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SUB SURFACE
Site Investigation Specialists,
Geotechnical & Environmental Consultants

GROUND INVESTIGATION REPORT

FOR
FORMER ROYAL MAIL SORTING OFFICE,
THE CRESCENT,
SPALDING,
PE11 1SL

PREPARED FOR
KARAVAN HOLDINGS LTD

REPORT NO. M3654A
JUNE 2023



SUB SURFACE MIDLANDS LIMITED
28 Brook House
Brook Street Business Centre
Brook Street
Tipton
West Midlands
DY4 9DD
Tel: (0121) 5208538 Fax: (0121) 5203878
Email: midlands@subsurface.co.uk
Website: www.subsurface.co.uk

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Sub Surface Midlands Limited
28 Brook House, Brook Street Business Centre, Brook Street, Tipton, West Midlands, DY4 9DD
Tel: 0121 5208538 Fax: 0121 5203878 Email: midlands@subsurface.co.uk

GROUND INVESTIGATION FOR FORMER ROYAL MAIL SORTING OFFICE, THE CRESCENT, SPALDING, PE11 1SL

CLIENT: KARAVAN HOLDINGS LTD

ARCHITECT: DESIGN STUDIO ARCHITECTS

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1. INTRODUCTION

This report has been prepared in accordance with an email, dated 24th March 2023, from the Architect on behalf of the Client.

The brief was set out in our estimate, ref. EM6012A and dated 24th March 2023, with amendments as the investigation proceeded and includes:

- 5 No. mini boreholes
- Insitu testing
- Geotechnical laboratory testing
- Contamination analysis
- Installation of standpipes followed by groundwater monitoring
- Provision of an interpretative report on the above.

It should be noted that we have previously issued a Phase I Desk Study Report for this site, ref. M3654 and dated October 2022, which should be read in conjunction with this Phase II Ground Investigation Report.

1.1 Site Location and Description

The site is located at the Former Royal Mail Sorting Office, The Crescent, Spalding, PE11 1SL, as indicated on Figure 1. The approximate National Grid Reference of the centre of the site is 524626E 322572N.

As shown on Figure 2, the about 0.11 hectare approximately rectangular shaped site is bounded by The Crescent to the northeast, Spring Gardens to the southeast, an overgrown flat car parking area to the southwest, and a building to the northwest. The site consists of a two-storey former Royer Mail sorting office, with warehouse space, a flat roof, a service yard and limited outside parking.

1.2 Proposed Development and Purpose of the Ground Investigation

We understand that it is proposed to refurbish the sorting office, with some minor extensions, into retail space on the ground floor and apartments on the upper floors, as shown on Figure 3.

The purpose of the investigation was to determine the ground conditions at the positions of the exploratory holes, to assess the likelihood of a general pattern of strata being present below the site and to establish the load bearing characteristics of the strata deriving, if possible, an assessment of the suitability of appropriate founding techniques.

In addition contamination analysis and assessment was required in order to determine necessary precautions and/or remedial measures required for the proposed development and to ascertain the need for any further sampling and analysis.

Sub Surface Midlands Limited
28 Brook House, Brook Street Business Centre, Brook Street, Tipton, West Midlands, DY4 9DD
Tel: 0121 5208538 Fax: 0121 5203878 Email: midlands@subsurface.co.uk

2. INVESTIGATION

2.1 Investigation Details

Five mini boreholes were put down to depths of between 1.42m and 5.45m using a Mini Sampling Rig fitted with windowless sample tubes of 86mm to 56mm diameter at the positions determined and set out by Sub Surface Midlands Limited, as shown on Figure 4. The samples were subsequently logged in accordance with BS.5930:2015+A1:2020 and the resulting Mini Borehole Records are appended. On completion M3 and M4 were backfilled with gravel as no installations were required.

2.2 Sub Surface Detail

Details of the strata encountered in the ground investigation are given on the appended Mini Borehole Records. The exploratory holes generally found Made Ground comprising layers of sand, gravel, clay and silt to depths of 5.00m and 5.45m, overlying brown very silty fine sand recorded below 5.00m in M2 and M5 (recorded as loose in M2 and medium dense in M5).

A general summary of the strata found is as follows:

2.2.1 Made Ground

Made ground was recorded in all exploratory holes. M1 recorded made ground to the base of the exploratory hole at 5.45m and M2 and M5 both recorded made ground to a depth of 5.00m (possibly natural in M5 below 4.00m). M3 and M4 recorded made ground to 1.42m and 1.43m respectively, at which depths the boreholes were terminated due to bricks preventing further progress.

Bituminous macadam was recorded to 0.20m in M1 and concrete was recorded to 0.17m in M2, M3 and M4, and to 0.25m in M5. The made ground then generally consisted of layers of sand, gravel and clay, with some layers of silt recorded in M5.

M3 and M4 both generally recorded fine to coarse gravel sized fragments of brick and stone, with metal in M3 and concrete in M4, to 0.50m and 0.40m respectively, overlying gravelly to very gravelly fine to coarse sand. M4 also recorded very sandy fine to coarse gravel sized fragments of stone between 0.60m and 0.70m, recorded as a possible pea gravel drain.

M1, M2 and M5 generally recorded layers of sand and gravel to between 1.00m and 1.30m, overlying clay to 2.00m in M1 and 2.15m in M5. M2 recorded friable brown very sandy silty clay to 1.40m, overlying sandy fine to coarse gravel sized fragments of brick with some pockets of clay and sand to 1.80m, overlying slightly gravelly silty clay to 1.95m.

M1 then recorded layers of sand and clay to 5.45m, with fine sand recorded below 5.00m. M2 recorded layers of gravel, sand and clay to 3.00m, overlying fine sand to 5.00m. M5 recorded silt to 2.70m, overlying clay to 3.00m then silt to 4.00m, overlying fine sand to 5.00m (possibly natural).

2.2.2 Drift Deposits

Brown very silty fine sand was recorded below 5.00m in both M2 and M5, recorded as loose in M2 and medium dense in M5.

Sub Surface Midlands Limited
28 Brook House, Brook Street Business Centre, Brook Street, Tipton, West Midlands, DY4 9DD
Tel: 0121 5208538 Fax: 0121 5203878 Email: midlands@subsurface.co.uk

2.2.3 Groundwater

Groundwater inflows were recorded in M1, M2 and M5 at 3.00m depth. It should be noted that groundwater levels and rates of inflow may be subject to seasonal and/ or climatic variations.

Monitoring of standpipes installed in M1, M2 and M5 on two scheduled visits, on 10th May 2023 and 15th June 2023, found no groundwater in any of the exploratory holes.

3. SAMPLING, TESTING AND MONITORING

3.1 Sampling

Continuous core, small disturbed and bulk disturbed samples were obtained for the strata encountered and were subjected to careful examination.

The samples will be retained for a period of one month after the issue of this report, for reference purposes, and then disposed of unless otherwise instructed.

3.2 Field Testing

Sixteen Standard Penetration Tests (SPTs) were performed in the mini boreholes, the results of which are recorded on the appended Standard Penetration Test Results Sheet with 'N' values and indicative relative density and shear strength, where appropriate, given on the Mini Borehole Records.

3.3 Installations and Monitoring

On completion of M1, M2 and M5 hdpe standpipes were installed to depths of 3.50m, 4.00m, and 5.00m respectively. The standpipes are slotted from 0.50m in M1 and 1.00m in M2 and M5, have an internal diameter of 50mm and have removable quick release gas valves to enable groundwater monitoring and sampling to be undertaken. Details of the installations are given on the Mini Borehole Records.

Monitoring of the standpipes for groundwater has been undertaken on two scheduled occasions using portable equipment. The results of the monitoring is given on the appended Groundwater Monitoring Results sheet.

3.4 Laboratory Testing

The following laboratory tests were carried out in accordance with BS.1377: 1990, where applicable, and the results are appended.

- Moisture content
- Particle size distribution by wet sieve analysis
- Soluble sulphate content and pH value tests.

Sub Surface Midlands Limited
28 Brook House, Brook Street Business Centre, Brook Street, Tipton, West Midlands, DY4 9DD
Tel: 0121 5208538 Fax: 0121 5203878 Email: midlands@subsurface.co.uk

Contamination analyses have been performed on five soil samples to determine: pH and concentrations of sulphate, sulphide, cyanide, arsenic, boron (soluble), cadmium, chromium, hexavalent chromium, copper, lead, mercury, molybdenum, nickel, selenium, zinc, speciated total petroleum hydrocarbons (TPHs), the speciated polynuclear aromatic hydrocarbons (PAHs) suite, the benzene/ ethylbenzene/ toluene/ xylene (BTEX) suite and phenols. In addition the five soil samples were subjected to an asbestos screen. Where asbestos was detected by the screen, asbestos type and detection was undertaken for three soil samples.

The results of the above analyses are appended.

4. APPRAISAL AND RECOMMENDATIONS

4.1 Comments on the Profile

At the outset it should be appreciated that only a small proportion of the area to be developed has been investigated and consequently the recommendations made and opinions expressed in this report can only be applied to such conditions as were encountered in the exploratory holes.

The exploratory holes indicate a nature and degree of similarity to the extent that we consider them likely to be representative of the natural ground conditions. However, no guarantee can be given.

Details of the findings of the investigation are given on the appended Mini Borehole Records and a summary of the ground conditions is given in Section 2.2.

4.2 Foundations

We understand that it is proposed to refurbish the sorting office, with some minor extensions, into retail space on the ground floor and apartments on the upper floors. However, at the time of writing this report no specific details regarding the proposed foundations and design loadings were available and consequently the recommendations given are in general terms only.

The ground investigation generally found Made Ground comprising layers of sand, gravel, clay and silt to depths of 5.00m and 5.45m, overlying brown very silty fine sand recorded below 5.00m in M2 and M5 (recorded as loose in M2 and medium dense in M5).

We would not recommend founding in the Made Ground in its present condition because of its inherent variability in consistency and compaction, and in parts the nature of its constituents.

In view of the depth of Made Ground shallow foundations in natural ground are not feasible and hence we recommend using piled foundations. For piled foundations, we would recommend cable percussive boreholes are carried out to assess the ground conditions at depth and obtain parameters for a pile design.

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28 Brook House, Brook Street Business Centre, Brook Street, Tipton, West Midlands, DY4 9DD
Tel: 0121 5208538 Fax: 0121 5203878 Email: midlands@subsurface.co.uk

With regard to the choice of pile type, consideration could be given to driven piles, continuous flight auger (CFA) piles or cast in-situ bored piles with the driven pile option probably being the most economical. However, in considering piles driven to a pre-determined set in the more competent strata at depth, it is essential to ensure that any vibrations set up during the driving process are not transmitted to adjacent/ nearby buildings, structures, services and/or slopes/ retaining walls as they may be detrimentally affected. Consequently, in respect of driven piles, we recommend that any tendering Specialist Piling Contractor confirm that vibrations will not detrimentally affect adjacent/ nearby buildings, structures, services and/or slopes/ retaining walls. If such confirmation cannot be given, as is likely in this case, then we would recommend using either CFA or cast in-situ bored piles.

