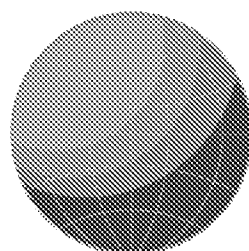


Ground Investigation Report

Report Reference: P19.142/GIR
283-285a Chichester Road, Bognor

Prepared For

Jent Estates Ltd



IMPACT
GEOTECHNICAL



Report Approval

Report Author(s)	Signature	Date
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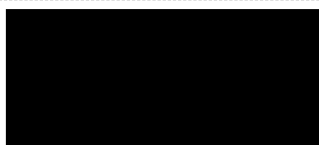
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10/11/2019

Revision – Requested by	Nature of Revision	Date
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Context

This report is written in the context of an agreed scope of work between Impact Geotechnical Ltd and the Client and should not be used in a different context. In light of additional information becoming available, improved practices and changes in legislation amendment or re-interpretation of the report in whole or part may be necessary after its original submission.

Professional Interpretation

The recommendations made and opinions expressed in the report are based on the conditions revealed by the site works together with an assessment of the data from the insitu and laboratory testing or in respect of the desktop reports. No responsibility can be accepted for conditions that have not been revealed by the research, site works and testing.

The Client is advised that the conditions observed on site by Impact Geotechnical Ltd at the time of any site survey may be subject to change. Certain indicators of the presence of hazardous substances may have been latent at the time of the most recent site reconnaissance and they may subsequently have become evident. It is not possible to assess areas which are inaccessible or where access is not granted and IGL accept no liability for risks subsequently identified therein.

The conceptual model, Risk assessment and sampling regime has been formulated in accordance with current UK guidance at time of production based upon the relevant information gained from Phase 1 and Phase 2 investigations. While the model and assessment offer opinions and interpretations of these guidelines, the comments made are for guidance only and no liability can be accepted for their accuracy. It is possible that aspects of Geo-environmental reports may need to be altered following consultation with the statutory regulatory bodies to suit planning requirements.

Intrusive Field Operations

The data collected through direct operations in the production of this report has been so obtained, unless directly otherwise stated, in accordance with current UK guidance, law or accepted industry practice, including but not limited to: BS.5930: 1990 Code of Practice for Site Investigations (Amendment 3: 2015), & BS.10175: 2011 + A1: 2013 Investigations into Potentially Contaminated Sites. Exact exploratory locations will depend upon access conditions, site use and plant capability, IGL do not accept liability for issues arising from material identified between or outside of the area of exploratory locations.

Laboratory Testing

Unless stated otherwise within the text, all geotechnical and material laboratory tests have been performed in accordance with the relevant British Standard Documents. Laboratory testing for contaminated land assessment is completed under the UKAS / MCERTS accreditation schemes, unless identified as otherwise in the report.

Human Health Risk Assessment Criteria

The Environment Agency has undertaken revision of the Soil Guideline Values (SGVs) which are partially complete. Where standards are available using the "new" approach, these have been utilised for correlative purposes. Where standards have not yet been revised, guidance following the "old" approach has been utilised. Please note that upon release of the remaining guidelines, the standards contained within this report may be subject to change. In addition, the second edition of the LQM CIEH guidance has now been released and will be utilised in favour of previously published guideline values.

Third Parties

The findings and opinions conveyed in this report are based on information obtained from a variety of sources, including that from previous Site investigations and chemical testing laboratories. IGL has assumed that such information is correct. IGL cannot and does not guarantee the authenticity or reliability of the information it has relied upon and can accept no responsibility for inaccuracies with the data supplied by other parties.

The accuracy of the historical map extracts supplied can not be guaranteed and it should be noted that different conditions may have existed between mapping sheet editions. Therefore, there can be no certainty that all areas of contamination have been identified during the Phase 1 investigation.

Definitions

Reference to the word "contamination" in this report does not relate to the statutory definition of contaminated land under 1990 Environmental Protection Act unless otherwise stated. The definition used in this report is: "Land that contains substances that, when present in sufficient quantities or concentrations, are likely to cause harm, directly or indirectly, to man, to the environment, or on occasion to other targets" (NATO CCMS, 1985).

IGL 2019



1.0 INTRODUCTION

Impact Geotechnical Ltd (IGL) were instructed by Jent Estates Ltd (the Client) (Q19.195.01, dated: October 2019), to carry out a Ground Investigation at 283-285a Chichester Road, Bognor Regis, West Sussex, PO21 5AH (hereafter referred to as the "site").

The site is situated to the northwest of the town of Bognor Regis and is formed by an approximately triangular plot which is presently occupied by a partially disused television aerial business and a domestic bungalow, both in the northwest corner of the plot.

It is understood that the bungalow is to be demolished and replaced with two semi-detached houses with a block of residential flats proposed to be constructed in the south/ central area of the site. Car parking and an access road utilising the existing access way will occupy the area between the buildings.

This investigation incorporated the construction of four windowless sample boreholes to a maximum depth of 7.00mbgl (metres below ground level); this was supplemented by the completion of one soil infiltration test at a depth of 1.50mbgl within a mechanically excavated trial pit. In addition, a total of seven dynamic cone penetrometer tests were completed to a maximum depth of 0.90mbgl to allow for determination of equivalent insitu California Bearing Ratio.

The aims of this report are to provide an outline Ground Model of the proposed development area, and to inform the detailed design of temporary and permanent works associated with the planned construction.

2.0 SITE LAYOUT

The plot under investigation is broadly triangular in plan area and is currently accessed at the northern elevation from Chichester Road, via a private driveway which is laid to scalplings; this leads to a central roughly laid car parking area which extends to the full width of the site and approximately half the way to the southern boundary. The driveway passes alongside a two-storey masonry building which is a disused satellite dish company premises, with flats above. This appears to have formerly been two residential houses, which have been knocked through.

At the northwest corner of the site is a masonry residential bungalow, enclosed within a wooden fence – as this building was occupied at the time of the survey no access was gained to this area.

The rear (southern) half of the site is formed by unmade ground which is heavily overgrown with brambles and weeds. In this area the ground level, which is relatively level across the remaining site area, drops in the order of 400mm. Access to this area was poor owing to the overgrown nature and the presence of heaps of discarded detritus including wooden panels, household items and masonry.

The site is bounded by shrubs and low-level trees including Hawthorn and Leylandii varieties. In addition, a mature Maple type tree is present along the eastern boundary and an Ash tree is noted at the northern boundary.



3.0 PHYSICAL SETTING

3.1 Geology

The Geology of Britain Viewer (BGS, 2019) indicates the site is underlain by River Terrace Deposits overlying Bedrock Geology of the Lambeth Group.

River Terrace Deposit – This is a stratum formerly classified as ‘Brickearth’ formed by periglacial processes within a tundra environment, lithologically this material is typically dominated by sand, silt and clay with partings of outwash gravel.

Lambeth Group – A sequence of variable soils formed during a period of significant sea level changes composed of stiff mottled clays, sands, gravel and bioclastic portions. In the Hampshire basin the dominant soil type is stiff mottled clay, weathering to stiff brown clay near the surface.

4.0 FIELDWORKS

The following intrusive works were carried out over the 16th October 2019 supervised by an Engineering Geologist from IGL. The SI was undertaken in accordance with the scope of works agreed with our Client and in relation to statutory guidance including BS5930: 1999 Code of Practice for Site Investigations (Amendment 3: 2015) and BS10175: 2011+A1: 2013 Investigation of Potentially Contaminated Sites: Code of Practice.

- Prior to any excavations taking place a Cable Avoidance Tool (CAT) was used to check for the position of any underlying electrical services. In addition, starter pits were excavated to 1.2 meters below ground level (mbgl) to clear test locations prior to any further drilling commencing.
- One mechanically excavated Trial Pit (TP1) was excavated to a depth of 1.50mbgl to allow BRE 365 soil infiltration testing to be completed. Once excavated the trial pit was filled with potable water and the subsequent fall in water level measured over a period of 240minutes.
- Four windowless sample boreholes (WS1-4) were constructed to a maximum depth of 7.00mbgl using a tracked windowless sampling rig. The recovered soils from each borehole and groundwater conditions were logged, with representative samples recovered to allow subsequent testing. Insitu SPT testing was completed at 1.00m centres within each hole. WS1 and WS2 were terminated at depths of 3.00m and 3.45mbgl respectively owing to sloughing of the borehole sides.
- A total of seven of Dynamic Cone Penetrometer tests were completed within proposed areas of car parking / pavements to determine equivalent CBR value. Tests achieved depths of between 127mm and 900mm.
- Upon completion exploratory holes were backfilled using arising materials and the surface finish reinstated to match existing.

The site layout plan indicating the position of the test location is provided in Appendix A, with photographs taken during the investigation in Appendix C.



5.0 GROUND CONDITIONS

5.1 Soils

The following table summarises the strata conditions encountered during the intrusive works:

Stratum	Depth Range Encountered	Detail Description
Surface Cover (WS4 only)	GL – max.0.05m	Macadam surface
Made Ground	GL-0.05m to 0.20-0.80m	Emplaced / reworked soils predominantly encountered as variably clayey and gravelly Sand. Gravels include flint and brick, locally including cobble sized brick. Within WS1 the upper Made Ground to a depth of 0.40mbgl is described as slightly organic. Within WS1 and WS2 an additional layer of Made Ground is recorded, described as silty and locally sandy Clay below depths of 0.40m and 0.50mbgl respectively.
Alluvium (WS1 only)	0.75m to 1.30m	Very soft consistency grey locally slightly sandy organic Clay / Silt.
River Terrace Deposit (Clay)	0.20-0.80m to 1.10-1.40m	Soft and locally firm consistency brown mottled silty and locally sandy Clay.
River Terrace Deposit (Sand)	1.10-2.40m to 2.80-3.20m	Loose to medium dense light brown and locally reddish brown slightly gravelly silty fine to coarse grained Sand. The gravel component is subangular to subrounded fine to coarse sized flint.
Lambeth Group	2.80-3.20m to >7.00m	Initially encountered as stiff consistency light grey / red mottled silty Clay to a depth of 4.80-6.30mbgl, subsequently encountered as very stiff consistency greenish grey mottled brown sandy Clay. At depths of 5.80m and 7.00mbgl in WS3 and WS4 respectively limestone bands were encountered, causing the refusal of the sampling equipment.

Please refer to the stratigraphic logs contained within Appendix B for a more detailed description.

5.2 Groundwater

Groundwater was encountered at depths between 0.40m and 0.90mbgl during the investigation works.

5.3 Visual and Olfactory Observations of Contamination

With the exception of anthropogenic materials encountered within the Made Ground soils, no visual or olfactory evidence of soil or groundwater contamination was noted during the investigation works.

6.0 Insitu Testing

6.1 Dynamic Cone Penetrometer

Equivalent CBR values were determine using the Dynamic Cone Penetrometer within areas of proposed pavement. This apparatus uses an 8kg drop weight to drive a fixed cone vertically into the ground, with the penetration per drop recorded using a ruler attached to the apparatus.



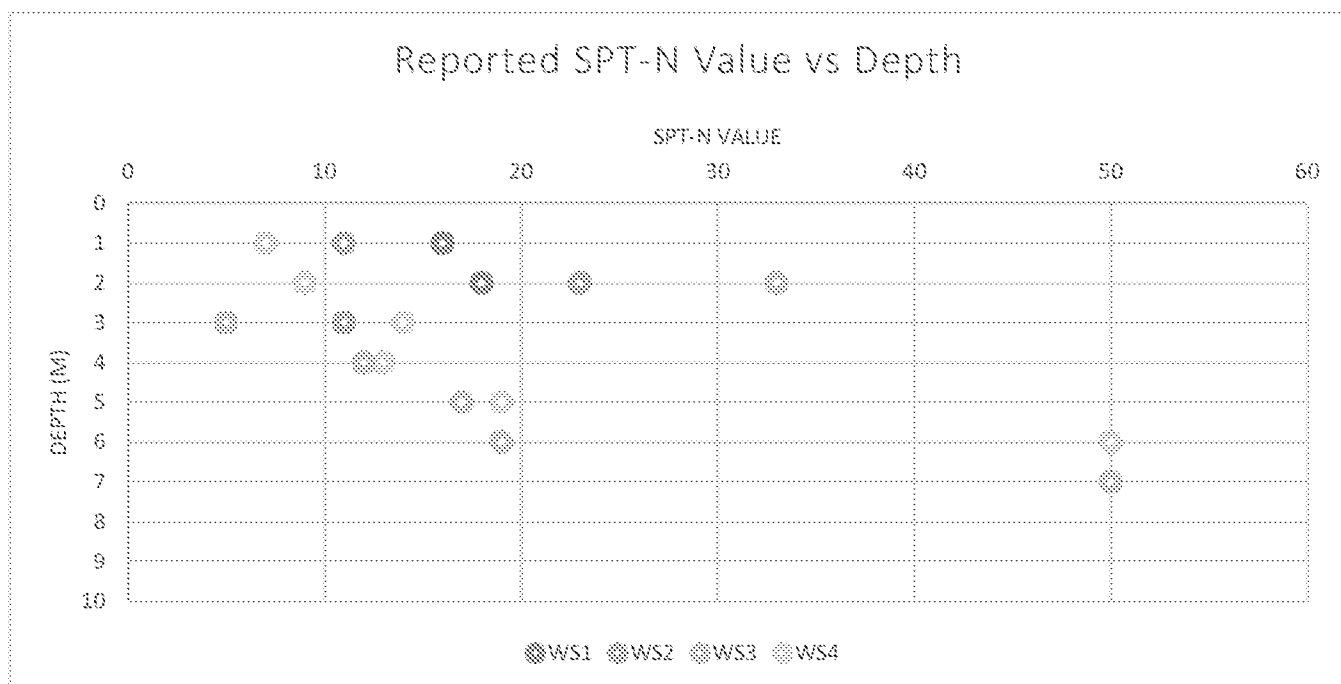
The table below summarises the results obtained.

Test	Equivalent CBR % at depth:		
	250	500	750
DCP1	51	11	31
DCP2	77	8	13
DCP3	-	-	-
DCP3a	9	4	11
DCP4	5	4	5
DCP5	4	5	7
DCP6	98	9	7

6.2 Standard Penetration Testing

Standard Penetration testing was completed throughout the drilling of WS1-WS4 at 1.00m centres. This form of testing is completed using a 63.5kg drop hammer weight, over a 750mm drop, measuring the blow counts for six, 75mm increments. The first two values are recorded as seating blows, with the remaining four values, added together to provide an 'N-value'.

The graph below summarises the results of this testing SPT-N values.



The upper River Terrace Deposits record variable N-values ranging from N=7-33; this is considered to be representative of the variable composition of the soil, including differing quantities of coarse granular material and changes in the major constituent from clay to sand.

Within the underlying Lambeth Group material, the initial SPT-N values recorded at 3.00mbgl indicate variable soft to stiff consistency with N values of N= 5-14. The subsequent records indicate stiff becoming very stiff consistency with SPT-N values of N=13-19 within the clay soils.



Limestone bands were recorded at the base of WS3 and WS4, both of which recorded test refusals (N>50).

6.3 Soil Infiltration Testing

Soil infiltration testing was completed within TP1 in accordance with the testing standards identified in BRE 365: 2016 'Soakaway Design'. The test included the squaring of the pit sides before filling with potable water, the subsequent decline in water level was measured to allow determination of the coefficient of permeability (k); using this testing method, the rate of outflow between 75% and 25% effective depths are used to determine the infiltration rate.

The pit was filled to a level of 0.35mbgl, and the water level monitored over the following 240minutes. The water level fell to a depth of 0.54mbgl which represents 84% of the effective fill depth; as a result, this test is not considered valid and an infiltration rate cannot be calculated.

