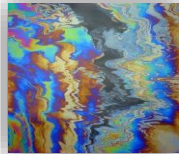




INVESTIGATE



REMEDiate



REGENERATE

TECHNICAL REPORT

**GROUND INVESTIGATION
FOR
NEW CAR PARK
BAE SYSTEMS
SAMLESBURY
LANCASHIRE
FOR
BAE SYSTEMS PLC**

**REPORT NO. 5900
AUGUST 2014**



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**GROUND INVESTIGATION FOR NEW CAR PARK, BAE SYSTEMS,
SAMLESBURY, LANCASHIRE**

CLIENT: BAE SYSTEMS PLC

ENGINEER: TRP CONSULTING

1. INTRODUCTION

This report has been prepared in accordance with emailed instructions, dated 23rd May 2014, from the Engineer on behalf of the Client.

The brief was set out in our estimate, ref. E9741 and dated 10th May 2014, with amendments as the investigation proceeded and includes:

- 6 No. trial pits
- 6 No. in-situ California Bearing Ratio tests
- 2 No. in-situ soakaway tests
- Geotechnical laboratory testing
- Contamination analysis
- Provision of an interpretative report on the above

1.1 Site Location and Description

The site is located at the Samlesbury Aerodrome, BAE Systems, Samlesbury, Lancashire as indicated on Figure 1. The approximate National Grid Reference of the centre of the site is 363358,431420.

As shown on Figure 2, the rectangular site is an extension of an existing car park located in the north east of the BAE Systems site and largely comprises a landscaped area with some surrounding tree screens.

1.2 Proposed Development and Purpose of the Ground Investigation

We understand that it is proposed to extend the existing car park.

The purpose of the investigation was to obtain an indication of the ground conditions, at the positions of the exploratory holes, to assess the likelihood of a general pattern of strata being present below the site and obtain parameters for the construction of the new car park.

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

2. INVESTIGATION

2.1 Investigation Details

Four mechanically excavated trial pits and two hand dug trial pits were taken out at the positions determined and set out by the Engineer, as shown on Figure 2. The trial pits were excavated to depths of between 1.00m and 2.00m, representative samples were taken and the materials were logged in accordance with BS. EN. 14688 and 14689: 2002-2004. The resulting Trial Pit Records are appended.

The trial pits were backfilled with arisings on completion by the excavator and it is therefore likely that loose or soft pockets will still remain.

2.2 Sub Surface Detail

Details of the strata encountered in the ground investigation are given on the appended Trial Pit Records. The trial pits largely encountered cohesive made ground comprising slightly gravelly, slightly sandy clay with occasional granular layers to depths of between 0.45m and 1.20m underlain by cohesive drift deposits.

2.2.1 Made Ground

The trial pits found grass overlying generally brown to dark brown clay to depths of between 0.25m and 0.50m.

In TP7 and TP8 the clay generally became dark grey and dark brown with increasing depth. In addition, TP8 found a soft, dark grey, gravelly clay with some plant remains and an organic odour from 1.00m to 1.20m.

In TP9 a dark brown, dark grey and dark orange brown, very ashy, gravelly sand layer was encountered from 0.50m to 0.60m overlying grey and orange brown mottled clay to 0.75m.

TP10 found a dark grey and dark brown, very sandy slag, stone and brick gravel from 0.30m to 0.40m, overlying grey brown clay.

In TP11 a dark brown, ashy, very gravelly, medium to coarse sand was found from 0.20m to 0.60m, overlying a very soft, dark greyish brown clay encountered to the termination of the hole at 1.00m.

In TP12 the initial dark brown clay became firm, grey brown and occasional orange brown from 0.40m where a low cobble content of stone was found.

Gravel sized fragments within the made ground generally comprised fine to coarse stone, brick, slag and clinker.

2.2.2 Drift Deposits

Underlying the made ground at 0.45m, TP7 found a grey brown and brown, gravelly, slightly sandy, silty clay with lenses of sand to 0.80m overlying a multi-coloured, very gravelly, sandy clay. From 1.00m was found a stiff, high strength, brown and occasional light grey mottled, slightly gravelly, slightly sandy, silty clay.

At 1.00m, TP8 encountered a stiff, high strength, brown, gravelly, slightly sandy, silty clay.

In TP9 a firm, medium strength, light orange brown and light grey brown, gravelly, sandy, silty clay was found to 1.00m, becoming stiff, high strength, multi-coloured and very gravelly from 1.20m and brown and gravelly from 1.50m.

Underlying the made ground from 0.90m to 1.00m, TP10 found a layer of fibrous peat over a soft, low strength, grey brown and dark grey mottled, slightly gravelly, slightly sandy, silty clay with some plant remains. The clay became stiff, high strength brown and occasional light grey mottled at 1.30m depth, and very gravelly and very sandy at 1.90m.

From 0.90m depth, TP12 encountered a soft brown and grey mottled, slightly gravelly, slightly sandy, silty clay with some sand lenses.

Gravel within the natural strata generally comprised subangular to rounded, fine to coarse quartz, sandstone and siltstone. In addition, a low to medium cobble content of quartz was found within TP7, TP8, TP9 and TP10.

2.2.4 Groundwater

Groundwater seepages were recorded at 1.50m and 1.80m in TP10. No groundwater was encountered in the remainder of the exploratory holes although it should be noted that they were only left open for a short period of time. Also groundwater levels and rates of inflow may be subject to seasonal and/ or climatic variations.

3. SAMPLING AND TESTING

3.1 Sampling

Small disturbed and bulk disturbed samples were obtained for the strata encountered and were subjected to careful examination and hand penetrometer / hand shear vane tests, where appropriate.

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

3.2 Field Testing

Twelve hand shear vane were undertaken in the trial pits and the results are given on the appended Trial Pit Records.

Six in-situ California Bearing Ratio (CBR) tests were carried out at the positions shown on Figure 2 at depths of between 0.20m and 0.70m. The depths correspond to the anticipated formation level for the proposed car park. The results of the in-situ CBR tests are appended.

On completion of TP7 and TP10 soakaway tests were undertaken. Water was added to the pits from a bowser and water levels were subsequently monitored over a period of between 240 and 300 minutes. Water levels were found to have fallen insufficiently to determine the Soil Infiltration Rate and hence soakaways are not feasible on this site. Details of the soakaway tests are appended.

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3.3 Laboratory Testing

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

- Moisture content, plastic limit and liquid limit tests
- Soluble sulphate content and pH value tests

Contamination analyses have been performed on eleven soil samples to determine: pH and concentrations of sulphate, sulphide, cyanide, arsenic, boron (soluble), cadmium, chromium, hexavalent chromium, copper, lead, mercury, nickel, selenium, zinc, speciated total petroleum hydrocarbons (TPHs), the speciated polynuclear aromatic hydrocarbons (PAHs) suite, the benzene/ ethylbenzene/ toluene/ xylene (BTEX) suite and phenols.

The results of the above analyses are appended.

4. APPRAISAL AND RECOMMENDATIONS

4.1 Comments on the Profile

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

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

Due to the nature of Made Ground localised variations in thickness and composition should be anticipated and hence interpolation or extrapolation from the exploratory holes to adjoining areas should only be undertaken with caution.

Details of the findings of the investigation are given on the appended exploratory hole records and a summary of the ground conditions is given in Section 2.2.

4.2 Excavations and Groundwater

In our opinion, there should be no particular difficulties in excavating the strata indicated in the exploratory holes utilising an appropriate and suitably sized mechanical excavator.

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

Groundwater seepages were recorded in TP10 at depths of 1.50m and 1.80m. The remaining trial pits did not encounter groundwater entries, although it should be noted that they were only left open for a relatively short period of time.

It should be noted that groundwater levels and rates of inflow may be subject to seasonal and/ or climatic variations.

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

Soakaway tests performed in TP7 and TP10 showed that for the purposes of soakaway design the strata tested should be classed as impermeable as a negligible amount of infiltration was measured.

4.3 Buried Concrete

For the design of buried concrete the recommendations given in Building Research Establishment (BRE) Special Digest 1 (September 2005 revision), "Concrete in Aggressive Ground", should be followed.

Determination of pH on the soil samples gave values in the range of 6.2 to 7.7.

Soluble sulphate concentrations were also determined for the soil samples and the results ranged from < 0.1 to 0.11 g/l.

The results indicate that the Design Sulphate Class for the site should be DS-1.

Our knowledge of the site and ground conditions indicates that the site is "brownfield" with potentially mobile groundwater.

Consequently, in accordance with the Design Sulphate Class for the site together with the site and groundwater conditions an Aggressive Chemical Environment for Concrete (ACEC) classification of AC-2z should be used as detailed on the appended extract.

4.4 Car Park

Insitu California Bearing Ratio (CBR) tests have been undertaken on soils at six positions shown on Figure 2 and the results of the tests are appended. A summary of the insitu CBR test results is as follows:

TABLE 1 INSITU CBR RESULTS

Expl. Hole No.	Depth (m)	Moisture Content (%)	CBR Value (%)	Strata
CBR7	0.20	19	2.5	MADE GROUND: brown and grey mottled slightly gravelly slightly sandy silty clay
CBR8	0.30	24	2.6	MADE GROUND: dark brown and light brown slightly gravelly slightly sandy silty clay
CBR9	0.50	20	6.5	MADE GROUND: brown ashy gravelly sandy silty clay.
CBR10	0.40	16	3.2	MADE GROUND: brown and grey brown slightly gravelly slightly sandy silty clay
CBR11	0.70	33	0.27	MADE GROUND: Dark brown silty clay
CBR12	0.40	20	3.3	MADE GROUND: grey brown and orange brown slightly gravelly slightly sandy silty clay

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It should be noted that the above values are moisture dependent and it is possible that the CBR values would reduce with increased moisture content; this being particularly so for cohesive strata.

Given the above it would be advisable to design on a CBR value of 2.5% for the proposed car park. If there is to be a delay before construction, to prevent water softening, loosening and disturbance, the formation strata should not be exposed.

In CBR11, a very low CBR value of 0.27% was determined for the made ground found at 0.70m depth, which is below the minimum suggested design CBR of 2.5%. This was due to the made ground in this area being very soft and with a high moisture content. In our opinion, such strata are considered unsuitable for supporting pavement foundations and would need permanent improvement. The options for this would include replacement of the soft horizons or soil treatment as detailed in the Department Of Transport's Interim Advice Note 73/06 Revision 1 (2009): Design Guidance For Road Pavement Foundations (Draft HD24) – Chapter 5 (paragraphs 5.16 to 5.21).

In TP10 a layer of fibrous peat was encountered between 0.90m and 1.00m and we would recommend that this is removed from beneath the car park area, which could otherwise produce excessive long term settlement.

It should be noted that the location of TP10 and CBR11/TP11 was to the east of the car park footprint.

4.5 Contamination Considerations

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

It should be appreciated that the suite of determinants consist of a range of common contaminants and the analysis is restricted to these in the absence of historical evidence of the source of the Made Ground. However, the absence of other specific contaminants cannot be guaranteed.

