



Client:

JC Brennan Developments Limited
74 Dickenson Road
Rusholme
Manchester
M14 5HF.

Ground Investigation - Geotechnical

Church Avenue, Middleton

July 2025

Site Ref: 6192/VCA-G

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Ground Investigation - Geotechnical

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Ground Investigation - Geotechnical

1. Introduction

This report is an account of an intrusive Geotechnical Ground Investigation carried out by GeoAssist Limited at the request of the Client JC Brennan Developments Limited as the potential owner and developer of the site at Church Avenue, Middleton.

The object of this geotechnical investigation was to obtain information on the nature, depth and extent of the superficial deposits and bedrock if encountered beneath the site to facilitate a Residential development.

Geotechnical parameters and groundwater regime were to be obtained.

The work was commissioned following acceptance of the quotation and an instruction to proceed issued by the Client JC Brennan Developments Limited on 30th June 2025.

It is understood that the proposed development for this site involves the construction of low-rise residential housing.

The approximate grid reference for the centre of the site is 388570E, 408810N.

The exploratory hole locations are indicated on the site plan in Appendix A1.

2. Description of the Site

2.1 Present

The site is located within a residential area on the southern side of Church Lane, Middleton approximately 2.5km to the northeast of Middleton town centre. The site forms a roughly rectangular parcel of land, and the levels gently falls away from Church Lane to the south. The site is comprised of a parcel of grass and scrubland with mature trees to the northeast corner, southeast and west, three small timber outbuildings (sheds) with felt roofs to the east and an area of paving at the northwest. It is understood that the site was formerly used as allotment gardens.

Residential property forms the site boundary to the west and south. Church Avenue forms the site boundary to the north over which is situated more residential property. Open land meets the eastern boundary of the site.

2.2 Proposed

It is understood that the proposed development incorporates the erection of five detached residential dwelling houses with associated private gardens, off road parking and a shared access road.

The proposed residential development is shown on the plan in Appendix A2.

3. Geology

The BGS online GeoIndex facility shows superficial drift deposits of Glacial Till are present on the site.

The solid geology is shown as being Interbedded mudstone, siltstone and sandstone, commonly with mudstones containing marine fossils in the lower part, and more numerous and thicker coal seams in the upper part of the Pennine Lower Coal Measures Formation.

No faults are shown as passing directly beneath the site

4. Mineworkings and Mineral Extraction

The site is situated within a Coal Mining Reporting Area.

The site is not within a Development High Risk Mining Area.

Whilst the Phase 1 undertaken by others indicates that the Site is situated within the Lancashire Coal Mining Reporting Area, however, there is no evidence of any past or current coal mining activity within 500m of the site, it is recommended that a preliminary COM 29M search with the Coal Authority is undertaken to confirm the status of the site in the respect of any impact there might be from past, present or future mine workings on this development site.

5. Intrusive Investigation

5.1 Exploratory Hole Programme

Six geotechnical exploratory holes referenced WS1 to WS6 were undertaken by GeoAssist using windowless sampling and dynamic probing techniques at the location as shown on the site plan in Appendix A1.

On completion of exploratory holes WS1 to WS3 gas/groundwater monitoring standpipes were installed.

Exploratory holes WS4 to WS6 were backfilled and reinstated on completion.

The details of the strata in the exploratory holes were recorded by a suitably qualified Professional Engineer.

All intrusive work was carried out in accordance with British standard 5930: 1999/2015 Code of Practice for Site Investigations and British Standard 10175: 2011 where applicable.

The fieldwork was completed on 7th July 2025 in dry weather conditions.

5.2 Field Sampling and Testing

Representative samples were taken of all the strata encountered in the exploratory holes.

In Situ Dynamic Penetration tests using the Standard SPT drop weight and drop height were carried out in the exploratory holes.

All samples were stored in airtight containers and returned to the laboratory for subsequent examination and testing.

Observations of groundwater conditions were made throughout the fieldwork operations.

5.3 Field Results

Full details of the subsoil conditions in the exploratory holes are given in the exploratory hole log sheets, which form Appendix C1 to this report.

6. Laboratory Investigation

6.1 Geotechnical Testing

The following geotechnical tests were performed in GeoAssist's laboratory on samples recovered from the exploratory holes.

Table 6.1 Geotechnical Testing

TEST	PURPOSE
Shear Strength from Hand Vane/Hand Penetrometer test	Assessment of in-situ shear strength of cohesive deposits
Natural Moisture Content and Classification test	Assessment of in-situ subsoil conditions and compressibility/shrinkage of cohesive deposits
Sulphate and pH test	Assessment of potential aggressive ground conditions with respect to subsurface concrete
Particle size distribution Test	Determination of grading characteristics of granular deposits.

6.2 Test Results

The results of the Hand Vane/Hand Penetrometer shear strength tests are given on the exploratory hole logs.

The geotechnical tests are given in the laboratory test results summary sheets, which form Appendices D1 to D4 to this report.

7. Subsurface Stratigraphy

The subsoil profile obtained from the exploratory holes WS1 to WS6 indicates the presence of variable grass/inferior vegetation over topsoil overlying gravelly sandy silty clay with sand and silt inclusions and partings. The clay at depth generally varies from firm to stiff becoming very stiff with depth.

Exploratory hole WS1 penetrated very stiff desiccated clays with evidence of fine rootlets present to 2.80m indicating the impact of the trees present in this area.

WS2 penetrated very soft organic silty clay to 2.00m interbedded with sand and very soft to firm clay beneath and present to 4.00m.

WS3 penetrated soft to firm clay to 3.00m depth with sand inclusions.

All of the exploratory holes were terminated in stiff to very stiff gravelly sandy silty clay present typically from around 3.00m to 4.00m depth.

Further details of the subsurface stratigraphy can be found in the exploratory hole log sheets which form Appendix C1 to this report.

Table 7.0 Subsoil Profile Summary

Strata	Depth of Strata (m) below ground level	
	Top	Base
Variable inferior grass/TOPSOIL	Ground Level	0.20
Very soft silty Clay with silt inclusions and sand horizons (organics present in WS2)	0.20	3.20 to 4.00 In WS2 and WS3
Firm to stiff to very stiff gravelly sandy silty Clay	3.20 to 4.00	Not proven

8. Groundwater

Seepage groundwater was recorded in exploratory holes WS2 and WS3 at 2.00m depth during the course of the fieldwork. The groundwater conditions entered on the exploratory hole logs are those observed at the time of the investigation and the water level may not have reached equilibrium with the surrounding water level prior to the record being taken. The groundwater monitoring undertaken in the standpipes installed in WS1 to WS3 recorded highest groundwater depths varying from dry in WS1, to 0.60m and 1.45m in WS2 and WS3 respectively. Groundwater levels will be subject to seasonal variation or changes in local drainage conditions and could be higher at certain times of the year particularly after periods of heavy rainfall.

9. Geotechnical Properties

The following sections summarise the geotechnical properties for the main strata encountered on this site and are based on physical description, measured and empirical values.

9.1 Upper Clay

Very Silty Clay with organic inclusions and sand horizons.

Table 9.1 Summary of Geotechnical Properties – Upper Clay

Property	Number of Tests	Range of Results	Weighted Mean
Sulphate 2:1 Water:Soil Extract	4	400 to 580 mg/l	580 mg/l
pH	4	6.9 to 7.0	NA
Shear Strength From Hand Vane Test	5	17 to 47kN/m ²	Unsuitable Highly compressible
Equivalent N value Uncorrected from SPT tests	6	0 to 5	Unsuitable Highly compressible

9.2 Lower Clay

Gravelly sandy silty Clay

Table 9.2 Summary of Geotechnical Properties – Lower Clay

Property	Number of Tests	Range of Results	Weighted Mean
Shear Strength From Hand Vane Test	9	71 to >250kN/m ²	150
Equivalent N value Uncorrected from SPT tests	18	5 to 60	N= 20 Assessed Cu = 100kN/m ²

10. Geotechnical Assessment

10.1 Design Criteria

The following design criteria would normally be assumed for this proposed development.

1. Structural loads of up to 50kN/m on strip foundations/trench fill foundations at shallow to moderate depth.
2. Allowable foundation settlement of less than 25mm and differential settlement of less than 10mm.

10.2 Foundation Design Considerations

The presence of very soft and soft silty clay with sand horizons to depths of 3.20m and 4.00m in WS2 and WS3 together with the organic inclusions precludes the use of traditional shallow depth strip foundations and the use of ground bearing slabs on this site. Groundwater is likely to be present at the partially infilled adjacent water course level and will impact on the stability of the silty sands for trench fill foundations.