Care must be taken to space the piles in any group to ensure the adequate utilisation of skin friction where this has been assumed in the calculation of the load bearing capacity of an individual pile. Checks must also be undertaken to confirm that the underlying ground supporting the pile group is not overstressed.

In determining the final pile design it should be noted that up to around 5.45m of the piles will be in Made Ground and due regard should be paid to the lack of lateral restraint over this length in cases where significant lateral forces are to be catered for.

To formulate the most satisfactory and economic scheme we recommend that competitive tenders and designs from Specialist Piling Contractors should be sought using the exploratory hole information obtained.

We recommend that a flexible joint is provided between the existing building and proposed extensions to allow for differential movement.

4.3 Floor Slab Construction

With regard to the design and construction of normal ground bearing floor slabs, it should be noted that due to the thickness of Made Ground there will be a risk of significant total and differential settlements, the extent of which will be a matter of chance rather than being assessable by calculation.

To obviate any significant damaging settlements we would recommend using a suspended floor slab with intermediate support designed on the same basis as the main foundations where the spans are too large for economical single suspended slab design.

4.4 Excavations and Groundwater

There should be no particular difficulties in excavating the strata indicated in the exploratory holes utilising an appropriate and suitably sized mechanical excavator. However, any concrete and bituminous macadam surfacing and the brick obstructions in M3 and M4 will need to be broken out prior to excavation.

It is recommended that all excavations to greater than 1.20m depth, or for shallower excavations where groundwater is encountered above this level, are closely supported, especially where man entry is required. Alternatively, where space permits, the excavations might be battered back to an appropriate angle.

Groundwater inflows were recorded in M1, M2 and M5 at 3.00m depth. It should be noted that groundwater levels and rates of inflow may be subject to seasonal and/ or climatic variations.

Sub Surface Midlands Limited
28 Brook House, Brook Street Business Centre, Brook Street, Tipton, West Midlands, DY4 9DD
Tel: 0121 5208538 Fax: 0121 5203878 Email: midlands@subsurface.co.uk

Monitoring of standpipes installed in M1, M2 and M5 on two scheduled visits, on 10th May 2023 and 15th June 2023, found no groundwater in any of the exploratory holes.

Should groundwater seepages occur and water accumulate in shallow excavations it should be able to be removed by pumping from a filtered sump.

4.5 Buried Concrete

For the design of buried concrete the recommendations given in Building Research Establishment (BRE) Special Digest 1 (February 2017 revision), "Concrete in Aggressive Ground", should be followed.

Determination of pH on the soil samples gave values in the range of 9.2 to 11.7 (alkaline).

Soluble sulphate concentrations were also determined for the soil samples and the results ranged from 0.36 to 1.3 g/l.

The results indicate that the Design Sulphate Class for the site should be DS-2.

Our knowledge of the site and ground conditions indicates that the site is "brownfield" with potentially mobile groundwater. Consequently, in accordance with the Design Sulphate Class for the site together with the site and groundwater conditions an Aggressive Chemical Environment for Concrete (ACEC) classification of AC-2 should be used as detailed on the appended extract.

4.6 Contamination Considerations

At the outset it should be noted that this contamination investigation is a baseline survey in order to provide a contamination risk assessment. Based upon the findings additional sampling, analysis and assessment may be required.

We have previously undertaken a Phase I Report, ref. M3654 and dated October 2022 and this Phase II ground investigation has been undertaken to provide an initial contamination risk assessment in accordance with the Phase I Conceptual Ground Model. Based upon the findings of the above additional sampling, analysis and assessment may be required.

It should be appreciated that the suite of determinants analysed for consists of a range of contaminants identified in the Conceptual Ground Model. However, the absence of any other specific contaminants cannot be guaranteed.

4.6.1 Assessment (Soil)

In order to provide an assessment of the presence of contamination five soil samples have been analysed for a suite of determinants and the results are appended.

Sub Surface Midlands Limited
28 Brook House, Brook Street Business Centre, Brook Street, Tipton, West Midlands, DY4 9DD
Tel: 0121 5208538 Fax: 0121 5203878 Email: midlands@subsurface.co.uk

Levels of the determinants have been compared against the most recently published guideline values. Contaminated Land: Applications in Real Environments (CL:AIRE) published guideline values in December 2009 to supplement previous guideline values. The Department for Environment, Food and Rural Affairs (DEFRA) published in March 2014 Category 4 Screening Levels (C4SLs) for arsenic, cadmium, lead, hexavalent chromium, benzo(a)pyrene and benzene. Land Quality Management Limited (LQM)/ Chartered Institute of Environmental Health (CIEH) then published Suitable for Use Levels (S4ULs) in November 2014, which largely superseded the previous guideline values. Updated S4ULs values for cadmium and phenols were published in July 2015 and for nickel in August 2015. The guideline values (S4ULs and occasionally C4SLs and CL:AIRE) are derived using the Environment Agency's CLEA Model and vary dependent upon the land use; allotment and residential use being the most sensitive and commercial/ industrial use being the least sensitive.

For the purposes of assessment, as the proposed development is to refurbish the sorting office into retail space on the ground floor and apartments on the upper floors, contamination analyses have been compared with the guideline values for a standard land use of residential without plant uptake (without homegrown produce).

Except for elevated levels of sulphate (total), the contamination analysis determined no elevated levels of the determinants analysed for when compared with the guideline values for a standard land use of residential without plant uptake (without homegrown produce). Guideline values for the assessment can be supplied directly to the Regulator, if requested.

An asbestos screen was undertaken on five soil samples and asbestos was detected in three samples. Analysis determined that white (chrysotile) asbestos was present as fibre bundles in M1 at 0.20m and M3 at 0.50m, and white (chrysotile) asbestos was present in microscopic insulation debris in M5 at 0.50m. Asbestos quantification from detailed gravimetric analysis recorded <0.001% in the sample from M3, 0.001% in the sample from M5, and 0.004% in the sample from M1.

4.6.2 Conclusions and Recommendations

Section 78a(2) of the Environmental Protection Act: 1990 as amended by the Contaminated Land (England) (Amendment) regulations 2012, and Section 86 of the Water Act 2003, defines CONTAMINATED LAND for the purposes of Part IIA as:

"any land which appears to the LOCAL AUTHORITY in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that:

(a) SIGNIFICANT HARM is being caused or there is a SIGNIFICANT POSSIBILITY of such harm being caused; or
(b) SIGNIFICANT POLLUTION OF CONTROLLED WATERS is being, or is likely to be, caused"

Before a LOCAL AUTHORITY can make the judgement that land appears to be CONTAMINATED LAND on the basis that SIGNIFICANT HARM is being caused, or that there is a SIGNIFICANT POSSIBILITY of such harm being caused, the LOCAL AUTHORITY must identify a SIGNIFICANT POLLUTANT LINKAGE. This means that each of the following has to be identified:

Sub Surface Midlands Limited
28 Brook House, Brook Street Business Centre, Brook Street, Tipton, West Midlands, DY4 9DD
Tel: 0121 5208538 Fax: 0121 5203878 Email: midlands@subsurface.co.uk

(a) a CONTAMINANT;
(b) a relevant RECEPTOR (defined as living organisms, ecological systems, controlled waters or property); and
(c) a PATHWAY by means of which either:
  (i) the CONTAMINANT is causing SIGNIFICANT HARM to that RECEPTOR, or
  (ii) there is a SIGNIFICANT POSSIBILITY of such harm being caused by that CONTAMINANT to that RECEPTOR

It should be noted that the words in capitals have a legal definition within the legislation.

Without a clear identification of all three elements of the pollutant linkage, land cannot be identified as contaminated under the regime.

The National Planning Policy Framework states that, “after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990”. Therefore, the general principles detailed above apply to this assessment.

Our assessment, based on five soil samples, indicates the presence of asbestos and elevated levels of sulphate (total) in the near surface Made Ground/ soils (source). The pathway from the source to site operatives during earthworks, the end users of the development and any proposed planting (receptors) will need to be removed by precautions and/ or remedial measures.

Where the contaminated materials are covered by buildings or a hard surface cover of concrete or bituminous macadam no clean cover will be required. As no soft landscaping is proposed for the development, and given the low levels of asbestos fibres recorded on the site, we consider that no other surface protection will be necessary. However, we recommend that site workers wear FFP3 masks during earthworks and if any significant volumes of asbestos is encountered work should be stopped and further advice sought from a specialist asbestos removal company.

If landscaped/planted borders and open space areas are involved in the development we recommend that a 450mm blanket of imported clean topsoil/ subsoil should be placed to protect the end users of the development and to provide a medium in which plants may grow unhindered. In addition trees and bushes, due to their deeper root system, should be pit planted on and in clean topsoil. A geotextile membrane should also be placed at the base of the cover layer to provide a barrier to any soils containing asbestos fibres.

Contaminated materials should, where possible, be retained on site. However, it should be appreciated that contaminated material left on site is the legal responsibility of the landowner, unless the person who created the contamination can be identified.

If waste materials are to be removed from the site, classification of the waste should be undertaken to determine the most appropriate tip to use and the associated costs. It should be noted that significant cost savings can sometimes be made on waste disposal by correct classification of the waste, a service that we can provide.

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28 Brook House, Brook Street Business Centre, Brook Street, Tipton, West Midlands, DY4 9DD
Tel: 0121 5208538 Fax: 0121 5203878 Email: midlands@subsurface.co.uk

S4ULs, C4SLs and CL:AIRE assume long term contact with contamination and assess chronic health risk. The risk of short term acute exposure to site personnel is dealt with in the remit of the Health and Safety Executive under the Health and Safety at Work Act: 1974 and Regulations made under the Act, including the Control of Substances Hazardous to Health (COSHH) Regulations and the Control of Asbestos Regulations (CAR 2012). The levels of contamination and risk to site personnel should be considered under the Construction Design and Management (CDM) Regulations at the planning stage and in the development of the designers and contractors Health and Safety Plans and Method Statements. The risk of contact with on-site soils should be minimised and site personnel involved in earthworks and excavations should wear suitable asbestos grade personal protective equipment (PPE).

Earthworks undertaken during dry weather might generate dust and in this instance dust should be damped down and dust masks made available to site operatives. In addition stockpiled materials should be sheeted over to prevent excessive airborne dust being formed.

4.7 General

It should be noted that we have made recommendations for further investigation in Section 4.2 to carry out cable percussive boreholes to assess the ground conditions at depth and obtain parameters for a pile design.

We recommend that consultation should be undertaken with, and the written approval obtained from, the Local Authority Environmental Health Officer and the Local Authority Building Control Officer prior to commencing development.

We trust that this report fulfils your present requirements but if you have any queries or we can be of further assistance please contact the undersigned or Mr Gurbinder Singh Mann at our Tipton office.

