



Main Investigation Report

at

The Burrows, West Street, Bedhampton, Havant, Hampshire PO9 1LR

for

Walthams Ltd.

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This is not a valid document for use in the design of the project unless it is titled Final in the document status box.

Current regulations and good practice were used in the preparation of this report. The recommendations given in this report must be reviewed by an appropriately qualified person at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

Commission

Soils Limited was commissioned by Walthams Ltd. to undertake an intrusive ground investigation and prepare a Main Investigation Report on land at The Burrows, West Street, Bedhampton, Havant, Hampshire PO9 1LR. The scope of the investigation was outlined in the Soils Limited quotation reference Q21860Rev1.01, dated 25th September 2019.

This document comprises the Main Investigation Report and incorporates the results, discussion and conclusions to this intrusive works.

This Main Investigation Report must be read in conjunction with the Preliminary Investigation Report undertaken on the above site by Soils Limited, ref: 17902/PIR, dated November 2019.

Standards

The site works, soil descriptions and geotechnical testing was undertaken in accordance with the following standards:

- BS 5930:2015 and BS EN ISO 22476-2 2005+A1:2011
- BS EN ISO 14688-1:2002+A1:2013
- BS EN ISO 14688-2:2004+A1:2013
- BS 10175:2011+A1:2013
- NHBC Standards 2019

The geotechnical laboratory testing was performed by GEO Site & Testing Services Ltd (GSTL) in accordance with the methods given in BS 1377:1990 Parts 1 to 8 and their UKAS accredited test methods.

For the preparation of this report, the relevant BS code of practice was adopted for the geotechnical laboratory testing technical specifications, in the absence of the relevant Eurocode specifications (ref: ISO TS 17892).

The chemical analyses were undertaken by I2 Analytical in accordance with their UKAS and MCERTS accredited test methods or their documented in-house testing procedures. This investigation did not comprise an environmental audit of the site or its environs.

Trial hole is a generic term used to describe a method of direct investigation. The term trial pit, borehole or window sample borehole implies the specific technique used to produce a trial hole.

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Section I Introduction

I.1 Objective of Investigation

Soils Limited was commissioned by Walthams Ltd. to undertake an intrusive ground investigation and to prepare a Main Investigation Report to supply the client and their designers with information regarding ground conditions, to assist in preparing a foundation scheme for development that was appropriate to the settings present on the site.

The investigation was to be undertaken to provide comment on appropriate foundation options for the proposed residential development. The investigation was to be made by means of in-situ testing and geotechnical laboratory testing undertaken on soil samples taken from the trial holes.

Soil samples were taken for chemical laboratory testing to enable recommendations for the safe redevelopment of the site and the protection of site workers, end-users and the public from any contamination identified as dictated by the Conceptual Site Model (CSM) in the Preliminary Investigation Report undertaken for the site by Soils Limited (ref: 17902/PIR_R26, dated November 2019) and/or the Revised Conceptual Site Model presented in Appendix C.1.

I.2 Location

The site was located at The Burrows, West Street, Bedhampton, Havant, Hampshire PO9 1LR and had an approximate O.S Land Ranger Grid Reference of SU 709 065.

The site location plan is given in Figure 1.

I.3 Site Description

The site comprised a former allotment with a single storey unit at the south of the site occupied by a hand car wash business. The site was heavily vegetated, including mature and semi-mature trees, with localised cleared areas and scattered dilapidated small greenhouses. The site was relatively flat with a gentle slope down to the south. The site was bound by residential land to the east and south, Hermitage Stream with commercial properties beyond to the west and allotments with railway beyond to the north. Manhole covers were noted onsite and indicative of a possible pipe or culvert underlying the site.

An aerial photograph has been included in Figure 2.

I.4 Proposed Development

The proposal comprised the demolition of existing structures onsite and subsequent redevelopment of the site into an apartment complex housing 20 No. 1 bed residential units. The proposed development comprised areas of hard landscaping including new

access road, parking space and pavements and areas of soft landscaping including public open space. No private gardens were proposed.

In compiling this report reliance was placed on drawing number 28065-SK110, dated March 2019, prepared by pdp architecture llp. Any change or deviation from the scheme outlined in the drawing could invalidate the foundation design and remediation recommendations presented within this report. Soils Limited must be notified about any such changes.

Development plans provided by the client are presented in Appendix D.

1.5 Anticipated Geology

The 1:50,000 BGS map showed the site to be situated on the London Clay Formation at the north of the site and the underlying Lambeth Group at the south of the site, overlain by superficial deposits of Alluvium across the whole site.

1.5.1 Alluvium

Alluvium is the most recent river or estuarine deposit and generally comprises silty clays usually with an appreciable organic content. Lenses of sand and gravel are also commonly found, as are pockets of peat.

The BSI Code of Practice for Foundations, BS8004: 1986, Clause 2.2.2.3.4 Peat and organic soils, includes the caveat that 'all these soils are highly compressible, and even lightly loaded foundations will be subject to considerable settlements over a long period if placed on them. For this reason, these soils are not suitable for carrying the loads for important structures'.

1.5.2 London Clay Formation

The London Clay Formation in the Hampshire region comprises silty and sandy clay, clayey and sandy silt, silty sand; sporadic claystones and thin beds of flint pebbles. The formation includes the Bognor Sand, Whitecliff Sand, Durley Sand, Portsmouth Sand and Nursling Sand Members. Crystals of gypsum (Selenite) are often found within the weathered part of the London Clay, and precautions against sulphate attack to concrete are sometimes required.

The lowest part of the London Clay Formation rests on the Reading Formation (Lambeth Group).

1.5.3 Lambeth Group

The Lambeth Group, formerly known as the Woolwich and Reading Beds, occurs in the London and Hampshire Basins, where it directly overlies the Chalk or Thanet Sand Formation, and is succeeded by the Harwich and London Clay Formations.

1.6 Limitations and Disclaimers

This Main Investigation Report relates to the site located at The Burrows, West Street, Bedhampton, Havant, Hampshire PO9 1LR and was prepared for the sole benefit of Walthams Ltd. (The "Client"). The report was prepared solely for the brief described in Section 1.1 of this report.

Soils Limited disclaims any responsibility to the Client and others in respect of any matters outside the scope of the above.

This report has been prepared by Soils Limited, with all reasonable skill, care and diligence within the terms of the Contract with the Client, incorporation of our General Conditions of Contract of Business and taking into account the resources devoted to us by agreement with the Client.

The report is personal and confidential to the Client and Soils Limited accept no responsibility of whatever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report wholly at its own risk.

The Client may not assign the benefit of the report or any part to any third party without the written consent of Soils Limited.

The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the client in accordance with their brief. As such these do not necessarily address all aspects of ground behaviour at the site.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot by plot basis prior to the construction of foundations. Supplied site surveys may not include substantial shrubs or bushes and is also unlikely to have data on any trees, bushes or shrubs removed prior to or following the site survey.

Where trees are mentioned in the text this means existing trees, substantial bushes or shrubs, recently removed trees (approximately 20 years to full recovery on cohesive soils) and those planned as part of the site landscaping).

Ownership of land brings with it onerous legal liabilities in respect of harm to the environment. "Contaminated Land" is defined in Section 57 of the Environment Act 1995 as:

"Land which is in such a condition by reason of substances in, on or under the land that significant harm is being caused or that there is a significant possibility of such harm being caused or that pollution of controlled waters is being, or is likely to be caused".

The investigation, analysis or recommendations in respect of contamination are made solely in respect of the prevention of harm to vulnerable receptors, using where possible best practice at the date of preparation of the report. The investigation and report do not address, define or make recommendations in respect of environmental liabilities. A separate environmental audit and liaison with statutory authorities is required to address these issues.

Ownership of copyright of all printed material including reports, laboratory test results, trial pit and borehole log sheets, including drillers log sheets remains with Soils Limited. License is for the sole use of the client and may not be assigned, transferred or given to a third party.

Section 2 Site Works

2.1 Proposed Project Works

The proposed intrusive investigation was designed to provide information on the ground conditions and to aid the design of foundations for the proposed residential development. The intended investigation, as outlined within the Soils Limited quotation (Q21860Rev1.01, dated 25th September 2019), was to comprise the following items:

- 4No. windowless sampler boreholes
- 4No. dynamic probes
- Installation of soil gas and groundwater monitoring wells
- Geotechnical laboratory testing
- Contamination laboratory testing

2.1.1 Actual Project Works

The actual project works were undertaken on 8th October 2019 and comprised:

- 4No. windowless sampler boreholes (WS1 – WS4)
- 4No. super heavy dynamic probes (DP1 – DP4)
- Installation of 3No. soil gas and groundwater monitoring wells
- Geotechnical laboratory testing
- Contamination laboratory testing

Three windowless sampler boreholes (WS1 – WS3) were backfilled with gravel and bentonite following the installation of monitoring wells, one borehole (WS4) was backfilled with gravel on completion. All trial hole locations have been presented in Figure 3.

Following completion of site works, soil cores were logged and sub sampled so that samples could be sent to the laboratory for both contamination and geotechnical testing.

2.2 Ground Conditions

On 8th October 2019, four windowless sampler boreholes (WS1 – WS4) were drilled to depths of 4.00m below ground level (bgl) at locations selected by the client.

Four super heavy dynamic probes (DP1 – DP4) were driven prior and adjacent to their corresponding windowless sampler boreholes to depths of 6.00m bgl.

Three standpipes were installed within windowless sample borehole locations WS1 – WS3 to allow for continued monitoring of both groundwater and soil gas, where present.

The maximum depths of trial holes have been included in Table 2.1.

All trial holes were scanned with a Cable Avoidance Tool (C.A.T.) and signal generator (Genny) prior to excavation to ensure the health and safety of the operatives.

Table 2.1 Final Depth of Trial Holes

Trial Hole	Depth (m bgl)	Trial Probe	Depth (m bgl)
WS1 ^w	4.00	DP1	6.00
WS2 ^w	4.00	DP2	6.00
WS3 ^w	4.00	DP3	6.00
WS4	4.00	DP4	6.00

Note: w - well installation

The approximate trial hole locations are shown on Figure 3.

The soil conditions encountered were recorded and soil sampling commensurate with the purposes of the investigation was carried out. The depths given on the trial hole logs and quoted in this report were measured from ground level.

The soils encountered from immediately below ground surface have been described in the following manner. Where the soil incorporated an organic content such as either decomposing leaf litter or roots or has been identified as part of the in-situ weathering profile, it has been described as Topsoil both on the logs and within this report. Where man has clearly either placed the soil, or the composition altered, with say greater than an estimated 5% of a non-natural constituent, it has been referred to as Made Ground both on the log and within this report.

For more complete information about the soils encountered within the general area of the site reference should be made to the detailed records given within Appendix A, but for the purposes of discussion, the succession of conditions encountered in the trial holes in descending order can be summarised as:

Made Ground (MG)
Alluvium (ALV)
London Clay Formation (LCF) [inferred from dynamic probes]
Lambeth Group (LMBE) [not encountered]

The ground conditions encountered in the trial holes are summarised in Table 2.2.