4.5.1 Assessment

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

The Department for Environment, Food and Rural Affairs (DEFRA) and the Environment Agency (EA) withdrew the soil guideline values (SGVs) and replaced the old CLR 10 document covering derivation of soil guideline values in 2008. This had the effect that any values derived using the old CLR 10 assumptions and parameters were no longer valid. DEFRA and EA published new soil guideline values (SGVs) for mercury, selenium, benzene, toluene, ethylbenzene and xylene on 31 March 2009, arsenic and nickel on 12 May 2009 and cadmium and phenols in June 2009. In July 2009 a substantial number of Generic Assessment Criteria (GACs) were published by Land Quality Management (LQM), in conjunction with the Chartered Institute of Environmental Health. Contaminated Land: Applications in Real Environments (CL:AIRE) guideline values were also published in December 2009 to supplement the above. The guideline values (SGVs, GACs and CL:AIRE) vary dependent upon the

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land use; allotment and residential use being the most sensitive and commercial/ industrial use being the least sensitive.

For the purposes of assessment, as the proposed development is for a car park, contamination analyses have been compared with the guideline values for a standard land use of commercial and industrial.

The contamination analysis determined no elevated levels of contaminants when compared with the guideline values for a standard land use of commercial and industrial. Guideline values for the assessment can be supplied directly to the Regulator, if requested.

In addition to the above, an assessment of risk to personnel who will come into contact with on-site materials throughout the site has been undertaken.

4.5.2 Conclusions and Recommendations

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

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

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

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

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

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

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

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

Our assessment, based on the results of the soil samples only, indicates that there are no contaminants requiring remediation and/or precautions to be taken for the proposed development.

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

Should it be necessary to remove on-site materials from the site, classification of the waste should be undertaken before submitting analysis to appropriate waste carriers and/ or waste disposal site operators to determine the most appropriate tip to use and the associated costs.

SGVs, GACs and CL:AIRE assume long term contact with contamination and assess chronic health risk. The risk of short term acute exposure to site personnel is dealt with in the remit of the Health and Safety Executive under the Health and Safety at Work Act: 1974 and Regulations made under the Act, including the Control of Substances Hazardous to Health (COSHH) Regulations. The levels of contamination and risk to site personnel should be considered under the Construction Design and Management (CDM) Regulations at the planning stage and in the development of the designers and contractors Health and Safety Plans and Method Statements. The risk of contact with on-site soils should be minimised and the following precautions should be taken as a minimum requirement.

Site personnel involved in earthworks and excavations should wear gloves, overalls, and boots and smoking should be prohibited.

4.6 General

In the preparation of this report no consideration has been given to

- the historical, geological, mining and/ or environmental setting of the site
- the possible presence of ground gas

as this was outside our brief.

We trust that this report fulfils your present requirements but if you have any queries or we can be of further assistance please contact the undersigned or Miss Anna Marsden at our Preston office.

SUB SURFACE NORTH WEST LIMITED
REPORT No. 5900
AUGUST 2014

T Plum B.Sc.(Hons.), M.Sc.
Geoenvironmental Engineer
For and on behalf of
Sub Surface Consultants Limited

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

INSITU TEST RESULTS



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

In - Situ Test Results

Site: NEW CAR PARK, BAE SYSTEMS, SAMLESBURY
Client: BAE SYSTEMS PLC
Engineer: TRP CONSULTING

Job Number
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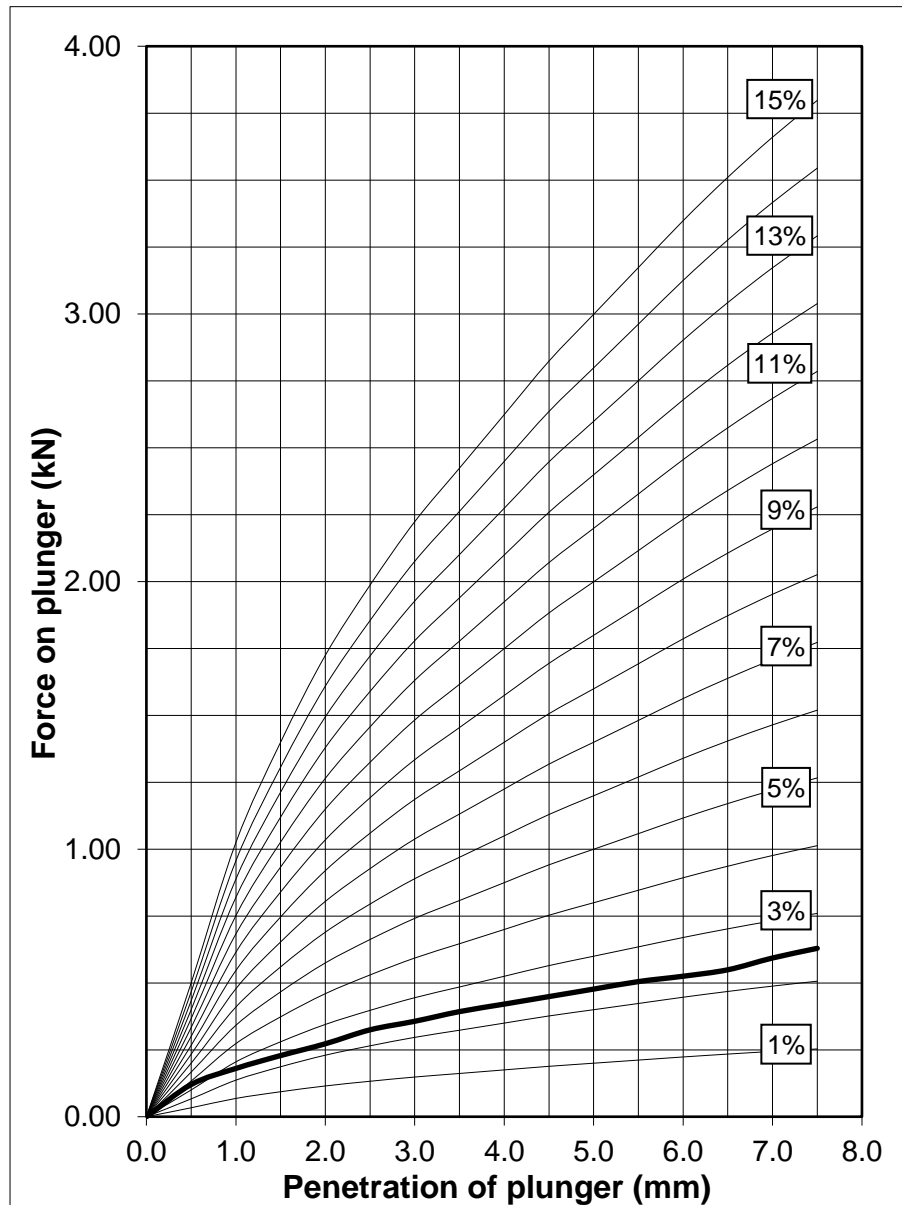
IN - SITU CALIFORNIA BEARING RATIO

Date: 03/07/14 Position: CBR 7 Sample No: 219 Depth: 0.20m

Description:

MADE GROUND: brown and grey mottled slightly gravelly slightly sandy clay

Penetration of Plunger mm	Force on Plunger	
	load gauge	kN
0.0	0.0	0.00
0.5	30.0	0.12
1.0	45.0	0.18
1.5	57.0	0.23
2.0	68.0	0.27
2.5	81.0	0.32
3.0	89.0	0.36
3.5	98.0	0.39
4.0	105.0	0.42
4.5	112.0	0.45
5.0	119.0	0.48
5.5	126.0	0.50
6.0	131.0	0.52
6.5	137.0	0.55
7.0	148.0	0.59
7.5	157.0	0.63



RESULTS Moisture Content = 19%

Pene-tration (mm)	Force kN	Standard Force kN	CBR %
2.5	0.32	13.2	2.5%
5.0	0.48	20.0	2.4%

In - Situ CBR value **2.5%**

comments:

Operator	Checked	Approved
T.M		



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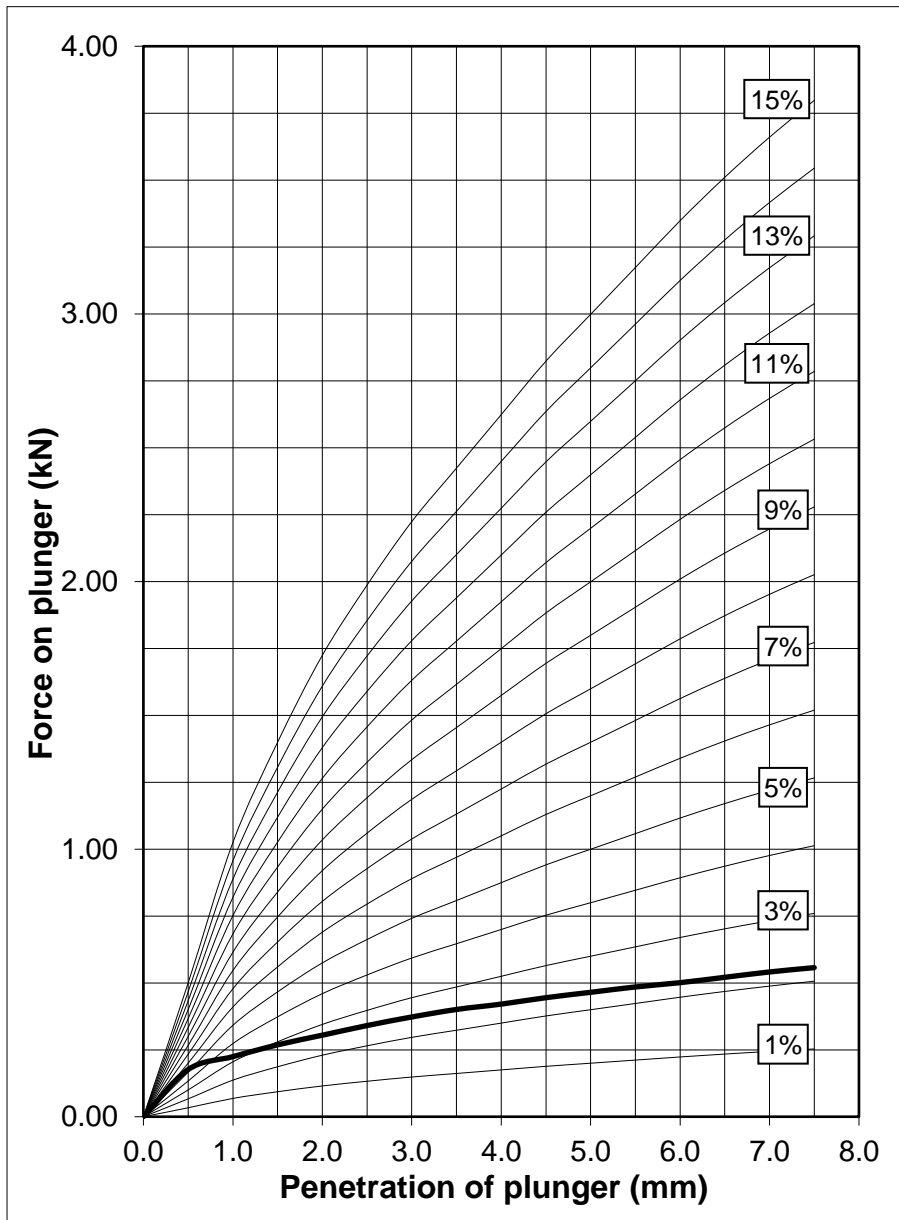
IN - SITU CALIFORNIA BEARING RATIO