SUB SURFACE CONSULTANTS LIMITED
REPORT No. M3654A
JUNE 2023

J. Hawkrigg

J. M. Hawkrigg M.Earth.Sc. (Hons.)
Geotechnical Engineer
For and on behalf of
Sub Surface Consultants Limited

C. A. Marsden B.Sc.(Hons.), C.Eng., M.I.C.E.
Director
For and on behalf of
Sub Surface Consultants Limited.

Sub Surface Midlands Limited
28 Brook House, Brook Street Business Centre, Brook Street, Tipton, West Midlands, DY4 9DD
Tel: 0121 5208538 Fax: 0121 5203878 Email: midlands@subsurface.co.uk

INSITU TEST RESULTS

SUB SURFACE
SITE INVESTIGATION, GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907

Standard Penetration Test Results

Site : FORMER ROYAL MAIL SORTING OFFICE, THE CRESCENT, SPALDING, PE11 1SL

Client : KARAVAN HOLDINGS LIMITED

Engineer : DESIGN STUDIO ARCHITECTS

Job Number M3654A

Sheet 1 / 1

Borehole Number	Base of Borehole (m)	End of Seating Drive (m)	End of Test Drive (m)	Test Type	Seating Blows per 75mm		Blows for each 75mm penetration				Result	Comments
					1	2	1	2	3	4		
M1	1.00	1.15	1.45	SPT	2	2	2	2	2	2	N=8	
M1	2.00	2.15	2.45	SPT	1	2	1	2	1	2	N=6	
M1	3.00	3.15	3.45	SPT	2	2	2	2	3	3	N=10	
M1	4.00	4.15	4.45	SPT	1	2	3	2	3	3	N=11	
M2	1.00	1.15	1.45	SPT	4	6	5	5	8	8	N=26	
M2	2.00	2.15	2.45	SPT	6	6	6	6	2	2	N=16	
M2	3.00	3.15	3.45	SPT	2	4	4	5	6	7	N=22	
M2	4.00	4.15	4.45	SPT	2	2	2	2	3	3	N=10	
M2	5.00	5.15	5.45	SPT	2	2	2	2	2	2	N=8	
M3	1.00	1.15	1.42	SPT	5	8	13	13	15	9	50/265mm	
M4	1.00	1.15	1.43	SPT	2	5	10	20	13	7	50/275mm	
M5	1.00	1.15	1.45	SPT	5	5	4	3	2	2	N=11	
M5	2.00	2.15	2.45	SPT	3	3	1	1	1	1	N=4	
M5	3.00	3.15	3.45	SPT	3	5	6	6	6	6	N=24	
M5	4.00	4.15	4.45	SPT	3	5	4	2	3	3	N=12	
M5	5.00	5.15	5.45	SPT	2	2	3	2	3	4	N=12	

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SITE INVESTIGATION AND SPECIALIST GEOTECHNICAL CONSULTANTS
3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907

Insitu Test Results

Site: FMR ROYAL MAIL SORTING OFFICE, THE CRESCENT, SPALDING, PE11 1SL

Client: KARAVAN HOLDINGS LTD

Architect: DESIGN STUDIO ARCHITECTS

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Groundwater Monitoring Results Sheet

Date	Hole No.	Standpipe Depth (m)	Response Zone (m)	Depth to Groundwater (m)
10/05/2023	M1	3.50	0.5-3.5	DRY
	M2	4.00	1.0-4.0	DRY
	M5	5.00	1.0-5.0	DRY
15/06/2023	M1	3.50	0.5-3.5	DRY
	M2	4.00	1.0-4.0	DRY
	M5	5.00	1.0-5.0	DRY

Remarks:

LABORATORY TEST RESULTS

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SITE INVESTIGATION, GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907

Laboratory Test Results

Site : FORMER ROYAL MAIL SORTING OFFICE, THE CRESCENT, SPALDING, PE11 1SL

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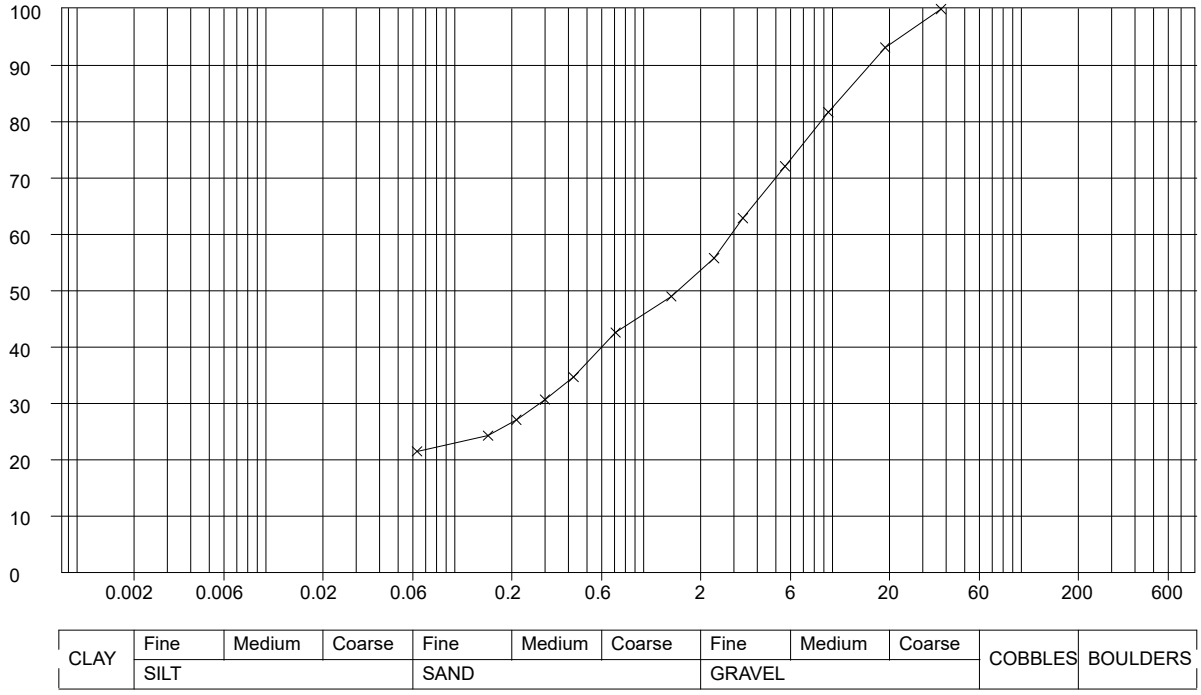
Engineer : DESIGN STUDIO ARCHITECTS

Job Number M3654A

Sheet 1/3

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit	Depth (m)	Sample	Laboratory Description
M2	2.00	C	MADE GROUND: brown and red clayey silty fine to coarse sand and fine to coarse gravel of brick and stone.



Sieve / Particle Size	% Passing
37.5 mm	100.0
19 mm	93.2
9.5 mm	81.7
5.6 mm	72.1
3.35 mm	62.9
2.36 mm	55.8
1.4 mm	49.0
710 µm	42.6
425 µm	34.7
300 µm	30.7
212 µm	27.1
150 µm	24.3
63 µm	21.5

Grading Analysis	
D85	12.2 mm
D60	2.9 mm
D10	<63.0 µm
Uniformity Coefficient	-

Particle Proportions	
Cobbles + Boulders	-
Gravel	46.4%
Sand	32.1%
Silt	-
Clay	-

Method of Preparation : BS 1377:PART 1:1990:7.3 Initial preparation 1990:7.4.5 Particle size tests

Method of Test : BS 1377:PART 2:1990:9 Determination of particle size distribution

Remarks :

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Laboratory Test Results

Site : FORMER ROYAL MAIL SORTING OFFICE, THE CRESCENT, SPALDING, PE11 1SL

Client : KARAVAN HOLDINGS LIMITED

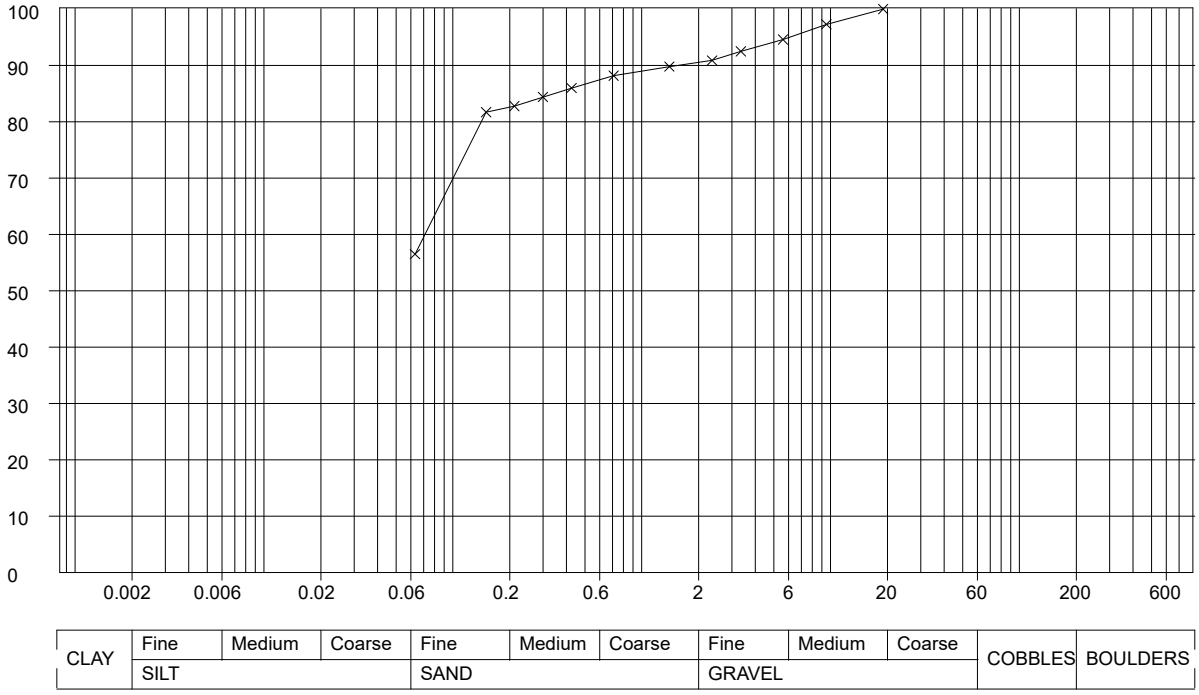
Engineer : DESIGN STUDIO ARCHITECTS

Job Number M3654A

Sheet 2/3

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit	Depth (m)	Sample	Laboratory Description
M5	2.20	C	MADE GROUND: yellowish brown slightly gravelly sandy silt. Gravel sized fragments are fine to medium stone.



