O4U # #866>" # &a! U b<
- ^_ D ##46!66N<NNO`"";866>6 #"P &"4 "@" 38! Q
- ^_ =6##4;3?@N`C48#6"4""3 #4#<

\$6"6"#4#";N<NNO`4##>#4"6 > #"#>#<" 86##" "P!#B 6!6!#> #66!4#6 #";###6434!;4" 4 6 #"P>> < $cGd^*e+(*$ =64!"#!">6"##Kf!<=6 3gE#3SP!h>@EShCP#86>#!#4R4D"J BQ# h##i: Q 68 43#6>46;!; ! < D"! #" ;38663"6#4!4 #>!@6866##! 3#PC< =6P643>63## 46>4"6 #" P>6I 6#J43j < R 3>" 4gESh@D> NMOaC>;#!#4#P! <=6 \$T2!#46>" 8 ">;###< =6548 6 #"#P#8669]DELK#4R#"k" P#! 8P<=66!6>4 3A #654 !" 4 ; <18;6;4 6P44""!"#" >8 "?#< =654 !"";67#8; P 386! 3 >><D!" !3 #"!#68 #P#" 4# 3 P 3 "4" 866 !>!4> <

Ι



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