7.0 LABORATORY TESTING

7.1 Geotechnical Testing

7.1.1 Atterberg Limits and Natural Moisture Content

In total, seven disturbed samples of the underlying soils were submitted for determination of their Natural Moisture Content (NMC) and Plasticity Index (PI).

The samples tested for NMC were selected from depths between 1.00m and 5.50mbgl. Results ranged between 26% and 47%.

Within the River Terrace Deposits the results indicate Liquid Limits between 34% and 65% and Plastic Limits between 17% and 23%. Once the portion retained on the 425µm had been taken into account (3-10%), the Modified PI results lie between 14% and 26%.

Within the underlying Lambeth Group soils the results indicate Liquid Limits between 61% and 68% and Plastic Limits between 19% and 25%. Once the portion retained on the 425µm had been taken into account (0-3%), the Modified PI results lie between 42% and 44%.

Based upon these results the River Terrace Deposit soils are of variable low to high plasticity. In accordance with the NHBC guidance (chapter 4.2 'Building Near Trees') these soils have Low to high shrinkage potential.

The underlying Lambeth Group soils are of high plasticity clay and would be considered to be of high shrinkage potential in accordance with NHBC guidance.

7.1.2 Sulphate and pH Analysis

Thirteen samples were submitted for determination of pH and Water Soluble Sulphate concentration over the depth range 0.30-6.45mbgl.

Water soluble sulphate concentrations were found to range from <10mg/l to 67mg/l, with pH levels ranging from 7.1 to 9.3.



7.1.3 Particle Size Distribution

Six disturbed samples of the granular portion of the River Terrace Deposit were submitted for determination of the constituent clast sizes by means of wet sieving with two of the samples subsequently analysed by means of a hydrometer to determine the proportion of silt and clay.

The table below summarises the results.

Sample	% of each sample, per grain size				Soil Description
	Gravel	Sand	Silt and Clay		
WS1 2.00m	46	48	3	4	Slightly silty / clayey SAND and GRAVEL
WS2 2.00m	57	34	10		Silty / clayey very sandy GRAVEL
WS2 3.00m	51	43	6		Slightly silty / clayey SAND and GRAVEL
WS3 1.50m	35	51	14		Silty / clayey very gravelly SAND
WS3 2.50m	37	56	8		Silty / clayey very gravelly SAND
WS4 1.50m	13	79	3	4	Slightly silty / clayey gravelly SAND

7.2 Geo-environmental Testing

7.2.1 Soil Analysis

At the request of the client's engineer a basic screen of certain soil samples for common soil contaminants was completed. Four soil samples from depths of 0.20-0.50mbgl were submitted to DETS, a UKAS and MCERTS accredited laboratory testing facility, for a screen of contamination testing. The suite of testing included an asbestos screen, heavy metals and hydrocarbons including speciated Total Petrol Hydrocarbons (TPH LQM aromatic/aliphatic split), BTEX, MTBE and speciated Polycyclic Aromatic Hydrocarbons (PAH), as well as a background suite of pH, SOM, total cyanide, and total phenols.

Three of the four were selected from Made Ground soils (WS1 @ 0.50mbgl, WS2 @ 0.30mbgl and WS3 @ 0.20mbgl) with the remaining selected from the upper River Terrace Deposit (WS4 @ 0.40mbgl).

This testing has been completed in isolation and without the benefit of a Phase 1 Geo-environmental Risk Assessment; as a result whilst it is possible to make comparisons against published screening criteria, the report is not intended as a full environmental Risk Assessment and as no Source-Pathway-Receptor linkages have been established a Conceptual Site Model will not be produced.

Screening Criteria

The results of this laboratory testing have been compared to published guidance criteria, widely referred to by consultants and Regulatory Authorities within the industry, and include the following:

- The UK Soil Guideline (SGVs) for selected metals, BTEX and phenols, produced by the EA and the Department of Environment, Food and Rural Affairs (DEFRA), 2009;



- Suitable 4 Use Levels (S4ULs) Generic Assessment Criteria (GAC) for 82no. contaminants developed by the Chartered Institute of Environmental Health (CIEH) in partnership with Land Quality Management Ltd (2015). It is anticipated that this screening criteria will be applied by the Local Authorities, but it should be noted that the CIEH S4ULs have not been issued through the EA or DEFRA;
- Provisional Category 4 Screening Levels (pC4SL) for lead, which have been produced by CL:AIRE (2014).
- Threshold values provided by the Water Regulations Advisory Scheme (WRAS) (2002)

Comparisons were made against guidance criteria for the 'residential with home-grown produce' land use setting, based upon the proposed end use. Results were compared to the 6.00% soil organic matter values where applicable within the Made Ground soils on the basis of the results obtained.

7.2.2 Analytical Results

Of the testing for inorganic contaminants, two exceedances of the guidance criteria were recorded. Both related to Lead in samples of Made Ground

Determinand	Recorded Concentration (mg/kg)	Screening Value (mg/kg)	Sample
Lead	1200	200	WS2 0.30m
Lead	822	200	WS3 0.20m

Several exceedance of PAH determinands were recorded.

Determinand	Recorded Concentration (mg/kg)	Screening Value (mg/kg)	Sample
Benzo(a)pyrene	9.03	3.00	WS3 0.20m
Benzo(a)pyrene	6.74	2.20	WS4 0.40m (lower screening value due to lower SOM)
Benzo(b)fluoranthene	13.20	3.70	WS3 0.20m
Dibenz(a,h)anthracene	1.38	0.30	WS3 0.20m
Dibenz(a,h)anthracene	0.77	0.24	WS4 0.40m (lower screening value due to lower SOM)

All TPH determinands, BTEX and MTBE were found to be below the screening values. Asbestos was not detected within any the Made Ground samples.

Full laboratory test results can be found in Appendix D.



8.0 DISCUSSION OF GROUND CONDITIONS

8.1 Soil Engineering Properties

The proposed development includes the construction of new low-rise buildings at the northwest corner as well as within the central / southern portion of the site. Exact proposed loads and construction forms are not known at the time of writing, however proposed ground bearing pressures are expected to be moderate.

Made Ground is recorded to a maximum depth of 0.80mbgl and is predominantly described as a variably clayey and gravelly Sand, locally becoming reworked clay.

Within the southern portion of the site, in WS1, the initial natural soil is considered to be representative of Alluvium and is described as very soft consistency grey slightly sandy organic Clay / Silt, extending to a depth of 1.30mbgl.

It is not considered that there is an SPT result which refers to this stratum; laboratory testing indicates that this material is intermediate plasticity clay and would be of medium shrinkage potential.

Elsewhere the upper natural soil is described as soft or firm consistency brown mottled silty and locally sandy Clay and are considered to represent River Terrace Deposits and were encountered to a depth of 1.10-1.40mbgl. The laboratory testing completed in this material indicates that it is of low shrinkage potential. Insitu SPT testing indicates N Values of N=7-11, which indicates soft to firm consistency.

Further River Terrace Deposit soils underlie this material and are described as variably gravelly Sand extending to depths of 2.80-3.20mbgl. Insitu testing results record N values of N=9-33, which indicates loose to medium dense granular soils; the high degree of variability is likely attributable to the variable granular content.

The bedrock geology of the Lambeth underlies the latter stratum and is initially described as stiff consistency grey and red mottled silty Clay, becoming very stiff greenish grey mottled silty Clay below 4.80-6.30mbgl.

At depths of 5.80mbgl in WS4 and 7.00mbgl in WS3 a layer of limestone was encountered, which caused refusal of SPT testing and was too hard for the samplers to penetrate.

Laboratory testing within the Lambeth Group indicates that it is a High Plasticity Clay and would be considered to be of high shrinkage potential.

Groundwater was encountered at depths between 0.40m and 0.90mbgl during the investigation works.

8.2 Shallow Foundations

The Made Ground soils encountered across the site would not be considered suitable as a bearing stratum; soils of this origin are frequently present in a weak and variable condition such that unacceptable settlement would be anticipated even under light loading intensities.

The upper cohesive portion of the River Terrace Deposit is considered to be too thin to be an effective founding stratum as the base of the material is encountered at 1.10-1.40mbgl. In addition, this material is absent in the location of WS1 and the Alluvium which is instead present would be unsuitable for structural loads owing to its apparent low strength character.



Whilst the loose to medium dense granular materials of the River Terrace Deposits which were encountered within the depth range 1.10-3.20mbgl would likely support structural loads, the stratum is saturated and was highly unstable within the sides of the excavations. As a result, it is expected that forming spread type foundations on the site would be highly problematic and a piled foundation should be considered.

8.3 Deep Foundations

As indicated the use of a spread type foundation is expected to be unsuitable and thus a piled foundation should be considered for the new development. It is expected that piles would be sited within the Lambeth Group at a depth of approximately 8.00-10.00mbgl; CFA piles are likely to be most suitable owing to the probability of sloughing of the excavation sides.

Further Ground investigation are likely to be required (depending upon the exact requirements of the of piling contractor) to inform the design of piles, and it is suggested that this should take the form of two exploratory boreholes extended to 15.00mbgl in the areas of the proposed buildings. It is likely that this would be undertaken by means of a cable percussion drilling rig, however the presence of limestone at a depth of 5.80-7.00mbgl is noted and it should be considered possible that a rotary percussive drilling rig would be subsequently required to penetrate this hard layer.

8.4 Floor Slabs and Pavements

The floor slab design will depend on the final foundation designs and is dependent on the underlying materials, including bearing capacity and the presence of any cohesive or Made Ground Soils.

A suspended floor slab is considered to be most suitable for this site owing to the variable nature of the Made Ground, as well as the low to medium shrinkage potential upper soils encountered. Such a floor should be designed in accordance with the NHBC guidance on building near trees.

On the basis of the results DCP testing it would be suggested that a design value of no higher than 4% CBR is used in the construction of new pavements.

8.5 Excavations and Groundwater

It is likely that excavations of less than 1.2mbgl will require support to their faces due to the variable nature of the Made Ground and upper soils. Should excavations be taken below this then adequate support should be provided in order to satisfy statutory safety regulations.

Groundwater has been identified up to 0.40mbgl during site works. Therefore, any excavation made below groundwater levels on site is expected to be subject to the inflow of groundwater which is expected to result in the further instability of excavation faces, particularly where granular soils are encountered. It is strongly recommended that provision is made in the specification of ground works for dewatering.

Where groundwater is identified within any of the excavations during the construction phase then it should be dealt with appropriately and removed using good engineering practices.



The design of any temporary retaining structures to support excavation faces should be made assuming the following moderately conservative parameters:

Material	Effective angle of friction (ϕ')	Effective Cohesion; c' (kPa)	Bulk Density kN/m^3
Made Ground	24	0	16
Alluvium	14-16	0	17
River Terrace Deposit (Clay)	24-26	0	18
River Terrace Deposit (Sand)	28-30	0	18

Infiltration testing indicates that the soils on site have very poor permeability, it would be suggested that alternative means such as storage / attenuation is explored as a means to dispose of surface water.

8.6 Aggressive Chemical Environment to Concrete

Sulphate concentrations within the Made Ground and Natural soils were found to range from <10mg/l to 67mg/l and pH levels were noted to range from 7.1 to 9.3 suggesting that a design class of DS-1 and a sub class of AC-1s should be adopted for buried concrete structures within these soils, (Reference made to current BRE SD1 Guidelines) based on the soils tested.

9.0 GEO-ENVIRONMENTAL RECOMMENDATIONS

The following recommendations are based on the plans proposed at the time of writing this report and may be subject to change.

9.1 Remedial Strategy

Further to the recommendations provided below, it is advised that the local planning authority should be consulted to determine whether a full Geo-environmental Assessment is required and subsequently if a standalone remedial strategy is required for submission.

Exceedances of what are considered to be the applicable 'Residential with Homegrown Produce' guidance criteria have been recorded relating to Lead and PAH determinands, notably including the carcinogenic PAH Benzo(a)pyrene.

The soil screening completed for this assessment is somewhat limited; including only 4no samples, three of which were of Made Ground and all taken from positions which were primarily located to target geotechnical purposes.

However, two Made Ground samples have indicated elevated Lead exceedances, one PAH exceedances as well as one sample of natural soils showing exceedances of PAH. Whilst the data set is not exhaustive there is evidence that both Made Ground and natural soils are impacted.



9.1.1 Proposed Areas of Soft Landscaping

It is presumed that the areas of soft landscaping which are proposed within the development will be 'communal' areas of garden. Nevertheless these will be in a residential setting and the contaminants identified would not be considered suitable to be left insitu within soft landscaped areas. Furthermore, the Made Ground soils encountered would not be considered to be suitable to be used as topsoil within a residential garden owing to the presence of detritus such as brick in the soil matrix.

The following must be implemented in proposed areas of soft landscaping:

- Removal of existing Made Ground soils to allow provision of at least 450mm up to finished levels of imported and certified subsoil/ topsoil (dependent on final landscape design and advice from landscape architect). This should be increased to 600mm within private gardens.

It is recommended that the formation level of this imported material is initially overlain by a geotextile membrane to prevent soil mixing and to provide a 'no-dig' barrier.

9.1.2 Watching Brief

A watching brief should be maintained on site, particularly during ground works. This must be undertaken as part of good working practices and in case there are any areas of unidentified contamination.

During any ground works, an appraisal of the exposed soils should be made by the on-site manager or developer's nominated person. If any material is noted to show visual and/or olfactory sign of contamination this material should be stockpiled separately and tested prior to its appropriate removal off site or re-use where necessary. A suitably qualified environmental specialist should be contacted to advise what further work is required.

The on-site manager / developer's nominated person should be able to display the relevant level of qualification and/or experience in managing construction works on contaminated land.

9.1.3 Imported Material

Any material intended to be used as subsoil or engineered fill should be analysed in order to confirm it is suitable for use.

As a minimum, sampling should consist of at least three samples for each source used. Validation testing of imported materials should be carried out insitu, after materials have been imported to site, and further to this, imported materials should be stored in designated on site areas.

Specific contaminants that should be tested and associated screening criteria are detailed in the table below.

Soil Type	Chemical Testing Required	Testing Frequency
Topsoil – Proven greenfield source	Heavy Metals, TPH, PAH, BTEX, MTBE + BS3882 physical testing.	On site: 1 per 200m ³
Topsoil – Unknown/ mixed/ brownfield source	Heavy Metals, TPH, PAH, BTEX, MTBE, Asbestos Screen + BS3882 physical testing.	On Site: 1 per 50m ³
Subsoil – Proven greenfield source	Heavy Metals, TPH, PAH, BTEX, MTBE, Asbestos Screen	On site: 1 per 200m ³
Engineered Fill	Heavy Metals, TPH, PAH, BTEX, MTBE, Asbestos Screen	On site: 1 per 200m ³



9.1.4 Waste Disposal

An explanation of Waste Disposal Guidance is presented below.

According to Technical Guidance WM3 – Waste Classification: Guidance on the classification and assessment of waste (2015), as part of Duty of Care, waste must be classified:

- Before it is collected, disposed of or recovered;
- To identify the controls that apply to the movement of the waste;
- To complete waste documents and records;
- To identify suitably authorised waste management options; and
- To prevent harm to people and the environment.

Before waste can be accepted at a landfill site, the landfill operator must be satisfied that the waste meets permit conditions, the waste acceptance procedures (WAP) and waste acceptance criteria (WAC).

Waste Acceptance Procedures

The WAP consist of three steps to identify and periodically check the main characteristics of the waste.

Level 1: basic characterisation – before waste is sent to landfill, its composition and properties must be verified to determine it is suitable for acceptance and at which class of site.

