



APPENDIX E

Laboratory Results- Geotechnical



TEST REPORT.

ISSUED BY : SOIL PROPERTY TESTING LTD.

DATE OF ISSUE : 04/03/14 PAGE 1 of 14 Pages

Contract

Serial No.

UK13.1429 - Selwyn Primary School

S27365



CLIENT:

Environmental Protection
Strategies Ltd
7B Caxton House
Broad Street
CAMBOURNE
CAMBRIDGE
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Soil Property Testing

18 Halcyon Court, St Margarets Way,
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SAMPLES SUBMITTED BY:

Environmental Protection

APPROVED SIGNATORIES:

- S.P.TOWNEND FGS
Technical Director
- W. JOHNSTONE
Deputy Technical/Quality Manager
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Quality Manager

SAMPLES LABELLED:

Selwyn Primary School

DATE RECEIVED: 18/02/14

SAMPLES TESTED BETWEEN 18/02/14 and 04/03/14

REMARKS: For the attention of Mr B Virtue

- NOTES:**
- 1 All remaining samples or remnants from this contract will be disposed of after 21 days from today, unless we are notified to the contrary.
 - 2 (a) UKAS - United Kingdom Accreditation Service.
(b) Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.
 - 3 Tests marked "NOT UKAS ACCREDITED" in this test report are not included in the UKAS Accreditation Schedule for this testing laboratory.
 - 4 This test report may not be reproduced other than in full except with the prior written approval of the issuing laboratory.



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SCHEDULE OF LABORATORY TESTS

Bh./ Tp No.	Sample Ref	Depth (from)	1:Moisture Content Determination 4:Liquid/Plastic Limit 1 Point 700:Sulphate Test (2:1 Water Sol) 702:Ph value of Soil or Water 20:CER Compaction 2.5 Kg method 19:California Bearing Ratio Test													Remarks			
WS1	D0.8	0.80	*	*	*	*													
WS4	B0.5	0.50	*	*			*	*											
WS5	D1.0	1.00	*	*	*	*													
	D2.0	2.00	*	*	*	*													
WS6	B0.5	0.50	*	*			*	*											
-	-	-	5	5	3	3	2	2											← Total Number of Tests →



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SUMMARY OF MOISTURE CONTENT, LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole/ Pit No.	Depth m.	Sample	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)	SAMPLE PREPARATION				Description	CLASS
								Method S/N	Ret'd 0.425mm (%)	Corr'd M/C <0.425mm	Curing Time (hrs.)		
WS1	0.80 -1.00	D0.8	21	46	19	27	0.07	N	0 (A)		25	Stiff yellowish brown slightly sandy silty CLAY with occasional calcareous aggregations, rare bluish grey veins and decayed roots	CI
WS4	0.50 -1.50	B0.5	32	77	29	48	0.06	N	0 (A)		29	Firm brownish grey CLAY and stiff orangey brown CLAY with occasional selenite crystals	CV
WS5	1.00 -1.20	D1.0	35	77	29	48	0.13	N	0 (A)		25	Firm yellowish brown CLAY with occasional bluish grey mottling and rare recently active and decayed roots	CV
WS5	2.00 -2.20	D2.0	32	77	29	48	0.06	N	0 (A)		25	Stiff yellowish brown CLAY with occasional bluish grey mottling, rare decayed roots and selenite crystals	CV
WS6	0.50 -1.50	B0.5	26	53	19	34	0.21	N	0 (A)		29	Firm grey slightly sandy CLAY and stiff grey CLAY	CH

METHOD OF PREPARATION : BS 1377:PART 1:1990:7.4 & PART 2:1990:4.2 S = Wet Sieved Specimen
N = prepared from Natural

METHOD OF TEST : BS 1377:PART 2:1990:3.2, 4.4, 5.3, 5.4

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample,
C = Core Cutter. A = Assumed, M = Measured

COMMENTS :

REMARKS TO INCLUDE : Sample disturbance, loss of moisture, variation from test procedure, location and origin
of test specimen within original sample. Oven drying temperature if not 105-110 deg C.



TEST REPORT.

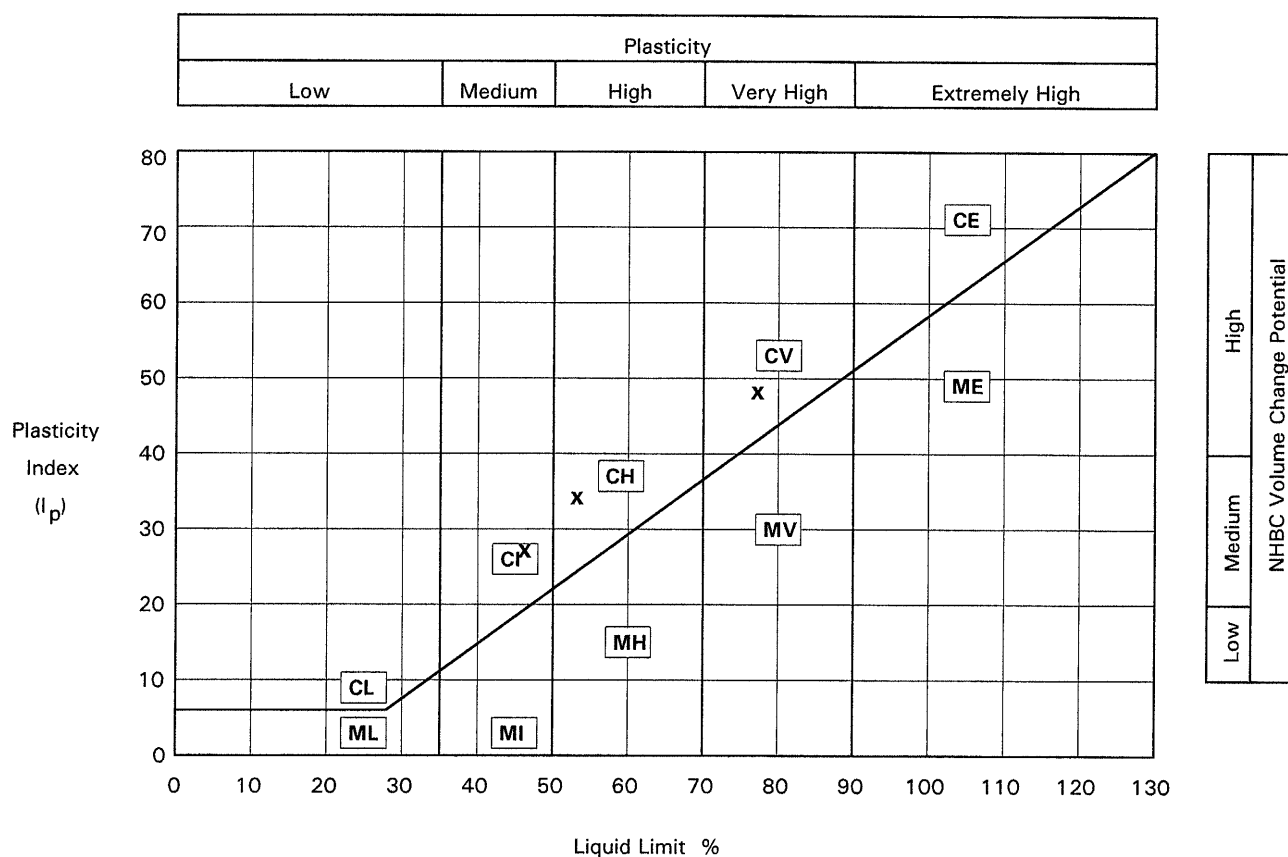
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PLOT OF PLASTICITY INDEX AGAINST LIQUID LIMIT USING CASAGRANDE CLASSIFICATION CHART



METHOD OF PREPARATION: BS 1377:PART 1:1990:7.4 & PART 2:1990:4.2

METHOD OF TEST : BS 1377:PART 2:1990:3.2, 4.4, 5.3, 5.4

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

COMMENTS : VOLUME CHANGE POTENTIAL: NHBC Standards Chapter 4.2 Unmodified Plasticity Index PLASTICITY CHART BS5930:1999:Figure 18



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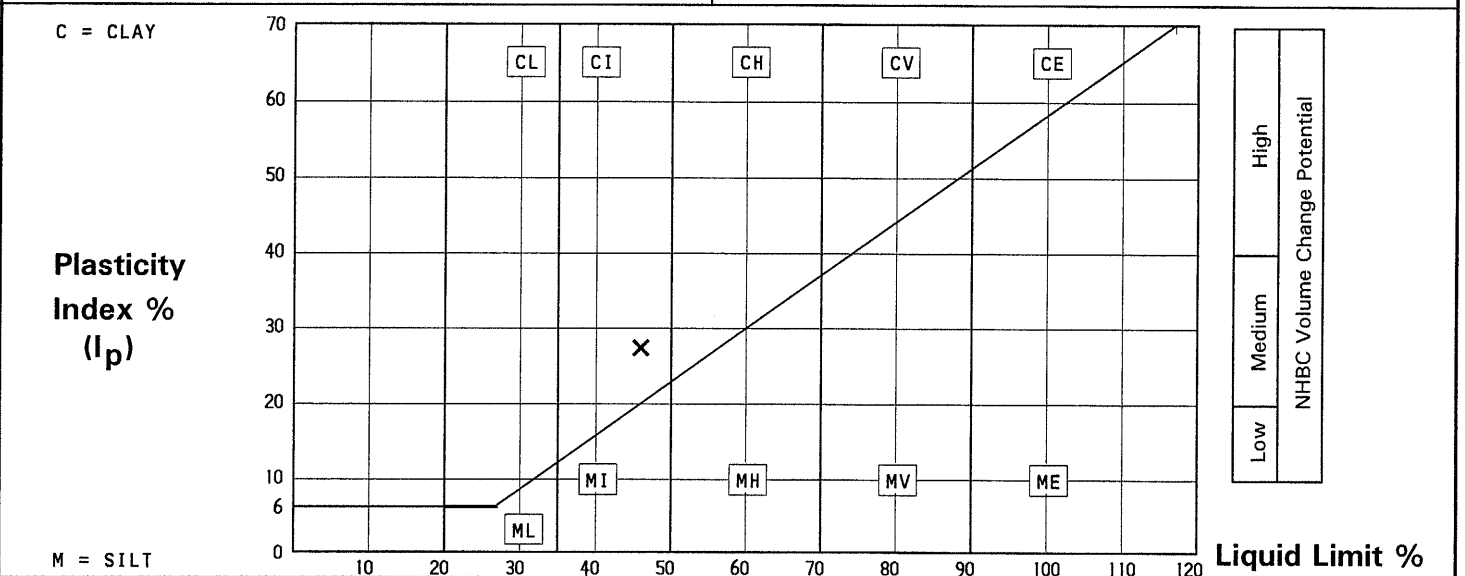
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DETERMINATION OF MOISTURE CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole/ Pit No.	Depth m.	Sample	Moisture Content %	Description	Remarks
WS1	0.80 -1.00	D0.8	21	Stiff yellowish brown slightly sandy silty CLAY with occasional calcareous aggregations, rare bluish grey veins and decayed roots	

PREPARATION				Liquid Limit	46 %
Method of Preparation	Specimen from Natural Soil			Plastic Limit	19 %
Sample retained 0.425 sieve	(Assumed)	0 %		Plasticity Index	27 %
Corrected moisture content for material passing 0.425mm		%		Liquidity Index	0.07
Curing Time	25 Hours			Clay Content	Not analysed. %
				Derived Activity (PI/CC)	Not analysed.



METHOD OF PREPARATION: BS 1377:PART 1:1990:7.4 & PART 2:1990:4.2

METHOD OF TEST : BS 1377:PART 2:1990:3.2, 4.4, 5.3, 5.4

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

COMMENTS : PLASTICITY CHART BS5930:1999:Figure 18
VOLUME CHANGE POTENTIAL: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
NOTE: Modified Plasticity Index I'_p = I_p x (% less than 425 microns/100)



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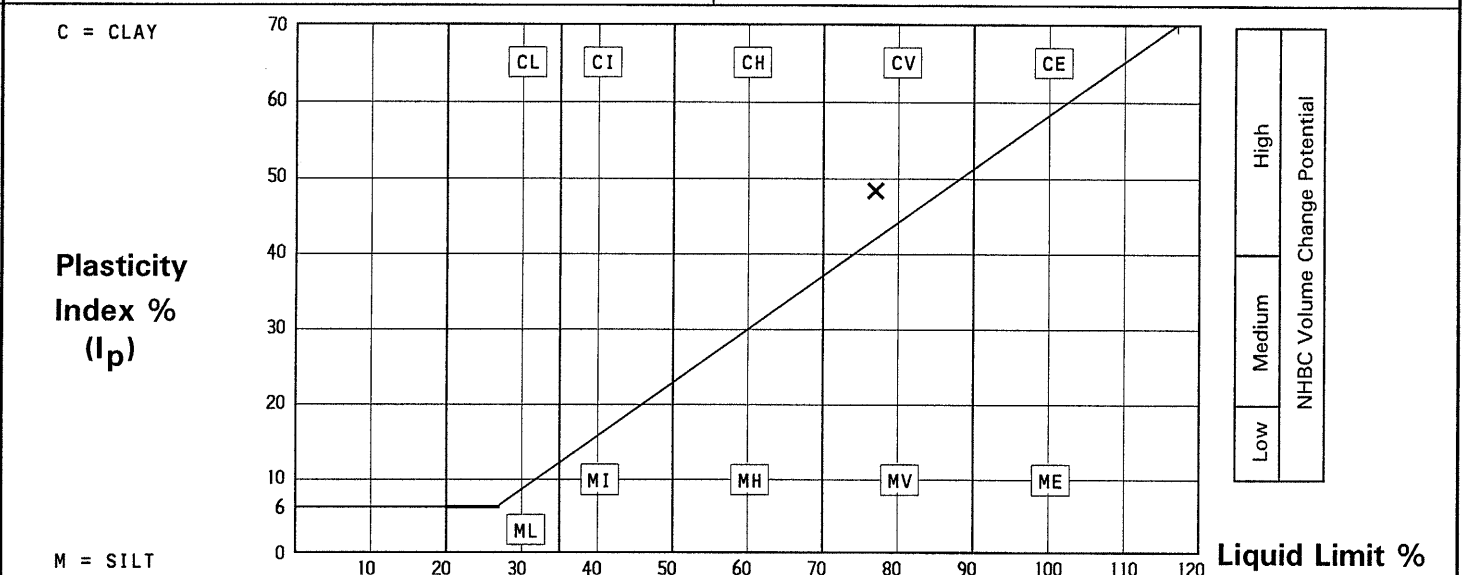
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DETERMINATION OF MOISTURE CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole/ Pit No.	Depth m.	Sample	Moisture Content %	Description	Remarks
WS4	0.50 -1.50	B0.5	32	Firm brownish grey CLAY and stiff orangey brown CLAY with occasional selenite crystals	Oven dried at a maximum of 80°C due to the presence of selenite

PREPARATION		Liquid Limit	77 %
Method of Preparation	Specimen from Natural Soil	Plastic Limit	29 %
Sample retained 0.425 sieve	(Assumed) 0 %	Plasticity Index	48 %
Corrected moisture content for material passing 0.425mm	%	Liquidity Index	0.06
Curing Time	29 Hours	Clay Content	Not analysed. %
		Derived Activity (PI/CC)	Not analysed.



METHOD OF PREPARATION: BS 1377:PART 1:1990:7.4 & PART 2:1990:4.2

METHOD OF TEST : BS 1377:PART 2:1990:3.2, 4.4, 5.3, 5.4

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

COMMENTS : PLASTICITY CHART BS5930:1999:Figure 18
VOLUME CHANGE POTENTIAL: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
NOTE: Modified Plasticity Index I_p = I_p x (% less than 425 microns/100)



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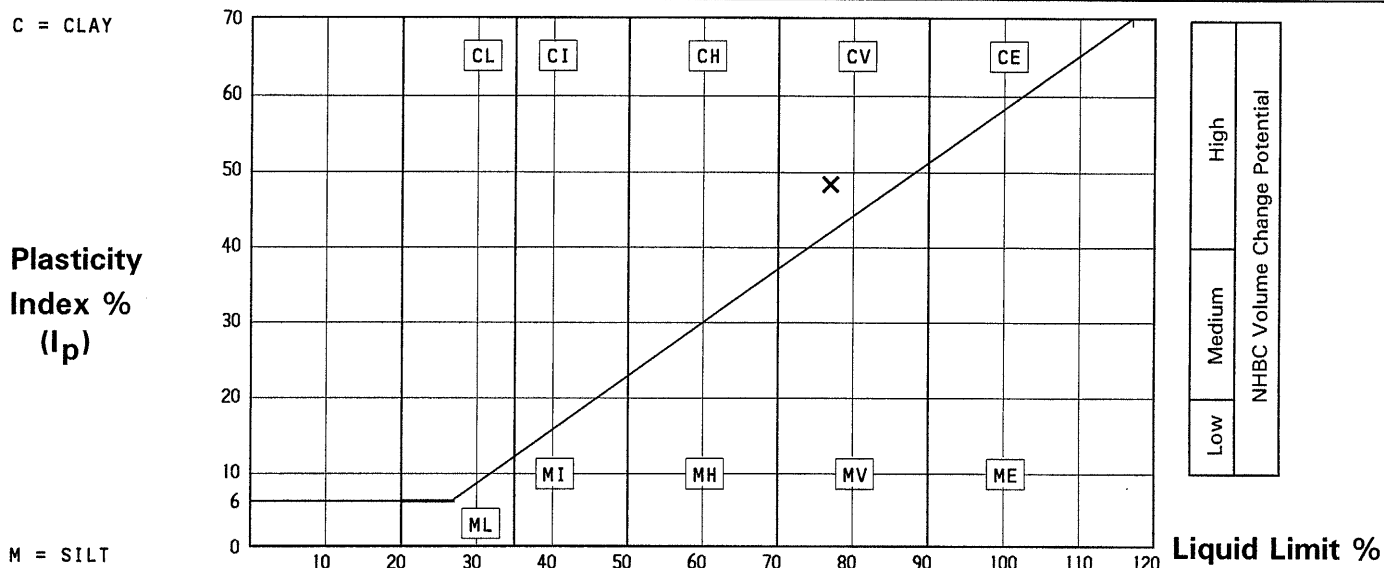
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DETERMINATION OF MOISTURE CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole/ Pit No.	Depth m.	Sample	Moisture Content %	Description	Remarks
WS5	1.00 -1.20	D1.0	35	Firm yellowish brown CLAY with occasional bluish grey mottling and rare recently active and decayed roots	

PREPARATION		Liquid Limit	77 %
Method of Preparation	Specimen from Natural Soil	Plastic Limit	29 %
Sample retained 0.425 sieve	(Assumed) 0 %	Plasticity Index	48 %
Corrected moisture content for material passing 0.425mm	%	Liquidity Index	0.13
Curing Time	25 Hours	Clay Content	Not analysed. %
		Derived Activity (PI/CC)	Not analysed.



METHOD OF PREPARATION: BS 1377:PART 1:1990:7.4 & PART 2:1990:4.2

METHOD OF TEST : BS 1377:PART 2:1990:3.2, 4.4, 5.3, 5.4

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

COMMENTS : PLASTICITY CHART BS5930:1999:Figure 18
VOLUME CHANGE POTENTIAL: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
NOTE: Modified Plasticity Index I_p = I_p × (% less than 425 microns/100)



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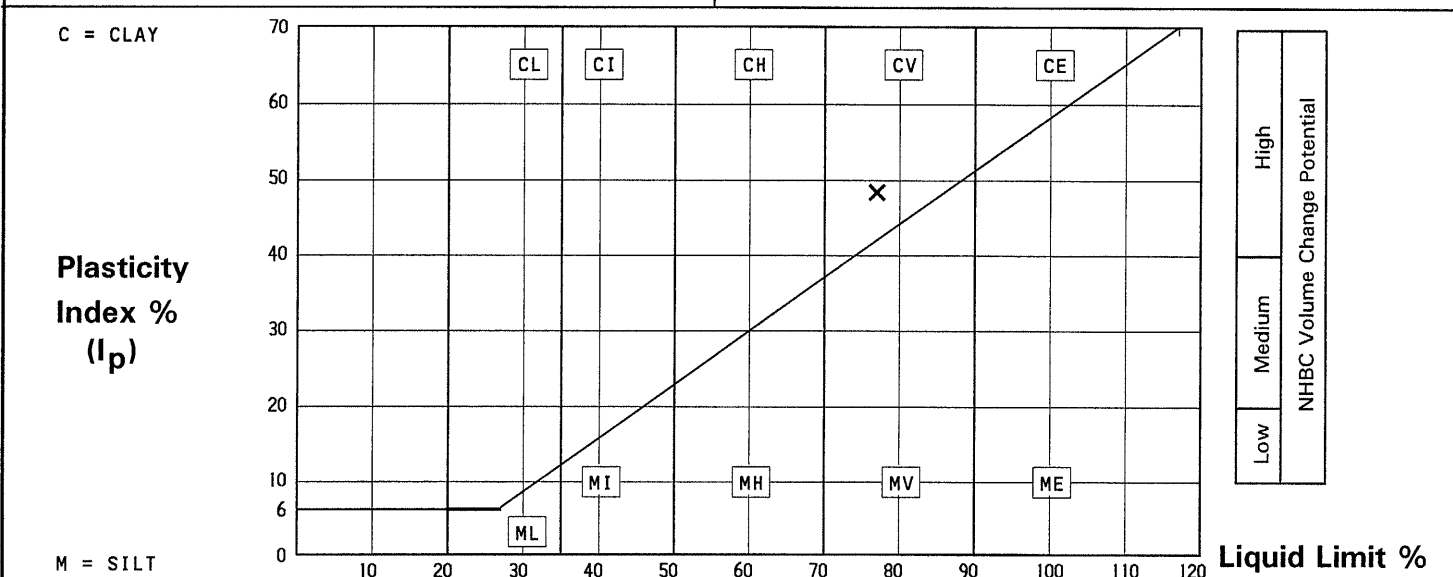
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DETERMINATION OF MOISTURE CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole/ Pit No.	Depth m.	Sample	Moisture Content %	Description	Remarks
WS5	2.00 -2.20	D2.0	32	Stiff yellowish brown CLAY with occasional bluish grey mottling, rare decayed roots and selenite crystals	Oven dried at a maximum of 80°C due to the presence of selenite

PREPARATION		Liquid Limit	77 %
Method of Preparation	Specimen from Natural Soil	Plastic Limit	29 %
Sample retained 0.425 sieve	(Assumed) 0 %	Plasticity Index	48 %
Corrected moisture content for material passing 0.425mm	%	Liquidity Index	0.06
Curing Time	25 Hours	Clay Content	Not analysed. %
		Derived Activity (PI/CC)	Not analysed.



METHOD OF PREPARATION: BS 1377:PART 1:1990:7.4 & PART 2:1990:4.2

METHOD OF TEST : BS 1377:PART 2:1990:3.2, 4.4, 5.3, 5.4

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

COMMENTS : PLASTICITY CHART BS5930:1999:Figure 18
VOLUME CHANGE POTENTIAL: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
NOTE: Modified Plasticity Index $I_p = I_p \times (\% \text{ less than } 425 \text{ microns}/100)$



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

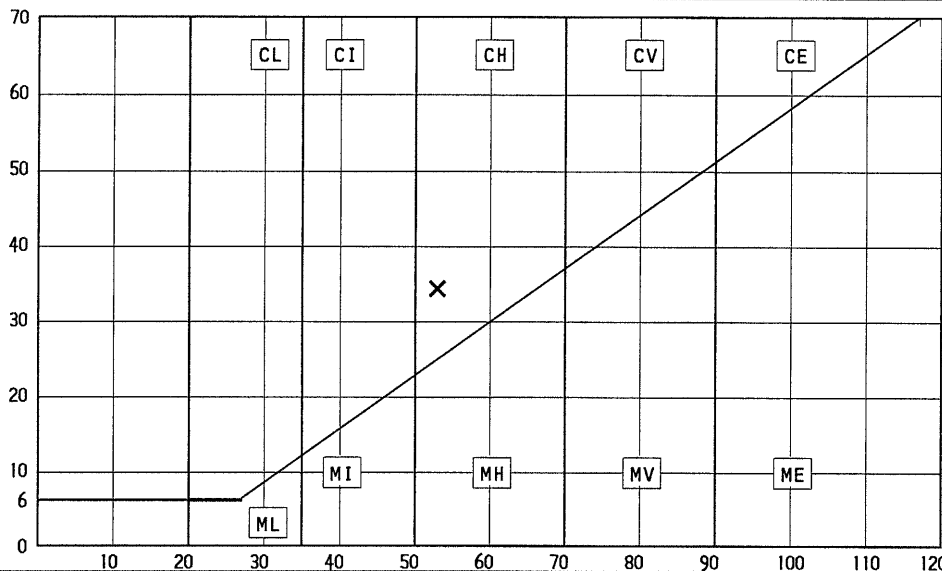
Borehole/ Pit No.	Depth m.	Sample	Moisture Content %	Description	Remarks
WS6	0.50 -1.50	B0.5	26	Firm grey slightly sandy CLAY and stiff grey CLAY	

PREPARATION		Liquid Limit	53 %
Method of Preparation	Specimen from Natural Soil	Plastic Limit	19 %
Sample retained 0.425 sieve	(Assumed) 0 %	Plasticity Index	34 %
Corrected moisture content for material passing 0.425mm	%	Liquidity Index	0.21
Curing Time	29 Hours	Clay Content	Not analysed. %
		Derived Activity (PI/CC)	Not analysed.

C = CLAY

Plasticity
Index %
(I_p)

M = SILT



High	NHBC Volume Change Potential
Medium	
Low	

Liquid Limit %

METHOD OF PREPARATION: BS 1377:PART 1:1990:7.4 & PART 2:1990:4.2

METHOD OF TEST : BS 1377:PART 2:1990:3.2, 4.4, 5.3, 5.4

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

COMMENTS : PLASTICITY CHART BS5930:1999:Figure 18
VOLUME CHANGE POTENTIAL: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
NOTE: Modified Plasticity Index I_p = I_p x (% less than 425 microns/100)



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LABORATORY CALIFORNIA BEARING RATIO TESTS ADJUSTED FOR SEASONAL MOISTURE CONTENT CHANGES.

Due to seasonal variations of water content in near surface soils, many clients require CBR test samples to be subjected to sample preparation in the laboratory before testing. With Clay soils, liquid and plastic limits and moisture contents are carried out to classify them on material passing 20mm. The plastic limit is then compared against the moisture content with due regard to the proportion of material then retained on a 0.425mm sieve. If the moisture content is already 2% or more above the plastic limit, compaction may take place immediately. If this is not the case a calculated amount of water is added to the sample and cured for 24 hours before compaction. The samples are then cured for a further 24 hours before CBR tests are carried out at both the top and bottom of the sample.

CALCULATION OF ADJUSTED MOISTURE CONTENT FOR CBR TESTING

When a significant proportion of a basically clay material is >0.425mm, the adjusted moisture content (MC) for test shall be derived as follows:

Obtain test specimens for CBR, Limits and Moisture content from Material Passing 20mm. (If the sample is large enough a moisture content may also be carried out on a representative portion of the whole sample including material greater than 20mm, and reported for information)

The Plastic Limit (PL) for the fine fraction is obtained by testing material passing the 0.425mm sieve. A notional 5% Moisture Content is to be allowed for material passing 20mm, and retained on the 0.425mm sieve. The proportion passing the 0.425mm is obtained by the wet sieve preparation method.

If X% passes 0.425mm, (100-X) % is retained on 0.425mm and with the 5% MC required to be incorporated for the retained 0.425mm portion, the adjusted MC for test shall be at least:

$$\frac{X(PL+2) + (100-X)5\%}{100} \text{ for the sample passing 20mm}$$

CALCULATIONS:

S27365 – UK13.1429 – Selwyn Primary School.

WS4 – B0.5 @ 0.50m 100% passing 0.425mm sieve
Plastic limit of specimen = 28.9%
Moisture content as received = 32.3%

Therefore moisture content adjustment not required
Moisture Content after CBR Test = 34%

WS6 – B0.5 @ 0.50m 100% passing 0.425mm sieve
Plastic limit of specimen = 18.6
Moisture content as received = 25.9%

Therefore moisture content adjustment not required
Moisture Content after CBR Test = 26%



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DETERMINATION OF CALIFORNIA BEARING RATIO (CBR)

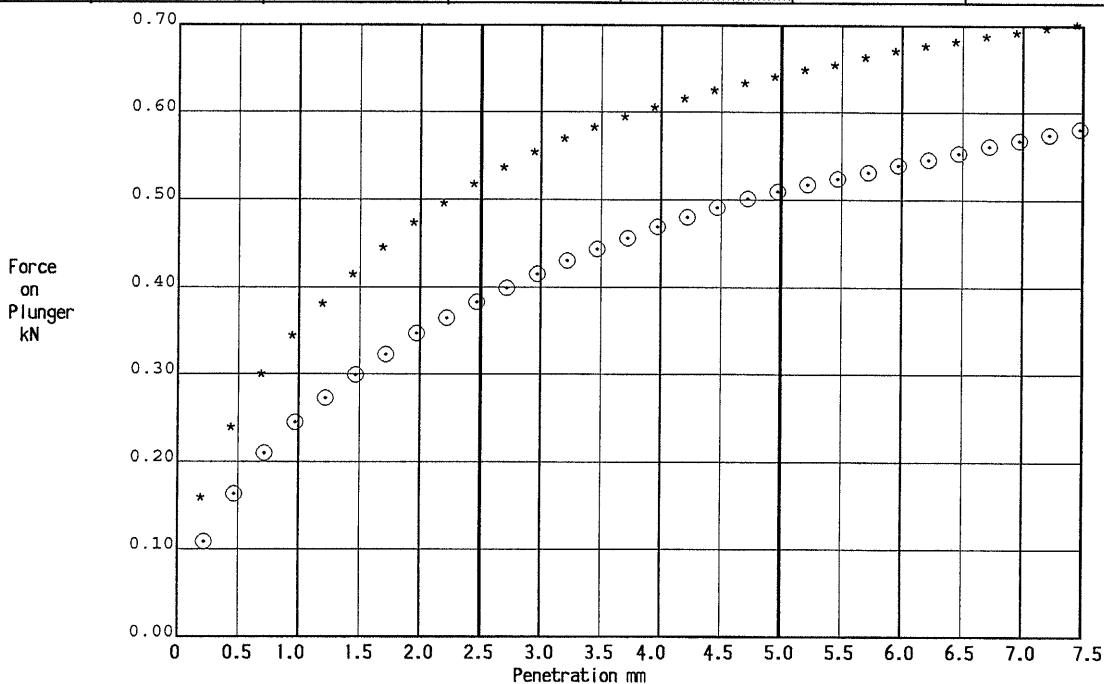
Borehole/ Pit No./ Chainage	Depth m.	Sample	Description	Remarks
WS4	0.50 -1.50	B0.5	Firm brownish grey CLAY and stiff orangey brown CLAY with occasional selenite crystals	Oven dried at a maximum of 80°C due to the presence of selenite

Moisture Content % TOP: 34 BOTTOM: 34 Average: 34 Bulk Density Mg/m³ 1.87 Dry Density Mg/m³ 1.39

CBR VALUES

Penetration mm	Force kN	Calculated CBR %	Corrected CBR %	Highest CBR %	Average CBR % (Shown if Top & Bottom CBR Values are within 10% of their Mean value)	% material retained on 20mm sieve and removed before test : 0
TOP	2.5	0.51	3.9		3.9	METHOD OF PREPARATION BS 1377:Part 4:1990 7.2.4 2.5kg Rammer Method.
*	5.0	0.64	3.2			
BOTTOM	2.5	0.38	2.9		2.9	Surcharge weights (kg) : 15
⊙	5.0	0.51	2.6			

SOAKED TEST : NO



METHOD OF PREPARATION: BS 1377:PART 1:1990:7.6.1 & 7.6.5 & PART 4:1990:7.2

METHOD OF TEST : BS 1377:PART 4:1990:7.4

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

COMMENTS :

REMARKS TO INCLUDE : Sample disturbance, loss of moisture, variation from test procedure, location and origin of test specimen within original sample. Oven drying temperature if not 105-110 deg C.



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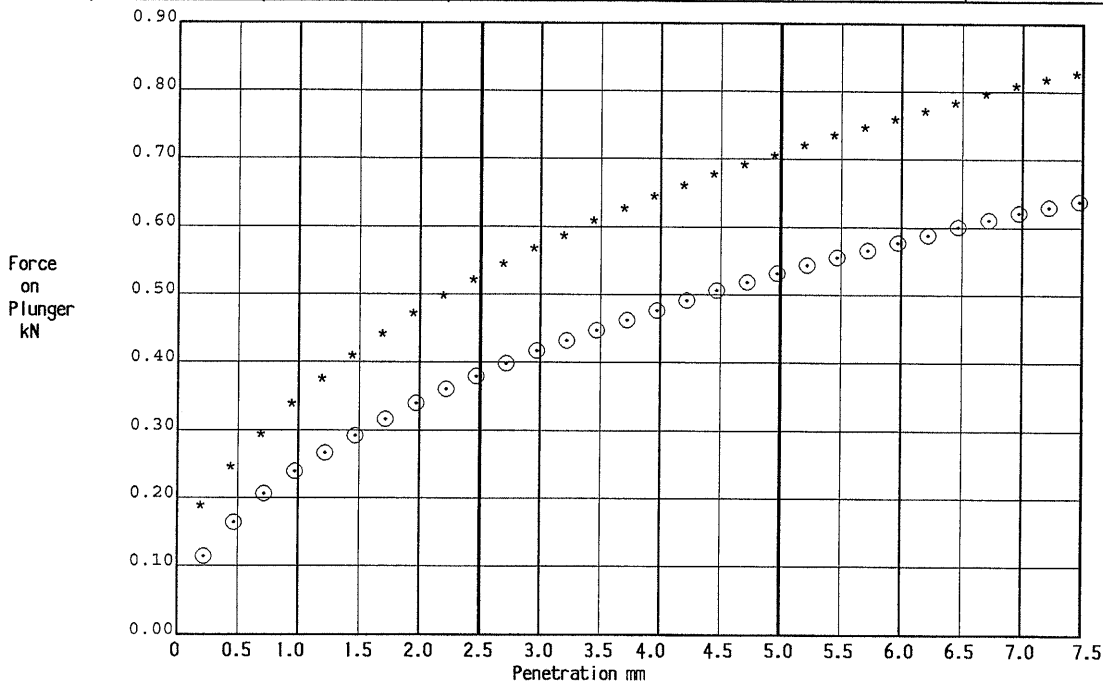
DETERMINATION OF CALIFORNIA BEARING RATIO (CBR)

Borehole/ Pit No./ Chainage	Depth m.	Sample	Description	Remarks
WS6	0.50 -1.50	B0.5	Firm grey slightly sandy CLAY and stiff grey CLAY	

Moisture Content % TOP: 26 BOTTOM: 27 Average: 26 Bulk Density Mg/m³ 1.96 Dry Density Mg/m³ 1.55

CBR VALUES

Penetration mm	Force kN	Calculated CBR %	Corrected CBR %	Highest CBR %	Average CBR % (Shown if Top & Bottom CBR Values are within 10% of their Mean value)	% material retained on 20mm sieve and removed before test : 0
TOP *	2.5 5.0	0.52 0.70	3.9 3.5		3.9	METHOD OF PREPARATION BS 1377:Part 4:1990 7.2.4 2.5kg Rammer Method.
BOTTOM ⊙	2.5 5.0	0.38 0.53	2.9 2.7			
						SOAKED TEST : NO



METHOD OF PREPARATION: BS 1377:PART 1:1990:7.6.1 & 7.6.5 & PART 4:1990:7.2

METHOD OF TEST : BS 1377:PART 4:1990:7.4

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

COMMENTS :

REMARKS TO INCLUDE : Sample disturbance, loss of moisture, variation from test procedure, location and origin of test specimen within original sample. Oven drying temperature if not 105-110 deg C.



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DETERMINATION OF THE SULPHATE CONTENT OF SOIL AND GROUNDWATER

Borehole/ Pit No.	Depth m.	Sample	Concentration of Soluble Sulphate			% of sample passing 2mm sieve	Description	Remarks
			Soil		Groundwater g/l			
			Acid Soluble SO ₃ %	Water Soluble, 2:1 SO ₃ g/l				
WS1	0.80 -1.00	D0.8		0.16		100	Stiff yellowish brown slightly sandy silty CLAY with occasional calcareous aggregations, rare bluish grey veins and decayed roots	
WS5	1.00 -1.20	D1.0		0.27		100	Firm yellowish brown CLAY with occasional bluish grey mottling and rare recently active and decayed roots	
WS5	2.00 -2.20	D2.0		1.68		100	Stiff yellowish brown CLAY with occasional bluish grey mottling, rare decayed roots and selenite crystals	Oven dried at a maximum of 80°C due to the presence of selenite

METHOD OF PREPARATION: BS 1377:PART 1:1990:7.5 BS1377:PART 3:1990:5.2 Acid Soluble, 5.3 Soil/Water Extract
: 5.4 Groundwater

METHOD OF TEST : BS 1377:PART 3:1990:5.5

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample,
C = Core Cutter

COMMENTS : Test not UKAS accredited.

REMARKS TO INCLUDE : Sample disturbance, loss of moisture, variation from test procedure, location and origin
of test specimen within original sample. Oven drying temperature if not 105-110 deg C.



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DETERMINATION OF THE pH VALUE

Borehole/ Pit No.	Depth m.	Sample	pH Value	Description	Remarks
WS1	0.80 -1.00	D0.8	7.9	Stiff yellowish brown slightly sandy silty CLAY with occasional calcareous aggregations, rare bluish grey veins and decayed roots	
WS5	1.00 -1.20	D1.0	7.9	Firm yellowish brown CLAY with occasional bluish grey mottling and rare recently active and decayed roots	
WS5	2.00 -2.20	D2.0	7.4	Stiff yellowish brown CLAY with occasional bluish grey mottling, rare decayed roots and selenite crystals	Oven dried at a maximum of 80°C due to the presence of selenite

METHOD OF PREPARATION: BS 1377:PART 1:1990:7 BS 1377:PART 3:1990:9.4

METHOD OF TEST : BS 1377:PART 3:1990:9.5

TYPE OF SAMPLE KEY : U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

COMMENTS : Test not UKAS accredited.

REMARKS TO INCLUDE : Sample disturbance, loss of moisture, variation from test procedure, location and origin of test specimen within original sample. Oven drying temperature if not 105-110 deg C.



APPENDIX F

Summary of Tier I Screening



**DERIVATION OF THE IN-HOUSE GENERIC ASSESSMENT CRITERIA
FOR A SCHOOL SETTING**

In order to generate the In-House Generic Assessment Criteria (GAC) for contaminants of concern at a school setting using the CLEA Human Health Risk Assessment Software (CLEA v1.06).

1 DEVELOPMENT OF THE LAND USE MODEL

In order to develop a land use model which is reflective of a school environment, EPS has selected the 'Commercial' standard land use model. The principal reason for this is that the use of most day schools are most comparable to a commercial land use when considering the duration human receptors spend on site, the type of buildings present and the activities undertaken than when compared to a residential land use.

However, the following notable differences to the standard commercial model have been identified for a school:

1. The ages of the main users of the site (students and staff) will range from 4-65 instead of 16-65.
2. The site users will spend fewer days on site due to prolonged school holidays.
3. Due to varying school hours, the main site users will spend more hours on site per day than a standard working day.
4. The school users are likely to spend more time outside on average each day than a standard commercial site user.

In order to account for these differences within the standard commercial land use model EPS made the following changes to the default commercial model settings:

CLEA Assessment Step 2:

- Change of Age Class (AC) range to AC5-16 instead of AC17 (see sensitivity analysis for justification of selection).

CLEA Assessment Step 4:

- Setting of exposure frequencies for inhalation, ingestion and skin contact for both indoor and outdoor in AC5 to AC16 to 200 days each instead of the default 230days indoor and 170days outdoor as defined in the standard commercial setting.
- Increase of indoor and outdoor occupancy periods per day from 8.3 hours and 0.7 hours to 8.5 hours and 2 hours respectively for AC5 to AC16.
- Import of max exposed skin fractions (indoor) for all age classes ($0.35\text{m}^2\text{m}^2$ and $0.33\text{m}^2\text{m}^2$ for AC5 and AC6 respectively, $0.22\text{m}^2\text{m}^2$ for AC7-14, and $0.21\text{m}^2\text{m}^2$ for AC15-16). These values are taken from the residential land-use model for the same age classes and are therefore considered conservative.
- Import of max exposed skin fraction (outdoor) for all age classes ($0.28\text{m}^2\text{m}^2$ and $0.26\text{m}^2\text{m}^2$ for AC5 and AC6 respectively, $0.15\text{m}^2\text{m}^2$ for AC7-10, and finally $0.14\text{m}^2\text{m}^2$ for AC11-16). These values are taken from the residential land-use model for the same age classes and are therefore considered conservative.

Screen prints taken from the CLEA software used for this site are included in Appendix A and show key changes to the standard Commercial model described above.



2 SENSITIVITY ANALYSES OF REMAINING MODEL SETTINGS

Prior to using the modified CLEA land use to generate any Assessment Criteria for the use at a school setting, EPS carried out sensitivity analyses on other model variables with the objective to ensure that any assessment of contaminant concentrations found at a site using the CLEA software would be protective of human health for all future site users.

The analyses comprised varying each of the remaining input parameters within the standard commercial land-use model to generate a number of assessment criteria values for Benzo(a)pyrene, which is considered a very sensitive contaminant. The parameters found to generate the most protective / stringent assessment criteria could then be selected for the final school model. The sensitivity analyses can be summarised as follows:

- Changing the default sandy loam soil type to clay increased the assessment criteria generated for the generic site setting therefore the default Sandy Loam soil was considered protective of future site users and used for the generic assessment.
- The Soil Organic Matter (SOM) content of near surface soils at most sites is often lower than the default SOM value of 6% therefore 1% and 3% SOM values were judged to be appropriately cautious values for use in the generic screening model as they yield more stringent assessment criteria for BaP and therefore provide additional protection to future site users.
- Testing of the results produced by the CLEA model by varying pH in soil found no impact upon the results for Benzo[a]pyrene. Whilst this is more likely to have an effect on inorganic / metal contaminants, it was considered prudent to use the CLEA standard pH value of 7.0 as it is the most likely value expected in normal soils.
- A comparison between the pre-defined building types was undertaken within the CLEA model to find the building that yielded the most stringent assessment criteria for Benzo(a)pyrene. When the building types were compared, the parameter settings used by the CLEA model for a pre-1970s office was found to calculate the most stringent targets and therefore this was chosen for the model.
- Whilst most school days are expected to last between 08:30hrs and 16:00hrs (7.5 hours total on site) with an average of approximately 1.5hrs of that total time expected being allocated to outdoor breaks or sporting activities. An extra 30mins outdoor activities and an extra 1hour indoors activities have been added to these periods during the modelling process as a precaution to allow for the possibility of time spent waiting on site before and after school as a result of travelling arrangements to and from school, or other social arrangements and any on-site after-school activities.
- When considering the most sensitive receptors to use the site it was concluded that female children aged between 4 and 16 (AC5-AC16) would be the most at risk from any potential contamination at the site due to their significant time spent on site and their physical characteristics, which make them more sensitive to potential contaminants of concern. It is believed that sixth form students (age 16-18) and adult teachers would also be present at the site as well, (AC17 (ages 16-65)) and an assessment criteria was therefore generated to check that this age group was not at more risk. The result confirmed a much higher result and it was therefore decided that AC 17 would not be included to ensure the most vulnerable children would be protected.
- A standard school year is comprised of a standard 38 teaching weeks (190 teaching days per year) when the site users would be expected on site. An additional 10 days was therefore added to this number as a precaution during the in-house assessment criteria calculation to allow for

teacher training days and other possible additional days which site users may be present on-site. This provides an added level of protection to children over the exposure period. This exposure frequency of 200 days has also been applied to both outdoor and indoor inhalation and skin contact pathways as it is considered reasonable that future site users would spend a period of time outside each day spent on site during lunchtime and other breaks.

3 DERIVATION OF THE IN-HOUSE ASSESSMENT CRITERIA

Physical and chemical data for key contaminants of concern were obtained from the Environment Agency (EA) Science Report; 'Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values - Science Report SC050021/SR7' for use in the CLEA model. In addition, appropriate Health Criteria Values (HCV) were obtained from the various EA / DEFRA toxicological reports and the LQM/CIEH Publication 'Generic Assessment Criteria for Human Health Risk Assessment 2nd Edition (2009)'. It is noted that at the time of issue of this document, a number of toxicological reports derived by DEFRA and the EA, including that of benzo(a)pyrene, are currently under review. However, in the absence of these revised data sources, EPS considers it appropriate for use in determining reasonable 'minimal risk' levels in the context of this site.

Using these chemical data and the amended commercial land use to describe the exposure pathways and critical receptor for a school, the CLEA software determined the following minimal risk screening criteria for determining if there is a need for further, more detailed investigation and / or assessment:

Contaminant of Concern	Human Health Screening Criteria (mg/kg) (1% SOM)	Human Health Screening Criteria (mg/kg) (3% SOM)
Arsenic	142	142
Cadmium	76	76
Mercury (elemental)	10.2	29.6
Mercury (methyl)	68.3	71
Nickel	869	869
Selenium	1000*	1000*
Benzene	14.3	26.1
Ethylbenzene	1,000*	1,000*
Toluene	1,000*	1,000*
Xylene (ortho / meta / para)	1,000*	1,000*
Aliphatic Hydrocarbons C5-6	1,000*	1,000*
Aliphatic Hydrocarbons C6-8	1,000*	1,000*
Aliphatic Hydrocarbons C8-10	1,000*	1,000*
Aliphatic Hydrocarbons C10-12	1,000*	1,000*
Aliphatic Hydrocarbons C12-16	1,000*	1,000*
Aromatic Hydrocarbons C8-10	1,000*	1,000*
Aromatic Hydrocarbons C10-12	1,000*	1,000*
Aromatic Hydrocarbons C12-16	1,000*	1,000*
Benzo(a)anthracene	21.9	24.7
Benzo(a)pyrene	3.48	3.77
Chrysene	31.5	35.4
Dibenz[ah]anthracene	3.24	3.47

Notes:

* = Assessment criteria are higher than 1000mg/kg however if such concentrations are recorded at a school site more detailed examination should be undertaken by an EPS risk assessor.



APPENDIX G

Example Method Statement for Construction Workers Encountering Unexpected Contamination

METHOD STATEMENT

ACTIONS TO BE TAKEN IN THE EVENT OF DISCOVERING UNEXPECTED CONTAMINATION DURING INTRUSIVE GROUNDWORKS

If at any point during intrusive groundworks at a site, evidence of unforeseen contamination is encountered in the form of significant noxious odours, discolouration, or instability within soils or sheen / discolouration in groundwater, the following actions will be taken:

- Intrusive works in the immediate area of the impacted ground will be suspended and the continuation of work in other areas of the site will be considered within the context of the site specific health & safety plan.
- Environmental Protection Strategies Ltd (EPS) will be contacted and appraised of the situation so that arrangements can be made to characterise the impact and determine what action may be necessary in addition to the scheduled site works. Where possible / health & safety plan permits, digital photographs of the impacted ground will be taken and emailed to EPS at the address below to assist in the initial assessment.
- It may well be necessary for EPS to attend site to undertake visual inspection and obtain samples for field and/or laboratory analysis, although the actions taken will be dependent on the nature of what is encountered.
- In cases where EPS consider the unforeseen contamination likely to pose a significant risk of significant harm to adjacent site users or local environmental receptors, the local authority and the Environment Agency will be informed of the situation and the actions being taken.
- Once appropriate action has been agreed and undertaken a written summary will be produced by EPS for submission to the Local Authority (and where relevant, the Environment Agency) in accordance with planning requirements. The submission will include details of work undertaken, analytical results of investigative and validation samples obtained and conclusions and recommendations for any further actions considered necessary.
- Where regulatory bodies have been involved, site works should only recommence following their agreement and in all cases should only recommence when the site manager considers it safe to do so within the context of the site specific health & safety plan.

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