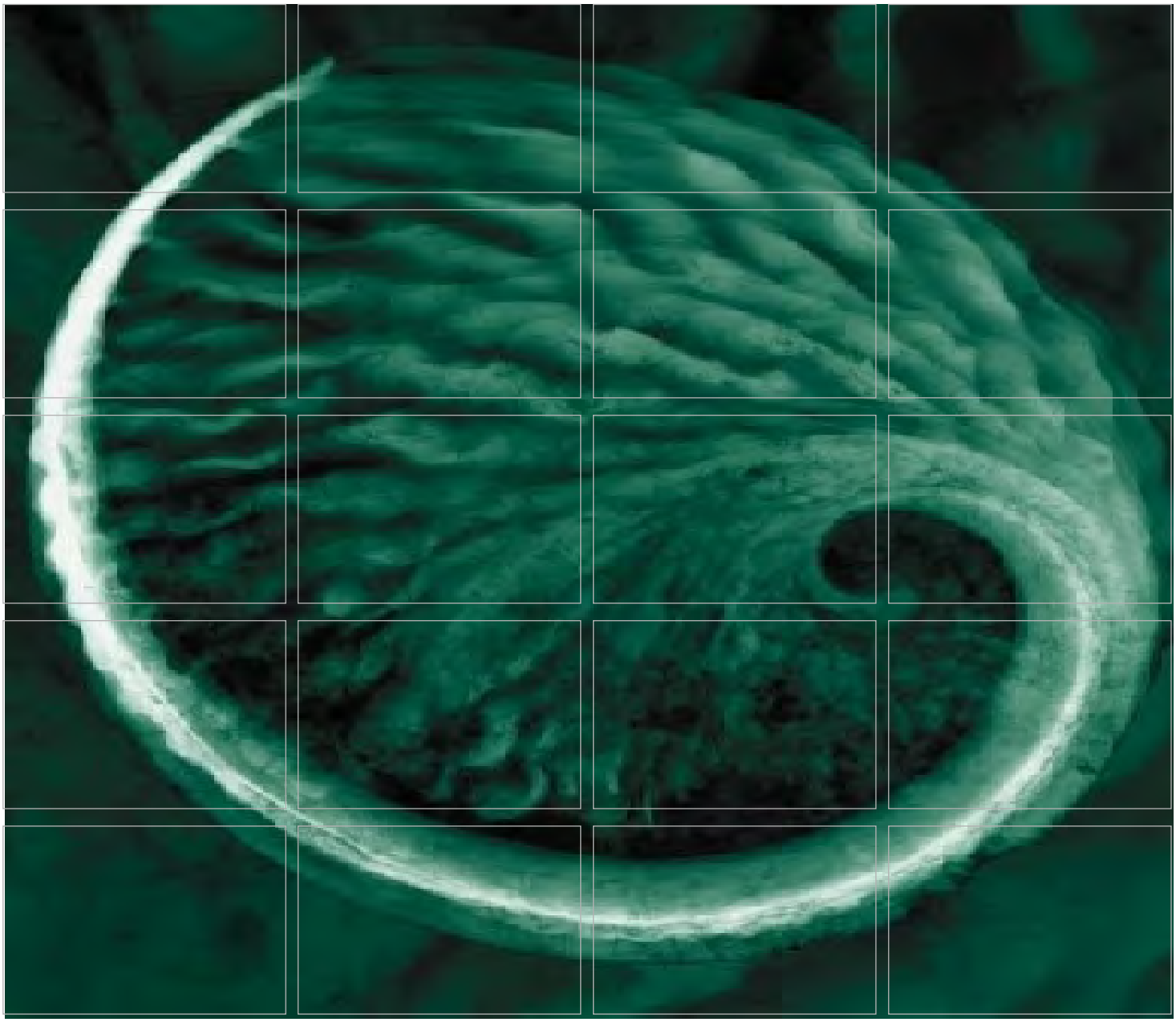

Mineral Resource Assessment for Miskin

Cardiff Plant, Miskin UK

Final Report

September 2010

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ERM

Robert Bosch Ltd

Mineral Resource Assessment for Miskin

September 2010

Reference: 0118282

For and on behalf of
Environmental Resources Management

Approved by: Simon Tillotson

Signed: 

Position: Partner

Date: 7th September 2010

CONTENTS

1 BACKGROUND

Environmental Resources Management Ltd (*ERM*) were commissioned by *Robert Bosch Ltd* (*Bosch*) to undertake a mineral resource assessment on part of their land at the Cardiff Plant, Miskin, UK (hereafter '*the Site*') (see *Figure 1*).

The land in question has recently been identified as part of a potential mineral resource within the *Vale of Glamorgan* UDP for the area, specifically for aggregates composed of Sands and Gravels. The remainder of the area identified in the UDP lies to the west and south of the area in question, outside Bosch ownership and to the far side of both the Cardiff – Swansea railway (which borders the Site) and the River Ely. *Figure 2* indicates the areas identified by the UDP proposal map both within and adjacent to the Bosch ownership.

The Site in question is due south east of the main Bosch production facility and is made up of agricultural land used for grazing purposes. A meandering stream runs through the centre of the area in a north to south direction. To the west of the stream the area is known on-site as the "South Field" and to the east and south of the stream is known as the "Back Field". The "South Field" is relatively flat in elevation around 27.5m AOD to 27m AOD, with the ground falling to the south and east to around 25.2m to 25.5m AOD on the southern and eastern edges of the area in question.

The objective of this assessment was to:

- investigate the background to the classification of this land through a desk-based review of documents pertaining to the policies behind the classification and of previous geological/mineral assessments of the area; and

- establish, through intrusive works, the extent to which the mineral resource exists.

The remainder of this report is arranged as follows:

- *Section 2*: Document Review;
- *Section* 3: Site Investigation Findings;
- *Section 4*: Conclusions.

Annexes to the report are as follows:

- *Annex A*: BGS borehole logs
- *Annex B*: ERM borehole logs; and
- *Annex C*: Laboratory certificates

2 DOCUMENT REVIEW

2.1 DOCUMENTATION REVIEWED

A desk review of the following documents was undertaken to identify the planning policies behind the land classification:

- The National Assembly of Wales. 2000. Mineral Planning Policy Wales;
- Welsh Assembly Government. 2004. Minerals Planning Policy Wales. Minerals Technical Advice Note (MTAN) Wales 1: Aggregates;
- Welsh Assembly Government. Sands and Gravel Supply For South East Wales – Position Statement; and
- Vale of Glamorgan. Adopted Unitary Development Plan 1996 – 2011. Chapter 9: Minerals.

In addition, a review of geology and mineral resource assessments was undertaken to establish the extent of the potential mineral resources in the local area. Documentation accessed was as follows:

- British Geological Survey, England and Wales Sheet 262, Bridgend, Solid and Drift Edition, Scale 1:50,000;
- Strahan, A. and Cantrill, T.C. 1904. The Geology of the South Wales Coal-Field, Part VI. The Country around Bridgend. Memoirs of the Geological Survey.
- Welsh Assembly Government. 2000. South Wales Sand and Gravel: Appraisal of Land-Based Extraction in South-East Wales (Symonds Group
- Thompson, A., Knapman, D. and Pethick, J. 2002. Comparative Impact Assessment of Land and Marine Sand & Gravel. Welsh Assembly Government (Symonds Group Ltd).
- British Geological Survey Logs. 1967 – 1976. 'ST07NE/163', 'ST07NE/166', 'ST07NE177', 'ST07NE181' and 'ST07NE184' (within the designated resource area) and 'ST07NE162', 'ST07NE171', ST07NE173', 'ST07NE174', 'ST07NE187' and 'ST07NE189' (outside the resource area).

2.2 MINERAL POLICY DOCUMENT REVIEW

2.2.1 *National and Regional Mineral Policy – Welsh National Assembly*

Mineral policy and planning is defined at a national, regional and local level. The national policy is detailed within *Minerals Planning Policy Wales* (December 2000), which sets out the land use policy guidance in relation to extraction of minerals and related development. In particular, it states the requirement to safeguard potential land-based resources of sands and gravels in South East Wales. The key principles of the policy are as follows:

- *Provide mineral resources to meet society's needs and to safeguard those resources;*
- *Protect areas of importance in regards to natural or built heritage;*
- *Limit the environmental impact of mineral extraction;*
- *Achieve high standard restoration and beneficial after-use; and*
- *Encourage efficient and appropriate use of minerals and re-use/recycling of suitable materials.*

Under *Section 14* of *Mineral Planning Policy Wales* (2000), it is suggested that policies and proposals regarding future workings of non-energy minerals should be made clear in the local unitary development plan where extraction of minerals should or most likely would take place.

Further to the *Mineral Planning Policy Wales* (2000) document, the Welsh Assembly issued a *Minerals Technical Advice Note* (2004) (*MTAN1: Aggregates*), which further emphasised the need to safeguard land-based resources as well as providing policy advice to local authorities, including *Vale of Glamorgan*. The technical note states that '*the use of marine dredged sand and gravel would probably continue for the foreseeable future but only where this remains consistent with the principles of sustainable development*'. The note states '*that (although) land based extraction is not considered appropriate at the present time; those resources must be safeguarded for potential use by future generations in development plans now in view of their relatively limited regional availability*'.

The *MTAN1: Aggregates* also proposed a buffer zone of 100 metres around permitted and allocated sand and gravel mineral extraction sites. The buffer zone was established to protect land uses that are most sensitive to the impact of mineral operations, including any building occupied by people on a regular basis.

2.2.2 Local Mineral Policy – Vale of Glamorgan

The *Vale of Glamorgan* sets out the local mineral policy and planning within Chapter 9 of their Unitary Development Plan (UDP), which was formally adopted in April 2005, covering a time period from 1996 to 2011. The Council is currently working on the preparation of a Local Development Plan (LDP) to cover 2011 to 2026. The objectives of the mineral policies are as follows:

- *To ensure that the needs of society for minerals are satisfied with due regard to the protection of the environment;*
- *To encourage the best and most efficient use of all available resources and to encourage recycling and the use of secondary materials where appropriate;*
- *To ensure that any environmental damage or loss of amenity caused by mineral operations is kept to an acceptable level;*
- *To ensure that land taken for mineral operations is reclaimed at the earliest opportunity and is capable of an acceptable use after working has come to an end; and*
- *To prevent the unnecessary sterilisation of mineral resources.*

As stated in '*Policy Mineral 1 – Mineral Exploration*', explorations will be permitted unless there is unacceptable impact to landscape character, visual amenity, nature conservation, residential amenity, the Glamorgan heritage coast, surface water and groundwater resources and/or scheduled ancient monuments and historic landscapes.

Within '*Policy Mineral 3 – Protection of further limestone resources and potential resources of sand and gravel*', 12 areas have been highlighted as potential sand and gravel resources. Within the Ely Valley, six areas, including land currently owned by Bosch, have been identified (see *Figure 3*). The policy states that these areas '*shall be protected from all forms of permanent building development in order that the workable resources may be preserved*'.

Calculations of the total area of potential resources within Vale of Glamorgan were not provided in the UDP, though ERM have calculated that the designated area on Bosch land accounts for 2.7% of the total area provisionally allocated. In regards to the Ely Valley portion of this area; potential resources designated on Bosch land accounts for approximately 7% of the total area (see *Figure 3*).

It should also be noted that potential sand and gravel resource identified on Bosch land is one of two areas to the east of the River Ely Valley, with the other four areas on the western side. As such, although not at a significant distance from the other designated areas, the Bosch area is a small isolated portion of the overall area.

The policy and planning decisions behind the 12 designated resource areas, included in the Vale of Glamorgan UDP, are based on the findings of a Sand and Gravel appraisal report for the Welsh Assembly in 2000 (see *Section 2.4*).

2.3 GEOLOGY DOCUMENT REVIEW

Local mineral policy and planning, in regards to the designation of sand and gravel resources, are likely to be influenced by the interpretation of geological and geomorphological information of the area. Targeted areas would focus on superficial or 'drift' deposits resulting from past glacial, fluvio-glacial and alluvial processes. Depositional features, which could potentially yield high volumes of 'clean' sands and gravels include glacial moraines, alluvial fans and former river terraces.

The British Geological Survey Map (England and Wales Sheet 262, Bridgend, Solid and Drift Edition, Scale 1:50,000, 1989) indicates that there are no artificial deposits or 'Made Ground' underlying the site. However, site management reported slag material of up to two metre thick had been imported historically during original site development works in the late 1980s. This material had originated from Newport steelworks and was, it is understood, imported to aid the preparation of a stable development footprint for building foundations. This included deposition of slag materials across the "South field".

With regards to drift deposits, the published map shows alluvium within the River Ely valley. There are no specific obvious features that explain the extent or configuration of the resource area allocations. Indeed the alluvium area is shown to underlie much of the Bosch ownership area. Additionally, the most northerly of the designated areas is shown to be glacial till on the published map, as are parts of the area within Bosch ownership.

The underlying bedrock of the area is the Llanishen Conglomerate (a member of the Lower Old Red Sandstone), which comprises of interbedded sandstone. No fault lines were identified in the area of study.

Geological memoirs of the local area (Strahan and Cantrill, 1904) suggest that in general, sand and gravel deposits across the area range between 2m to 3m thick. This is confirmed by a small mining shaft/pit near Llanharry, approximately 5km north west of the Site. The exception, as noted in the memoir, is a substantial layer of sands and gravels near Pontyclun, approximately 3km north west of the Site, of up to 19.5m thickness. The origins of the gravels are termed 'doubtful' and considered to be a mixture of glacial deposits and alluvium.

In addition to these references, 11 borehole logs were obtained from the British Geological Society (BGS) 'Georecords' online system, which were recorded as been advanced between 1967 and 1976, within the area currently allocated by the draft Plan within the Bosch property area. The location of these boreholes is shown on *Figure 2* and the logs are reproduced in *Annex A*. These boreholes were part of a larger number (28 in total) that were advanced in an area between the current southern edge of the production facility and the current location of the sewage works to the south east. The presence of geotechnical testing data on the logs could suggest that these boreholes were part of exploratory geotechnical works associated with the sewage works, pre-construction.

Five BGS boreholes were obtained from within the designated resource area on Bosch land. To the south and east of the stream, the borehole records suggest thin layers of sands and gravels between 1.3m and 2.4m thick. The sand and gravel deposits were recorded as been underlain by sandy silt and then a very sandy clay. To the north and west, in the 'South field' the borehole logs record sandy silty gravel between 0.79m and 2.1m thick, underlain by extensive layers of silty sand and/or sandy clay with boulders. Based on these logs there is no evidence of sand and gravel deposits greater than 2.4m thick.

To establish the nature and extent of sand and gravel on Bosch land beyond the resource area, six additional borehole logs were obtained from the BGS, within 50 metres of the designated boundary. The thickest sand and gravel units (3.0 – 3.35 metres) were recorded south west of the resource area, nearer the Ely River. In other boreholes to the north, south and east of the resource area, a general thinning out of sand and gravel away from the Ely River is evident, with no sand and gravel recorded in the most eastern borehole log

(ST07NE171) (See *Figure 2* for borehole locations and *Annex A* for borehole logs). Moreover, when comparing sand and gravel thickness between the resource area and adjacent Bosch land, there would seem to be no discernable difference in the underlying drift deposits and therefore no evidence of a definitive sand and gravel resource.

2.4 MINERAL RESOURCE DOCUMENT REVIEW

ERM reviewed a study conducted for *National Assembly for Wales* in 2000 which assessed potential land-based resources of sand and gravel in South East Wales entitled '*South Wales Sand and Gravel: Appraisal of Land-Based Extraction in South East Wales, National Assembly for Wales'*. The report used geomorphological mapping and reviewed existing borehole data to identify a series of potential resources, including the Ely Valley region of Vale of Glamorgan. The report suggested that for a single deposit to be deemed economically viable, the following characteristics need to apply:

- *'Mineral' should be defined as relatively 'clean' sand and gravel, containing less than 15% silt and clay;*
- *the average thickness of mineral should be no less than one metre;*
- *the maximum ratio of overburden to mineral should be no more than 1.5 to 1; and*
- *the minimum quantity of extractable mineral should be approximately 0.5 million tonnes.*

To calculate the potential tonnage of mineral and overburden within an individual resource, the report used a figure of 1.6 tonnes per cubic metre as the in-situ bulk density (as a minimum estimate).

The report identifies six individual sand and gravel resources within the Ely Valley region of Vale of Glamorgan, including the area on Bosch-owned land, covered in this study. It is therefore, assumed that the designated resource areas, as outlined in the Vale of Glamorgan UDP, are based on the geomorphological interpretations of the Welsh Assembly report. Moreover, within the conclusions of the report, the following statement is made:

"*It is emphasised, however, that more detailed investigation and testing of individual resources is needed before these (potential resources) can be relied upon as an alternative to the existing supply regime*".

A follow on study conducted in 2002 entitled '*Comparative Impact Assessment of Land and Marine Sand & Gravel, Welsh Assembly Government*' was reviewed and reference to the 2000 findings were reported within. In summary, the report concludes that within the context of sustainability, marine-dredged resources of sand and gravel (which currently supply all sand and gravel resources for South East Wales) should be phased out over a period of time, with a future emphasis on areas further offshore. The report also suggested that future land-based sand and gravel resources (including those within *Vale of Glamorgan*) should also be considered.

The mineral resource document estimates that the total quantity of potential land-based sand and gravel resource in South East Wales is 393 million tonnes, including those areas affected by known environmental or planning constraints. This estimate is further referenced in the Monmouth UDP Mineral Policy section (Chapter 15), where an estimated 40% of sand and gravel resources (approximately 157 million tonnes) is based. For this report, ERM were unable to attain an estimate for the Vale of Glamorgan.

This report, through a detailed investigation of the individual resource on Bosch-owned land, will assess whether the area can be considered to be economically viable, based on the original criteria used in the Welsh Assembly report.

3 SITE INVESTIGATION FINDINGS

3.1 INTRODUCTION

Following the document review, ERM conducted an intrusive site investigation between 30th June and 5th July 2010, consisting of the advancement of seven boreholes across the area of the potential mineral resource area, as identified in the Local Development Plan (LDP) (see *Figure 2*). Boreholes BH1-4 and BH7 were advanced within the "South Field" and BH5 and BH 6 within the "Back Field" to the east of the stream.

Each borehole was advanced up to 10 metres below ground level (m bgl) to confirm the near surface geology and in particular the presence, nature and thickness of Sand and Gravel deposits. The borehole logs are reproduced in *Annex B*.

At each location, up to five bulk samples were collected of the Sands and Gravels where possible, or of the surrounding geology depending on the nature of the geology encountered. The bulk samples were submitted to the laboratory (Geolab) and scheduled for analysis of Particle Size Distribution (PSD) (see *Table3a* for results) and bulk density (see *Table 3b* for results). The laboratory certificates are reproduced in *Annex C*.

All boreholes were backfilled and sealed to ground level with bentonite-cement grout.

3.2 OBSERVED GEOLOGY

Figures 4a and *Figure 4b* reproduce cross-sections through the upper 10m of the groundmass profile within the area of interest.

Made ground deposits were only encountered in BH1, BH2 and BH3, all located to the west of the stream and in the northern half of the area in question. At BH1, the northernmost borehole (and closest location to the production facility) the made ground was up to 1.9m thick, composed of a slag material, confirmed to have been imported from steelworks in Newport by Site Management.

This slag material thinned slightly to the west and south to 1.1m in BH2 and 1.8m in BH3 and was absent in BH7 to the south. At BH4 adjacent to the stream and in all the remaining borehole locations to the west of the stream within the "Back Field" the made ground was also absent. The absence of made ground in the borehole log for ST07NE184 (adjacent to BH2) is because this borehole predated the importation of the slag in the late 1980s.

Underlying the Made Ground in the northern area of the site and topsoil in other areas were alluvial deposits composed of sandy/silty clay or clayey silt with occasional gravels. This unit was typically 2m to 2.3m thick in the central area of the site, thinning to the south and east to around 1.5m thick. The deposits thickened towards BH3 and BH2 in the north western area of the site to a maximum of 2.9m at BH2. At BH1 in the northernmost part of the area however the deposits were only 0.5m thick.

As the general ground elevation is similar in the northern area of the site (west of the stream), the presence of such a relatively thin deposit at BH1 compared to other boreholes in this area (BH2 and BH3) is likely to be as a result of the presence of thicker deposits of made ground (1.9m) at this location. This also suggests a general levelling of the "South Field" area to create a development platform. Thus overburden (made ground and drift) above the sand and gravel resource varies between 1.3 and 4m. The BGS logs pre-date the reported importation of made ground and thus underestimate the total amount of overburden material.

Sands and Gravels underlie the natural clays and silts at all borehole locations. The Sands and Gravels are at their thickest at BH1 in the far north of the potential mineral resource area (PMRA) where the deposit is 5.7m thick but this includes two 0.3m and 0.4m thick intervening clay horizons in the lower part (with actual total sand and gravel thickness of 5m, but with main uninterrupted upper sand and gravel horizon of 3.3m). To the south of this location at BH2 and BH3, the sand and gravels thin to around 1.1m although the PSD analysis (see below) suggests a high gravel content to the underlying clayey gravel. The unit thickens to around 2m south and west of the stream. BH7 in the south of the PMRA records 3m of sand and gravel but with the exception of this and BH1, the majority of boreholes across the MPRA record a deposit between 1 -2m thick.

The Sands and Gravels are underlain by a clayey gravel or gravelly clay in the northern/western part of the Site (BH1 and BH2) or by sandy/clayey silt across the remainder of the site. The silt layer can be as shallow as 3.5m bgl (BH5) and continues to the end of the borehole (up to 10.1m bgl).

Water strikes were generally recorded at the top or within the upper part of the Sand and Gravel deposit, with evidence from the BGS boreholes that rest water level was generally elevated above the top of the sand and gravel i.e. the water was confined by the overlying silts and clays. It is likely that water within the sand and gravel is in hydraulic continuity with the local stream and potentially the River Ely to the south-west, although the influence of drainage associated with the railway line on the flow regime is not known.

3.3 LABORATORY RESULTS

3.3.1 Particle Size Distribution (PSD)

The samples for PSD analysis were largely obtained from soils identified in the field as representing the Sands and Gravels unit. The results are shown in *Table 3a.*

Table 3a Particle Size Distribution Analysis

Borehole Location/Sample	Soil Fractions (%)				Log Description
	Cobbles	Gravel	Sand	Silt & Clay	
BH1 (2.5-2.7m)	0	47	36	17	Sands and Gravels
BH1 (3.0-3.3m)	0	66	23	11	Sands and Gravels
BH1 (3.5-4.0m)	0	60	29	11	Sands and Gravels
BH1 (4.1-4.6m)	0	69	27	4	Sands and Gravels
BH1 (4.8-5.1m)	0	43	54	3	Gravelly Sand
BH2 (4.0-4.5m)	0	85	11	4	Sandy Gravels
BH2 (4.5-5.0m)	0	51	23	26	Clayey Gravels
BH2 (5.0-6.0m)	0	72	19	9	Clayey Gravels/Gravelly Clay
BH2 (6.0-7.0m)	0	75	14	11	Gravelly Clay
BH2 (8.0-9.0m)	14	55	13	18	Gravelly Clay
BH3 (2.6-3.0m)	0	58	32	10	Sandy, Gravelly Silt
BH3 (3.0-4.0m)	10	43	38	9	Sandy, Gravelly Silt
BH3 (4.0-4.5m)	0	86	12	2	Sandy Gravels
BH3 (4.5-5.0m)	0	77	22	1	Sandy Gravels
BH3 (5.0-6.0m)	0	25	59	16	Gravelly Sand/Silt
BH4 (1.5-1.9m)	0	64	26	10	Gravelly Silty Sand
BH4 (1.9-2.3m)	0	93	6	1	Slightly Sandy Gravel
BH4 (2.5-3.0m)	0	71	26	3	Gravelly Sand
BH4 (3.5-4.0m)	0	35	56	9	Gravelly Sand
BH4 (4.5-4.9m)	0	5	87	8	Silty Sand
BH5 (1.8-2.4m)	0	58	29	13	Clayey Gravel
BH5 (2.4-2.7m)	0	81	17	2	Sandy Gravel
BH5 (2.7-3.0m)	0	85	14	1	Sandy Gravel
BH5 (3.1-3.5m)	0	72	26	2	Gravelly Sand
BH5 (3.5-3.8m)	0	15	21	64	Sandy Silt
BH6 (1.5-2.0m)	0	50	37	13	Clayey Gravelly Sand
BH6 (2.0-2.5m)	0	46	40	14	Clayey Gravelly Sand
BH6 (2.5-3.0m)	0	86	12	2	Sands and Gravels
BH6 (3.0-3.5m)	0	92	7	1	Sands and Gravels
BH7 (3.5-4.0m)	0	57	30	13	Sandy Clayey Gravels
BH7 (4.0-4.5m)	0	80	17	3	Sandy Gravel
BH7 (4.5-5.0m)	0	89	10	1	Sandy Gravel/Gravelly Sand
BH7 (5.0-5.5m)	0	93	6	1	Sandy Gravel
BH7 (6.0-7.0m)	0	25	57	18	Sandy Gravel/Sandy Silt

The majority of samples taken from the sand and gravel unit are characterised by a high percentage of gravels (typically 60-80%), followed by sands, with very low percentages of silt and clay. The PSD results confirm that in the northern/western region of the Site (BH1 and BH2), gravel content is generally identified at lower depths than in the southern region of the Site.

At all borehole locations, with the exception of BH6, there is a significant decline in gravels between the penultimate sample and the lowest sample collected. The gravels tend to be replaced by an increase in sand and silts and clays, suggesting a fining down of sediments; confirming the base of the Sands and Gravels unit.

The BGS logs reported an extensive layer of sandy silt underlying the Sands and Gravels. A representative sample of this sandy silt layer, underlying the Sands and Gravels, was collected at BH5 (3.5m - 3.8m bgl). The sample showed a high percentage of silt and clay (64%) followed by lower percentages of sand (15%) and gravel (21%).

3.3.2 Bulk Density

The bulk density of a soil is determined by the mass of the materials which make up the soil and the volume the mass occupies. Density is highly dependant on the content of minerals within a soil as well as the compaction of the material. Soils are naturally loosened during drilling and field extraction of samples, and are re-compacted and oven dried in the laboratory to give bulk and dry density. Bulk density is used for geotechnical studies, especially in regards to the stability of building foundations and to assess the nature of potential aggregates.

For the purpose of this report, density analysis was conducted to confirm the presence and extent of the Sand and Gravel unit, and to provide quantity estimates. The results of bulk density analysis are shown in *Table 3b*.