The preferred option would be for piled foundations penetrating into the lower stiff to very stiff gravelly sandy silty Clay present at variable depth across the site.

10.3 Excavations

Shallow to moderate depth excavations to be left open for any period of time will require full support for vertical faces to prevent instability of the excavation sides in the very soft deposits.

10.4 Pile Foundations

The use of pile foundations penetrating into the more competent clay deposits present at variable depth across the should be considered for the proposed foundations solution.

The magnitude of the loads to be taken by pile foundations can only be determined by consultation with the relevant piling contractor.

The piling contractor/warranty provider may require that the conformity of the lower clays beneath the deepest pile tip be proved for a depth of at least 5.00m below designed pile tip depth which on this site would require LCP boring techniques.

10.6 Ground Shrinkage and Heave

The exploratory holes encountered cohesive deposits within influencing depth of foundations including pile foundations with low to intermediate modified plasticity index up to 20% and low to medium volume change potential. The NHBC Standards Section 4.2 Building near trees must be followed for foundation design and any mitigating measures that might be required including for piled foundations. The desiccated and dry nature of the upper clay penetrated in WS1 along with fine rootlets evident to 2.80m depth indicates the potential for tree roots to penetrate to at least this depth.

10.7 Subsurface Concrete Attack

The results of the soluble sulphate and pH tests carried out on samples of made ground and clay obtained from this site in general indicate that according to Building Research Establishments Special Digest 1 (2005) particular precautions for concrete foundations will be required.

Generally, the use of concrete mix design sulphate class DS-2 and according to ACEC Class AC-2 of Table C1 conditions can be used for subsurface concrete mix design.



Matthew Benson MSc GMSCE
Geotechnical/Environmental Engineer



Mark Richardson MSc CEng MICE
Technical Director

Field investigations have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions are, and can be, variable and have only been tested at isolated locations across the site. Therefore, the potential exists for ground conditions to be encountered which are different to those considered in this report.

This report has been prepared by GeoAssist Limited with all reasonable professional skill and care within the terms of the contract with JC Brennan Developments Limited. The report is confidential to JC Brennan Developments Limited, their/the named persons, advisors and bankers, and GeoAssist Limited accepts no responsibility of whatever nature to third parties to whom this report may be divulged. GeoAssist Limited owns the copyright in this report. All rights are reserved, and unauthorised use is prohibited. JC Brennan Developments Limited may use the report for their/her/his own purposes, provided always that payment for the ground investigation is made in full by the due date.

Appendix A

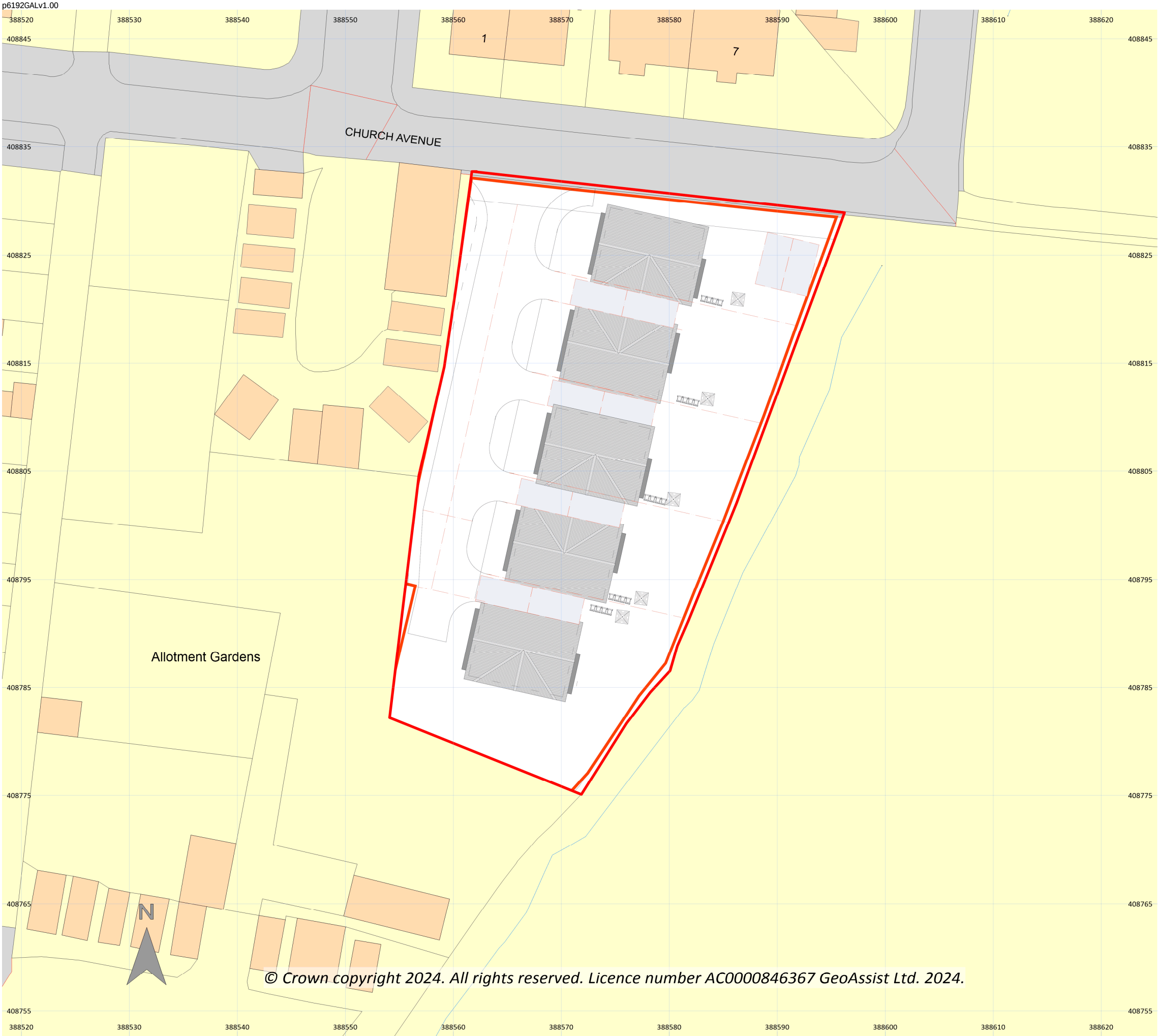
- A1 Site Plan with Exploratory Hole Locations
- A2 Proposed Site Plan



A1 Site Plan

Site Name	Church Avenue
Location	Middleton
GeoAssist Ref	6192VCA
Client	JC Brennan Developments Limited
	74 Dickenson Road Rusholme Manchester M14 5HF.
Planning Consultant	
NGR (centre of site)	388570,408810
Production Date	September 2025
Survey Method	
Surveyor	Others
Status	Final v1.00
Base Survey	OSGB36

Do Not Scale



A2 Proposed Plan

Site Name	Church Avenue
Location	Middleton
GeoAssist Ref	6192VCA
Client	JC Brennan Developments Limited
	74 Dickenson Road Rusholme Manchester M14 5HF.
Planning Consultant	
NGR (centre of site)	388570,408810
Production Date	September 2025
Survey Method	
Surveyor	Others
Status	Final v1.00
Base Survey	OSGB36

Do Not Scale

Appendix B

- B1 Terminology used in Soil Descriptions
- B2 List of Abbreviations
- B3 Concrete in Aggressive Ground
- B4 Standard Penetration Test

Terminology used in Soil Descriptions

The procedure and principles given in BS EN ISO 14688-1:2002 Part 1: 'Identification and description' have been adopted in producing the soil descriptions contained within this report.

The general identification and description of soils is based on a flexible system for immediate (field) use by experienced persons, covering both material and mass characteristics by visual and manual techniques.

Details are given of the individual characteristics for identifying soils and the descriptive terms in regular use, including those related to the results of tests from the field.

This part of ISO 14688 is applicable to natural soils *in situ*, similar man-made materials *in situ* and soils redeposited by man.

Particular sections of BS EN ISO 14688-1:2002 Part 1 are reproduced here in order to clarify the production of the soil descriptions contained within this report.

Identification of soil

General

Soil characteristics that generally permit soil to be identified with adequate accuracy for general (or preliminary) characterization are outlined below. A more accurate identification and classification based on grading, plasticity or organic content can be achieved by laboratory tests. In addition to identifying soils, the condition in which a soil is encountered, any particular secondary constituents, other features of a soil, such as carbonate content, particle shape, surface roughness of particles, odour, any common names and the geological classification are indicated.