Date: 03/07/14 Position: CBR 8 Sample No: 194 Depth: 0.30m

Description:

MADE GROUND: dark brown and light brown slightly gravelly slightly sandy silty clay

Penetration of Plunger mm	Force on Plunger	
	load gauge	kN
0.0	0.0	0.00
0.5	44.0	0.18
1.0	56.0	0.22
1.5	67.0	0.27
2.0	76.0	0.30
2.5	85.0	0.34
3.0	93.0	0.37
3.5	100.0	0.40
4.0	105.0	0.42
4.5	111.0	0.44
5.0	116.0	0.46
5.5	121.0	0.48
6.0	125.0	0.50
6.5	130.0	0.52
7.0	135.0	0.54
7.5	139.0	0.56



RESULTS Moisture Content = 24%

Pene-tration (mm)	Force kN	Standard Force kN	CBR %
2.5	0.34	13.2	2.6%
5.0	0.46	20.0	2.3%

In - Situ CBR value **2.6%**

comments:

Operator	Checked	Approved
T.M		



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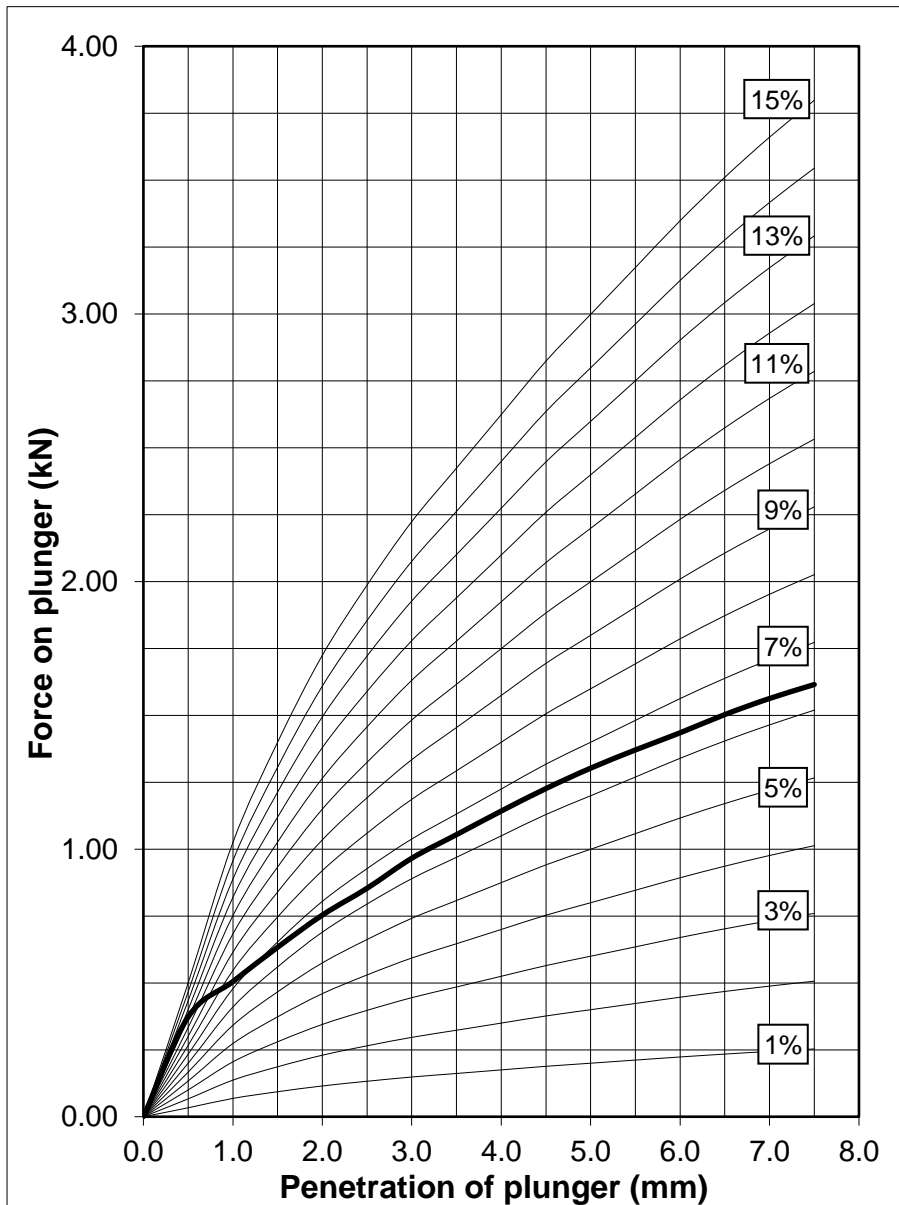
IN - SITU CALIFORNIA BEARING RATIO

Date: 03/07/14 Position: CBR 9 Sample No: 218 Depth: 0.50m

Description:

MADE GROUND: Brown ashy gravelly sandy silty clay

Penetration of Plunger mm	Force on Plunger	
	load gauge	kN
0.0	0.0	0.00
0.5	93.0	0.37
1.0	126.0	0.50
1.5	158.0	0.63
2.0	188.0	0.75
2.5	213.0	0.85
3.0	241.0	0.97
3.5	263.0	1.05
4.0	285.0	1.14
4.5	306.0	1.23
5.0	325.0	1.30
5.5	342.0	1.37
6.0	358.0	1.43
6.5	375.0	1.50
7.0	390.0	1.56
7.5	403.0	1.61



RESULTS Moisture Content = **20%**

Pene-tration (mm)	Force kN	Standard Force kN	CBR %
2.5	0.85	13.2	6.5%
5.0	1.30	20.0	6.5%

In - Situ CBR value **6.5%**

comments:

Operator	Checked	Approved
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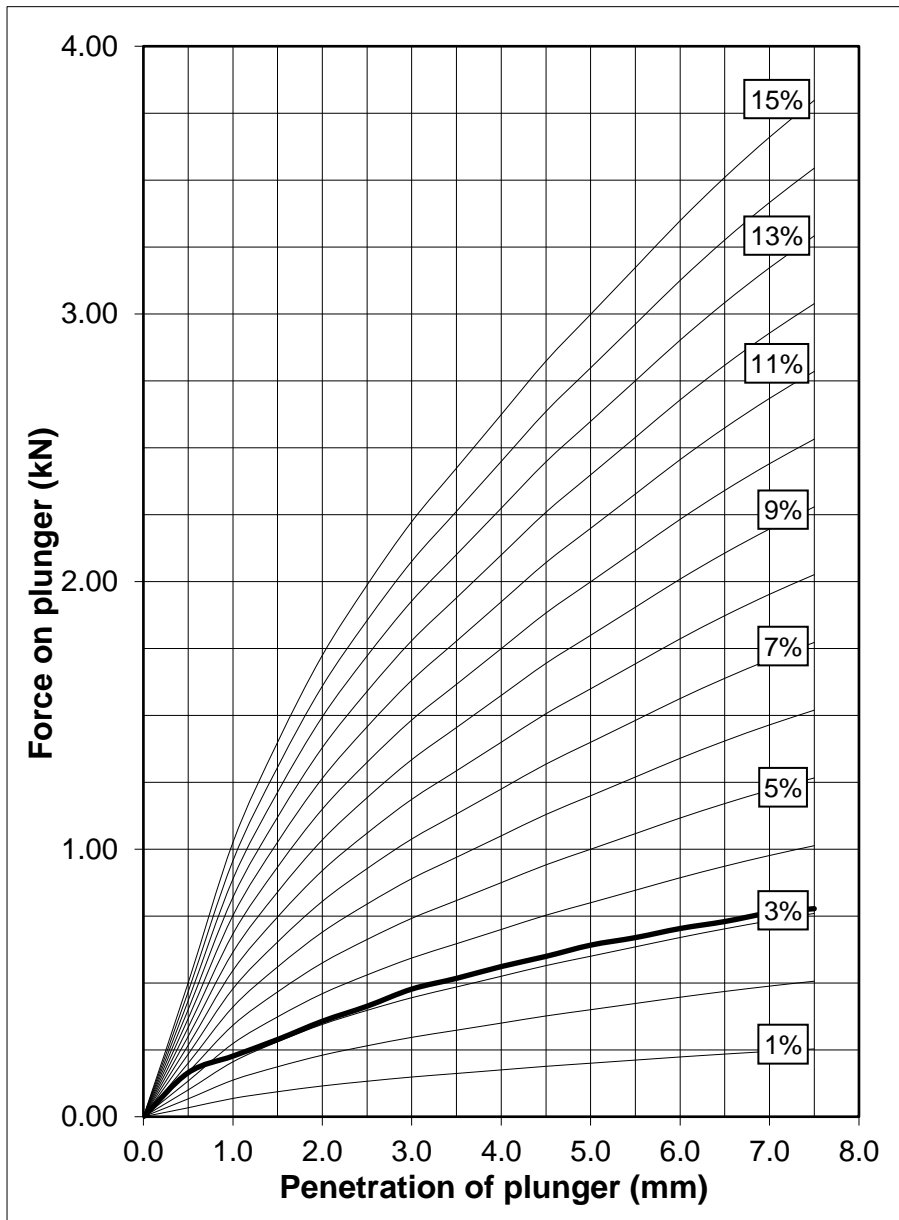
IN - SITU CALIFORNIA BEARING RATIO

Date: 03/07/14 Position: CBR 10 Sample No: 205 Depth: 0.40m

Description:

MADE GROUND: brown and grey brown slightly gravelly slightly sandy silty clay

Penetration of Plunger mm	Force on Plunger	
	load gauge	kN
0.0	0.0	0.00
0.5	41.0	0.16
1.0	56.5	0.23
1.5	72.0	0.29
2.0	89.0	0.36
2.5	103.0	0.41
3.0	119.0	0.48
3.5	129.0	0.52
4.0	140.0	0.56
4.5	149.5	0.60
5.0	160.0	0.64
5.5	167.0	0.67
6.0	175.5	0.70
6.5	182.0	0.73
7.0	190.0	0.76
7.5	194.0	0.78



RESULTS Moisture Content = 16%

Pene-tration (mm)	Force kN	Standard Force kN	CBR %
2.5	0.41	13.2	3.1%
5.0	0.64	20.0	3.2%

In - Situ CBR value **3.2%**

comments:

Operator

Checked

Approved

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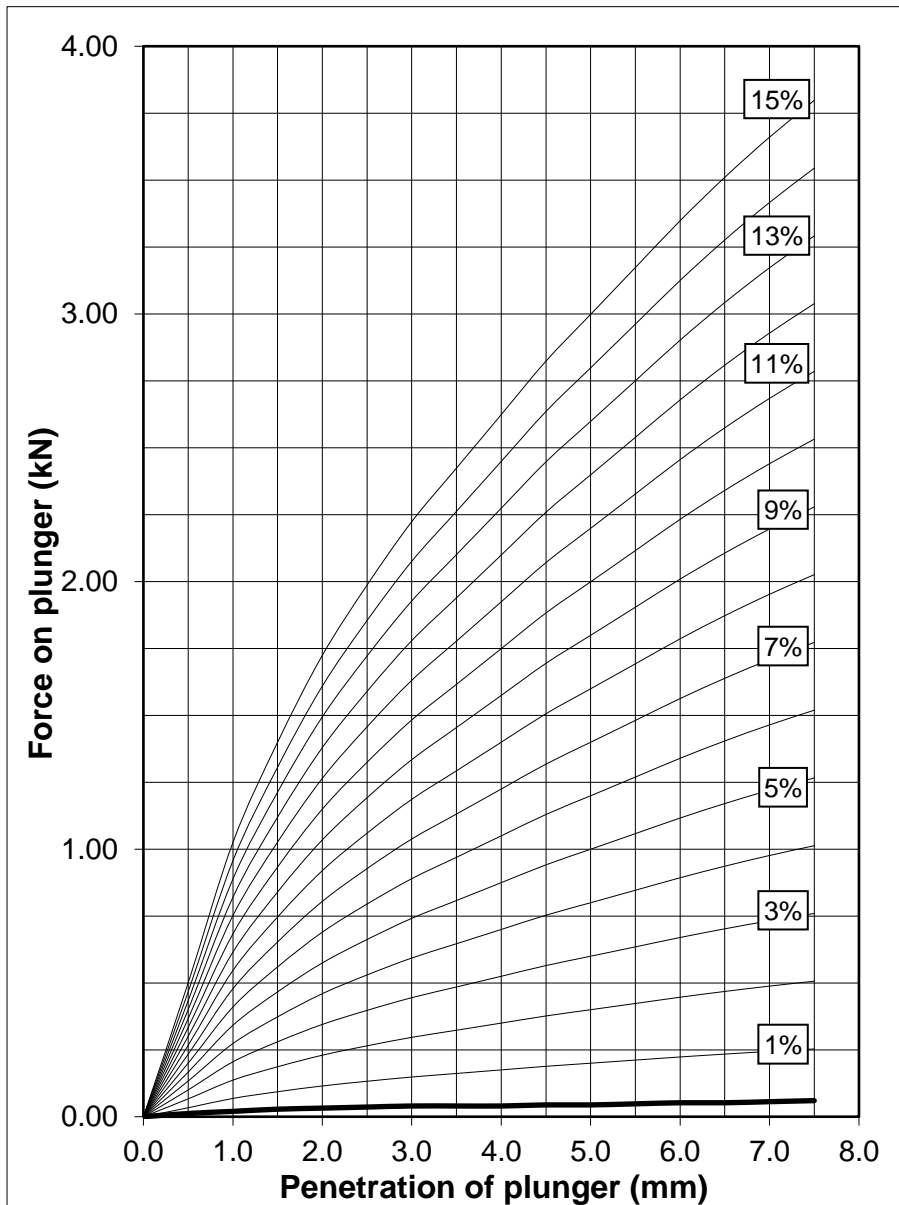
IN - SITU CALIFORNIA BEARING RATIO

Date: 03/07/14 Position: CBR 11 Sample No: 206 Depth: 0.70m

Description:

MADE GROUND: Dark brown silty clay

Penetration of Plunger mm	Force on Plunger	
	load gauge	kN
0.0	0.0	0.00
0.5	3.0	0.01
1.0	5.0	0.02
1.5	7.0	0.03
2.0	8.0	0.03
2.5	9.0	0.04
3.0	10.0	0.04
3.5	10.0	0.04
4.0	10.0	0.04
4.5	11.0	0.04
5.0	11.0	0.04
5.5	12.0	0.05
6.0	13.0	0.05
6.5	13.0	0.05
7.0	14.0	0.06
7.5	15.0	0.06



RESULTS Moisture Content = 33%

Pene-tration (mm)	Force kN	Standard Force kN	CBR %
2.5	0.04	13.2	0.3%
5.0	0.04	20.0	0.2%

In - Situ CBR value **0.27%**

comments:

Operator	Checked	Approved
T.M		



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Sheet:
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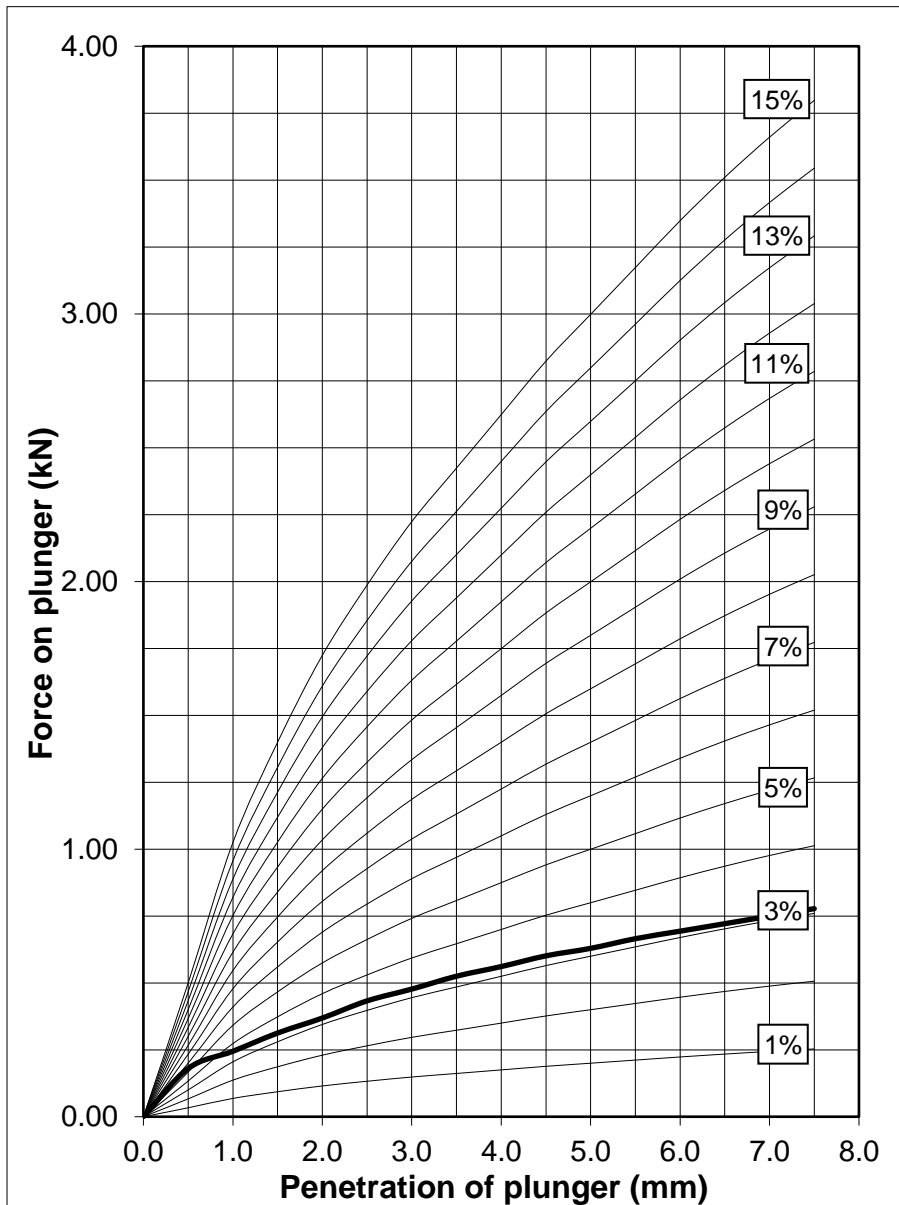
IN - SITU CALIFORNIA BEARING RATIO

Date: 03/07/14 Position: CBR 12 Sample No: 195 Depth: 0.40m

Description:

MADE GROUND: grey brown and orange brown slightly gravelly slightly sandy silty clay

Penetration of Plunger mm	Force on Plunger	
	load gauge	kN
0.0	0.0	0.00
0.5	45.0	0.18
1.0	61.0	0.24
1.5	78.0	0.31
2.0	92.0	0.37
2.5	108.0	0.43
3.0	119.0	0.48
3.5	131.0	0.52
4.0	140.0	0.56
4.5	150.0	0.60
5.0	157.0	0.63
5.5	166.0	0.67
6.0	173.0	0.69
6.5	180.0	0.72
7.0	187.0	0.75
7.5	194.0	0.78



RESULTS Moisture Content = 20%

Pene-tration (mm)	Force kN	Standard Force kN	CBR %
2.5	0.43	13.2	3.3%
5.0	0.63	20.0	3.1%

In - Situ CBR value **3.3%**

comments:

Operator	Checked	Approved
T.M		



SUB SURFACE

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

Insitu Test Results

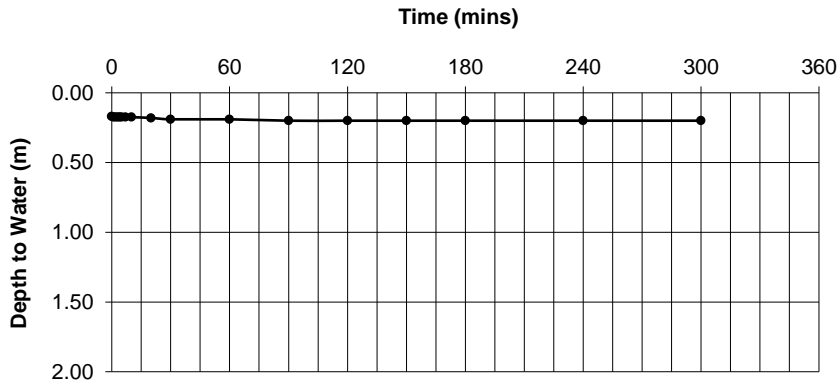
Site: NEW CAR PARK, BAE SYSTEMS, SAMLESBURY, LANCASHIRE
Client: BAE SYSTEMS PLC
Engineer: TRP CONSULTING

Job Number
5900
Sheet:
1 / 2

Soakaway Test

Hole No: TP7

TEST NO: 1
DATE: 02/07/14



Time (min)	Depth (m)
0	0.17
1	0.18
2	0.18
3	0.18
4	0.18
5	0.18
7	0.18
10	0.18
20	0.18
30	0.19
60	0.19
90	0.20
120	0.20
150	0.20
180	0.20
240	0.20
300	0.20

Length of pit: L = 1.10 m
 Width of pit: W = 0.50 m
 Depth of pit: D = 1.50 m
 Base area of pit: A = 0.55 m²

100% effective depth D100 = 0.17 m
 75% effective depth D75 = 0.50 m
 50% effective depth D50 = 0.84 m
 25% effective depth D25 = 1.17 m

time to D75 T75 = N/A sec
 time to D25 T25 = N/A sec

time from D75 to D25 t_{p75-25} = N/A sec
 (T25 - T75)

volume between D75 & D25 V_{p75-25} = 0.37 m³
 (A x (D25 - D75))

surface area to D50 inc. base a_{p50} = 2.68 m²
 ((2x(D-D50)x(W+L)) + A)

SOIL INFILTRATION RATE

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

f = N/A m/sec

Test Strata:
(see Trial Pit)

Remarks: Soil infiltration rate not able to be calculated due to very low permeability



SUB SURFACE

SITE INVESTIGATION AND SPECIALIST GEOTECHNICAL CONSULTANTS
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Insitu Test Results

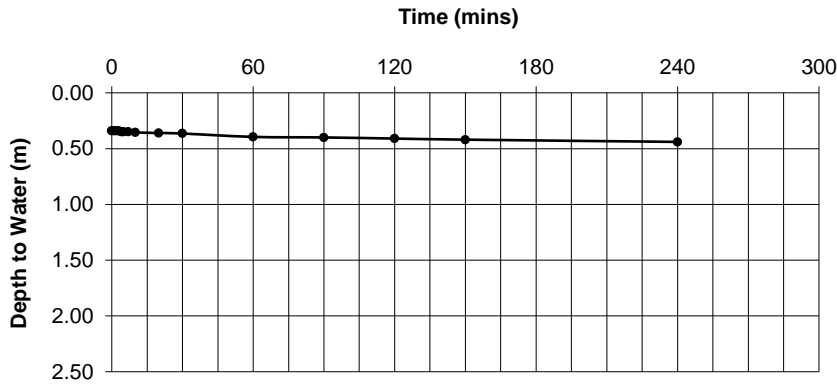
Site: NEW CAR PARK, BAE SYSTEMS, SAMLESBURY, LANCASHIRE
Client: BAE SYSTEMS PLC
Engineer: TRP CONSULTING

Job Number
5900
Sheet:
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Soakaway Test

Hole No: TP10

TEST NO: 1
DATE: 02/07/14



Time (min)	Depth (m)
0	0.34
1	0.34
2	0.34
3	0.34
4	0.35
5	0.35
7	0.35
10	0.36
20	0.36
30	0.37
60	0.40
90	0.40
120	0.41
150	0.42
240	0.44

Length of pit: L = 1.50 m
 Width of pit: W = 0.50 m
 Depth of pit: D = 2.00 m
 Base area of pit: A = 0.75 m²

100% effective depth D100 = 0.34 m
 75% effective depth D75 = 0.76 m
 50% effective depth D50 = 1.17 m
 25% effective depth D25 = 1.59 m

time to D75 T75 = N/A sec
 time to D25 T25 = N/A sec

time from D75 to D25 t_{p75-25} = N/A sec
 (T25 - T75)

volume between D75 & D25 V_{p75-25} = 0.62 m³
 (A x (D25 - D75))

surface area to D50 inc. base a_{p50} = 4.07 m²
 ((2x(D-D50)x(W+L)) + A)

SOIL INFILTRATION RATE

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

f = N/A m/sec

Test Strata:
(see Trial Pit)

Remarks: Soil infiltration rate not able to be calculated due to very low permeability

LABORATORY TEST RESULTS



SUB SURFACE

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

Laboratory Test Results

Site : NEW CAR PARK, BAE SAMLESBURY, LANCASHIRE

Client : BAE SYSTEMS PLC

Engineer : TRP CONSULTING

Job Number

5900

Sheet

1 / 1

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

Borehole/ Trial Pit	Depth (m)	Sample	Natural Moisture Content %	Sample Passing 425µm Sieve		Liquid Limit %	Plastic Limit %	Plasticity Index %	Liquidity Index	Group Symbol	Laboratory Description
				Percentage %	Moisture Content %						
TP10	1.00	D	24	79	30	33	16	17	0.82	CL	Grey brown and dark grey mottled slightly gravelly slightly sandy silty CLAY. Gravel is subangular to rounded fine to coarse sandstone and quartz
TP12	0.90	D	25	89	28	36	18	18	0.56	CI	Brown and grey mottled slightly gravelly slightly sandy silty CLAY. Gravel is subangular to rounded fine to medium sandstone and siltstone
TP7	0.50	D	18	83	22	28	16	12	0.50	CL	Grey brown and orange brown mottled gravelly slightly sandy silty CLAY. Gravel is subangular to rounded fine to coarse quartz, sandstone and siltstone
TP8	1.30	D	21	85	25	36	19	17	0.35	CI	Brown gravelly slightly sandy silty CLAY. Gravel is subangular to rounded fine to coarse quartz, siltstone and sandstone
TP9	0.75	B	22	94	23	33	18	15	0.33	CL	Brown, orange brown and light grey brown gravelly sandy silty CLAY. Gravel is subangular to rounded fine to coarse sandstone, quartz and siltstone

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

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

Remarks :



SUB SURFACE

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

Laboratory Test Results

Site : NEW CAR PARK, BAE SAMLESBURY, LANCASHIRE

Client : BAE SYSTEMS PLC

Engineer : TRP CONSULTING

Job Number

5900

Sheet

1 / 1

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

Borehole/ Trial Pit	Depth (m)	Sample	Concentration of Soluble Sulphate			Percentage of sample passing 2mm Sieve %	pH	Classification	Laboratory Description
			Soil		Groundwater g / l				
			Total S03 %	S04 in 2:1 water:soil g / l					
TP10	0.30	D		0.02		6.2	DS-1	MADE GROUND: dark grey and dark brown very sandy gravel sized fragments of fine to coarse slag, stone and brick	
TP10	0.60	B		0.02		6.6	DS-1	MADE GROUND: brown, grey brown and grey slightly gravelly slightly sandy clay. Gravel sized fragments are fine to coarse stone and brick	
TP11	0.20	D		0.02		6.3	DS-1	MADE GROUND: dark brown ashy very gravelly medium to coarse sand. Gravel sized fragments are fine to coarse brick, stone and slag	
TP11	0.60	D		0.11		6.3	DS-1	MADE GROUND: dark grey brown slightly brown slightly gravelly slightly sandy silty clay. Gravel sized fragments are fine to coarse brick and stone	
TP12	0.40	D		<0.01		6.9	DS-1	MADE GROUND: grey brown and occasional orangish brown slightly gravelly slightly sandy silty clay. Gravel sized fragments are fine to coarse stone	
TP7	0.50	D		0.01		7.7	DS-1	Grey brown and orange brown mottled gravelly slightly sandy silty CLAY. Gravel is subangular to rounded fine to coarse quartz, sandstone and siltstone	
TP7	0.80	B		<0.01		7.7	DS-1	Multi coloured very gravelly sandy silty CLAY. Gravel is subangular to rounded fine to coarse quartz, siltstone and sandstone	
TP8	0.30	D		<0.01		7.0	DS-1	MADE GROUND: dark brown, grey brown and occasional brown and grey mottled slightly gravelly slightly sandy silty clay. Gravel sized fragments are fine to coarse stone, brick and clinker	
TP8	0.70	B		0.02		6.2	DS-1	MADE GROUND: dark brown and dark grey slightly gravelly slightly sandy silty clay. Gravel sized fragments are fine to coarse stone and brick	
TP9	0.50	D		<0.01		6.4	DS-1	MADE GROUND: dark brown, dark grey and dark orange brown very ashy gravelly sand. Gravel sized fragments are fine to coarse slag and stone	

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

Method of Test : Laboratory in-house methods based on BS1377: Part 3 for contents of water soluble sulphate, total sulphate and pH.

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



AGGRESSIVE CHEMICAL ENVIRONMENT FOR CONCRETE (ACEC) SITE CLASSIFICATION

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

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

Notes

- a Applies to locations on sites that comprise either undisturbed ground that is in its natural state (ie not brownfield - Table C2) or clean fill derived from such ground
- b The limits of Design Sulfate Classes based on 2:1 water/soil extracts have been lowered relative to previous Digests (Box C7).
- c Applies only to locations where concrete will be exposed to sulfate ions (SO₄) which may result from the oxidation of sulfides (eg pyrite) following ground disturbance (Appendix A1 and Box C8).
- d For flowing water that is potentially aggressive to concrete owing to high purity or an aggressive carbon dioxide level greater than 15mg/l (Section C2.2.3), increase the ACEC Class to AC-2z.

Explanation of suffix symbols to ACEC Class

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

Table C1 Aggressive Chemical Environment for Concrete (ACEC) classification for brownfield locations^a

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

Notes

- a Brownfield sites are those sites, or parts of sites, that might contain chemical residues produced by or associated with industrial production (Section C5.1.3).
- b The limits of Design Sulfate Classes based on 2:1 water/soil extracts have been lowered relative to previous Digests (Box C7).
- c Applies only to locations where concrete will be exposed to sulfate ions (SO₄) which may result from the oxidation of sulfides (eg pyrite) following ground disturbance (Appendix A1 and Box C8).
- d An additional account is taken of hydrochloric and nitric acids by adjustment to sulfate content (Section C5.1.3).
- e The limit on water-soluble magnesium does not apply to brackish groundwater (chloride content between 12 000mg/l and 17000 mg/l). This allows 'm' to be omitted from the relevant ACEC Classification. Seawater (chloride content about 18 000 mg/l) and stronger brines are not covered by this table.

Explanation of suffix symbols to ACEC Class

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

CONTAMINATION ANALYSIS RESULTS



Final Report

Report Number: 14-05531 Issue-1

Initial Date of Issue: 17-Jul-14

Client: Sub Surface

Client Address: 3 Peel Street
Preston
Lancashire
PR2 2QS

Contact(s): Simon Gabbatt

Client Reference: 5900 New Car Park, BAE Systems, Samlesbury

Quotation No.: **Date Received:** 10-Jul-14

Order No.: 5900 **Date Instructed:** 09-Jul-14

No. of Samples: 16 **Results Due:** 17-Jul-14

**Turnaround:
(Weekdays)** 7

Date Approved: 17-Jul-14

Approved By:

Details: Keith Jones, Technical Manager

Results Summary - Soil

Report No.: 14-05531 Issue-1

Project: 5900 New Car Park, BAE Systems, Samlesbury

Client: Sub Surface	Chemtest Sample ID.:				28286	28287	28288	28289	28290	28291	28292	28293	28294	28295	28296
Quote:	Client Sample Ref.:														
Order No.: 5900	Client Sample ID.:				TP7	TP7	TP7	TP8	TP8	TP8	TP9	TP9	TP10	TP10	TP10
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.30	0.50	0.80	0.05	0.30	0.70	0.10	0.50	0.05	0.30	0.60
	Bottom Depth(m):														
	Date Sampled:				02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14
Determinand	Accred.	SOP	Units	LOD											
Moisture	N	2030	%	0.02	17	14	8.2	30	16	21	23	17	22	16	20
pH	M	2010			8.3	7.7	7.7	6.6	7.0	6.2	6.9	6.4	6.1	6.2	6.6
Boron (Hot Water Soluble)	M	2120	mg/kg	0.4	0.48			1.4		0.49	0.61	< 0.40	0.67	0.55	
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/L	0.01		0.010	< 0.010		< 0.010	0.023		< 0.010		0.015	0.020
Cyanide (Total)	M	2300	mg/kg	0.5	< 0.50			< 0.50		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	
Sulphide (Easily Liberatable)	M	2325	mg/kg	0.5	8.6			2.6		2.5	1.9	2.3	1.5	2.8	
Sulphate (Total)	M	2430	%	0.01	0.061			0.093		0.051	0.073	0.13	0.071	0.066	
Arsenic	M	2450	mg/kg	2	10			10		15	11	32	8.7	14	
Cadmium	M	2450	mg/kg	0.1	0.22			0.23		0.15	0.21	0.20	0.17	0.24	
Chromium	M	2450	mg/kg	5	24			26		30	21	17	19	16	
Copper	M	2450	mg/kg	5	22			18		20	20	57	18	47	
Mercury	M	2450	mg/kg	0.1	< 0.10			< 0.10		0.10	< 0.10	< 0.10	< 0.10	< 0.10	
Nickel	M	2450	mg/kg	5	29			23		28	25	40	21	34	
Lead	M	2450	mg/kg	5	31			36		37	31	52	33	30	
Selenium	M	2450	mg/kg	0.2	0.25			0.26		0.36	0.41	0.83	0.38	0.57	
Zinc	M	2450	mg/kg	5	41			38		41	36	27	29	27	
Chromium (Hexavalent)	N	2490	mg/kg	0.5	< 0.50			< 0.50		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	
TPH >C6-C10	N	2670	mg/kg	1	< 1.0			< 1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
TPH >C10-C21	N	2670	mg/kg	1	1.1			8.6		< 1.0	3.1	22	3.9	41	
TPH >C21-C40	N	2670	mg/kg	1	8.3			19		< 1.0	11	31	11	120	
Total TPH >C6-C40	N	2670	mg/kg	10	< 10			28		< 10	14	53	15	160	
Naphthalene	M	2700	mg/kg	0.1	< 0.10			< 0.10		< 0.10	< 0.10	0.30	< 0.10	0.41	
Acenaphthylene	M	2700	mg/kg	0.1	< 0.10			< 0.10		< 0.10	< 0.10	0.87	< 0.10	0.42	
Acenaphthene	M	2700	mg/kg	0.1	< 0.10			< 0.10		< 0.10	< 0.10	0.15	< 0.10	0.18	
Fluorene	M	2700	mg/kg	0.1	< 0.10			< 0.10		< 0.10	< 0.10	0.27	< 0.10	0.23	
Phenanthrene	M	2700	mg/kg	0.1	0.96			0.33		< 0.10	0.35	0.62	0.51	2.6	
Anthracene	M	2700	mg/kg	0.1	0.22			0.13		< 0.10	0.11	0.20	0.17	0.58	
Fluoranthene	M	2700	mg/kg	0.1	1.5			0.88		0.43	0.85	1.0	1.3	11	
Pyrene	M	2700	mg/kg	0.1	1.4			0.85		0.43	0.79	1.0	1.3	11	
Benzo[a]anthracene	M	2700	mg/kg	0.1	0.53			0.81		1.4	1.1	0.33	1.3	5.1	
Chrysene	M	2700	mg/kg	0.1	0.57			0.61		0.62	0.66	1.2	1.1	6.6	
Benzo[b]fluoranthene	M	2700	mg/kg	0.1	< 0.10			< 0.10		< 0.10	0.58	< 0.10	0.65	6.9	
Benzo[k]fluoranthene	M	2700	mg/kg	0.1	< 0.10			< 0.10		< 0.10	0.39	< 0.10	0.32	3.0	

Results Summary - Soil

Report No.: 14-05531 Issue-1

Project: 5900 New Car Park, BAE Systems, Samlesbury

Client: Sub Surface	Chemtest Sample ID.:				28286	28287	28288	28289	28290	28291	28292	28293	28294	28295	28296
Quote:	Client Sample Ref.:														
Order No.: 5900	Client Sample ID.:				TP7	TP7	TP7	TP8	TP8	TP8	TP9	TP9	TP10	TP10	TP10
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.30	0.50	0.80	0.05	0.30	0.70	0.10	0.50	0.05	0.30	0.60
	Bottom Depth(m):														
	Date Sampled:				02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14
Determinand	Accred.	SOP	Units	LOD											
Benzo[a]pyrene	M	2700	mg/kg	0.1	< 0.10			< 0.10		< 0.10	0.32	< 0.10	0.63	5.1	
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.1	< 0.10			< 0.10		< 0.10	0.32	< 0.10	0.40	3.6	
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.1	< 0.10			< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	0.84	
Benzo[g,h,i]perylene	M	2700	mg/kg	0.1	< 0.10			< 0.10		< 0.10	0.27	< 0.10	0.51	3.6	
Total Of 16 PAH's	N	2700	mg/kg	2	5.2			3.6		2.9	5.7	5.9	8.2	61	
Benzene	M	2760	µg/kg	1	< 1.0			< 1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Toluene	M	2760	µg/kg	1	< 1.0			< 1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Ethylbenzene	M	2760	µg/kg	1	< 1.0			< 1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
m & p-Xylene	M	2760	µg/kg	1	< 1.0			< 1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
o-Xylene	M	2760	µg/kg	1	< 1.0			< 1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Methyl Tert-Butyl Ether	M	2760	µg/kg	1	< 1.0			< 1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Total Phenols	M	2920	mg/kg	0.3	< 0.30			< 0.30		< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	

Report No.: 14-05531 Issue-1

Project: 5900 New Car Park, BAE Systems, Samlesbury

Client: Sub Surface	Chemtest Sample ID.:				28297	28298	28299	28300	28301
Quote:	Client Sample Ref.:								
Order No.: 5900	Client Sample ID.:				TP11	TP11	TP11	TP12	TP12
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.00	0.20	0.60	0.00	0.40
	Bottom Depth(m):								
	Date Sampled:				02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14
Determinand	Accred.	SOP	Units	LOD					
Moisture	N	2030	%	0.02	21	20	27	25	19
pH	M	2010			6.0	6.3	6.3	7.5	6.9
Boron (Hot Water Soluble)	M	2120	mg/kg	0.4	0.68	0.47		0.51	0.49
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/L	0.01		0.016	0.11		< 0.010
Cyanide (Total)	M	2300	mg/kg	0.5	< 0.50	< 0.50		< 0.50	< 0.50
Sulphide (Easily Liberatable)	M	2325	mg/kg	0.5	2.4	3.4		5.6	2.3
Sulphate (Total)	M	2430	%	0.01	0.054	0.091		0.071	0.027
Arsenic	M	2450	mg/kg	2	11	29		10	8.6
Cadmium	M	2450	mg/kg	0.1	0.15	< 0.10		0.22	0.10
Chromium	M	2450	mg/kg	5	17	12		15	25
Copper	M	2450	mg/kg	5	24	72		21	28
Mercury	M	2450	mg/kg	0.1	< 0.10	< 0.10		< 0.10	< 0.10
Nickel	M	2450	mg/kg	5	23	53		19	22
Lead	M	2450	mg/kg	5	31	16		31	34
Selenium	M	2450	mg/kg	0.2	0.40	0.20		< 0.20	< 0.20
Zinc	M	2450	mg/kg	5	22	11		26	24
Chromium (Hexavalent)	N	2490	mg/kg	0.5	< 0.50	< 0.50		< 0.50	< 0.50
TPH >C6-C10	N	2670	mg/kg	1	< 1.0	< 1.0		< 1.0	< 1.0
TPH >C10-C21	N	2670	mg/kg	1	< 1.0	< 1.0		5.9	1.4
TPH >C21-C40	N	2670	mg/kg	1	7.0	< 1.0		20	10
Total TPH >C6-C40	N	2670	mg/kg	10	< 10	< 10		26	12
Naphthalene	M	2700	mg/kg	0.1	< 0.10	< 0.10		< 0.10	< 0.10
Acenaphthylene	M	2700	mg/kg	0.1	< 0.10	< 0.10		< 0.10	< 0.10
Acenaphthene	M	2700	mg/kg	0.1	< 0.10	< 0.10		< 0.10	< 0.10
Fluorene	M	2700	mg/kg	0.1	< 0.10	< 0.10		< 0.10	< 0.10
Phenanthrene	M	2700	mg/kg	0.1	0.69	< 0.10		0.35	< 0.10
Anthracene	M	2700	mg/kg	0.1	0.14	< 0.10		0.13	< 0.10
Fluoranthene	M	2700	mg/kg	0.1	1.4	0.25		0.93	0.39
Pyrene	M	2700	mg/kg	0.1	1.4	0.27		0.96	0.46
Benzo[a]anthracene	M	2700	mg/kg	0.1	1.0	< 0.10		0.52	0.60
Chrysene	M	2700	mg/kg	0.1	0.91	< 0.10		0.40	0.53
Benzo[b]fluoranthene	M	2700	mg/kg	0.1	0.81	< 0.10		0.51	< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.1	0.61	< 0.10		0.25	< 0.10

Report No.: 14-05531 Issue-1

Project: 5900 New Car Park, BAE Systems, Samlesbury

Client: Sub Surface	Chemtest Sample ID.:				28297	28298	28299	28300	28301
Quote:	Client Sample Ref.:								
Order No.: 5900	Client Sample ID.:				TP11	TP11	TP11	TP12	TP12
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.00	0.20	0.60	0.00	0.40
	Bottom Depth(m):								
	Date Sampled:				02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14	02-Jul-14
Determinand	Accred.	SOP	Units	LOD					
Benzo[a]pyrene	M	2700	mg/kg	0.1	0.61	< 0.10		0.53	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.1	0.24	< 0.10		0.30	< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.1	< 0.10	< 0.10		< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.1	0.34	< 0.10		0.34	< 0.10
Total Of 16 PAH's	N	2700	mg/kg	2	8.2	< 2.0		5.2	< 2.0
Benzene	M	2760	µg/kg	1	< 1.0	< 1.0		< 1.0	< 1.0
Toluene	M	2760	µg/kg	1	< 1.0	< 1.0		< 1.0	< 1.0
Ethylbenzene	M	2760	µg/kg	1	< 1.0	< 1.0		< 1.0	< 1.0
m & p-Xylene	M	2760	µg/kg	1	< 1.0	< 1.0		< 1.0	< 1.0
o-Xylene	M	2760	µg/kg	1	< 1.0	< 1.0		< 1.0	< 1.0
Methyl Tert-Butyl Ether	M	2760	µg/kg	1	< 1.0	< 1.0		< 1.0	< 1.0
Total Phenols	M	2920	mg/kg	0.3	< 0.30	< 0.30		< 0.30	< 0.30

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVCOs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at our Coventry laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

Sample Retention and Disposal

All soil samples will be retained for a period of 1 month following the date of the test report

All water samples will be retained for 7 days following the date of the test report

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.co.uk

TRIAL PIT RECORD SHEETS



SUB SURFACE

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

Site
NEW CAR PARK, BAE SAMLESBURY, LANCASHIRE

Trial Pit Number
TP7

Excavation Method MECHANICAL EXCAVATOR	Dimensions 0.50m x 1.10m x 1.50m	Ground Level (mOD)	Client BAE SYSTEMS PLC	Job Number 5900
	Location AS PLAN	Dates 02/07/2014	Engineer TRP CONSULTING	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10-0.30 0.10-0.30	B D*				(0.40)	MADE GROUND: grass over brown slightly gravelly slightly sandy clay with occasional rootlets. Gravel sized fragments are fine to coarse stone and occasional ceramics and brickfrom 0.10m: occasional grey mottling		
0.50	D				0.40 0.45 (0.35)	MADE GROUND: dark grey and brown slightly gravelly slightly sandy clay with occasional rootlets. Gravel sized fragments are fine to coarse stone		
0.80-1.00	B				0.80 (0.20)	Grey brown and orange brown mottled gravelly slightly sandy silty CLAY with lenses of fine to medium sand and occasional relic rootlets. Gravel is subangular to rounded fine to coarse quartz, sandstone and siltstone		
1.20	D		HV@1.10m, c=92kPa		1.00 (0.50)	Multi coloured very gravelly sandy silty CLAY with medium cobble content of quartz and with occasional lenses of clayey gravel. Gravel is subangular to rounded fine to coarse quartz, siltstone and sandstone		
1.50	D		HV@1.50m, c=129kPa 02/07/2014:DRY		1.50	Stiff high strength brown and occasional light grey mottled slightly gravelly slightly sandy silty CLAY with low cobble content of quartz and occasional relic rootlets. Gravel is subangular to rounded fine to coarse quartz, siltstone and sandstone		
						Complete at 1.50m		

Plan 	Remarks D* = 1 Plastic Jar Sample, 1 Amber Glass Jar Sample, 1 Vial Sample, taken for chemical testing. Pit sides remained vertical and stable. Trial pit remained dry. HV = Hand Shear Vane test.	
		Scale (approx) 1:25



SUB SURFACE

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Site
NEW CAR PARK, BAE SAMLESBURY, LANCASHIRE

Trial Pit Number
TP8

Excavation Method MECHANICAL EXCAVATOR	Dimensions 0.50m x 1.30m x 1.50m	Ground Level (mOD)	Client BAE SYSTEMS PLC	Job Number 5900
	Location AS PLAN	Dates 02/07/2014	Engineer TRP CONSULTING	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.05-0.20	D*				(0.25)	MADE GROUND: grass over dark brown and occasional brown mottled gravelly slightly sandy silty clay with some rootlets. Gravel sized fragments are fine to coarse stone, sandstone and clinker		
0.30-0.50 0.30-0.50	B D*				0.25 (0.75)	MADE GROUND: dark brown and grey brown slightly gravelly slightly sandy silty clay with some rootlets. Gravel sized fragments are fine to coarse stone and occasional brick and clinker with occasional brown and grey mottling to 0.70mfrom 0.70m: firm medium strength		
0.70-0.90	B		HV@0.70m, c=43kPa HV@0.80m, c=62kPa		1.00	MADE GROUND: soft low strength dark grey gravelly slightly sandy silty clay with some rootlets and plant remains. Gravel sized fragments are fine to coarse stone, brick, quartz and slag (organic odour)		
1.00-1.20	B		HV@1.00m, c=35kPa		(0.20) 1.20	Stiff high strength brown gravelly slightly sandy silty CLAY with occasional rootlets and medium cobble content of quartz. Gravel is fine to coarse quartz, sandstone and siltstoneat 1.50m: old land drain		
1.30	D		HV@1.30m, c= 104kPa 02/07/2014:DRY		(0.30) 1.50	Complete at 1.50m		

Plan	Remarks		
.	D* = 1 Plastic Jar Sample, 1 Amber Glass Jar Sample, 1 Vial Sample, taken for chemical testing.		
.	Pit sides remained vertical and stable.		
.	Trial pit remained dry.		
.	HV = Hand Shear Vane test.		
.	Scale (approx)	Logged By	Figure No.
.	1:25	ALM/DK	5900.TP8



SUB SURFACE

SITE INVESTIGATION, GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
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Site
NEW CAR PARK, BAE SAMLESBURY, LANCASHIRE

Trial Pit Number
TP9

Excavation Method MECHANICAL EXCAVATOR	Dimensions 0.50m x 1.30m x 1.60m	Ground Level (mOD)	Client BAE SYSTEMS PLC	Job Number 5900
	Location AS PLAN	Dates 03/07/2014	Engineer TRP CONSULTING	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10-0.30 0.10-0.30	B D*				(0.50)	MADE GROUND: grass over dark brown slightly gravelly slightly sandy clay with some roots and rootlets. Gravel sized fragments are fine to coarse stone, brick, concrete, clinker and plastic		
0.50-0.60 0.50-0.60 0.60-0.75	B D* B				0.50 (0.10) 0.60 (0.15) 0.75	MADE GROUND: dark brown, dark grey and dark orange brown very ashy gravelly sand. Gravel sized fragments are fine to coarse slag and stone		
0.75-0.95	B		HV@0.80m, c=74kPa		(0.25)	MADE GROUND: grey and orange brown mottled slightly gravelly slightly sandy clay with some relic roots and rootlets. Gravel sized fragments are fine to coarse stone, slag and clinker		
1.00-1.20	B				1.00 (0.20)	Firm medium strength light brown, orange brown and light grey brown gravelly sandy silty CLAY with occasional roots and many lenses of fine to medium sand and with low cobble content of quartz. Gravel is subangular to rounded fine to coarse sandstone, quartz and siltstone		
1.50	D				(0.40) 1.60	Stiff high strength multi coloured very gravelly silty sandy CLAY with medium cobble content of quartz. Gravel is angular to subrounded fine to coarse quartz, mudstone, siltstone and sandstone		
			02/07/2014:DRY			Stiff brown gravelly slightly sandy slightly silty CLAY with low cobble content of quartz and occasional relic rootlets. Gravel sized fragments are fine to coarse quartz, sandstone and siltstone		
						Complete at 1.60m		

Plan	Remarks		
.	D* = 1 Plastic Jar Sample, 1 Amber Glass Jar Sample, 1 Vial Sample, taken for chemical testing.		
.	Pit sides remained vertical and stable.		
.	Trial pit remained dry.		
.	HV = Hand Shear Vane test.		
.	Scale (approx)	Logged By	Figure No.
.	1:25	ALM/DK	5900.TP9



SUB SURFACE

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Site
NEW CAR PARK, BAE SAMLESBURY, LANCASHIRE

Trial Pit Number
TP10

Excavation Method MECHANICAL EXCAVATOR	Dimensions 0.50m x 1.50m x 2.00m	Ground Level (mOD)	Client BAE SYSTEMS PLC	Job Number 5900
	Location AS PLAN	Dates 02/07/2014	Engineer TRP CONSULTING	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.05-0.20	D*				(0.30)	MADE GROUND: grass over brown gravelly slightly sandy clay with some rootlets. Gravel sized fragments are fine to coarse stone		
0.30-0.50	B D*				0.30 (0.10) 0.40	MADE GROUND: dark grey and dark brown very sandy gravel sized fragments of fine to coarse slag, stone and brick		
0.60-0.80	B				(0.50)	MADE GROUND: brown slightly gravelly slightly sandy silty clay. Gravel sized fragments are fine to coarse stone and brickfrom 0.40m: becoming brown, grey brown and grey		
0.90-1.00	B				0.90 (0.10) 1.00	Fibrous PEAT		
1.00	D		HV@1.10m, c=23kPa		(0.30)	Soft low strength grey brown and dark grey mottled slightly gravelly slightly sandy silty CLAY with some roots, rootlets and plant remains. Gravel is subangular to rounded fine to coarse sandstone and quartz		
1.50	D		Seepage(1) at 1.50m. HV@1.50m, c=85kPa		1.30 (0.60)	Stiff high strength brown and occasional light grey mottled slightly gravelly slightly sandy silty CLAY with low cobble content of quartz. Gravel is subrounded fine to coarse quartz, sandstone and siltstone		∇1
			HV@1.80m, c=81kPa Seepage(2) at 1.90m. 02/07/2014:		1.90 (0.10) 2.00	Brown very gravelly very sandy silty CLAY. Gravel is subangular to rounded fine to coarse quartz, sandstone and siltstone		∇2
						Complete at 2.00m		

Plan	Remarks		
	D* = 1 Plastic Jar Sample, 1 Amber Glass Jar Sample, 1 Vial Sample, taken for chemical testing. Pit sides remained vertical and stable. Seepage at 1.50m and seepage at base. HV = Hand Shear Vane test.		
	Scale (approx)	Logged By	Figure No.
	1:25	ALM/DK	5900.TP10



SUB SURFACE

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Site
 NEW CAR PARK, BAE SAMLESBURY, LANCASHIRE

Trial Pit Number
TP11

Excavation Method HAND EXCAVATED	Dimensions 0.25m x 0.25m	Ground Level (mOD)	Client BAE SYSTEMS PLC	Job Number 5900
	Location AS PLAN	Dates 03/07/2014	Engineer TRP CONSULTING	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.20 0.00-0.20	B D*				(0.20)	MADE GROUND: grass over dark brown slightly gravelly slightly sandy silty clay with low cobble content and many roots and rootlets. Gravel sized fragments are fine to coarse stone		
0.20-0.60 0.20-0.60	B D*				0.20 (0.40)	MADE GROUND: dark brown ashy very gravelly medium to coarse sand. Gravel sized fragments are fine to coarse brick, stone and slag		
0.60-1.00 0.60-1.00	B D				0.60 (0.40)	MADE GROUND: very soft dark greyish brown slightly gravelly slightly sandy silty clay. Gravel sized fragments are fine to coarse brick and stone		
			03/07/2014: DRY		1.00	Complete at 1.00m		

Plan 	Remarks D* = 1 Plastic Jar Sample, 1 Amber Glass Jar Sample, 1 Vial Sample, taken for chemical testing. Pit sides remained vertical and stable. Trial pit remained dry. Hand dug due to possible services being present.		
	Scale (approx) 1:25	Logged By DM/DK	Figure No. 5900.TP11



SUB SURFACE

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

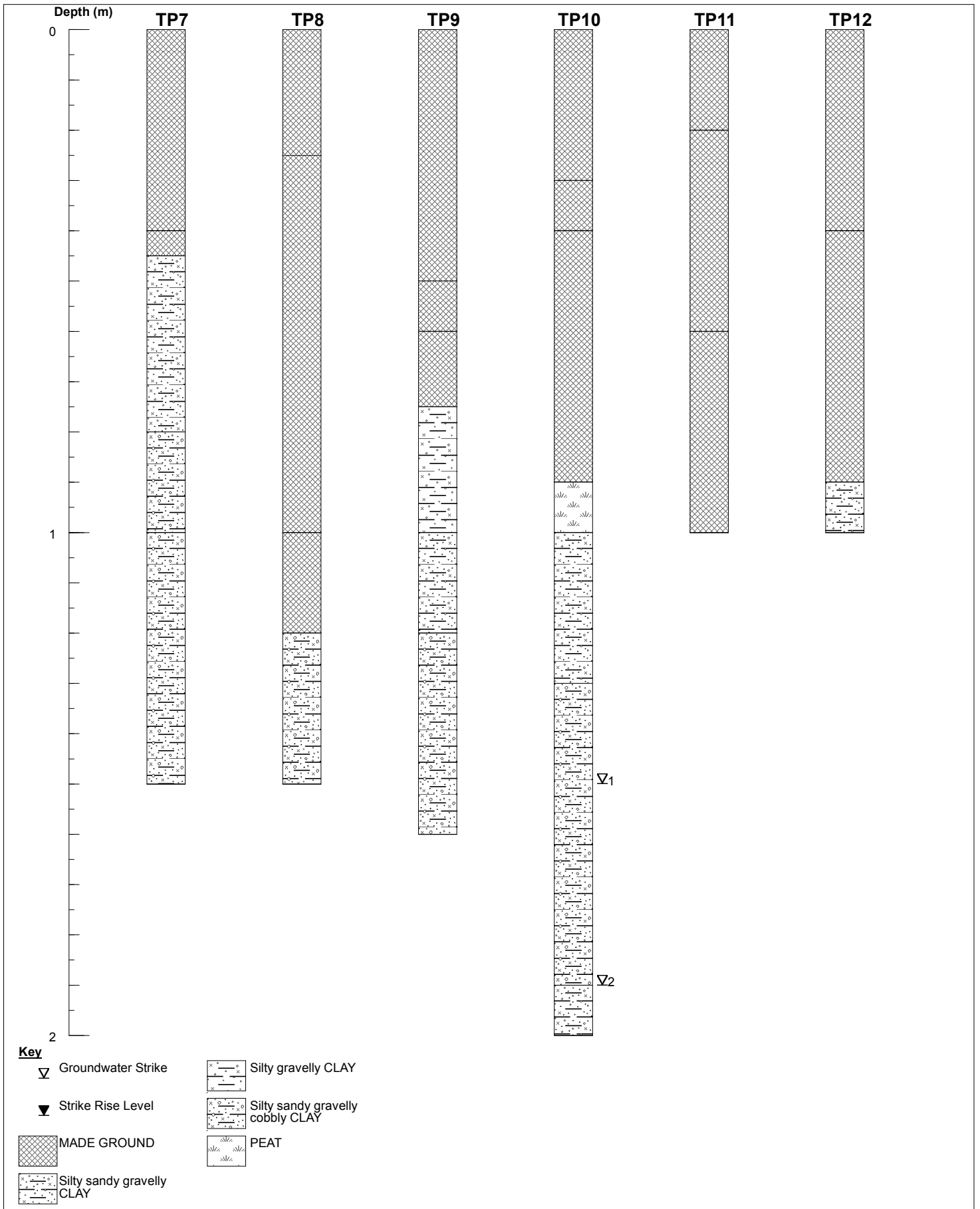
Site
 NEW CAR PARK, BAE SAMLESBURY, LANCASHIRE