Level 2: compliance testing – if production of waste is regular, waste must be periodically checked to ensure that properties have not changed.

Level 3: on-site verification – each delivery must be checked to ensure that it is the expected waste and that it has not been contaminated in storage or transport.

Waste Acceptance Criteria

The European Waste Catalogue (List of Waste Regulations) should be used in the determination of whether a waste is hazardous.

Waste producers must characterise waste for the Duty of Care Description whether or not it is intended to send it to landfill. This includes making an assessment of its hazardousness (is it classified hazardous waste or not) unless it is an absolute non-hazardous entry waste. This is achieved by reference to the List of Waste Regulations.

Note, WAC testing cannot be used to make an assessment of whether a waste is hazardous.

Summary:

Before a waste producer can take waste to a landfill site for disposal, they must check the landfill has the appropriate permit, and must have completed the following:

- Duty of Care transfer note/ Hazardous Waste consignment note;
- Pre-treatment declaration form;
- Waste code (using List of Wastes);



- Composition of the waste (by testing, if necessary); and
- WAC testing (if required).

Requirements are considered in more detail within Waste Acceptance at Landfills (2010).

It is prudent to ascertain the testing requirements of the waste facility prior to the movement of any spoil. All relevant dockets will need to be kept to provide evidence of the removal of waste. If in doubt, the Environment Agency should be contacted for advice at an early stage to avoid any delays.

A copy of such documentation should be retained and forwarded to the environmental consultant for inclusion into a verification/validation report, where required.

9.1.5 Services

We would recommend that if new services are present in the design of this development, the local water board are contacted to determine the type of pipework that should be used on this site on the basis of the elevated levels of contamination proven.

It is recommended the services are situated within lined trenches. The trenches should be lined with a geotextile membrane and backfilled with clean fill, such as pea shingle, which will demarcate the services from the surrounding soils, protecting both the services and the future maintenance workers.

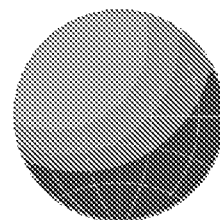
APPENDICES

Appendix A – Site Plan

Appendix B – Stratigraphic Logs

Appendix C – Photographs

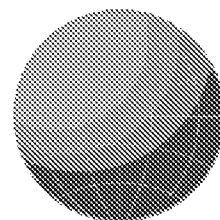
Appendix D – Laboratory Certificates



IMPACT
GEOTECHNICAL

APPENDIX A

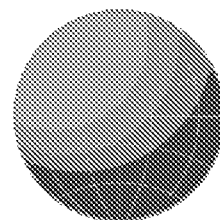
Site Plan



IMPACT
GEOTECHNICAL

APPENDIX B

Stratigraphic Logs



IMPACT
GEOTECHNICAL



IMPACT
GEOTECHNICAL

Borehole Log

Borehole No.
WS1
Sheet 1 of 1

Project Name: 283-285a Chichester Road	Project No P19.142	Co-ords n/a	Hole Type WLS
Location: Bognor Regis		Level n/a	Scale NTS
Client: Alex Eggett		Date(s) 16/10/2019	Logged By GC

Well	Sample and Insitu Testing			Results	Depth (m)	Level (m AOD)	Legend	Stratum Description	
	Water Strikes	Depth(s)	Type						
		0.20	ES	N=16 (0,0/2,2,6,6)	0.40			MADE GROUND: Probably reworked organic sandy Silt. Sand is medium to coarse. Frequent plant remains.	
		0.50 0.50	D ES		0.75			MADE GROUND: possibly reworked brown mottled grey silty Clay. Scattered subangular to subrounded, fine to coarse sized flint gravel.	
		1.00 1.00-1.45	D SPT		1.30			Very soft consistency grey locally slightly sandy organic CLAY / SILT. Sand is fine to medium. (possible ALLUVIUM)	1
		1.50	D	N=18 (1,3/3,4,5,6)	2.80			Medium dense reddish brown and locally light brown slightly gravelly SAND. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse sized flint. (RIVER TERRACE DEPOSIT)	2
		2.00 2.00-2.45	D SPT		3.00			Stiff consistency light grey mottled red silty CLAY. (LAMBETH GROUP)	3
		2.50	D						
		3.00	D					End of hole at 3.00mbgl	

Remarks

Hand excavated pit to 1.00mbgl. Groundwater encountered at 0.75m, rising to 0.40mbgl. SPT's completed at 1.00m centres. End of windowless sample at 3.00mbgl due to collapse of borehole sides to 2.10mbgl. Backfilled with arisings on completion.



IMPACT
GEOTECHNICAL

Borehole Log

Borehole No.
WS2
Sheet 1 of 1

Project Name: 283-285a Chichester Road

Project No
P19.142

Co-ords
n/a

Hole Type
WLS

Location: Bognor Regis

Level
n/a

Scale
NTS

Client: Alex Eggett

Date(s)
16/10/2019

Logged By
GC

Well	Sample and Insitu Testing			Results	Depth (m)	Level (m AOD)	Legend	Stratum Description	
	Water Strikes	Depth(s)	Type						
		0.30	ES	N=11 (2,4/4,2,3,2)	0.50			MADE GROUND: Dark brown gravelly clayey Sand. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse sized flint and brick.	1
		0.50	D					MADE GROUND: Reworked brown silty sandy Clay. Sand is fine to medium. Rare coarse sand sized brick rubble.	
		0.60	ES					Soft consistency light brown mottled silty CLAY. (RIVER TERRACE DEPOSIT)	
		1.00	D	N=23 (2,3/5,5,5,8)	1.40			Medium denseligh brown becoming reddish brown slightly gravelly SAND. Sand is fine to coarse. Gravel is subangular to rounded, fine to coarse sized flint. (RIVER TERRACE DEPOSIT)	2
		1.00-1.45	SPT						
		1.50	D						
		2.00	D	N=11 (1,1/2,2,4,3)	3.20			Stiff consistency light grey mottled red silty CLAY. (LAMBETH GROUP)	3
		2.00-2.45	SPT						
		2.50	D						
		3.00	D		3.45			End of hole at 3.45mbgl	4
		3.00-3.45	SPT						

Remarks

Hand excavated pit to 1.00mbgl. Groundwater encountered at 0.90m. SPT's completed at 1.00m centres. End of windowless sample at 3.45mbgl due to collapse of borehole sides to 2.40mbgl. Backfilled with arisings on completion.



IMPACT
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Borehole Log

Borehole No.
WS3
Sheet 1 of 2

Project Name: 283-285a Chichester Road

Project No
P19.142

Co-ords
n/a

Hole Type
WLS

Location: Bognor Regis

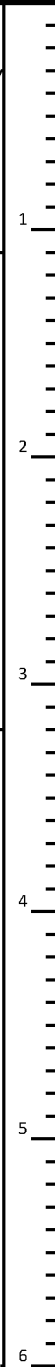
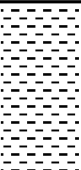
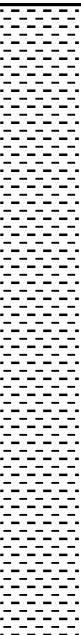
Level
n/a

Scale
NTS

Client: Alex Eggett

Date(s)
16/10/2019

Logged By
GC

Well	Sample and Insitu Testing			Results	Depth (m)	Level (m AOD)	Legend	Stratum Description		
	Water Strikes	Depth(s)	Type							
		0.20	ES		0.30			MADE GROUND: Dark brown gravelly clayey Sand. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse and cobble sized sized flint and brick.		
		0.50 0.50	D ES					Firm consistency mottled silty CLAY. Locally slightly sandy. Sand is fine to medium, becoming very sandy at base. (RIVER TERRACE DEPOSIT)		
		1.00	D		1.10					
		1.50	D							
		2.00 2.00-2.45	D SPT		N=33 (10,8/9,10,7,7)		3.20			Medium dense reddish brown and locally light brown slightly gravelly SAND. Sand is fine to coarse. Gravel is subangular to subrounded, fine to corse sized flint. (RIVER TERRACE DEPOSIT)
		2.50	D							
		3.00 3.00-3.45	D SPT		N=5 (1,2/1,2,1,2)					
		4.00 4.00-4.45	D SPT		N=12 (1,2/1,2,4,5)					
		4.50	D							Stiff consistency light grey mottled red silty CLAY. (LAMBETH GROUP)
		5.00 5.00-5.45	D SPT		N=17 (2,2/3,3,5,6)					
5.50	D									
6.00	SPT	N=19 (1,2/3,4,5,6)					Continued.....			

Remarks

Hand excavated pit to 1.00mbgl. Groundwater encountered at 0.85m. SPT's completed at 1.00m centres. End of windowless sample at 7.00mbgl. Backfilled with arisings on completion.



IMPACT
GEOTECHNICAL

Borehole Log

Borehole No.
WS3
Sheet 2 of 2

Project Name: 283-285a Chichester Road

Project No
P19.142

Co-ords
n/a

Hole Type
WLS

Location: Bognor Regis

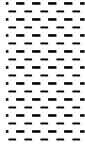
Level
n/a

Scale
NTS

Client: Alex Eggett

Date(s)
16/10/2019

Logged By
GC

Well	Sample and Insitu Testing			Results	Depth (m)	Level (m AOD)	Legend	Stratum Description	
	Water Strikes	Depth(s)	Type						
		6.50	D	N=50 (6,19/50 for 30mm)	7.00			Continued.....	7
		7.00 7.00-7.45	D SPT					Very stiff consistency greenish grey mottled brown sandy CLAY. (LAMBETH GROUP) * Below 6.70m scattered angular to subangular medium to coarse sized limestone	
								End of hole at 7.00mbgl	
									8
									9
									10
									11
									12

Remarks

Hand excavated pit to 1.00mbgl. Groundwater encountered at 0.85m. SPT's completed at 1.00m centres. End of windowless sample at 7.00mbgl. Backfilled with arisings on completion.

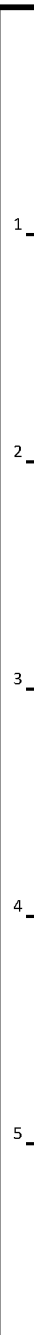
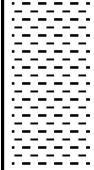
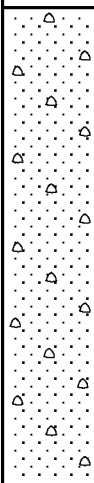
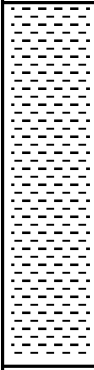
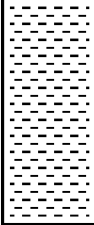


Borehole No.
WS4
Sheet 1 of 1

Hole Type	WLS
1	0.0000
2	0.0000
3	0.0000
4	0.0000
5	0.0000
6	0.0000
7	0.0000
8	0.0000
9	0.0000
10	0.0000
11	0.0000
12	0.0000
13	0.0000
14	0.0000
15	0.0000
16	0.0000
17	0.0000
18	0.0000
19	0.0000
20	0.0000
21	0.0000
22	0.0000
23	0.0000
24	0.0000
25	0.0000
26	0.0000
27	0.0000
28	0.0000
29	0.0000
30	0.0000
31	0.0000
32	0.0000
33	0.0000
34	0.0000
35	0.0000
36	0.0000
37	0.0000
38	0.0000
39	0.0000
40	0.0000
41	0.0000
42	0.0000
43	0.0000
44	0.0000
45	0.0000
46	0.0000
47	0.0000
48	0.0000
49	0.0000
50	0.0000
51	0.0000
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53	0.0000
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58	0.0000
59	0.0000
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61	0.0000
62	0.0000
63	0.0000
64	0.0000
65	0.0000
66	0.0000
67	0.0000
68	0.0000
69	0.0000
70	0.0000
71	0.0000
72	0.0000
73	0.0000
74	0.0000
75	0.0000
76	0.0000
77	0.0000
78	0.0000
79	0.0000
80	0.0000
81	0.0000
82	0.0000
83	0.0000
84	0.0000
85	0.0000
86	0.0000
87	0.0000
88	0.0000
89	0.0000
90	0.0000
91	0.0000
92	0.0000
93	0.0000
94	0.0000
95	0.0000
96	0.0000
97	0.0000
98	0.0000
99	0.0000
100	0.0000

Scale
NTS

Logged By
GC

Well	Sample and Insitu Testing			Results	Depth (m)	Level (m AOD)	Legend	Stratum Description			
	Water Strikes	Depth(s)	Type								
		0.20	ES	N=7 (1,2/3,1,1,2)	0.50 0.20			MADE GROUND: Tarmac			
		0.50 0.50	D ES				MADE GROUND: Angular fine to medium gravel of flint.				
		1.00 1.00-1.45	D SPT				Soft to firm consistency mottled sandy silty CLAY. Sand is fine to medium, becoming very sandy at base. (RIVER TERRACE DEPOSIT)				
		1.50	D								
		2.00 2.00-2.45	D SPT					Loose light brown and locally reddish brown slightly gravelly SAND. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse sized flint. (RIVER TERRACE DEPOSIT)			
		2.50	D								
		3.00 3.00-3.45	D SPT				Stiff consistency light grey mottled red silty CLAY. (LAMBETH GROUP)				
		4.00 4.00-4.45	D SPT								Very stiff consistency greenish grey mottled brown sandy CLAY. (LAMBETH GROUP)
		4.50	D								
		5.00 5.00-5.45	D SPT	N=19 (2,2/3,4,5,7)				4.80			
		5.50	D								
		5.80	SPT	N=50 (25 for 75mm 50 for 50mm)	5.80			End of hole at 5.80mbgl			

Hand excavated pit to 1.00mbgl. Groundwater encountered at 0.50m. SPT's completed at 1.00m centres. End of windowless sample at 5.80mbgl due to refusal. Backfilled with arisings on completion.



IMPACT
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Trial Pit Log

Trial Pit No.
TP1
Sheet 1 of 1

Project Name: 283-285a Chichester Road

Project No
P19.142

Co-ords
n/a

Hole Type
TP

Location: Bognor Regis

Pit Dimensions

Level
n/a

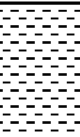
Scale
NTS

Client: Alex Eggett

1.50 m
0.45 m

Date(s)
16/10/2019

Logged By
GC

Well	Sample and Insitu Testing			Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
	Water Strikes	Depth(s)	Type					
					0.40			MADE GROUND: Dark brown gravelly clayey Sand. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse sized flint and brick.
					0.70			Soft to firm consistency brown mottled slightly sandy silty CLAY. Sand is fine to medium. (RIVER TERRACE DEPOSIT)
					1.50			Loose to medium dense fine to medium grained SAND. (RIVER TERRACE DEPOSIT)
								End of Trial Pit at 1.50mbgl

Remarks

No Groundwater encountered. Hole backfilled with arisings. Soil infiltration conducted in general accordance with BRE 365.