The identification and description of soils generally follows the flow chart in Figure B1.1 attached.

Particle size

Particle size is the fundamental basis for designating mineral soils using particle fractions to distinguish the soil mechanical behaviour.

Table B1 shows the terms to be used for each soil fraction and its sub-fractions, together with the corresponding chosen range of particle sizes.

Basic soils are soils with uniform grading (i.e. they consist of particles of only one size range as specified in Table B1.1

Table B1.1 Particle Size Fractions

Soil fractions	Sub-fractions	Symbols	Particle sizes mm
Very coarse soil	Large boulder	LBo	> 630
	Boulder	Bo	> 200 to 630
	Cobble	Co	> 63 to 200
Coarse soil	Gravel	Gr	> 2,0 to 63
	Coarse gravel	CGr	> 20 to 63
	Medium gravel	MGr	> 6,3 to 20
	Fine gravel	FGr	> 2,0 to 6,3
	Sand	Sa	> 0,063 to 2,0
	Coarse sand	CSa	> 0,63 to 2,0
	Medium sand	MSa	> 0,2 to 0,63
	Fine sand	FSa	> 0,063 to 0,2
Fine soil	Silt	Si	> 0,002 to 0,063
	Coarse silt	CSi	> 0,02 to 0,063
	Medium silt	MSi	> 0,006 3 to 0,02
	Fine silt	FSi	> 0,002 to 0,006 3
	Clay	Cl	≤ 0,002

APPENDIX B1

Form No.: QF029AEN

Composite soils

General

Most soils are composite and consist of principal and secondary fractions. They are designated by a noun (main term) describing the principal fraction and by one or more adjectives (qualifying terms) describing the secondary fractions (e.g. sandy gravel saGr, gravelly clay grCl).

Principal fraction

The principal fraction in terms of mass determines the engineering properties of the soil and is given in capital letters for clarity.

In the case of very coarse soils, the principal fraction is the relevant very coarse soil fraction predominating in terms of mass. The very coarse fraction should be separated from the sample before identifying the fine and coarse fractions.

In the case of coarse soils, the principal fraction is the relevant coarse soil fraction predominating in terms of mass.

Composite coarse soils include a fines fraction (silt and/or clay) that does not determine the engineering properties of the soil.

In the case of fine soils, the principal fraction is the relevant fine soil type determining the engineering properties of the soil.

In the case of composite fine soils, the fines fraction determines the engineering properties of the soil. The fines fraction is regarded as determining the characteristics of a composite soil if this is of at least medium dry strength or exhibits a certain degree of plasticity.

In both cases, the soil is termed either "clay" or "silt", depending on the plasticity of the fines fraction and not on the grading.

Secondary fractions

Secondary and further fractions do not determine but will affect the engineering properties of the soil. The secondary fractions as adjectives are placed with the term describing the principal fraction in the order of their relevance.

If coarse secondary fractions are present in a particularly small or particularly large proportion, the term "slightly" or "very" shall precede the qualifying term.

If it is a fine soil, the properties of which are determined by fines fractions, a soil can be identified as "silt" or "clay" by checking for the presence of fine secondary constituents on the basis of its plasticity properties.

If, in the case of coarse soils, two soil fractions are present in approximately equal proportions, an oblique shall be placed between the relevant terms, e.g. gravel/sand (Gr/Sa) or fine/medium sand (FSa/MSa).

Plasticity

Assessment of the plasticity and identification of a soil as either silt or clay permits the soil to be qualified as being of low plasticity or high plasticity.

An exact determination can only be made by establishing the liquid limit and the plastic limit in laboratory tests.

Organic content

Small quantities of dispersed organic matter in a soil can produce a distinctive odour and colour. The intensity of odour and colour indicates the proportion of organic matter and should be described.

Determination of consistency

The consistency of a cohesive soil shall be determined in a manual test, permitting the following identification and description:

- a) a soil is to be identified as **very soft** if it exudes between the fingers when squeezed in the hand;
- b) a soil is to be identified as **soft** if it can be moulded by light finger pressure;
- c) a soil is to be identified as **firm** if it cannot be moulded by the fingers, but rolled in the hand to thick threads without breaking or crumbling;
- d) a soil is to be identified as **stiff** if it crumbles and breaks when rolled to thick threads but is still sufficiently moist to be moulded to a lump again;
- e) a soil is to be identified as **very stiff** if it has dried out and is mostly light coloured. It can no longer be moulded but crumbles under pressure. It can be indented by the thumbnail.

Preliminary descriptions are based on visual and manual identification only.

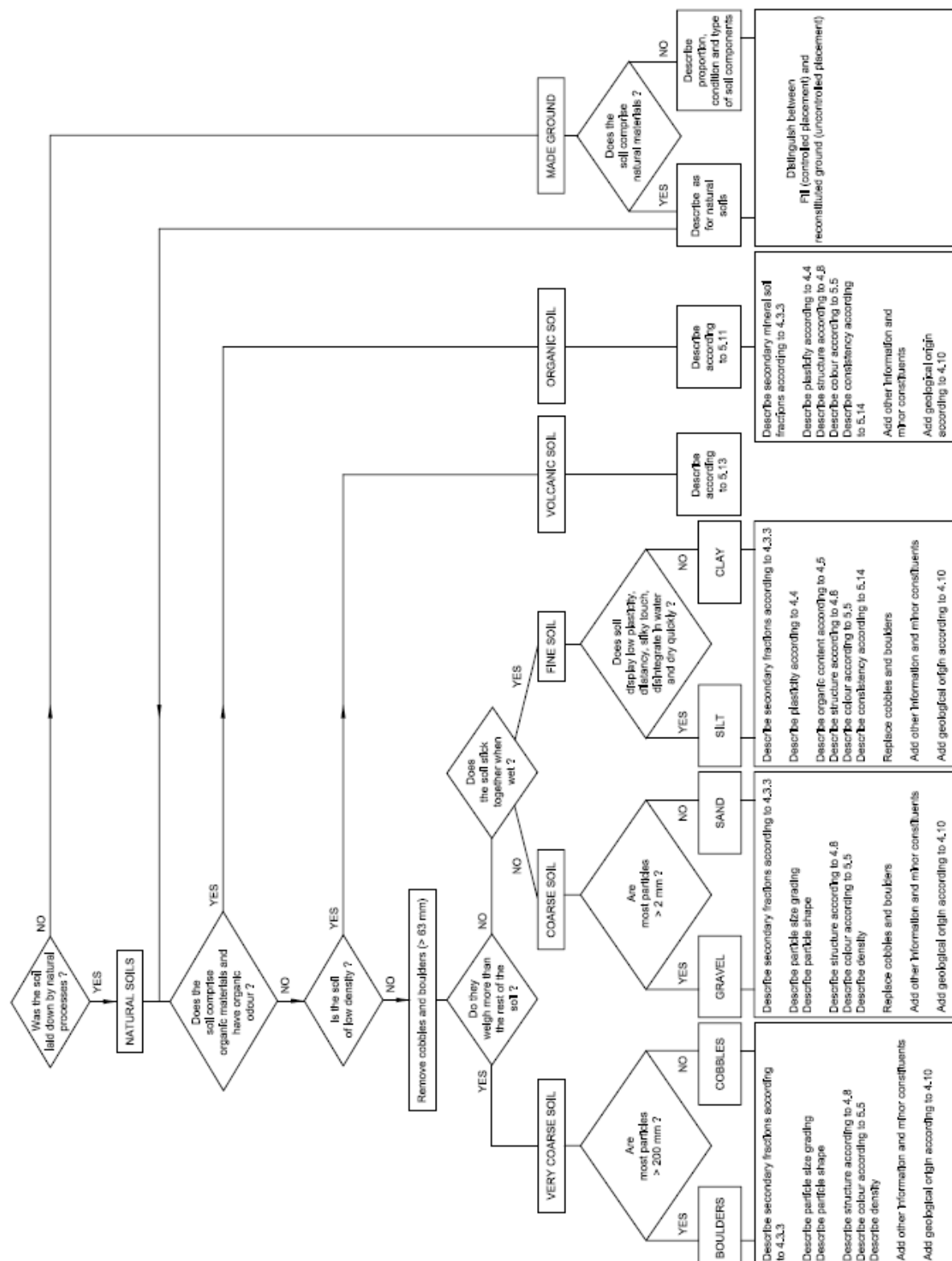


Figure B1.1 Flow chart for the identification and description of soils

Terminology used in Soil Classification

The procedure and principles given in BS EN ISO 14688-2:2004 Part 2: 'Principles for a classification' have been adopted in producing the soil descriptions contained within this report where laboratory or in situ field tests have been carried out.