Table 2.2 Ground Conditions

Strata	Epoch	Depth Encountered (m bgl)		Typical Thickness (m)	Typical Description
		Top	Bottom		
MG	Anthropocene	0.00	1.80–2.35	2.00	Dark brown slightly sandy CLAY with frequent roots and occasional flint, brick, chalk and clinker gravel fragments, overlying light yellowish brown sandy silty GRAVEL made up of medium to coarse subangular to subrounded gravel sized fragments of chalk and flint.
ALV	Quaternary	1.85–2.35	5.40 ² –6.00 ^{1,2}	Not proven ³	Dark grey mottled black slightly fine sandy CLAY
LCF	Eocene	5.40 ² –6.00 ^{1,2}	>6.00 ¹	Not proven ³	No sample recovered

Note: ¹ Final depth of trial hole. ² Depth inferred from dynamic probe ³ Base of strata not categorically proven. 0.00 denotes ground level.

2.3 Ground Conditions Encountered in Trial Holes

The ground conditions encountered in trial holes have been described below in descending order. The engineering logs are presented in Appendix A.1.

2.3.1 Made Ground

The encountered Made Ground underlying the site comprised two distinct types.

The upper stratum of Made Ground was encountered in all four trial holes and persisted to depths ranging between 0.50m and 0.75m bgl. This stratum typically comprised dark brown slightly sandy CLAY with frequent roots/rootlets and occasional flint, brick, chalk and clinker gravel fragments.

The second type of Made Ground was encountered in all four trial holes underlying the upper Made Ground stratum and persisted to depths ranging between 1.85m and 2.35m bgl. This horizon comprised light yellowish brown sandy silty GRAVEL made up of medium to coarse subangular to subrounded gravel sized fragments of chalk and flint. Whilst there was nothing in terms of its composition to determine this horizon as Made Ground (i.e. lack of anthropogenic materials), the stratum was largely out of context with the surrounding area and likely to comprise fill emplaced to level the site following redirection of the adjacent stream (likely to formerly have encroached onto the site) during construction of the railway, and has therefore been referred to as Made Ground in this report.

The final depths of Made Ground have been included in Table 2.3.

Table 2.3 Final Depth of Made Ground

Trial Hole	Depth (m bgl)
WS1	1.90
WS2	2.00
WS3	1.80
WS4	2.35

2.3.2 Alluvium

Soils described as Alluvium were encountered underlying the Made Ground from depths ranging between 1.80m and 2.35m bgl and persisted to the full investigatory depth of 4.00m bgl for the windowless sampler boreholes. The lower horizon was inferred within dynamic probes at depths ranging between 5.40m bgl and full investigatory depth of 6.00m bgl.

The Alluvium comprised dark grey mottled black slightly fine sandy CLAY. The Alluvium encountered within WS1 was described as having a higher fraction of fine sand than in the remaining trial holes.

The final depths of Alluvium have been included in Table 2.4.

Table 2.4 Final Depth of Alluvium

Trial Hole	Depth (m bgl)
WS1/DPI	4.00 ¹ /6.00 ¹
WS2/DP2	4.00 ¹ /5.40 ²
WS3/DP3	4.00 ¹ /5.70 ²
WS4/DP4	4.00 ¹ /5.70 ²
Note: ¹ Final depth of trial hole/probe.	
² Depth inferred from dynamic probe	

2.3.3 London Clay Formation

Soils inferred to consist of London Clay Formation were inferred from dynamic probes to extend from depths of between 5.40m and 5.70m bgl and persisted to the full investigatory depth of 6.00m bgl. London Clay Formation was not considered to have been reached within DP1.

No sample recovery was possible to allow classification of the soil.

The final depths of London Clay Formation have been included in Table 2.5.

Table 2.5 Final Depth of London Clay Formation

Trial Hole	Depth (m bgl)
DPI	Not encountered
DP2	6.00 ¹
DP3	6.00 ¹
DP4	6.00 ¹

Trial Hole	Depth (m bgl)
Note: ¹ Final depth of trial hole/probe.	

2.4 Roots

Roots/rootlets were encountered in all four trial holes observed to depths ranging between 1.00m and 1.40m bgl within soils of Made Ground. The maximum observed depths of root penetration have been included in Table 2.6.

Table 2.6 Depth of Root Penetration

Trial Hole	Depth (m bgl)
WS1	1.40
WS2	1.20
WS3	1.40
WS4	1.00

Roots may be found to greater depth at other locations on the site particularly close to trees and/or trees that have been removed both within the site and its close environs.

It must be emphasised that the probability of determining the maximum depth of roots from a narrow diameter borehole is low. A direct observation such as from within a trial pit is necessary to gain a better indication of the maximum root depth.

The site was noted as heavily vegetated across the site including mature and semi-mature trees.

2.5 Groundwater

No groundwater strikes were recorded during the drilling of any of the windowless sampler boreholes. Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was conducted in October (2019), when groundwater levels should be rising from their annual minimum (lowest) elevation, which typically occurs around September. The annual maximum (highest) elevation typically occurs around March. Although no groundwater was encountered and the adjacent river is likely lined, the presence of groundwater cannot be completely discounted. Groundwater strikes may have been masked during drilling process and groundwater could be anticipated at levels likely to commensurate with the adjacent river levels.

Groundwater equilibrium conditions may only be conclusively established, if a series of observations are made via groundwater monitoring wells. At the time of reporting, Soils Limited were not commissioned to undertake groundwater monitoring within the monitoring wells installed onsite.

Section 3 Discussion of Geotechnical In-Situ and Laboratory Testing

3.1 Dynamic Probe Tests

Dynamic probing (DPSH) was undertaken four locations (DP1 – DP4) prior and adjacent to the drilling of their corresponding windowless sampler borehole to depths of 6.00m bgl. The results were converted to equivalent SPT “N60” values based on dynamic energy using commercial computer software (Geostru). The results were then interpreted based on the classifications outlined in Appendix B.1.

The SPT “N60” values presented have been corrected in accordance with BS EN 22476 Part 3, to account for the rig efficiency, borehole depth, overburden factors etc. Further correction of the ‘N’ values should therefore not be necessary. The energy ratio of the drilling rig was 71%. The energy ratio for each location is presented on the individual logs within Appendix B.3.

The Alluvium recorded equivalent SPT “N60” values between <1 and 14 classifying the cohesive soils as extremely low to medium strength with inferred undrained cohesions of between <10kPa and 70kPa.

The London Clay Formation inferred at depth recorded equivalent SPT “N60” values between 17 and 27 classifying the cohesive soils as high strength with undrained cohesive strengths of between 85kPa and 135kPa.

A full interpretation of the DPSH tests are outlined in Appendix B.2, Table B.2.1.

3.2 Atterberg Limit Tests

Atterberg Limit tests were performed on three samples obtained from the Alluvium. The results were classified in accordance with BRE Digest 240 and NHBC Standards Chapter 4.2.

The Alluvium was classified as medium to high volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

A full interpretation of the Atterberg Limit tests are outlined in Table B.2.2, Appendix B.2 and the laboratory report in Appendix B.3.

3.3 Particle Size Distribution Tests

Particle Size Distribution (PSD) tests were performed on two samples obtained from the granular Made Ground.

The PSD tests showed the granular soils of the Made Ground did not have a volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter

4.2. Note that a cohesive soil is only classified as having a volume change potential if it is also plastic and an Atterberg Limit test can be conducted on the strata.

A full interpretation of the PSD tests are outlined in Table B.2.3, Appendix B.2 and the laboratory report in Appendix B.3.

3.4 Sulphate and pH Tests

One sample was taken from the granular Made Ground and one from the Alluvium for water soluble sulphate (2:1) and pH testing in accordance with Building Research Establishment Special Digest 1, 2005, 'Concrete in Aggressive Ground'.

Water soluble sulphate and pH testing were undertaken on an additional five samples of Made Ground.

The results from the testing are summarised in Table 3.1.

Table 3.1 Sulphate Content

Stratum	No. of Tests	W/S Sulphate (mg/l)	pH
MG	6	13 – 34	7.2 – 8.3
ALV	1	655	8.1

The significance of the sulphate and pH test results are discussed in Section 4.4 and the laboratory report in Appendix B.3.

Section 4 Foundation Design

4.1 General

An engineering appraisal of the soil types encountered during the site investigation and likely to be encountered during the redevelopment of this site is presented. Soil descriptions are based on analysis of disturbed samples taken from the trial holes.

4.1.1 Made Ground and Topsoil

The terms *Fill* and *Made Ground (non-engineered fill)* are used to describe material, which has been placed by man either for a particular purpose e.g. to form an embankment, or to dispose of unwanted material. For the former use, the Fill and/or Made Ground may well have been selected for the purpose and placed and compacted in a controlled manner. With the latter, great variations in material type, thickness and degree of compaction invariably occur and there can be deleterious or harmful matter, as well as potentially methanogenic organic material.

The BSI Code of Practice for Foundations, BS 8004:2015, Clause 4.1.2.2 states, *'Spread foundations should not be placed on non-engineered fill unless such use can be justified on the basis of a thorough ground investigation and detailed design.'*

The encountered Made Ground underlying the site comprised two distinct types.

The upper stratum of Made Ground was encountered in all four trial holes and persisted to depths ranging between 0.50m and 0.75m bgl. This stratum typically comprised dark brown slightly sandy CLAY with frequent roots/rootlets and occasional flint, brick, chalk and clinker gravel fragments.

The second type of Made Ground was encountered in all four trial holes underlying the upper Made Ground stratum and persisted to depths ranging between 1.85m and 2.35m bgl. This horizon comprised light yellowish brown sandy silty GRAVEL made up of medium to coarse subangular to subrounded gravel sized fragments of chalk and flint. Whilst there was nothing in terms of its composition to determine this horizon as Made Ground (i.e. lack of anthropogenic materials), the stratum was largely out of context with the surrounding area and likely to comprise fill emplaced to level the site following redirection of the adjacent stream (likely to formerly have encroached onto the site) during construction of the railway, and has therefore been referred to as Made Ground in this report.

The depths of Made Ground have been included in Table 2.3.

A result of the inherent variability, particularly of uncontrolled Topsoil, Fill and/or Made Ground is that it is usually unpredictable in terms of bearing capacity and settlement characteristics. Foundations should, therefore, be taken through any Topsoil and/or Made Ground and either into, or onto a suitable underlying natural

stratum of adequate bearing characteristics.

4.1.2 Alluvium

Soils described as Alluvium were encountered underlying the Made Ground from depths ranging between 1.80m and 2.35m bgl and persisted to the full investigatory depth of 4.00m bgl for the windowless sampler boreholes. The lower horizon was inferred within dynamic probes at depths ranging between 5.40m bgl and full investigatory depth of 6.00m bgl.

The Alluvium comprised dark grey mottled black slightly fine sandy CLAY. The Alluvium encountered within WS1 was described as having a higher fraction of fine sand than in the remaining trial holes.

The results from DPSH testing inferred that the cohesive soils of the Alluvium were extremely low to medium strength, with undrained cohesions ranging between <10kPa and 70kPa.

The results from Atterberg Limit tests showed the cohesive soils of Alluvium had a medium to high volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

Soils of the Alluvium are normally consolidated, predominantly granular soils and as such are expected to display low to moderate bearing capacities with moderate to high settlement, and variable, characteristics. The soils of the Alluvium were not considered a suitable founding stratum for the proposed development due to variations in composition and deposition thickness across the site.

4.1.3 London Clay Formation

Soils inferred to consist of London Clay Formation were inferred from dynamic probes to extend from depths of between 5.40m and 5.70m bgl and persisted to the full investigatory depth of 6.00m bgl

The results from DPSH testing inferred that the London Clay Formation was of high strength with undrained cohesions between 85kPa and 135kPa.

Soils of the London Clay Formation are heavily overconsolidated cohesive soils and expected to display moderate bearing capacities with moderate settlement characteristics. The soils of the London Clay Formation were considered a suitable bearing stratum for the adoption of a piled foundation solution, given the depth to its upper horizon.

4.1.4 Roots

Roots/rootlets were encountered in all four trial holes observed to depths ranging between 1.00m and 1.40m bgl. Roots may be found to greater depth at other locations on the site particularly close to trees and/or trees that have been removed both within the site and its close environs.

The site was noted as heavily vegetated across the site including mature and semi-mature trees.

4.1.5 Groundwater

No groundwater strikes were recorded during the drilling of any of the windowless sampler boreholes. Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage. The investigation was conducted in October (2019), when groundwater levels should be rising from their annual minimum (lowest) elevation, which typically occurs around September. The annual maximum (highest) elevation typically occurs around March. Although no groundwater was encountered and the adjacent river is likely lined, the presence of groundwater cannot be completely discounted. It should be anticipated that groundwater be present at elevations likely to be commensurate with adjacent river levels.

4.2 Foundation Scheme General

The proposal comprised the demolition of existing structures onsite and subsequent redevelopment of the site into an apartment complex housing 20 No. 1 bed residential units. The proposed development comprised areas of hard landscaping including new access road, parking space and pavements and areas of soft landscaping including public open space. No private gardens were proposed.

In compiling this report reliance was placed on drawing number 28065-SK110, dated March 2019, prepared by pdp architecture llp. Any change or deviation from the scheme outlined in the drawing could invalidate the foundation design and remediation recommendations presented within this report. Soils Limited must be notified about any such changes.

Development plans provided by the client are presented in Appendix D.

4.2.1 Guidance on Shrinkable Soils

The Building Research Establishment (BRE) Digests 240, 241 and 242 provide guidance on 'best practice' for the design and construction of foundations on shrinkable soils.

The results from Atterberg Limits Tests showed that the Alluvium had medium to high volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

High volume change potential must therefore be adopted.

The BRE Digest 241 states: "An increasingly common, potentially damaging situation is where trees or hedges have been cut down prior to building. The subsequent long-term swelling of the zone of clay desiccated by the roots, as

moisture slowly returns to the ground, can be substantial. The rate at which the ground recovers is very difficult to predict and if there is any doubt that recovery is complete then bored pile foundations with suspended beams and floors should be used”.

The stated intention of the NHBC is to ensure that shrinkage and swelling of plastic soils does not adversely affect the structural integrity of foundations to such a degree that remedial works would be required to restore the serviceability of the building. It must be borne in mind that adherence to the NHBC tables and design recommendations may not, in all cases, totally prevent foundation movement and cracking of brickwork might occur.

The BRE Digest 240 suggests: *“Two courses of action are open:*

Estimate the potential for swelling or shrinkage and try to avoid large changes in the water content, for example by not planting trees near the foundations.

Accept that swelling or shrinkage will occur and take account of it. The foundations can be designed to resist resulting ground movements or the superstructure can be designed to accommodate movement without damage.”

The design of foundations suitable to withstand movements is presented in BRE Digest 241 “Low-rise buildings on shrinkable clay soils: Part 2”.

4.3 Foundation Scheme

Foundations **must not** be constructed within any Made Ground/Topsoil and Alluvium due to the likely variability and potential for large load induced settlements both total and differential.

In consideration of the site history and encountered ground conditions, a piled foundation solution was considered the most suitable for the proposed development. Further intrusive investigation via cable percussive methods would be required to determine soil parameters at greater depth to inform design of a piled foundation solution.

4.3.1 Ground Floor Slab

NHBC Standards 2019 states ground floors should be constructed as suspended floors where:

- *“the foundation depth dictated by the NHBC Standards 2019, Chapter 4.2.10 would exceed 1.5m bgl;”*
- *“ground floor construction is undertaken when the surface soils are seasonally desiccated;”*
- *“the depth of fill exceeds 600mm;”*
- *“there is shrinkable soil that could be subject to movement, expansive material or other unstable soils;”*

- “the ground has been subject to vibratory improvement;” or
- “ground or fill is not suitable to support ground-bearing slabs.”

Made Ground was encountered to depths >600mm across the site which dictates the ground floor slab should be constructed as suspended.

4.3.2 Piled Foundations

Piled foundations must be taken through any Made Ground and Alluvium into suitable strength soils of the London Clay Formation.

The construction of a piled foundation is a specialist job with the actual pile working load depending on the particular type pile and installation method. Prior to finalising the foundation design the advice from a reputable contractor who is familiar with the ground and groundwater conditions present at the site should be sought.

Further intrusive investigation via cable percussive methods would be required to determine soil parameters at greater depth to inform design of a piled foundation solution.

4.4 Subsurface Concrete

Sulphate concentration measured in 2:1 water/soil extracts for Made Ground fell into Class **DS-1** of the BRE Special Digest 1 2005, ‘Concrete in Aggressive Ground’. Table C2 of the Digest indicated ACEC (Aggressive Chemical Environment for Concrete) site classifications of **AC-1**. The pH of the soils tested ranged between 7.2 and 8.3.

Sulphate concentration measured in 2:1 water/soil extracts for the London Clay Formation fell into Class **DS-2** of the BRE Special Digest 1 2005, ‘Concrete in Aggressive Ground’. Table C2 of the Digest indicated ACEC (Aggressive Chemical Environment for Concrete) site classifications of **AC-2**. The pH of the soils tested ranged between 7.2 and 8.3.

The classifications given were determined using the mobile groundwater case, in the view of groundwater being encountered. The laboratory results are presented in Appendix B.3.

A summary of the concrete classifications is presented in Table 4.1.

Table 4.1 Aggressive Chemical Environment Concrete Classification

Stratum	DS	ACEC
MG	DS-1	AC-1
ALV	DS-2	AC-2

Concrete to be placed in contact with soil or groundwater must be designed in accordance with the recommendations of Building Research Establishment Special

Digest 1 2005, '*Concrete in Aggressive Ground*' taking into account any possible exposure of potentially pyrite bearing natural ground and the pH of the soils.

4.5 Excavations

Shallow excavations in the Made Ground are likely to be marginally stable in the short term at best.

Deeper excavations taken into the Alluvium are unlikely to be stable and would require support. Unsupported earth faces formed during excavation may be liable to collapse without warning and suitable safety precautions should therefore be taken to ensure that such earth faces are adequately supported or battered back to a safe angle of repose before excavations are entered by personnel.

Excavations beneath the groundwater table are likely to be unstable and dewatering of foundation trenches may be necessary. Although no groundwater was encountered and the adjacent river is likely lined, the presence of groundwater cannot be completely discounted. Groundwater may be present at elevations commensurate with adjacent river water levels. At the time of reporting, no groundwater monitoring had been commissioned.

Section 5 Determination of Chemical Analysis

5.1 Site Characterisation and Revised Conceptual Site Model

The Preliminary Investigation Report undertaken by Soils Limited (ref: 17902/PIR dated November 2019) identified a low risk of ground contamination associated with previous site activities.

The main intrusive investigation identified Made Ground to depths ranging between 1.80m and 2.35m bgl and was encountered to comprise two distinct types.

The upper stratum of Made Ground was encountered in all four trial holes and persisted to depths ranging between 0.50m and 0.75m bgl. This stratum typically comprised dark brown slightly sandy CLAY with frequent roots/rootlets and occasional flint, brick, chalk and clinker gravel fragments.

The second type of Made Ground was encountered in all four trial holes underlying the upper Made Ground stratum and persisted to depths ranging between 1.85m and 2.35m bgl. This horizon comprised light yellowish brown sandy silty GRAVEL made up of medium to coarse subangular to subrounded gravel sized fragments of chalk and flint. Whilst there was nothing in terms of its composition to determine this horizon as Made Ground (i.e. lack of anthropogenic materials), the stratum was largely out of context with the surrounding area and likely to comprise fill emplaced to level the site following redirection of the adjacent stream (likely to formerly have encroached onto the site) during construction of the railway, and has therefore been referred to as Made Ground in this report.

Soils of Alluvium were encountered underlying the Made Ground and inferred to persist to depths greater than 5.40m bgl.

5.2 Soil Sampling

Sampling locations were selected by the client. Sampling depths were selected by Soils Limited based on observations made during logging of the soil cores.

5.3 Determination of Chemical Analysis

The driver for determination of the analysis suite was the information obtained from the Preliminary Investigation Report and Main Investigation Report intrusive investigation. Table 5.1 outlines the specification for each sample tested.

Table 5.1 Chemical Analysis Specification

Substance	Locations:Depths (m bgl)			
	WS1:0.20 ⁵	WS2:0.20 ⁵	WS3:0.20 ⁵	WS4:0.20 ⁵
Asbestos Screen	✓	✓	✓	✓
Total Phenols	✓	✓	✓	✓

Total Cyanide	✓	✓	✓	✓
Organic Matter	✓	✓	✓	✓
pH	✓	✓	✓	✓
Heavy Metals	✓	✓	✓	✓
Metalloids	✓	✓	✓	✓
Organics	✓	✓	✓	✓

Notes: **Metals:** Cd, Cr, Pb, Hg, Ni, Se, CN, S, Cu, Zn, Bo, Be, V. **metalloids:** As. **organics:** USEPA 16 speciated PAH. **Asbestos screening** was undertaken in accordance with HSG 248. ^s = Soil sample.

Section 6 Qualitative Risk Assessment

6.1 Assessment Criteria

The assessment criteria used to determine risks to human health are derived and explained within Appendix C.3.

6.2 Representative Contamination Criteria - Soil

The proposal comprised the demolition of existing structures onsite and subsequent redevelopment of the site into an apartment complex housing 20 No. 1 bed residential units. The proposed development comprised areas of hard landscaping including new access road, parking space and pavements and areas of soft landscaping including public open space. No private gardens were proposed.

In compiling this report reliance was placed on drawing number 28065-SK110, dated March 2019, prepared by pdp architecture llp. Any change or deviation from the scheme outlined in the drawing could invalidate the foundation design and remediation recommendations presented within this report. Soils Limited must be notified about any such changes.

Based on the proposed development, the results of the chemical analysis have been compared against generic guidance values for a 'Residential with public open' end use, as presented in SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination December 2014 (C4SL), derived for the protection of human health. Where this document has not published screening values for determinants, screening values derived for the same end use have been adopted from the following published guidance; DEFRA Soil Guideline Values (SGV) and LQM/CIEH/Suitable 4 Use Level (S4UL).

To assess the potential toxicity to the human health receptor from the concentrations of organic compounds tested for, Soil Organic Matter (SOM) tests were undertaken on the samples submitted for chemical testing, which revealed SOM values of between 5.3% and 7.6%. For each soil sample tested, the Soil Organic Matter recorded was used to derive the appropriate guideline value for organic determinants.

Table 6.1 outlines the samples that have exceeded their relevant assessment criteria. The full laboratory report is presented in Appendix C.2.

Table 6.1 Summary of Chemical Analysis of Soils Sample Exceedance

Substance	Sample locations where SGV, C4SL or S4UL adopted were exceeded for the 'POS residential' land-use scenario
Lead	680mg/kg against 630mg/kg – WS03:0.30 (C4SL)

In summary, one of the samples tested showed concentrations in excess of the relevant C4SL for a POS residential land-use scenario. In WS3 at 0.20m bgl, lead was recorded

at a concentration of 680mg/kg against the POS residential end-use C4SL of 630mg/kg.

None of the other substances tested recorded concentrations above the adopted screening values.

6.2.1 Asbestos

No Asbestos Containing Material (ACM) was detected within any of the samples tested. However, it is possible that asbestos is present in other areas of the site. If encountered, the discovery strategy detailed below must be followed and care must be taken to ensure any such material is separated and disposed of in an appropriate manner to a licensed waste facility.

6.3 Groundwater

No groundwater strikes were recorded during drilling of the trial holes for this investigation. It is recommended that groundwater monitoring is undertaken to aid in foundation design and to collect samples if considered necessary to assess risks to sensitive groundwater receptors

6.4 Tier 1 Quantitative Risk Assessment

Quantitative risk assessments are undertaken for the soil, groundwater and soil gas. The CSM has been updated to take account of the assessments below and presented in Appendix C.1. The full laboratory chemical report is presented in Appendix C.2.

6.4.1 Soils

One of the samples tested showed concentrations in excess of the relevant C4SL for a POS residential land-use scenario. In WS3 at 0.20m bgl, lead was recorded at a concentration of 680mg/kg against the POS residential end-use C4SL of 630mg/kg. The presence of elevated (against other samples) concentration of zinc within the sample suggests that the Lead contamination is likely to be a fragment of lead zinc flashing from the glass houses formally located on the site.

Trial hole WS3 is situated beneath the footprint of the proposed building and therefore any potential contamination linkages to the end-user receptor will be broken by the building floor slab. It should be noted that due to the shallow nature of the impacted soil it is likely to be removed as part of the site preparation before commencement of the redevelopment of the site.

The Tier 1 Quantitative risk assessment therefore established that there was **no risk to the human health receptors** of future end-users.

6.4.2 Groundwater

The Preliminary Investigation Report (ref.:17902/PIR, dated November 2019) identified the site to be situated on the boundary of a Secondary Aquifer – A in the form of the superficial Alluvium and the bedrock Lambeth Group and the

unproductive strata of the London Clay Formation. The groundwater vulnerability is recorded as high for both Secondary Aquifers on site.

A quantitative Groundwater Risk Assessment was not commissioned as part of the site investigation report. However, it is considered that the elevated lead recorded in WS103 at a depth of 0.20m represents a low risk to groundwater quality. This consideration is based on the cohesive nature of the alluvium which is recorded to underlie the Made Ground in this area, which will significantly retard localised vertical migration and the low solubility and mobility of lead in the predominantly pH neutral soils on the site.

6.4.3 Soil Gas

The Preliminary Investigation Report identified a very low to low risk of soil gas associated with previous onsite activities. Given the depth of Made Ground and Alluvium encountered underlying the site, in line with current guidance, a minimum of six soil gas monitoring visits across a period of approximately three months should be undertaken to quantify the underlying gassing regime and allow development of a full soil gas risk assessment for the site.

Three soil gas monitoring wells were installed onsite at the time of investigation. At the time of reporting, no soil gas monitoring had been commissioned.

6.5 Conclusions and Recommendations

Soil chemical analysis recorded one samples with substance levels over their representative POS residential guideline values. The impacted soil identified was located beneath the proposed footprint of the building at shallow depth. Therefore, impact soils are likely to be removed as part of the site strip and redevelopment and will not present risk to the human health receptor.

Following the findings of the intrusive investigation with respect to environmental considerations, the following recommendations are made:

- In line with current guidance, a minimum of six soil gas monitoring visits are recommended over a period of approximately three months to allow development of full soil gas risk assessment for the site.

6.6 Duty of Care

Groundworkers must maintain a good standard of personal hygiene including the wearing of overalls, boots, gloves and eye protectors and the use of dust masks during periods of dry weather.

To prevent exposure to airborne dust by both the general public and construction personnel the site should be kept damp during dry weather and at other times when dust is generated as a result of construction activities. The site should be securely fenced at

all times to prevent unauthorised access.

Washing facilities should be provided and eating restricted to mess huts.

6.7 Excavated Material

Excavated material as waste must be defined or classified prior to any disposal, transport, recycling or re-use at or by an appropriately licensed or exempt carrier and/or off-site disposal facility. The requirements inherent in both Duty of Care and Health and Safety must also be complied with. In order to determine what is to happen, what is suitable, appropriate and most effective in the disposal of wastes, especially those subject to CDM waste management plan requirements, several factors must be considered and competent advice should always be sought.

The amount, type and nature of the material to be removed will in part determine the amount and type of analysis that may be required to comply with current waste guidance, and thereby allow a competent person to suitably classify the material. Often this data is uncertain or unavailable, especially in the early stages of a project, and therefore further investigation, testing and analysis may be required as additional information regarding the development becomes available.

Wastes must be classified and defined by their solid characteristics to comply with current waste guidance. Existing information and analysis derived for environmental purposes may therefore be suitable for use in this context. Waste Acceptance Criteria (WAC) report the leachability of materials and therefore cannot be used to classify, characterise or define wastes. The only purpose of a WAC analysis is to determine the suitability of a given material for acceptance at one of the three different types of available licenced landfills (inert, stable non-reactive hazardous or hazardous).

Other options are available that may lead to significant savings against disposal to landfill and expert advice should always be sought from a competent person to advise on their relative costs or benefits and advise on any additional analysis, sampling or investigation that may be required to reduce remaining uncertainties and comply with current guidance. Further consideration of results using HazWasteOnline™ can be undertaken on request to give an indication of potentially hazardous properties in the materials analysed.

6.8 Re-use of Excavated Material On-site

The re-use of on-site soils may be undertaken either under the Environmental Permitting Regulations 2007 (EPR), in which case soils other than uncontaminated soils are classed as waste, or under the CL:AIRE Voluntary Code of Practice (CoP) which was published in September 2008 and is accepted as an alternative regime to the EPR.

Under the EPR, material that is contaminated but otherwise suitable for re-use is also classified as waste and its re-use should be in accordance with the Environmental

Permitting Regulations 2007 (EPR). Environmental Permit Exemptions (EPE) are for the re-use of non-hazardous or inert waste only; hazardous waste cannot be re-used under a permit exemption. EPE apply only to imported inert waste materials; inert material arising on site and recovered on site is not classified as waste and does not require an exemption. It is possible that materials arising on-site will be classified as inert and would not need an exemption.

Environmental Permit Exemptions are only allowed for certain activities, placing controls on the quantities that can be stored and re-used. The re-use of waste shall be within areas and levels defined in planning applications and permissions for the development. An EPE requires a site-specific risk assessment for the receptor site to demonstrate that the materials are suitable for use, i.e. that they will not give rise to harm to human health or pollution of the environment.

Under the CL:AIRE voluntary code of practice (CoP) materials excavated on-site are not deemed contaminated if suitable for re-use at specified locations or generally within the site.

Material that may have been classified as hazardous waste under the EPR may be re-used. The CoP regime requires that a 'Qualified Person' as defined under the CoP reviews the development of the Materials Management Plan, including review of Risk Assessments and Remediation Strategy/Design Statement together with documentation relating to Planning and Regulatory issues, and signs a Declaration which is forwarded to the Environment Agency and which confirms compliance with the CoP.

Should it be necessary to import materials from another site where materials are excavated and which is not material from a quarry or produced under a WRAP protocol, then an EPE would be necessary for the imported material whether the work was managed under the CoP or the EPR.

6.9 Imported Material

Any soil, which is to be imported onto the site, must undergo chemical analysis to permit classification prior to its importation and placement in order to ascertain its status with specific regard to contamination, i.e. to prove that it is suitable for the purpose for which it is intended.

6.10 Discovery Strategy

There may be areas of contamination not identified during the course of the investigation. Such occurrences may also be discovered during the demolition and construction phases for the redevelopment of the site.

Care should be taken during excavation works especially to investigate any soils, which appear by eye (e.g. such as fibrous materials, large amounts of ash and unusual discolouration), odour (e.g. fuel, oil and chemical type odours or unusual odours such as

sweet odours or fishy odours) or wellbeing (e.g. light headedness and/or nausea, burning of nasal passages and blistering or reddening of skin due to contact with soil) to be contaminated or of unusual and/or different character to standard soils or those analysed.

In the event of any discovery of potentially contaminated soils or materials, this discovery should be quarantined and reported to the most senior member of site staff or the designated responsible person at the site for action. The location, type and quantity must be recorded and the Local Authority, and a competent and appropriate third party Engineer/Environmental consultant notified immediately. An approval from the Local authority must be sought prior to implementing any proposed mitigation action.

The discovery strategy must remain on site at all times and must demonstrate a clear allocation of responsibility for reporting and dealing with contamination. A copy of the strategy must be placed on the health and safety notice board and /or displayed in a prominent area where all site staff are able to take note of and consult the document at any time. Any member of the workforce entering the site to undertake any excavation must be made aware of the potential to discover contamination and the discovery strategy.

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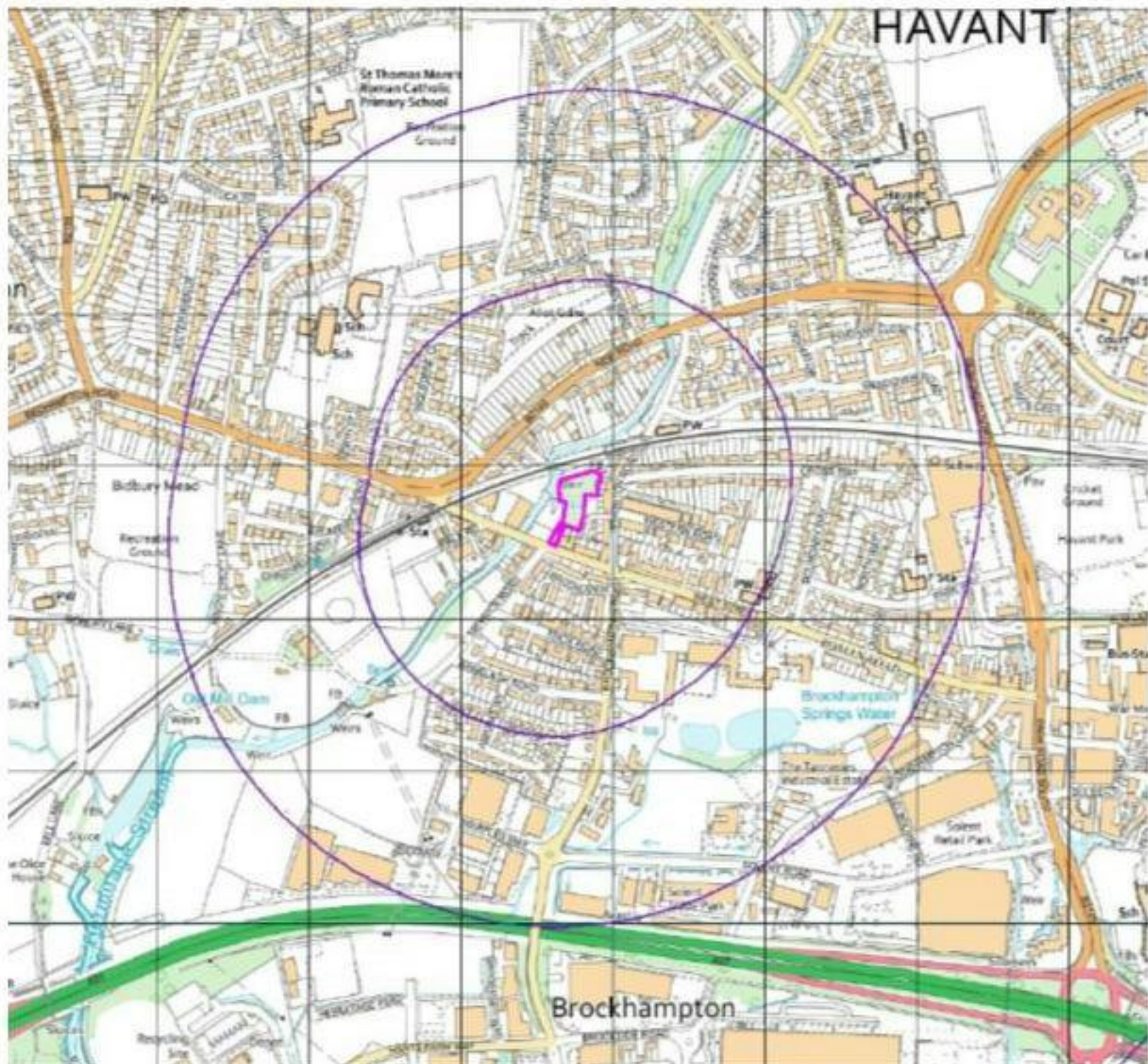


Figure 1 – Site Location Map



Job Number
17902

Client
Walthams Ltd.

Project
The Burrows, West Street, Bedhampton, Havant,
Hampshire PO9 1LR

Date
November 2019



Figure 2 – Aerial Photograph

Project

The Burrows, West Street,
Bedhampton, Havant, Hampshire
PO9 1LR

Client

Walthams Ltd.

Date

November 2019

Job Number

17902



Figure 3 – Trial Hole Plan

Project

The Burrows, West Street,
Bedhampton, Havant, Hampshire
PO9 1LR

Client

Walthams Ltd.

Date

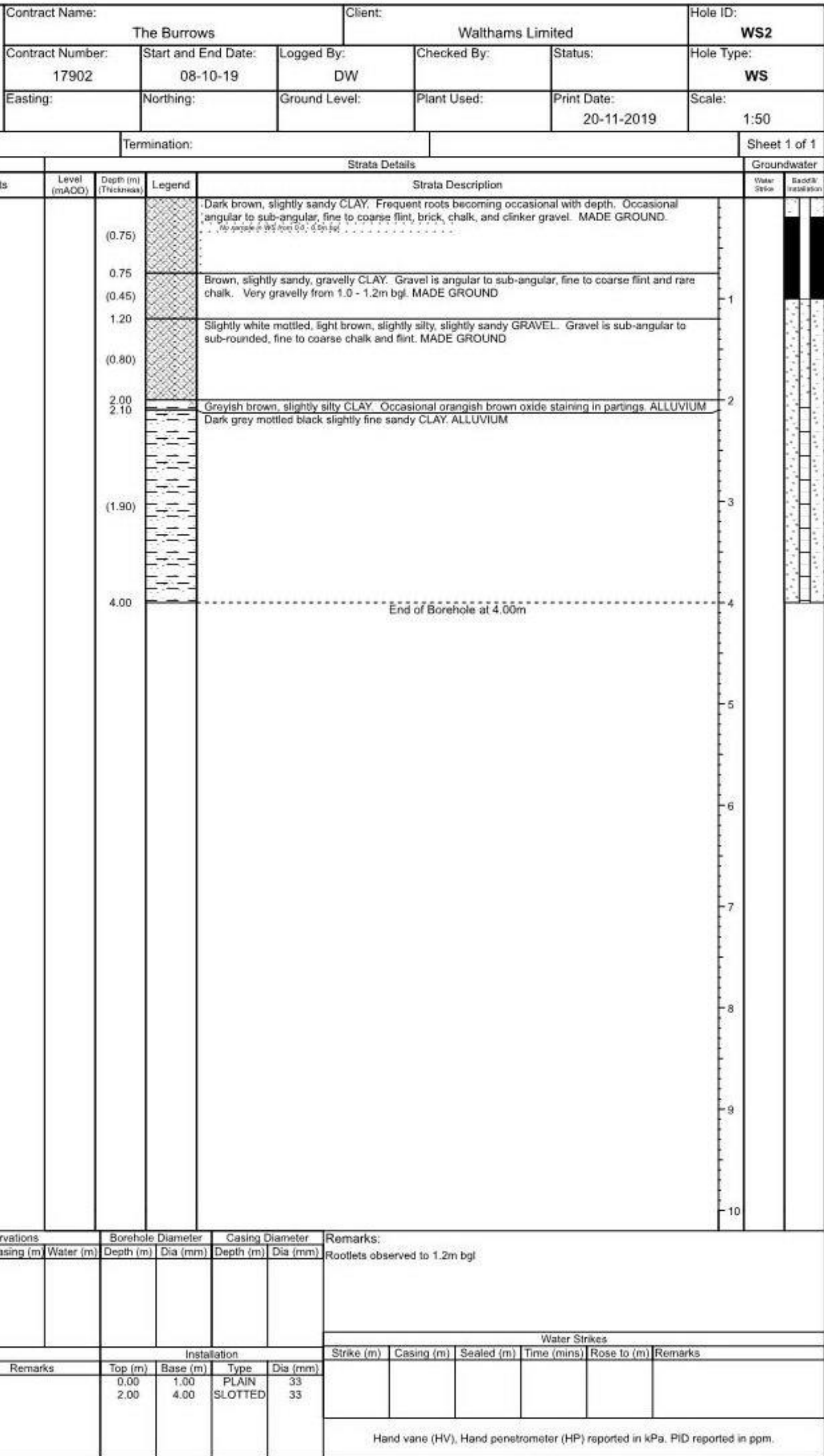
November 2019

Job Number

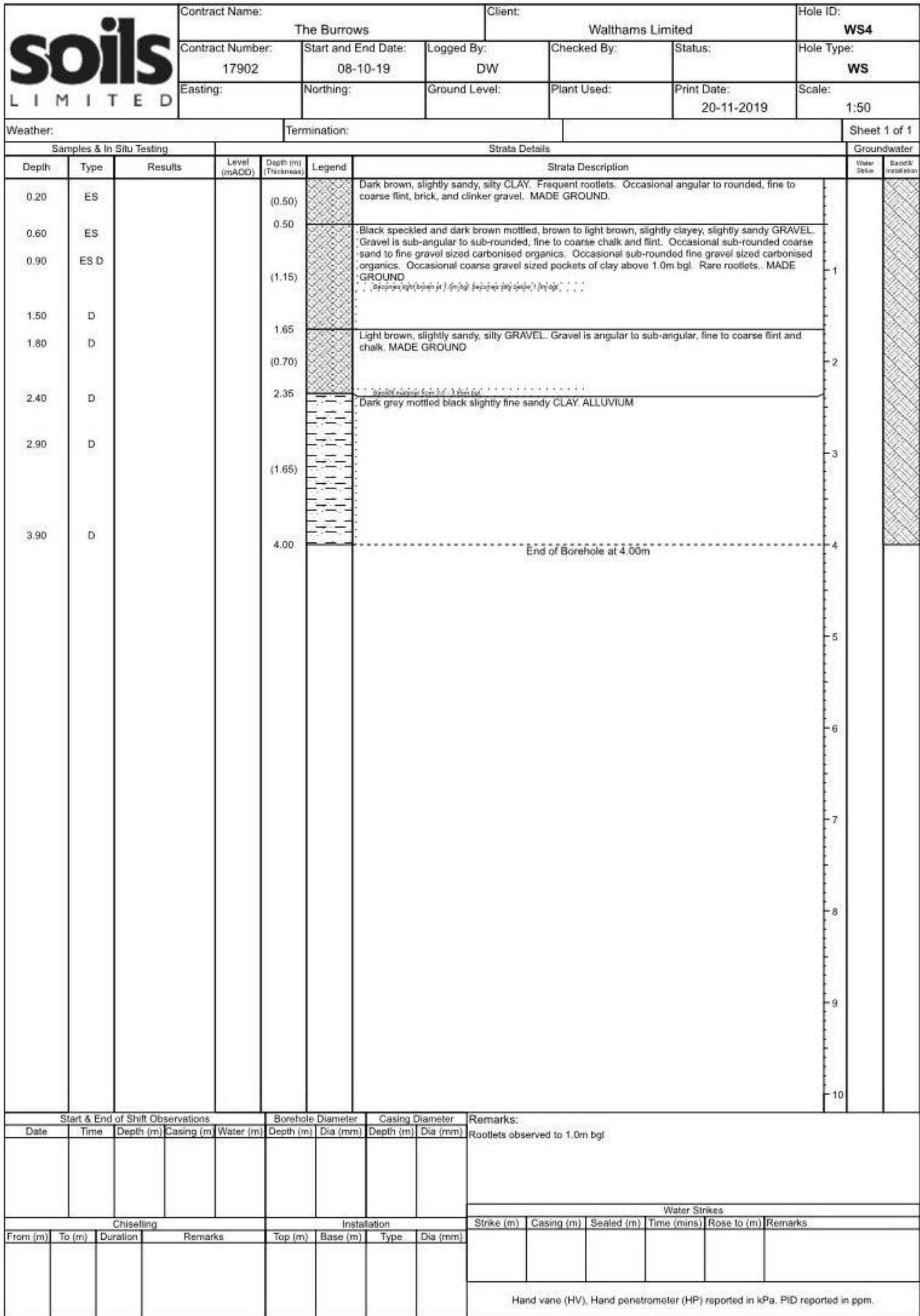
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Appendix A Field Work

Appendix A.1 Engineers Logs



Start & End of Shift Observations					Borehole Diameter		Casing Diameter		Remarks:					
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)	Rootlets observed to 1.4m bgl					
										Water Strikes				
Chiselling					Installation				Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
From (m)	To (m)	Duration	Remarks		Top (m)	Base (m)	Type	Dia (mm)						
					0.00	1.00	PLAIN	33						
					1.00	4.00	SLOTTED	33						
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.														



Appendix B Geotechnical In-Situ and Laboratory Testing

Appendix B.1 Classification

Classification based on SPT "N" values:

The inferred undrained strength of the cohesive soils was based on the SPT "N" blow counts, derived from the relationship suggested by Stroud (1974) and classified using Table B.1.1. (Ref: Stroud, M. A. 1974, "The Standard Penetration Test – its application and interpretation", Proc. ICE Conf. on Penetration Testing in the UK, Birmingham. Thomas Telford, London.).

Table B.1.1 SPT "N" Blow Count Cohesive Classification

Classification	Undrained Cohesive Strength C_u (kPa)
Extremely low	<10
Very low	10 – 20
Low	20 – 40
Medium	40 – 75
High	75 – 150
Very high	150 – 300
Extremely high	> 300

Note: (Ref: BS EN ISO 14688-2:2004+A1:2013 Clause 5.3.)

Appendix B.2 Interpretation

Table B.2.1 Interpretation of DPSH Blow Counts

DP	Strata	Equivalent SPT N60 Blow Counts	Inferred Cohesive Strength/Granular Density
DPI	ALV 1.90 – 2.40 Sandy CLAY	<1	Extremely low ($C_u = <10\text{kPa}$)
	ALV 2.40 – 3.00 Sandy CLAY	3 – 7	Very low to low ($C_u = 15 – 35\text{kPa}$)
	ALV 3.00 – 3.60 Sandy CLAY	<1	Extremely low ($C_u = <10\text{kPa}$)
	ALV ¹ 3.60 – 6.00 Sandy CLAY	3 – 14	Very low to medium ($C_u = 15 – 70\text{kPa}$)
DP2	ALV ¹ 2.00 – 5.40 Sandy CLAY	7 – 14	Low to medium ($C_u = 35 – 70\text{kPa}$)
	LCF ¹ 5.40 – 6.00 CLAY	17 – 20	High ($C_u = 85 – 100\text{kPa}$)
DP3	ALV ¹ 1.80 – 5.70 Sandy CLAY	7 – 14	Low to medium ($C_u = 35 – 70\text{kPa}$)
	LCF ¹ 5.70 – 6.00 CLAY	17	High ($C_u = 85\text{kPa}$)
DP4	ALV ¹ 2.30 – 5.70 Sandy CLAY	7 – 10	Low to medium ($C_u = 35 – 50\text{kPa}$)
	LCF ¹ 5.70 – 6.00 CLAY	24 – 27	High ($C_u = 120 – 135\text{kPa}$)

Note: ¹ Ground conditions inferred past the base of windowless sampler boreholes. Rig efficiency: 71%

Table B.2.2 Interpretation of Atterberg Limit Tests

Stratum	Moisture Content (%)	Plasticity Index (%)	Passing 425µm Sieve (%)	Modified Plasticity Index (%)	Soil Classification	Volume Change Potential	
						BRE	NHBC
LCF	12 - 30	32 - 45	100	32 - 45	CH	Medium to high	Medium to high

Stratum	Moisture Content (%)	Plasticity Index (%)	Passing 425µm Sieve (%)	Modified Plasticity Index (%)	Soil Classification	Volume Change Potential BRE	Potential NHBC
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Note: BRE Volume Change Potential refers to BRE Digest 240 (based on Atterberg results)
 NHBC Volume Change Potential refers to NHBC Standards Chapter 4.2
 Soils Classification based on British Soil Classification System
The most common use of the term clay is to describe a soil that contains enough clay-sized material or clay minerals to exhibit cohesive properties. The fraction of clay-sized material required varies, but can be as low as 15%. Unless stated otherwise, this is the sense used in Digest 240. The term can be used to denote the clay minerals. These are specific, naturally occurring chemical compounds, predominately silicates. The term is often used as a particle size descriptor. Soil particles that have a nominal diameter of less than 2 µm are normally considered to be of clay size, but they are not necessarily clay minerals. Some clay minerals are larger than 2 µm and some particles, 'rock flour' for example, can be finer than 2 µm but are not clay minerals.
 (The Atterberg Limit Tests were undertaken in accordance with BS 1377:Part 2:1990 Clauses 3.2, 4.3 and 5)

Table B.2.3 Interpretation of PSD Tests

Location	Depth (m bgl)	Soil Description	Volume Change Potential		Passing 63µm Sieve (%)
			BRE	NHBC	
WS1	1.50	Sandy silty GRAVEL (MG)	No	No	15
WS3	1.50	Sandy silty GRAVEL (MG)	No	No	9

Note: BRE 240 states that a soil has a volume change potential when the clay fraction **exceeds 15%**. Only the silt and clay combined fraction are determined by sieving therefore the volume change potential is estimated from the percentage passing the 63µm sieve. NHBC Standards Chapter 4.2 states that a soil is shrinkable if the percentage of silt and clay passing the 63µm sieve is greater than 35% and the Plasticity Index is greater than 10%.
 (The Particle Size Distribution Tests were undertaken in accordance with BS 1377: Part 2: 1990 Clause 9)

Appendix B.3 Geotechnical In-Situ and Laboratory Results

Project Name:	The Burrows	Project No.	17902	Co-ords:		Hole Type	DP
Location:	West Street, Bedhampton, Havant, Hampshire PO9 1LR	Level:	m AOD	Scale	1:50	Logged By	
Client:	Walthams Limited	Dates:	08-10-2019				

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
0.0					
0.1					
0.2					
0.3					
0.4					
0.5					
0.6					
0.7					
0.8					
0.9					
1.0					
1.1					
1.2					
1.3					
1.4					
1.5					
1.6					
1.7					
1.8					
1.9					
2.0					
2.1					
2.2					
2.3					
2.4					
2.5					
2.6					
2.7					
2.8					
2.9					
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9.0					
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9.2					
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9.5					
9.6					
9.7					
9.8					
9.9					
10.0					

Remarks	Fall Height	750mm	Cone Base Diameter	50.5mm
	Hammer Weight	63.5kg	Final Depth	6m
	Probe Type	DPSH-B	Energy Ratio (Er)	71%

Project Name:	The Burrows	Project No.	17902	Co-ords:		Hole Type	DP
Location:	West Street, Bedhampton, Havant, Hampshire PO9 1LR	Level:	m AOD	Scale	1:50	Logged By	
Client:	Walthams Limited	Dates:	08-10-2019				

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
0					
0.1	2				
0.2	2				
0.3	2				
0.4	2				
0.5	2				
0.6	2				
0.7	2				
0.8	2				
0.9	2				
1.0	2				
1.1	3				
1.2	4				
1.3	4				
1.4	5				
1.5	4				
1.6	5				
1.7	8				
1.8	9				
1.9	10				
2.0	7				
2.1	4				
2.2	4				
2.3	4				
2.4	3				
2.5	2				
2.6	3				
2.7	2				
2.8	3				
2.9	3				
3.0	3				
3.1	4				
3.2	2				
3.3	3				
3.4	3				
3.5	4				
3.6	2				
3.7	3				
3.8	3				
3.9	4				
4.0	3				
4.1	3				
4.2	3				
4.3	3				
4.4	3				
4.5	3				
4.6	3				
4.7	3				
4.8	3				
4.9	3				
5.0	3				
5.1	3				
5.2	3				
5.3	3				
5.4	4				
5.5	3				
5.6	4				
5.7	3				
5.8	4				
5.9	5				
6.0	5				
6.1	5				
6.2	5				
6.3	5				
6.4	5				
6.5	7				
6.6	6				
6.7	6				
6.8					
6.9					
7.0					
7.1					
7.2					
7.3					
7.4					
7.5					
7.6					
7.7					
7.8					
7.9					
8.0					
8.1					
8.2					
8.3					
8.4					
8.5					
8.6					
8.7					
8.8					
8.9					
9.0					
9.1					
9.2					
9.3					
9.4					
9.5					
9.6					
9.7					
9.8					
9.9					
10.0					

Remarks	Fall Height	750mm	Cone Base Diameter	50.5mm
	Hammer Weight	63.5kg	Final Depth	6m
	Probe Type	DPSH-B	Energy Ratio (Er)	71%

Project Name:	The Burrows	Project No.	17902	Co-ords:		Hole Type	DP
Location:	West Street, Bedhampton, Havant, Hampshire PO9 1LR	Level:	m AOD	Scale	1:50	Logged By	
Client:	Walthams Limited	Dates:	08-10-2019				

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
0.0					
0.1					
0.2					
0.3					
0.4					
0.5					
0.6					
0.7					
0.8					
0.9					
1.0					
1.1					
1.2					
1.3					
1.4					
1.5					
1.6					
1.7					
1.8					
1.9					
2.0					
2.1					
2.2					
2.3					
2.4					
2.5					
2.6					
2.7					
2.8					
2.9					
3.0					
3.1					
3.2					
3.3					
3.4					
3.5					
3.6					
3.7					
3.8					
3.9					
4.0					
4.1					
4.2					
4.3					
4.4					
4.5					
4.6					
4.7					
4.8					
4.9					
5.0					
5.1					
5.2					
5.3					
5.4					
5.5					
5.6					
5.7					
5.8					
5.9					
6.0					
6.1					
6.2					
6.3					
6.4					
6.5					
6.6					
6.7					
6.8					
6.9					
7.0					
7.1					
7.2					
7.3					
7.4					
7.5					
7.6					
7.7					
7.8					
7.9					
8.0					
8.1					
8.2					
8.3					
8.4					
8.5					
8.6					
8.7					
8.8					
8.9					
9.0					
9.1					
9.2					
9.3					
9.4					
9.5					
9.6					
9.7					
9.8					
9.9					
10.0					

Remarks	Fall Height	750mm	Cone Base Diameter	50.5mm
	Hammer Weight	63.5kg	Final Depth	6m
	Probe Type	DPSH-B	Energy Ratio (Er)	71%

Project Name:	The Burrows	Project No.	17902	Co-ords:		Hole Type	DP
Location:	West Street, Bedhampton, Havant, Hampshire PO9 1LR	Level:	m AOD	Scale	1:50	Logged By	
Client:	Walthams Limited	Dates:	08-10-2019				

Depth (m)	Blows/100mm				Torque (Nm)
	10	20	30	40	
0.0	3				
0.1	4				
0.2	5				
0.3	5				
0.4	7				
0.5	10				
0.6	10				
0.7	12				
0.8	7				
0.9	5				
1.0	5				
1.1	4				
1.2	4				
1.3	4				
1.4	8				
1.5	7				
1.6	4				
1.7	3				
1.8	3				
1.9	3				
2.0	3				
2.1	3				
2.2	3				
2.3	3				
2.4	3				
2.5	3				
2.6	3				
2.7	3				
2.8	3				
2.9	3				
3.0	3				
3.1	3				
3.2	3				
3.3	3				
3.4	3				
3.5	3				
3.6	3				
3.7	3				
3.8	3				
3.9	3				
4.0	3				
4.1	3				
4.2	3				
4.3	3				
4.4	3				
4.5	3				
4.6	3				
4.7	3				
4.8	3				
4.9	3				
5.0	3				
5.1	3				
5.2	3				
5.3	3				
5.4	3				
5.5	3				
5.6	3				
5.7	3				
5.8	3				
5.9	3				
6.0	3				
6.1	3				
6.2	3				
6.3	3				
6.4	3				
6.5	3				
6.6	3				
6.7	3				
6.8	3				
6.9	3				
7.0	3				
7.1	3				
7.2	3				
7.3	3				
7.4	3				
7.5	3				
7.6	3				
7.7	3				
7.8	3				
7.9	3				
8.0	3				
8.1	3				
8.2	3				
8.3	3				
8.4	3				
8.5	3				
8.6	3				
8.7	3				
8.8	3				
8.9	3				
9.0	3				
9.1	3				
9.2	3				
9.3	3				
9.4	3				
9.5	3				
9.6	3				
9.7	3				
9.8	3				
9.9	3				
10.0	3				

Remarks	Fall Height	750mm	Cone Base Diameter	50.5mm
	Hammer Weight	63.5kg	Final Depth	6m
	Probe Type	DPSH-B	Energy Ratio (Er)	71%



4041



Environmental Science

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e: reception@i2analytical.com

Analytical Report Number : [REDACTED]

Project / Site name: 17a The Burrows

Samples received on: 22/10/2019

Your job number: 17902

Samples instructed on: 22/10/2019

Your order number: 17902

Analysis completed by: 29/10/2019

Report Issue Number: 1

Report issued on: 29/10/2019

Samples Analysed: 3 soil samples

Signed: [REDACTED]

Zina Abdul Razzak
 Senior Quality Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
 leachates - 2 weeks from reporting
 waters - 2 weeks from reporting
 asbestos - 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

Iss No 19-67552-1 17a The Burrows 17902

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The results included within the report are representative of the samples submitted for analysis.

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Environmental Science

Analytical Report Number: 19-67552

Project / Site name: 17a The Burrows

Your Order No: 17902

Lab Sample Number	1339393	1339394	1339395		
Sample Reference	WS2	WS2	WS2		
Sample Number	None Supplied	None Supplied	None Supplied		
Depth (m)	0.50	1.40	2.70		
Date Sampled	08/10/2019	08/10/2019	08/10/2019		
Time Taken	None Supplied	None Supplied	None Supplied		
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	17	17
Total mass of sample received	kg	0.001	NONE	0.61	0.86

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.2	8.3	8.1		
Total Sulphate as SO ₄	%	0.005	MCERTS	-	0.047	0.106		
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.025	0.013	0.65		
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	13.0	655		
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-	2.5	32		
Total Sulphur	%	0.005	MCERTS	-	0.028	1.94		
Ammonium as NH ₄	mg/kg	0.5	MCERTS	-	1.5	0.6		
Ammonium as NH ₄ (10:1 leachate equivalent)	mg/l	0.05	MCERTS	-	0.15	0.06		
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-	< 2.0	< 2.0		

Heavy Metals / Metalloids

Magnesium (water soluble)	mg/kg	5	NONE	-	5.1	33		
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-	2.6	16		



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**Analytical Report Number : 19-67552****Project / Site name: 17a The Burrows**

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1339393	WS2	None Supplied	0.50	Brown clay and loam.
1339394	WS2	None Supplied	1.40	Beige clay and sand with gravel.
1339395	WS2	None Supplied	2.70	Grey clay.



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Environmental Science

Analytical Report Number : 19-67552

Project / Site name: 17a The Burrows

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Ammonium as NH ₄ in soil	Determination of Ammonium/Ammonia/Ammoniacal Nitrogen by the colorimetric salicylate/nitroprusside method, 10:1 water extraction.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	MCERTS
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 extraction.	L082-PL	D	MCERTS
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 °C)	In-house method based on BS1377 Part 2, 1990, Classification tests	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests**	L038-PL	D	MCERTS
Total Sulphur in soil as %	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006: Methods for the Determination of Metals in Soil	L038-PL	D	MCERTS
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	W	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.



2788

Laboratory Report



GEO Site & Testing Services Ltd

Contract Number: 46284

Client Ref: **17902**Report Date: **01-11-2019**

Client PO:

Client **Soils Limited**
Thomas Telford House
Unit 11
Sun Valley Business Park
Winnall Close
Winchester
SO23 0LB

Contract Title: **17a The Burrows**
 For the attention of: **Tim Rudkin**

Date Received: **24-10-2019**Date Completed: **01-11-2019**

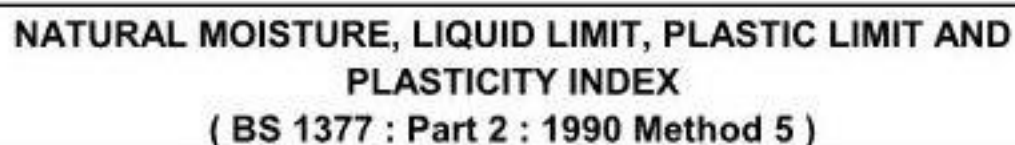
Test Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	3
1 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.4 & 5.3 - * UKAS	3
PSD Wet Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	2
Disposal of samples for job	1

Notes: Observations and Interpretations are outside the UKAS Accreditation
 * - denotes test included in laboratory scope of accreditation
 # - denotes test carried out by approved contractor
 @ - denotes non accredited tests

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 Signatories:

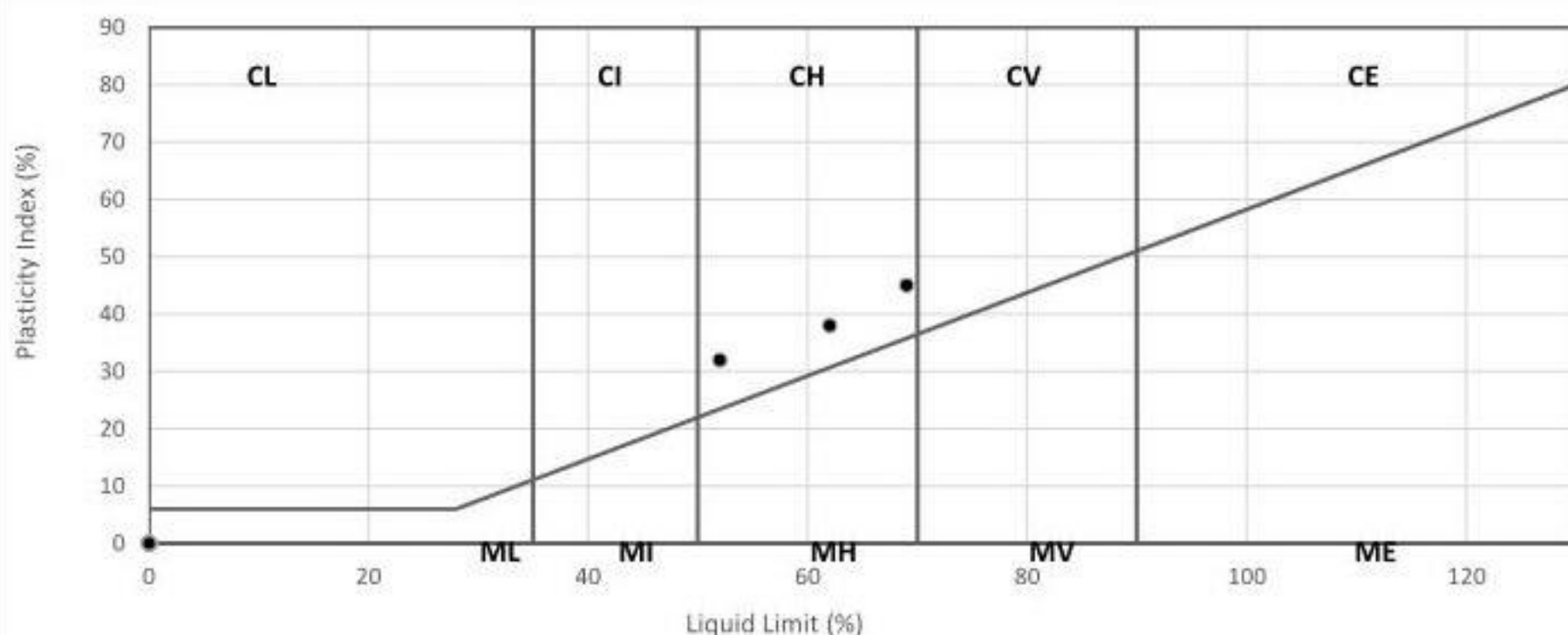
Emma Sharp (Office Manager) - Paul Evans (Quality/Technical Manager) - Richard John (Advanced Testing Manager)
 Sean Penn (Administrative/Accounts Assistant) - Shaun Jones (Laboratory manager) - Wayne Honey (Administrative/Quality Assistant)



Contract Number	46284	
Project Location	17a The Burrows	
Date Tested	29/10/2019	

[illegible]

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION
BS 5930:1999+A2:2010



Operators	Checked	01/11/2019	Wayne Honey (Administrative/Quality Assistant)
Ieuan Williams	Approved	01/11/2019	Paul Evans (Quality/Technical Manager)





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number **46284**

Borehole/Pit No. **WS1**

Site Name **17a The Burrows**

Sample No.

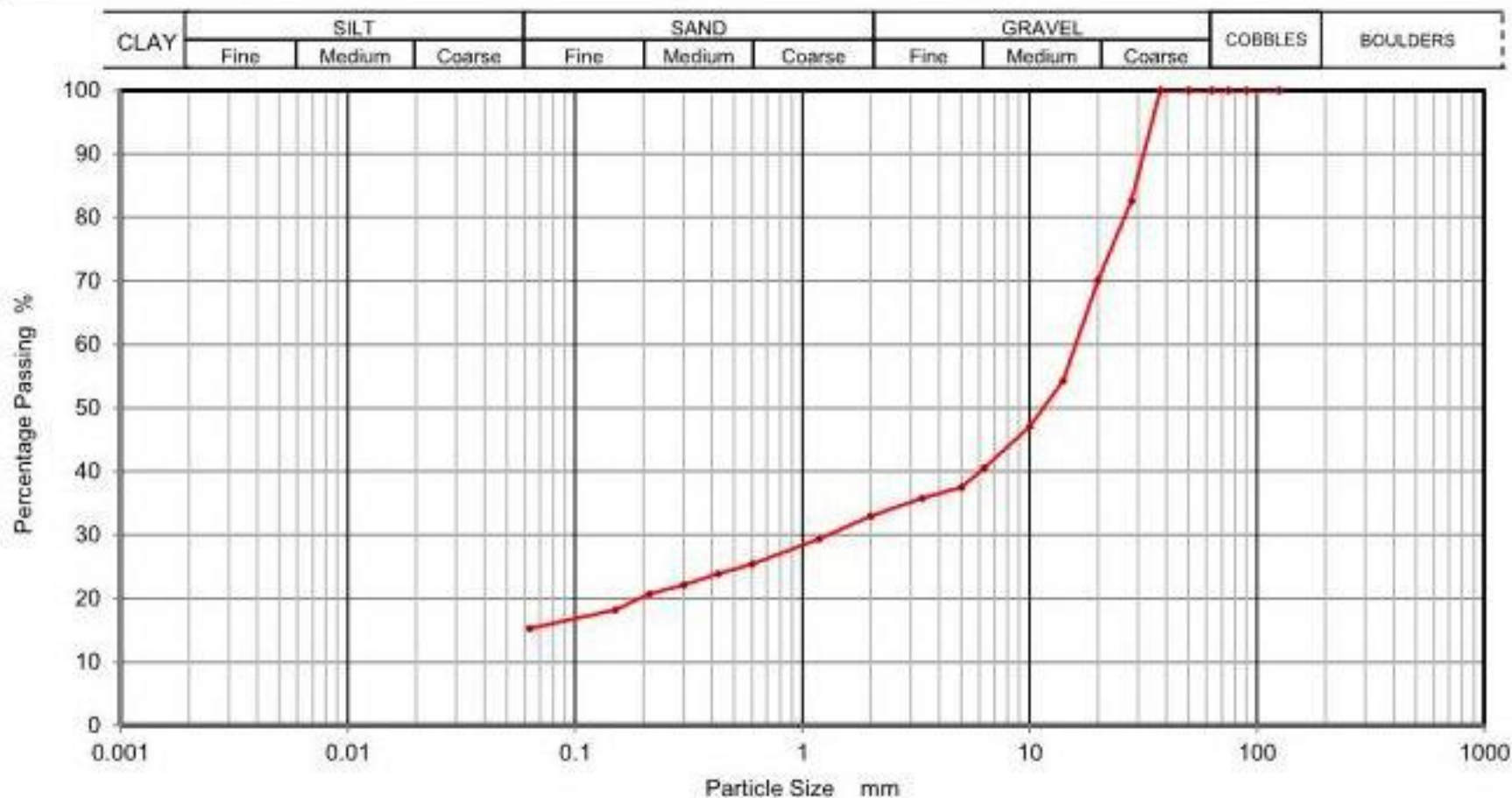
Soil Description **Brown clayey silty sandy GRAVEL**

Depth Top **1.50**

Depth Base

Date Tested **30/10/2019**

Sample Type **D**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	83		
20	70		
14	54		
10	47		
6.3	41		
5	37		
3.35	36		
2	33		
1.18	29		
0.6	25		
0.425	24		
0.3	22		
0.212	21		
0.15	18		
0.063	15		

Sample Proportions	% dry mass
Cobbles	0
Gravel	67
Sand	18
Silt and Clay	15

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	31/10/2019	Wayne Honey
RO/MH	Approved	01/11/2019	Paul Evans





PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Contract Number **46284**

Borehole/Pit No. **WS3**

Site Name **17a The Burrows**

Sample No.

Soil Description **Brown clayey silty sandy GRAVEL**

Depth Top **1.50**

Depth Base

Date Tested **30/10/2019**

Sample Type **D**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	70		
14	56		
10	42		
6.3	33		
5	29		
3.35	26		
2	23		
1.18	21		
0.6	19		
0.425	18		
0.3	16		
0.212	13		
0.15	11		
0.063	9		

Sample Proportions	% dry mass
Cobbles	0
Gravel	77
Sand	14
Silt and Clay	9

Remarks
Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	31/10/2019	Wayne Honey
RO/MH	Approved	01/11/2019	Paul Evans



Appendix C Chemical Laboratory Testing

Appendix C.1 Conceptual Site Model

Table C.I.1 CSM Revised Post Testing

Source	Identified Contaminant	Exposure Pathway	Receptor	Initial Assessment from Desk Study and Main Investigation Report Information			Comments	Proposed Investigation
				Severity	Probability	Risk		
Made Ground Onsite source of contamination	Heavy Metals	Inhalation of dust	Site Workers/Site Maintenance	Medium	Unlikely	Very low	Lead concentration recorded in exceedance of POS residential land-use screening values in one of four samples tested. The impact soils were encountered at shallow depth and likely to be removed during development of the site.	Ground workers to follow regulations on health and safety during development (HSE, 1991).
			End Users	Medium	Unlikely	Very low		
			Off-site Users	Medium	Unlikely	Very low		
	Heavy Metals	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	Medium	Unlikely	Very low		Six soil gas monitoring visits across a period of three months in line with current guidance to allow development of soil gas risk assessment for the site.
			End Users	Medium	Unlikely	Very low		
	Heavy Metals	Migration via surface runoff	Surface Water	Minor	Unlikely	Very low	Impermeable geology underlying site will act as aquiclude to deep groundwater receptors.	
		Migration in solution via groundwater	Surface Water	Minor	Unlikely	Very low		
			Shallow Aquifer	Minor	Unlikely	Very low		
			Deep Aquifer	-	-	-		
		Direct contact with construction material	Buried structures	Minor	Unlikely	Very low		
			Buried Services	Minor	Unlikely	Very low		

Appendix C.2 Chemical Laboratory Results



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Environmental Science

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e: reception@i2analytical.com

Analytical Report Number : [REDACTED]

Project / Site name: 17a The Burrows

Samples received on: 22/10/2019

Your job number: 17902

Samples instructed on: 23/10/2019

Your order number: 17902

Analysis completed by: 29/10/2019

Report Issue Number: 1

Report issued on: 29/10/2019

Samples Analysed: 4 soil samples

Signed: [REDACTED]

Rexona Rahman
 Head of Customer Services
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

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soils - 4 weeks from reporting
 leachates - 2 weeks from reporting
 waters - 2 weeks from reporting
 asbestos - 6 months from reporting

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Environmental Science

Analytical Report Number: 19-67555

Project / Site name: 17a The Burrows

Your Order No: 17902

Lab Sample Number	1339423	1339424	1339425	1339426	
Sample Reference	WS1	WS2	WS3	WS4	
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)	0.20	0.20	0.20	0.20	
Date Sampled	08/10/2019	08/10/2019	08/10/2019	08/10/2019	
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	18	17
Total mass of sample received	kg	0.001	NONE	0.80	1.0

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected
------------------	------	-----	-----------	--------------	--------------	--------------	--------------

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.3	7.4	7.5	7.5
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	< 1
Water Soluble S04 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.034	0.014	0.021	0.026
Sulphide	mg/kg	1	MCERTS	< 1.0	1.2	2.4	< 1.0
Organic Matter	%	0.1	MCERTS	5.3	5.9	7.6	7.2
Total Organic Carbon (TOC)	%	0.1	MCERTS	3.1	3.4	4.4	4.2

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0
----------------------------	-------	---	--------	-------	-------	-------	-------

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.77	1.5	0.90	2.1
Anthracene	mg/kg	0.05	MCERTS	0.17	0.34	0.15	0.33
Fluoranthene	mg/kg	0.05	MCERTS	2.0	3.0	2.0	3.6
Pyrene	mg/kg	0.05	MCERTS	1.8	2.7	1.8	3.1
Benzo(a)anthracene	mg/kg	0.05	MCERTS	1.0	1.5	1.2	1.9
Chrysene	mg/kg	0.05	MCERTS	1.3	1.9	1.3	1.8
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	1.3	1.9	1.9	2.4
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.75	1.1	0.52	1.1
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.1	1.5	1.3	1.9
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.58	0.81	0.81	1.1
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.19	0.24	0.21	0.34
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.70	0.97	0.92	1.3

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	11.7	17.4	13.0	20.8
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Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	15	15	17	21
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.6	1.4	2.0	2.2
Boron (water soluble)	mg/kg	0.2	MCERTS	2.4	2.3	1.3	2.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.6	0.7	3.3	0.9
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	27	27	30	32
Copper (aqua regia extractable)	mg/kg	1	MCERTS	71	63	120	130
Lead (aqua regia extractable)	mg/kg	1	MCERTS	200	190	680	610
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.3	0.6	< 0.3	0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	21	23	52	27
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	1.6	2.2	2.3	2.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	47	45	41	52
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	300	260	520	460



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**Analytical Report Number : 19-67555****Project / Site name: 17a The Burrows**

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1339423	WS1	None Supplied	0.20	Brown loam and clay with vegetation.
1339424	WS2	None Supplied	0.20	Brown loam and clay with vegetation and gravel
1339425	WS3	None Supplied	0.20	Brown loam and clay with vegetation.
1339426	WS4	None Supplied	0.20	Brown loam and clay with vegetation.



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Environmental Science

Analytical Report Number : 19-67555

Project / Site name: 17a The Burrows

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 °C)	In-house method based on BS1377 Part 2, 1990, Classification tests	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	BS1377 Part 3, 1990, Chemical and Electrochemical Tests**	L009-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests**	L009-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.

Sample ID	Other_ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
WS1		S	19-67555	1339423	c	Sulphide in soil	L010-PL	c
WS1		S	19-67555	1339423	c	Total cyanide in soil	L080-PL	c
WS2		S	19-67555	1339424	c	Sulphide in soil	L010-PL	c
WS2		S	19-67555	1339424	c	Total cyanide in soil	L080-PL	c
WS3		S	19-67555	1339425	c	Sulphide in soil	L010-PL	c
WS3		S	19-67555	1339425	c	Total cyanide in soil	L080-PL	c
WS4		S	19-67555	1339426	c	Sulphide in soil	L010-PL	c
WS4		S	19-67555	1339426	c	Total cyanide in soil	L080-PL	c

Appendix C.3 General Assessment Criteria

Appendix D Information Provided by the Client



site block plan

schedule of accommodation
 20nr 1-bed 1 person
 12 apartments 43m²
 5 apartments 45m²
 3 apartments 47m²

associated cycle
 & refuse stores

8 car parking spaces

GIA 1115m²
 site area 2910m²
 area of flood area 1400m²

NOTE
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 NO SIGNIFICANT RISK

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REVISION	DATE	BY	DESCRIPTION
1			
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10			



PRELIMINARY



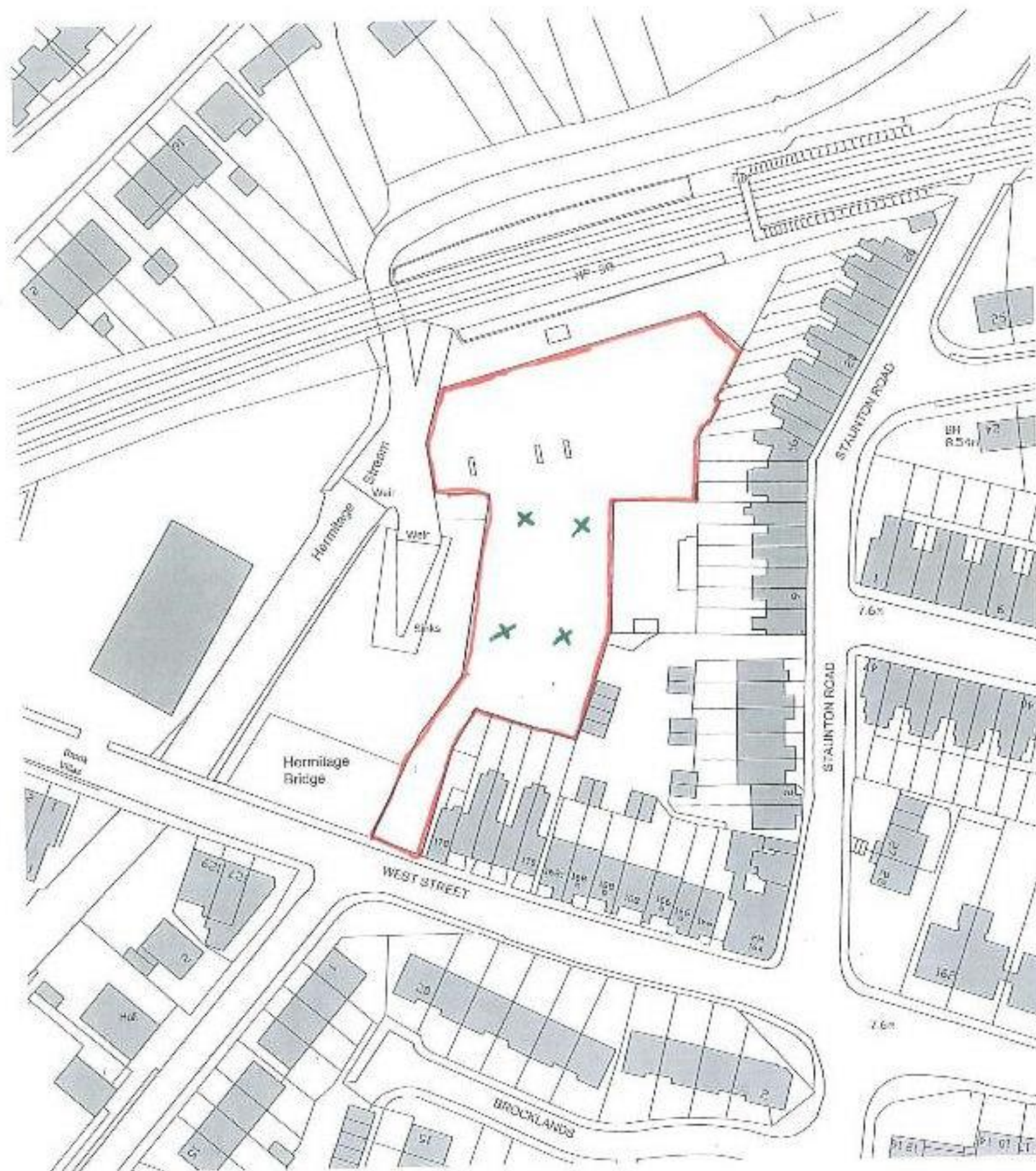
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Project	Proposed Development The Burrows West Street Bedhampton
Client	Site Block Plan
Drawn	MAS
Date	Mar 2019
At scale	1:250
As scale	1:500
Scale	28065-SK110
Status	Feasibility



X TRIAL HOLE
POSITIONS.

client	MAS	checked	MBW
date	Mar 2019	status	Feasib
project code	1:1250	28065-SK1	

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