Trial Pit Number
TP12

Excavation Method HAND EXCAVATED	Dimensions 0.25m x 0.25m	Ground Level (mOD)	Client BAE SYSTEMS PLC	Job Number 5900
	Location AS PLAN	Dates 03/07/2014	Engineer TRP CONSULTING	Sheet 1/1

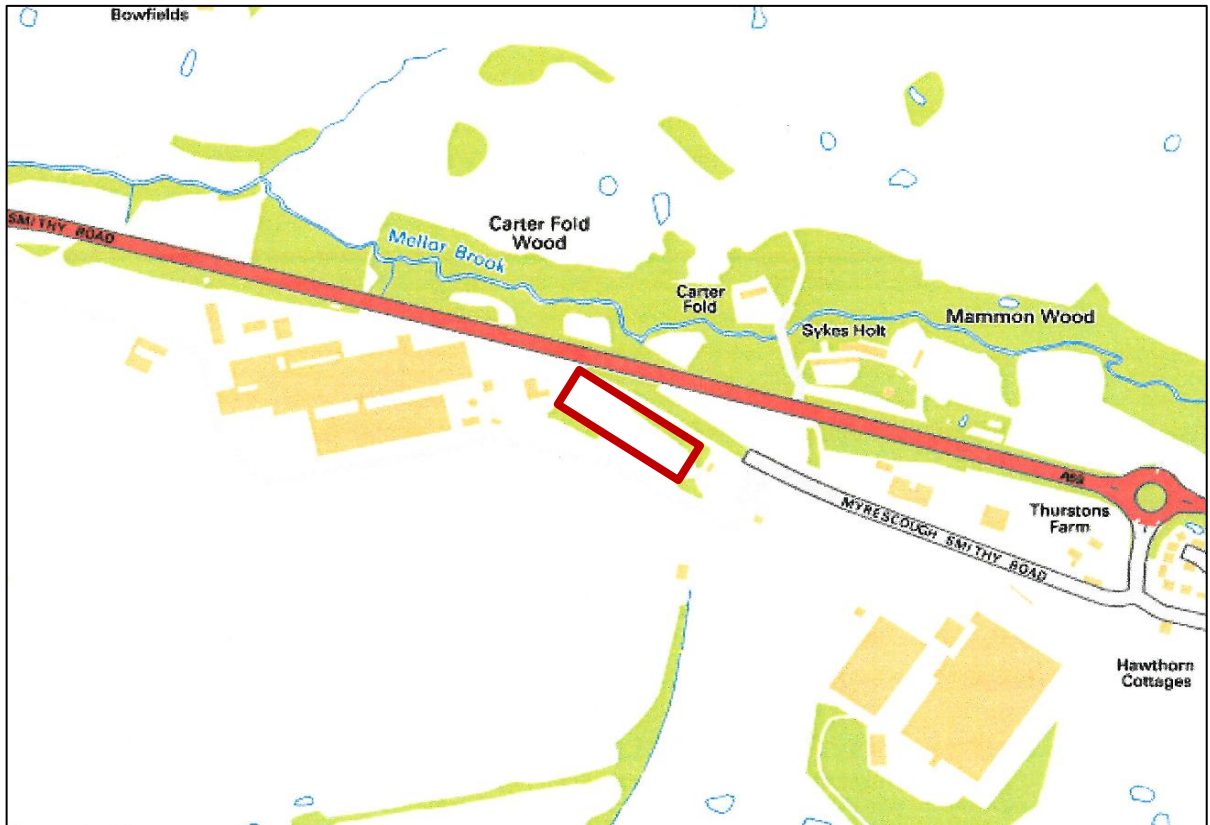
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.40 0.00-0.40	B D*				(0.40)	MADE GROUND: grass over dark brown slightly gravelly slightly sandy silty clay with many roots and rootlets. Gravel sized fragments are subangular to rounded fine to coarse stone and slag		
0.40-0.90 0.40-0.90	B D*				0.40 (0.50)	MADE GROUND: firm grey brown and occasional orangish brown slightly gravelly slightly sandy silty clay with low cobble content and some roots and rootlets. Gravel sized fragments are fine to coarse stone		
0.90-1.00	D		03/07/2014: DRY		0.90 (0.10) 1.00	Soft brown and grey mottled slightly gravelly slightly sandy silty CLAY with some fine to coarse sand lenses. Gravel is subangular to rounded fine to medium sandstone and siltstone Complete at 1.00m		

Plan 	Remarks D* = 1 Plastic Jar Sample, 1 Amber Glass Jar Sample, 1 Vial Sample, taken for chemical testing. Pit sides remained vertical and stable. Trial pit remained dry. Hand dug due to possible services being present.		
	Scale (approx) 1:25	Logged By DM/DK	Figure No. 5900.TP12



 SUB SURFACE SITE INVESTIGATION, GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS 3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907	Nominal Section			
	Site NEW CAR PARK, BAE SAMLESBURY, LANCASHIRE	Date Drawn 26/08/2014	Date Checked	Sheet 1/1
Client BAE SYSTEMS PLC	Drawn By	Checked By	Scale 1:10[V]	Figure No. 5900.1


FIGURES

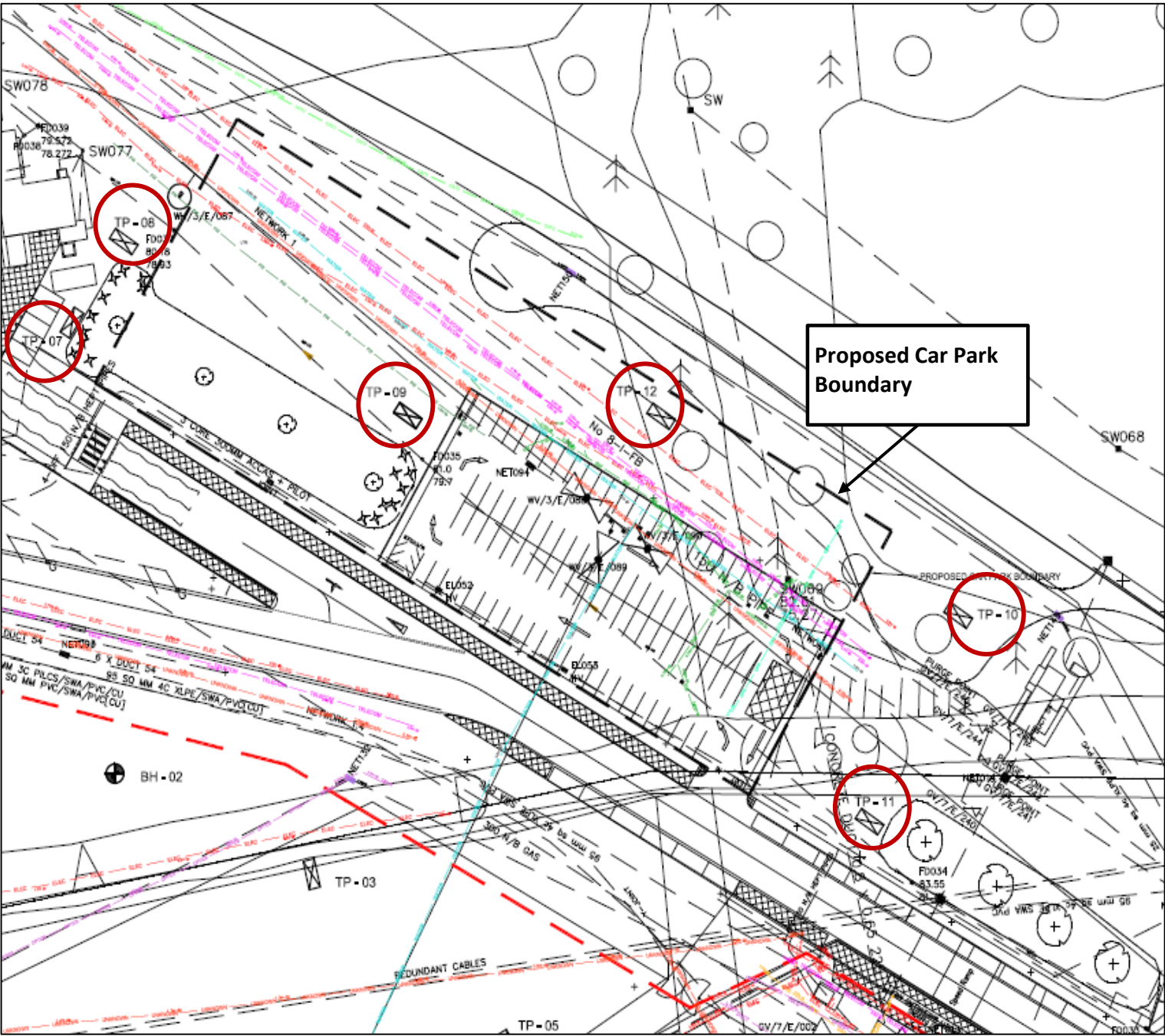


SUB SURFACE

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

General Site Location

Site NEW CAR PARK, BAE SYSTEMS, SAMLESBURY, LANCASHIRE	Date Drawn 21/08/2014	Date Checked	Orientation 	Job No. 5900
Client BAE SYSTEMS PLC	Drawn By TP	Checked By	Scale -	Figure No. 1



○ Trial pit/ CBR Locations

Proposed Car Park Boundary



SUB SURFACE

SITE INVESTIGATION AND SPECIALIST GEOTECHNICAL CONSULTANTS
 3 Peel Street, Preston, PR2 2QS, Tel: (01772) 561185 Fax: (01772) 204907

Site
NEW CAR PARK, BAE SYSTEMS, SAMLESBURY, LANCASHIRE

Client
BAE SYSTEMS PLC

Trial Pit/ CBR Location Plan

Date Drawn	21-Aug-14	Date Checked		Orientation		Job No.	5900
Drawn By	TP	Checked By		Scale	-	Figure No.	2