The classification principles established in this part of ISO 14688 permit soils to be grouped into classes of similar composition and geotechnical properties and, with respect to their suitability for geotechnical engineering purposes.

This part of ISO 14688 is applicable to natural soil and similar man-made material *in situ* and redeposited, but it is not a classification of soil by itself.

Particular sections of BS EN ISO 14688-1:2002 Part 2 are reproduced here in order to clarify the production of the soil descriptions contained within this report.

Principles of soil classifications

General

Soils shall be classified into soil groups on the basis of their nature, which is the composition only, irrespective of their water content or compactness, taking into account the particle size distribution (grading), plasticity, organic content, genesis as appropriate.

The most common approach to classification is to divide the soils on the basis of particle size grading and plasticity. The division is made on the relative size fractions present for the coarser soil fractions, determined on the whole sample, and on the plasticity of the finer fractions (Table B1.2).

Table B1.2 Principles of a classification of soils

Criterion	Soil group	Quantification	Denomination into groups of similiar properties			Further subdivision as appropriate by
Wet soil does not stick together	very coarse	most particles > 200 mm	Bo	xBo		Requires special consideration
		most particles > 63 mm	Co	boCo, saCo, grCo	coBo sagrCo	
	coarse	most particles > 2 mm	Gr	coGr	cosaGr	Particle size (grading) Shape of grading curve Relative density Permeability
		most particles > 0,063 mm	Sa	saGr, grSa siGr, clGr orSa	sasiGr, grsiSa siSa, clSa, saclGr	
Wet soils sticks together	fine	low plasticity dilatant	Si	saSi	sagrSi saclSi	Plasticity Water content Strength, sensitivity Compressibility, stiffness (Clay mineralogy)
		plastic non-dilatant	Cl	clSi, siCl orSi, orCl	sagrCl	
Dark colour, low density	organic		Or	saOr, siOr	clOr	Requires special consideration
Not naturally	Made ground	deposited	Mg	xMg	Man-made material	Requires special consideration
					Relaid natural materials	As for natural soils
Key to symbols						Cases requiring special consideration should be classified according to national or project requirements
Soil	Principal	Secondary or tertiary component				
Boulders	Bo	bo	Gr(gr) and Sa(sa) can be subdivided into fine F(f), medium M(m) or coarse C(c)			
Cobbles	Co	co				
Gravel	Gr	gr				
Sand	Sa	sa				
Silt	Si	si				
Clay	Cl	cl	any combination of components			
Organic	Or	or				
Made ground	Mg	—				
		x				

APPENDIX B1

Form No.: QF029AEN

Fractions

Soil is a mixture of materials of different particle size, which are grouped into fractions as specified in BS EN ISO 14688-1.

Classification of coarse and very coarse soils is to be based on the particle size distribution alone (see Table B1.3)

Table B1.3 Classification of very coarse soils

Fraction	Percent by mass	Term
Boulders	< 5	low boulder content
	5 to 20	medium boulder content
	> 20	high boulder content
Cobbles	< 10	low cobble content
	10 to 20	medium cobble content
	> 20	high cobble content

In the case of soils composed of both fine and coarse material, classification is to be based on both plasticity and particle size distribution.

Particle size distribution (grading)

The particle sizes and their distribution in a soil are determined by mechanical analysis carried out by the separation of the coarser fractions by sieving on a series of standard sieves and the determination of the finer fractions by sedimentation.

The results of the sieving and sedimentation process are plotted as a grading curve.

Plasticity

The fine fractions of soil, represented by clay and silt and containing clay minerals (see also BS EN ISO 14688-1), both alone or in mixtures with coarser material, are usually classified according to their plasticity characteristics. This is carried out on the basis of laboratory tests to determine the liquid limit w_L and plastic limit w_P .

Organic content

When soils with organic constituents are classified according to their organic content (Table B1.4), a distinction is to be made between organic soils and mineral soils with an organic content.

Table B1.4 Classification of soils with organic constituents

Soil	Organic content (≤ 2 mm) % of dry mass
Low-organic	2 to 6
Medium-organic	6 to 20
High-organic	> 20

Classification of coarse and composite organic soils accumulated *in situ* is based on the type of organic matter and that of organic soils, on the genetic origin and the degree of decomposition of the organic constituents.

APPENDIX B1

Form No.: QF029AEN

Undrained shear strength of fine soils

The terms to be used for the designation of the undrained shear strength according to the results of laboratory and field tests are given in Table B1.5.

Table B1.5 Undrained shear strength of fine soils

Undrained shear strength of clays	Undrained shear strength c_u kPa
Extremely low	< 10
Very low	10 to 20
Low	20 to 40
Medium	40 to 75
High	75 to 150
Very high	150 to 300
Extremely high ^a	> 300
^a Materials with shear strength greater than 300 kPa may behave as weak rocks and should be described as rocks according to ISO 14689-1.	

Table B1.6 Guiding values for the division of mineral soils on a basis of the contents of various fractions

Fraction	Content of fraction in wt % of material ≤ 63 mm	Content of fraction in wt % of material ≤ 0,063 mm	Name of soil	
			Modifying term	Main term
Gravel	20 to 40 > 40		gravelly	gravel
Sand	20 to 40 > 40		sandy	sand
Silt + clay (fine soil)	5 to 15	< 20	slightly silty	silt silt clay clay
		≥ 20	slightly clayey	
	15 to 40	< 20	silty	
		≥ 20	clayey	
	> 40	< 10		
		10 to 20	clayey	
		20 to 40	silty	
		> 40		

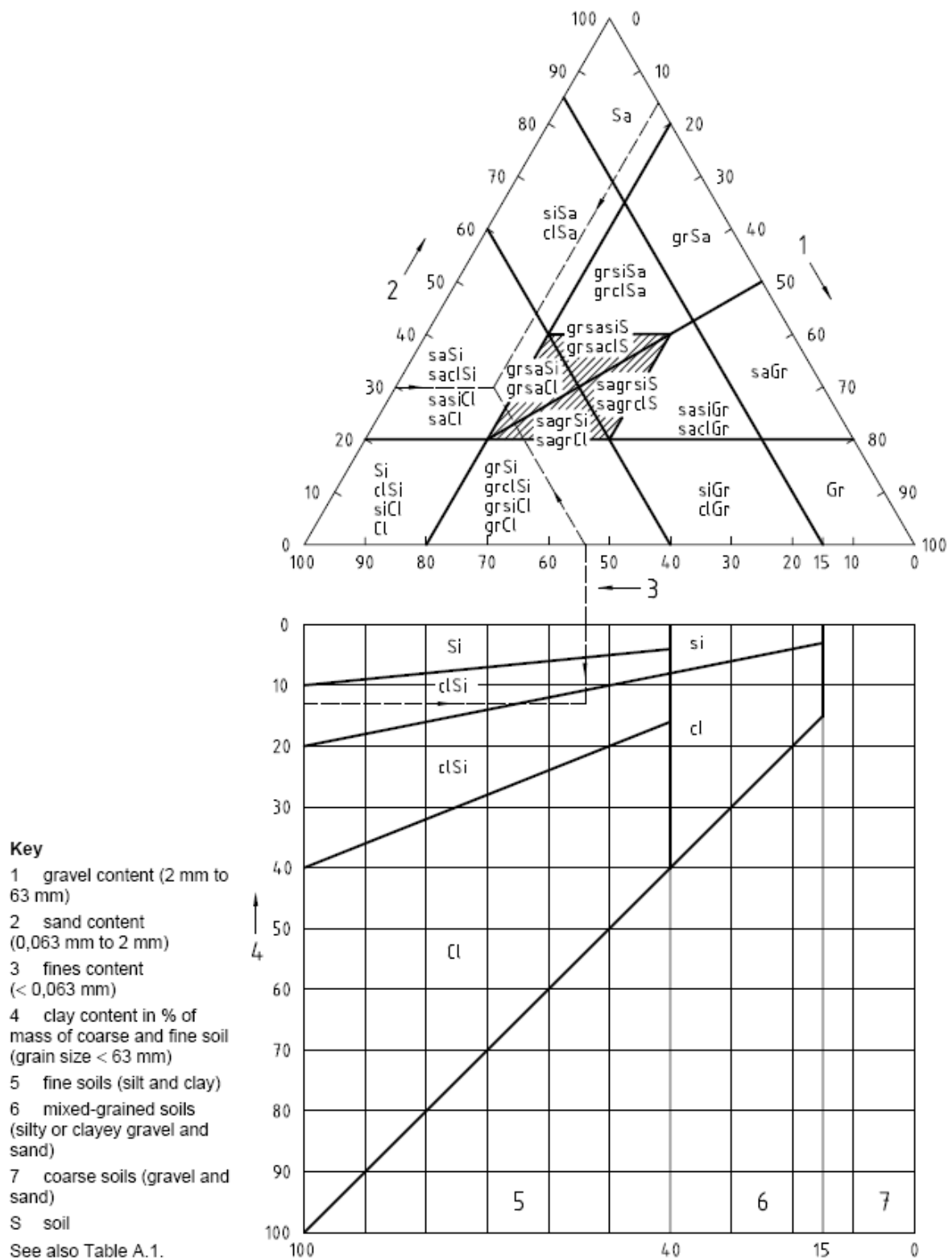


Figure B1.2 Classification of soils, based on grading alone

References

BS EN ISO 14688-1: 2002

Geotechnical investigation and testing — Identification and classification of soil — Part 1: Identification and description