Sieve / Particle Size	% Passing
19 mm	100.0
9.5 mm	97.3
5.6 mm	94.6
3.35 mm	92.5
2.36 mm	90.9
1.4 mm	89.8
710 µm	88.2
425 µm	86.0
300 µm	84.4
212 µm	82.8
150 µm	81.7
63 µm	56.5

Grading Analysis	
D85	346.9 µm
D60	75.1 µm
D10	<63.0 µm
Uniformity Coefficient	-

Particle Proportions	
Cobbles + Boulders	-
Gravel	9.4%
Sand	34.1%
Silt	-
Clay	-

Method of Preparation : BS 1377:PART 1:1990:7.3 Initial preparation 1990:7.4.5 Particle size tests

Method of Test : BS 1377:PART 2:1990:9 Determination of particle size distribution

Remarks :

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Laboratory Test Results

Site : FORMER ROYAL MAIL SORTING OFFICE, THE CRESCENT, SPALDING, PE11 1SL

Client : KARAVAN HOLDINGS LIMITED

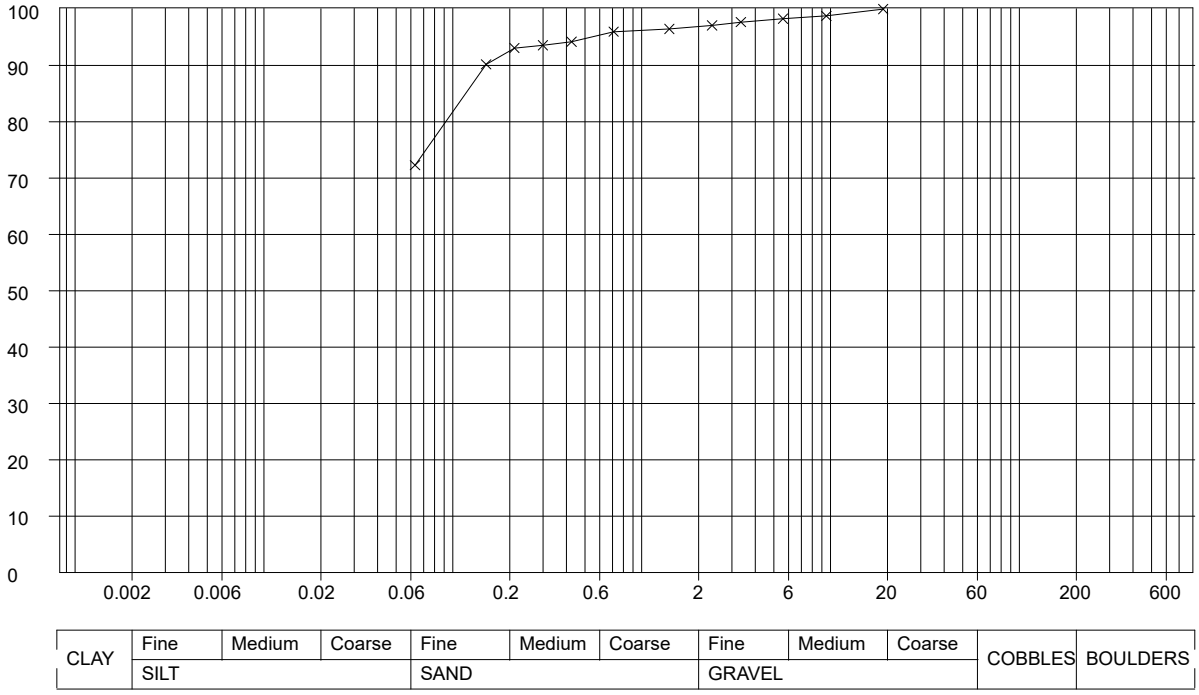
Engineer : DESIGN STUDIO ARCHITECTS

Job Number M3654A

Sheet 3/3

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit	Depth (m)	Sample	Laboratory Description
M5	3.30	C	MADE GROUND: brown slightly gravelly sandy silt. Gravel sized fragments are fine to medium stone, brick and concrete.



Sieve / Particle Size	% Passing
19 mm	100.0
9.5 mm	98.8
5.6 mm	98.3
3.35 mm	97.7
2.36 mm	97.1
1.4 mm	96.5
710 µm	96.0
425 µm	94.2
300 µm	93.6
212 µm	93.1
150 µm	90.2
63 µm	72.3

Grading Analysis	
D85	124.7 µm
D60	-
D10	<63.0 µm
Uniformity Coefficient	-

Particle Proportions	
Cobbles + Boulders	-
Gravel	3.1%
Sand	24.6%
Silt	-
Clay	-

Method of Preparation : BS 1377:PART 1:1990:7.3 Initial preparation 1990:7.4.5 Particle size tests

Method of Test : BS 1377:PART 2:1990:9 Determination of particle size distribution

Remarks :

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Laboratory Test Results

Site : FORMER ROYAL MAIL SORTING OFFICE, THE CRESCENT, SPALDING, PE11 1SL

Client : KARAVAN HOLDINGS LIMITED

Engineer : DESIGN STUDIO ARCHITECTS

Job Number M3654A

Sheet 1 / 1

DETERMINATION OF MOISTURE CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY AND LIQUIDITY INDEX

Borehole/ Trial Pit	Depth (m)	Sample	Natural Moisture Content %	Sample Passing 425µm Sieve		Liquid Limit %	Plastic Limit %	Plasticity Index %	Liquidity Index	Group Symbol	Laboratory Description
				Percentage %	Moisture Content %						
M5	1.00	D	11							NP	MADE GROUND: orange and brown very gravelly fine to coarse sand with occasional pockets of clay. Gravel sized fragments of brick and stone.

Method of Preparation : BS 1377:PART 1:1990:7.4 Preparation of samples for classification tests BS 1377:PART 2:1990:4.2 & 5.2 Sample preparations

Method of Test : BS 1377:PART 2:1990:3 Determination of moisture content 1990:4 Determination of the liquid limit BS 1377:PART 2:1990:5 Determination of the plastic limit and plasticity index

Remarks :

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Laboratory Test Results

Site : FORMER ROYAL MAIL SORTING OFFICE, THE CRESCENT, SPALDING, PE11 1SL

Client : KARAVAN HOLDINGS LIMITED

Engineer : DESIGN STUDIO ARCHITECTS

Job Number M3654A

Sheet 1 / 1

DETERMINATION OF THE pH VALUE AND THE SULPHATE CONTENT OF SOIL AND GROUNDWATER

Borehole/ Trial Pit	Depth (m)	Sample	Concentration of Soluble Sulphate			Percentage of sample passing 2mm Sieve %	pH	Classification	Laboratory Description
			Soil		Groundwater g /l				
			Total S03 %	S04 in 2:1 water:soil g /l					
M2	1.50	C		1.10			10.3	DS-2	MADE GROUND: brown and red sandy fine to coarse gravel sized fragmnets of brick with some pockets of dark brown clay and light brown sand.
M2	2.00	C		1.30			10.1	DS-2	MADE GROUND: brown and red clayey silty fine to coarse sand and fine to coarse gravel of brick and stone.
M4	0.50	C		0.24			11.7	DS-1	MADE GROUND: red fine to coarse sand with high cobble sized fragments of brick.
M5	1.00	D		0.36			9.2	DS-1	MADE GROUND: orange and brown very gravelly fine to coarse sand with occasional pockets of clay. Gravel sized fragments of brick and stone.

Method of Preparation : BS 1377:PART 1:1990:7.5 Preparation of soil for chemical tests BS 1377:PART 3:1990:5.2, 5.3, 5.4 & 9.4

Method of Test : Laboratory in-house methods based on BS1377: Part 3 for contents of water soluble sulphate, total sulphate and pH. Laboratory in-house method based on MEWAM (Environment Agency, 2006) for total sulphur

Remarks : Classification relates to Design Sulphate Class of BRE Special Digest 1 (2005)

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AGGRESSIVE CHEMICAL ENVIRONMENT FOR CONCRETE (ACEC) SITE CLASSIFICATION.

Table C1 Aggressive Chemical Environment for Concrete (ACEC) classification for natural ground locations [a]

Sulfate				Groundwater		
Design Sulfate Class for location	2:1 water/soil extract [b]	Groundwater	Total potential sulfate [c]	Static water	Mobile water	ACEC Class for location
1	2 (SO_4 mg/l)	3 (SO_4 mg/l)	4 (SO_4 %)	5 (pH)	6 (pH)	7
DS-1	< 500	< 400	< 0.24	≥ 2.5		AC-1s
					> 5.5 [d]	AC-1 [d]
					2.5–5.5	AC-2z
DS-2	500–1500	400–1400	0.24–0.6	> 3.5		AC-1s
					> 5.5	AC-2
				2.5–3.5		AC-2s
					2.5–5.5	AC-3z
DS-3	1600–3000	1500–3000	0.7–1.2	> 3.5		AC-2s
					> 5.5	AC-3
				2.5–3.5		AC-3s
					2.5–5.5	AC-4
DS-4	3100–6000	3100–6000	1.3–2.4	> 3.5		AC-3s
					> 5.5	AC-4
				2.5–3.5		AC-4s
					2.5–5.5	AC-5
DS-5	> 6000	> 6000	> 2.4	> 3.5		AC-4s
				2.5–3.5	≥ 2.5	AC-5

Notes
a Applies to locations on sites that comprise either undisturbed ground that is in its natural state (ie is not brownfield – Table C2) or clean fill derived from such ground.
b The limits of Design Sulfate Classes based on 2:1 water/soil extracts have been lowered relative to previous Digests (Box C7).
c Applies only to locations where concrete will be exposed to sulfate ions (SO_4) which may result from the oxidation of sulfides (eg pyrite) following ground disturbance (Appendix A1 and Box C8).
d For flowing water that is potentially aggressive to concrete owing to high purity or an aggressive carbon dioxide level greater than 15 mg/l (Section C2.2.3), increase the ACEC Class to AC-2z.

Explanation of suffix symbols to ACEC Class
- Suffix 's' indicates that the water has been classified as static.
- Concrete placed in ACEC Classes that include the suffix 'z' primarily have to resist acid conditions and may be made with any of the cements or combinations listed in Table D2 on page 42.

Table C2 Aggressive Chemical Environment for Concrete (ACEC) classification for brownfield locations [a]

Sulfate and magnesium						Groundwater		ACEC
Design Sulfate Class for location	2:1 water/soil extract [b]		Groundwater		Total potential sulfate [c]	Static water	Mobile water	Class for location
1	2 (SO_4 mg/l)	3 (Mg mg/l)	4 (SO_4 mg/l)	5 (Mg mg/l)	6 (SO_4 %)	7 (pH) [d]	8 (pH) [d]	9
DS-1	< 500		< 400		< 0.24	≥ 2.5		AC-1s
							> 6.5 [d]	AC-1
							5.5–6.5	AC-2z
							4.5–5.5	AC-3z
							2.5–4.5	AC-4z
DS-2	500–1500		400–1400		0.24–0.6	> 5.5		AC-1s
							> 6.5	AC-2
						2.5–5.5		AC-2s
							5.5–6.5	AC-3z
							4.5–5.5	AC-4z
							2.5-4.5	AC-5z
DS-3	1600–3000		1500–3000		0.7–1.2	> 5.5		AC-2s
							> 6.5	AC-3
						2.5–5.5		AC-3s
							5.5–6.5	AC-4
							2.5–5.5	AC-5
DS-4	3100–6000	≤ 1200	3100–6000	≤ 1000	1.3–2.4	> 5.5		AC-3s
							> 6.5	AC-4
						2.5–5.5		AC-4s
							2.5–6.5	AC-5
DS-4m	3100–6000	> 1200 [e]	3100–6000	> 1000 [e]	1.3–2.4	> 5.5		AC-3s
							> 6.5	AC-4m
						2.5–5.5		AC-4ms
							2.5–6.5	AC-5m
DS-5	> 6000	≤ 1200	> 6000	≤ 1000	> 2.4	> 5.5		AC-4s
						2.5–5.5	≥ 2.5	AC-5
DS-5m	> 6000	> 1200 [e]	> 6000	> 1000 [e]	> 2.4	> 5.5		AC-4ms
						2.5–5.5	≥ 2.5	AC-5m

Notes
a Brownfield locations are those sites, or parts of sites, that might contain chemical residues produced by or associated with industrial production (Section C5.1.3).
b The limits of Design Sulfate Classes based on 2:1 water/soil extracts have been lowered from previous Digests (Box C7).
c Applies only to locations where concrete will be exposed to sulfate ions (SO_4), which may result from the oxidation of sulfides such as pyrite, following ground disturbance (Appendix A1 and Box C8).
d An additional account is taken of hydrochloric and nitric acids by adjustment to sulfate content (Section C5.1.3).
e The limit on water-soluble magnesium does not apply to brackish groundwater (chloride content between 12 000 mg/l and 17 000 mg/l). This allows 'm' to be omitted from the relevant ACEC classification. Seawater (chloride content about 18 000 mg/l) and stronger brines are not covered by this table.

Explanation of suffix symbols to ACEC Class
- Suffix 's' indicates that the water has been classified as static.
- Concrete placed in ACEC Classes that include the suffix 'z' have primarily to resist acid conditions and may be made with any of the cements in Table D2 on page 42.
- Suffix 'm' relates to the higher levels of magnesium in Design Sulfate Classes 4 and 5.

CONTAMINATION ANALYSIS RESULTS

Certificate of Analysis

Certificate Number	23-10621	*Issued:*	16-May-23

Client Sub Surface Laboratories Ltd
3 Peel Street
Preston
Lancashire
PR2 2QS

Our Reference	23-10621
Client Reference	M3654A
Order No	(not supplied)
Contract Title	FORMER ROYAL MAIL SORTING OFFICE, SPALDING
Description	7 Soil samples.
Date Received	04-May-23
Date Started	04-May-23
Date Completed	16-May-23
Test Procedures	Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Kirk Bridgewood
General Manager

2139

Summary of Chemical Analysis
Soil Samples

Our Ref 23-10621
Client Ref M3654A
Contract Title FORMER ROYAL MAIL SORTING OFFICE, SPALDING

				Lab No	2166270	2166271	2166272	2166273	2166274	2166275	2166276
				.Sample ID	M1	M2	M2	M3	M4	M5	M5
				Depth	0.20	1.50	2.00-3.00	0.50	0.50	0.50	1.00-1.45
				Other ID	585	575	577	583	563	553	554
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Sampling Date	20/04/2023	20/04/2023	20/04/2023	20/04/2023	20/04/2023	20/04/2023	20/04/2023
				Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**								
Asbestos Quantification	DETSC 1102	0.001	%	0.004			< 0.001		0.001	
Preparation											
Moisture Content	DETSC 1004	0.1	%	7.3	13		8.7	5.8	9.7	
Metals											
Arsenic	DETSC 2301#	0.2	mg/kg	23	17		15	29	11	
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	0.7	0.9		1.1	0.7	1.8	
Cadmium	DETSC 2301#	0.1	mg/kg	0.6	0.3		0.2	0.2	0.3	
Chromium	DETSC 2301#	0.15	mg/kg	31	20		22	22	20	
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0		< 1.0	< 1.0	< 1.0	
Copper	DETSC 2301#	0.2	mg/kg	30	23		14	16	19	
Lead	DETSC 2301#	0.3	mg/kg	22	70		24	12	26	
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	0.06		< 0.05	< 0.05	< 0.05	
Molybdenum	DETSC 2301#	0.4	mg/kg	1.8	1.6		1.7	1.1	1.2	
Nickel	DETSC 2301#	1	mg/kg	21	15		15	18	12	
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5		< 0.5	< 0.5	< 0.5	
Zinc	DETSC 2301#	1	mg/kg	55	51		120	55	37	
Inorganics											
pH	DETSC 2008#		pH	9.8	10.3	10.1	11.5	11.7	10.4	9.2
Cyanide, Total	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1		< 0.1	< 0.1	< 0.1	
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l		1100	1300		240		360
Sulphide	DETSC 2024*	10	mg/kg	28	20		130	47	< 10	
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.11	0.42		1.2	0.29	0.28	
Petroleum Hydrocarbons											
C5-C10 Gasoline Range Organics (GRO): HS_1D_Total	DETSC 3321*	0.1	mg/kg	< 0.1	< 0.1		< 0.1	< 0.1	< 0.1	
C10-C24 Diesel Range Organics (DRO): EH_1D_Total	DETSC 3311#	10	mg/kg	40	69		34	26	35	
EPH (C10-C40): EH_1D_Total	DETSC 3311#	10	mg/kg	60	110		40	33	53	
Benzene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01		< 0.01	< 0.01	< 0.01	
Ethylbenzene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01		< 0.01	< 0.01	< 0.01	
Toluene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01		< 0.01	< 0.01	< 0.01	
m+p Xylene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01		< 0.01	< 0.01	< 0.01	
o Xylene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01		< 0.01	< 0.01	< 0.01	
MTBE	DETSC 3321	0.01	mg/kg	< 0.01	< 0.01		< 0.01	< 0.01	< 0.01	
C24-C40 Lube Oil Range Organics (LORO): EH_1D_Total	DETSC 3311#	10	mg/kg	20	41		< 10	< 10	18	
PAHs											
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1		< 0.1	< 0.1	< 0.1	
Acenaphthylene	DETSC 3301	0.1	mg/kg	0.4	< 0.1		< 0.1	< 0.1	0.2	
Acenaphthene	DETSC 3301	0.1	mg/kg	0.4	< 0.1		< 0.1	< 0.1	< 0.1	
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1		< 0.1	< 0.1	< 0.1	
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1		< 0.1	< 0.1	0.6	

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 23-10621
Client Ref M3654A
Contract Title FORMER ROYAL MAIL SORTING OFFICE, SPALDING

			Lab No	2166270	2166271	2166272	2166273	2166274	2166275	2166276
			.Sample ID	M1	M2	M2	M3	M4	M5	M5
			Depth	0.20	1.50	2.00-3.00	0.50	0.50	0.50	1.00-1.45
			Other ID	585	575	577	583	563	553	554
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sampling Date	20/04/2023	20/04/2023	20/04/2023	20/04/2023	20/04/2023	20/04/2023	20/04/2023
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**							
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1		< 0.1	< 0.1	0.4	
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1		< 0.1	< 0.1	1.5	
Pyrene	DETSC 3301	0.1	mg/kg	0.2	< 0.1		< 0.1	< 0.1	1.4	
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1		< 0.1	< 0.1	0.7	
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1		< 0.1	< 0.1	0.6	
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1		< 0.1	< 0.1	0.5	
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1		< 0.1	< 0.1	0.3	
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1		< 0.1	< 0.1	0.7	
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1		< 0.1	< 0.1	0.5	
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1		< 0.1	< 0.1	0.1	
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1		< 0.1	< 0.1	0.4	
PAH 16 Total	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6		< 1.6	< 1.6	7.9	
Phenols										
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3		< 0.3	< 0.3	< 0.3	

Key: * -not accredited. # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Asbestos Analysis
Soil Samples

Our Ref 23-10621
Client Ref M3654A
Contract Title FORMER ROYAL MAIL SORTING OFFICE, SPALDING

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2166270	M1 585 0.20	SOIL	Chrysotile	Chrysotile present as fibre bundles	Pierce Booth
2166271	M2 575 1.50	SOIL	NAD	none	Pierce Booth
2166273	M3 583 0.50	SOIL	Chrysotile	Chrysotile present as fibre bundles	Pierce Booth
2166274	M4 563 0.50	SOIL	NAD	none	Pierce Booth
2166275	M5 553 0.50	SOIL	Chrysotile	Chrysotile present in microscopic insulation debris	Pierce Booth

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * -not included in laboratory scope of accreditation.

Summary of Asbestos Quantification Analysis
Soil Samples

Our Ref 23-10621
Client Ref M3654A
Contract Title FORMER ROYAL MAIL SORTING OFFICE, SPALDING

		Lab No	2166270	2166273	2166275
		.Sample ID	M1	M3	M5
		Depth	0.20	0.50	0.50
		Other ID	585	583	553
		Sample Type			
		Sampling Date	20/04/2023	20/04/2023	20/04/2023
		Sampling Time			
Test	**Method**	**Units**			
Total Mass% Asbestos (a+b+c)	DETSC 1102	Mass %	**0.004**	**< 0.001**	**0.001**
Gravimetric Quantification (a)	DETSC 1102	Mass %	na	na	na
Detailed Gravimetric Quantification (b)	DETSC 1102	Mass %	0.004	<0.001	0.001
Quantification by PCOM (c)	DETSC 1102	Mass %	na	na	na
Potentially Respirable Fibres (d)	DETSC 1102	Fibres/g	na	na	na
Breakdown of Gravimetric Analysis (a)					
Mass of Sample		g	608.53	513.07	543.00
ACMs present*		type			
Mass of ACM in sample		g			
% ACM by mass		%			
% asbestos in ACM		%			
% asbestos in sample		%			
Breakdown of Detailed Gravimetric Analysis (b)					
% Amphibole bundles in sample		Mass %	na	na	na
% Chrysotile bundles in sample		Mass %	0.004	<0.001	0.001
Breakdown of PCOM Analysis (c)					
% Amphibole fibres in sample		Mass %	na	na	na
% Chrysotile fibres in sample		Mass %	na	na	na
Breakdown of Potentially Respirable Fibre Analysis (d)					
Amphibole fibres		Fibres/g	na	na	na
Chrysotile fibres		Fibres/g	na	na	na

* Denotes test or material description outside of UKAS accreditation.
% asbestos in Asbestos Containing Materials (ACMs) is determined by
by reference to HSG 264.
Recommended sample size for quantification is approximately 1kg
# denotes deviating sample

Information in Support of the Analytical Results

Our Ref 23-10621
Client Ref M3654A
Contract FORMER ROYAL MAIL SORTING OFFICE, SPALDING

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2166270	M1 0.20 SOIL	20/04/23	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2166271	M2 1.50 SOIL	20/04/23	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2166272	M2 2.00-3.00 SOIL	20/04/23	PT 1L	pH + Conductivity (7 days)	
2166273	M3 0.50 SOIL	20/04/23	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2166274	M4 0.50 SOIL	20/04/23	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2166275	M5 0.50 SOIL	20/04/23	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2166276	M5 1.00-1.45 SOIL	20/04/23	PT 500ml	pH + Conductivity (7 days)	

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Information in Support of the Analytical Results

List of HWOL Acronyms and Operators

Acronym	Description
HS	Headspace analysis
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
2D	GC-GC - Double coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative eg. EH+HS_Total or EH_CU+HS_Total

Det	Acronym
C5-C10 Gasoline Range Organics (GR(	HS_1D_Total
C10-C24 Diesel Range Organics (DRO)	EH_1D_Total
EPH (C10-C40)	EH_1D_Total
C24-C40 Lube Oil Range Organics (LO	EH_1D_Total

End of Report

MINI BOREHOLE RECORD SHEETS

SUB SURFACE

SITE INVESTIGATION, GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907

Site	Borehole Number
FORMER ROYAL MAIL SORTING OFFICE, THE CRESCENT, SPALDING, PE11 1SL	M1

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
MINI PERCUSSIVE			KARAVAN HOLDINGS LIMITED	M3654A
Location	**Dates**	**Engineer**		**Sheet**
AS PLAN	20/04/2023	DESIGN STUDIO ARCHITECTS		1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						(0.20)	MADE GROUND: bituminous macadam.			
0.20-1.00	C			0.20m to 1.00m - 100% Recovery		0.20	MADE GROUND: brown very gravelly fine to coarse sand with medium cobble sized fragments of brick and concrete. Gravel sized fragments are fine to coarse brick and stone.			
						(0.30)				
						0.50	MADE GROUND: red sandy fine to coarse gravel sized fragments of brick and stone, with high cobble sized fragments of brick.			
						(0.50)				
1.00-1.45 1.00-2.00 1.00-1.45	D C SPT N=8			1.00m to 2.00m - 80% Recovery 2,2/2,2,2,2		1.00	MADE GROUND: brown very gravelly slightly silty fine to coarse sand. Gravel sized fragments are fine to coarse brick and stone.			
						(0.30)				
						1.30	MADE GROUND: dark brown slightly gravelly slightly sandy silty clay. Gravel sized fragments are fine to medium brick and stone. (Slight organic odour).			
						(0.70)	...below 1.70m: yellowish brown, gravelly, no odour.			
							...below 1.90m: dark brown, slightly gravelly.			
2.00-2.45 2.00-3.00 2.00-2.45	D C SPT N=6			2.00m to 3.00m - 85% Recovery 1,2/1,2,1,2		2.00	MADE GROUND: orangish brown very gravelly silty fine to coarse sand. Gravel sized fragments are fine to coarse brick and stone.			
						(0.35)				
						2.35	MADE GROUND: very soft brown slightly sandy silty clay.			
						(0.20)				
						2.55	MADE GROUND: brown clayey silty fine sand.			
3.00-3.45 3.00-4.00	D C			Water inflow(1) at 3.00m. 3.00m to 4.00m - 65% Recovery			...below 3.00m: slightly gravelly, no clay. Gravel sized fragments are fine to coarse brick and stone.		▽1	
3.00-3.45	SPT N=10			2,2/2,2,3,3		(1.45)				
4.00-4.45 4.00-5.00 4.00-4.45	D C SPT N=11			4.00m to 5.00m - 100% Recovery 1,2/3,2,3,3		4.00	MADE GROUND: very soft brown and dark grey mottled slightly gravelly sandy silty clay. Gravel sized fragments are fine brick and stone.			
						(1.00)				

Remarks

Hand dug inspection pit from GL to 1.20m to check for services.
Core diameter: 86mm to 1.00m, 76mm to 3.00m and 56mm to 5.00m.
Groundwater inflow at 3.00m.
On completion backfilled with arisings and installed a 50mm dia hdpe groundwater monitoring standpipe with gravel surround to 3.50m, a Benonite seal from 0.50m to 0.20m and a concreted in lockable steel protective cover from 0.20m to GL.

Scale (approx)	Logged By
1:25	AP/JH/VW

Figure No. M3654A.M1

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Site	Borehole Number
FORMER ROYAL MAIL SORTING OFFICE, THE CRESCENT, SPALDING, PE11 1SL	M1

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
MINI PERCUSSIVE			KARAVAN HOLDINGS LIMITED	M3654A
Location		**Dates**	**Engineer**	**Sheet**
AS PLAN		20/04/2023	DESIGN STUDIO ARCHITECTS	2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						5.00				
						(0.45)	MADE GROUND: yellowish brown and dark grey slightly gravelly slightly clayey silty fine sand with occasional pockets of clay. Gravel sized fragments are fine to medium brick and stone.			
				20/04/2023:		5.45	Complete at 5.45m			

Remarks

Scale (approx)	Logged By
1:25	AP/JH/VW

Figure No. M3654A.M1

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Site	Borehole Number
FORMER ROYAL MAIL SORTING OFFICE, THE CRESCENT, SPALDING, PE11 1SL	M2

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
MINI PERCUSSIVE			KARAVAN HOLDINGS LIMITED	M3654A
Location	**Dates**		**Engineer**	**Sheet**
AS PLAN	20/04/2023		DESIGN STUDIO ARCHITECTS	1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						(0.17) 0.17	MADE GROUND: concrete.			
0.17-1.00	C			0.17m to 1.00m - 100% Recovery		(0.28) 0.45	MADE GROUND: light brown slightly silty sandy fine to coarse gravel sized fragments of stone.			
						(0.55) 1.00	MADE GROUND: orangish brown and greyish brown slightly ashy slightly silty sandy fine to coarse gravel sized fragments of brick and stone, with occasional cobble sized fragments of brick.			
1.00-1.45	D			1.00m to 2.00m - 100% Recovery						
1.00-2.00	C									
1.00-1.45	SPT N=26			4,6/5,5,8,8		(0.30) 1.30	MADE GROUND: light brown very gravelly fine to coarse sand. Gravel sized fragments are fine to coarse brick and stone.			
						(0.10) 1.40	MADE GROUND: friable brown very sandy silty clay.			
						(0.40) 1.80	MADE GROUND: brown and red sandy fine to coarse gravel sized fragments of brick with some pockets of dark brown clay and light brown sand. ...below 1.60m: no pockets of clay.			
						(0.15) 1.95	MADE GROUND: firm brown slightly gravelly silty clay with some pockets and bands of sand.			
2.00-2.45	D			2.00m to 3.00m - 100% Recovery		2.00	MADE GROUND: red sandy fine to coarse gravel sized fragments of brick.			
2.00-3.00	C					(0.25) 2.25	MADE GROUND: brown and red clayey silty fine to coarse sand and fine to coarse gravel of brick and stone. ...below 2.15m: clayey.			
2.00-2.45	SPT N=16			6,6/6,6,2,2		(0.15) 2.40				
						(0.10) 2.50	MADE GROUND: red fine to coarse gravel sized fragments of brick and metal nail.			
							MADE GROUND: brown very silty fine sand.			
						(0.50) 3.00	MADE GROUND: very soft to soft bluish grey silty clay. ...below 2.65m: soft, brown, sandy. ...below 2.85m: very sandy.		▽1	
3.00-3.45	D			Water inflow(1) at 3.00m.						
3.00-4.00	C			3.00m to 4.00m - 100% Recovery		(0.35) 3.35	MADE GROUND: brown very gravelly slightly clayey silty fine sand with medium cobble sized fragments of brick. Gravel sized fragments are fine to medium brick and stone.			
3.00-3.45	SPT N=22			2,4/4,5,6,7						
							MADE GROUND: brown slightly silty fine sand.			
4.00-4.45	D			4.00m to 5.00m - 100% Recovery						
4.00-5.00	C						...below 4.00m: slightly gravelly, silty. Gravel sized fragments are fine to medium brick and stone.			
4.00-4.45	SPT N=10			2,2/2,2,3,3		(1.65)				
5.00-5.45	SPT N=8			2,2/2,2,2,2						

Remarks

Hand dug inspection pit from GL to 1.20m to check for services.
Core diameter: 86mm to 2.00m, 76mm to 3.00m, 67mm to 4.00m and 56mm to 5.00m.
Groundwater inflow at 3.00m.
On completion backfilled with arisings and installed a 50mm dia hdpe groundwater monitoring standpipe with a gravel surround to 4.00m, a Bentonite seal from 1.00m to 0.20m.

Scale (approx)	Logged By
1:25	AP/JH/VW

Figure No. M3654A.M2

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SITE INVESTIGATION, GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

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Site	Borehole Number
FORMER ROYAL MAIL SORTING OFFICE, THE CRESCENT, SPALDING, PE11 1SL	M2

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
MINI PERCUSSIVE			KARAVAN HOLDINGS LIMITED	M3654A
Location	**Dates**		**Engineer**	**Sheet**
AS PLAN	20/04/2023		DESIGN STUDIO ARCHITECTS	2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
5.00-5.45	D			20/04/2023:		5.00 (0.45) 5.45	Loose brown very silty fine SAND. Complete at 5.45m			

Remarks

Scale (approx)	Logged By
1:25	AP/JH/VW

Figure No. M3654A.M2

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Site	Borehole Number
FORMER ROYAL MAIL SORTING OFFICE, THE CRESCENT, SPALDING, PE11 1SL	M3

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
MINI PERCUSSIVE			KARAVAN HOLDINGS LIMITED	M3654A
Location		**Dates**	**Engineer**	**Sheet**
AS PLAN		20/04/2023	DESIGN STUDIO ARCHITECTS	1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.17)	MADE GROUND: concrete.		
0.17-1.00	C			0.15m to 1.00m - 75% Recovery		0.17	MADE GROUND: red very sandy gravel sized fragments of brick, stone and metal, with low cobble sized fragments of brick.		
						(0.33)			
						0.50	MADE GROUND: light brown very gravelly fine to coarse sand. Gravel sized fragments are fine to coarse stone, brick and metal nail.		
1.00-1.42 1.00-1.42	SPT 50/265 D			5,8/13,13,15,9		(0.92)	...below 1.00m: yellowish brown.		
				20/04/2023:DRY		1.42	...at 1.42m: refused on red brick.		
							Complete at 1.42m		

Remarks

Hand dug inspection pit from GL to 1.20m to check for services.
Core diameter: 86mm to 1.00m.
No groundwater encountered.
On completion backfilled with gravel.

Scale (approx)	Logged By
1:25	AP/JH/VW

Figure No. M3654A.M3

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Site	Borehole Number
FORMER ROYAL MAIL SORTING OFFICE, THE CRESCENT, SPALDING, PE11 1SL	M4

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
MINI PERCUSSIVE			KARAVAN HOLDINGS LIMITED	M3654A
Location		**Dates**	**Engineer**	**Sheet**
AS PLAN		20/04/2023	DESIGN STUDIO ARCHITECTS	1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						(0.17) 0.17	MADE GROUND: concrete.		
0.17-1.00	C			0.25m to 1.00m - 100% Recovery		(0.23) 0.40	MADE GROUND: brown very sandy fine to coarse garvel sized fragments of stone, concrete and brick.		
						(0.20) 0.60	MADE GROUND: red fine to coarse sand with high cobble sized fragments of brick.		
						(0.10) 0.70	MADE GROUND: brown very sandy fine to coarse gravel sized fragments of stone. (Possible pea gravel drain).		
1.00-1.43 1.00-1.43	SPT 50/275 D			2,5,10,20,13,7		(0.73)	MADE GROUND: brown gravelly fine to coarse sand with low cobble sized fragments of brick. Gravel sized fragments are fine to coarse stone, brick and wood. ...below 1.00m: red.		
				20/04/2023:DRY		1.43	...at 1.43m: refused on red brick.		
							Complete at 1.43m		

Remarks

Hand dug inspection pit from GL to 1.20m to check for services.
Core diameter: 86mm to 1.00m.
No groundwater encountered.
On completion backfilled with gravel.

Scale (approx)	Logged By
1:25	AP/JH/VW

Figure No. M3654A.M4

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Site	Borehole Number
FORMER ROYAL MAIL SORTING OFFICE, THE CRESCENT, SPALDING, PE11 1SL	M5

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
MIN PERCUSSIVE			KARAVAN HOLDINGS LIMITED	M3654A
	Location AS PLAN	**Dates** 20/04/2023	**Engineer** DESIGN STUDIO ARCHITECTS	**Sheet** 1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						(0.25)	MADE GROUND: concrete.			
0.25-1.00	C			0.25m to 1.00m - 100% Recovery		0.25	MADE GROUND: brown gravelly fine to coarse sand with medium cobble sized fragments of brick and concrete.			
						(0.40)				
						0.65	MADE GROUND: red sandy fine to coarse gravel sized fragments of brick, with medium cobble sized fragments of brick.			
						(0.35)	...below 0.90m: gravel sized fragments of brick and stone.			
1.00-1.45 1.00-2.00 1.00-1.45	D C SPT N=11			1.00m to 2.00m - 80% Recovery 5,5/4,3,2,2		1.00	MADE GROUND: orange and brown very gravelly fine to coarse sand with occasional pockets of clay. Gravel sized fragments are fine to coarse brick and stone.			
						(0.50)				
						1.50	MADE GROUND: firm greyish brown and dark grey slightly silty sandy clay.			
						(0.65)	...at 1.90m: with pockets of silty sand.			
2.00-2.45 2.00-3.00 2.00-2.45	D C SPT N=4			2.00m to 3.00m - 95% Recovery 3,3/1,1,1,1		2.15	...below 2.00m: very soft, slightly gravelly. Gravel sized fragments are fine to coarse stone and brick.			
						(0.30)	MADE GROUND: yellowish brown slightly gravelly sandy silt. Gravel sized fragments are fine to medium stone.			
						2.45	MADE GROUND: vey soft grey clayey silt.			
						(0.25)	...below 2.60m: greyish brown.			
						2.70	MADE GROUND: soft brown very sandy silty clay.			
						(0.30)				
3.00-3.45 3.00-4.00 3.00-3.45	D C SPT N=24			Water inflow(1) at 3.00m. 3.00m to 4.00m - 80% Recovery 3,5/6,6,6,6		3.00	MADE GROUND: brown slightly gravelly sandy silt. Gravel sized fragments are fine to medium stone, brick and concrete.		▽1	
						(1.00)				
4.00-4.45 4.00-5.00 4.00-4.45	D C SPT N=12			4.00m to 5.00m - 100% Recovery 3,5/4,2,3,3		4.00	MADE GROUND: brown slightly gravelly very silty fine sand. Gravel sized fragments are fine to medium stone and brick. (Possibly natural)			
						(1.00)				
5.00-5.45	SPT N=12			2,2/3,2,3,4						

Remarks

Hand dug inspection pit from GL to 1.20m to check for services.
Core diameter: 86mm to 1.00m, 76mm to 1.00m, 76mm to 3.00m, 66mm to 4.00m and 56mm to 5.00m.
Groundwater inflow at 3.00m.
On completion backfilled with arisings and installed a 50mm dia hdpe groundwater monitoring standpipe with a gravel surround to 5.00m, a Bentonite seal from 1.00m to 0.20m.

Scale (approx)	Logged By
1:25	AP/JH/VW

Figure No. M3654A.M5

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SUB SURFACE

SITE INVESTIGATION, GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

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Site	Borehole Number
FORMER ROYAL MAIL SORTING OFFICE, THE CRESCENT, SPALDING, PE11 1SL	M5

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
MIN PERCUSSIVE			KARAVAN HOLDINGS LIMITED	M3654A
	Location AS PLAN	**Dates** 20/04/2023	**Engineer** DESIGN STUDIO ARCHITECTS	**Sheet** 2/2

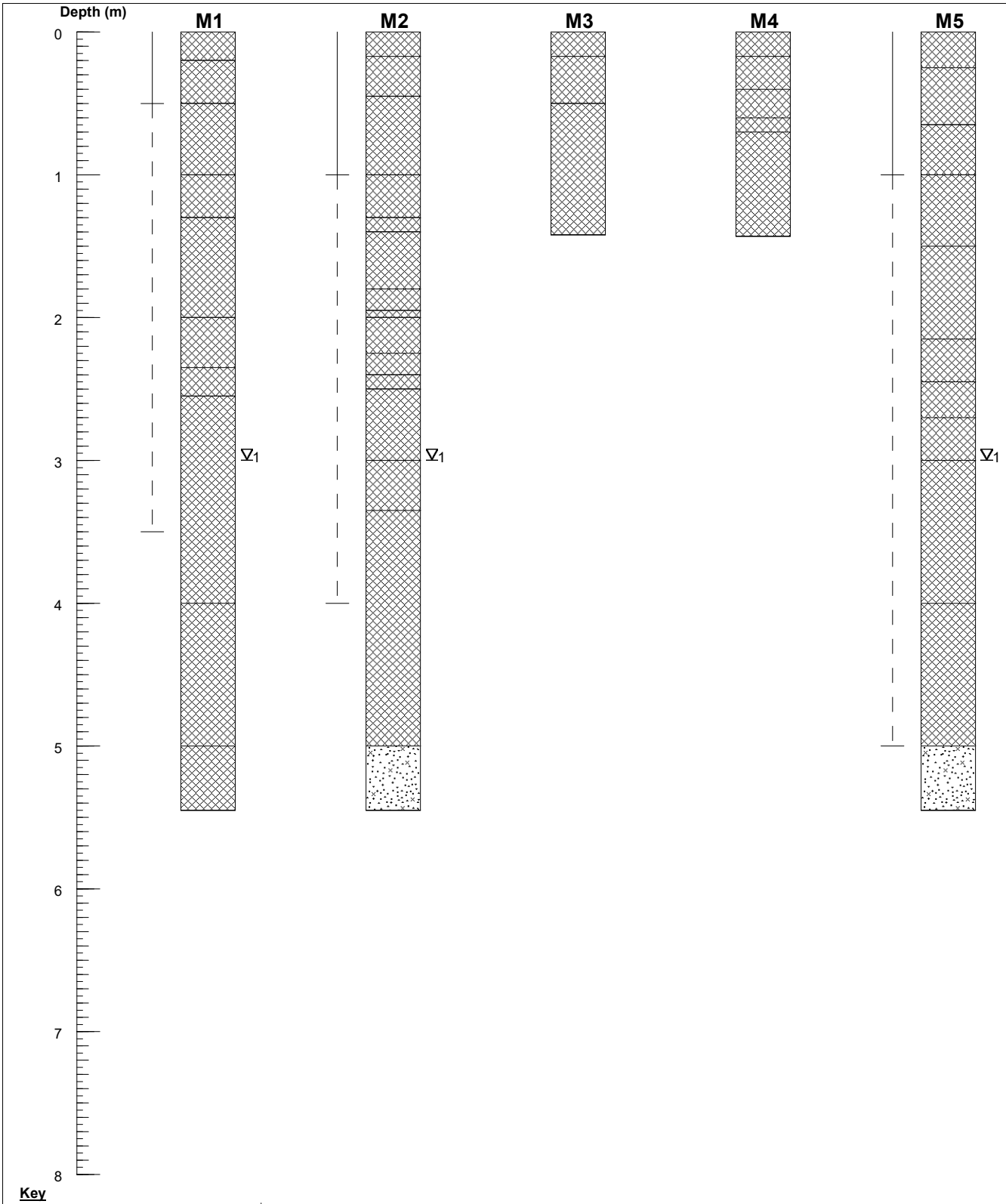
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
5.00-5.45	D			20/04/2023:		5.00 (0.45) 5.45	Medium dense brown very silty fine SAND. Complete at 5.45m			

Remarks

Scale (approx)	Logged By
1:25	AP/JH/VW

Figure No. M3654A.M5

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Key

- ∇ Groundwater Strike
- ▼ Strike Rise Level
- ∇ Highest recorded piezo level
- ● Piezometer Tip
- Slotted Standpipe
- MADE GROUND
- Silty SAND

SUB SURFACE
SITE INVESTIGATION, GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
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Nominal Section

Site	Date Drawn	Date Checked	Sheet	Job Number
FORMER ROYAL MAIL SORTING OFFICE, THE CRESCENT, SPALDING, PE11 1SL	04/07/2023		1/1	M3654A
Client	**Drawn By**	**Checked By**	**Scale**	**Figure No.**
KARAVAN HOLDINGS LIMITED			1:40[V]	M3654A.1

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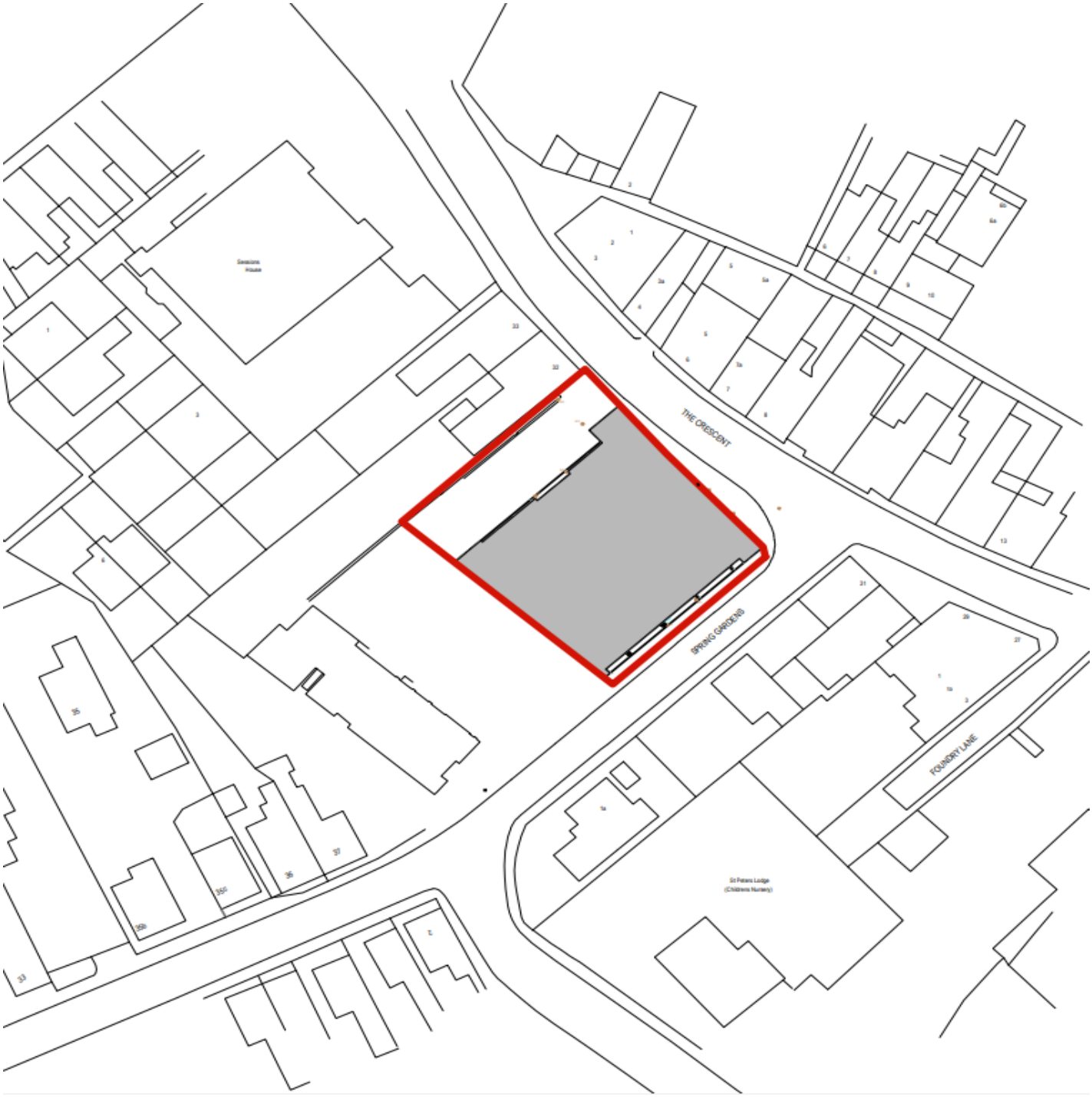
FIGURES



SUB SURFACE
SITE INVESTIGATION AND SPECIALIST GEOTECHNICAL CONSULTANTS
3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907

General Site Location

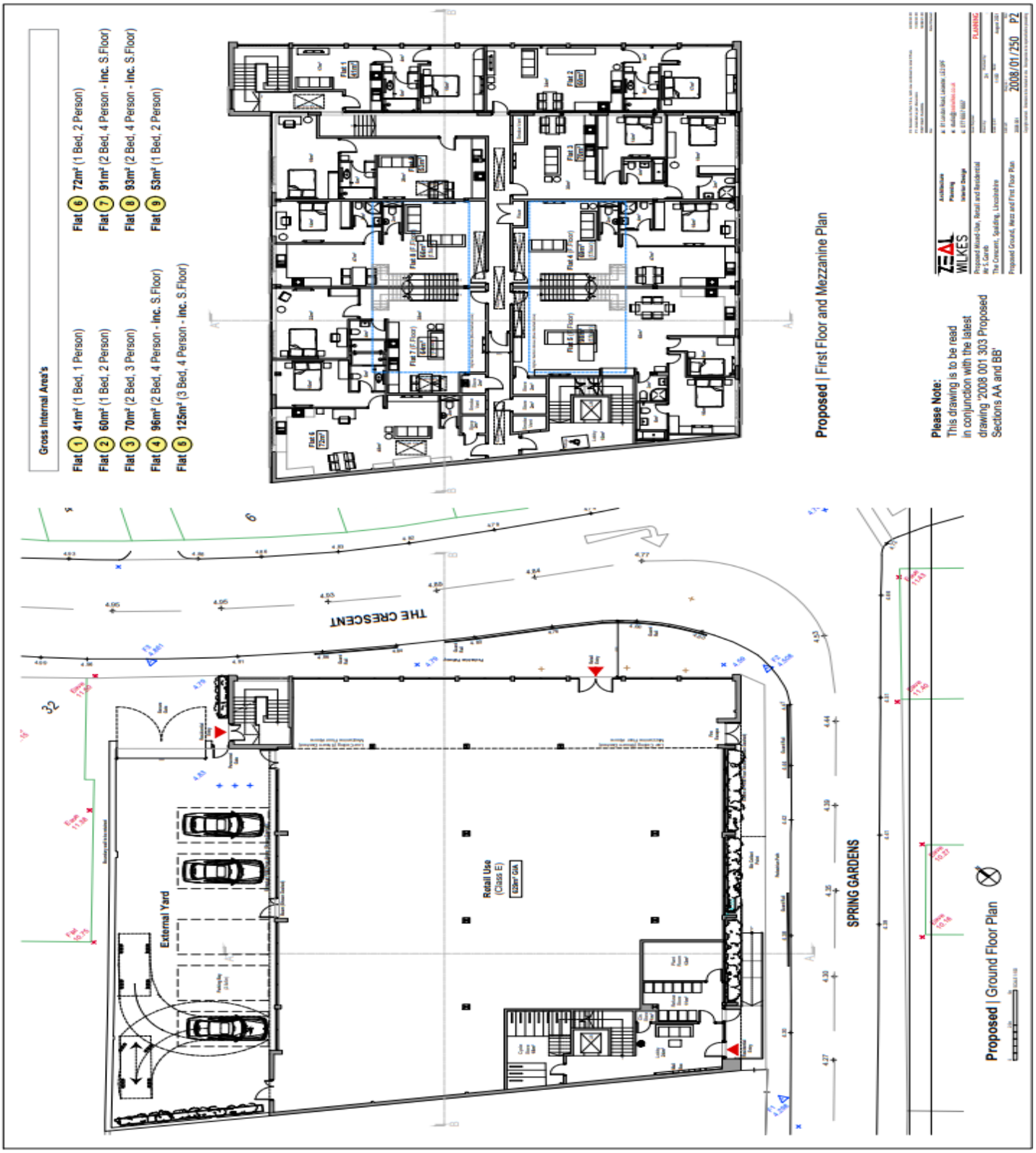
Site	Date Drawn	Date Checked	Orientation	Job No.
FORMER ROYAL MAIL SORTING OFFICE, THE CRESCENT, SPALDING, PE11 1SL	20-Jun-23		N	M3654A
Client	**Drawn By**	**Checked By**	**Scale**	**Figure No.**
KARAVAN HOLDINGS LTD	JMH		_	1



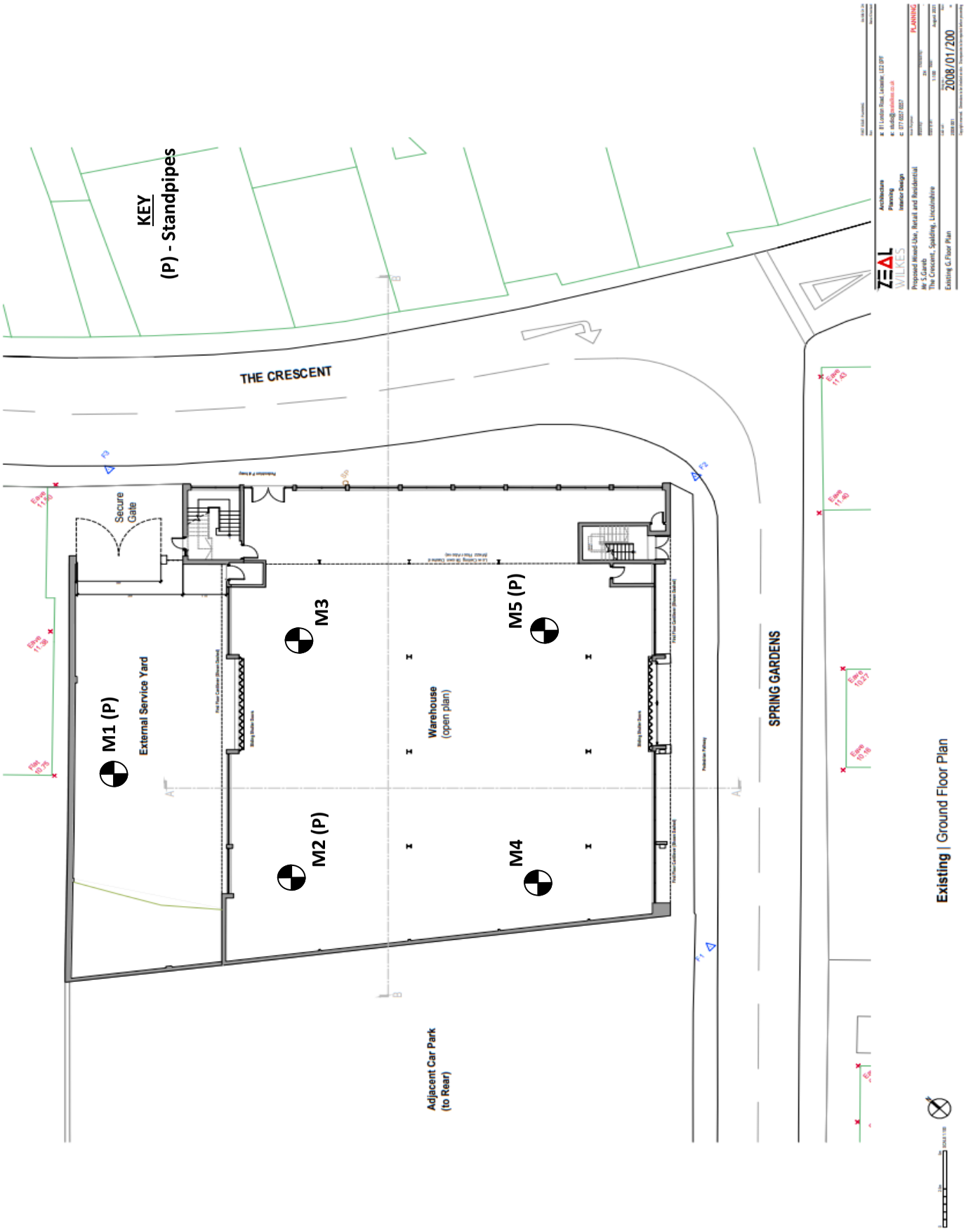
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Site Location

Site	Date Drawn	Date Checked	Orientation	Job No.
FORMER ROYAL MAIL SORTING OFFICE, THE CRESCENT, SPALDING, PE11 1SL	20-Jun-23		N	M3654A
Client	**Drawn By**	**Checked By**	**Scale**	**Figure No.**
KARAVAN HOLDINGS LTD	JMH		_	2



SUB SURFACE SITE INVESTIGATION AND SPECIALIST GEOTECHNICAL CONSULTANTS 3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907			Proposed Development Plan	
Site FORMER ROYAL MAIL SORTING OFFICE, THE CRESCENT, SPALDING, PE11 1SL	Date Drawn 20-Jun-23	Date Checked	Orientation	Job No. M3654A
Client KARAVAN HOLDINGS LTD	Drawn By JMH	Checked By	Scale –	Figure No. 3



SUB SURFACE SITE INVESTIGATION AND SPECIALIST GEOTECHNICAL CONSULTANTS 3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907	Exploratory Hole Location Plan			
Site FORMER ROYAL MAIL SORTING OFFICE, THE CRESCENT, SPALDING, PE11 1SL	Date Drawn 20-Jun-23	Date Checked	Orientation N	Job No. M3654A
Client KARAVAN HOLDINGS LTD	Drawn By JMH	Checked By	Scale –	Figure No. 4