BRE 365 Soil Infiltration Testing			
Project Ref	P19 142	Hole Ref	TP1
Site Name	Chichester Road	Test Number	1

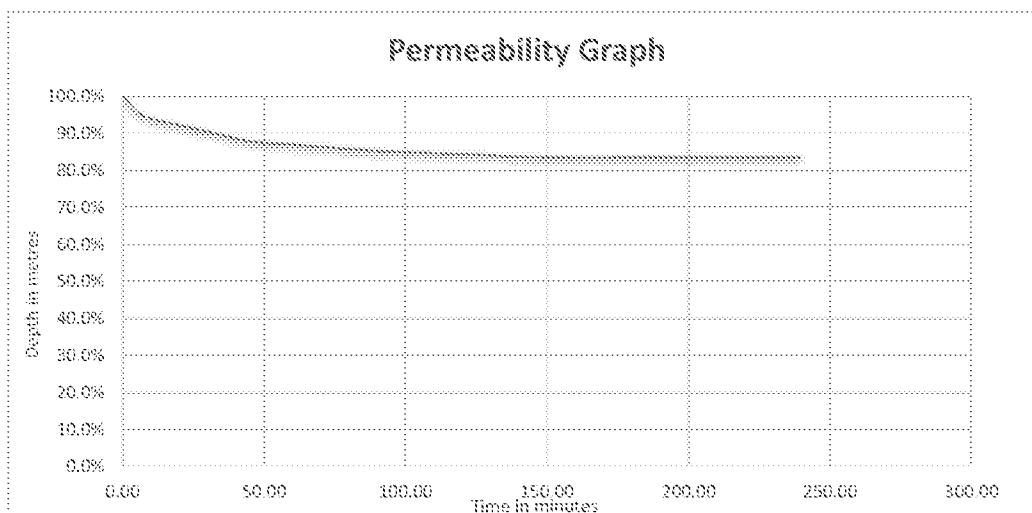
Hole Ref TP1

Test Number 1

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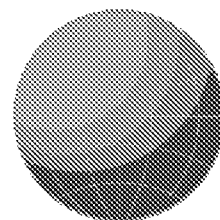
Pit Size		Time in mins	
Length	1.50		75%
Width	0.45		25%
Depth	1.50		

not valid



APPENDIX C

Photographs



IMPACT
GEOTECHNICAL

1.



2.



3.



4.



Investigation Photographs

Project Ref: P19.142

ARUN DISTRICT COUNCIL BR/13/21/DOC

Site Name: Chichester Road, Bognor

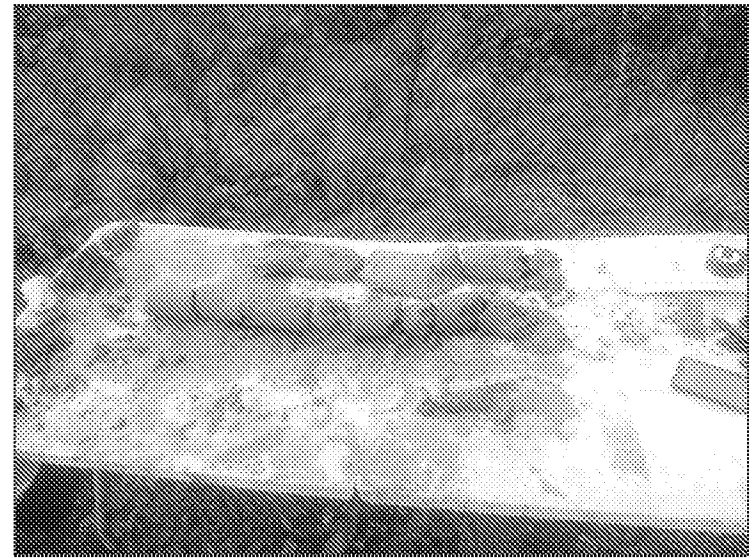
- 1. WS1
- 2. WS1
- 3. WS1
- 4. WS1



5.



6.



7.



8.



Investigation Photographs

Project Ref: P19.142

ARUN DISTRICT COUNCIL BR/13/21/DOC

Site Name: Chichester Road, Bognor

5. WS2
6. WS2.
7. WS2
8. WS3



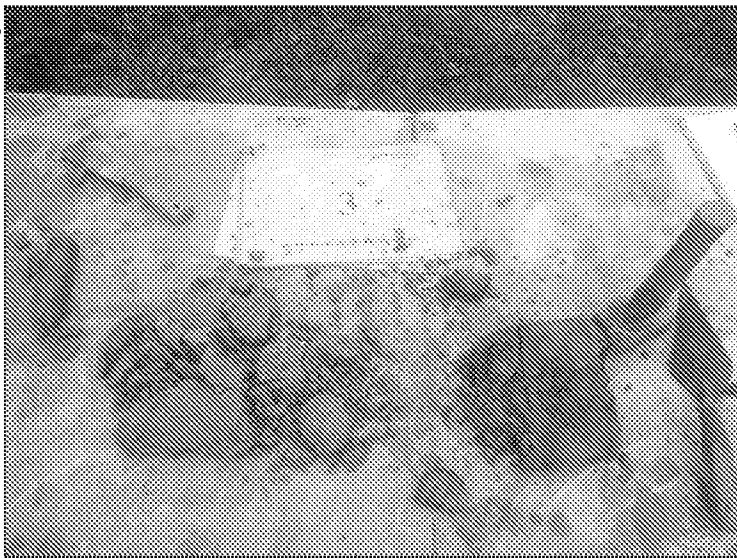
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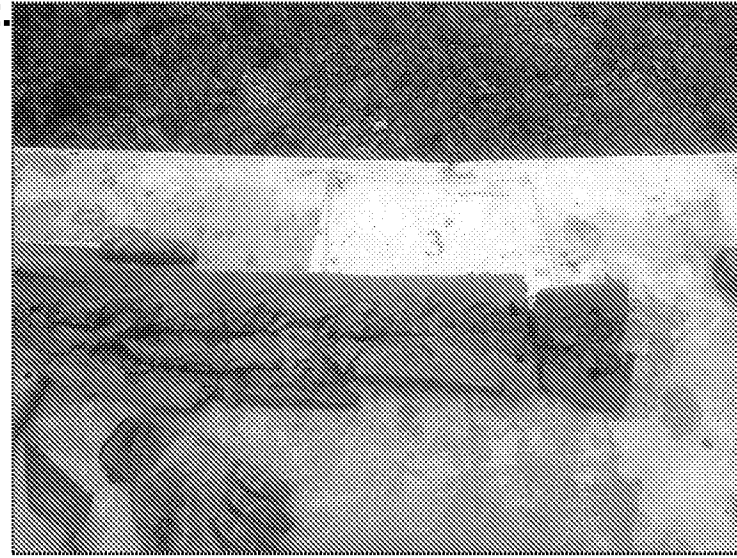
10.



11.



12.



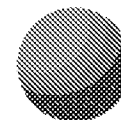
Investigation Photographs

Project Ref: P19.142

ARUN DISTRICT COUNCIL BR/13/21/DOC

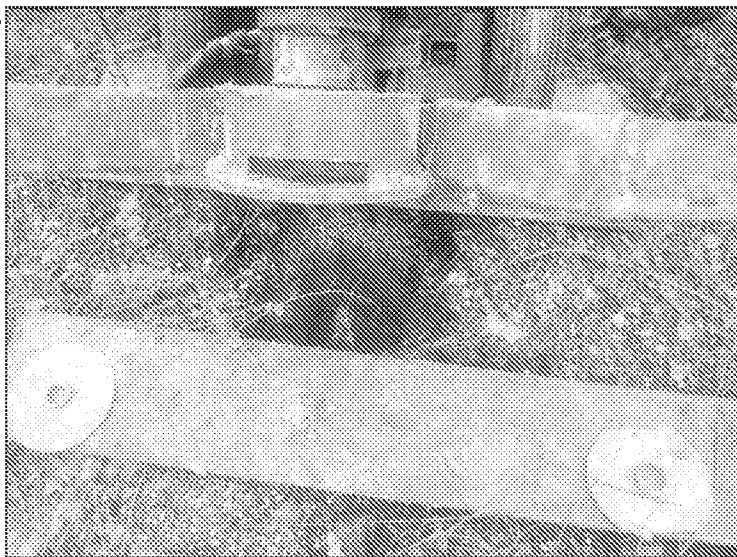
Site Name: Chichester Road, Bognor

9. WS3
10. WS3
11. WS3
12. WS3.



IMPACT
GEOTECHNICAL

13.



14.



15.



16.



Investigation Photographs

Project Ref: P19.142

ARUN DISTRICT COUNCIL BR/13/21/DOC

Site Name: Chichester Road, Bognor

13. WS4
14. WS4.
15. WS4
16. WS4.



17.



18.



19.



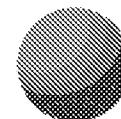
Investigation Photographs

Project Ref: P19.142

ARUN DISTRICT COUNCIL BR/13/21/DOC

Site Name: Chichester Road, Bognor

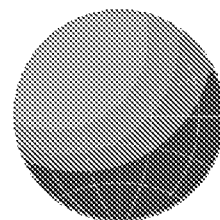
17. WS4
18. WS4
19. WS4



IMPACT
GEOTECHNICAL

APPENDIX D

Laboratory Certificates



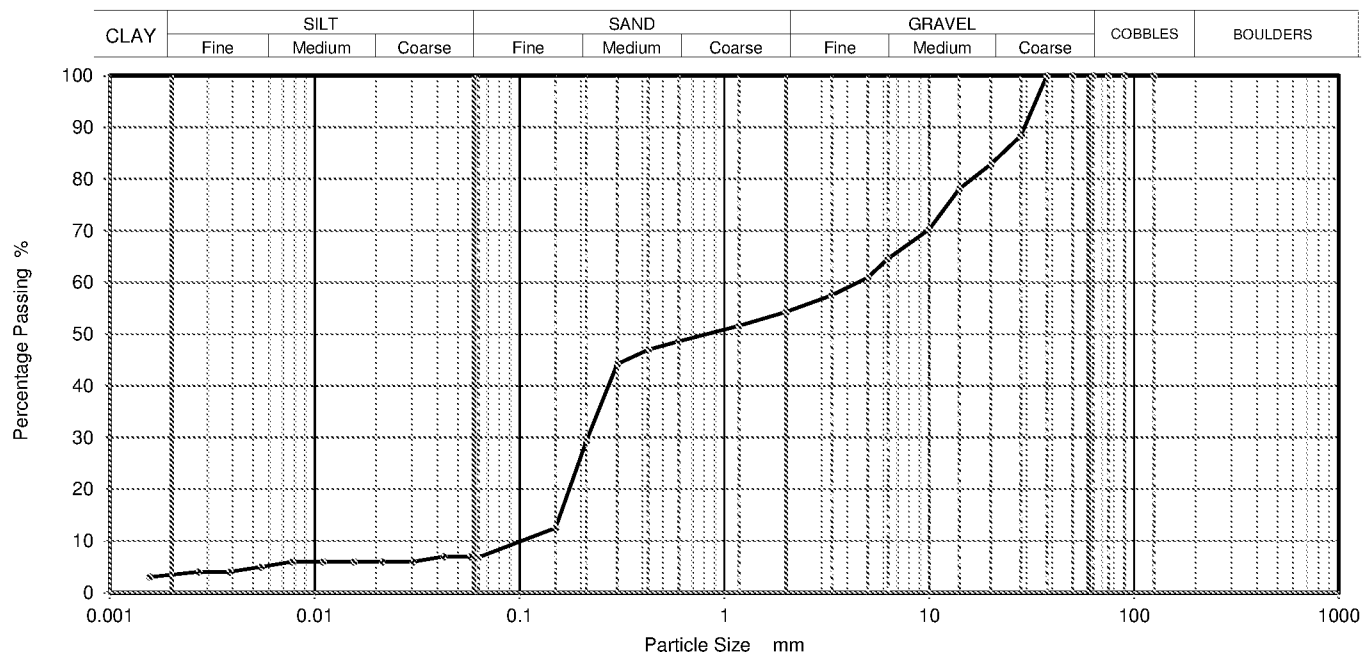
IMPACT
GEOTECHNICAL



PARTICLE SIZE DISTRIBUTION

Job Ref	27323
Borehole/Pit No.	WS1
Sample No.	-
Depth Top	2.00 m
Depth Base	- m
Sample Type	D
Samples received	21/10/2019
Schedules received	17/10/2019
Project started	22/10/2019
Date tested	29/10/2019

Site Name	Chichester Road, Bognor		
Project No.	P19.142	Client	Impact Geotechnical
Soil Description	Yellowish brown slightly silty slightly clayey very gravelly SAND (gravel is fine and sub-rounded to sub-angular)		
Test Method	BS1377:Part 2: 1990, clause 9.0		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0575	7
90	100	0.0428	7
75	100	0.0302	6
63	100	0.0213	6
50	100	0.0156	6
37.5	100	0.0110	6
28	88	0.0078	6
20	83	0.0055	5
14	78	0.0039	4
10	70	0.0027	4
6.3	65	0.0016	3
5	61		
3.35	58		
2	54		
1.18	52		
0.6	49		
0.425	47		
0.3	44		
0.212	29		
0.15	13		
0.063	7		

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	45.7
Sand	47.6
Silt	3.2
Clay	3.5

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks
Preparation and testing in accordance with BS1377 unless noted below



K4 Soils Laboratory
Unit 8, Olds Close, Watford, Herts. WD18 9RU

Checked and Approved

Initials: J.P

Date: 04/11/2019

MSF-5-R3

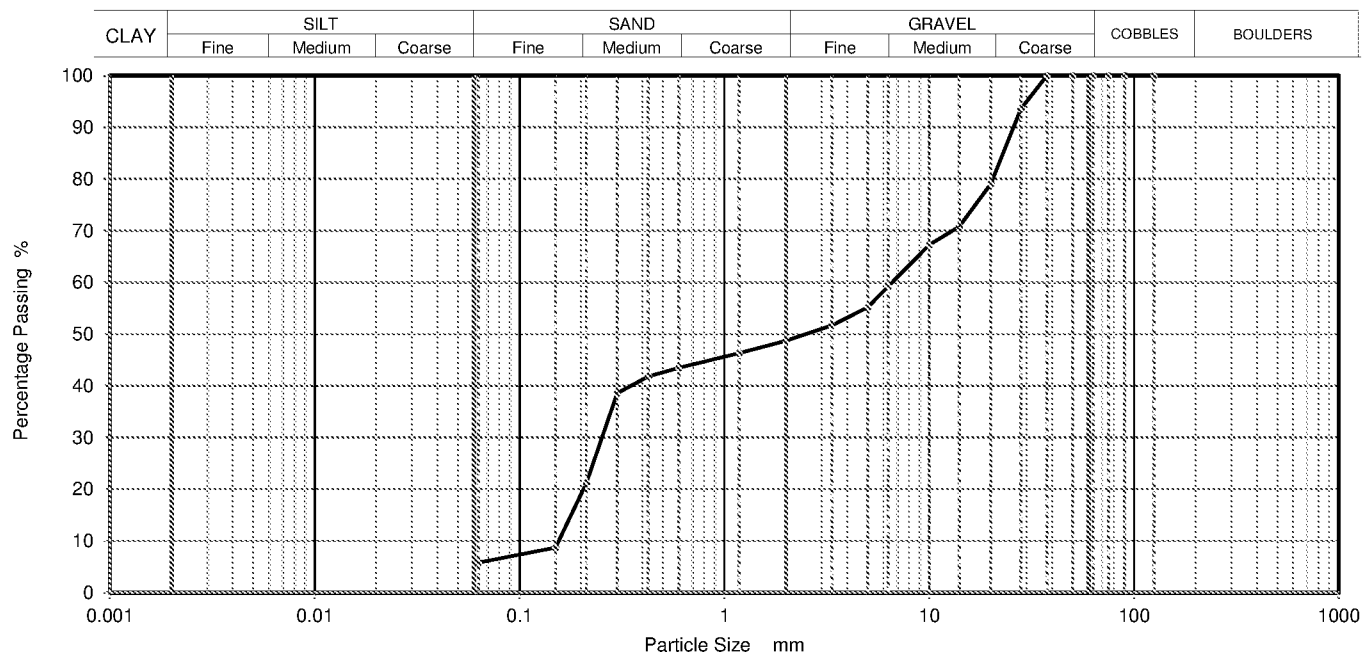
Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)



PARTICLE SIZE DISTRIBUTION

Job Ref	27323
Borehole/Pit No.	WS2
Sample No.	-
Depth Top	3.00 m
Depth Base	- m
Sample Type	D
Samples received	21/10/2019
Schedules received	17/10/2019
Project started	22/10/2019
Date tested	28/10/2019

Site Name	Chichester Road, Bognor		
Project No.	P19.142	Client	Impact Geotechnical
Soil Description	Orangish brown clayey very sandy GRAVEL (gravel is fmc and sub-rounded to sub-angular)		
Test Method	BS1377:Part 2: 1990, clause 9.0		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	94		
20	79		
14	71		
10	67		
6.3	59		
5	55		
3.35	52		
2	49		
1.18	46		
0.6	44		
0.425	42		
0.3	39		
0.212	21		
0.15	9		
0.063	6		

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	51.3
Sand	42.9
Fines <0.063mm	5.8

Grading Analysis	
D100 mm	
D60 mm	6.58
D30 mm	0.253
D10 mm	0.156
Uniformity Coefficient	42
Curvature Coefficient	0.062

Remarks
Preparation and testing in accordance with BS1377 unless noted below



K4 Soils Laboratory
Unit 8, Olds Close, Watford, Herts, WD18 9RU

Checked and Approved

Initials: J.P

Date: 04/11/2019

MSF-5-R3

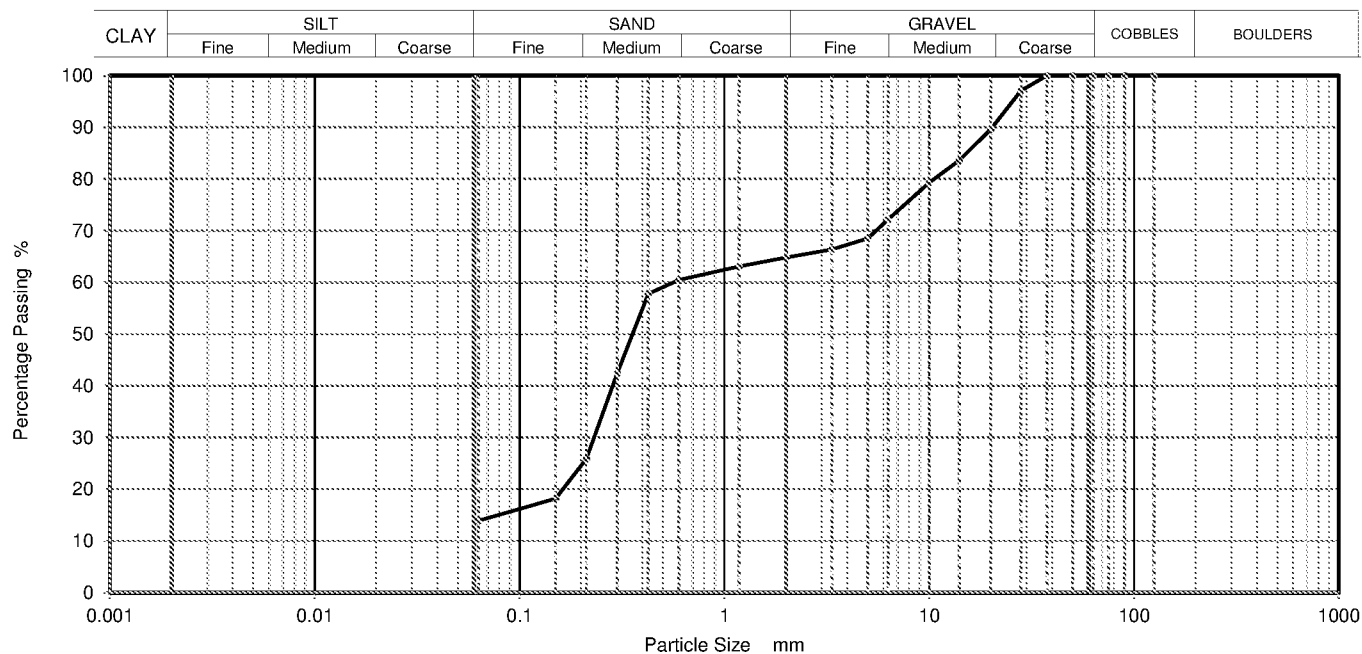
Approved Signatories: K.Phaure (T)



PARTICLE SIZE DISTRIBUTION

Job Ref	27323
Borehole/Pit No.	WS3
Sample No.	-
Depth Top	1.50 m
Depth Base	- m
Sample Type	D
Samples received	21/10/2019
Schedules received	17/10/2019
Project started	22/10/2019
Date tested	28/10/2019

Site Name	Chichester Road, Bognor		
Project No.	P19.142	Client	Impact Geotechnical
Soil Description	Orangish brown and greyish brown clayey very gravelly SAND (gravel is fmc and sub-rounded to sub-angular)		
Test Method	BS1377:Part 2: 1990, clause 9.0		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	97		
20	90		
14	84		
10	79		
6.3	72		
5	69		
3.35	66		
2	65		
1.18	63		
0.6	61		
0.425	58		
0.3	42		
0.212	26		
0.15	18		
0.063	14		

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	35.2
Sand	50.9
Fines <0.063mm	13.9

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks
Preparation and testing in accordance with BS1377 unless noted below



K4 Soils Laboratory
Unit 8, Olds Close, Watford, Herts, WD18 9RU

Checked and Approved

Initials: J.P

Date: 04/11/2019

MSF-5-R3

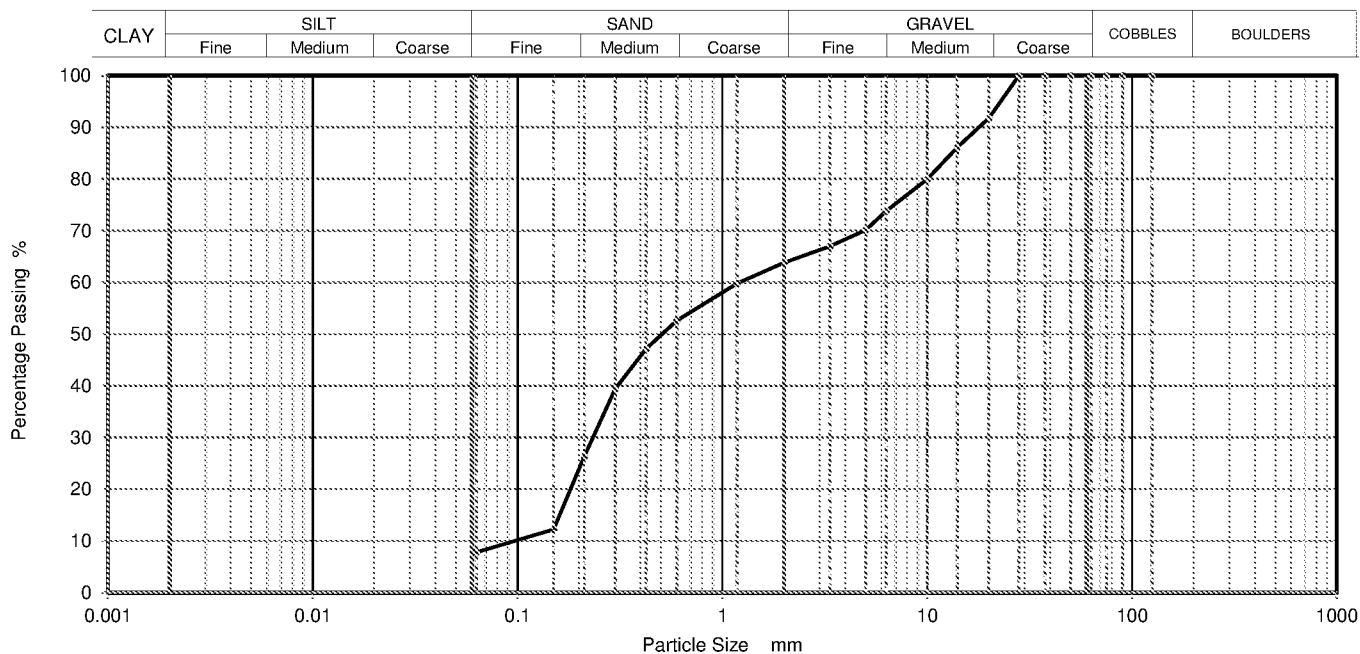
Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)



PARTICLE SIZE DISTRIBUTION

Job Ref	27323
Borehole/Pit No.	WS3
Sample No.	-
Depth Top	2.50 m
Depth Base	- m
Sample Type	D
Samples received	21/10/2019
Schedules received	17/10/2019
Project started	22/10/2019
Date tested	29/10/2019

Site Name	Chichester Road, Bognor		
Project No.	P19.142	Client	Impact Geotechnical
Soil Description	Orangish brown clayey very gravelly SAND (gravel is fmc and sub-rounded to sub-angular)		
Test Method	BS1377:Part 2: 1990, clause 9.0		



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	92		
14	86		
10	80		
6.3	74		
5	70		
3.35	67		
2	64		
1.18	60		
0.6	53		
0.425	47		
0.3	39		
0.212	26		
0.15	12		
0.063	8		

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	36.2
Sand	55.9
Fines <0.063mm	7.8

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	12
Curvature Coefficient	0.46

Remarks
Preparation and testing in accordance with BS1377 unless noted below



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Date: 04/11/2019

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Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

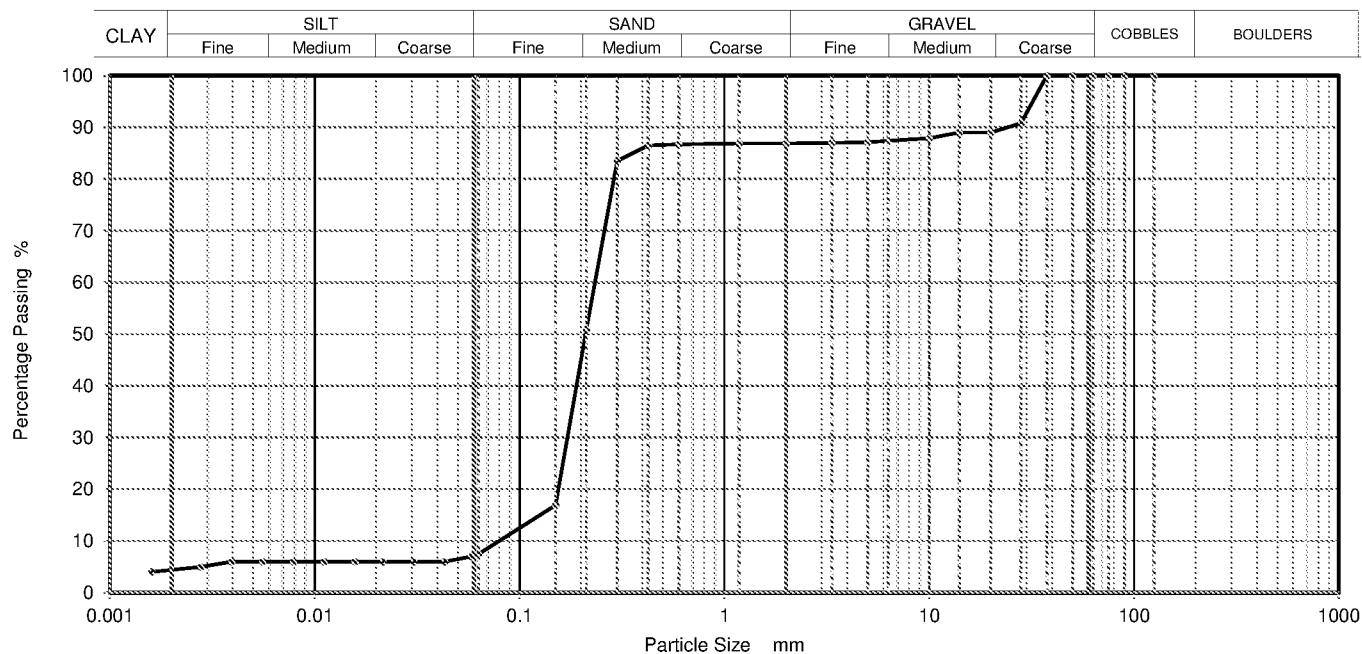
MSF-5-R3



PARTICLE SIZE DISTRIBUTION

Job Ref	27323
Borehole/Pit No.	WS4
Sample No.	-
Depth Top	1.50 m
Depth Base	- m
Sample Type	D
Samples received	21/10/2019
Schedules received	17/10/2019
Project started	22/10/2019
Date tested	28/10/2019

Site Name	Chichester Road, Bognor		
Project No.	P19.142	Client	Impact Geotechnical
Soil Description	Brown slightly silty slightly clayey gravelly SAND (gravel is fmc and sub-rounded)		
Test Method	BS1377:Part 2: 1990, clause 9.0		



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0582	7
90	100	0.0431	6
75	100	0.0305	6
63	100	0.0216	6
50	100	0.0157	6
37.5	100	0.0111	6
28	91	0.0079	6
20	89	0.0056	6
14	89	0.0039	6
10	88	0.0028	5
6.3	87	0.0016	4
5	87		
3.35	87		
2	87		
1.18	87		
0.6	87	Particle density (assumed) 2.70 Mg/m ³	
0.425	87		
0.3	84		
0.212	51		
0.15	17		
0.063	7		

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	13.1
Sand	79.4
Silt	3.2
Clay	4.3

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	2.9
Curvature Coefficient	1.6

Remarks
Preparation and testing in accordance with BS1377 unless noted below



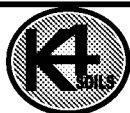
K4 Soils Laboratory
Unit 8, Olds Close, Watford, Herts, WD18 9RU

Checked and Approved

Initials: J.P
Date: 04/11/2019

MSF-5-R3

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

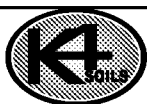


Summary of Natural Moisture Content, Liquid Limit and Plastic Limit Results

Job No. 27323	Project Name Chichester Road, Bognor	Programme	
		Samples received	21/10/2019
Project No. P19.142	Client Impact Geotechnical	Schedule received	17/10/2019
		Project started	22/10/2019
		Testing Started	01/11/2019

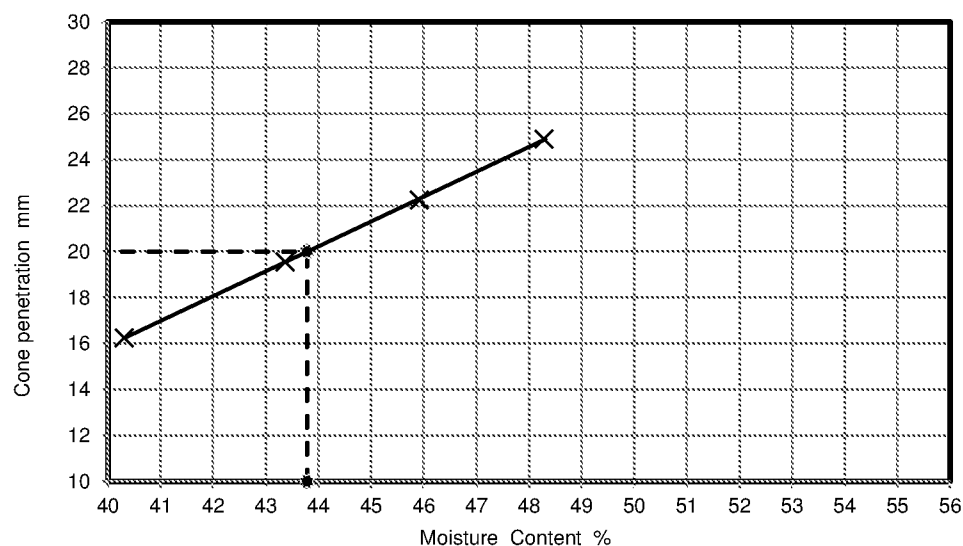
Hole No.	Sample				Soil Description	NMC %	Passing 425µm %	LL %	PL %	PI %	Remarks
	Ref	Top m	Base m	Type							
WS1	-	1.00	1.45	D	Brown slightly mottled dark grey slightly gravelly sandy silty CLAY (gravel is fm and sub-angular to angular)	47	96	44	23	21	
WS2	-	1.00	-	D	Orangish brown slightly mottled grey and dark grey slightly gravelly slightly sandy silty CLAY (gravel is fm and sub-angular to angular)	26	95	38	18	20	
WS3	-	4.00	-	D	Reddish brown slightly mottled grey silty CLAY	27	100	67	23	44	
WS3	-	5.50	-	D	Reddish brown slightly mottled grey and orangish brown silty CLAY with rare fine gravel	26	99	61	19	42	
WS4	-	1.00	-	D	Light orangish brown slightly mottled grey slightly gravelly slightly fine sandy silty CLAY with traces of fine rootlets (gravel is fm and sub-angular to angular)	29	90	34	17	17	
WS4	-	2.50	-	D	Reddish brown slightly mottled grey and orangish brown slightly gravelly silty CLAY (gravel is fm and sub-angular to angular)	30	97	65	21	44	
WS4	-	5.00	-	D	Orangish brown slightly mottled grey and reddish brown silty CLAY	29	100	68	25	43	

 2519	Test Methods: BS1377: Part 2: 1990: Natural Moisture Content : clause 3.2 Atterberg Limits: clause 4.3, 4.4 and 5.0	Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU	Checked and Approved Initials J.P Date: 04/11/2019
	Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)		MSF-5-R1



LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

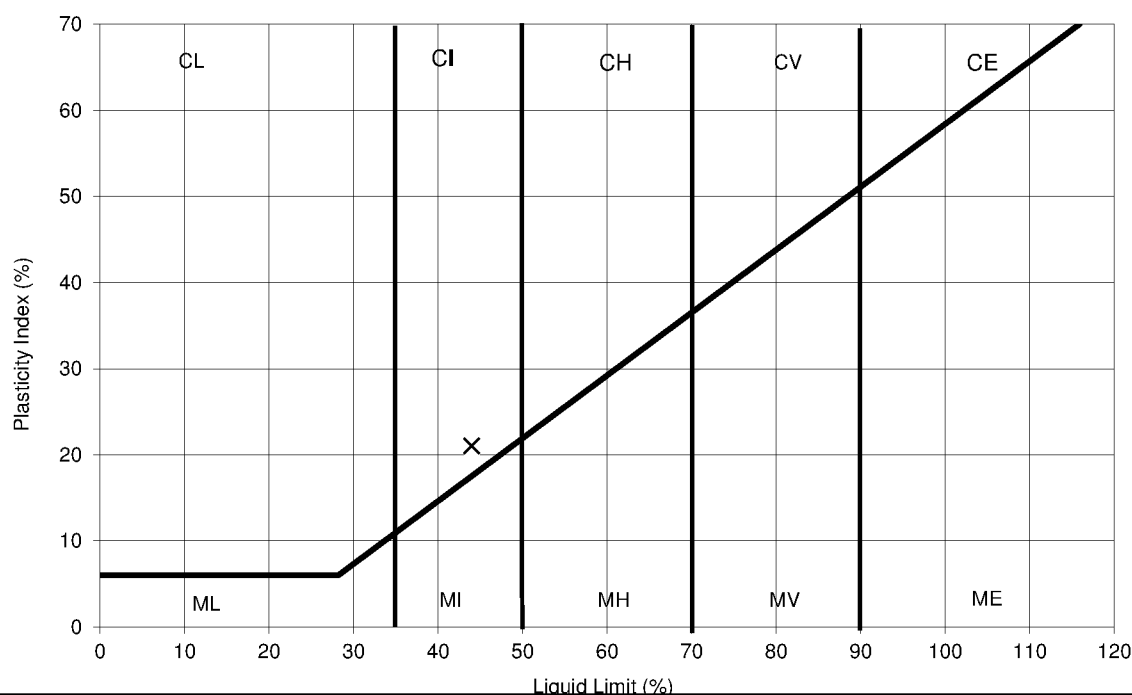
				Job No.	27323
				Borehole/Pit No.	WS1
Site Name	Chichester Road, Bognor			Sample No.	-
Project No.	P19.142	Client	Impact Geotechnical	Depth Top	1.00 m
Soil Description	Brown slightly mottled dark grey slightly gravelly sandy silty CLAY (gravel is fm and sub-angular to angular)			Depth Base	1.45 m
				Sample Type	D
				Samples received	21/10/2019
				Schedules received	17/10/2019
				Project Started	22/10/2019
				Date Tested	01/11/2019



NATURAL MOISTURE CONTENT	47	%
% PASSING 425µm SIEVE	96	%
LIQUID LIMIT	44	%
PLASTIC LIMIT	23	%
PLASTICITY INDEX	21	%

Remarks

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method

BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index

BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method

Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU

Checked and Approved

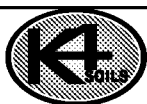
Initials: J.P

Date: 04/11/2019

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

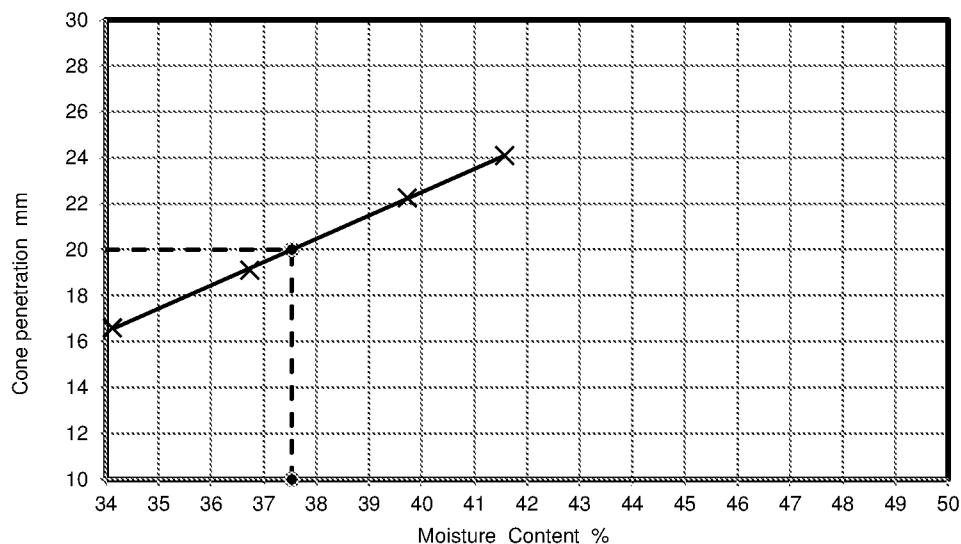
MSF-5 R2

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LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

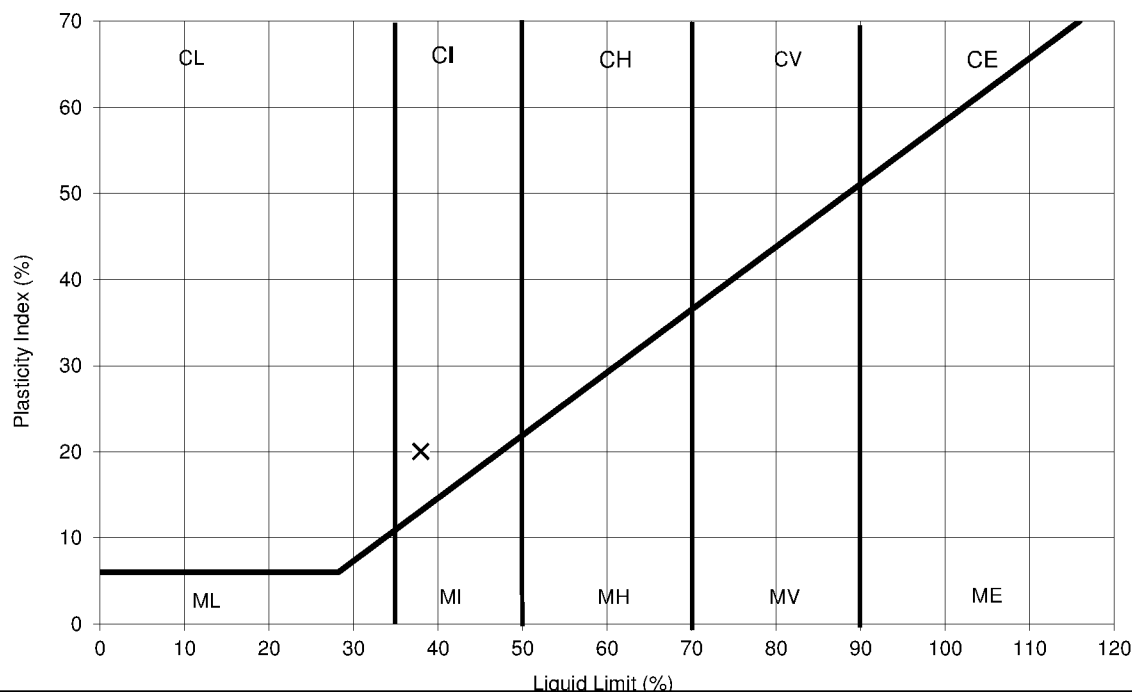
	LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX			Job No.	27323	
				Borehole/Pit No.	WS2	
Site Name	Chichester Road, Bognor			Sample No.	-	
Project No.	P19.142	Client	Impact Geotechnical	Depth Top	1.00	m
Soil Description	Orangish brown slightly mottled grey and dark grey slightly gravelly slightly sandy silty CLAY (gravel is fm and sub-angular to angular)			Depth Base	-	m
				Sample Type	D	
				Samples received	21/10/2019	
				Schedules received	17/10/2019	
				Project Started	22/10/2019	
				Date Tested	01/11/2019	



NATURAL MOISTURE CONTENT	26	%
% PASSING 425µm SIEVE	95	%
LIQUID LIMIT	38	%
PLASTIC LIMIT	18	%
PLASTICITY INDEX	20	%

Remarks

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method
 BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index
 BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method
 Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU

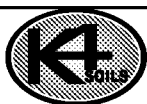
Checked and Approved

Initials: J.P
 Date: 04/11/2019

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

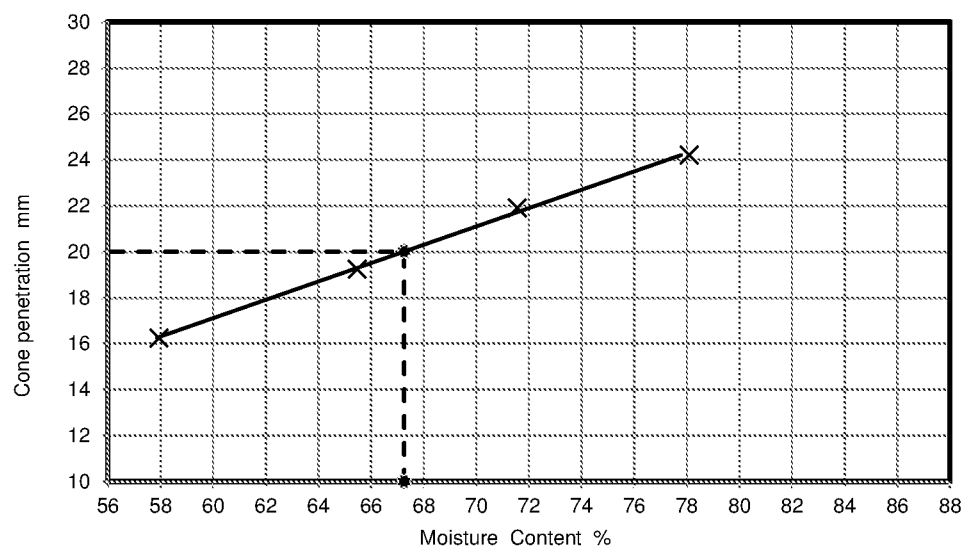
MSF-5 R2

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LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

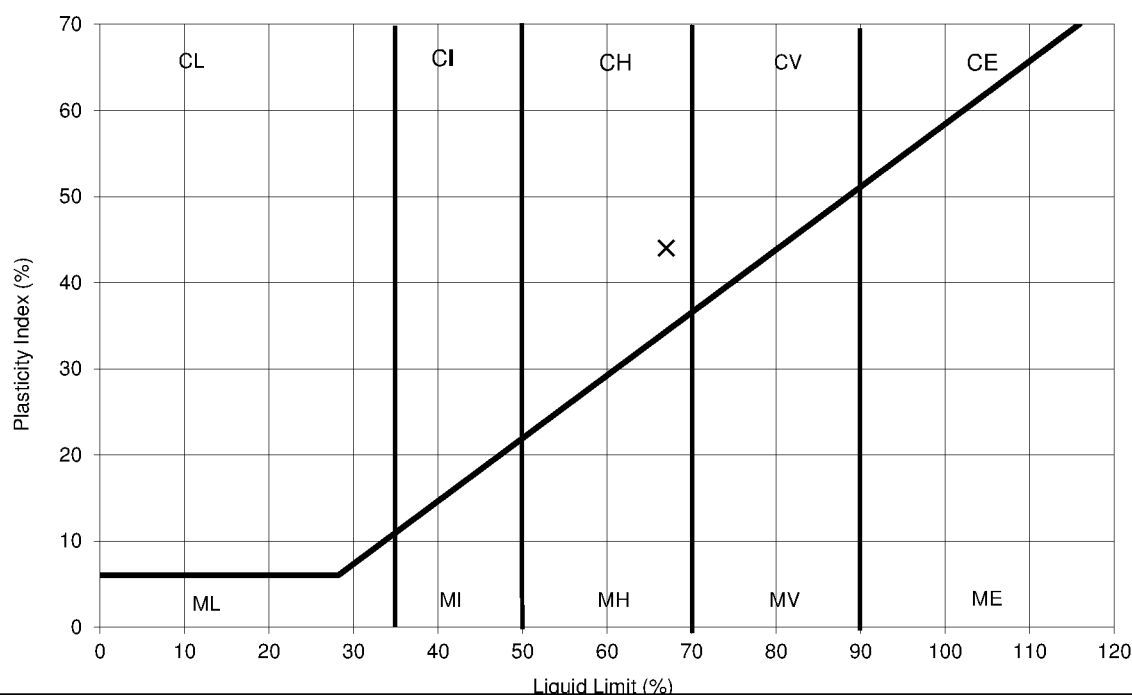
Job No.	27323		
Borehole/Pit No.	WS3		
Sample No.	-		
Depth Top	4.00	m	
Depth Base	-	m	
Sample Type	D		
Samples received	21/10/2019		
Schedules received	17/10/2019		
Project Started	22/10/2019		
Date Tested	01/11/2019		
Site Name	Chichester Road, Bognor		
Project No.	P19.142	Client	Impact Geotechnical
Soil Description	Reddish brown slightly mottled grey silty CLAY		



NATURAL MOISTURE CONTENT	27	%
% PASSING 425µm SIEVE	100	%
LIQUID LIMIT	67	%
PLASTIC LIMIT	23	%
PLASTICITY INDEX	44	%

Remarks

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method

BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index

BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method

Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU

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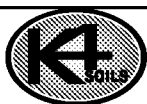
Initials: J.P

Date: 04/11/2019

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

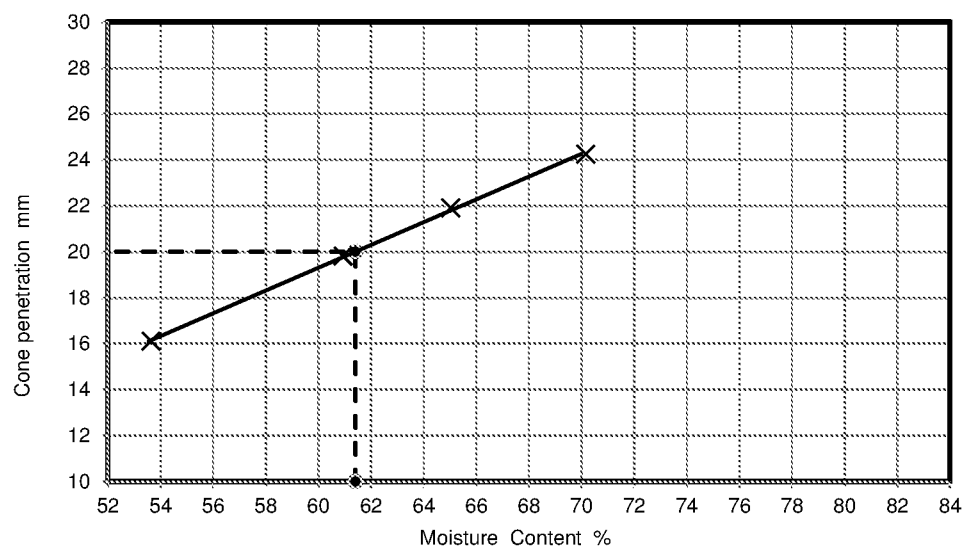
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LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

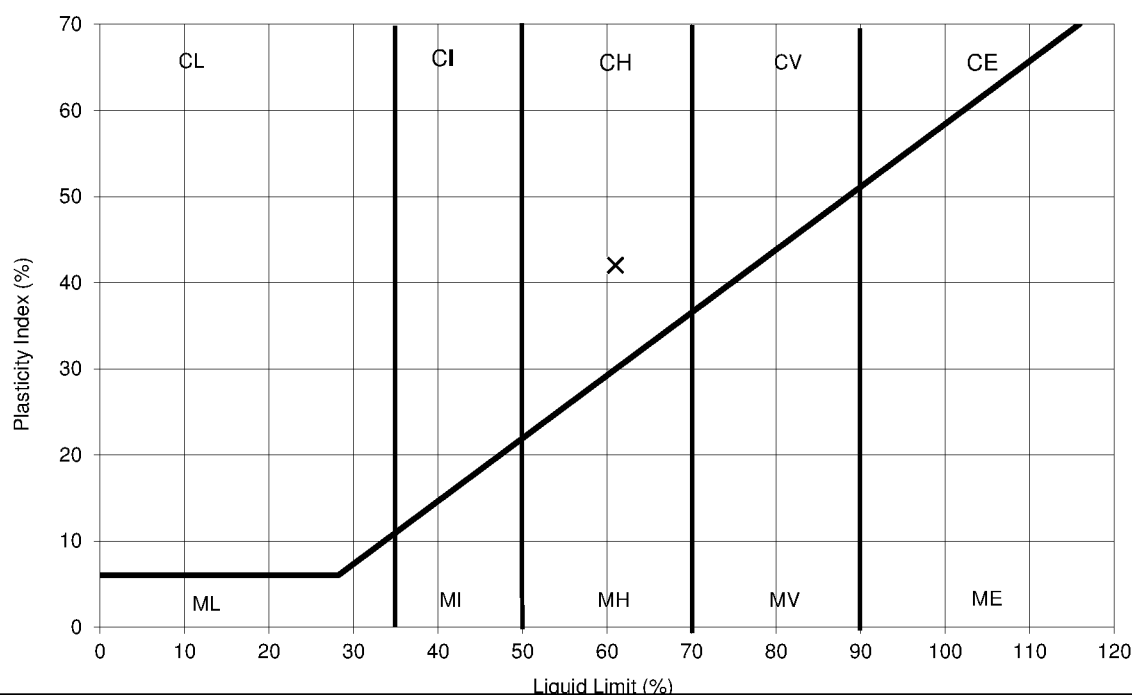
Site Name	Chichester Road, Bognor			Job No.	27323
Project No.	P19.142	Client	Impact Geotechnical	Borehole/Pit No.	WS3
Soil Description	Reddish brown slightly mottled grey and orangish brown silty CLAY with rare fine gravel			Sample No.	-
				Depth Top	5.50 m
				Depth Base	- m
				Sample Type	D
				Samples received	21/10/2019
				Schedules received	17/10/2019
				Project Started	22/10/2019
				Date Tested	01/11/2019



NATURAL MOISTURE CONTENT	26	%
% PASSING 425µm SIEVE	99	%
LIQUID LIMIT	61	%
PLASTIC LIMIT	19	%
PLASTICITY INDEX	42	%

Remarks

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method

BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index

BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method

Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU

Checked and Approved

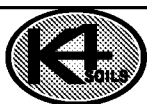
Initials: J.P

Date: 04/11/2019

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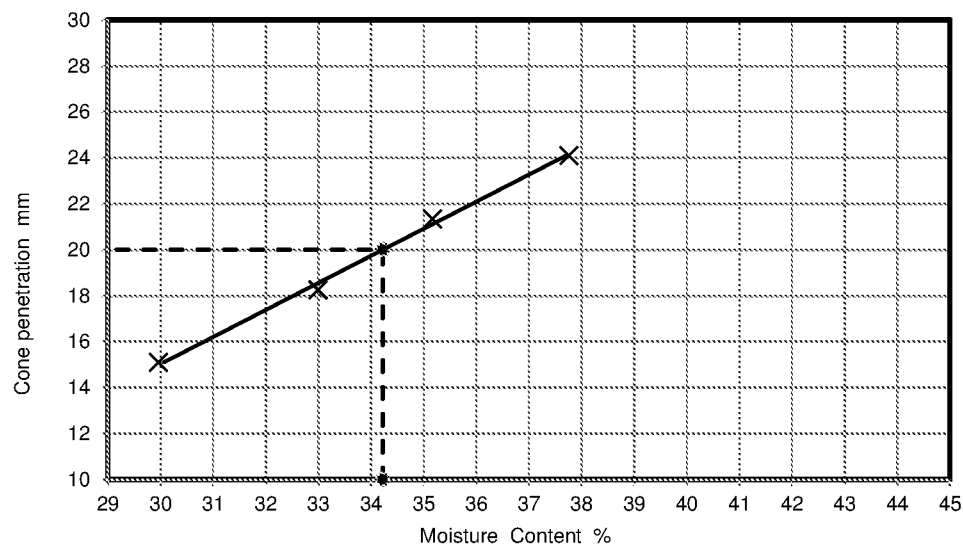
Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

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LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

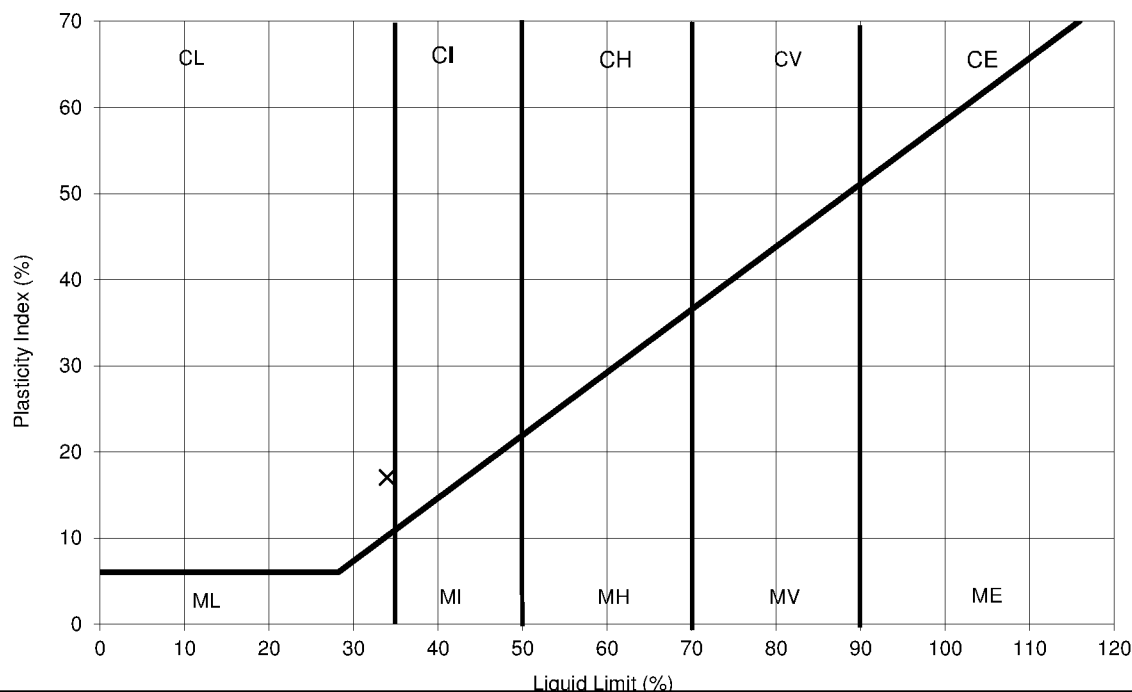
Site Name	Chichester Road, Bognor			Job No.	27323
Project No.	P19.142	Client	Impact Geotechnical	Borehole/Pit No.	WS4
Soil Description	Light orangish brown slightly mottled grey slightly gravelly slightly fine sandy silty CLAY with traces of fine rootlets (gravel is fm and sub-angular to angular)			Sample No.	-
				Depth Top	1.00 m
				Depth Base	- m
				Sample Type	D
				Samples received	21/10/2019
				Schedules received	17/10/2019
				Project Started	22/10/2019
				Date Tested	01/11/2019



NATURAL MOISTURE CONTENT	29	%
% PASSING 425µm SIEVE	90	%
LIQUID LIMIT	34	%
PLASTIC LIMIT	17	%
PLASTICITY INDEX	17	%

Remarks

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method
BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index
BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method
Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU

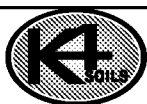
Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

Checked and Approved

Initials: J.P
Date: 04/11/2019

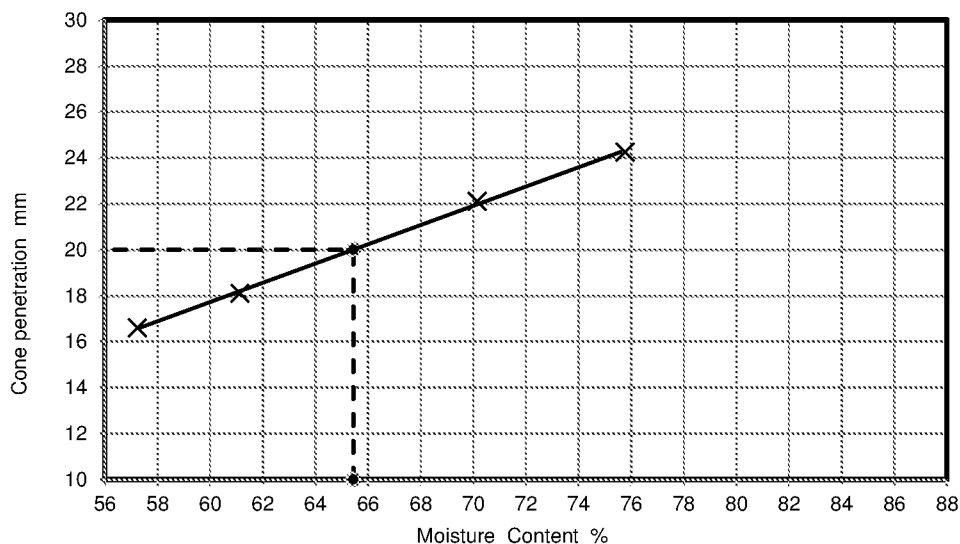
MSF-5 R2

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LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

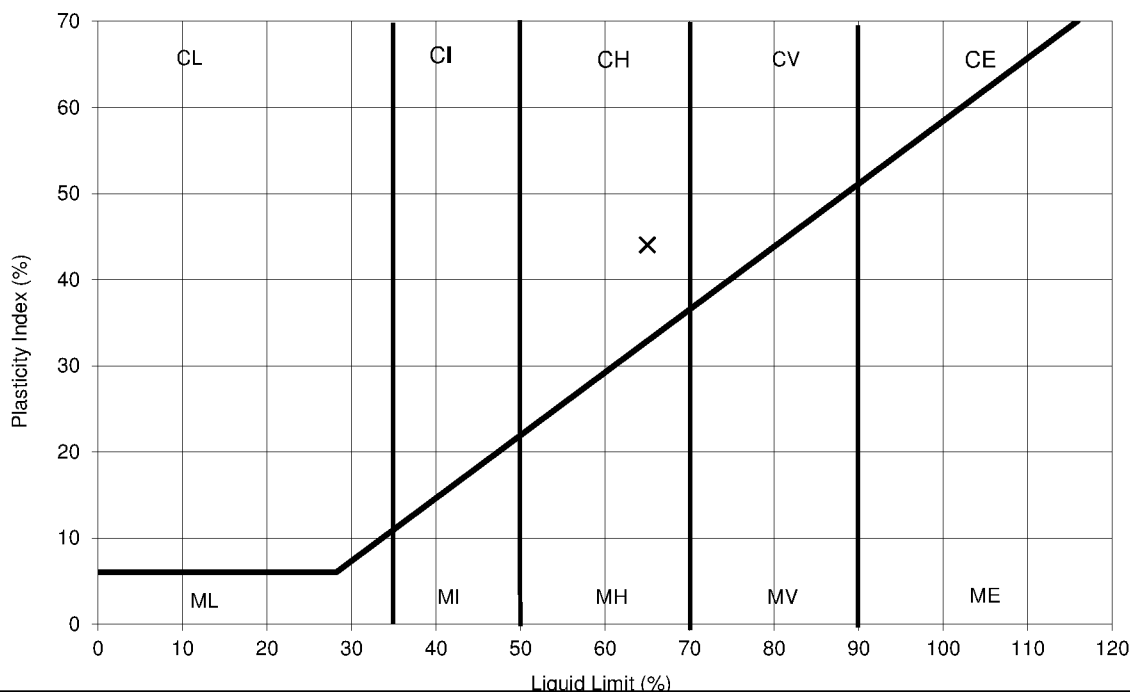
	LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX			Job No.	27323	
				Borehole/Pit No.	WS4	
Site Name	Chichester Road, Bognor			Sample No.	-	
Project No.	P19.142	Client	Impact Geotechnical	Depth Top	2.50	m
Soil Description	Reddish brown slightly mottled grey and orangish brown slightly gravelly silty CLAY (gravel is fm and sub-angular to angular)			Depth Base	-	m
				Sample Type	D	
				Samples received	21/10/2019	
				Schedules received	17/10/2019	
				Project Started	22/10/2019	
				Date Tested	01/11/2019	



NATURAL MOISTURE CONTENT	30	%
% PASSING 425µm SIEVE	97	%
LIQUID LIMIT	65	%
PLASTIC LIMIT	21	%
PLASTICITY INDEX	44	%

Remarks

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method

BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index

BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method

Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU

Checked and Approved

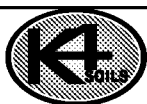
Initials: J.P

Date: 04/11/2019

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

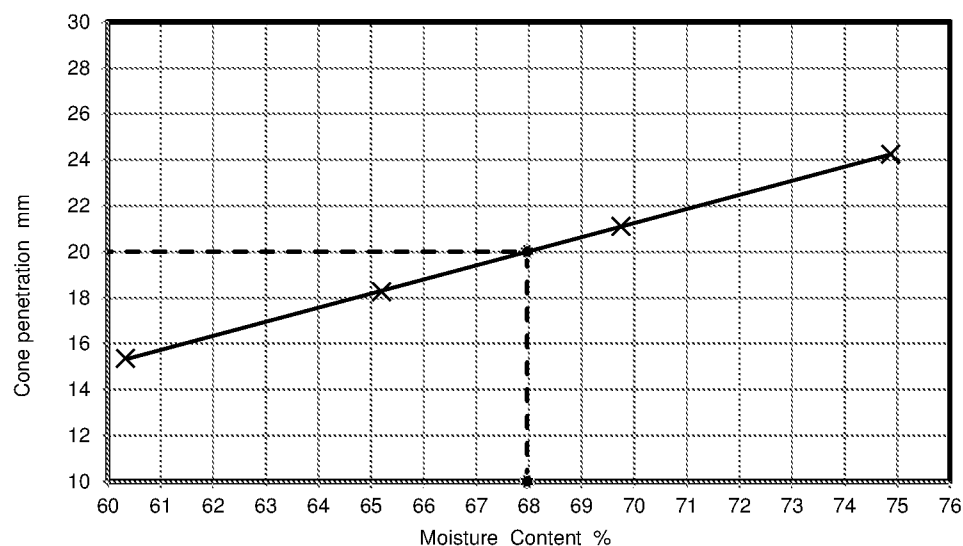
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2519



LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

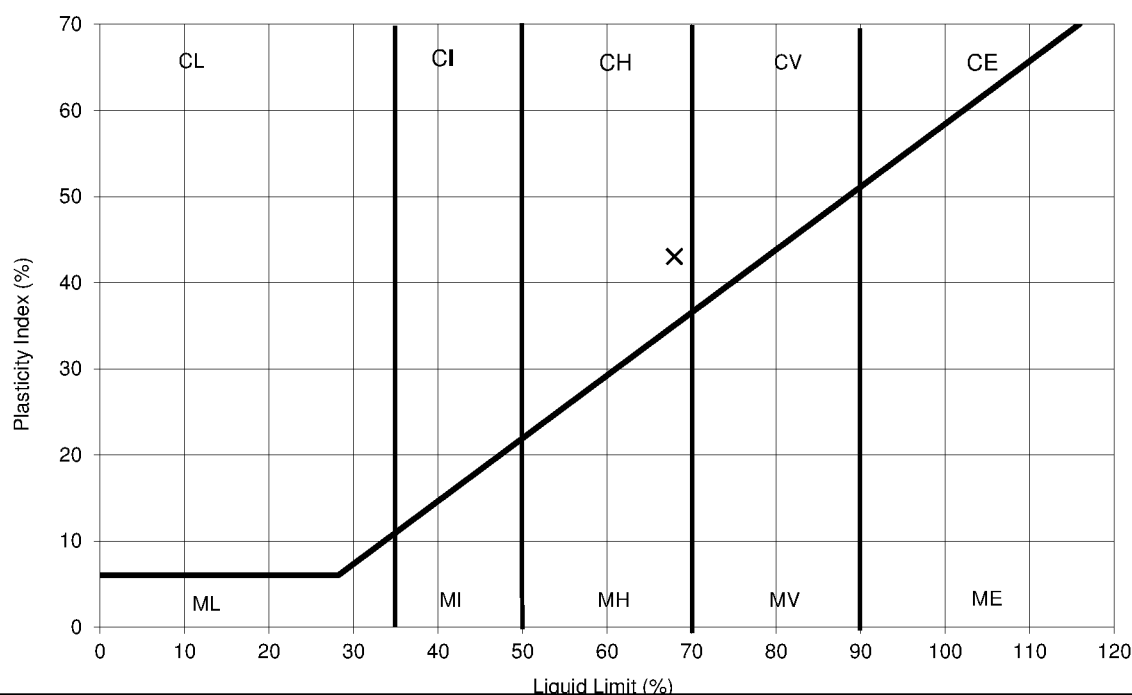
				Job No.	27323
				Borehole/Pit No.	WS4
Site Name	Chichester Road, Bognor			Sample No.	-
Project No.	P19.142	Client	Impact Geotechnical	Depth Top	5.00 m
Soil Description	Orangish brown slightly mottled grey and reddish brown silty CLAY			Depth Base	- m
				Sample Type	D
				Samples received	21/10/2019
				Schedules received	17/10/2019
				Project Started	22/10/2019
				Date Tested	01/11/2019



NATURAL MOISTURE CONTENT	29	%
% PASSING 425µm SIEVE	100	%
LIQUID LIMIT	68	%
PLASTIC LIMIT	25	%
PLASTICITY INDEX	43	%

Remarks

PLASTICITY INDEX



TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method

BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index

BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying method

Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU

Checked and Approved

Initials: J.P

Date: 04/11/2019



Graham Carter
Impact Geotechnical Ltd
26 Anmore Road
Denmead
Hants
PO7 6NP

DETS Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN

DETS Report No: 19-14852

Site Reference: Chichester Road, Bognor

Project / Job Ref: P19.142

Order No: P19.142

Sample Receipt Date: 18/10/2019

Sample Scheduled Date: 18/10/2019

Report Issue Number: 1

Reporting Date: 29/10/2019

Authorised by:



Technical Manager

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Soil Analysis Certificate						
DETS Report No: 19-14852	Date Sampled	16/10/19	16/10/19	16/10/19	16/10/19	16/10/19
Impact Geotechnical Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Chichester Road, Bognor	TP / BH No	WS1	WS1	WS2	WS2	WS2
Project / Job Ref: P19.142	Additional Refs	ES	D	ES	D	D
Order No: P19.142	Depth (m)	0.50	1.00 - 1.45	0.30	1.00 - 1.45	2.00 - 2.45
Reporting Date: 29/10/2019	DETS Sample No	442201	442202	442204	442205	442206

Determinand	Unit	RL	Accreditation					
Asbestos Screen ^(S)	N/a	N/a	ISO 17025	Not Detected		Not Detected		
pH	pH Units	N/a	MCERTS	7.1	7.7	7.7	8.1	8.4
Total Cyanide	mg/kg	< 2	NONE	< 2		< 2		
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	53	29	23	11	< 10
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.05	0.03	0.02	0.01	< 0.01
Organic Matter	%	< 0.1	MCERTS	4.2		4		
Arsenic (As)	mg/kg	< 2	MCERTS	11		13		
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.3		0.8		
Chromium (Cr)	mg/kg	< 2	MCERTS	21		24		
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2		< 2		
Copper (Cu)	mg/kg	< 4	MCERTS	18		76		
Lead (Pb)	mg/kg	< 3	MCERTS	101		1200		
Mercury (Hg)	mg/kg	< 1	NONE	< 1		< 1		
Nickel (Ni)	mg/kg	< 3	MCERTS	14		20		
Selenium (Se)	mg/kg	< 3	NONE	< 3		< 3		
Zinc (Zn)	mg/kg	< 3	MCERTS	117		563		
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2		< 2		

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Subcontracted analysis (S)



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Soil Analysis Certificate						
DETS Report No: 19-14852	Date Sampled	16/10/19	16/10/19	16/10/19	16/10/19	16/10/19
Impact Geotechnical Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Chichester Road, Bognor	TP / BH No	WS2	WS3	WS3	WS3	WS3
Project / Job Ref: P19.142	Additional Refs	D	ES	D	D	D
Order No: P19.142	Depth (m)	3.00 - 3.45	0.20	3.00 - 3.45	5.00 - 5.45	6.00 - 6.45
Reporting Date: 29/10/2019	DETS Sample No	442207	442208	442210	442211	442212

Determinand	Unit	RL	Accreditation					
Asbestos Screen ^(S)	N/a	N/a	ISO 17025	Not Detected				
pH	pH Units	N/a	MCERTS	8.4	8.0	8.5	8.3	8.3
Total Cyanide	mg/kg	< 2	NONE		< 2			
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	19	67	20	< 10	< 10
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.02	0.07	0.02	< 0.01	< 0.01
Organic Matter	%	< 0.1	MCERTS		5			
Arsenic (As)	mg/kg	< 2	MCERTS		10			
Cadmium (Cd)	mg/kg	< 0.2	MCERTS		1			
Chromium (Cr)	mg/kg	< 2	MCERTS		26			
Chromium (hexavalent)	mg/kg	< 2	NONE		< 2			
Copper (Cu)	mg/kg	< 4	MCERTS		629			
Lead (Pb)	mg/kg	< 3	MCERTS		822			
Mercury (Hg)	mg/kg	< 1	NONE		< 1			
Nickel (Ni)	mg/kg	< 3	MCERTS		11			
Selenium (Se)	mg/kg	< 3	NONE		< 3			
Zinc (Zn)	mg/kg	< 3	MCERTS		602			
Total Phenols (monohydric)	mg/kg	< 2	NONE		< 2			

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Subcontracted analysis (S)



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Soil Analysis Certificate						
DETS Report No: 19-14852	Date Sampled	16/10/19	16/10/19	16/10/19		
Impact Geotechnical Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Chichester Road, Bognor	TP / BH No	WS4	WS4	WS4		
Project / Job Ref: P19.142	Additional Refs	ES	D	D		
Order No: P19.142	Depth (m)	0.40	1.00 - 1.45	5.00 - 5.45		
Reporting Date: 29/10/2019	DETS Sample No	442213	442214	442216		

Determinand	Unit	RL	Accreditation				
Asbestos Screen ^(S)	N/a	N/a	ISO 17025				
pH	pH Units	N/a	MCERTS	7.6	8.2	9.3	
Total Cyanide	mg/kg	< 2	NONE	< 2			
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	< 10	< 10	< 10	
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	< 0.01	< 0.01	< 0.01	
Organic Matter	%	< 0.1	MCERTS	1			
Arsenic (As)	mg/kg	< 2	MCERTS	7			
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2			
Chromium (Cr)	mg/kg	< 2	MCERTS	21			
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2			
Copper (Cu)	mg/kg	< 4	MCERTS	11			
Lead (Pb)	mg/kg	< 3	MCERTS	22			
Mercury (Hg)	mg/kg	< 1	NONE	< 1			
Nickel (Ni)	mg/kg	< 3	MCERTS	12			
Selenium (Se)	mg/kg	< 3	NONE	< 3			
Zinc (Zn)	mg/kg	< 3	MCERTS	50			
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2			

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Subcontracted analysis (S)



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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 19-14852	Date Sampled	16/10/19	16/10/19	16/10/19	16/10/19	
Impact Geotechnical Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Chichester Road, Bognor	TP / BH No	WS1	WS2	WS3	WS4	
Project / Job Ref: P19.142	Additional Refs	ES	ES	ES	ES	
Order No: P19.142	Depth (m)	0.50	0.30	0.20	0.40	
Reporting Date: 29/10/2019	DETS Sample No	442201	442204	442208	442213	

Determinand	Unit	RL	Accreditation				
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.17	0.33
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.21	0.35
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.67	0.62
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.47	0.74
Phenanthrene	mg/kg	< 0.1	MCERTS	0.26	1.54	7.11	5.83
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	0.16	2.11	1.71
Fluoranthene	mg/kg	< 0.1	MCERTS	1.15	2.69	19.30	11.70
Pyrene	mg/kg	< 0.1	MCERTS	1.04	2.28	15.40	10.40
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.69	1.27	10.70	6.29
Chrysene	mg/kg	< 0.1	MCERTS	0.49	1.26	9.44	5.13
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.81	1.57	13.20	8.15
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	0.26	0.50	4.02	2.40
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.62	1.09	9.03	6.74
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.71	1.06	6.82	4.63
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	0.12	1.38	0.77
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.59	0.92	5.48	3.91
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	6.6	14.5	105	69.7

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



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Soil Analysis Certificate - EPH Texas Banded						
DETS Report No: 19-14852	Date Sampled	16/10/19				
Impact Geotechnical Ltd	Time Sampled	None Supplied				
Site Reference: Chichester Road, Bognor	TP / BH No	WS4				
Project / Job Ref: P19.142	Additional Refs	ES				
Order No: P19.142	Depth (m)	0.40				
Reporting Date: 29/10/2019	DETS Sample No	442213				

Determinand	Unit	RL	Accreditation				
EPH Texas (>C16 - C21)	mg/kg	< 1	MPCERTS	64			

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



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Soil Analysis Certificate - TPH CWG Banded

DETS Report No: 19-14852	Date Sampled	16/10/19	16/10/19	16/10/19	16/10/19
Impact Geotechnical Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Chichester Road, Bognor	TP / BH No	WS1	WS2	WS3	WS4
Project / Job Ref: P19.142	Additional Refs	ES	ES	ES	ES
Order No: P19.142	Depth (m)	0.50	0.30	0.20	0.40
Reporting Date: 29/10/2019	DETS Sample No	442201	442204	442208	442213

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2	7	4	
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	106	53	
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10	< 10	295	109	
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21	< 21	408	166	
Total >C5 - C35	mg/kg	< 42	NONE	< 42	< 42	408	166	

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 19-14852	Date Sampled	16/10/19	16/10/19	16/10/19	16/10/19	
Impact Geotechnical Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Chichester Road, Bognor	TP / BH No	WS1	WS2	WS3	WS4	
Project / Job Ref: P19.142	Additional Refs	ES	ES	ES	ES	
Order No: P19.142	Depth (m)	0.50	0.30	0.20	0.40	
Reporting Date: 29/10/2019	DETS Sample No	442201	442204	442208	442213	

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Toluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5
Ethylbenzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
p & m-xylene	ug/kg	< 2	MCERTS	7	< 2	< 2	< 2	< 2
o-xylene	ug/kg	< 2	MCERTS	4	< 2	< 2	< 2	< 2
MTBE	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



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Soil Analysis Certificate - Sample Descriptions

DETS Report No: 19-14852

Impact Geotechnical Ltd

Site Reference: Chichester Road, Bognor

Project / Job Ref: P19.142

Order No: P19.142

Reporting Date: 29/10/2019

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
442201	WS1	ES	0.50	30.6	Brown loamy clay
442202	WS1	D	1.00 - 1.45	23	Brown loamy sand
442204	WS2	ES	0.30	17.6	Brown loamy sand with brick
442205	WS2	D	1.00 - 1.45	19	Brown sandy clay
442206	WS2	D	2.00 - 2.45	14.2	Light brown sandy clay
442207	WS2	D	3.00 - 3.45	21.5	Brown loamy clay
442208	WS3	ES	0.20	12.2	Black loamy sand with stones and concrete
442210	WS3	D	3.00 - 3.45	19.8	Brown sandy clay
442211	WS3	D	5.00 - 5.45	16.6	Light brown loamy clay
442212	WS3	D	6.00 - 6.45	15.7	Brown loamy clay
442213	WS4	ES	0.40	17.2	Brown loamy sand with stones
442214	WS4	D	1.00 - 1.45	17.2	Brown sandy clay
442216	WS4	D	5.00 - 5.45	16.1	Blue loamy sand

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample ^{1/5}

Unsuitable Sample ^{u/5}



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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 19-14852

Impact Geotechnical Ltd

Site Reference: Chichester Road, Bognor

Project / Job Ref: P19.142

Order No: P19.142

Reporting Date: 29/10/2019

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received