BS EN ISO 14688-2: 2004

Geotechnical investigation and testing — Identification and classification of soil — Part 2: Principles for a classification

Abbreviations
Exploratory Hole log
Sample Type

AGS Code	Sample Type	AGS Code	Sample Type
B	Bulk Disturbed sample	SPT	Penetration Test – split spoon
CBR	CBR sample	U	Undisturbed sample – open drive
CPT	Penetration Test – cone	UF	Undisturbed sample failed recovery
D	Small disturbed sample	W	Water sample
PU	Piston sample	C - ES	Environmental sample

SPT and CPT – Standard Penetration Test

Blow Count (N) – If full penetration of 450mm then the total number of blows for the last 300mm is given.

If limited penetration following 150mm seating blows then the number of blows for the stated penetration is given.

If limited penetration then the total number of blows for the stated penetration is given.

The N values are actual blows recorded and uncorrected.

U - Undisturbed Sample

Blow Count – total number of blows for recovered length

Legend – As per British Standard – if blank then CAVITY/OPEN HOLE

Core Rec.:

T - Total Core Recovery as a percentage of the cored run

S – Solid Core Recovery as a percentage of the cored run

RQD – Rock Quality Designation as a percentage of the cored run

FI – Fracture index as number of fractures per metre

l_f – Fracture spacing as the average length of solid core pieces between natural fractures over core length of reasonable uniform characteristics

APPENDIX B2

Form No.: QF033AEN

Laboratory Test Summary Sheet

Tests on Soils

AGS Code	Test Name	AGS Code	Test Name
ASB	Asbestos	IDEN	In Situ Density
BDEN	Bulk Density	IGNIS	Loss on Ignition
CBR	California Bearing Ratio	IVAN	In Situ Vane
CD	Consolidated drained (single stage)	LS	Linear shrinkage
CDM	Consolidated drained (multi stage)	MCVG	Moisture Condition Value
CLSS	Atterberg Limits	NMC	Natural Moisture content
CMPG	Compaction	OMS	Organic Matter
CNMT	Contaminant and Chemical	PD	Particle density
CONG	Consolidation	PHS	pH
CU	Consolidated undrained with pwp measurement (single stage)	PTST	Laboratory permeability
CUM	Consolidated undrained with pwp measurement (multi stage)	RELD	Relative Density
DDEN	Dry Density	SHBG	Shear box
FRST	Frost Susceptibility	SLIM	Shrinkage Limit
GRAD HY	Particle Size (Hydrometer)	SULWS	Sulphate on 2:1 Water:Soil Extract
GRAD WS	Particle size (wet Sieve)	TNPC	Ten Per Cent Fines
HVP	Hand vane – peak	UU	Unconsolidated quick undrained (single stage)
ICBR	In situ CBR	UUM	Unconsolidated quick undrained (multi stage)

Tests on rocks and Aggregates

AGS Code	Test Name	AGS Code	Test Name
ACV	Aggregate crushing value	SHOR	Shore hardness
BRAZ	Tensile Strength by Brazilian method	SOUN	Aggregate Soundness Test
LOSA	Aggregate Los Angeles Abrasion	UCS	Uniaxial Compressive Strength
PLSI	Point Load Index – size corrected	WTAB	Aggregate Water Absorption

4. Reference AGS Format Edition 3

Concrete in Aggressive Ground

1. Assessing the Aggressive Chemical Environment

In order to assess the levels of sulphate in the ground or groundwater, which may have a deleterious effect on concrete, the sulphate content of soil and groundwater may be determined in accordance with BS 1377 (2001) Test 3:5. The sulphate contents determined are grouped into Aggressive Chemical Environment for Concrete (ACEC) site classifications in Building Research Establishment Special Digest 1 – Part 1 (2005) Tables C1 and C2 as reproduced below.

Based on this classification BRE Special Digest 1 gives recommendations for the design of suitable concrete mixes to resist chemical attack for each ACEC classification. Care should be taken in the interpretation of results over the site area, if classification is based solely on groundwater analysis, it should be based on the highest sulphate concentration recorded. Where a large number of results from soil analysis are available it should be based on the average of the highest 20 per cent of the results. If a varied set of results are recorded from a limited sampling programme it is important to carry out further analyses before a detailed classification is given.

2. References

BS 1377: 2001: 'Methods of Test for Soils for Civil Engineering Purposes': British Standards Institution.

BRE Special Digest 1: 2005: 'Concrete in Aggressive Ground': Building Research Establishment.

Table C1 Aggressive Chemical Environment for Concrete (ACEC) classification for natural ground locations ^a						
Sulfate Design Sulfate Class for location	2:1 water/soil extract ^b	Groundwater	Total potential sulfate ^c	Groundwater 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	> 5.5 ^d 2.5–5.5	AC-1s AC-1 ^d AC-2z
DS-2	500–1500	400–1400	0.24–0.6	> 3.5 2.5–3.5	> 5.5 2.5–5.5	AC-1s AC-2 AC-2s AC-3z
DS-3	1600–3000	1500–3000	0.7–1.2	> 3.5 2.5–3.5	> 5.5 2.5–5.5	AC-2s AC-3 AC-3s AC-4
DS-4	3100–6000	3100–6000	1.3–2.4	> 3.5 2.5–3.5	> 5.5 2.5–5.5	AC-3s AC-4 AC-4s AC-5
DS-5	> 6000	> 6000	> 2.4	> 3.5 2.5–3.5	≥ 2.5	AC-4s 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 (SO₄) 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.

Appendix B3

Page 1 of 2

GeoAssist Limited

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

Sulfate and magnesium						Groundwater		ACEC Class for location
Design Sulfate Class for location	2:1 water/soil extract ^b		Groundwater		Total potential sulfate ^c	Static water	Mobile water	
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
							2.5–5.5	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	AC-5
							≥ 2.5	
DS-5m	> 6000	> 1200 ^e	> 6000	> 1000 ^e	> 2.4	> 5.5		AC-4ms
							2.5–5.5	AC-5m
							≥ 2.5	

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 (SO₄), 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.

Standard Penetration Test

The full procedure for carrying out the Standard Penetration Test (SPT) is given in EN ISO 22476-3:2005+A1:2011: Geotechnical investigation and testing - Field testing - Part 3: Standard penetration test.

The Energy ratio for the hammer used on this site is 72% as given in the test certificate attached.

The blow counts N noted on the borehole logs are the uncorrected field blows counts as recorded.

Essentially the test consists of driving a 50mm external diameter split barrel sampler into the soil using a 63.5kg hammer dropping 760mm. The penetration resistance is expressed as the number of blows required to obtain 300mm penetration below an initial seating drive of 150mm through any disturbed ground at the bottom of the borehole. The number of blows for the 300mm test drive penetration is recorded on the borehole log as the N-value.

The test is normally performed on sands, but may also be used in gravels, weak rocks and glacial tills in which case the driving shoe may be replaced by a cone. When attempting the standard penetration test in very dense materials or weathered bedrock it may be necessary to terminate the test before completion to prevent damage to the equipment. In these circumstances it is important to distinguish how the blow count relates to the penetration of the sampler. This may be achieved in the following manner.