Table 3b Bulk Density Analysis

Borehole Location/Sample	Moisture Content (%)	Bulk Density (Mg/m^3)	Dry Density (Mg/m^3)
BH1 (2.5-2.7m)	15	2.36	2.06
BH1 (3.0-3.3m)	10	2.44	2.21
BH1 (3.5-4.0m)	10	2.38	2.16
BH1 (4.1-4.6m)	8	2.4	2.28
BH1 (4.8-5.1m)	18	2.37	2
BH2 (4.0-4.5m)	5	2.54	2.43
BH2 (4.5-5.0m)	12	2.38	2.13
BH2 (5.0-6.0m)	10	2.49	2.25
BH2 (6.0-7.0m)	9	2.55	2.35
BH2 (8.0-9.0m)	13	2.41	2.14
BH3 (2.6-3.0m)	10	2.46	2.24
BH3 (3.0-4.0m)	10	2.44	2.21
BH3 (4.0-4.5m)	5	2.24	2.12
BH3 (4.5-5.0m)	10	2.25	2.05
BH3 (5.0-6.0m)	25	2.15	1.72
BH4 (1.5-1.9m)	11	2.24	2.02
BH4 (1.9-2.3m)	5	2.2	2.09
BH4 (2.5-3.0m)	8	2.35	2.17
BH4 (3.5-4.0m)	12	2.42	2.16
BH4 (4.5-4.9m)	24	2.31	1.86
BH5 (1.8-2.4m)	8	2.48	2.31
BH5 (2.4-2.7m)	9	2.13	1.96

Borehole Location/Sample	Moisture Content (%)	Bulk Density (Mg/m³)	Dry Density (Mg/m³)
BH5 (2.7-3.0m)	6	2.23	2.11
BH5 (3.1-3.5m)	3	2.27	2.19
BH5 (3.5-3.8m)	12	2.2	1.97
BH6 (1.5-2.0m)	12	2.42	2.15
BH6 (2.0-2.5m)	11	2.45	2.21
BH6 (2.5-3.0m)	5	2.24	2.14
BH6 (3.0-3.5m)	5	2.22	2.12
BH7 (3.5-4.0m)	12	2.45	2.2
BH7 (4.0-4.5m)	5	2.16	2.06
BH7 (4.5-5.0m)	6	2.3	2.17
BH7 (5.0-5.5m)	5	2.2	2.09
BH7 (6.0-7.0m)	17	2.33	1.99

The bulk density analysis suggests that the Sands and Gravels are relatively consistent throughout the Site, ranging from 2.13 Mg/m³ at BH5 (2.4 – 2.7m bgl) to 2.55 Mg/m³ at BH2 (6.0 – 7.0m bgl). The bulk density, when compared to the dry density values is seen as consistent throughout the unit, with a range of 1.86 Mg/m³ at BH4 (4.5 – 4.9m bgl) to 2.43 Mg/m³ at BH2 (6.0 – 7.0m bgl).

Moisture content ranged from 3% at BH5 (3.1-3.5m) to 25% at BH3 (5.0 - 6.0m).

3.4 SAND AND GRAVEL RESOURCE QUANTITY

Based on the thickness of sands and gravels recorded in the historic BGS referenced borehole logs and the borings advanced by ERM, ERM have used a visualisation software package, EVS, to provide a volumetric estimate of the sand and gravels present. An oblique 3D plot of the area is reproduced in *Figure 5*, showing the relative thickness of the sand and gravel deposits in the area of study.

Our estimate is 127,010m³. Using the average dry density from samples obtained (2.215 Mg/m³) (see *Table 3b*), ERM estimate that this equates to 281,327 tonnes of sand and gravel within the resource. However, this laboratory dry density is calculated based on the re-compaction of the material, to perform the tests, and is not considered to be a 'true field' density value. A standard density for Sand and Gravel (used for foundation design and construction) provides an estimated capacity of 228,618 tonnes. When using the bulk density of 1.6 Mg/m³ (as utilised in the Welsh Assembly 2000 report, see *Section 2.4*), this provides a lower estimated capacity of 203,216 tonnes.

To put the tonnage estimated to be present in context, the amount present on Bosch owned land would represent some 0.06% of the 393 million tonnes of land-based sand and gravel deposits that are estimated to be present in South East Wales.

The overburden material (those materials overlying the sand and gravels has an estimated volume of 283,850m³. This would mean more than twice the

amount of material would have to be removed from the site before extraction of the resource.

Although we have no estimate available of the volume that is considered by the Vale of Glamorgan to be within their authority area, as noted above, the mineral resource on Bosch-owned land would contribute approximately 2.7% of spatial coverage to Vale of Glamorgan designated sand and gravel resource (and 7% in the Ely Valley) (see *Figure 3*), and therefore again, is likely to be a small proportion of any resource present.

4 CONCLUSIONS

Environmental Resources Management Ltd (*ERM*) were commissioned by *Robert Bosch Ltd* (*Bosch*) to undertake a mineral resource assessment of a part of land at the Cardiff Plant, Miskin, UK. The objective of this assessment was to identify the background to the classification of this land, and establish the extent to which the mineral resource exists through policy review and an intrusive site investigation.

The national and regional mineral policy documents emphasise the need to safeguard potential future resources of land-based aggregates, in particular Sands and Gravels. Current excavation of Sands and Gravels are entirely marine-dredged based although it is recommended in reports commissioned by the *Welsh Assembly Government* that consideration should be given to land-based (as well as offshore) resources, although the exploitation of any such resources should be mindful of impacts to the environment and the sustainability of such operations.

As part of the mineral policy, there is a requirement for the local authorities of South East Wales to identify potential mineral resources. Within the *Vale of Glamorgan* UDP (1996 – 2011), potential resources have been identified, including land in the Ely Valley region and in particular, an area within Bosch owned land.

ERM undertook a review of other relevant documents including geological maps of the region, geological memoirs and mineral assessments (on behalf of the Welsh National Assembly) for the South East region. It is clear from this initial desk review, that the designation of the mineral resource area on-site was based on the alluvium deposits in the region. In regards to geology, the maps identify a mixture of alluvium or glacial till (boulder clay) across most of the Bosch ownership area and both north and south of the areas allocated outside the ownership. Geological logs obtained from the BGS for previous exploratory borings across the area of interest indicated sand and gravel deposits less than 2.4m thick within the resource area, and up to 3.35m thick on adjacent land, nearer the Ely River.

An intrusive site investigation including the advancement of seven boreholes up to 10m bgl was performed between 30th June and 5th July, to record the extent of sand and gravels onsite. The sand and gravels unit was observed to be limited to a maximum thickness of 4.5 metres in the northern/western parts of the area, with a general decline in thickness towards the southern/eastern region of the area to between 1.1m and 2m thickness. The deposits are underlain by clayey gravel in the northern part of the area and by an extensive layer of sandy silt to the south.

Particle Size Distribution and Bulk Density analysis confirmed the existence and extent of the Sand and Gravel unit, which suggests a gravel dominant

unit with minor sand element. The majority of sand and gravel collected within the resource area can be defined as 'clean' minerals (see *Section 2.4*), due to the low percentage of silt and clay, which generally make up less than 15% per sample.

Based on calculations of the volume of the sand and gravel deposits and the average/standard density, it is estimated that the capacity of the resource would range between 203,216 and 281,327 tonnes. This estimated capacity is considerably lower than the minimum quantity of 0.5 million tonnes, as quoted in the Welsh Assembly 2000 report. Furthermore, with an overburden ratio of >2:1, this individual resource would not have 'passed' the search criteria of the 2000 report (See *Section 2.4*), which the Vale of Glamorgan has potentially used as its basis for designation. For a regional perspective, the resource area equates to a very small (0.06%) proportion of the total estimated quantity for South East Wales.

Although we have no estimate available of the volume that is considered by the Vale of Glamorgan to be within their authority area, the mineral resource on Bosch-owned land would contribute approximately 2.7% of spatial coverage to Vale of Glamorgan designated sand and gravel resource (and 7% in the Ely Valley) and as such, on a local scale, would again be a small proportion of any resource present.

Additionally the potential sand and gravel resource, identified on Bosch land, is constrained by:

- the railway line and river to the south-west, with no direct link to other potential areas within the Ely Valley; and

- a high, confined water table which is likely connected with the nearby river, resulting in any future extraction requiring the unit to undergo 'wet working' in an attempt to reduce impact on the local hydrological system.

In addition, the potential resource is located within an area already designated for employment use in the adopted UDP (see *Figure 6*). As such, it would be a major constraint to delivery of what could potentially become a major employment opportunity regionally as employment-based buildings would not be permitted within 100 metres of the resource area, as detailed in *paragraph 70* of the *MTAN1: Aggregates* (see *Section 2.2.1*).

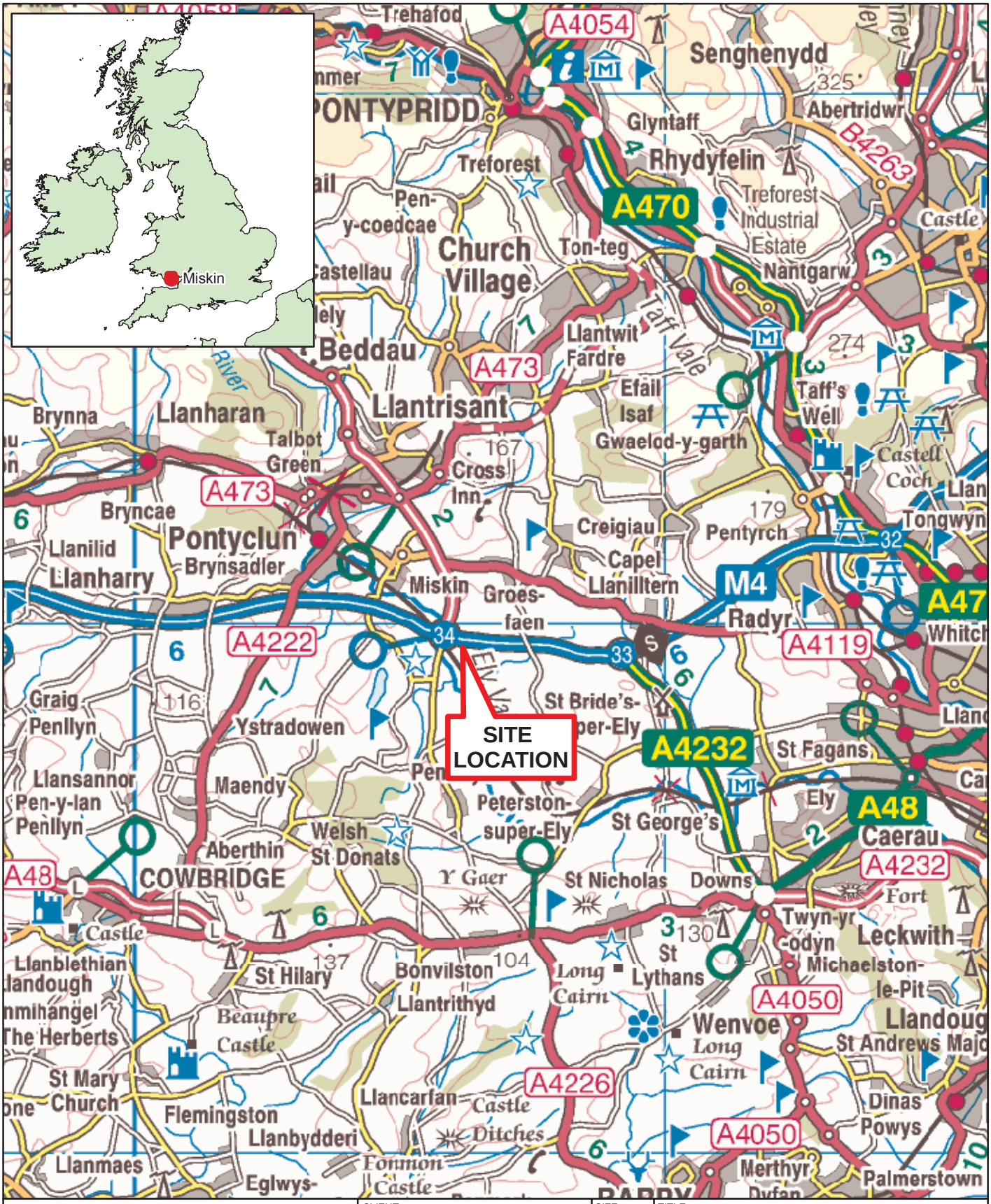
Additionally the current southernmost facility unit on the site is within 100m of the northern edge of the resource area, suggesting that the overall extraction area would be limited by the proximity of the existing buildings.

In theory the aggregate might be extracted prior to construction of any subsequent development (or even used in that construction) but the distance restrictions from existing buildings, the presence of the overlying materials

and the isolated location of the resource would further question the economic viability of the resource.

In addition, whilst consideration of ecology and nature conservation matters falls outside of the scope of ERM's brief, subject to the findings of ongoing ecology work separately commissioned by Bosch, the proximity of the resource to the Ely Valley SSSI would appear to present a further significant constraint.

Figures



CLIENT: Robert Bosch Ltd

SIZE: A4

TITLE: Figure 1
Site Location Plan
Starter Motors and Generators
Cardiff Plant, Miskin,

ERM
St. Nicholas House
31-34 High Street
Bristol
BS1 2AW
Tel: 01173 158523
Fax: 01173 158510

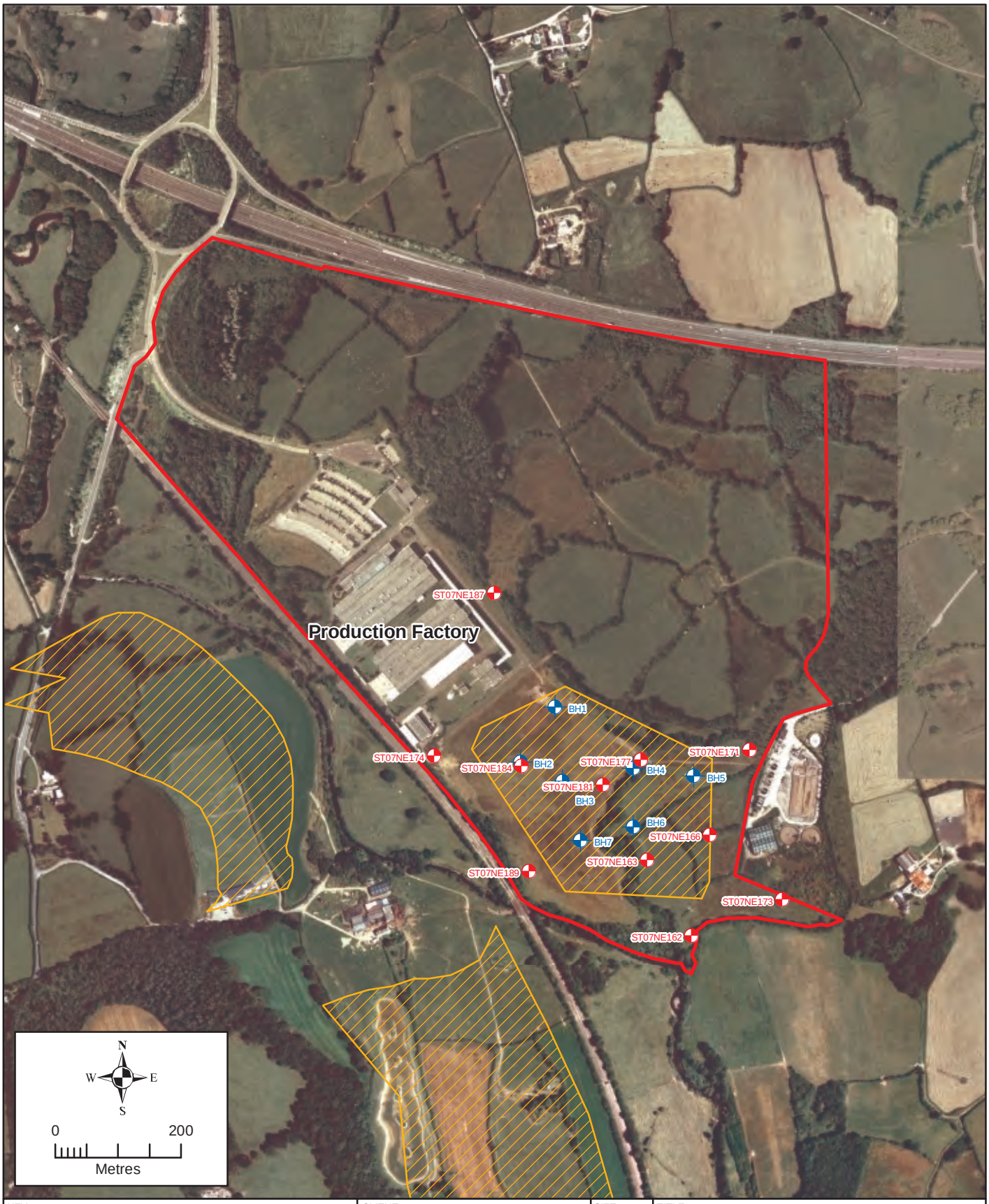
DATE: 21/07/2010	CHECKED: VB	PROJECT: 0118282
DRAWN: MTC	APPROVED:	SCALE: 1:100,000

SOURCE: Contains Ordnance Survey data © Crown copyright and database 2010. License number 0100031673.
PROJECTION: British National Grid

DRAWING: MiskinMineralSiteLocationPlan.mxd

REV: 0

File: 0118282Miskin_MineralGIS_IG_VB\Maps\MiskinMineralSiteLocationPlan.mxd



KEY:

- SiteBoundary
- Sand Gravel Allocation Areas
- ERM Borehole Location
- BGS Borehole Location

CLIENT: Robert Bosch Ltd

SIZE: A4

TITLE:
Figure 2
Site Layout
Starter Motors and Generators
Cardiff Plant, Miskin

ERM
St. Nicholas House
31-34 High Street
Bristol
BS1 2AW
Tel: 01173 158523
Fax: 01173 158510

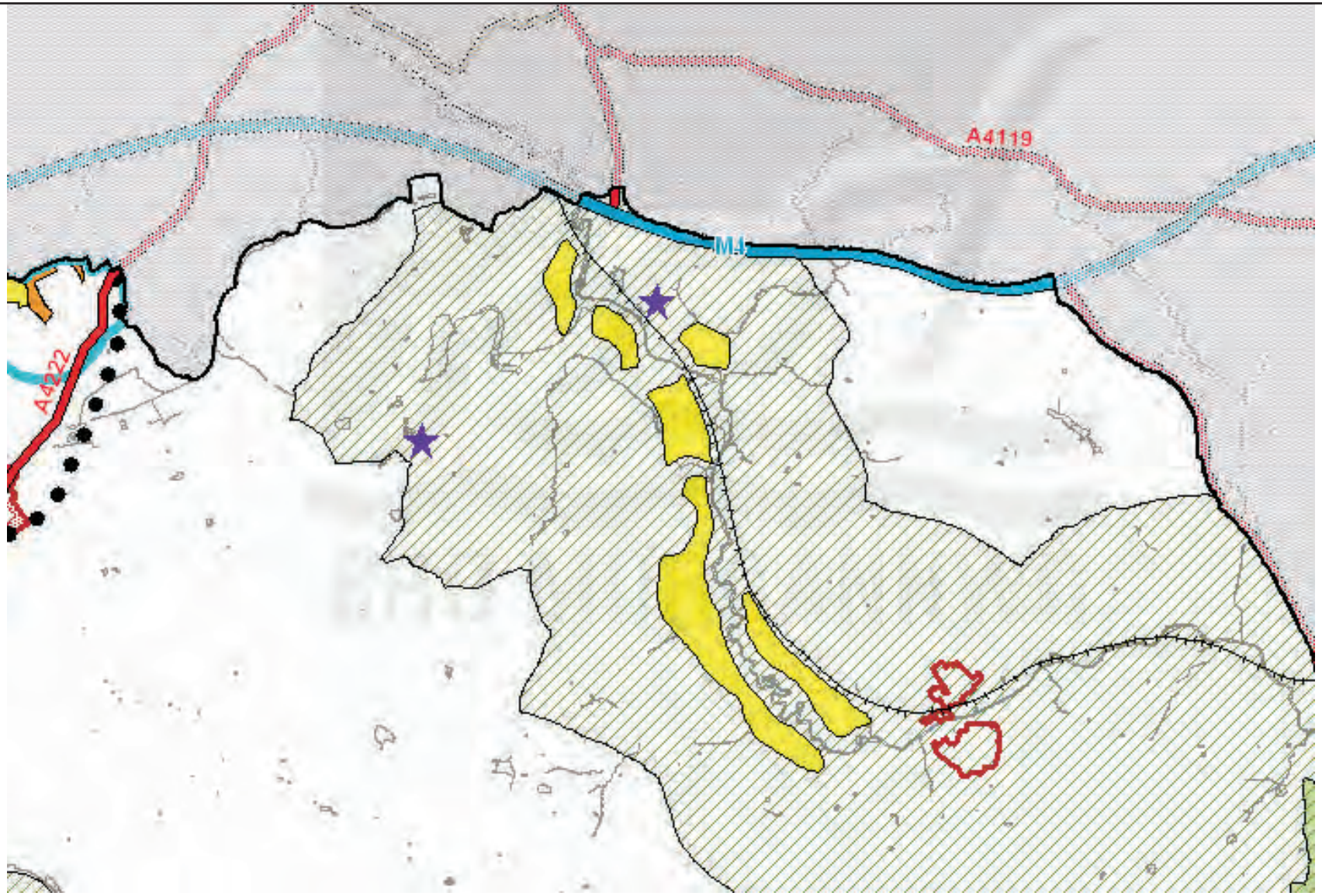
DATE: 03/09/2010	CHECKED: VB	PROJECT: 0118282
DRAWN: MTC	APPROVED:	SCALE: As Scale Bar

SOURCE: (c) 2010 Microsoft Corporation and its data suppliers
PROJECTION: British National Grid

DRAWING: MiskinMineralSiteLayout.mxd

REV: 0

File: 0118282Miskin_MineralGIS_IG_VB\Maps\MiskinMineralSiteLayout.mxd



KEY:

CLIENT: Robert Bosch Ltd

SIZE: A4

TITLE: Figure 3
Potential Mineral Resource Areas in the Ely Valley Region. Originally from Vale of Glamorgan Unitary Development Plan (UDP)

Bristol Office
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Facsimile: +44 (0) 117 315 8511

ERM

DATE: 13.08.10 | CHECKED: SR | PROJECT: 0118282

DRAWN: MTC | APPROVED: | SCALE: As Scale Bar

SOURCE:

DRAWING: 0118282_3 - 13.07.10

REV: 0

North

South

BH1

ST07NE/181

BH6

ST07NE/163

27.0
26.5
26.0
25.5
25.0
24.5
24.0
23.5
23.0
22.5
22.0
21.5
21.0
20.5
20.0
19.5
19.0
18.5
18.0
17.5
17.0
16.5
16.0
15.5

Approx 300m

KEY:

- Made Ground
- Silts, Clays, Sands
- Sands and Gravels
- Sand & Silt / Silt
- Gravelly Clay

CLIENT: Robert Bosch Ltd

SIZE: A3

TITLE: Figure 4a
North – South Cross Section

Bristol Office
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Bristol BS1 2AW
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Facsimile: +44 (0) 117 315 8511

ERM

DATE: 28.07.10	CHECKED: SR	PROJECT: 0118282
DRAWN: MTC	APPROVED:	SCALE: Not to Scale

SOURCE: Bing Maps

DRAWING: 0118282_1 - 28.07.10

REV: 0

West

East

BH2

BH3

ST07NE/181

BH4

BH5

>25mbgl

27.5
27.0
26.5
26.0
25.5
25.0
24.5
24.0
23.5
23.0
22.5
22.0
21.5
21.0
20.5
20.0
19.5
19.0
18.5
18.0
17.5
17.0

Approx 300m

KEY:

- Made Ground
- Silts, Clays, Sands
- Sands and Gravels
- Sand & Silt / Silt
- Gravelly Clay

CLIENT: Robert Bosch Ltd

SIZE: A3

TITLE: Figure 4b
West – East Cross Section

Bristol Office
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Bristol BS1 2AW
Telephone: +44 (0) 117 315 8510
Facsimile: +44 (0) 117 315 8511

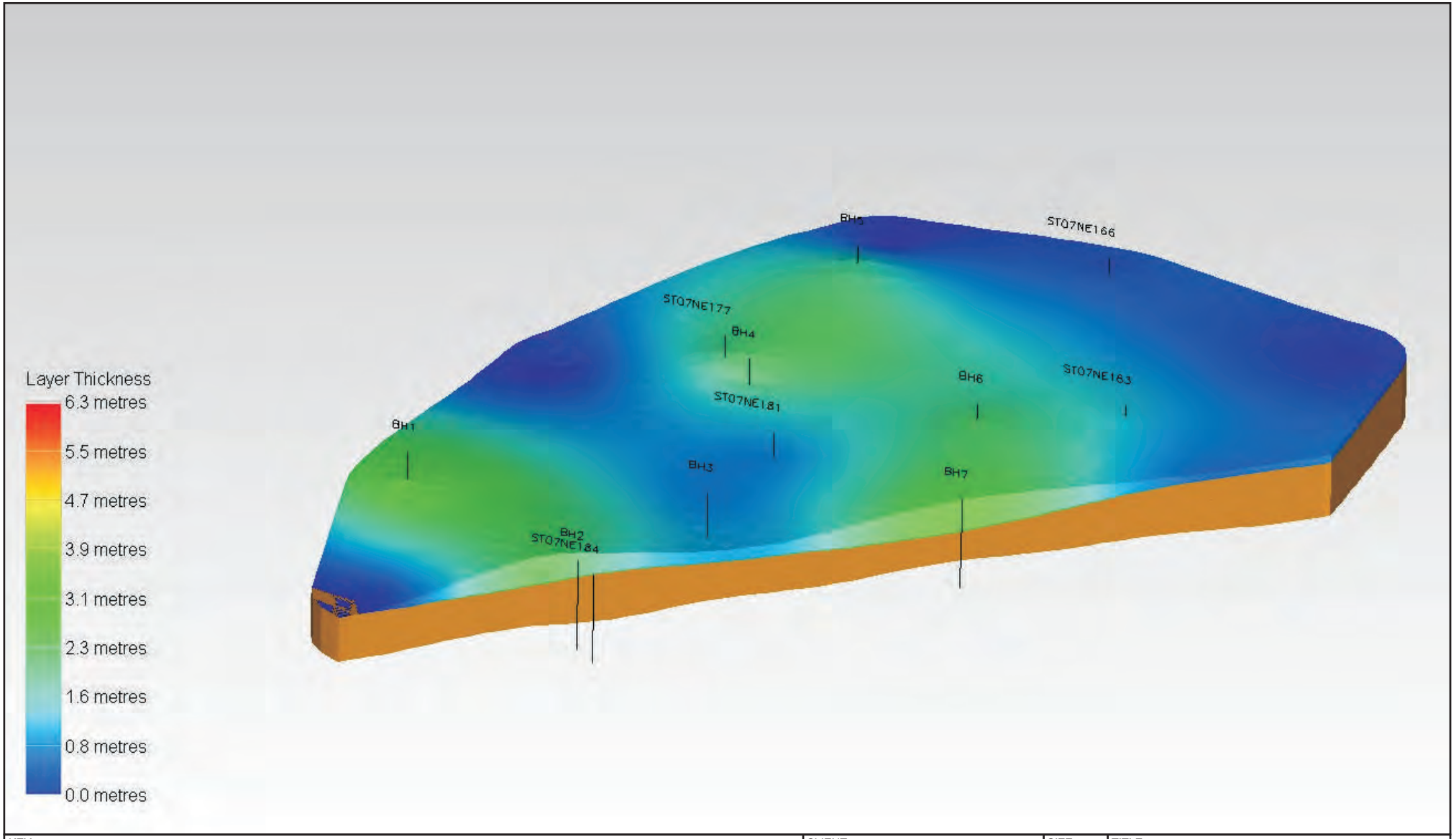
ERM

SOURCE: Bing Maps

DATE: 28.07.10	CHECKED: SR	PROJECT: 0118282
DRAWN: MTC	APPROVED:	SCALE: Not to Scale

DRAWING: 0118282_2 - 28.07.10

REV: 0



KEY:

CLIENT: Robert Bosch Ltd

SIZE: A4

TITLE: Figure 5
EVS Model of Sand and Gravel Unit Underlying the Site

Bristol Office
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31-34 High Street
Bristol BS1 2AW
Telephone: +44 (0) 117 315 8510
Facsimile: +44 (0) 117 315 8511

ERM

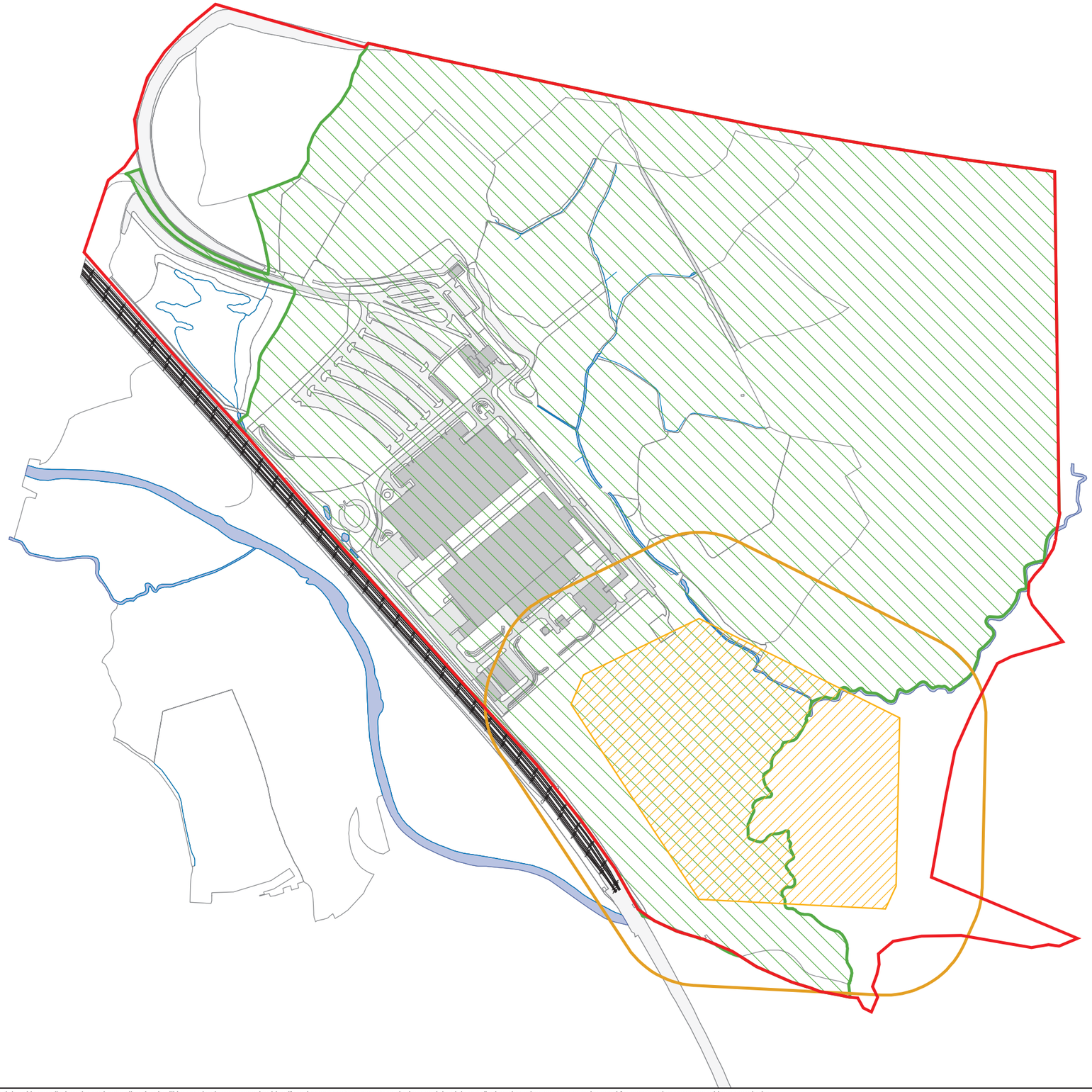
DATE: 13.08.10 | CHECKED: SR | PROJECT: 0118282

DRAWN: MTC | APPROVED: | SCALE: As Scale Bar

SOURCE:

DRAWING: 0118282_4 - 13.07.10

REV: 0



KEY:

- Site Boundary
- Sand and Gravel Designation Area
- MTAN 100m Buffer Zone
- Employment Designated Area

N
W E
S

0 200
Metres

TITLE:

Figure 6
Employment and Resource Designation with MTAN 100m Buffer Zone

CLIENT:	SIZE:
Robert Bosch Ltd	A3

DATE: 03/09/2010	CHECKED: VB	PROJECT: 0118282
DRAWN: MTC	APPROVED:	SCALE: As Scale Bar

DRAWING:	REV:
MiskinMineralEmployment_Resourse.mxd	0

ERM
St. Nicholas House
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Tel: 01173 158523
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PROJECTION: British National Grid

File: 0118282\Miskin_MineralGIS_JG_VB\Maps\MiskinMineralEmployment_Resourse.mxd

Annex A

BGS Borehole Logs

ST07NE/163 (1"262)

Holst Soil Engineering Limited

Borehole No. 2

BOREHOLE LOG

0660 7887.

Contract No. SI.2903/F.3426
Location Gwern-Y-Gedrych
Client South Glamorgan
Method of Boring Percussion
Diameter of Borehole 0.20m

Sheet 1 of 2
Chainage
Ground Level 25.17m AOD
Date 14.6.76

Description of Strata	Legend	Depth Below G.L.(m)	Thickness of Strata(m)	Type of Sample	c KN/sq.m	Ø deg	m.c. %	γ Kg/cu.m	N
TOPSOIL		0.20	0.20						
Firm grey brown clayey stony SAND		1.00	0.80	0.50	28	26	9.8	2230	
Brown medium dense sandy coarse GRAVEL		2.30	1.30	1.50					20
Medium dense grey fine sandy SILT		10.00	7.70	2.50					12
				4.50					19
				6.00					10
				7.50					9
				9.00					11

Key

- ▯ Undisturbed Sample
- O Disturbed Sample
- △ Water Sample
- I Penetration Test
- Ø Angle of Friction
- m.c. Moisture Content
- γ Bulk Density
- N S.P.T. Value
- c Apparent Cohesion

Remarks (Observations of Ground Water etc.)

Water struck at 1.90m
After 20 mins rose to 1.70m
Final standing level 0.80m

Water levels are subject to seasonal or tidal variations and should not be taken as constant

ST07NE/163

Holst Soil Engineering Limited

BOREHOLE LOG

Borehole No. 2

Contract No. SI.2903/F.3426
Location ....Gwern-Y-Gedrych.....
Client.....South Glamorgan.....
Method of Boring Percussion.....
Diameter of Borehole ..0.20m.....

Sheet ...2. of 2.....
Chainage .....
Ground Level .....25.17m AOD
Date ....14.6.76.....

Description of Strata	Legend	Depth Below G.L.(m)	Thickness of Strata(m)	Type of Sample	c KN/sq.m	ø deg	m.c. %	γ Kg/cu.m	N
Medium dense grey fine sandy SILT				10.50					15
				12.00					15
		13.20	3.20						
Soft grey brown laminated CLAY with bands of silt				13.50	No recovery				
				14.40	18	0	25.9	1910	
		14.90	1.70						
Stiff dark brown very sandy very stony CLAY				16.00	89	6	10.5	2320	
		16.50	1.60						

Key
- ▯ Undisturbed Sample
- O Disturbed Sample
- △ Water Sample
- I Penetration Test
- ø Angle of Friction
- m.c. Moisture Content
- γ Bulk Density
- N S.P.T. Value
- c Apparent Cohesion

Remarks (Observations of Ground Water etc.)

Water levels are subject to seasonal or tidal variations and should not be taken as constant

ST07NE 1166 (1"262)

Holst Soil Engineering Limited

5

BORECHOLE LOG 0670 7891

Contract No. SI.2903/F.3426
Location Gwern-Y-Gedrych
Client South Glamorgan
Method of Boring Percussion
Diameter of Borehole 0.20m

Sheet 1 of 1
Chainage
Ground Level 25.53m AOD
Date 24.6.76

Description of Strata	Legend	Depth Below G.L.(m)	Thickness of Strata(m)	Type of Sample	c KN/sq.m	Ø deg	m.c. %	γ Kg/cu.m	N
TOPSOIL		0.20	0.20						
Stiff light grey brown mottled very sandy CLAY with occasional stones				0.80	76	6	20.4	2000	
		1.30	1.10						
Grey brown SAND and GRAVEL				1.50	55	34	19.9	2280	
		2.00	0.70						
Medium dense grey brown medium/coarse grained sandy GRAVEL				2.80					29
		3.70	1.70						
Loose/medium dense grey fine sandy SILT				4.00					9
				5.50					10
		6.40	2.70	6.50	173	8	12.0	2310	
Stiff grey brown very sandy CLAY with stones and occasional bands of sand from 7.50m				7.80	126	0	10.5	2390	
		8.30	1.90						

Key

- □ Undisturbed Sample
- ○ Disturbed Sample
- △ Water Sample
- I Penetration Test
- Ø Angle of Friction
- m.c. Moisture Content
- γ Bulk Density
- N S.P.T. Value
- c Apparent Cohesion

Remarks (Observations of Ground Water etc.)

Water struck at 1.80m
After 20 mins rose to 0.90m
Sealed off at 6.50m
Final standing level 1.20m

Water levels are subject to seasonal or tidal variations and should not be taken as constant

NDATION ENGINEERING
Ltd.

BOREHOLE LOG

ST 07NE/177

1"262

LOCATION : PONTYCLUN SEWERAGE
BOREHOLE No. : A4
BOREHOLE DIA. : 6"
GROUND LEVEL : 85'. O.D 0659 7903
DATE (Start) : 5 . 2 . 67
WATER LEVEL : See Table

Description	Thickness	Depth	Sample	Remarks
TOPSOIL	2'-6"	0'-0" / 2'-6"	1	
Soft brown sandy CLAY (sand layers from 2'-6")	5'-6"	2'-6" / 6'-0"	2, 3, 4	
Very compact sandy silty c.m.f. GRAVEL	7'-0"	13'-0"	5	100 blows/ft
			6	
Med. dens. grey m.f. SAND	3'-0"	16'-0"	7	35 blows/ft
Med. dens. grey silty very fine SAND	19'-0"+		8	22 blows/ft
(Soft silt layers from 24'-0")		(24'-0")	9	5 blows/ft
			10	10 blows/ft
			11	15 blows/ft
		35'-0"		BOREHOLE COMPLETE

BOREHOLE SCALE : 1"=5' • : DISTURBED SAMPLE ▮ : UNDISTURBED SAMPLE ⊣⊢ STANDARD PENETRATION TEST

NDATION ENGINEERING Ltd.

ST 07 NE/181

1"262

BOREHOLE LOG

LOCATION : PONTYCLUN SEWERAGE BOREHOLE No. : A 8

BOREHOLE DIA. : 6" GROUND LEVEL : 84' O.D 0653 7899

DATE (Start) : 10 . 2 . 67 WATER LEVEL : See Notes

Description	Thickness	Depth		Sample	Remarks
TOPSOIL	0'-0.5"	0'-0.5"			
Soft brown CLAY	1'-0"	1'-0"		B 1	
Soft light brown sandy stoney CLAY (sand layers + stones from 4'-6")	6'-0"	(4'-6")		B 2	U4 failed
Loose sandy silty c.+f GRAVEL	2'-6"	7'-6"		B 3	1½
		10'-0"		B 4	13 blows/ft 1T
Med. dense, grey silty fine SAND	25'-0" +			B 5	56 blows/ft 0.5T
				B 6	12 blows/ft 0.9T
				B 7	9 blows/ft 0.66T
				B 8	10 blows/ft 0.7T
(soft silt layers from 32'-0")		(32'-6")		B 9	
		35'-0"			6 blows/ft
					BOREHOLE COMPLETE

Note: Water struck at 7'-0" B.G.L. Water standing at 3'-0" B.G.L. through lunch break with borehole cased + cleared out to 20'-0" B.G.L.

Ltd.

BOREHOLE LOG

ST07NE/184

1" 262

0640 7902

LOCATION : PONTYCLUN SEWERAGE

BOREHOLE No. : A II

BOREHOLE DIA. : 6"

GROUND LEVEL : 84' O.D.

DATE (Start) : 17 . 2 . 67

WATER LEVEL : See Table

Description	Thickness	Depth	Sample	Remarks
TOPSOIL	0'-5"	0'-0"		
Firm brown CLAY	1'-6"	0'-5"		
Soft light brown sandy CLAY with peat layers	2'-3"	2'-8"	● 1	
Med. dens. silty sandy s.m.f. GRAVEL	2'-6"	4'-6"	● 2	33 blows/ft 1½
		7'-0"	● 3	
Stiff brown sandy CLAY with boulders	18'-0" +		U.4	failed
			● 5	
			● 6	126 blows/ft
		25'-0"	U.4	failed
			● 7	80 blows/5" (initial)
			BOREHOLE COMPLETE	

HOLE SCALE : 1" = 5' • : DISTURBED SAMPLE ▮ : UNDISTURBED SAMPLE ·· STANDARD PENETRATION TEST

DATION ENGINEERING
ltd.

BOREHOLE LOG

ST 07NE/189
1"262
0641 7886.

LOCATION : PONTYCLUN
BOREHOLE DIA. : 6" SEWERAGE
DATE (Start) : 14. 2. 67

BOREHOLE No. : A16
GROUND LEVEL : 85'.00.
WATER LEVEL : See Table

Description	Thickness	Depth	Sample	Remarks
TOPSOIL	0'-5"	0'-0"		
Soft brown sandy CLAY	3'-3"	0'-5"	D 1	
Soft brown clayey SAND	3'-0"	4'-0"	D 2	
			U 3	U4 failed
Soft red brown sandy CLAY	4'-0"	7'-0"		
		11'-0"	U 4	U4 failed
Compact a.m.f. GRAVEL with boulders	10'-0"		D 5	
			D 6	81 blows 6
		21'-0"	D 7	31 blows 11
Stiff red-brown sandy CLAY with boulders	4'-0" +			
		25'-0"	D 8 123	blows 11
			BOREHOLE COMPLETE	

HOLE SCALE : 1" = 5' • - DISTURBED SAMPLE ▯ - UNDISTURBED SAMPLE ⊢ STANDARD PENETRATION TEST

NDATION ENGINEERING Ltd.

BOREHOLE LOG

ST07NE/187
1"262
0624 7908

LOCATION : PONTYCLUN
BOREHOLE DIA. : 8" SEWERAGE
DATE (Start) : 25 . 2 . 67

BOREHOLE No. : A 14
GROUND LEVEL : 88' O.D
WATER LEVEL : See Table

Description	Thickness	Depth	Sample	Remarks
		0'-0"		
TOPSOIL Firm brown CLAY	0'-6"	0'-6"	1	1½" T
Firm light brown sandy CLAY	1'-6"	1'-0"	2	
Compact sandy gravelly CLAY	2'-0"	3'-0"		
		5'-0"	3	68 blows/ft
Very compact becoming med.dens. GRAVEL	7'-0"			
				11 blows/ft 0.8"
		12'-0"	4	
Med. dens. silty sandy c.m. GRAVEL	4'-0"			
		16'-0"	5	25 blows/ft
				2"
Very compact grey silty fine SAND	6'-0"			
				45 blows/
		22'-0"	6	
Stiff sandy CLAY with boulders	3'-0"			
		25'-0"		
Compact BOULDERS with traces of clayey sand	6'-6" +		7	U4 failed 180 blows 2½" (initial)
		31'-6"		BOREHOLE COMPLETE

BOREHOLE SCALE : 1" = 5' • : DISTURBED SAMPLE ▮ : UNDISTURBED SAMPLE ⊣ STANDARD PENETRATION TEST

DATION ENGINEERING
Ltd.

BOREHOLE LOG

ST07 NE/174
1"262

LOCATION : PONTYCLUN
BOREHOLE DIA. : 6" BEVERLEY SE
DATE (Start) : 5 : 5 . 67

BOREHOLE No. : A1
GROUND LEVEL : 88' O.D. 0635 7932
WATER LEVEL : See Table

Description	Thickness	Depth	Sample	Remarks
TOPSOIL	1'-0"	0'-0" / 1'-0"	S 1	
Firm light brown sandy CLAY	3'-0"	4'-0"	S 2	
Soft sandy CLAY with occ. stones & vegetation	3'-6"	7'-6"	U4 S 3	U4 failed
Loose clayey SAND with occ. stones	4'-6"	12'-0"	+ S 4	16 blows/ft 1.5"
Stiff grey sandy boulder CLAY	22'-0"		S 5	1½"/ft
(becomes hard at 20'-0")		20'-0"	S 7	
			S 8	
			S 9	
			S 10	U4 failed
Compact boulder GRAVEL	5'-0"	34'-0"	S 11 +	60 blows/4" (initial)
		37'-0"		
Hard sandy CLAY with boulders	7'-0"		+ S 12	70 blows/6" (initial)
		44'-0"	S 13	
Hard red MARL	5'-0" +			
		49'-0"	+ S 14	125 blows/2" (initial)

HOLE SCALE 1" = 1' D = DISTURBED SAMPLE B = UNDISTURBED SAMPLE BOREHOLE COMPLETE
I = STANDARD PENETRATION TEST

ST07NE/173 (1"262)

Holst Soil Engineering Limited

Borehole No. 12

BOREHOLE LOG

0690 7884

Contract No. ..SI.2903/F.3426.....
Location .....Gwern-Y-Gedrych.....
Client.....South Glamorgan.....
Method of Boring.....Percussion.....
Diameter of Borehole ...0.20m.....

Sheet ...1.of.....1.....
Chainage .....
Ground Level .27.11m.AOD.....
Date....8.6.76.....

Description of Strata	Legend	Depth Below G.L.(m)	Thickness of Strata(m)	Type of Sample	c KN/sq.m	ø deg	m.c. %	γ Kg/cu.m	N
TOPSOIL		0.30	0.30						
Firm grey brown mottled sandy silty CLAY with occasional stones		1.70	1.40	1.00	65	0	18.7	2180	
Firm brown very sandy CLAY with bands of clayey sand		2.40	0.70	1.90	40	10	14.8	2225	
Firm brown very sandy stony CLAY		3.00	0.60	2.80	No recovery				
Boulder obstruction - driven ahead of borehole		6.20	3.20						
Very stiff brown sandy stony CLAY		7.60	1.40	6.40	193	17	9.3	2320	
Dense red brown medium grained SAND		8.90	1.30	8.20					44
Dense brown grey sandy medium/ coarse grained GRAVEL		10.40	1.50	9.90					36

Key

- ▯ Undisturbed Sample
- O Disturbed Sample
- △ Water Sample
- I Penetration Test
- Ø Angle of Friction
- m.c. Moisture Content
- γ Bulk Density
- N S.P.T. Value
- c Apparent Cohesion

Remarks (Observations of Ground Water etc.)

Continuous seepage from 0.80m
Struck again at 7.50m
After 20 mins rose to 6.80m
Final standing level 0.30m

Water levels are subject to seasonal or tidal variations and should not be taken as constant

ST07NE/171 (1'262)

Holst Soil Engineering Limited

10

BOREHOLE LOG

0683 7909

Contract No. SI.2903/F.3426
Location Gwern-Y-Gedrych
Client South Glamorgan
Method of Boring Percussion
Diameter of Borehole 0.20m

Sheet 1 of 1
Chainage
Ground Level 28.12m AOD
Date 23.6.76

Description of Strata	Legend	Depth Below G.L.(m)	Thickness of Strata(m)	Type of Sample	c KN/sq.m	Ø deg	m.c. %	γ Kg/cu.m	N
TOPSOIL		0.30	0.30						
Firm grey brown sandy CLAY with occasional stones		1.90	1.60	1.00	55	6	17.6	2085	
Stiff grey brown very sandy stony CLAY		3.30	1.40	2.30	74	10	12.3	2210	
Medium grained brown SAND		3.90	0.60	3.10	104	19	12.3	2215	
Brown laminated CLAY		4.10	0.20	4.10					14
Medium dense brown medium grained SAND		5.40	1.30						
Stiff grey brown sandy CLAY		5.70	0.30						
Dense brown medium grained SAND		6.30	0.60	6.00					54
Stiff grey brown very silty sandy stony CLAY with sand pockets		8.00	1.70	7.50	193	12	11.0	2335	

Key

- □ Undisturbed Sample
- O Disturbed Sample
- △ Water Sample
- I Penetration Test
- Ø Angle of Friction
- m.c. Moisture Content
- γ Bulk Density
- N S.P.T. Value
- c Apparent Cohesion

Remarks (Observations of Ground Water etc.)

Water struck at 3.20m
After 20 mins rose to 2.50m
Final Standing level 1.20m

Water levels are subject to seasonal or tidal variations and should not be taken as constant

ST 07 NE/162

Holst Soil Engineering Limited (1"262)

1

BOREHOLE LOG

0665 7876

Contract No. SI.2903/F.3426
Location....Gwern-Y-Gedrych.....
Client.....South Glamorgan (Welsh Water Authority)
Method of Boring.....Percussion.....
Diameter of Borehole ..0.20m.....

Sheet ...1 of .....1.....
Chainage .....
Ground Level ..24.4m. AOD.....
Date....12.6.76.....

Description of Strata	Legend	Depth Below G.L.(m)	Thickness of Strata(m)	Type of Sample	c KN/sq.m	Ø deg	m.c. %	γ Kg/cu.m	N
TOPSOIL		0.40	0.40						
Soft brown mottled silty CLAY				0.90	30	0	44.6	1745	
		1.40	1.00	1.50					
Soft grey brown very silty CLAY with thin sand bands					16	0	45.3	1990	
		2.00	0.60						
Clayey SAND and GRAVEL		2.40	0.40						
Brown clayey silty SAND with occasional small stones				2.70	14	12	12.0	2135	
		3.20	0.80						
Stiff grey brown very sandy CLAY with bands of silt, sand and occasional stones				4.20	65	32	9.5	2265	
				6.00					
		6.90	3.70						
Boulder obstruction - driven ahead of borehole		8.30	1.40	8.30					
Very stiff grey browr very silty very sandy stony CLAY				9.50					
		10.00	1.70						

Key

- ▯ Undisturbod Sample
- O Disturbed Sample
- △ Water Sample
- I Penetration Test
- Ø Angle of Friction
- m.c.Moisture Content
- γ Bulk Density
- N S.P.T. Value
- c Apparent Cohesion

Remarks (Observations of Ground Water etc.)

Water struck at 1.50m
After 20 mins rose to 1.40m
Final standing level 0.90m

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Annex B

ERM Borehole Logs

Environmental Resources Management
Borehole Log

Borehole No. **BH1**

Page 1 of 1

Client:	**Robert Bosch Ltd**	Drilling Method:	**Shell & Auger**	Coordinates:	**306453.7**
Location:	**Miskin**	Drill Rig Type:	**Cable Percussion**		**179113.88**
		Borehole Diameter:	**100mm**	Ground Level:	**27.22m AOD**
ERM Project No:	**0118282**	Logged by:	**Simon Robinson**	Total Depth:	**9.3m**
		Dates Drilled:	**30.06.10**		

Description of Strata	Depth and thickness of strata (m)	O.D. Level (m)	Observations	PID (ppmv)	Sampling	Sample Intervals	Ground-water Depth	Backfill/ Installation Details
MADE GROUND: Firm, dark brown silty clay with gravels. Gravels are coarse to boulder, angular, composed of slag material, limestone.	0	27.0	Black fibrous 'marker' layer stained immediate clay material. Slight tar odour.		BH1-2.5		▽	
Very soft, dark grey/green, silty SANDY CLAY. Sands are fine.	1.9	25.0			BH1-3.0			
Dark grey/brown, slightly clayey SANDS and GRAVELS. Sands are fine to coarse. Gravels are fine to pebble, angular, composed of limestone and sandstone.	2.4	24.5			BH1-3.5			
Dark grey/green, GRAVELLY SAND. Sands are coarse. Gravels are coarse to pebble, angular to rounded, composed of limestone.	4.7	22.5			BH1-4.1			
Soft, dark grey SILTY CLAY with occasional gravels. Gravels are coarse, rounded, composed of limestone.	5.7	21.5			BH1-4.8			
Dark grey/brown, slightly clayey GRAVELS. Gravels are fine to boulder, angular to rounded, composed of limestone and chert.	6.1	21.0			BH1-6.1			
Soft to firm, dark brown/grey CLAY.	6.9	20.5						
Dark grey, slightly clayey GRAVELS. Gravels are fine to boulder, angular to rounded, composed of limestone and chert.	7.2	20.0						
Firm to stiff, dark brown, slightly sandy gravelly CLAY. Sands are coarse. Gravels are fine to pebble, angular to subangular, composed of limestone.	8.1	19.0						
	9.3	18.0						

Remarks:

Soil bore in 'South' field east of production building

Groundwater:

▼ Depth:

▽ Strike: 4.1m bgl

Backfill/Installation Details:

Concrete:
Bentonite: 0.0 - 9.3m bgl
Gravel:
Plain pipe:
Slotted screen:
Well diameter:
Slot size:
Well material:
Filter pack grain size:

Environmental Resources Management
Borehole Log

Borehole No. **BH2**

Client:	**Robert Bosch Ltd**	Drilling Method:	**Shell & Auger**	Coordinates:	**306398.51**
Location:	**Miskin**	Drill Rig Type:	**Cable Percussion**		**179026.09**
		Borehole Diameter:	**100mm**	Ground Level:	**27.38m AOD**
ERM Project No:	**0118282**	Logged by:	**Simon Robinson**	Total Depth:	**9.5m**
		Dates Drilled:	**30.06.10**		

Description of Strata	Depth and thickness of strata (m)	O.D. Level (m)	Observations	PID (ppmv)	Sampling	Sample Intervals	Ground-water Depth	Backfill/ Installation Details
MADE GROUND: Soft - firm, dark brown silty clay with gravels. Gravels are coarse to cobble, angular, composed of slag material, limestone.	0	27.0						
Soft, dark grey/green SILTY CLAY with occasional gravels.	1.1	26.5						
Soft, dark grey/green, slightly sandy CLAYEY SILT with gravels. Sands are fine. Gravels are fine to pebble, angular to rounded, composed of limestone.	2.2	26.0						
		25.5						
		25.0						
		24.5						
		24.0						
Dark brown, slightly clayey SANDY GRAVELS. Sands are coarse. Gravels are coarse to cobble, angular to subrounded, composed of limestone.	4.0	23.5			BH2-4.0		▽	
		23.0						
Dark brown, slightly sandy CLAYEY GRAVELS. Sands are fine. Gravels are fine to boulder, angular to subrounded, composed of limestone.	4.5	22.5			BH2-4.5			
	5.1	22.0			BH2-5.0			
Firm to stiff, dark brown, slightly silty GRAVELLY CLAY. Gravels are fine to cobble, angular to subrounded, composed of limestone.		21.5						
		21.0			BH2-6.0			
		20.5						
		20.0						
		19.5						
		19.0			BH2-8.0			
		18.5						
Stiff, grey slightly gravelly CLAY. Gravels are fine to pebble, rounded, composed of limestone.	9.0	18.0						
	9.5							

Remarks:

Soil bore in 'South' field east of production building

Groundwater:

▼ Depth:

▽ Strike: 4.0m bgl

Backfill/Installation Details:

Concrete:
Bentonite: 0.0 - 9.5m bgl
Gravel:
Plain pipe:
Slotted screen:
Well diameter:
Slot size:
Well material:
Filter pack grain size:

Environmental Resources Management
Borehole Log

Borehole No. **BH3**

Client:	**Robert Bosch Ltd**	Drilling Method:	**Shell & Auger**	Coordinates:	**306465.21**
Location:	**Miskin**	Drill Rig Type:	**Cable Percussion**		**178995.89**
		Borehole Diameter:	**100mm**	Ground Level:	**27.21m AOD**
ERM Project No:	**0118282**	Logged by:	**Simon Robinson**	Total Depth:	**9.0m**
		Dates Drilled:	**01.07.10**		

Description of Strata	Legend	Depth and thickness of strata (m)	O.D. Level (m)	Observations	PID (ppmv)	Sampling	Sample Intervals	Ground-water Depth	Backfill/ Installation Details
MADE GROUND: Very soft, dark grey, silty, gravelly clay. Gravels are fine to cobble, angular to rounded, composed of limestone, sandstone and coal fragments.		0	27.0						
MADE GROUND: Very soft, dark brown/red, sandy, silty, gravelly, clay. Sands are coarse. Gravels are fine to cobble, angular to rounded, composed of limestone, sandstone and coal fragments.		0.9	26.5						
Soft, light grey/green, slightly clayey SILT.		1.7	26.0						
Soft, light green, slightly sandy, slightly gravelly CLAYEY SILT. Sands are fine. Gravels are medium to pebble, subangular to rounded, composed of limestone.		2.0	25.5						
Soft, light grey/green, SANDY, GRAVELLY SILT. Sands are fine. Gravels are coarse to pebble, angular to subrounded, composed of limestone.		2.6	25.0			BH3-2.6			
Dark grey SANDY GRAVELS. Sands are coarse. Gravels are coarse to cobble, subrounded to rounded, composed of limestone.		4.0	24.5			BH3-3.0			
Dark grey, GRAVELLY SAND. Sands are coarse. Gravels are fine to cobble, subangular to rounded, composed of limestone.		4.5	24.0			BH3-4.0			
Very soft, dark grey, slightly clayey, slightly sandy SILT. Sands are fine.		5.1	23.5			BH3-4.5			
			23.0			BH3-5.0			
			22.5						
			22.0						
			21.5						
			21.0						
			20.5						
			20.0						
			19.5						
			19.0						
			18.5						
		9.0							

Remarks:

Soil bore in the middle of the 'South' field east of production building

Groundwater:

▼ Depth:

▽ Strike: 4.0m bgl

Backfill/Installation Details:

Concrete:
Bentonite: 0.0 - 9.0m bgl
Gravel:
Plain pipe:
Slotted screen:
Well diameter:
Slot size:
Well material:
Filter pack grain size:

Environmental Resources Management
Borehole Log

Borehole No. **BH4**

Client:	**Robert Bosch Ltd**	Drilling Method:	**Shell & Auger**	Coordinates:	**306578.12**
Location:	**Miskin**	Drill Rig Type:	**Cable Percussion**		**179016.03**
		Borehole Diameter:	**100mm**	Ground Level:	**25.69m AOD**
ERM Project No:	**0118282**	Logged by:	**Simon Robinson**	Total Depth:	**9.0m**
		Dates Drilled:	**01.07.10**		

Description of Strata	Depth and thickness of strata (m)	O.D. Level (m)	Observations	PID (ppmv)	Sampling	Sample Intervals	Ground-water Depth	Backfill/ Installation Details
Soft to firm, dark brown/light brown, slightly clayey SILT with rootlets.	0	25.5						
Soft, light grey/yellow SANDY CLAY with rare gravels. Gravels are pebble, subrounded, composed of limestone and siltstone.	0.6	25.0						
Light grey/yellow, clayey, gravelly SILTY SAND. Sands are fine to coarse. Gravels are fine to cobble, angular to rounded, composed of limestone.	1.5 1.9	24.5 24.0 23.5			BH4-1.5 BH4-1.9		▽	
Dark grey, slightly sandy GRAVELS. Sands are coarse. Gravels are coarse to cobble, subangular to rounded, composed of limestone.	2.5	23.0			BH4-2.5			
Dark grey, GRAVELLY SAND. Sands are coarse. Gravels are fine to pebble, angular to subrounded, composed of limestone and sandstone.		22.5 22.0			BH4-3.5			
Dark grey, slightly silty SAND. Sands are fine to coarse.	4.5	21.5 21.0			BH4-4.5			
Very soft, dark grey SILT.	4.9	20.5 20.0 19.5 19.0 18.5 18.0 17.5 17.0						
	9.0							

Remarks:

Soil bore in the eastern region of the 'South' field near the stream

Groundwater:

▽ Depth:

▽ Strike: 1.9m bgl

Backfill/Installation Details:

Concrete:
Bentonite: 0.0 - 9.0m bgl
Gravel:
Plain pipe:
Slotted screen:
Well diameter:
Slot size:
Well material:
Filter pack grain size:

Environmental Resources Management
Borehole Log

Borehole No. **BH5**

Page 1 of 1

Client:	**Robert Bosch Ltd**	Drilling Method:	**Shell & Auger**	Coordinates:	**306674.35**
Location:	**Miskin**	Drill Rig Type:	**Cable Percussion**		**179004.15**
		Borehole Diameter:	**100mm**	Ground Level:	**25.54m AOD**
ERM Project No:	**0118282**	Logged by:	**Simon Robinson**	Total Depth:	**8.0m**
		Dates Drilled:	**02.07.10**		

Description of Strata	Depth and thickness of strata (m)	O.D. Level (m)	Observations	PID (ppmv)	Sampling	Sample Intervals	Ground-water Depth	Backfill/ Installation Details
Firm to stiff, dark brown, slightly clayey SILT with rootlets.	0 – 0.3	25.5 – 25.0						
Firm to stiff, light grey/brown, slightly sandy CLAYEY SILT. Sands are fine to medium.	0.3 – 1.3	25.0 – 24.0						
Light grey/brown, CLAYEY SILTY SAND with rare gravels. Sands are fine to coarse. Gravels are medium to pebble, subangular, composed of limestone.	1.3 – 1.5	24.0						
Brown/grey, slightly silty GRAVELLY SAND. Sands are coarse. Gravels are fine to pebble, subangular to rounded, composed of limestone.	1.5 – 1.8	24.0 – 23.5			BH5-1.8			
Dark grey, silty, sandy, very CLAYEY GRAVEL. Sands are fine to coarse. Gravels are fine to cobble, subangular to rounded, composed of limestone.	1.8 – 2.4	23.5 – 23.0			BH5-2.4 BH5-2.7		▽	
Dark grey, SANDY GRAVEL. Sands are coarse. Gravels are fine to cobble, subrounded to rounded, composed of limestone, sandstone and chert.	2.4 – 3.1	23.0 – 22.5			BH5-3.1			
Dark grey, slightly silty, GRAVELY SAND. Sands are fine to coarse. Gravels are fine to pebble, rounded, composed of limestone and chert.	3.1 – 3.5	22.5 – 22.0			BH5-3.5			
Soft, dark grey, slightly gravelly, SANDY SILT. Sands are fine to coarse. Gravels are fine to pebble, subrounded to rounded, composed of limestone.	3.5 – 5.1	22.0 – 20.5						
Soft to firm, light grey, slightly clayey SILT.	5.1 – 8.0	20.5 – 18.0						

Remarks:

Soil bore east of the 'South' field

Groundwater:

▽ Depth:

▽ Strike: 2.4m bgl

Backfill/Installation Details:

Concrete:
Bentonite: 0.0 - 8.0m bgl
Gravel:
Plain pipe:
Slotted screen:
Well diameter:
Slot size:
Well material:
Filter pack grain size:

Environmental Resources Management
Borehole Log

Borehole No. **BH6**

Client:	**Robert Bosch Ltd**	Drilling Method:	**Shell & Auger**	Coordinates:	**306578.46**
Location:	**Miskin**	Drill Rig Type:	**Cable Percussion**		**178923.31**
		Borehole Diameter:	**100mm**	Ground Level:	**25.48m AOD**
ERM Project No:	**0118282**	Logged by:	**Simon Robinson**	Total Depth:	**10.1m**
		Dates Drilled:	**05.07.10**		

Description of Strata	Legend	Depth and thickness of strata (m)	O.D. Level (m)	Observations	PID (ppmv)	Sampling	Sample Intervals	Ground-water Depth	Backfill/ Installation Details
Soft to firm, light brown, slightly clayey SILT.		0	25.0						
		0.4							
Soft, light brown, CLAYEY SILT.		0.8	24.5						
Very soft, light grey/orange mottled brown, slightly silty, SANDY CLAY. Sands are fine to coarse.		1.3	24.0			BH6-1.5			
Light/dark grey, CLAYEY GRAVELLY SAND. Sands are fine to coarse. Gravels are coarse to pebble, subrounded to rounded, composed of limestone.		2.5	23.5			BH6-2.0			
			23.0			BH6-2.5		▽	
Dark grey/brown, SANDS and GRAVELS. Sands are coarse. Gravels are fine to cobble, subangular to rounded, composed of limestone and chert.		3.6	22.5			BH6-3.0			
			22.0						
Very soft to soft, dark grey, slightly clayey SILT.			21.5						
			21.0						
			20.5						
			20.0						
			19.5						
			19.0						
			18.5						
			18.0						
			17.5						
			17.0						
			16.5						
			16.0						
		10.1	15.5						

Remarks:

Soil bore east of the 'South' field near the stream

Groundwater:

▽ Depth:

▽ Strike: 2.5m bgl

Backfill/Installation Details:

Concrete:
Bentonite: 0.0 - 10.1m bgl
Gravel:
Plain pipe:
Slotted screen:
Well diameter:
Slot size:
Well material:
Filter pack grain size:

Environmental Resources Management
Borehole Log

Borehole No. **BH7**

Client:	**Robert Bosch Ltd**	Drilling Method:	**Shell & Auger**	Coordinates:	**306494.29**
Location:	**Miskin**	Drill Rig Type:	**Cable Percussion**		**178901.55**
		Borehole Diameter:	**100mm**	Ground Level:	**27.33m AOD**
ERM Project No:	**0118282**	Logged by:	**Simon Robinson**	Total Depth:	**8.0m**
		Dates Drilled:	**02.07.10**		

Description of Strata	Depth and thickness of strata (m)	O.D. Level (m)	Observations	PID (ppmv)	Sampling	Sample Intervals	Ground-water Depth	Backfill/ Installation Details
MADE GROUND: Soft, dark brown/red silty, gravelly clay. Gravels are fine to cobble, angular to rounded, composed of limestone, chert, siltstone and sandstone.	0	27.0						
Soft, dark grey, slightly silty SANDY GRAVELLY CLAY. Sands are fine. Gravels are fine to pebble, subrounded, composed of limestone.	1.3	26.0						
Dark grey/light brown, SANDY CLAYEY GRAVELS. Sands are coarse. Gravels are fine to pebble, subrounded to rounded, composed of limestone.	3.0	24.0			BH7-3.5			
Dark brown/grey SANDY GRAVEL. Sands are coarse. Gravels are fine to pebble, rounded, composed of limestone.	4.0	23.0			BH7-4.0		▽	
Dark grey, GRAVELLY SAND. Sands are coarse. Gravels are fine to pebble, subangular to rounded, composed of limestone.	4.6 5.0	22.5 22.0			BH7-4.5 BH7-5.0			
Dark brown/grey SANDY GRAVEL. Sands are coarse. Gravels are fine to pebble, rounded, composed of limestone.		21.5			BH7-6.0			
Soft, dark grey/brown, slightly gravelly, SANDY SILT. Sands are fine. Gravels are fine to coarse, rounded, composed of limestone.	6.2	21.0						
Soft, dark grey, slightly sandy SILT with rare gravels. Sands are fine. Gravels are fine to pebble, rounded, composed of limestone.	7.1	20.0						
	9.0	18.5						

Remarks:

Soil bore in the 'South' field near the stream

Groundwater:

▼ Depth:

▽ Strike: 4.0m bgl

Backfill/Installation Details:

Concrete:
Bentonite: 0.0 - 9.0m bgl
Gravel:
Plain pipe:
Slotted screen:
Well diameter:
Slot size:
Well material:
Filter pack grain size:

Annex C

Laboratory Certificates

Laboratory Report

LABORATORY TESTING SERVICES LIMITED

Contract Number: 10482

Client's Reference: tbc

Report Date: 27-07-2010

Client Name: Apex Drilling Services Limited
Sturmi Way
Village Farm Industrial Estate, Pyle
Bridgend
CF33 6BZ

Contract Title: Bosch, Miskin
For the attention of: Keith Richards

Date Received: 07-07-2010
Date Commenced: 07-07-2010
Date Completed: 27-07-2010

Test Description	Quantity	Checked	Approved
PSD Wet Sieve method BS1377:1990 2/9.2 *	34		
Bulk/Dry Density	34		

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

Approved Signatories:
D V Edwards (Managing Director), Alun Walters (Technical Manager), E Sharp (Technical Co-Ordinator).

GEO Laboratory Testing Services Ltd, Units 24-26, The Avenue, Delta Lakes, Llanelli, Carmarthenshire SA15 2DS
Telephone: 01554 757 734 | Fax: 01554 775 107 | Email: info@geolab.org.uk | Website: http://geolab.org.uk

SUMMARY OF SOIL DENSITY TESTS.

(B.S. 1377 : PART 4 : 4.3/4.4 : 1990)

Trial Pit Number	Sample Number	Depth m	**Moisture Content %**	**Bulk Density Mg/m3**	**Dry Density Mg/m3**	**Method of Laboratory compaction (kg Rammer)**	**Maximum Dry Density Mg/m3**	**Minimum Dry Density Mg/m3**	**Remarks**
BH1		**2.50**	**15**	**2.36**	**2.06**				
BH1		**3.00**	**10**	**2.44**	**2.21**				
BH1		**3.50**	**10**	**2.38**	**2.16**				
BH1		**4.10**	**8**	**2.4**	**2.28**				
BH1		**4.80**	**18**	**2.37**	**2**				
BH2		**4.00**	**5**	**2.54**	**2.43**				
BH2		**4.50**	**12**	**2.38**	**2.13**				
BH2		**5.00**	**10**	**2.49**	**2.25**				
BH2		**6.00**	**9**	**2.55**	**2.35**				
BH2		**8.00**	**13**	**2.41**	**2.14**				
BH3		**2.60**	**10**	**2.46**	**2.24**				
BH3		**3.00**	**10**	**2.44**	**2.21**				
BH3		**4.00**	**5**	**2.24**	**2.12**				
BH3		**4.50**	**10**	**2.25**	**2.05**				
BH3		**5.00**	**25**	**2.15**	**1.72**				
BH4		**1.50**	**11**	**2.24**	**2.02**				
BH4		**1.90**	**5**	**2.2**	**2.09**				
BH4		**2.50**	**8**	**2.35**	**2.17**				
BH4		**3.50**	**12**	**2.42**	**2.16**				
BH4		**4.50**	**24**	**2.31**	**1.86**				
BH5		**1.80**	**8**	**2.48**	**2.31**				
BH5		**2.40**	**9**	**2.13**	**1.96**				

27/07/2010 27/07/2010

Checked By **Date** **Approved By** **Date**

LABORATORY TESTING SERVICES LIMITED

Bron-y-Glyn, Penarth

Contract No. **GEO/220/04**

Client Ref No **P244**

SUMMARY OF SOIL DENSITY TESTS.

(B.S. 1377 : PART 4 : 4.3/4.4 : 1990)

Trial Pit Number	Sample Number	Depth m	**Moisture Content %**	**Bulk Density Mg/m3**	**Dry Density Mg/m3**	**Method of Laboratory compaction (kg Rammer)**	**Maximum Dry Density Mg/m3**	**Minimum Dry Density Mg/m3**	**Remarks**
BH5		**2.70**	**6**	**2.23**	**2.11**				
BH5		**3.10**	**3**	**2.27**	**2.19**				
BH5		**3.50**	**12**	**2.2**	**1.97**				
BH6		**1.50**	**12**	**2.42**	**2.15**				
BH6		**2.00**	**11**	**2.45**	**2.21**				
BH6		**2.50**	**5**	**2.24**	**2.14**				
BH6		**3.00**	**5**	**2.22**	**2.12**				
BH7		**3.50**	**12**	**2.45**	**2.2**				
BH7		**4.00**	**5**	**2.16**	**2.06**				
BH7		**4.50**	**6**	**2.3**	**2.17**				
BH7		**5.00**	**5**	**2.2**	**2.09**				
BH7		**6.00**	**17**	**2.33**	**1.99**				

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LABORATORY TESTING SERVICES LIMITED

Bron-y-Glyn, Penarth

Contract No. **GEO/220/04**

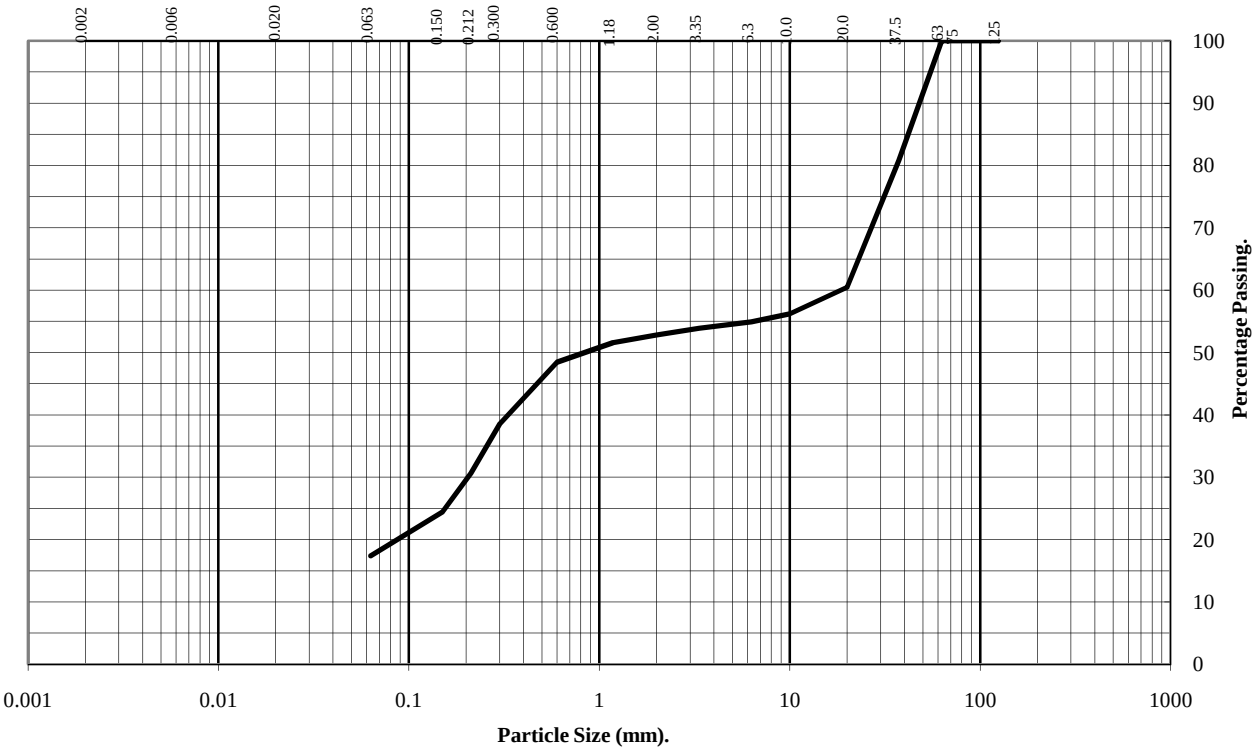
Client Ref No **P244**

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH1** Type: **B** Depth (m): **2.50** to **2.70**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	81
20	60
10	56
6.3	55
3.35	54
2.00	53
1.18	52
0.60	48
0.300	39
0.212	31
0.150	24
0.063	17

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	47
Sand	36
Silt and Clay	17

Remarks:

#- not determined

27/07/2010

Checked by **Date**

27/07/2010

Approved by **Date**

LABORATORY TESTING SERVICES LIMITED

Bosch, Miskin

Contract No.:

10482-070710

Client Ref No:

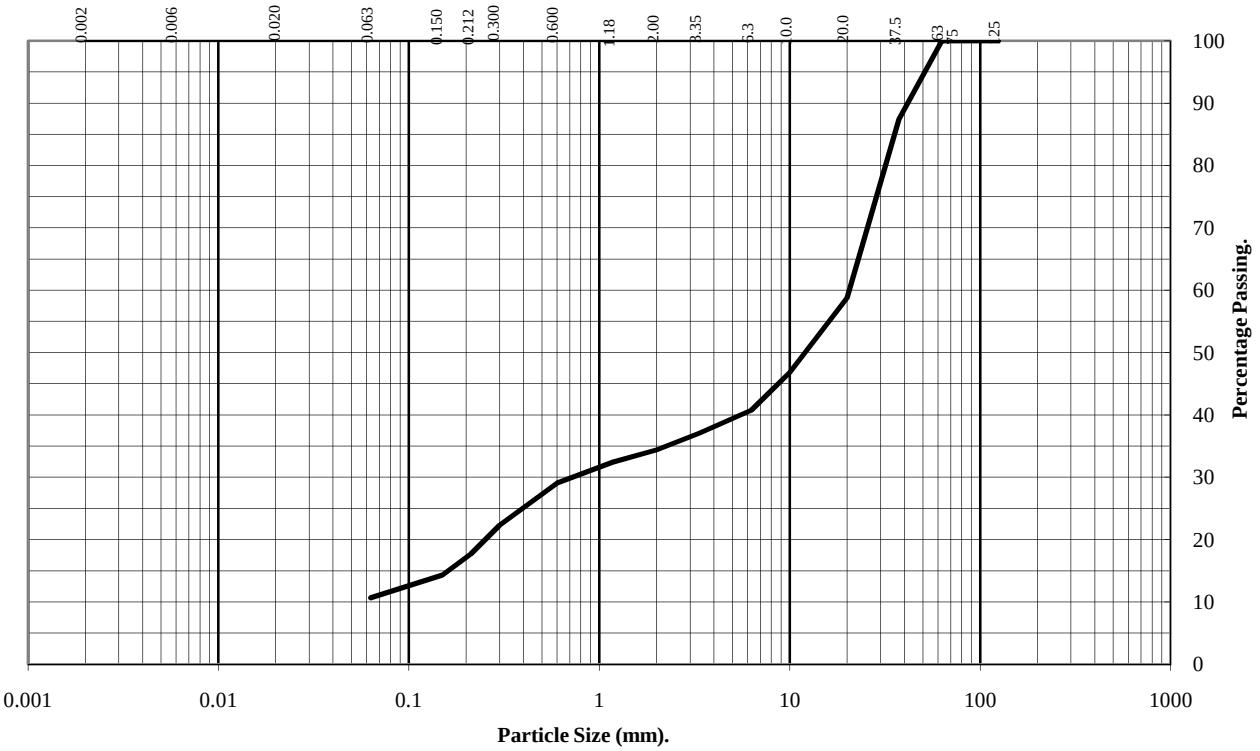
UKAS TESTING 2788

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH1** Type: **B** Depth (m): **3.00** to **3.30**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	87
20	59
10	47
6.3	41
3.35	37
2.00	34
1.18	32
0.60	29
0.300	22
0.212	18
0.150	14
0.063	11

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	66
Sand	23
Silt and Clay	11

Remarks:

#- not determined

27/07/2010

Checked by **Date**

27/07/2010

Approved by **Date**

LABORATORY TESTING SERVICES LIMITED

Bosch, Miskin

Contract No.:

10482-070710

Client Ref No:

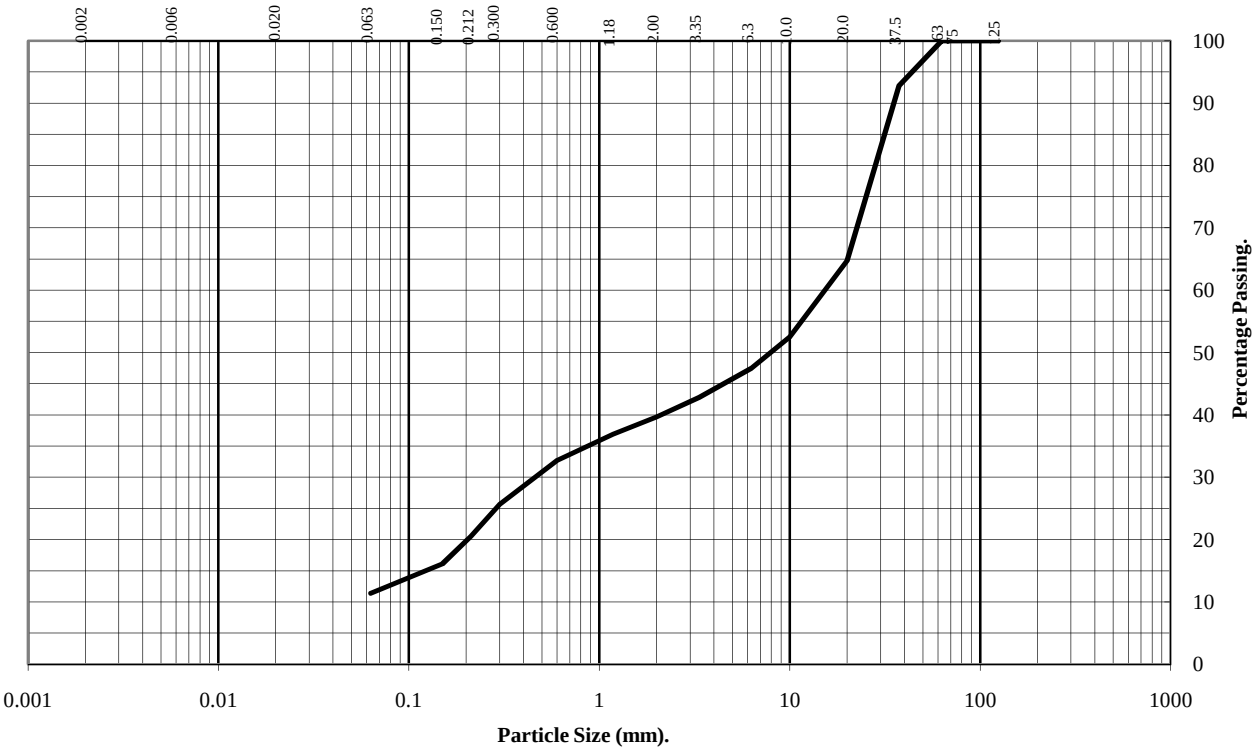
UKAS TESTING 2788

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH1** Type: **B** Depth (m): **3.50** to **4.00**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	93
20	65
10	52
6.3	47
3.35	43
2.00	40
1.18	37
0.60	33
0.300	26
0.212	21
0.150	16
0.063	11

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	60
Sand	29
Silt and Clay	11

Remarks:

#- not determined

27/07/2010

Checked by **Date**

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LABORATORY TESTING SERVICES LIMITED

Bosch, Miskin

Contract No.:

10482-070710

Client Ref No:

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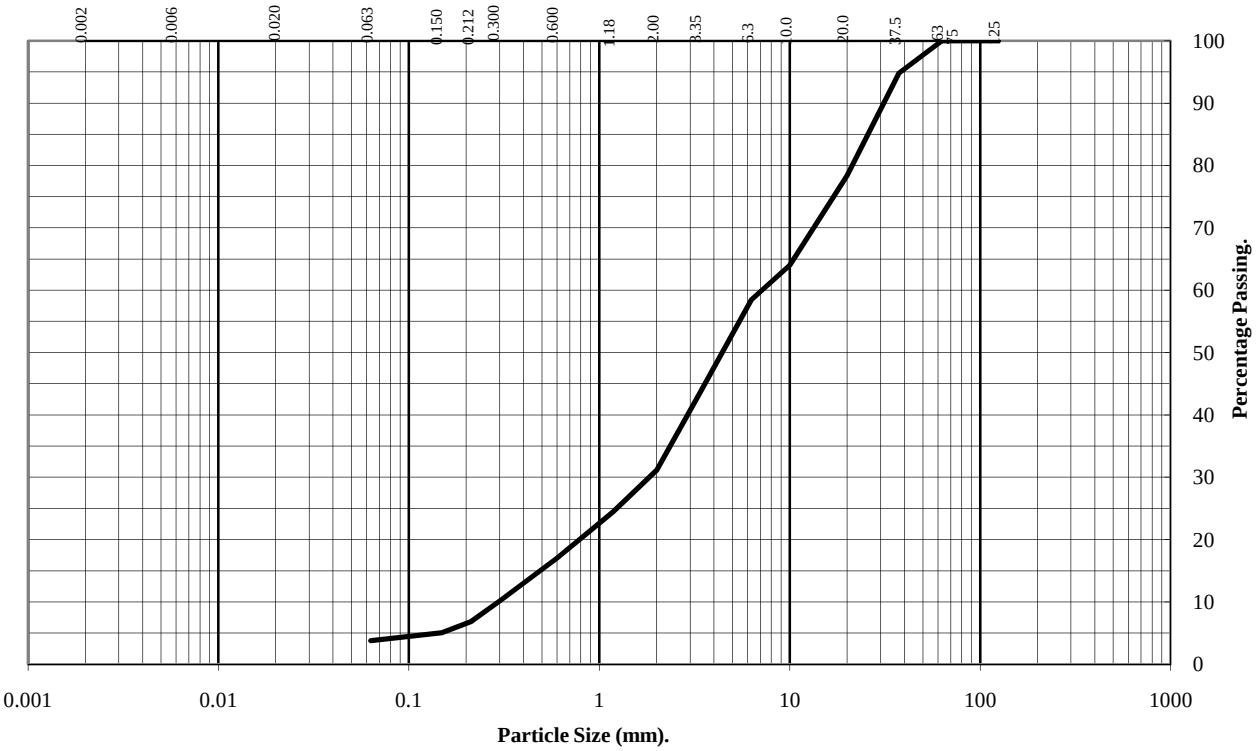
PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH1** Type: **B** Depth (m): **4.10** to **4.60**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	95
20	78
10	64
6.3	58
3.35	43
2.00	31
1.18	24
0.60	17
0.300	10
0.212	7
0.150	5
0.063	4

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	69
Sand	27
Silt and Clay	4

Remarks:

#- not determined

27/07/2010

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LABORATORY TESTING SERVICES LIMITED

Bosch, Miskin

Contract No.:

10482-070710

Client Ref No:

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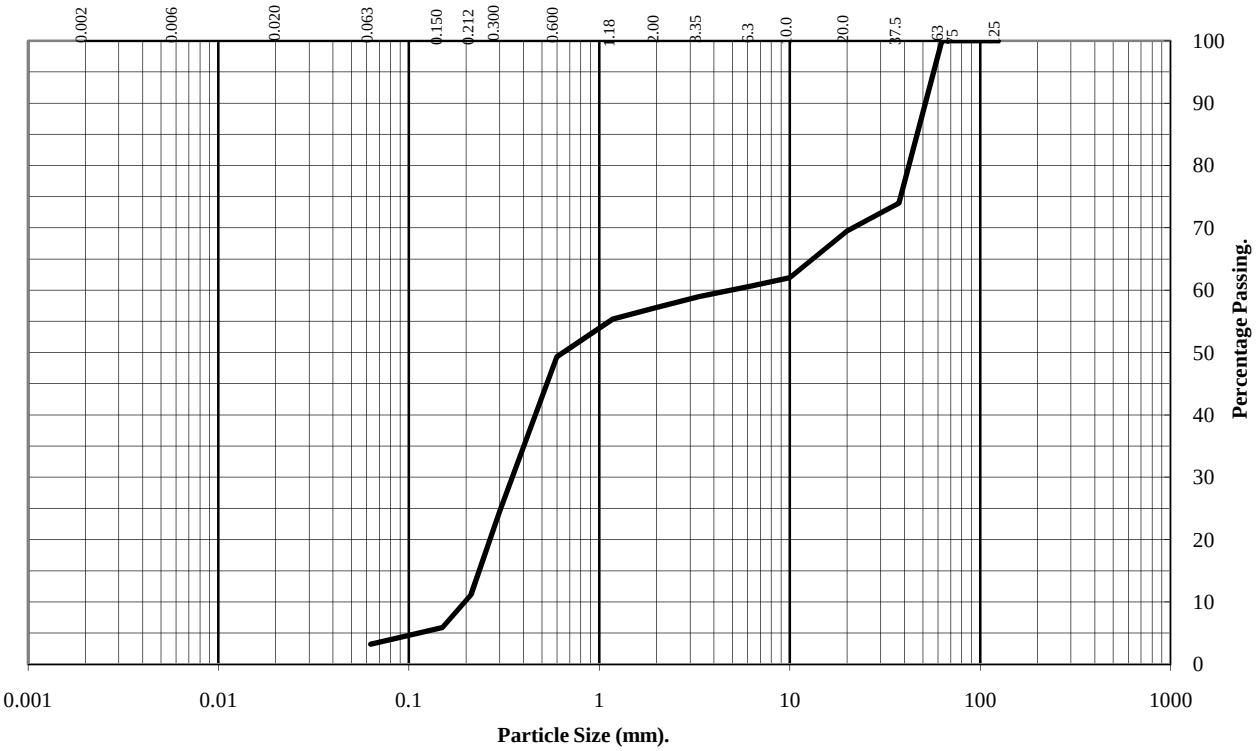
PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH1** Type: **B** Depth (m): **4.80** to **5.10**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	74
20	69
10	62
6.3	61
3.35	59
2.00	57
1.18	55
0.60	49
0.300	24
0.212	11
0.150	6
0.063	3

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	43
Sand	54
Silt and Clay	3

Remarks:

#- not determined

27/07/2010

Checked by **Date**

27/07/2010

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LABORATORY TESTING SERVICES LIMITED

Bosch, Miskin

Contract No.:

10482-070710

Client Ref No:

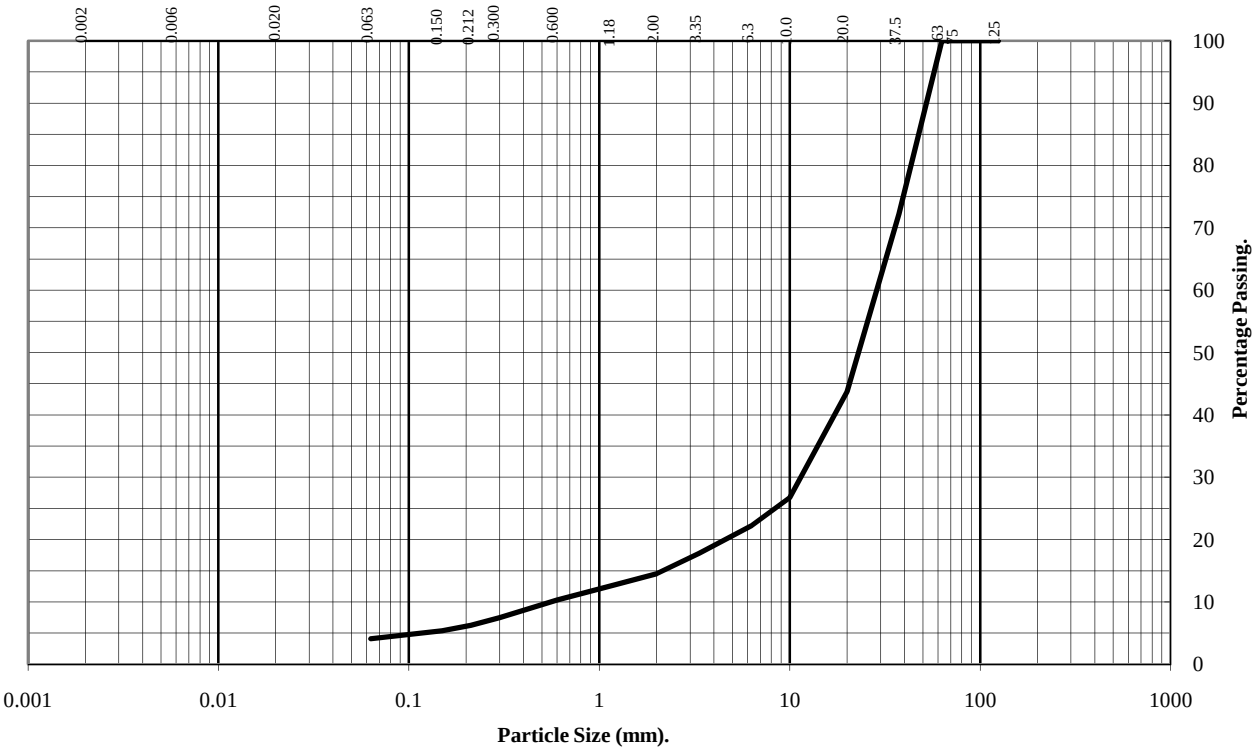
UKAS TESTING 2788

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH2** Type: **B** Depth (m): **4.00** to **4.50**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	72
20	44
10	27
6.3	22
3.35	18
2.00	15
1.18	13
0.60	10
0.300	7
0.212	6
0.150	5
0.063	4

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	85
Sand	11
Silt and Clay	4

Remarks:

#- not determined

27/07/2010

Checked by **Date**

27/07/2010

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LABORATORY TESTING SERVICES LIMITED

Bosch, Miskin

Contract No.:

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Client Ref No:

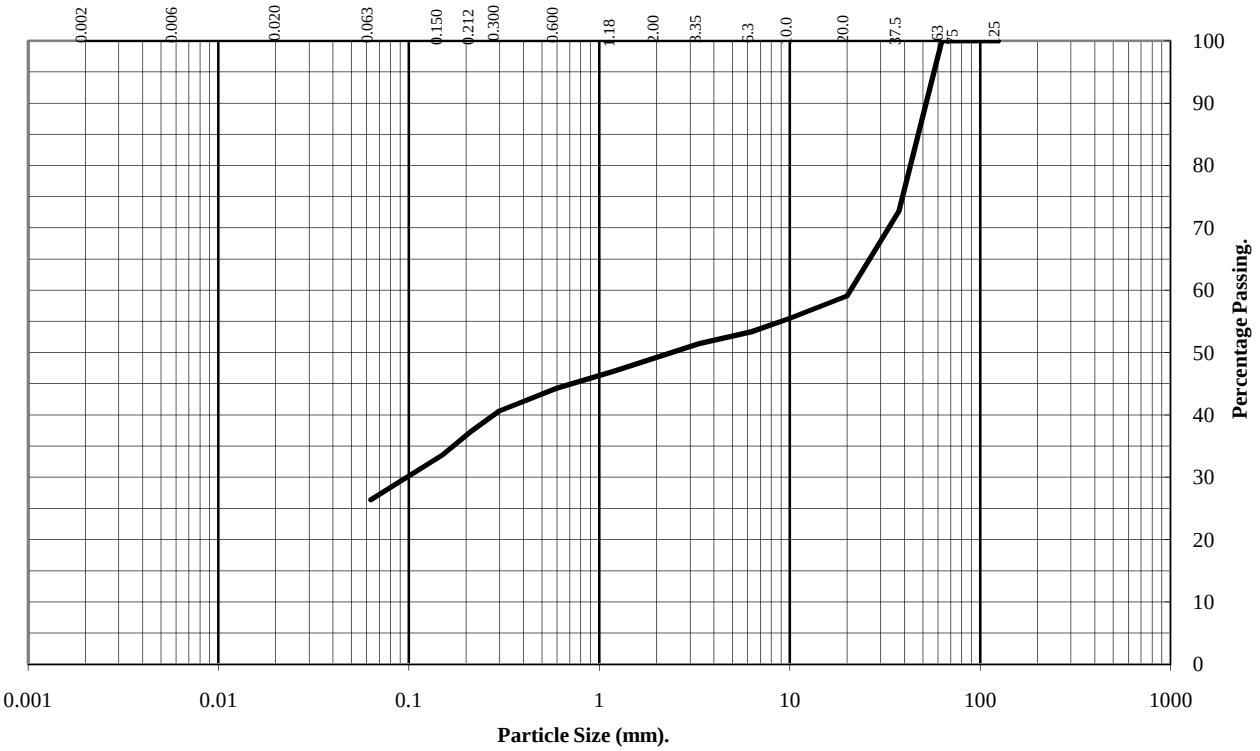
UKAS TESTING 2788

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH2** Type: **B** Depth (m): **4.50** to **5.00**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	73
20	59
10	55
6.3	53
3.35	51
2.00	49
1.18	47
0.60	44
0.300	41
0.212	37
0.150	34
0.063	26

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	51
Sand	23
Silt and Clay	26

Remarks:

#- not determined

27/07/2010

Checked by **Date**

27/07/2010

Approved by **Date**

LABORATORY TESTING SERVICES LIMITED

Bosch, Miskin

Contract No.:

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Client Ref No:

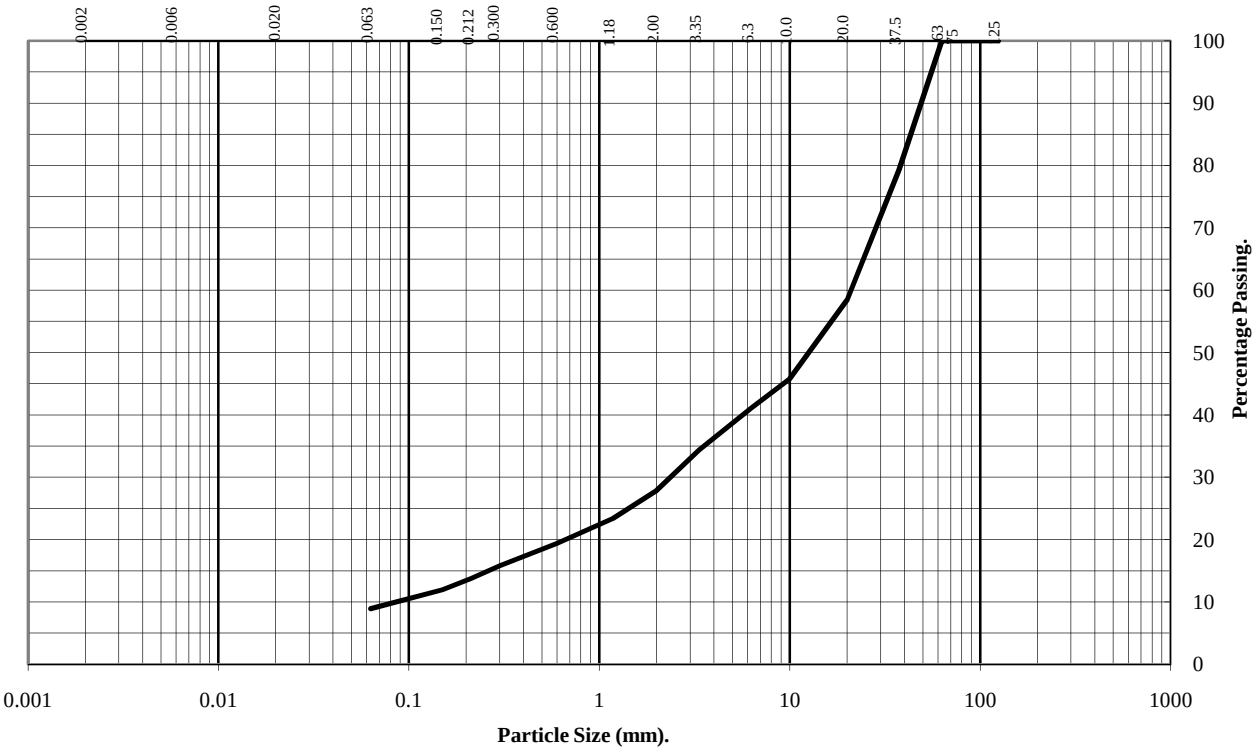
UKAS TESTING 2788

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH2** Type: **B** Depth (m): **5.00** to **6.00**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	79
20	58
10	46
6.3	41
3.35	34
2.00	28
1.18	23
0.60	19
0.300	16
0.212	14
0.150	12
0.063	9

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	72
Sand	19
Silt and Clay	9

Remarks:

#- not determined

27/07/2010

Checked by **Date**

27/07/2010

Approved by **Date**

LABORATORY TESTING SERVICES LIMITED

Bosch, Miskin

Contract No.:

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Client Ref No:

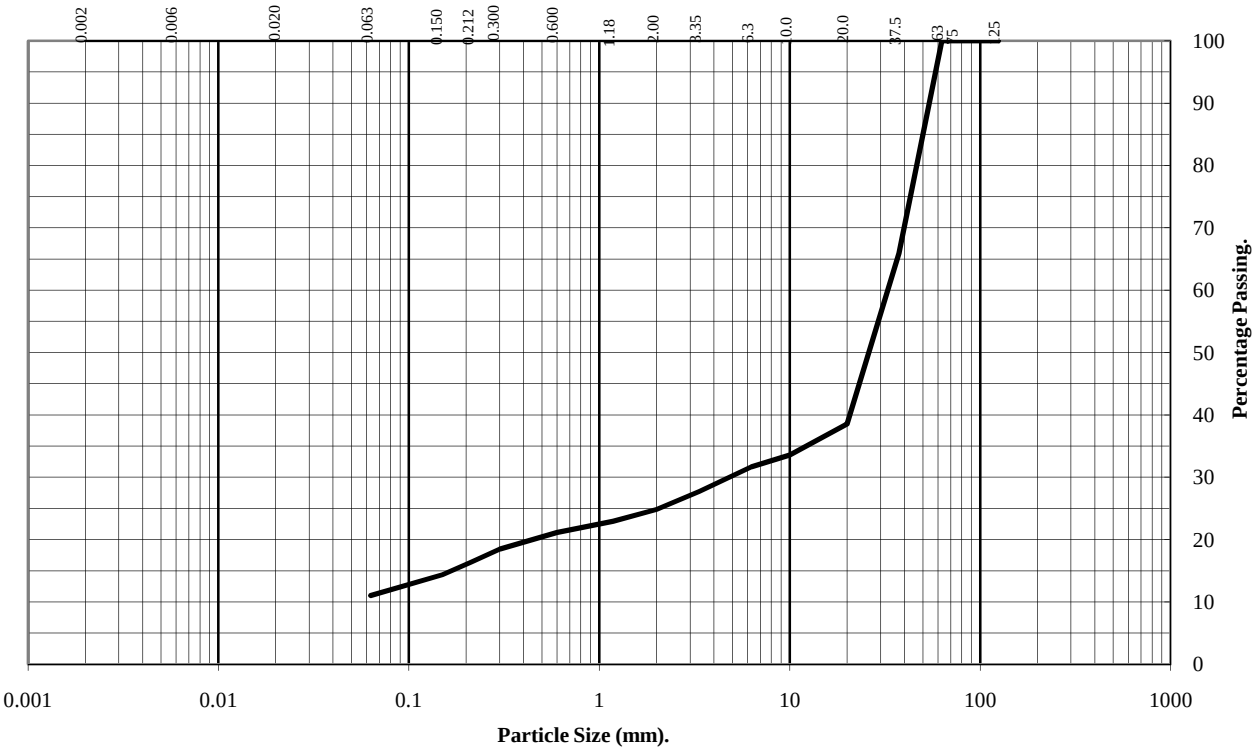
UKAS TESTING 2788

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH2** Type: **B** Depth (m): **6.00** to **7.00**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	66
20	39
10	34
6.3	32
3.35	28
2.00	25
1.18	23
0.60	21
0.300	18
0.212	16
0.150	14
0.063	11

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	75
Sand	14
Silt and Clay	11

Remarks:

#- not determined

27/07/2010

Checked by **Date**

27/07/2010

Approved by **Date**

LABORATORY TESTING SERVICES LIMITED

Bosch, Miskin

Contract No.:

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Client Ref No:

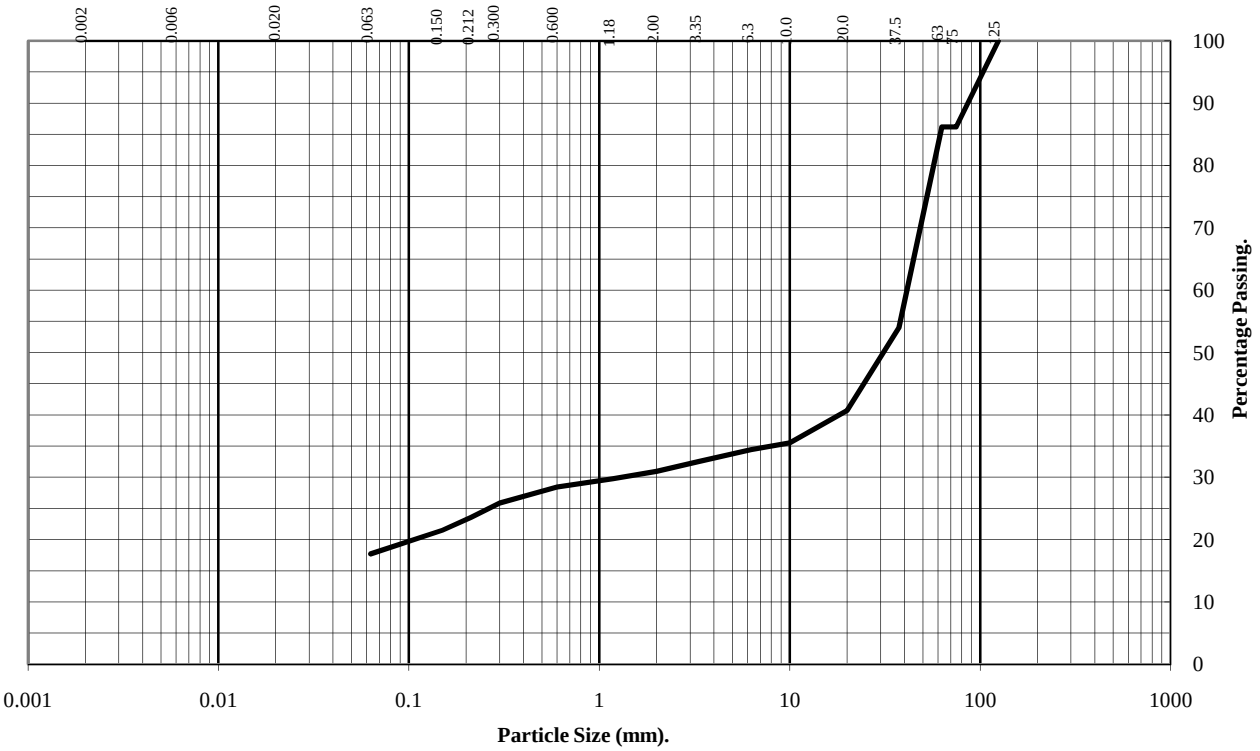
UKAS TESTING 2788

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH2** Type: **B** Depth (m): **8.00** to **9.00**



BS Test Sieve	Percentage Passing
125	100
75	86
63	86
37.5	54
20	41
10	36
6.3	34
3.35	33
2.00	31
1.18	30
0.60	28
0.300	26
0.212	24
0.150	21
0.063	18

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	14
Gravel	55
Sand	13
Silt and Clay	18

Remarks:

#- not determined

27/07/2010

Checked by **Date**

27/07/2010

Approved by **Date**

LABORATORY TESTING SERVICES LIMITED

Bosch, Miskin

Contract No.:

10482-070710

Client Ref No:

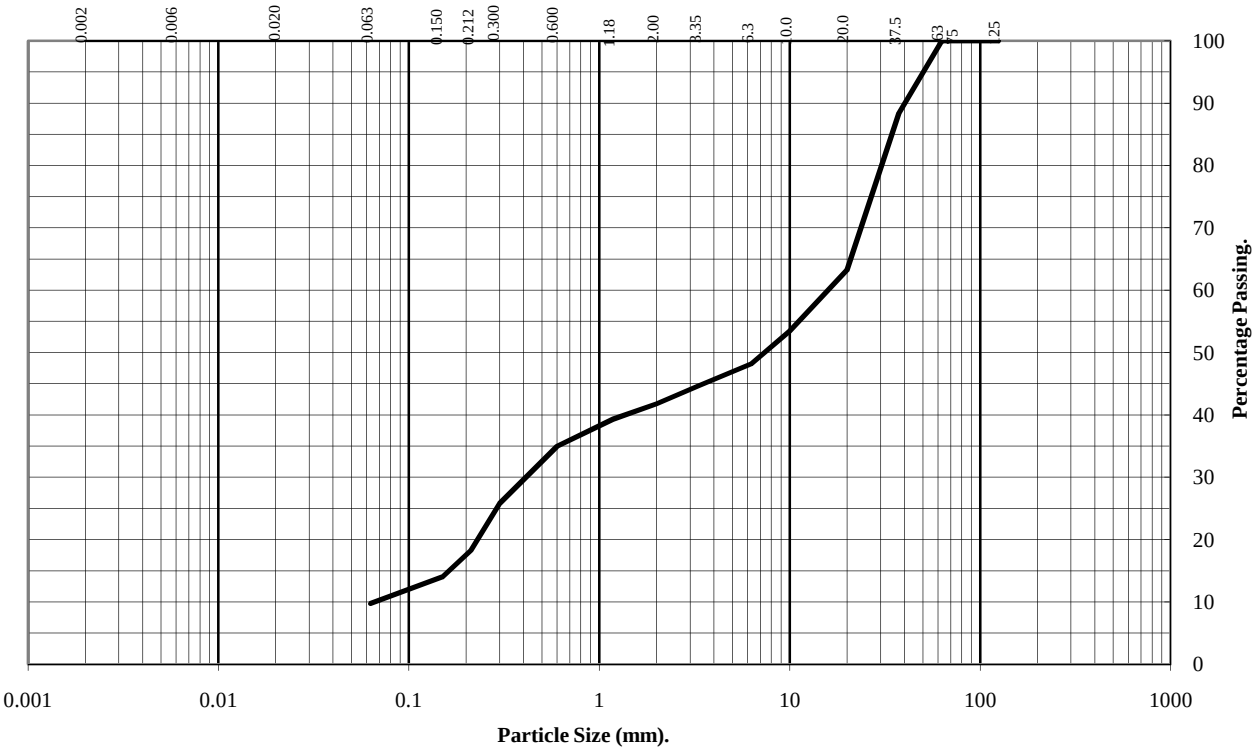
UKAS TESTING 2788

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH3** Type: **B** Depth (m): **2.60** to **3.00**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	88
20	63
10	53
6.3	48
3.35	45
2.00	42
1.18	39
0.60	35
0.300	26
0.212	18
0.150	14
0.063	10

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	58
Sand	32
Silt and Clay	10

Remarks:

#- not determined

27/07/2010

Checked by **Date**

27/07/2010

Approved by **Date**

LABORATORY TESTING SERVICES LIMITED

Bosch, Miskin

Contract No.:

10482-070710

Client Ref No:

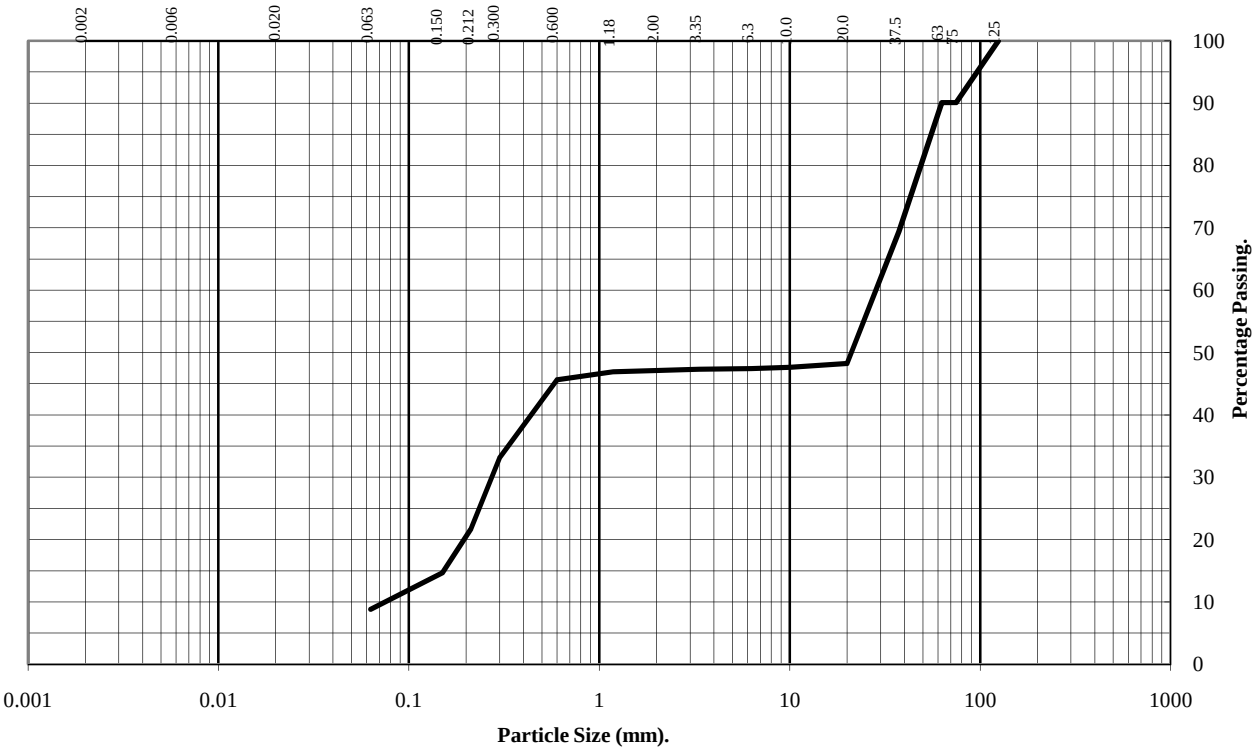
UKAS TESTING 2788

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH3** Type: **B** Depth (m): **3.00** to **4.00**



BS Test Sieve	Percentage Passing
125	100
75	90
63	90
37.5	69
20	48
10	48
6.3	47
3.35	47
2.00	47
1.18	47
0.60	46
0.300	33
0.212	22
0.150	15
0.063	9

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	10
Gravel	43
Sand	38
Silt and Clay	9

Remarks:

#- not determined

27/07/2010

Checked by **Date**

27/07/2010

Approved by **Date**

LABORATORY TESTING SERVICES LIMITED

Bosch, Miskin

Contract No.:

10482-070710

Client Ref No:

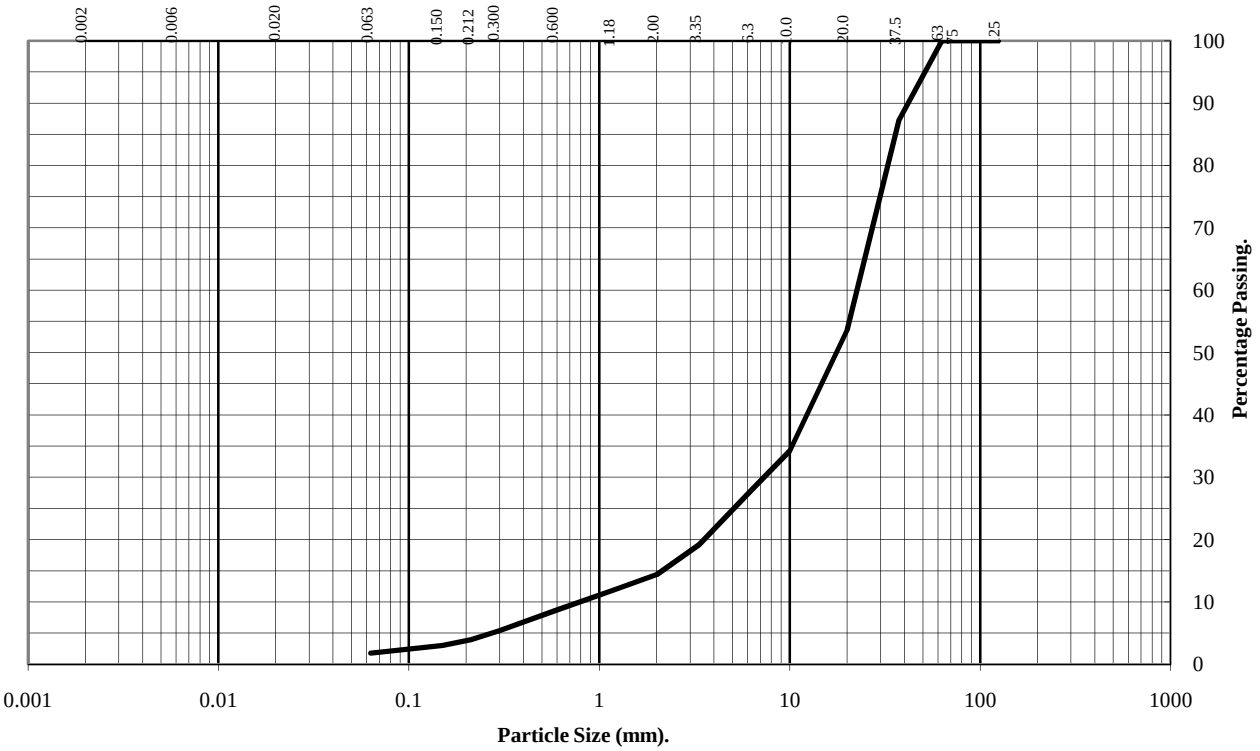
UKAS TESTING 2788

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH3** Type: **B** Depth (m): **4.00** to **4.50**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	87
20	54
10	34
6.3	28
3.35	19
2.00	14
1.18	12
0.60	9
0.300	5
0.212	4
0.150	3
0.063	2

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	86
Sand	12
Silt and Clay	2

Remarks:

#- not determined

27/07/2010

Checked by **Date**

27/07/2010

Approved by **Date**

LABORATORY TESTING SERVICES LIMITED

Bosch, Miskin

Contract No.:

10482-070710

Client Ref No:

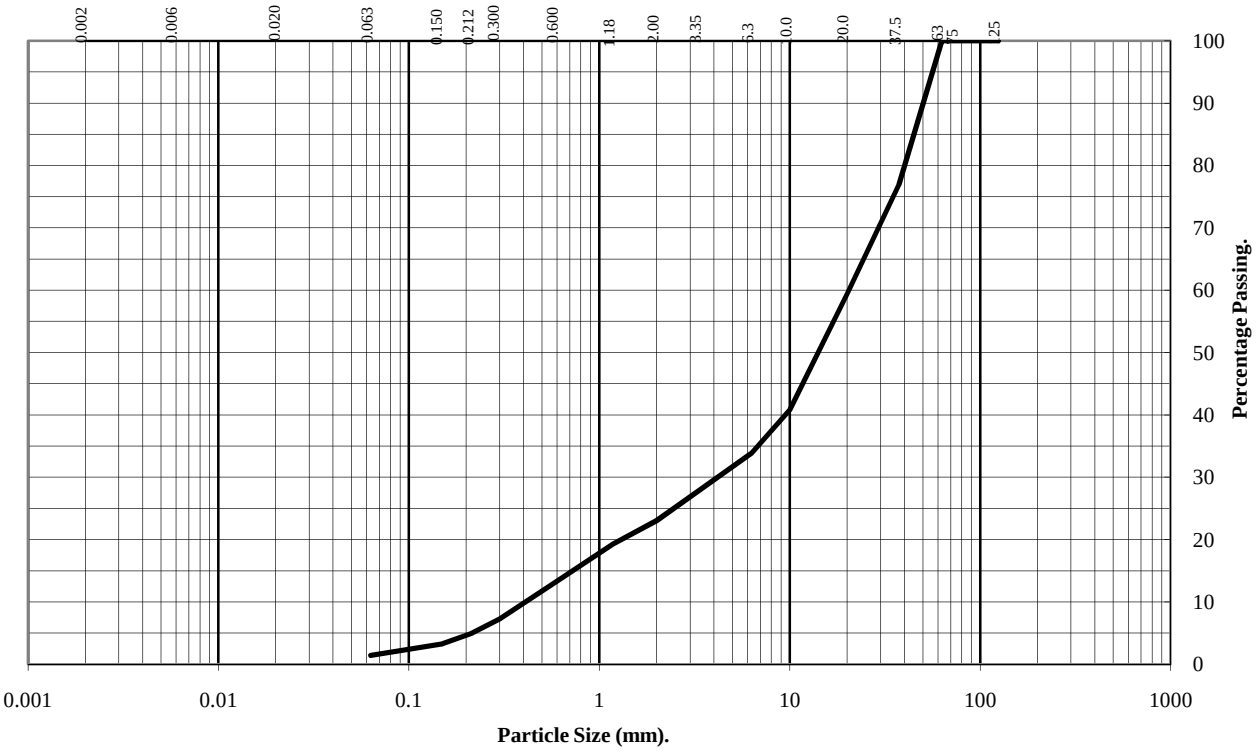
UKAS TESTING 2788

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH3** Type: **B** Depth (m): **4.50** to **5.00**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	77
20	59
10	41
6.3	34
3.35	28
2.00	23
1.18	19
0.60	13
0.300	7
0.212	5
0.150	3
0.063	1

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	77
Sand	22
Silt and Clay	1

Remarks:

#- not determined

27/07/2010

Checked by **Date**

27/07/2010

Approved by **Date**

LABORATORY TESTING SERVICES LIMITED

Bosch, Miskin

Contract No.:

10482-070710

Client Ref No:

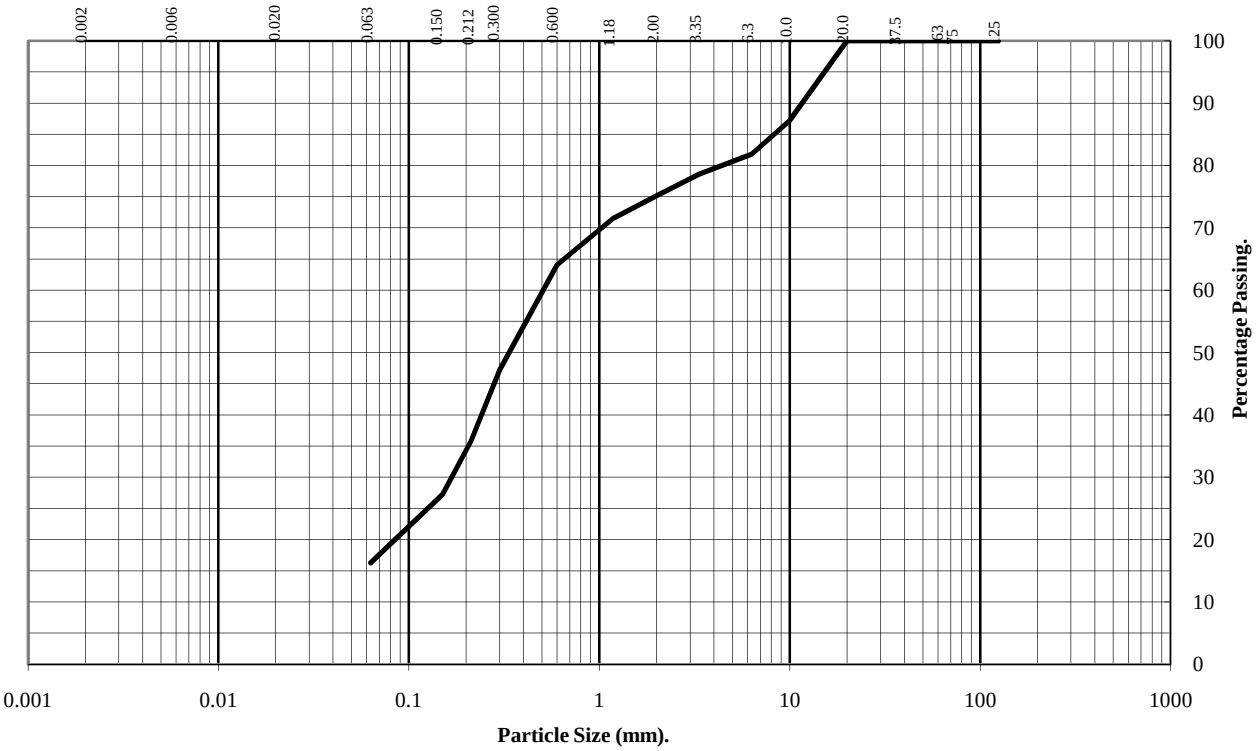
UKAS TESTING 2788

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH3** Type: **B** Depth (m): **5.00** to **6.00**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	87
6.3	82
3.35	79
2.00	75
1.18	71
0.60	64
0.300	47
0.212	36
0.150	27
0.063	16

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	25
Sand	59
Silt and Clay	16

Remarks:

#- not determined

27/07/2010

Checked by **Date**

27/07/2010

Approved by **Date**

LABORATORY TESTING SERVICES LIMITED

Bosch, Miskin

Contract No.:

10482-070710

Client Ref No:

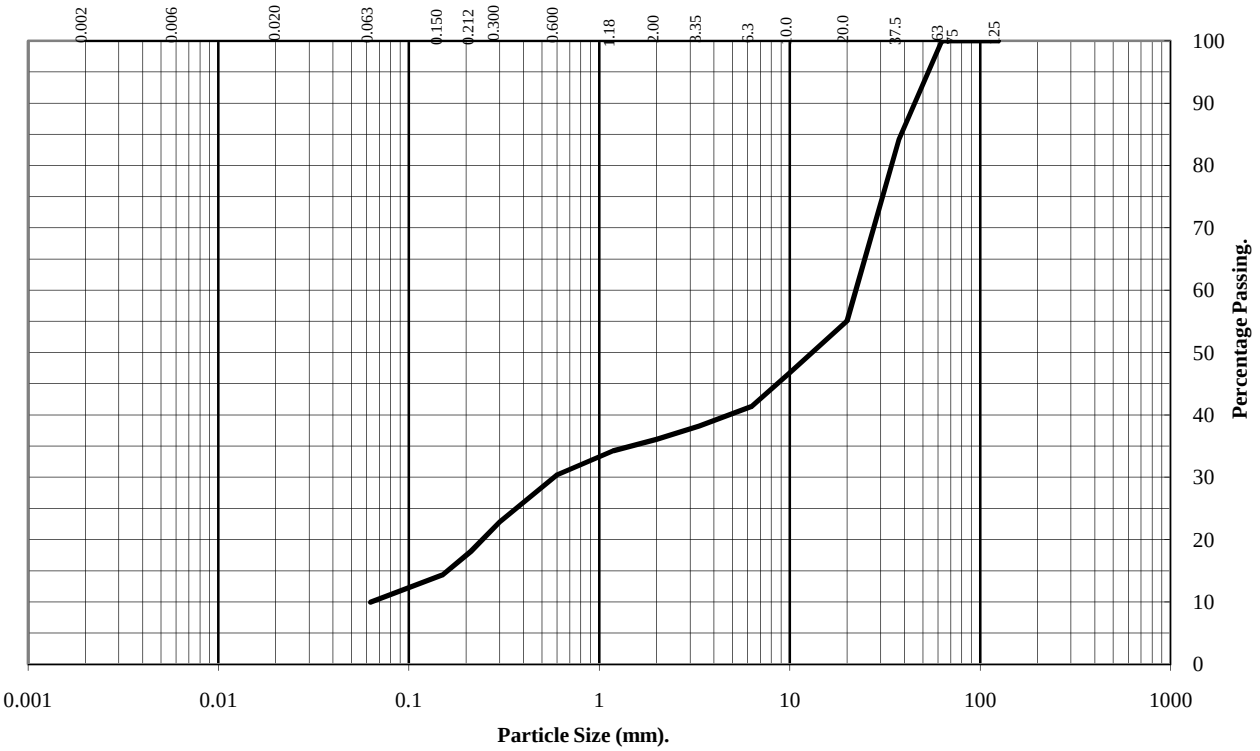
UKAS TESTING 2788

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH4** Type: **B** Depth (m): **1.50** to **1.90**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	84
20	55
10	47
6.3	41
3.35	38
2.00	36
1.18	34
0.60	30
0.300	23
0.212	18
0.150	14
0.063	10

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	64
Sand	26
Silt and Clay	10

Remarks:

#- not determined

27/07/2010

Checked by **Date**

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Approved by **Date**

LABORATORY TESTING SERVICES LIMITED

Bosch, Miskin

Contract No.:

10482-070710

Client Ref No:

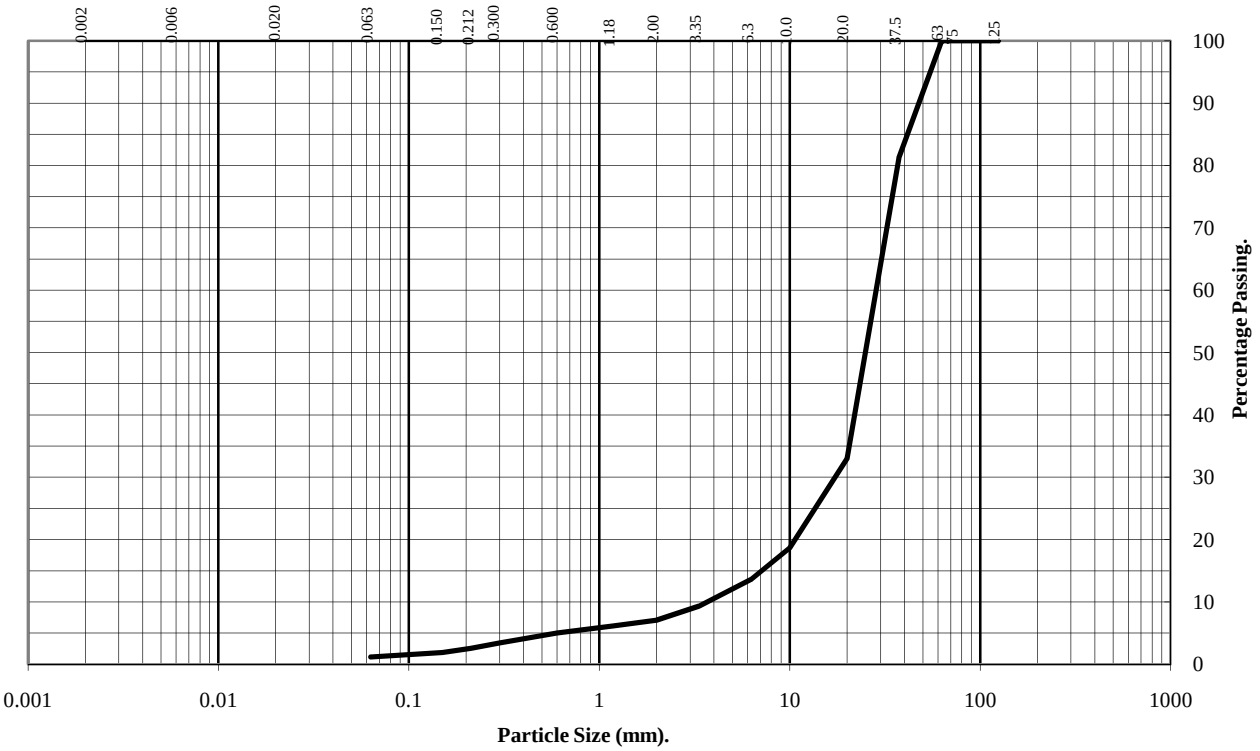
UKAS TESTING 2788

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH4** Type: **B** Depth (m): **1.90** to **2.30**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	81
20	33
10	19
6.3	14
3.35	9
2.00	7
1.18	6
0.60	5
0.300	3
0.212	3
0.150	2
0.063	1

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	93
Sand	6
Silt and Clay	1

Remarks:

#- not determined

27/07/2010

Checked by **Date**

27/07/2010

Approved by **Date**

LABORATORY TESTING SERVICES LIMITED

Bosch, Miskin

Contract No.:

10482-070710

Client Ref No:

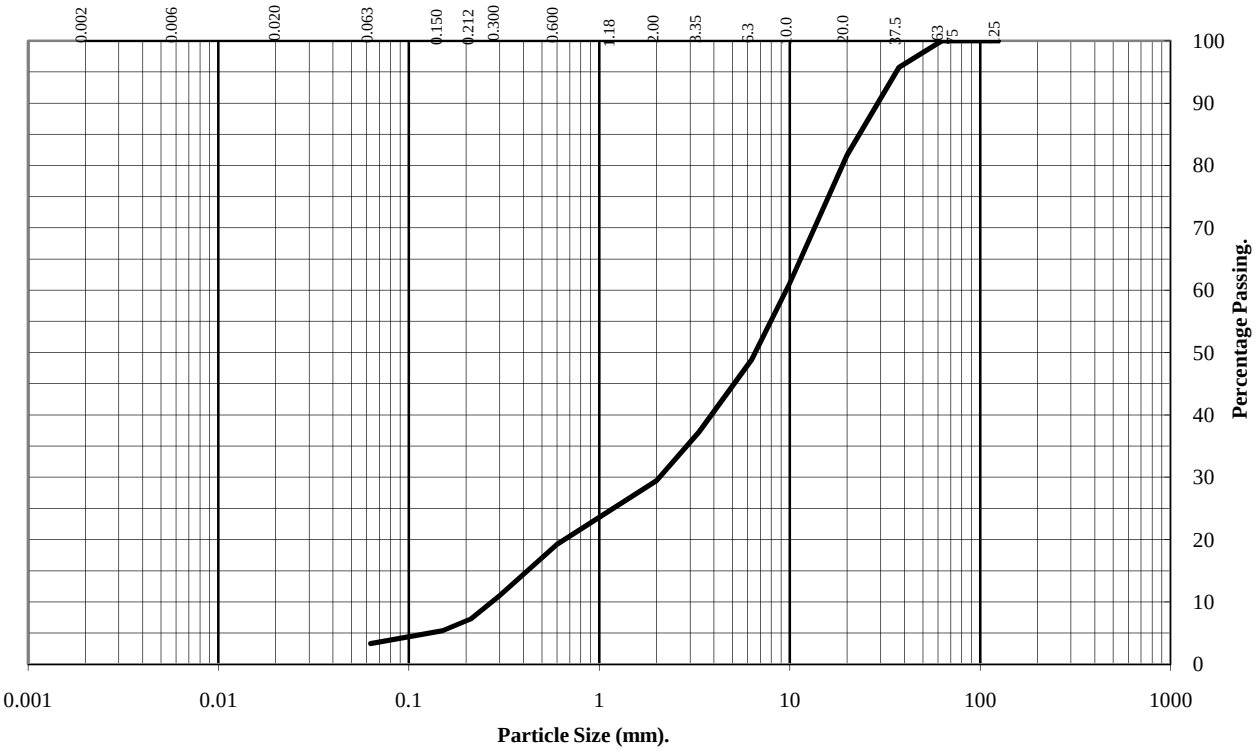
UKAS TESTING 2788

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH4** Type: **B** Depth (m): **2.50** to **3.00**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	96
20	82
10	61
6.3	49
3.35	37
2.00	29
1.18	25
0.60	19
0.300	11
0.212	7
0.150	5
0.063	3

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	71
Sand	26
Silt and Clay	3

Remarks:

#- not determined

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Checked by **Date** **Approved by** **Date**

LABORATORY TESTING SERVICES LIMITED

Bosch, Miskin

Contract No.:
10482-070710
Client Ref No:

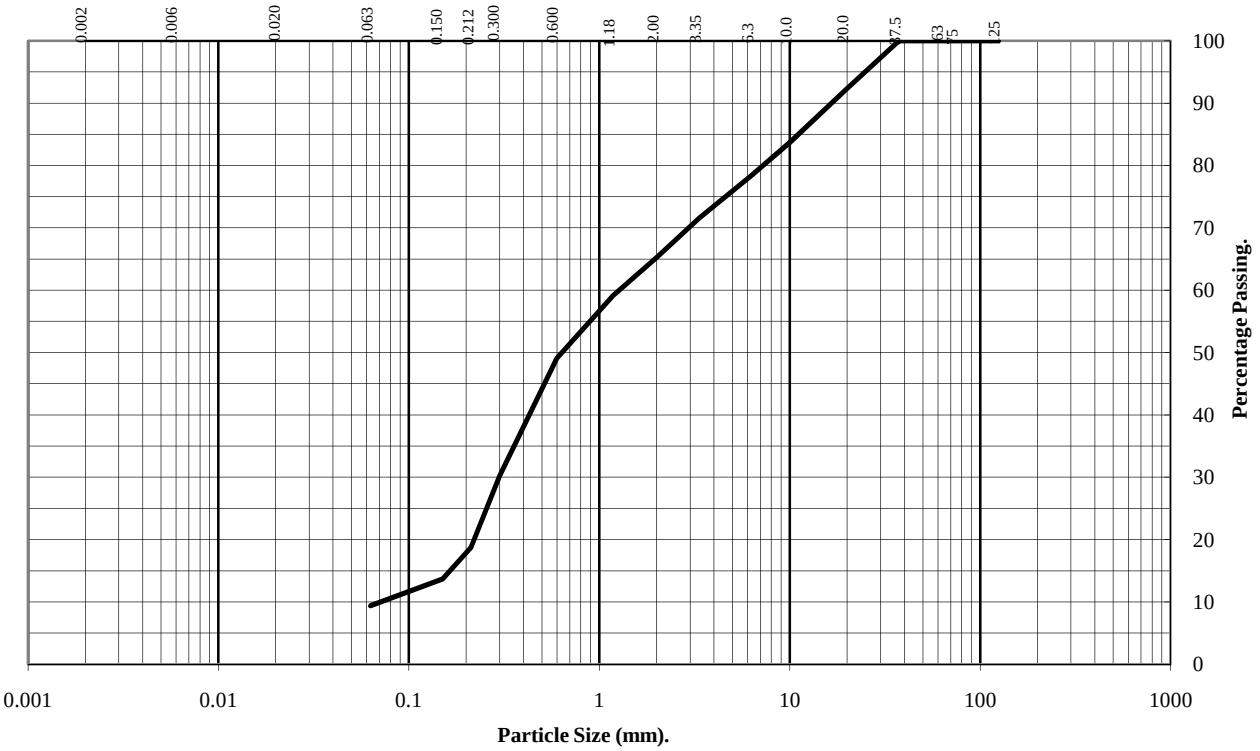
UKAS TESTING 2788

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH4** Type: **B** Depth (m): **3.50** to **4.00**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	92
10	84
6.3	78
3.35	72
2.00	65
1.18	59
0.60	49
0.300	30
0.212	19
0.150	14
0.063	9

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	35
Sand	56
Silt and Clay	9

Remarks:

#- not determined

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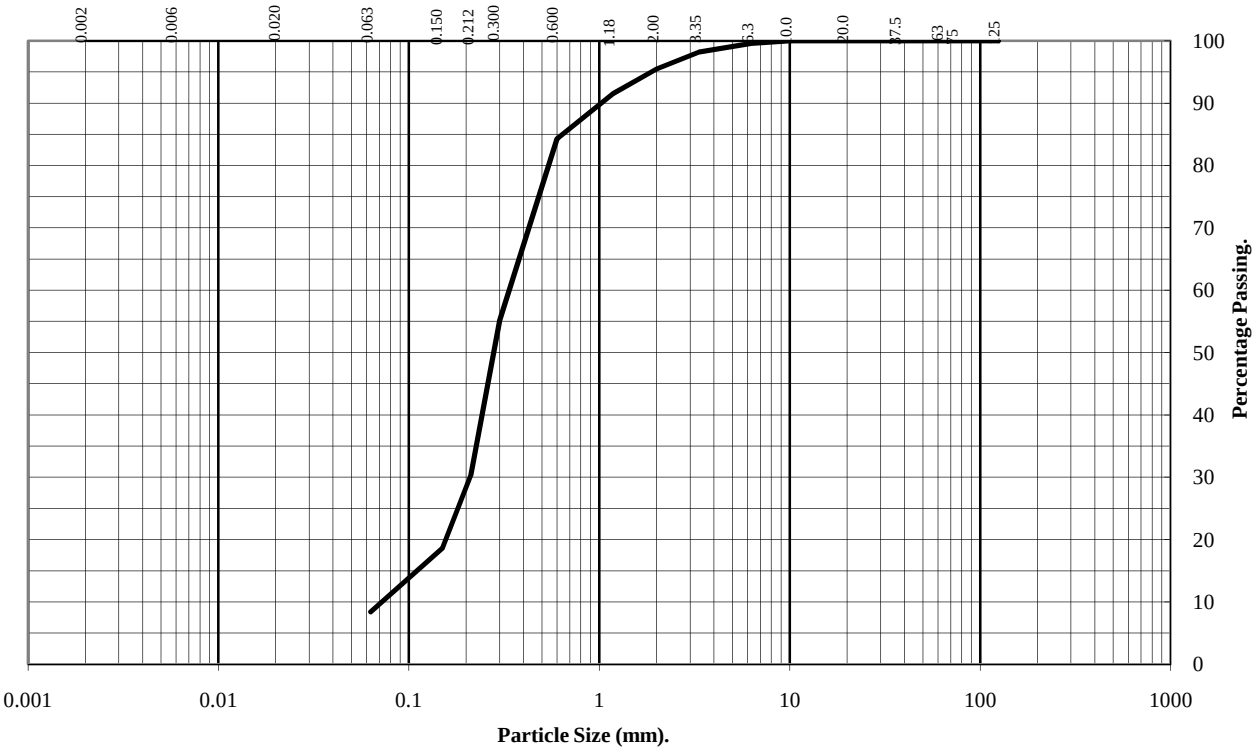
PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH4** Type: **B** Depth (m): **4.50** to **4.90**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	100
6.3	100
3.35	98
2.00	95
1.18	92
0.60	84
0.300	55
0.212	30
0.150	19
0.063	8

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	5
Sand	87
Silt and Clay	8

Remarks:

#- not determined

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LABORATORY TESTING SERVICES LIMITED

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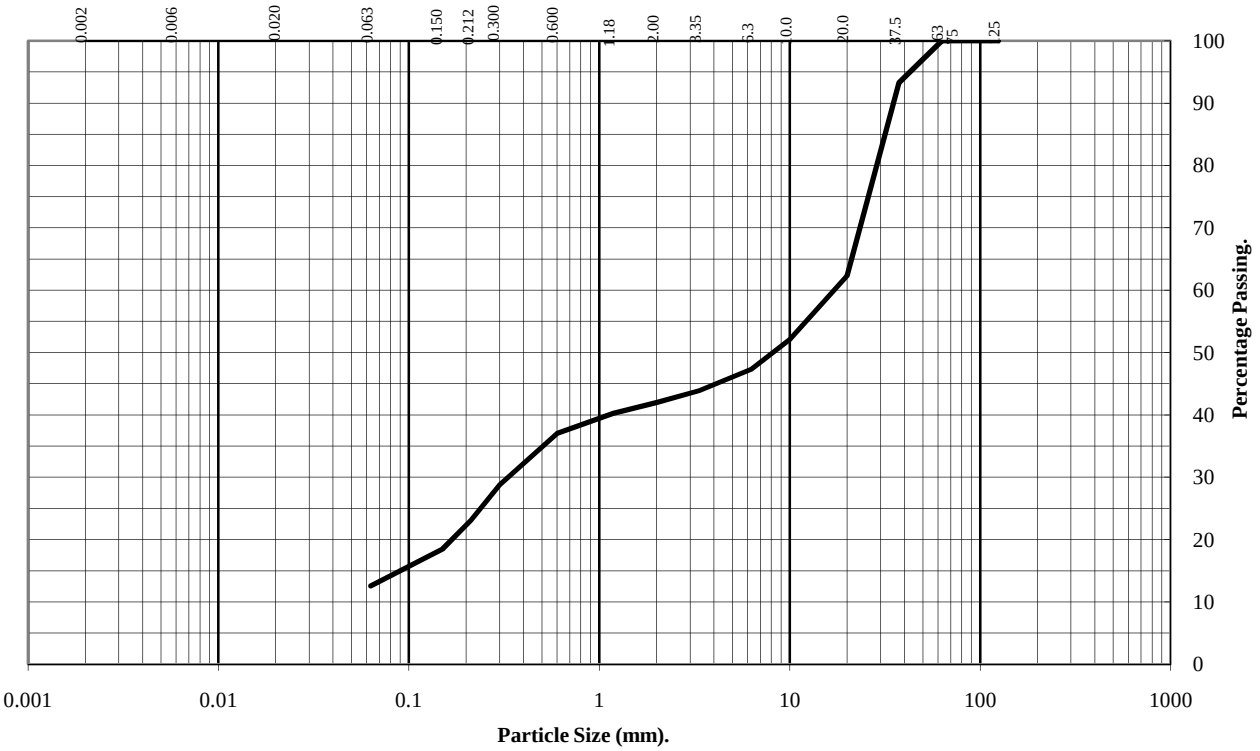
PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH5** Type: **B** Depth (m): **1.80** to **2.40**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	93
20	62
10	52
6.3	47
3.35	44
2.00	42
1.18	40
0.60	37
0.300	29
0.212	23
0.150	18
0.063	13

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	58
Sand	29
Silt and Clay	13

Remarks:

#- not determined

27/07/2010

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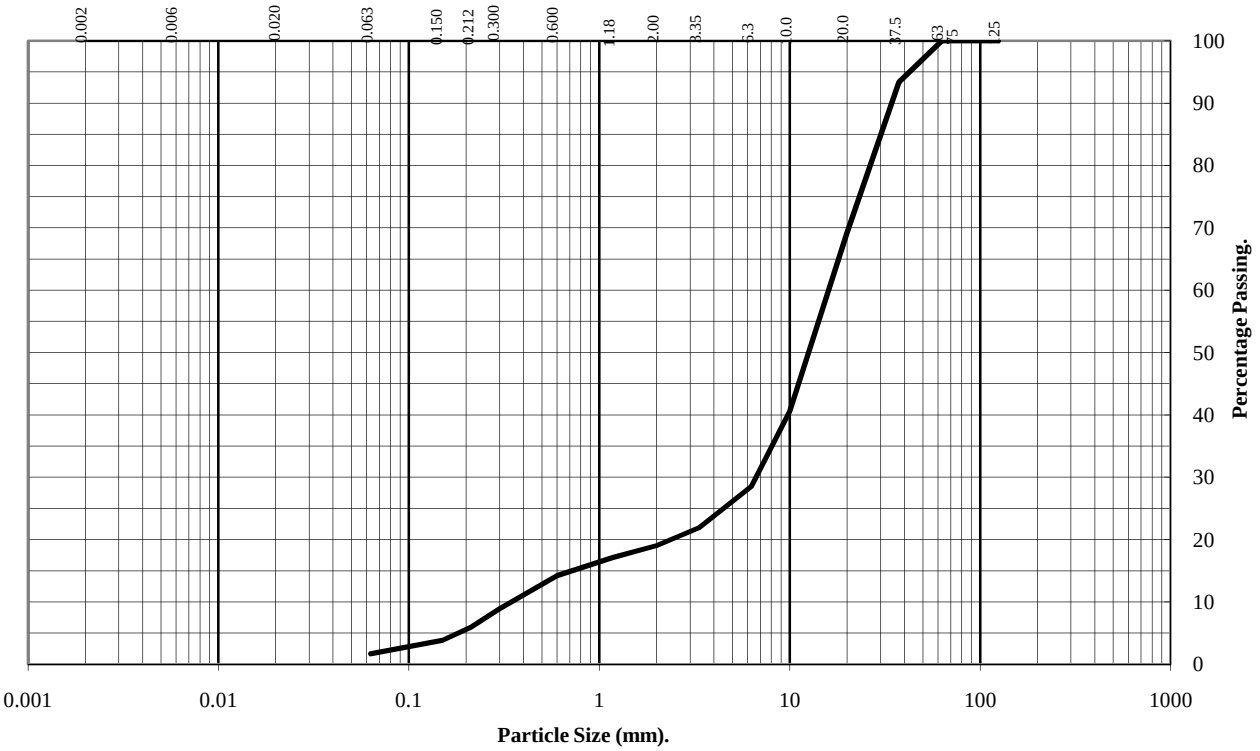
PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH5** Type: **B** Depth (m): **2.40** to **2.70**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	93
20	69
10	41
6.3	29
3.35	22
2.00	19
1.18	17
0.60	14
0.300	9
0.212	6
0.150	4
0.063	2

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	81
Sand	17
Silt and Clay	2

Remarks:

#- not determined

27/07/2010

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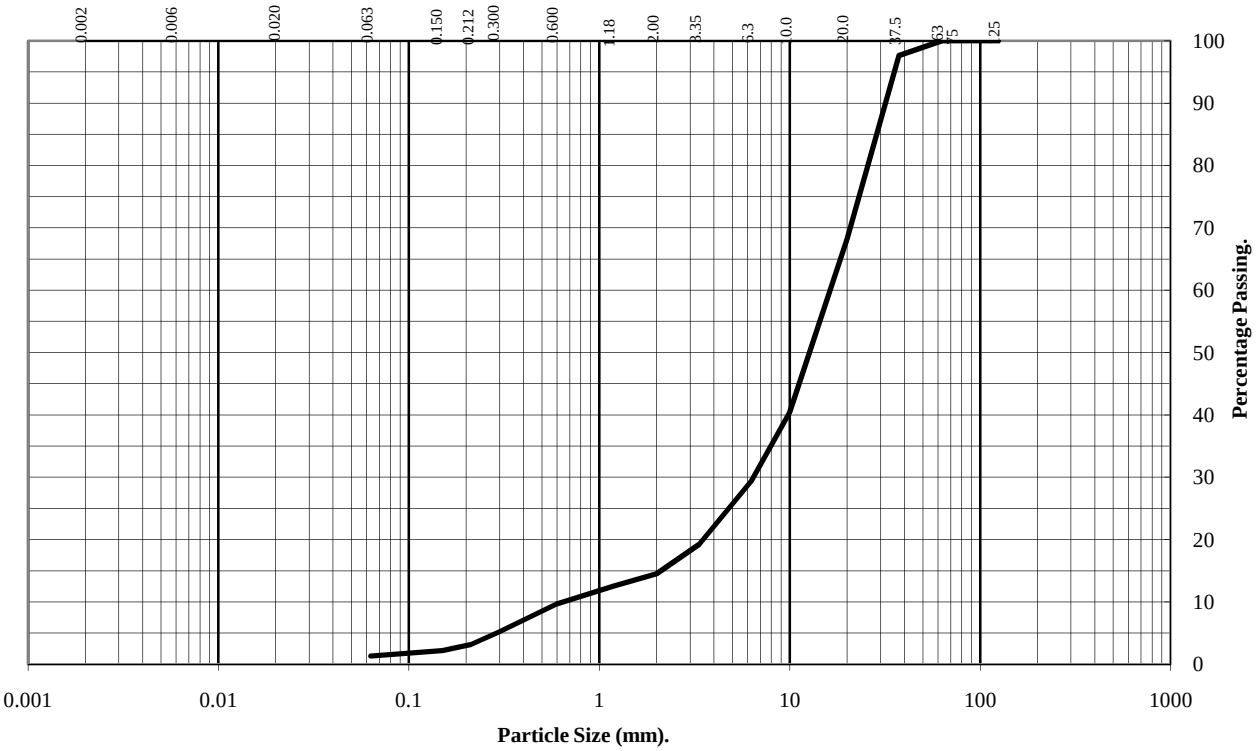
PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH5** Type: **B** Depth (m): **2.70** to **3.00**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	98
20	68
10	40
6.3	29
3.35	19
2.00	15
1.18	13
0.60	10
0.300	5
0.212	3
0.150	2
0.063	1

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	85
Sand	14
Silt and Clay	1

Remarks:

#- not determined

27/07/2010

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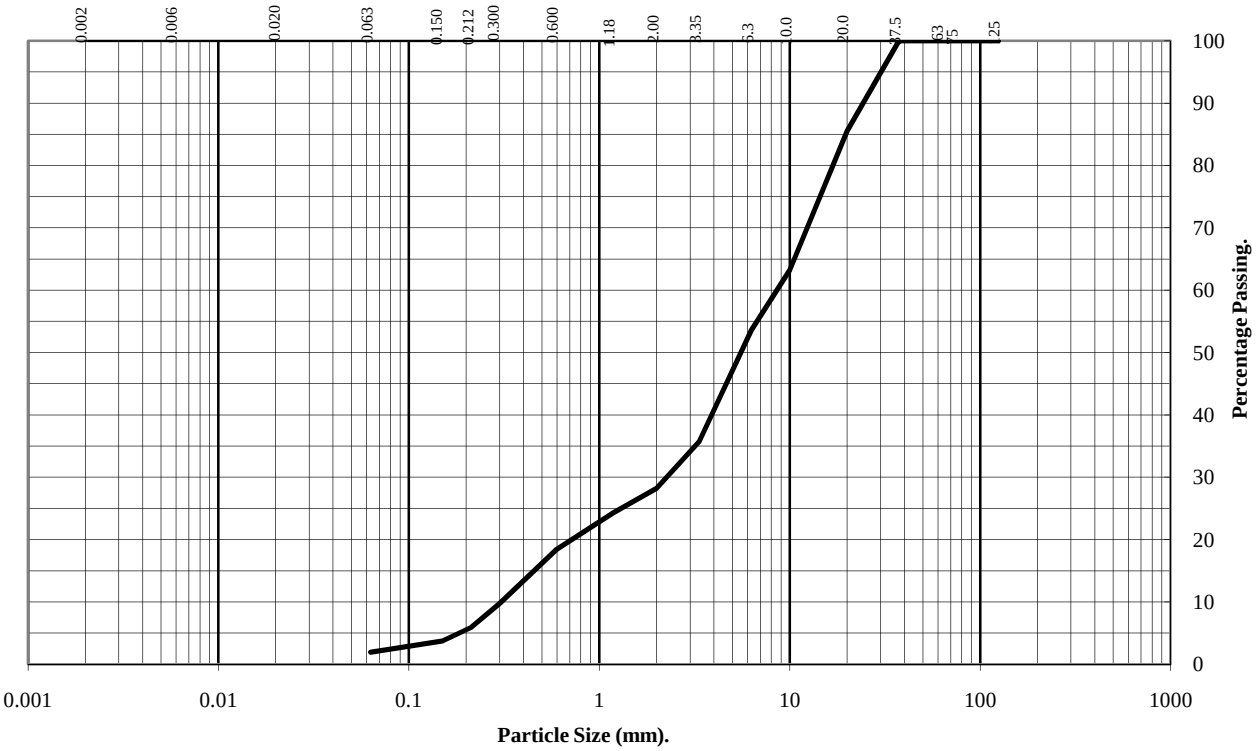
PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH5** Type: **B** Depth (m): **3.10** to **3.50**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	86
10	63
6.3	54
3.35	36
2.00	28
1.18	24
0.60	18
0.300	10
0.212	6
0.150	4
0.063	2

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	72
Sand	26
Silt and Clay	2

Remarks:

#- not determined

27/07/2010

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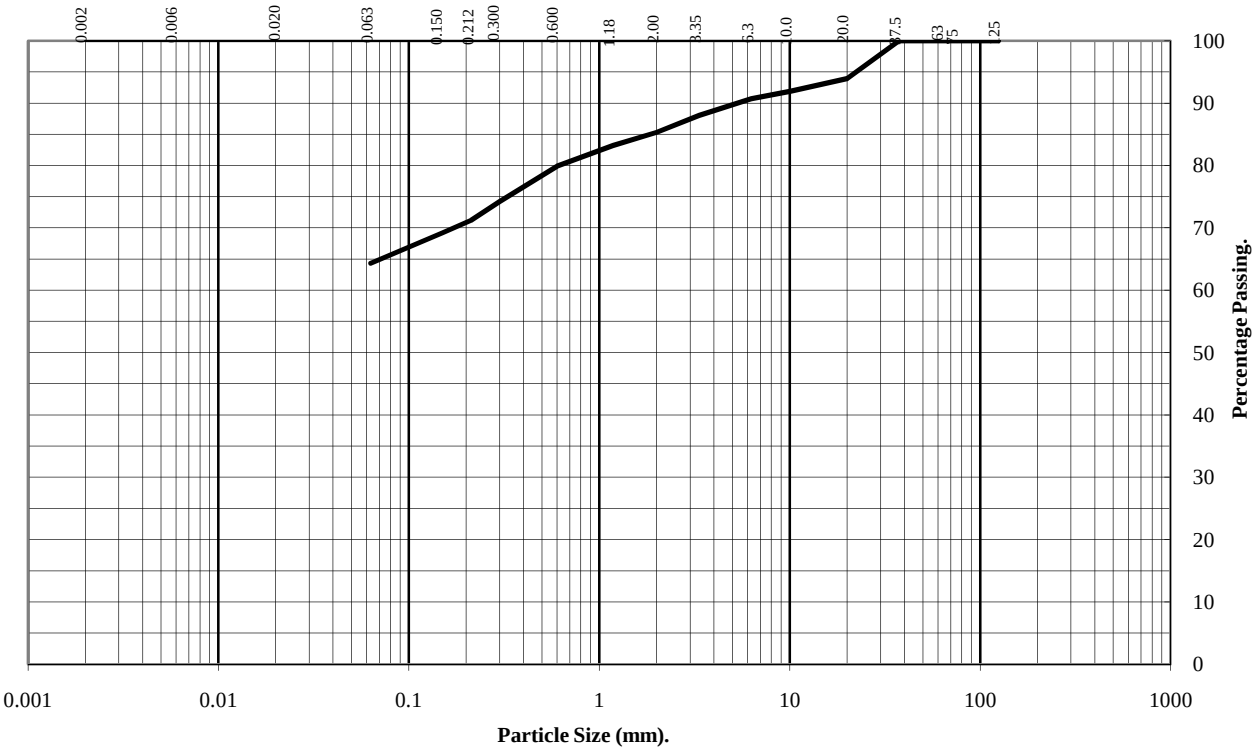
PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH5** Type: **B** Depth (m): **3.50** to **3.80**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	94
10	92
6.3	91
3.35	88
2.00	85
1.18	83
0.60	80
0.300	74
0.212	71
0.150	69
0.063	64

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	15
Sand	21
Silt and Clay	64

Remarks:

#- not determined

27/07/2010

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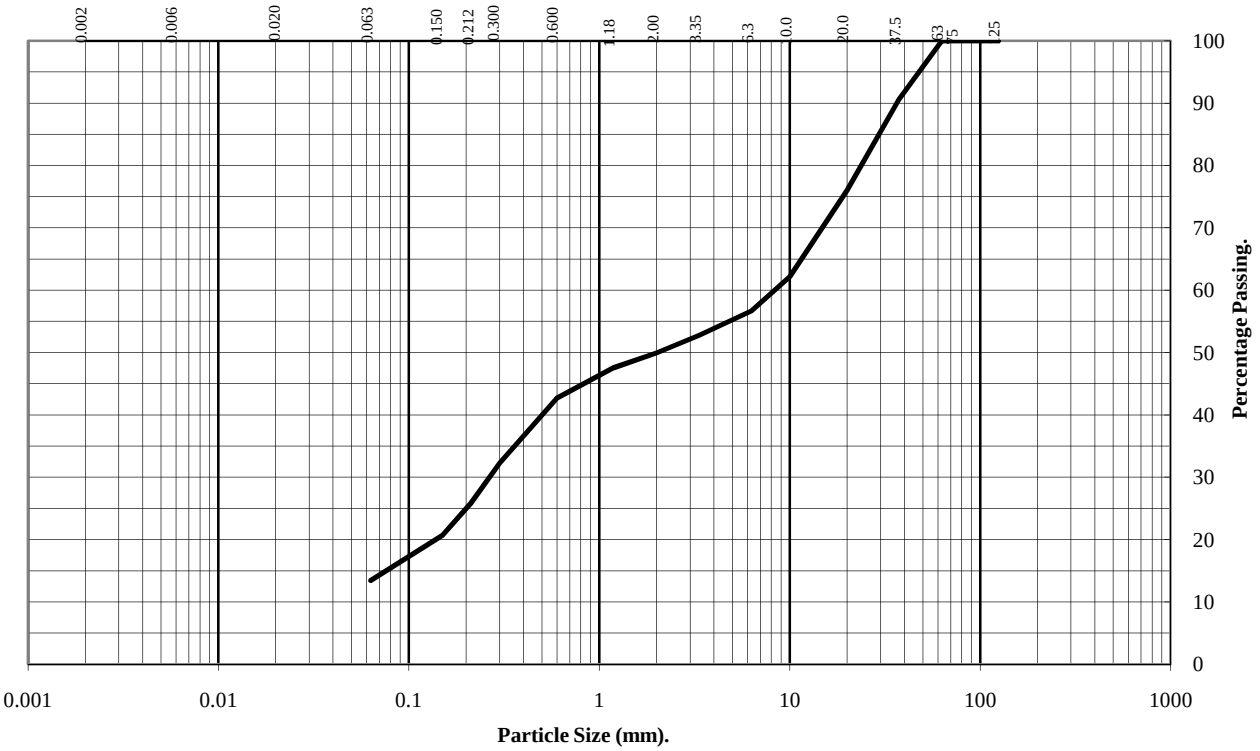
PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH6** Type: **B** Depth (m): **1.50** to **2.00**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	91
20	76
10	62
6.3	57
3.35	53
2.00	50
1.18	48
0.60	43
0.300	32
0.212	26
0.150	21
0.063	13

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	50
Sand	37
Silt and Clay	13

Remarks:

#- not determined

27/07/2010

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LABORATORY TESTING SERVICES LIMITED

Bosch, Miskin

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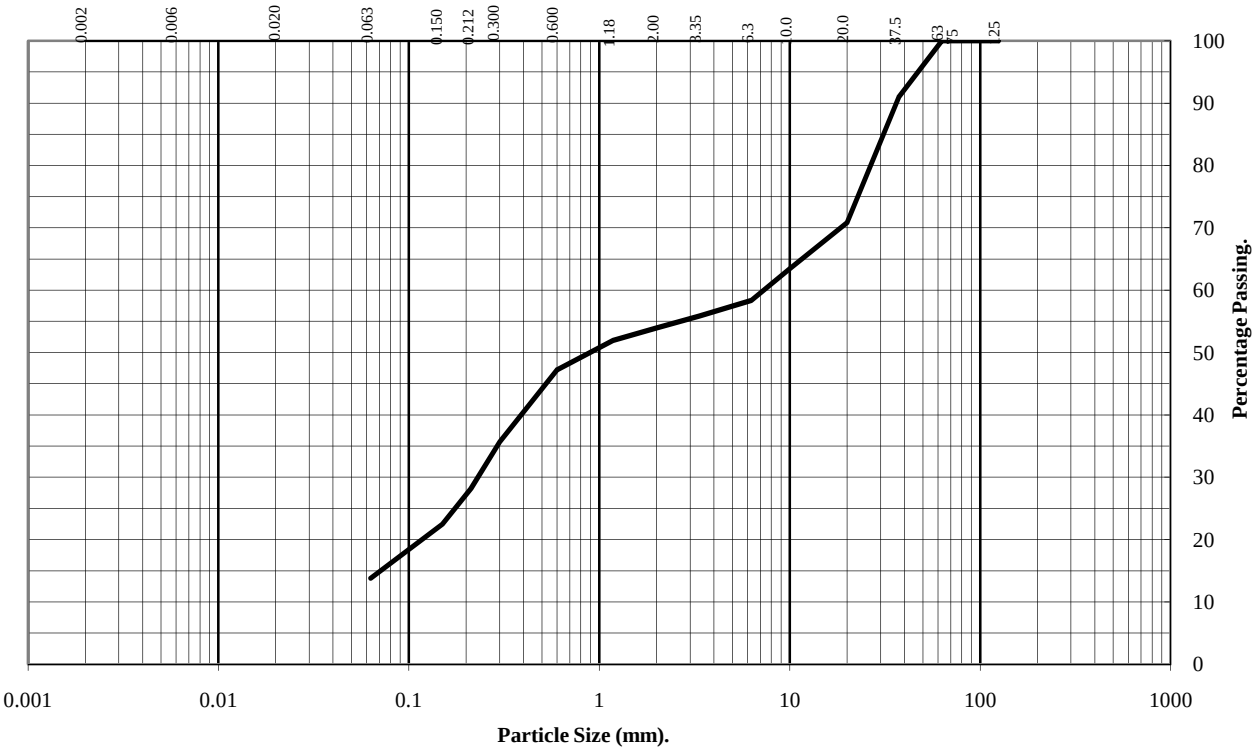
PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH6** Type: **B** Depth (m): **2.00** to **2.50**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	91
20	71
10	63
6.3	58
3.35	56
2.00	54
1.18	52
0.60	47
0.300	36
0.212	28
0.150	22
0.063	14

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	46
Sand	40
Silt and Clay	14

Remarks:

#- not determined

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Checked by **Date** **Approved by** **Date**

LABORATORY TESTING SERVICES LIMITED

Bosch, Miskin

Contract No.:
10482-070710
Client Ref No:

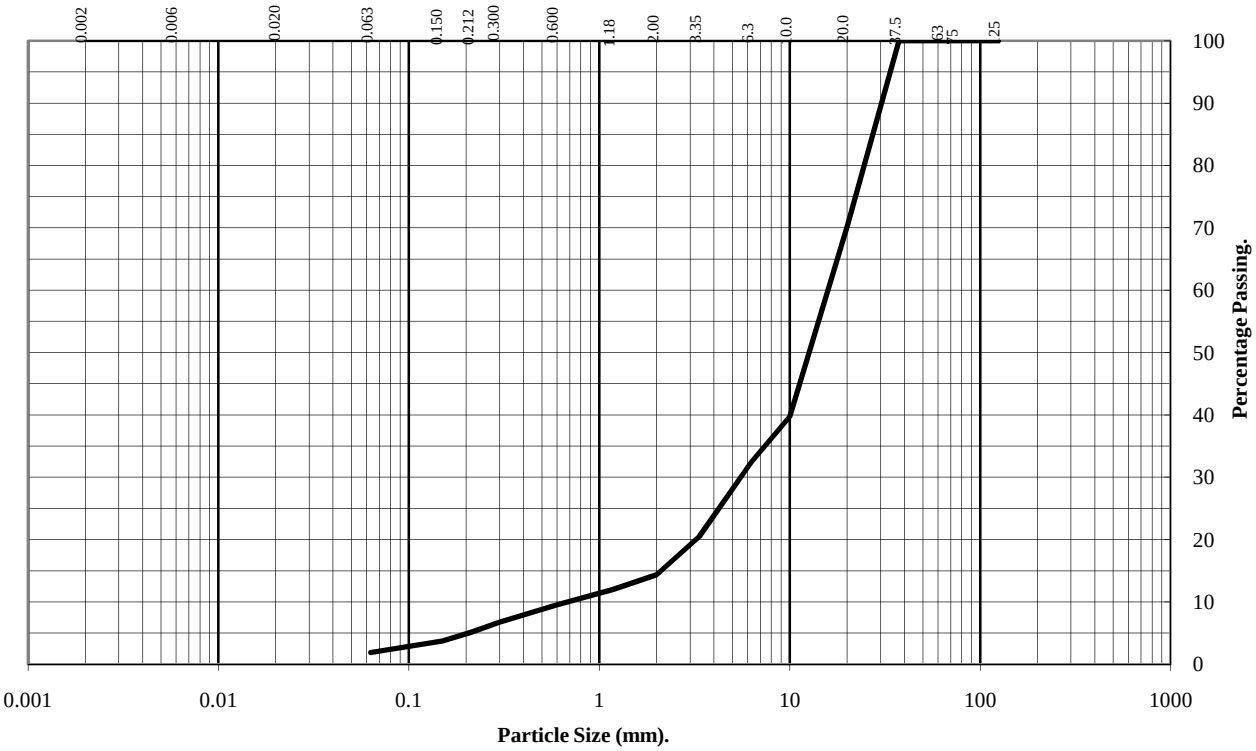
UKAS TESTING 2788

PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH6** Type: **B** Depth (m): **2.50** to **3.00**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	100
20	70
10	40
6.3	32
3.35	20
2.00	14
1.18	12
0.60	10
0.300	7
0.212	5
0.150	4
0.063	2

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	86
Sand	12
Silt and Clay	2

Remarks:

#- not determined

27/07/2010

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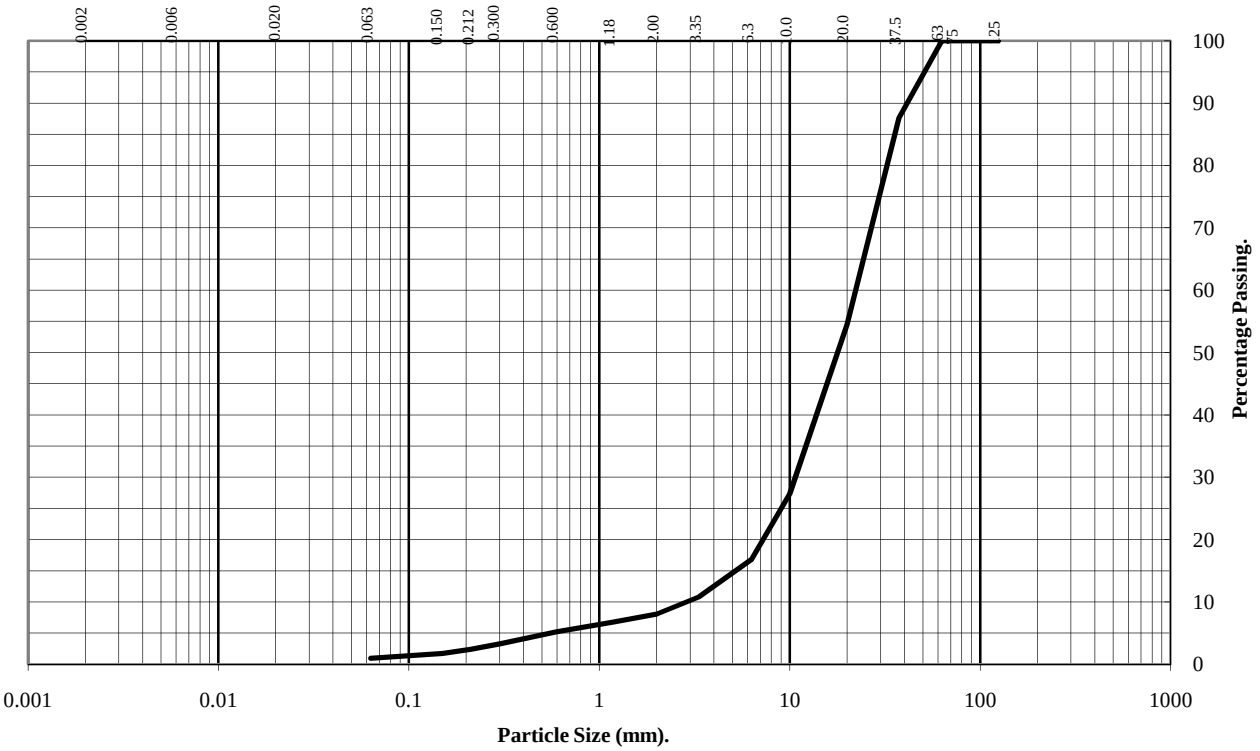
PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH6** Type: **B** Depth (m): **3.00** to **3.50**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	88
20	54
10	27
6.3	17
3.35	11
2.00	8
1.18	7
0.60	5
0.300	3
0.212	2
0.150	2
0.063	1

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	92
Sand	7
Silt and Clay	1

Remarks:

#- not determined

27/07/2010

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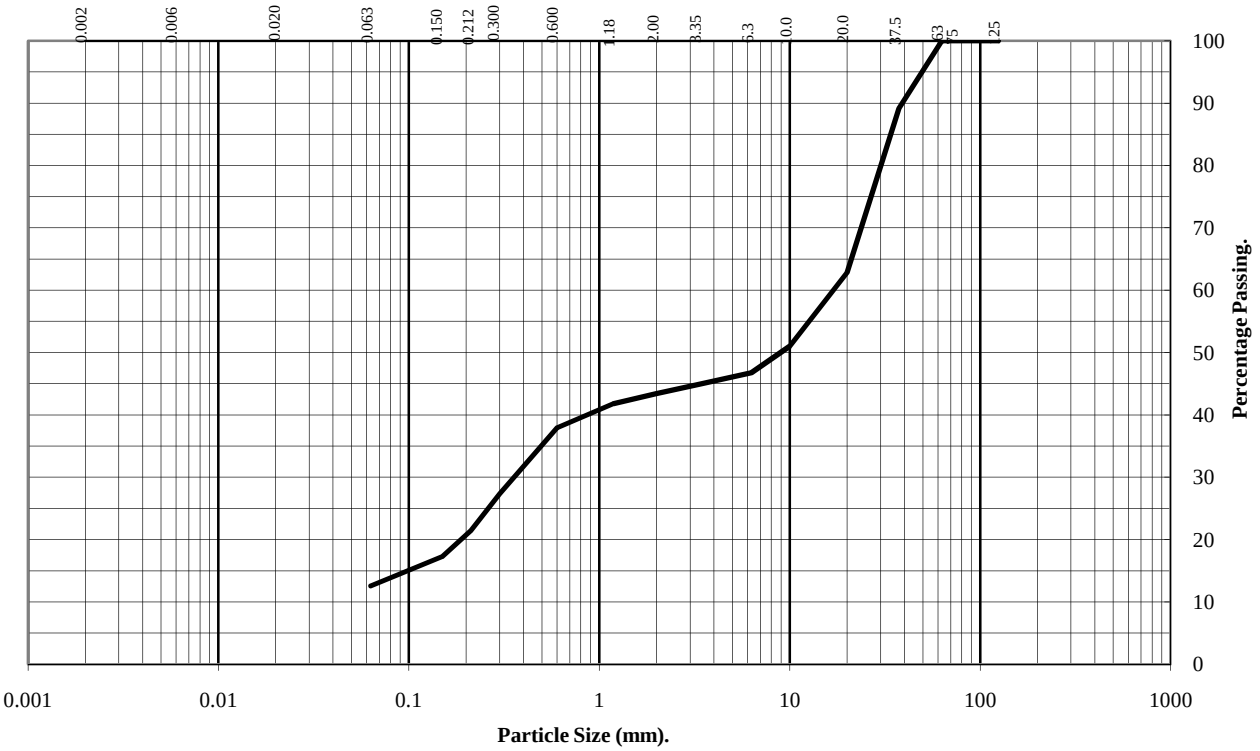
PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH7** Type: **B** Depth (m): **3.50** to **4.00**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	89
20	63
10	51
6.3	47
3.35	45
2.00	43
1.18	42
0.60	38
0.300	27
0.212	21
0.150	17
0.063	13

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	57
Sand	30
Silt and Clay	13

Remarks:

#- not determined

27/07/2010

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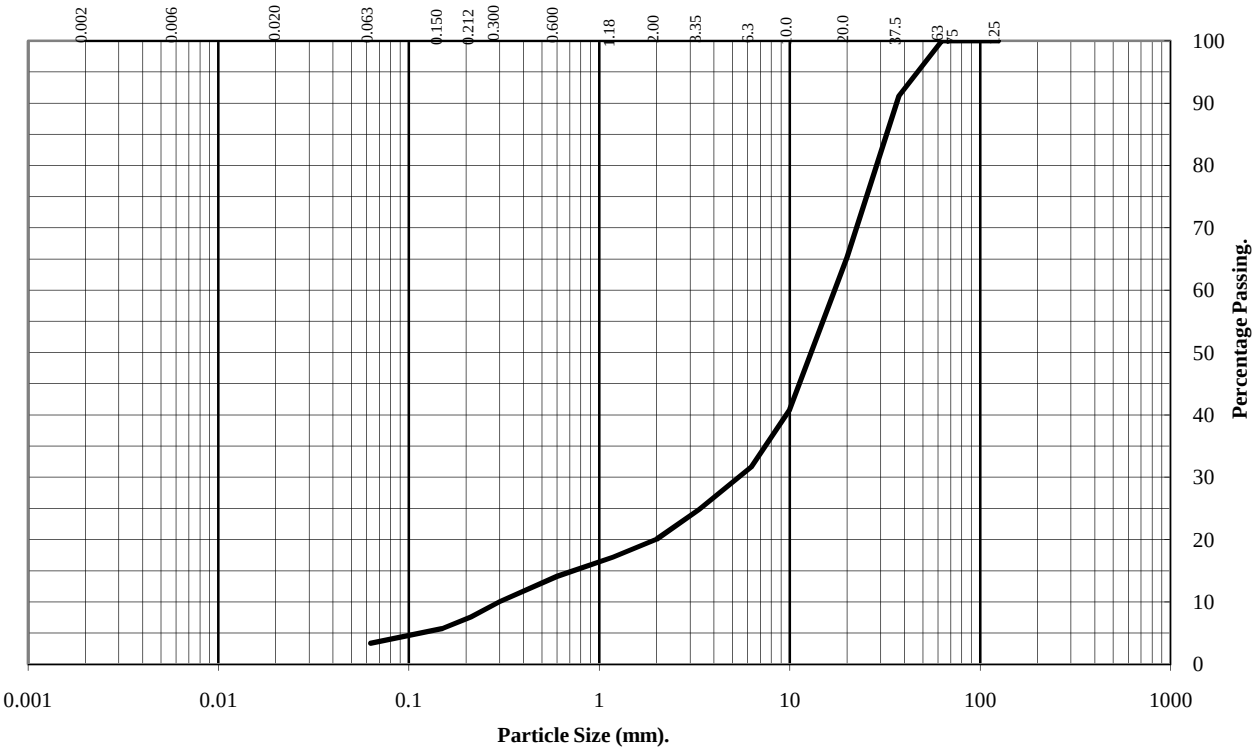
PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH7** Type: **B** Depth (m): **4.00** to **4.50**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	91
20	65
10	41
6.3	32
3.35	25
2.00	20
1.18	17
0.60	14
0.300	10
0.212	8
0.150	6
0.063	3

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	80
Sand	17
Silt and Clay	3

Remarks:

#- not determined

27/07/2010

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LABORATORY TESTING SERVICES LIMITED

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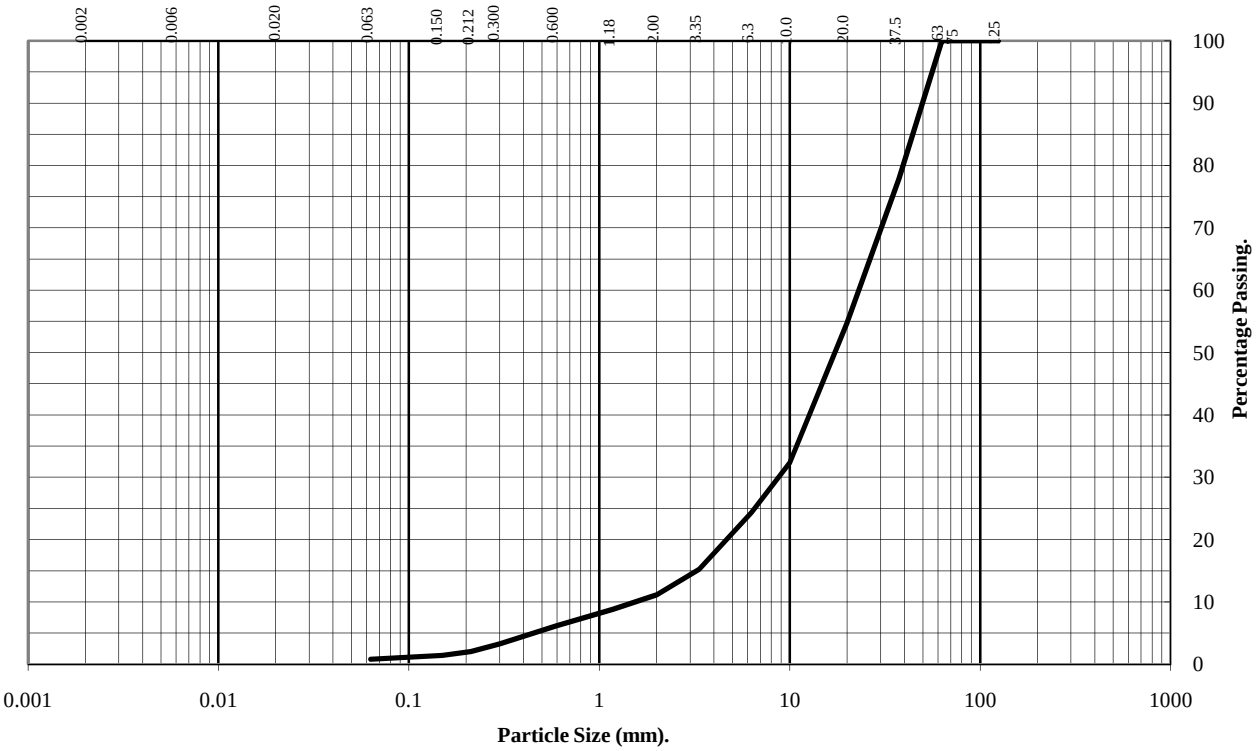
PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH7** Type: **B** Depth (m): **4.50** to **5.00**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	78
20	55
10	32
6.3	24
3.35	15
2.00	11
1.18	9
0.60	6
0.300	3
0.212	2
0.150	1
0.063	1

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	89
Sand	10
Silt and Clay	1

Remarks:

#- not determined

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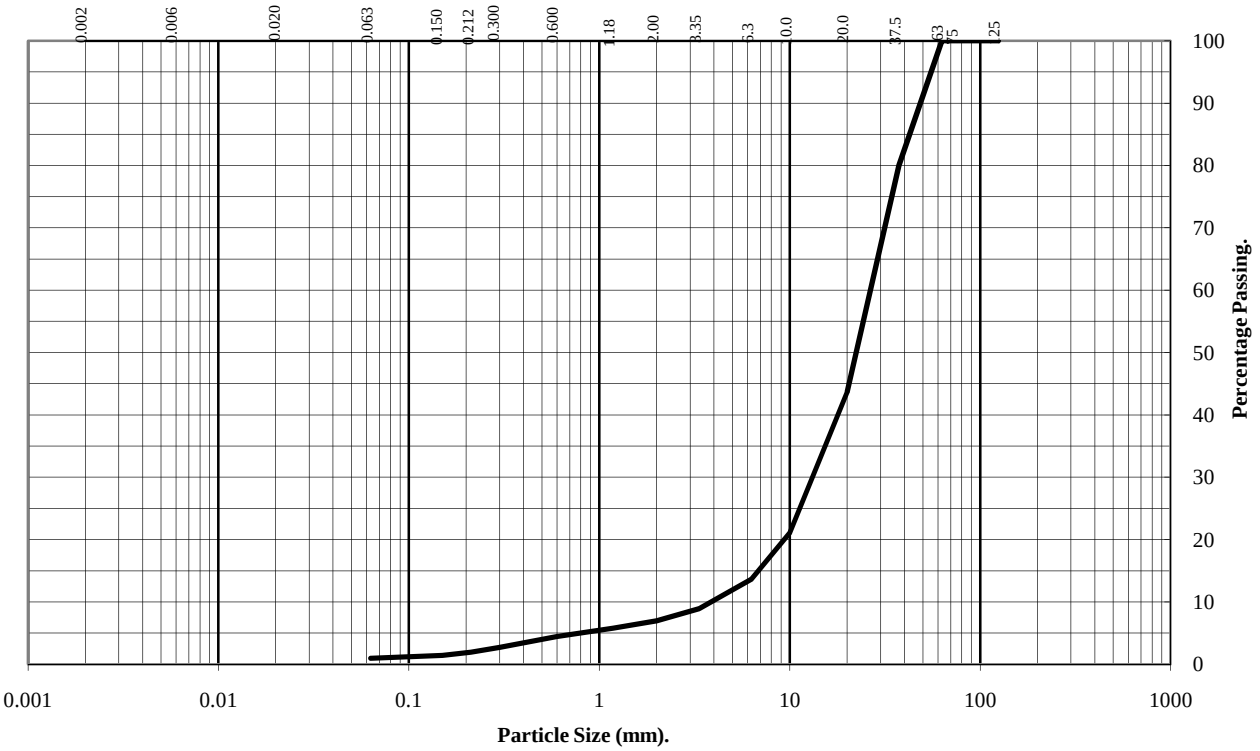
PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH7** Type: **B** Depth (m): **5.00** to **5.50**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	80
20	44
10	21
6.3	14
3.35	9
2.00	7
1.18	6
0.60	4
0.300	3
0.212	2
0.150	1
0.063	1

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	93
Sand	6
Silt and Clay	1

Remarks:

#- not determined

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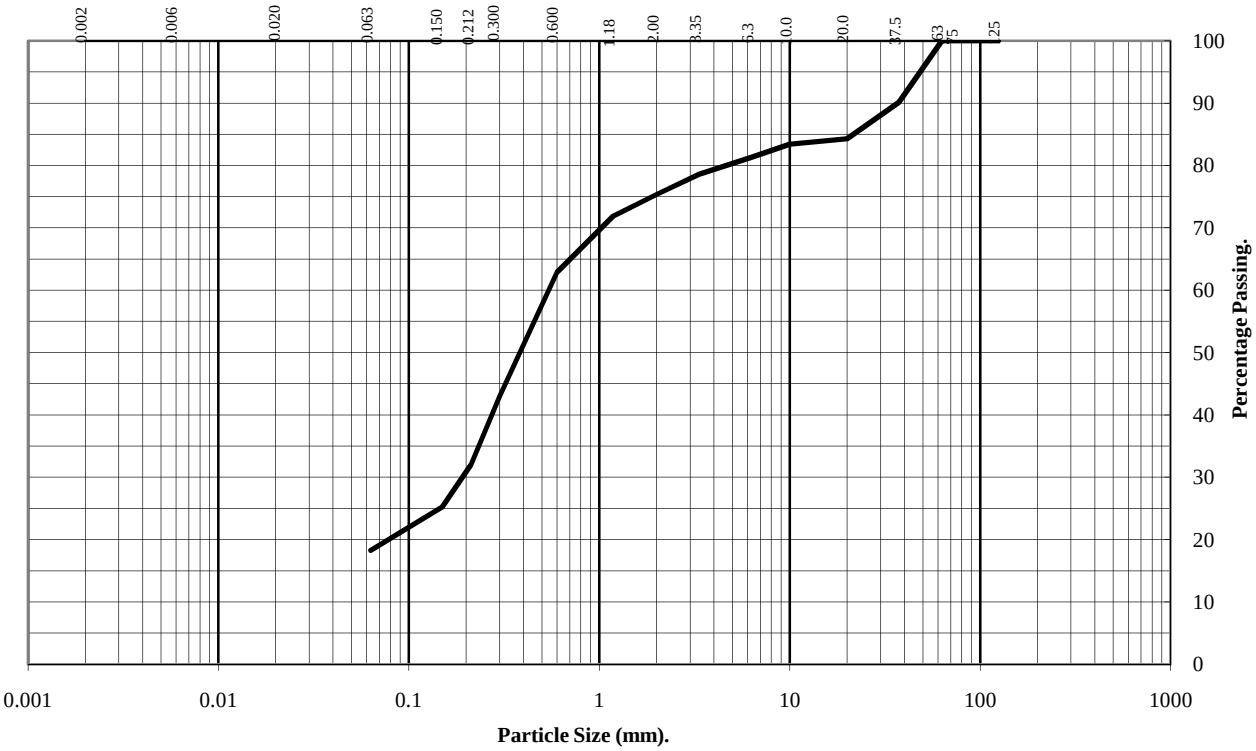
PARTICLE SIZE DISTRIBUTION TEST

BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Hole Number: **BH7** Type: **B** Depth (m): **6.00**



BS Test Sieve	Percentage Passing
125	100
75	100
63	100
37.5	90
20	84
10	83
6.3	81
3.35	79
2.00	75
1.18	72
0.60	63
0.300	43
0.212	32
0.150	25
0.063	18

Particle Diameter	Percentage Passing
0.02	#
0.006	#
0.002	#

Soil Fraction	Total Percentage
Cobbles	0
Gravel	25
Sand	57
Silt and Clay	18

Remarks:

#- not determined

27/07/2010

Checked by **Date**

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LABORATORY TESTING SERVICES LIMITED

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