- (a) Where the 150mm seating drive is complete and where the test drive is terminated at 50 blows the number of blows for the partial test drive (usually 50) and the penetration of the sampler within the test drive are recorded. An approximate N-value may be obtained by linear extrapolation of the number of blows recorded for the partial test drive.
- (b) If the total penetration is equal to or less than the 150mm seating drive then the number of blows (usually 50) and the depth of penetration within the initial seating penetration are recorded on the borehole logs.

The N-value obtained from the Standard Penetration Test may be used to assess the terms for classification of relative density of sands and gravels only in accordance with Table 10 of BS 5930: 2015+A1:2020, Code of Practice for Site Investigations, as follows:

Term	Classification based on uncorrected SPT N-values for use of borehole logs Blows/300mm Penetration
Very loose	0-4
Loose	4-10
Medium dense	10 - 30
Dense	30 - 50
Very dense	over 50

The blow counts N noted on the borehole logs are the uncorrected field blows counts as recorded.

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

ARCHWAY ENGINEERING (UK) LTD
AINLEYS INDUSTRIAL ESTATE
ELLAND
WEST YORKSHIRE
HX5 9JP

SPT Hammer Ref: DART314
Test Date: 04/03/2025
Report Date: 04/03/2025
File Name: DART314.spt
Test Operator: TW

Instrumented Rod Data

Diameter d_r (mm): 54
Wall Thickness t_r (mm): 6.4
Assumed Modulus E_a (GPa): 208
Accelerometer No.1: 72572
Accelerometer No.2: 72572

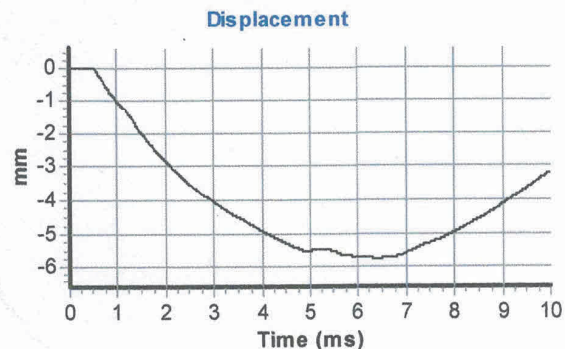
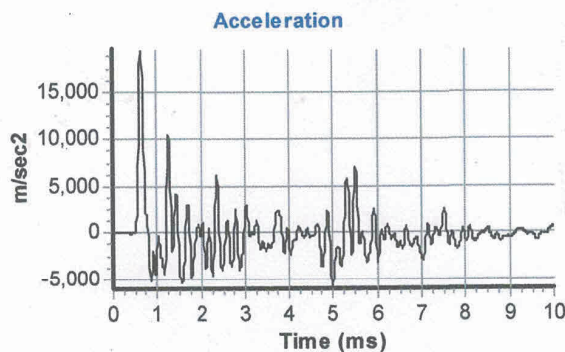
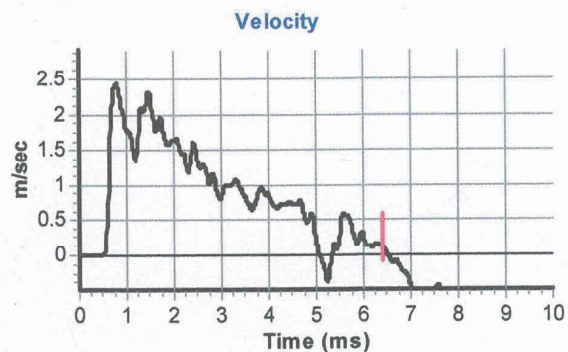
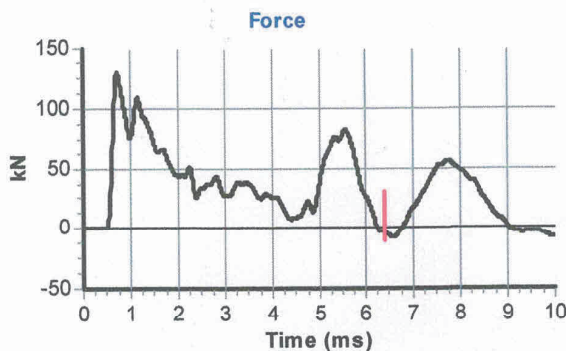
SPT Hammer Information

Hammer Mass m (kg): 63.5
Falling Height h (mm): 760
SPT String Length L (m): 10.0

Comments / Location

GEO ASSIST LTD

93226



Calculations

Area of Rod A (mm^2): 957
Theoretical Energy E_{theor} (J): 473
Measured Energy E_{meas} (J): 342

Energy Ratio E_r (%):

72

Signed: T WILKINSON
Title: FITTER

The recommended calibration interval is 12 months

Appendix C

C1 Exploratory Hole Logs WS1 to WS6

GeoAssist Limited		Exploratory Hole Record Sheet						Ref: WS2		
Consultant: 0		Project: Church Avenue Location: Middleton						Sheet: 1		
Client: JC Brennan Developments Limited		Equipment: Archway Dart Rig with DCP Probe				Ground Level: 131.91 m.AOD Co-ordinates: Easting: 388572.5(m) Northing: 408786.9(m) Dates: 07/07/2025 to 07/07/2025				
Drilling Foreman: M Walton STRATUM DESCRIPTION Engineer/Geologist: M Benson		Depth (Thick) (m)	Reduced Level (mAOD)	Strata Legend/ Standpipe Backfill	Samples/Tests Depth (m) from to			Sample Type/No	Blow Count N/(U)	Field Records
0 Vegetation over soft brown very silty CLAY with roots		0.20	131.71							
Very soft to soft brown/grey organic silty CLAY with sand inclusions					0.30 0.40 0.40 0.50	C1 D1				
1		(1.80)			1.00		CP1	0		Hand vane at 1.50m - 19kPa
					1.50 1.60	D2				
2 Grey/brown SILT/CLAY		2.00	129.91		2.00		CP2	0		Wet at 2.00m depth
		2.30	129.61		2.50 2.60	D3				
Brown silty fine to medium SAND with silty clay inclusions		(0.70)			3.00		CP3	0		Hand vane at 3.30m - 17kPa Hand vane at 3.70m - 34kPa
3 Very soft to firm brown slightly gravelly very silty CLAY		(1.00)			3.70 3.80	D4				
4 Firm to stiff brown slightly gravelly very silty CLAY with silty sand inclusions		4.00	127.91		4.00		CP4	9		Hand vane at 4.80m - 71kPa
		(1.50)			4.50 4.90	CP5 D5	15			
5		5.50	126.41		5.00 5.50	CP6 D6	14			Hand penetrometer at 5.50m - 134kPa
		(0.50)			5.90 6.00	D7				
6 Dynamic Probe only from 6.00m depth		6.00	125.91		6.00		CP7	28		07/07/2025: On completion of exploratory hole at 8.00m. Casing at 4.00m. Standing water level Nil with casing. On withdrawal of casing groundwater monitoring standpipe installed to 5.00m with response zone from 1.00m to 5.00m
Stiff to very stiff gravelly sandy silty CLAY - Interpreted Stratum		(2.00)			7.00		CP8	39		
7		8.00	123.91		7.90		CP9	60		
Exploratory Hole complete at 8.00m										
9										
10										
Remarks:								Logged: M Benson Date: 08/07/2025 Checked: M Richardson Date: 10/09/2025 Site Ref: 6192/VCA Scale 1:50 approx		
The groundwater conditions entered on the exploratory hole logs are those observed at the time of the drilling operations and the water level may not have reached equilibrium with the surrounding water level prior to the record being taken. Standing groundwater levels will be subject to seasonal variation or changes in local drainage conditions and could be higher at certain times of the year particularly after periods of heavy rainfall.										

GeoAssist Limited		Exploratory Hole Record Sheet					Ref: WS3		
Consultant: 0		Project: Church Avenue Location: Middleton					Sheet: 1		
Client: JC Brennan Developments Limited		Equipment: Archway Dart Rig with DCP Probe					Ground Level: 132.74 m.AOD Co-ordinates: Easting: 388558.5(m) Northing: 408806.2(m) Dates: 07/07/2025 to 07/07/2025		
Drilling Foreman: M Walton		Depth (Thick) (m)	Reduced Level (mAOD)	Strata Legend/ Standpipe Backfill	Samples/Tests			Field Records	
STRATUM DESCRIPTION Engineer/Geologist: M Benson					Depth (m) from to	Sample Type/No	Blow Count N/(U)		
0 Vegetation over dark grey clayey TOPSOIL		0.20	132.54						
Orange/brown with light brown and grey very sandy silty CLAY with sand inclusions		(0.80)			0.30 0.40 0.40 0.50	C1 D1			
1 Firm brown/grey silty CLAY with brown sand inclusions		1.00 (1.00)	131.74		1.00 1.20 1.20 1.30	CP1 D2	5		Hand vane at 1.20m - 42kPa
2 Soft to firm brown slightly gravelly very silty CLAY		2.00 (1.00)	130.74		2.00 2.50 2.50 2.60	CP2 D3	5		Wet at 2.00m depth Hand vane at 2.50m - 47kPa
3 Loose brown silty fine to medium SAND		3.00 3.20	129.74 129.54		3.00 3.10 3.00 3.00	D4 CP3	8		
Stiff brown gravelly sandy silty CLAY					3.50 3.60	D5			Hand penetrometer at 3.50m - 130kPa
4		(1.80)			4.00 4.50 4.50 4.60	CP4 D6	11		Hand penetrometer at 4.50m - 107kPa
Dynamic Probe only from 5.00m depth		5.00	127.74		5.00	CP5	16		
5 Stiff gravelly sandy silty CLAY - Interpreted Stratum									
6		(3.00)			6.00	CP6	17		
7					7.00	CP7	23		
8 Exploratory Hole complete at 8.00m		8.00	124.74		7.90	CP8	39		07/07/2025: On completion of exploratory hole at 8.00m. Casing at 3.00m. Standing water level at 4.70m with casing. On withdrawal of casing groundwater monitoring standpipe installed to 5.00m with response zone from 1.00m to 5.00m
9									
10									
Remarks: The groundwater conditions entered on the exploratory hole logs are those observed at the time of the drilling operations and the water level may not have reached equilibrium with the surrounding water level prior to the record being taken. Standing groundwater levels will be subject to seasonal variation or changes in local drainage conditions and could be higher at certain times of the year particularly after periods of heavy rainfall.							Logged: M Benson Date: 08/07/2025 Checked: M Richardson Date: 10/09/2025 Site Ref: 6192/VCA Scale 1:50 approx		

GeoAssist Limited		Exploratory Hole Record Sheet					Ref: WS4	
Consultant: 0		Project: Church Avenue Location: Middleton					Sheet: 1	
Client: JC Brennan Developments Limited		Equipment: Archway Dart Rig with DCP Probe					Ground Level: 132.94 m.AOD Co-ordinates: Easting: 388581.6(m) Northing: 408804.2(m) Dates: 07/07/2025 to 07/07/2025	
Drilling Foreman: M Walton		Depth (Thick) (m)	Reduced Level (mAOD)	Strata Legend/ Standpipe Backfill	Samples/Tests			Field Records
STRATUM DESCRIPTION					Depth (m) from to		Sample Type/No	
Engineer/Geologist: M Benson								
0 Grass over brown clayey TOPSOIL with roots		0.20	132.74					
Dark brown sandy silty CLAY with fine rootlets		0.40	132.54		0.30 0.40	C1		
Stiff orange/brown and grey slightly gravelly sandy silty CLAY		(0.60)			0.50 0.60	D1		
1 Exploratory Hole complete at 1.00m		1.00	131.94					
2								
3								
4								
5								
6								
7								
8								
9								
10								

Remarks:

The groundwater conditions entered on the exploratory hole logs are those observed at the time of the drilling operations and the water level may not have reached equilibrium with the surrounding water level prior to the record being taken.
Standing groundwater levels will be subject to seasonal variation or changes in local drainage conditions and could be higher at certain times of the year particularly after periods of heavy rainfall.

Logged: M Benson
Date: 08/07/2025
Checked: M Richardson
Date: 10/09/2025
Site Ref: 6192/VCA
Scale 1:50 approx

GeoAssist Limited		Exploratory Hole Record Sheet					Ref: WS5	
Consultant: 0		Project: Church Avenue Location: Middleton					Sheet: 1	
Client: JC Brennan Developments Limited		Equipment: Archway Dart Rig with DCP Probe					Ground Level: 132.03 m.AOD Co-ordinates: Easting: 388558.73(m) Northing: 408791.9(m) Dates: 07/07/2025 to 07/07/2025	
Drilling Foreman: M Walton		Depth (Thick) (m)	Reduced Level (mAOD)	Strata Legend/ Standpipe Backfill	Samples/Tests			Field Records
STRATUM DESCRIPTION Engineer/Geologist: M Benson					Depth (m) from to	Sample Type/No	Blow Count N/(U)	
0 Vegetation over dark grey clayey sand and gravel - MADE GROUND		0.10	131.93		0.30 0.40 0.50 0.60	C1 D1	07/07/2025: On completion of exploratory hole at 1.00m. Standing water level Nil. Exploratory hole backfilled and reinstated.	
Grey/brown organic silty CLAY		(0.80)						
1 Grey/brown gravelly sandy silty CLAY		0.90 1.00	131.13 131.03					
Exploratory Hole complete at 1.00m								
-2								
-3								
-4								
-5								
-6								
-7								
-8								
-9								
-10								
Remarks: The groundwater conditions entered on the exploratory hole logs are those observed at the time of the drilling operations and the water level may not have reached equilibrium with the surrounding water level prior to the record being taken. Standing groundwater levels will be subject to seasonal variation or changes in local drainage conditions and could be higher at certain times of the year particularly after periods of heavy rainfall.							Logged: M Benson Date: 08/07/2025 Checked: M Richardson Date: 10/09/2025 Site Ref: 6192/VCA Scale 1:50 approx	

GeoAssist Limited		Exploratory Hole Record Sheet					Ref: WS6	
Consultant: 0		Project: Church Avenue Location: Middleton					Sheet: 1	
Client: JC Brennan Developments Limited		Equipment: Archway Dart Rig with DCP Probe					Ground Level: 133.7 m.AOD Co-ordinates: Easting: 388563.5(m) Northing: 408829.5(m) Dates: 07/07/2025 to 07/07/2025	
Drilling Foreman: M Walton		Depth (Thick) (m)	Reduced Level (mAOD)	Strata Legend/ Standpipe Backfill	Samples/Tests			Field Records
STRATUM DESCRIPTION					Depth (m) from to		Sample Type/No	
Engineer/Geologist: M Benson								
0 Grass over orange/brown and grey brick rubble - MADE GROUND		0.20	133.50					
Grey silty sand with gravel - MADE GROUND		0.40	133.30		0.30 0.40	C1		
Very stiff orange/brown with light grey gravelly very sandy silty CLAY		(0.60)						
		1.00	132.70		0.80 0.90	D1		
1 Exploratory Hole complete at 1.00m								
2								
3								
4								
5								
6								
7								
8								
9								
10								
Remarks: The groundwater conditions entered on the exploratory hole logs are those observed at the time of the drilling operations and the water level may not have reached equilibrium with the surrounding water level prior to the record being taken. Standing groundwater levels will be subject to seasonal variation or changes in local drainage conditions and could be higher at certain times of the year particularly after periods of heavy rainfall.							Logged: M Benson Date: 08/07/2025 Checked: M Richardson Date: 10/09/2025 Site Ref: 6192/VCA Scale 1:50 approx	

Appendix D

D1	Laboratory Summary Sheet
D2	Classification Test Summary
D3	Sulphate and pH Summary
D4	Particle Size Distribution Graphs

GeoAssist Limited SOIL LABORATORY SUMMARY SHEET	Project: Church Avenue Location: Middleton Client: JC Brennan Developments Limited Consultant :	Site Ref: 6192/VCA Project Code :
		Hole Ref WS1 to WS6

Sample Ref.	Depth m	Sample Description	Classification					Triaxial Compression					Chemical		Test Code
			LL %	PL %	PI %	% passing 425 m	Moist Cont. %	Bulk Density Mg/m³	Sample Size mm	Confining Pressure kN/m²	Deviator /Shear Stress kN/m²	Shear Cohesion kN/m² /Friction angle degrees	So4 2:1 extract Soil:Water mg/l	pH	
WS1 D1	0.40	Orange/brown with light grey gravelly sandy silty CLAY with silt inclusions					-						400	7.0	SULWS PH
WS1 D2	0.70	Orange/brown with light grey gravelly sandy silty CLAY with silt inclusions	38	17	21	96	17								NMC CLSS
WS1 D3	2.50	Brown gravelly sandy silty CLAY with occasional sand inclusions	35	16	19	87	16								NMC CLSS
WS1 D4	3.50	Brown slightly gravelly sandy silty CLAY with fine rootlets to 2.80m depth					16								NMC
WS1 D5	4.50	Brown slightly gravelly sandy silty CLAY with fine rootlets to 2.80m depth					19								NMC
WS2 D1	0.40	Brown/grey organic silty CLAY with sand inclusions					-						580	6.9	SULWS PH
WS2 D2	1.50	Brown/grey organic silty CLAY with sand inclusions					66								NMC
WS2 D3	2.50	Brown silty fine to medium SAND with silty clay inclusions					-								GRAD WS
WS2 D4	3.70	Brown slightly gravelly very silty CLAY	31	13	18	98	20								NMC CLSS
WS2 D5	4.80	Brown slightly gravel very silty CLAY with silty sand inclusions					16								NMC
WS2 D6	5.40	Brown slightly gravel very silty CLAY with silty sand inclusions					16								NMC
WS2 D7	5.90	Brown gravelly sandy silty CLAY	18	11	7	62	9.5								NMC CLSS

GeoAssist Limited SOIL LABORATORY SUMMARY SHEET	Project:	Church Avenue	Site Ref:	6192/VCA
	Location:	Middleton	Project Code :	
	Client:	JC Brennan Developments Limited	Hole Ref	WS1 to WS6
	Consultant :			

Sample Ref.	Depth m	Sample Description	Classification					Triaxial Compression					Chemical		Test Code
			LL %	PL %	PI %	% passing 425 m	Moist Cont. %	Bulk Density Mg/m ³	Sample Size mm	Confining Pressure kN/m ²	Deviator /Shear Stress kN/m ²	Shear Cohesion kN/m ² /Friction angle degrees	So4 2:1 extract Soil:Water mg/l	pH	
WS3 D1	0.40	Orange/brown with light brown and grey very sandy silty CLAY with sand inclusions					-						400	7.0	SULWS PH
WS3 D2	1.20	Orange/brown with light brown and grey very sandy silty CLAY with sand inclusions	24	14	10	100	21								NMC CLSS
WS3 D3	2.50	Brown slightly gravelly very silty CLAY					16								NMC CLSS
WS3 D4	3.00	Brown silty fine to medium SAND					-								GRAD WS
WS3 D5	3.50	Brown gravelly sandy silty CLAY	21	11	10	97	14								NMC CLSS
WS3 D6	4.50	Brown gravelly sandy silty CLAY					13								NMC
WS4 D1	0.50	Orange/brown and grey slightly gravelly sandy silty CLAY					23								NMC
WS5 D1	0.50	Grey/brown organic silty CLAY					35								NMC
WS6 D1	0.80	Orange/brown with light grey gravelly very sandy silty CLAY					13								NMC

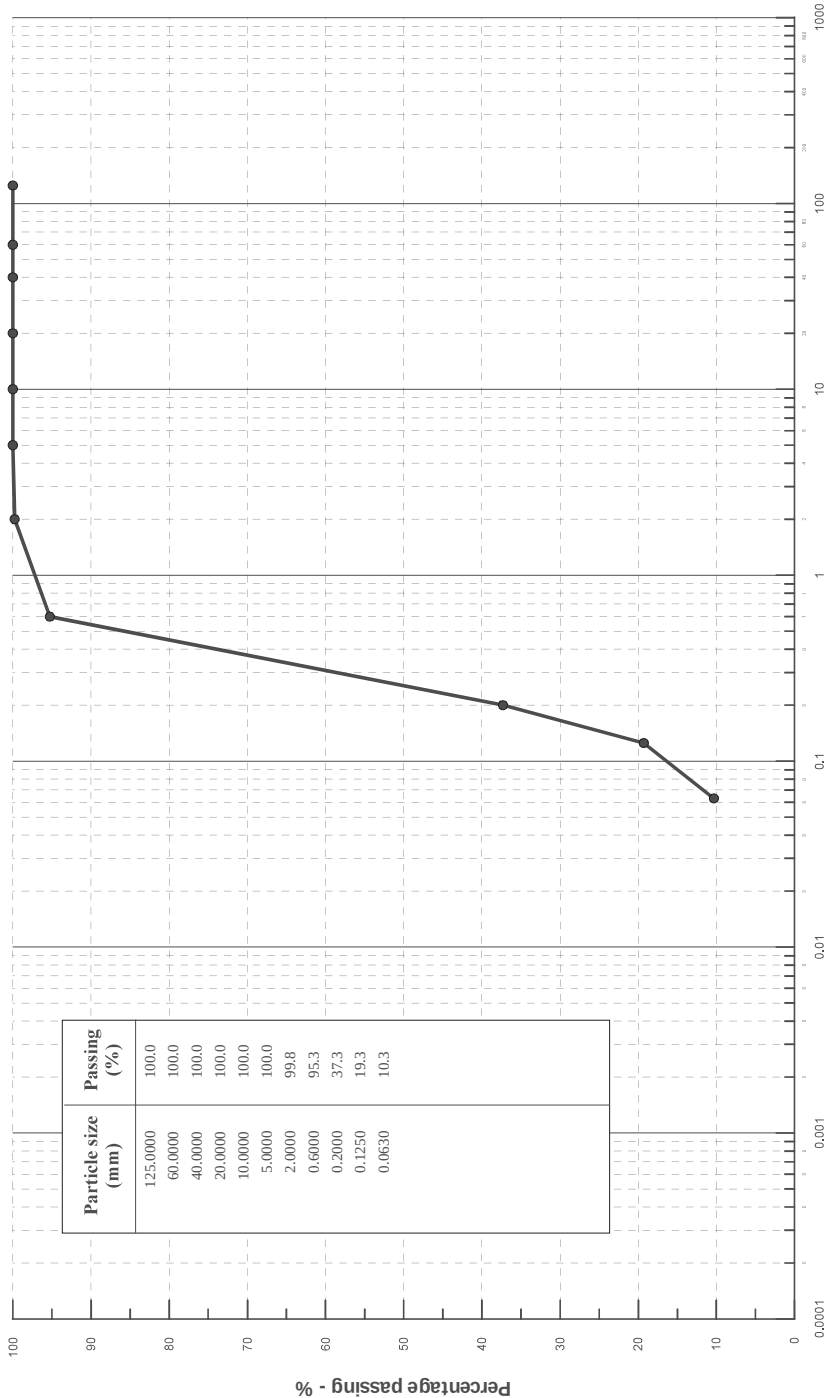
Site Reference:			6192 VCA						
Project Site:			Church Avenue						
Project Location:			Middleton						
Client:			JC Brennan Developments Limited						
Consultant:			0						
CLASSIFICATION TEST									
Borehole Reference	Sample	Depth	Liquid Limit %	Plastic Limit %	Plasticity Index %	passing 425 micron %	Natural Moisture Content %	Modified Plasticity Index %	Material Code
WS1	D2	0.70	38	17	21	96	17	20	CI
WS1	D3	2.50	35	16	19	87	16	17	CL/CI
WS2	D4	3.70	31	13	18	98	20	18	CL
WS2	D7	5.90	18	11	7	62	9.5	4	CL/ML
WS3	D2	1.20	24	14	10	100	21	10	CL
WS3	D5	3.50	21	11	10	97	14	10	CL
		Mean	28	14	14	90	16	13	
		Maximum	38	17	21	100	21	20	
CLAY		Minimum	18	11	7	62	10	4	
		Standard Deviation	8	3	6	14	4	6	
		Count	6	6	6	6	6	6	

Site Reference:			6192	VCA		
Project Site:			Church Avenue			
Project Location:			Middleton			
Client:			C Brennan Developments Limited			
Consultant:			0			
	GEOTECHNICAL SULPHATE AND PH TEST					
Borehole Reference	Sample	Depth	SO4 2:1 Water:Soil extract mg/l	pH	SO4 Water mg/l	
WS1	D1	0.40	400	7.0		
WS2	D1	0.40	580	6.9		
WS3	D1	0.60	400	7.0		
		Mean	460	7.0		
ALL		Maximum	580	7.0		
		Minimum	400	6.9		
	Standard Deviation		104	0.1		
		Count	3			

PARTICLE SIZE DISTRIBUTION GRAPH

Site Number: 6192
Site Reference: VCA

Project: Church Avenue
Location: Middleton
Client: C Brennan Developments Limited
Consultant: 0



BH No: WS3
Sample: D4
Depth: 3.00m

%	SIZE
0.0	Cobbles
0.2	Gravel
89.4	Sand
10.3	Silt and Clay

CLAY	SILT			SAND			GRAVEL	COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse			