

GROUND APPRAISAL REPORT
for the site at
VILLA GARDENS, WATERLOOVILLE
on behalf of
LINDEN HOMES SOUTHERN LIMITED

GE9185\GAR\APR13		STATUS: FINAL	
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Executive Summary	
Scope of works	To undertake a geotechnical and geo-environmental ground investigation.
Form of Development	Residential development with private gardens, soft landscaping, access road, car parking and associated infrastructure.
Site Description	The site comprised an L shaped parcel of land located on a gentle slope with a fall towards the east. The site comprised part of a former school, although all buildings had been demolished at the time of the investigation, such that the site was covered by asphalt surfaces and hardcore. Numerous trees were located around the site's perimeter.
Ground Conditions	The ground conditions comprised a succession of Topsoil or Made Ground over dayey gravel of Head Deposits and high strength clay of the London Clay Formation.
Groundwater	Groundwater was not encountered during the intrusive investigation and is not anticipated at shallow depth. However, perched water may be present within more gravelly horizons or lenses within the Head Deposits.
Foundations	It is considered that conventional foundations could be adopted for the proposed development with a net allowable bearing capacity of 125kPa recommended for the high strength soils of the London Clay Formation. Foundations should be designed in accordance with the NHBC high volume change classification, thus requiring a minimum founding depth of 1.0m bgl. However, localised deepening is recommended (as detailed within the main report) due to the presence of desiccation and/or influence of trees.
Floor Slabs	Suspended floor slabs are recommended for the ground conditions encountered.
Excavations	Shallow excavations are likely to remain stable in the short term. Long, deep excavations or those taken below groundwater are highly likely to become unstable rapidly and appropriate precautions should be adopted.
Pavements	A CBR value of 3% is recommended for pavement design and the shallow soils are considered to be frost susceptible thus requiring a minimum pavement thickness of 450mm.
Sub-surface concrete	Test results indicate that class DS2, AC-2, concrete will be required.
Ground Gases	In the absence of any specific source of ground gas or associated pollutant linkage, it is considered that no specific remedial action is warranted.
Radon Gas	Radon protection measures are not required for this site.
Soil contamination	Contamination has not been identified within the near surface soils.
Site workers	Safe systems of works are likely to be required on the basis of site observations and test results.
End users	No soil contamination has been identified and thus, other than the placement of suitable topsoil in gardens, no remedial measures are considered to be required.
Soft landscaping	Site won Topsoil could be stockpiled from excavations for re-use in soft landscaped areas. Imported Topsoil and/or subsoil will require chemical testing to verify its suitability for use on this site.
Built Environment	Whilst it is considered probable that standard water supply pipes could be used on this site, it is recommended that confirmation of the protection measures required (if any) for water mains should be sought from the local water utility company.
Groundwater	In the absence of any plausible pollutant linkages, no measures are considered necessary to protect groundwater.
Waste Disposal	Analytical results indicate that any natural soils removed from site as waste are likely to be classified as "inert". However, WAC tests would be recommended on any waste soil arisings for off-site disposal.
Discovery strategy	A discovery strategy should be employed, so that any evidence of possible unidentified contamination can be dealt with appropriately.
<i>This Executive Summary is intended to provide a brief summary of the main findings and conclusions of the investigation. For detailed information, the reader is referred to the main report ref. GE9185\GAR\APR13</i>	



1. Introduction

Geo-Environmental Services Limited was instructed by Linden Homes Southern Limited to undertake a geotechnical and geo-environmental ground appraisal for the proposed redevelopment of the site off Villa Gardens, Waterlooville, Hampshire, herein referred to as "the site" (see Figure 1).

The proposed redevelopment comprises the clearance of existing hard landscaping and the construction of houses with gardens and associated development infrastructure. The development is proposed to comprise an extension to the redevelopment of the adjacent St Michael's Convent site.

2. Walkover Survey

The site comprised an approximately 'L-shaped' parcel of ground which extended to approximately 0.3Ha and was located at NGR 468600, 109710. The ground level fell, from west to east, by approximately 2m over the 60-70m length of the site.

At the time of the site walkover survey, the site was covered by an asphalt surface with residual paint marking indicating a former use as a playground. Numerous trees and bushes were present around the site's perimeter.

The site was bounded to the north by houses and gardens; to the east by the former St Michael's Convent, which was undergoing redevelopment for housing; to the south by an area of open space with sheltered housing beyond; and to the north by a recently constructed vicarage and church beyond. The site was accessed off Villa Gardens.

3. Desk Study

The desk study comprised a review of published geological and hydrogeological mapping, together with a review of environmental disclosure reports and historic mapping obtained as part of the assessment undertaken for the adjacent development, as presented in the Ground Investigation Report GE8472-GIR-JAN12.

Published geological mapping indicated the site to be underlain by Head Deposits over the London Clay Formation including the Bognor Sand Member.

Head Deposits are drifts produced by solifluction, the downslope movement of debris outwash during the periglacial period, and characteristically comprise poorly sorted sand, gravel, clay and chalk of local derivation.

In the Hampshire area, the **London Clay Formation** varies in composition and can comprise firm to very stiff silty clay, silty sand, interbedded silt, sand and clay. The granular strata are often water bearing. Occasional concretions of mudstone can also be present. Crystals of gypsum (Selenite) are often found within the weathered part of the London Clay and precautions against sulphate attack to concrete are sometimes required.

The **Bognor Sand Member** of the London Clay Formation comprises a silty sand.

Soils of high leaching potential (U) and a Secondary 'A' aquifer (superficial deposits) and Unproductive Strata (bedrock) have been identified beneath the site. The site outside of any Source Protection Zone (SPZ) for surface or groundwater abstraction for public supply.



No pollutions which could have impacted the chemical quality of the site were identified. A surface watercourse, Hermitage Stream, was located approximately 150m to the east and approximately 15m lower than the subject site.

The site was not recorded as being situated within a flood risk area.

Whilst the outer edge of a 'landfill' buffer zone was located approximately 150m to the south-east of the subject site, the actual areas of landfill to which this buffer applied were on the opposite side of the Hermitage Stream, a shallow valley and/or beneath 1960s housing. It is thus considered that no plausible migration pathway exists between the subject site and the off-site 'landfill' and as such this has not been considered further.

The site was recorded as not being in an area affected by a coal mining area or non-coal mining. British Geological Survey (BGS) geological hazard assessments for the site are summarised in Table 1.

Geological Hazard	Hazard Rating
Shallow mining	Low hazard
Collapsible ground	Very Low hazard
Compressible ground	No hazard
Ground dissolution	No hazard
Landslide	Very low hazard
Running sand	Low Hazard

Table 1 Summary of BGS Geological Hazards

Records from the BGS show that the site is located in an area where <1% of homes are above the action level for radon and that radon protection measures are not required in new dwellings and extensions.

No contemporary trade directory entries were recorded for the site and whilst numerous entries were recorded within 250m of the site, these were not considered a high risk in terms of potentially contaminative activities impacting the site.

A review of historic mapping for the site and surrounding area has shown that the site comprised a field or enclosed land until 1932 when it was shown to comprise an orchard. The 1966 map showed the site to comprise a playground and part of St Peter's Primary School. This use continued to be shown on maps until 2011 at which time the site was shown as cleared land. The surrounding land was shown to have become developed from fields to houses and gardens to the north and west, and from 1909 the land to the east was shown to be developed and labelled as St Michael's Convent. A Laundry was shown within the convent complex and the investigation of the convent complex (GE8472-GIR-JAN12) identified the laundry as a 'wet' process only.

4. Preliminary Risk Assessment

A Preliminary Risk Assessment ('PRA') and Conceptual Site Model ('CSM') have been prepared in accordance with CLR11 based on information obtained as part of the desk study. Possible risks associated with potential sources of contamination and sensitive receptors identified have been assessed following a source-pathway-receptor ('SPR') approach in accordance with current UK protocols.

A risk may only exist where a plausible SPR linkage is present and where the quantity or concentration of a contaminant is sufficient so as to pose harm. Under the statutory definition, "Contamination" may only strictly exist where contaminants pose a risk of harm to a receptor. Risk may be defined as a function of the magnitude and severity of any adverse effects arising from contamination.



For the purpose of the Preliminary Risk Assessment, risk is expressed as a function of the nature of the source, the sensitivity of a receptor, and the magnitude or likelihood of any associated pathway(s) between the source and receptor. The source, pathway(s) and receptor are each rated on a ten-point qualitative scale, with the overall level of risk being expressed as a multiple of those ratings. A summary of the criteria is given in Table 2.

Category	Individual Sources, Pathways and Receptors	Overall Risk Rating (product of SxPxR)
Negligible	0	<1
Very Low	1	1-5
Very Low to Low	1.5	6-9
Low	2	10-14
Low to Medium	2.5	15-22
Medium	3	23-35
Medium to High	3.5	36-55
High	4	56-79
High to Very High	4.5	80-110
Very High	5	111-125

Table 2 Summary of Risk Ranking Scheme

Possible sources of contamination identified or discounted as part of the desk study are summarised in Table 3.

Source	Comments	Rating
General quality of near surface soils	The site appears to have comprised open land which became developed for use as a primary school by the 1960s and remained in that use until recently when the school was demolished and the site cleared as part of the construction of the new church and vicarage immediately to the west of the site. Generic contaminants could exist naturally or through the former land use and could include metals/metalloids, non-metals and organic contaminants.	Low (2)

Table 3 Possible Sources of Contamination

Furthermore, potential receptors associated with the site and its redevelopment, identified or otherwise discounted, are summarised in Table 4.

Receptor	Description	Comments	Rating
Site Workers	Persons involved in construction and future maintenance of the proposed development.	Ground workers could become exposed during site clearance, construction and maintenance.	Medium (3)
End Users	Occupants of the proposed redevelopment.	Occupation of the proposed development including houses, gardens and any amenity soft landscaping.	High (4)
Soft Landscaping	Areas of planting including lawns, shrubs, trees, etc.	No evidence of harm to existing site vegetation was observed.	Low (2)
Built Environment	Buried concrete for foundations and plastics for potable water supply pipes.	Aggressive ground conditions could be present.	Low (2)
Adjacent Land Users	Sensitive land uses identified within the immediately vicinity.	The site is located within a generally residential setting.	High (4)
Groundwater	Controlled Waters contained within the aquifer(s) beneath the site	The site overlies a Secondary Aquifer over Unproductive Strata and is outside of any SPZ.	Low (2)



Receptor	Description	Comments	Rating
Surface Water	Controlled Waters within lakes, rivers and ponds, etc., or coastal waters.	No surface water on the site.	Low (2)
Ecological receptors	Fauna and flora, RAMSAR Site, SPA, SSSI.	The current site condition is not considered conducive to habitation by protected species.	Negligible (0)

NOTE: Ecological receptors are not considered further as they were (0) rated for sensitivity screening.

Table 4 Possible Receptors of Contamination

Whilst the above sources and receptors have been identified, Table 5 illustrates the pathways by which a contaminant linkage might plausibly exist.

		Potential Sources
		Near Surface Soils (2)
Potential Receptors	Site Workers (3)	Ingestion, Dermal Contact, Inhalation (3)
	End Users (4)	Ingestion, Dermal Contact, Inhalation (4)
	Soft Landscaping (Phytotoxicity) (2)	Plant Uptake (3)
	Built Environment (2)	Chemical Attack on Concrete and Water Supplies (4)
	Adjacent Land Uses (4)	Leaching, Lateral Migration (1)
	Groundwater (2)	Downward Migration to Water Table (2)
	Surface Water (2)	Leaching, Lateral migration (2)

Table 5 Potential Pollutant Linkage Ratings

A summary of the preliminary risk ratings is given in Table 6.

		Potential Sources
		Near Surface Soils
Potential Receptors	Site Workers	Low
	End Users	Medium
	Soft Landscaping (Phytotoxicity)	Low
	Built Environment	Low to Medium
	Adjacent Land Uses	Very Low to Low
	Groundwater	Very Low to Low
	Surface Water	Very Low to Low

Table 6 Preliminary risk rating

The following factors that might impact the geotechnical condition of the site were:

- The possible presence of shrinkable soils on the site, which may affect foundation design and construction.
- The presence of shallow groundwater and/or perched water beneath the site.
- The presence of laterally and vertically variable strata and the impact these could have on construction.



- The condition and quality of shallow ground which could impact foundation (housing and road) design and construction.

5. Investigation Strategy

The investigation strategy comprised providing general coverage of the site to assess ground and groundwater conditions and to support the geotechnical and contamination assessments. The investigation included:

- The excavation of 8No. trial pits, logging of exposed strata and recovery of samples for laboratory testing.
- In-situ probing to assess the California Bearing Ratio (CBR) value of near surface soils.
- Geotechnical testing in order to classify the soils for foundation design purposes.
- Geochemical laboratory testing on selected samples recovered from the boreholes to support a Tier 1 contamination risk assessment.

6. Ground Conditions

The ground conditions encountered were consistent with those anticipated from the desk study, i.e. with a mantle of Made Ground overlying Head Deposits and London Clay Formation. A summary of the ground conditions encountered in the trial pits is presented in Table 7.

Top (m bgl)	Base (m bgl)	Description
0	0.4	Topsoil: Grey brown silty clay with flint gravel and roots.
0	0.1 – 0.7	Made Ground: Tarmac; dark brown gravelly clay with brick fragments; grey sandy clay with gravel of flint, red brick and breeze block.
0.1 – 0.7	1.0 – 2.4	Head Deposits: Medium to high strength orange-brown and grey gravelly CLAY.
1.0 – 2.4	1.4 – 2.8+	Head Deposits: Orange-brown and grey clayey GRAVEL and COBBLE of flint.
1.4 – 2.4	3.1+	London Clay Formation: High strength orange-brown and grey CLAY with fine and medium flint gravel; High strength blue-grey and orange mottled silty CLAY becoming closely to very closely fissured with depth.

Table 7 Summary of Ground Conditions

Occasional fine live roots were present to at least 3.1m bgl in TP1; at least 3.0m bgl in TP2; from 2.3m bgl in TP3; and to at least 2.5m bgl in TP7.

Observations from foundation excavations on the adjacent site have shown that the more gravelly Head Deposits are present as a series of lenses and thus changes in ground conditions within the sides and base of excavations should be anticipated.

Some instability was observed in TP1 where it passed through the gravelly and cobbly Head Deposits from 1.20m to 1.65m bgl.

7. Groundwater

Groundwater was not encountered within the trial pits. It is possible, given the ground conditions encountered, that perched water or discontinuous could be present within the more permeable gravel horizons of the Head Deposits.



It should be noted that groundwater levels may rise and fall both seasonally and in response to prolonged periods of rainfall and may only be conclusively monitored in standpipes installed within boreholes. Nonetheless, given the site's proximity to the River Test and associated stream channels, groundwater should be anticipated within the likely construction depth zone.

8. Geotechnical Testing and Assessment

The results of geotechnical testing undertaken as part of the ground investigation are summarised in Table 8 below.

Parameter	Topsoil	Made Ground	Head Deposits	London Clay Formation
pH	7.8	7.7 – 8.1	7.1 – 8.3	8.3 – 8.4
Water soluble sulphate (g/l)	<0.020	<0.020 – 0.032	<0.020 – 0.43	0.33 – 0.73
Water content (%)	-	-	12 – 35	15 – 33
Liquid Limit (%)	-	-	55 – 88	65 – 75
Plastic Limit (%)	-	-	20 – 32	21 – 28
Plasticity Index (%)	-	-	30 – 56	37 – 51
Modified Plasticity Index (%)	-	-	12 – 53	37 – 51

Table 8 Summary of Geotechnical Testing

CBR values in the range 3-6% were measured by Mexecon probing at shallow depth in the trial pits. Whilst some higher values were measured, these were attributed to the presence of gravel and cobble sized flint within shallow soils and thus these values were not representative of the soil mass.

Whilst visual evidence of desiccation, e.g. hard, crumbly/friable fissured clay, was observed during the original investigation on the adjacent site, as summarised in GE8472/GIR/JAN12, no clear visual evidence of desiccation was observed during the investigation on the Phase 2 site. Desiccation is a transient soil condition related commonly related to seasonal fluctuation in soil moisture content in response to climatic conditions and moisture uptake from vegetation. The intrusive investigation was undertaken following a prolonged period of heavy rainfall which would reduce the potential for desiccation to be identified visually.

Soil water content test results are plotted on Figure 3 and indicate possible zones of lower soil water content within several of the exploratory holes constructed as part of this investigation. Hand penetrometer profiles are presented in Figure 4. A summary of desiccation indicators is presented in Table 9.

Exploratory Hole	Depth of Desiccation Indicator (m bgl)					
	Live Roots*	w	w = PL	w < PL	w < 0.4LL ⁺	HP
TP1	>3.1	1.5	-	1.0	2.0	2.0
TP2	>3.0	1.5, 2.0	-	2.0	2.0, 3.0	1.5
TP3	>2.3	1.5	-	-	-	1.5
TP4	2.4	2.0, 2.5, 3.0**	-	2.0	2.0	-
TP5	1.5	-	2.0	-	2.0	-
TP6	1.1	1.5	-	-	1.0, 2.0	-
TP7	2.3	-	-	-	1.0	1.0, 2.0
TP8	1.5	-	-	-	-	2.5

NOTE: w – water content; PL – plastic limit; LL – liquid limit; HP – hand penetrometer strength; * roots at depth were rare or very rare and <1mm in diameter; + several of the water contents were only marginally below the 40%LL value; ** lower water contents in TP4 were associated with clayey gravel.

Table 9 Soil Desiccation Depth Indicators



9. Foundations

Whilst individually, each of the indicators presented in Table 9 may be prone to misinterpretation, a combined assessment of all of the indicators is considered to prove a more robust approach. On this basis minimum founding depths to account for desiccation and/or the presence of live roots (ignoring very rare roots) are summarised in Table 10.

Exploratory Hole	Minimum founding depth (m bgl)
TP1	2.0
TP2	2.0
TP3	1.5
TP4	2.5
TP5	2.0
TP6	2.0
TP7	2.3
TP8	1.5

Table 10 Minimum founding depths based on soil desiccation assessment

Given the presence of potentially desiccated soils and the variation in volume change potential identified from laboratory testing, it is recommended that foundations are designed in accordance with the high volume change potential classification set out in NHBC Standards and that foundations are taken through any Made Ground (if present), disturbed ground, root zones and any desiccated zone to terminate in competent strata. This would require foundations to extend to depths in the range 1.5-2.5m over much of the site, but could also require the construction of deeper foundations in proximity to some trees, where roots are present to depths in excess of the minimum depth stated in Table 10 and where desiccation has been identified to depths of, or greater than the minimum stated in Table 10.

Foundations which are proposed in proximity to trees should be designed in accordance with NHBC Standards Chapter 4.2, and design approaches 4.2B and 4.2C, which incorporate the water demand of trees and the distance of the tree from the nearest portion of foundation. As there are numerous high water demand trees on site, this should be used as the design driver. Where this approach demonstrates that conventional foundations deeper than 2.5m would be required, alternative foundation solutions should be considered. In addition, the soil water content profiling has demonstrated the presence of potentially desiccated soils within several zones of influence associated with specific trees on the site and thus heave could occur where trees are removed or where they remain and seasonal fluctuations result in desiccation and heave cycles.

Where the foundation depth assessment demonstrates that conventional foundations could be constructed, an allowable bearing capacity of 125kPa is recommended for the dayey gravel/gravelly clay of the Head Deposits and the high strength clay of the London Clay Formation. Total settlement should remain within tolerable limits for these bearing capacities.

Given the high volume change potential of the clay soils beneath the site and presence of desiccation in some areas, it is recommended that heave protection measures, such as void formers, compressible media or the like, are incorporated within foundation construction across the site in line with NHBC guidance.

Conventional foundation excavations should be concreted or blinded as soon as possible following excavation to avoid any disturbance of the founding strata. Where this cannot be achieved within a single day, it is recommended that the excavation is terminated approximately 0.5m above the final foundation level to protect the bearing strata and that this cover is removed immediately before concreting or blinding.



On the basis of the ground conditions encountered, it is recommended that suspended floor slabs are constructed on this site.

10. Excavations

Shallow excavations would be likely to remain stable in the short term although some overdig and localised collapse should be anticipated. Deep excavations are likely to be marginally stable, at best, in the short term and an allowance should be made for trench support.

Ground works should be designed in such a manner to avoid man entry into excavations.

11. Pavements

On the basis of testing undertaken to date, it is recommended that a CBR of 3% is assumed for the soils at shallow depth. The sub-grade is considered unlikely to be frost susceptible.

Any soft spots in the formation level may induce reflective cracking in the pavement and allowance should be made for removing soft spots and replacement with engineered fill.

12. Soakaways

On the basis of the ground conditions encountered, i.e. clay, it is considered that soakaways would not function satisfactorily and thus measures to store and attenuate peak storm flow are recommended. A permeability of less than 10^{-7} m/s is anticipated for the soils encountered.

13. Sulphates

The water soluble sulphate concentrations reported ranged from <0.020g/l to 0.73g/l and thus on initial review indicate that Class DS1 to DS2 concrete could be required. However, further assessment in line with Clause 5.1.1 of BRE Special Digest 1 indicates that buried concrete should be designed in accordance with Class DS-2 of BRE Special Digest 1, with an ACEC class of AC-2. The advice of this publication should be taken for the design and specification of all sub surface concrete.

It is possible that further testing could enable zoning of the site to limit the extent of DS2 concrete required.

14. Environmental Risk Assessment

The desk study did not identify any specific potentially contaminative activities on-site or in proximity to the site. On this basis samples were selected for analysis to provide general coverage of the site. Soil samples were submitted for laboratory screening for a generic suite of commonly occurring contaminants. Full details of the results are presented in Appendix D.

15. Human Health

Given the proposed residential end use, the soil results have been assessed and compared against current Soil Guideline Values (SGVs) and Generic Assessment Criteria (GAC) criteria for residential use. No exceedances were identified in relation to the proposed end use screening values.

Given the absence of Topsoil on the site, it is likely that it will be necessary to import Topsoil on to the development. Prior to importation, the chemical, physical and nutritional suitability of all Topsoil and subsoil should be verified. Importation of topsoil or subsoil from unverified or unsuitable



sources would require their removal from site and replacement with suitable materials. As a matter of good practice, it is recommended that the location, approximate extent and thickness of any imported subsoil and/or topsoil are recorded and presented in the Validation/Verification Report to be prepared by the Environmental Consultant. A copy of the recommended specification for imported subsoil and topsoil is provided in Appendix D.

16. Soft Landscaping - Phytotoxic Effects

Arsenic, Copper, Nickel, Zinc and Water Soluble Boron are phytotoxic elements that might be hazardous to plant growth. The concentrations of these elements have been compared against the limits derived for phytotoxicity by the ICRCL in publication 70/90 1990 entitled 'Notes on the Restoration and Aftercare of Metalliferous Mining Sites for Pasture and Grazing'. Of the results, none exceeded the respective guideline values for protecting against phytotoxicity, and it is concluded that remediation is not warranted in this respect.

17. Built Environment

The results of the chemical testing have been compared to the thresholds given in the UKWIR Guidance entitled 'Guidance for the Selection of Water Supply Pipes to be used in Contaminated Land' published 2011. On the basis of the testing undertaken to date, it is considered that standard pipe materials would be suitable on this site. It is recommended that confirmation is sought from the local water utility company.

All services should be laid in over-excavated trenches, backfilled with inert granular fill and a marker tape laid at shallow depth within the backfill.

18. Site Workers

The safety of personnel working on contaminated land sites was prescribed by the CDM Regulations, Health and Safety at Work Act, and the COSHH Regulations. Site workers are advised to consult these statutes in order to protect the safety of persons in their employ. As a minimum requirement, the wearing of overalls, boots and gloves, should be compulsory and eating and drinking should be restricted to designated "clean areas". Additional guidance can be sought from the CIRIA publication entitled "A Guide for Safe Working on Contaminated Sites".

19. Controlled Waters

In the absence of any plausible pollutant linkage, it is considered that no specific remedial measures are required to protect controlled waters.

20. Waste Disposal

The results of chemical testing of the soils undertaken to date indicates that the chemical quality of the natural soils encountered on site is such that they are likely to be generally classified as "Inert", as indicated by the testing undertaken to date. However, it is recommended that Waste Acceptance Criteria Testing (WAC testing) is carried out once any soils have been identified for off-site disposal as waste.

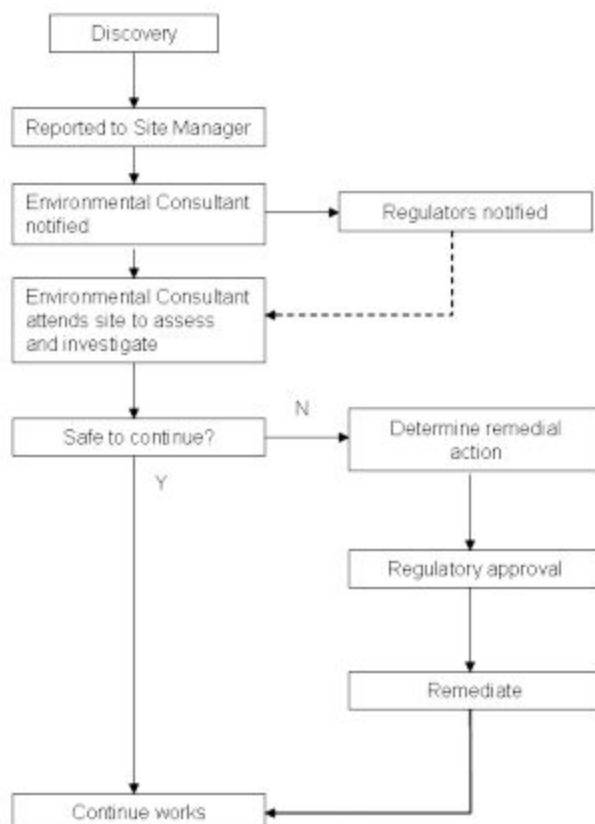
21. Discovery Strategy

Whilst an intrusive investigation has been undertaken on the site, it remains possible that unexpected soil conditions may be encountered during the process of construction.



Should previously undiscovered contamination be encountered during construction, this should be reported to the site manager immediately in order that any necessary inspection and assessment by the Environmental Consultant can be made. Records should be kept, and samples submitted for analysis where conditions encountered are not as anticipated. The results of any such testing should be sent to the relevant planning authority for consultation.

The process is shown below.



Discovery Strategy Process

A copy of the discovery strategy should be lodged on site, and provisions made to ensure that all workers are made aware of their responsibility to observe, report, and act on any potentially suspicious or contaminated materials they may encounter.

**Caveat**

The data collected from the investigations have been used to provide an interpretation of the geo-environmental conditions pertaining to the site. The recommendations and opinions expressed in this report are based on the data obtained.

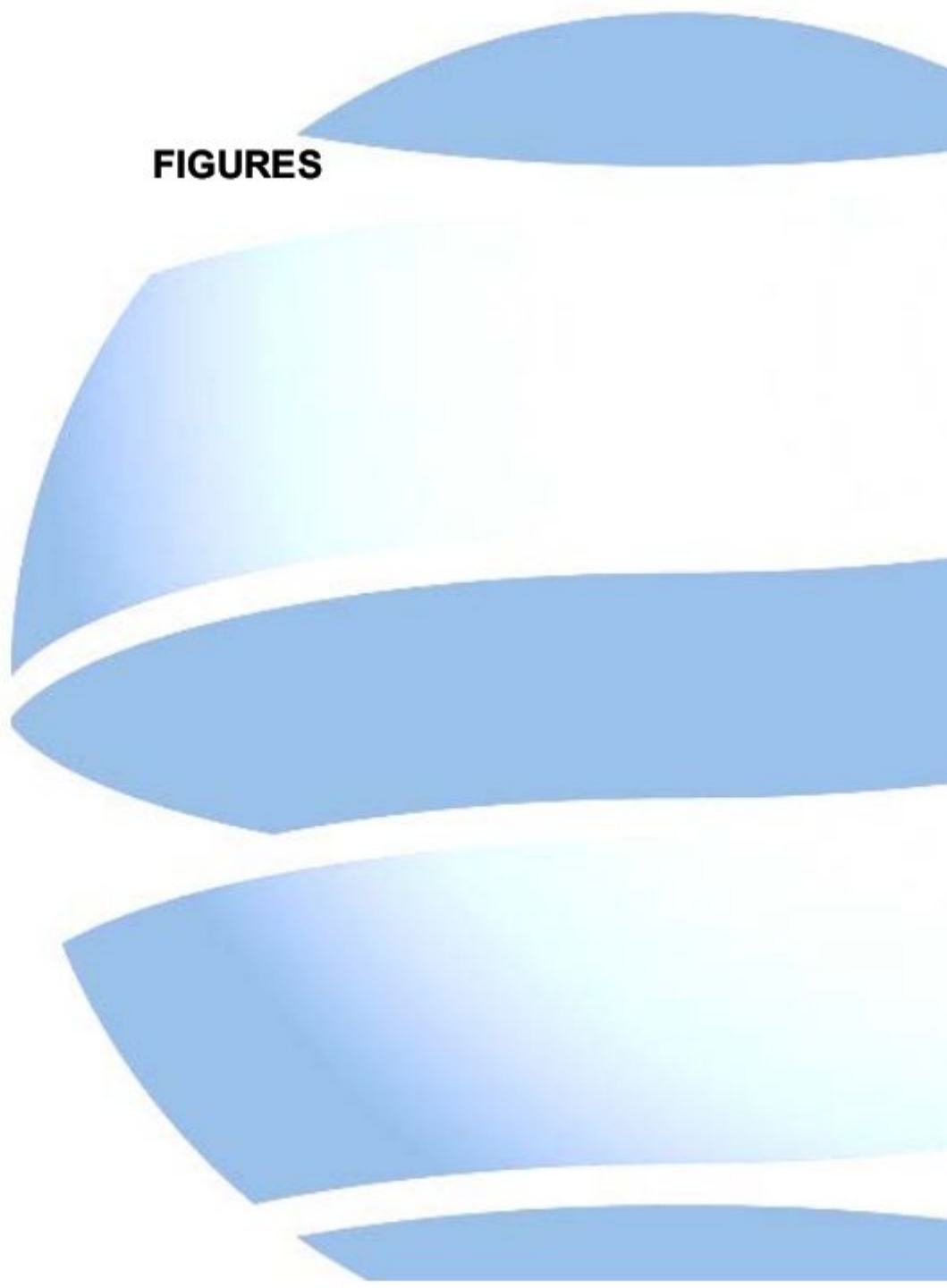
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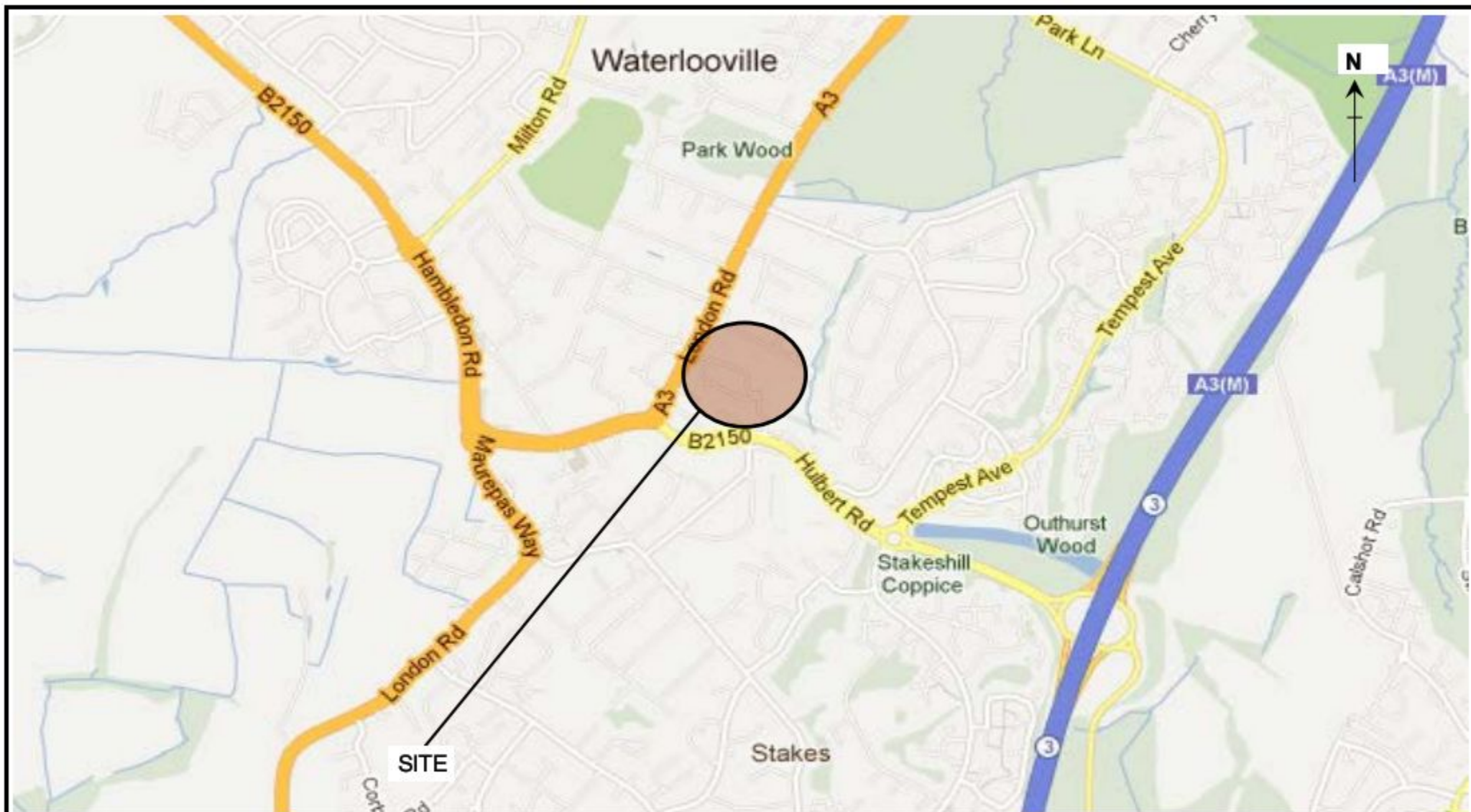
Information contained in this report is intended for the use of the client and their agents, and Geo-Environmental can take no responsibility for the use of this information by any third party for uses other than that described in this report.

It should be noted that in particular the concentrations and levels of mobile liquid and gaseous materials are likely to vary with time. The results obtained may therefore only be representative of the conditions at the time of sampling. Such reservations have been indicated in the text where such conditions are considered to apply.

Geo-Environmental does not indemnify any third parties such as the vendor against any dispute or claim arising from any finding or result of this investigation or any claim or dispute arising as a result of any decisions made thereof.

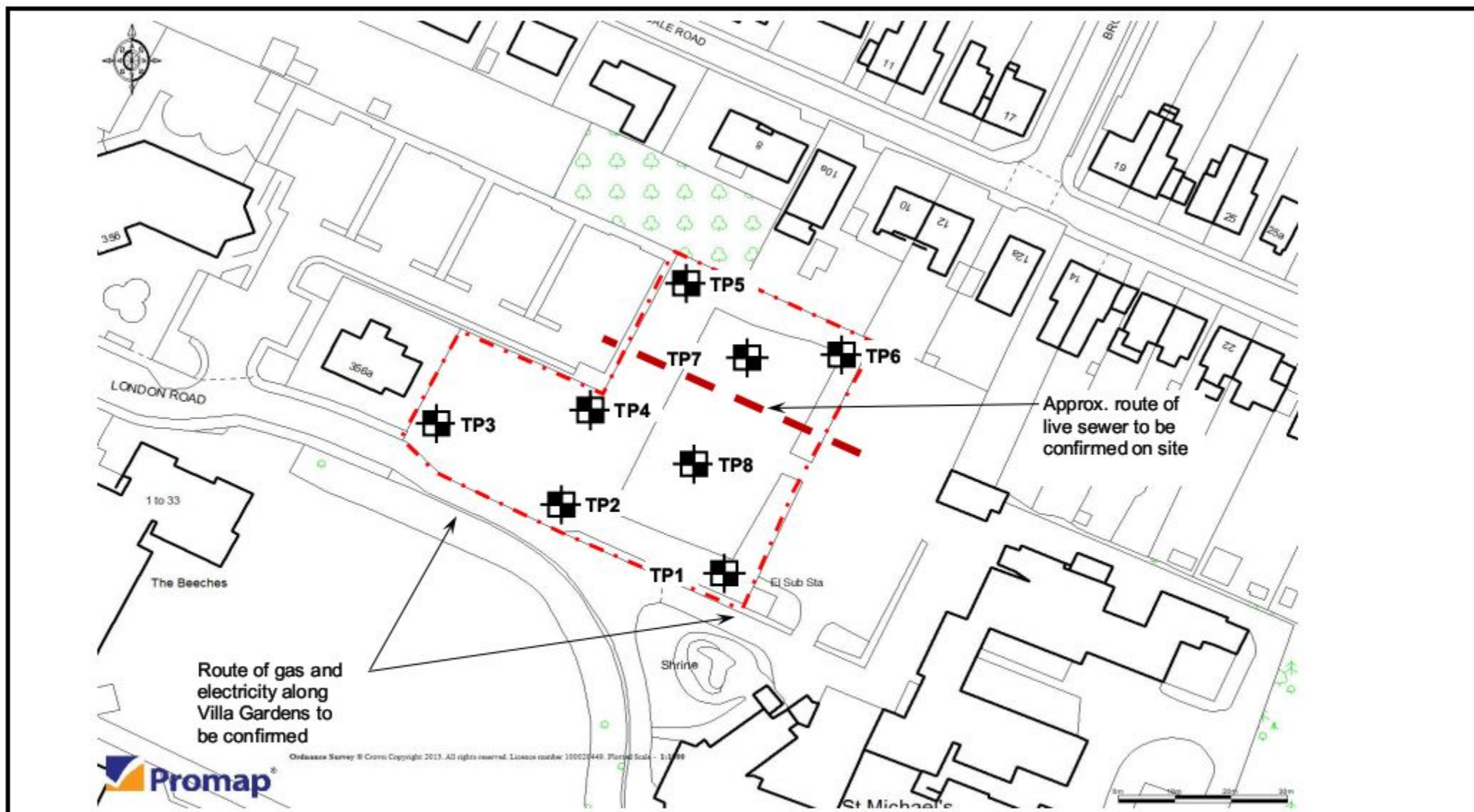
FIGURES





Project:	St Michael's Convent Phase 2, Villa Gardens, Waterloooville			Title	Site Location Plan	
Client:	Linden Homes Southern Limited			Geo-Environmental Services Ltd 28 Crescent Road, Brighton, BN2 3RP T: 01273 699 399 F: 01273 699 388 E: mail@gesl.net W: www.gesl.net		
Ref No:	GE9185	Revision:	0			
Drawn:	GR	Date:	06/02/2013			
Figure:	1	Scale:	Not To Scale			


Geo-Environmental



Project:	St Michael's Convent Phase 2, Villa Gardens, Waterloo			Title	Proposed Trial Pit Location Plan	
Client:	Linden Homes Southern Limited			Geo-Environmental Services Ltd	 Geo-Environmental	
Ref No:	GE9185	Revision:	0	28 Crescent Road, Brighton, BN2 3RP		
Drawn:	GR	Date:	06/02/2013	T: 01273 699 399 F: 01273 699 388		
Figure:	2	Scale:	Not To Scale	E: mail@gesl.net W: www.gesl.net		



Geo-Environmental

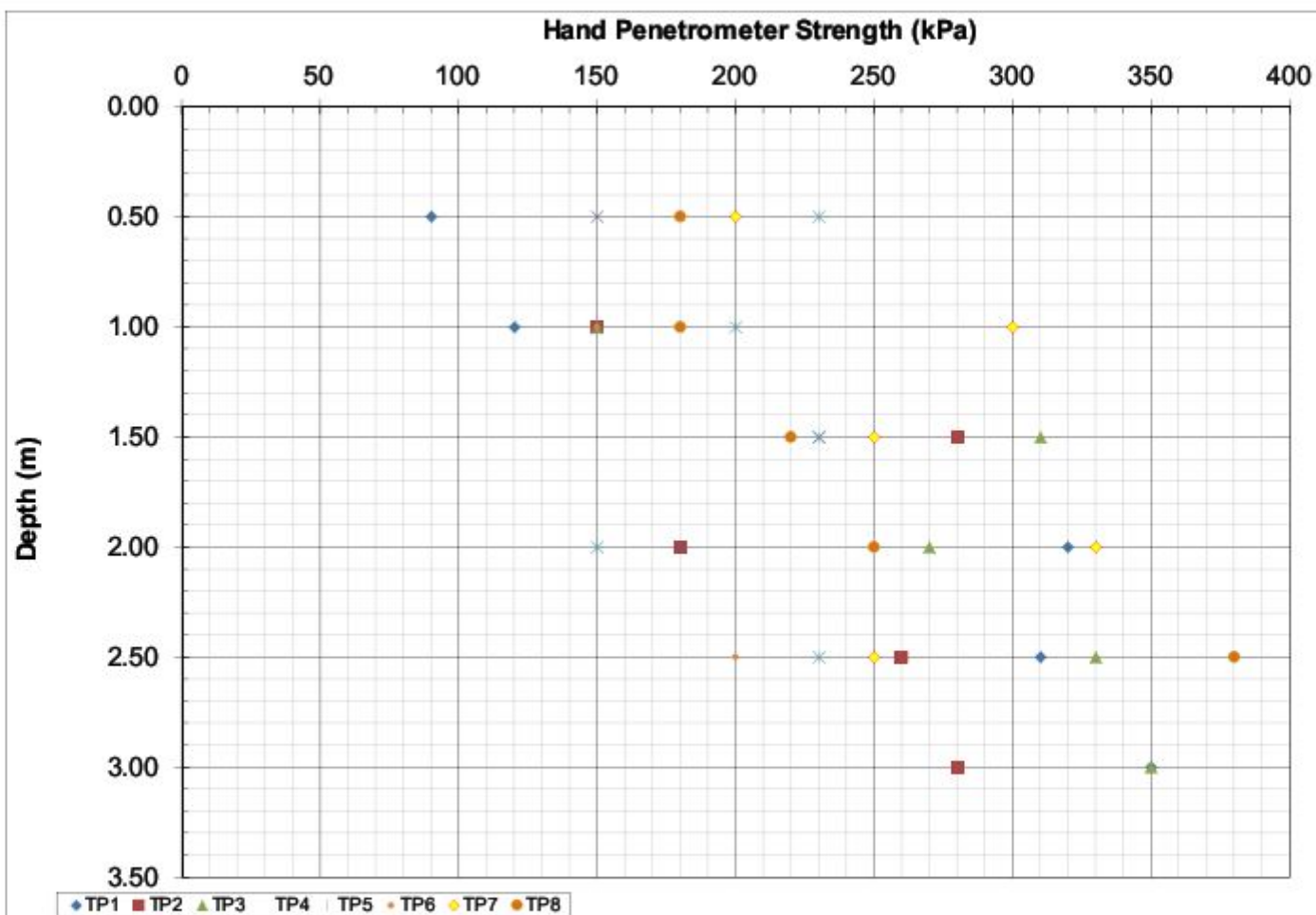
Geo-Environmental Services Ltd. Tel: 01273 699 366 Fax: 01273 699 368 www.ges.co.uk

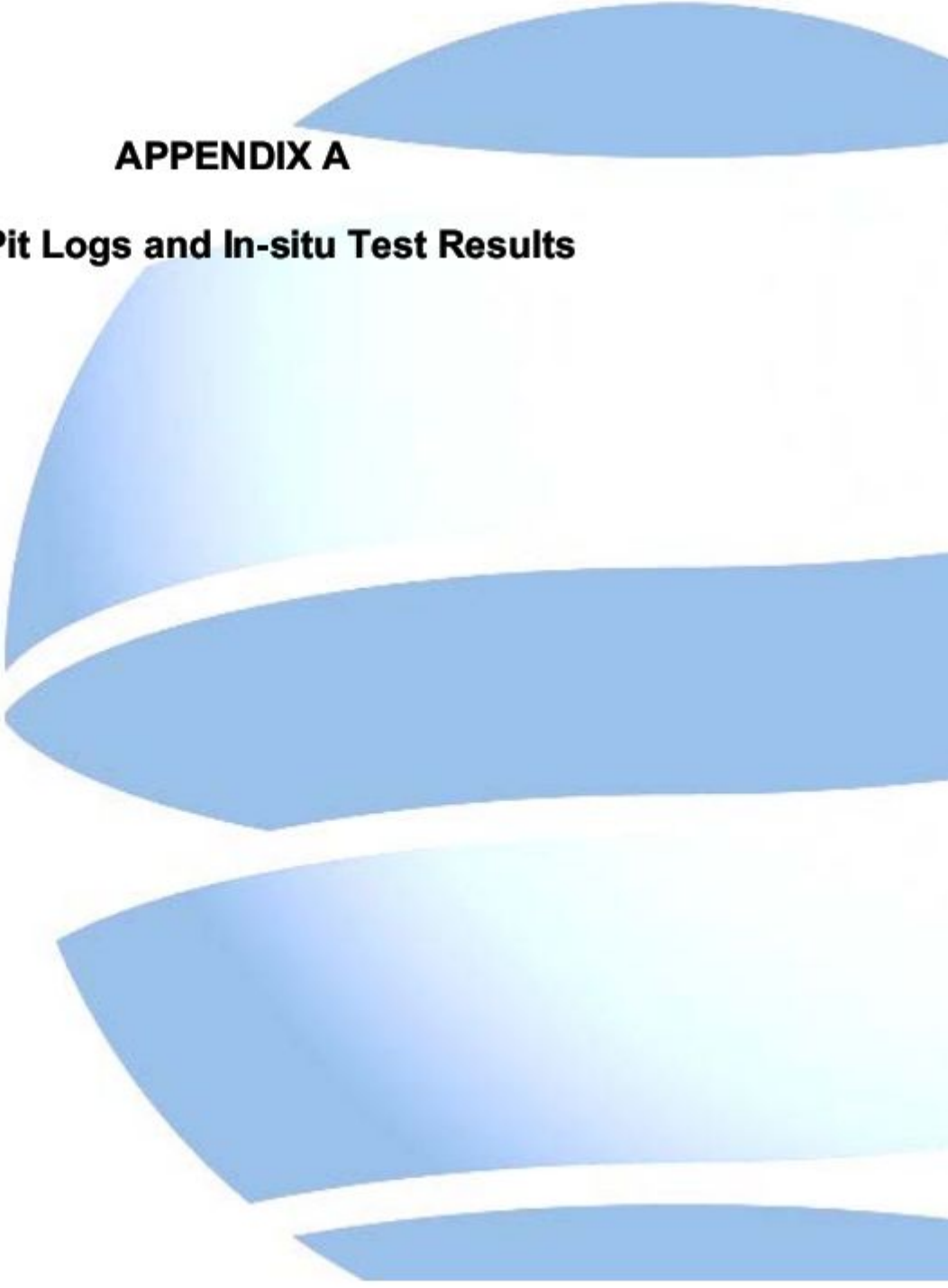
Figure 1 is a scatter plot showing the vertical distribution of water content (%) for eight sampling points (TP1 to TP8) at depths from 0.00 to 3.50 meters. The x-axis represents Water Content (%) from 10 to 40, and the y-axis represents Depth (m) from 0.00 to 3.50. Data points are marked with different symbols for each sampling point: TP1 (blue diamond), TP2 (red square), TP3 (green triangle), TP4 (cyan asterisk), TP5 (grey cross), TP6 (orange circle), TP7 (red diamond), and TP8 (yellow circle).

Depth (m)	TP1 (%)	TP2 (%)	TP3 (%)	TP4 (%)	TP5 (%)	TP6 (%)	TP7 (%)	TP8 (%)
1.00	24.0	35.0	25.0	28.0	33.0	26.0	30.0	30.0
1.50	13.0	17.0	20.0	28.0	30.0	15.0	32.0	35.0
2.00	25.0	20.0	20.0	24.0	28.0	26.0	27.0	32.0
2.50	25.0	27.0	27.0	24.0	28.0	27.0	27.0	28.0
3.00	27.0	30.0	30.0	28.0	28.0	27.0	27.0	28.0



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APPENDIX A

Trial Pit Logs and In-situ Test Results

SAMPLING & TESTING		STRATA DESCRIPTION		STRATA				
				Legend	mOD	mBGL	Water	S/Pipe
0.20 D(1) 0.50 HPEN=0.9kg/cm2 D(2) 1.00 HPEN=1.2kg/cm2 D(3) 1.50 D(4) 2.00 HPEN=3.2kg/cm2 D(5) 2.50 HPEN=3.1kg/cm2 D(6) 3.00 HPEN=3.5kg/cm2 D(7)		Tarmac (MADE GROUND).				0.10 (0.10)		
		Medium strength light orange-brown CLAY with frequent gravel to cobble sized sub-rounded to sub-angular flint and frequent 1-10mm live roots (HEAD DEPOSITS)				0.25 (0.05)		
		Medium strength light orange-brown CLAY with frequent fine to medium sub-angular to sub-rounded flint gravel and frequent live roots 1-5mm (HEAD DEPOSITS)				0.90 (0.30)		
		Light orange and grey clayey flint GRAVEL and COBBLE with occasional fine roots (HEAD DEPOSITS)				1.20 (0.40)		
		High strength light orange-brown and grey mottled CLAY with frequent fine to medium flint gravel. Rare fine 1-2mm decaying roots observed at 1.8-2.5m bgl. Rare live 1-4mm roots observed between 2.0-2.5m bgl (LONDON CLAY FORMATION)				1.65 (1.00)		
		High strength blue-grey locally orange mottled closely to very closely fissured CLAY with rare fine live roots 1mm diameter to 3.1m bgl (LONDON CLAY FORMATION)				2.70 (0.40)		
		End of Trial Pit at 3.10 m				3.10		

SAMPLES: D=disturbed B=bulk U=undisturbed TESTS: MAC=macintosh IVAN=vane HPEN=penetrometer SPT=split-spoon CPT=cone WATER=V=strike W=rest OTHERS: (2.00)=strata

Stability: Pit collapsing from gravel between 1.2-1.65m bgl	Type: Machine Excavated Trial Pit	Ref: GE9185	Position: TP1
Groundwater: No Groundwater Encountered	Method:	Start: 07/02/2013	Scale: 1:25
Plant:	Project: St Michael's Convent Phase 2	Finish: 07/02/2013	Size: -
Remarks:	Client: Linden Homes Southern Limited	Filled: -	Depth: 3.10mBGL
		Eng: EGMN	Level: -
		Drawn: NH	Figure: FIG
		Old: EGMN	Sheet: Sheet 1 of 1

SAMPLING & TESTING		STRATA DESCRIPTION	STRATA			
			Legend	mOD	mBGL	Water
0.20	D(1)	Dark brown silty clay with frequent fine to medium flint gravel and fine to coarse redbrick with frequent 1-5mm live roots (MADE GROUND).			(0.20)	
0.50	D(2)	Light grey clayey sandy gravel. Gravel is fine to medium sub-angular to angular of flint gravel with coarse gravel to cobble size red brick and breeze block. Clay pipe at 0.5m bgl encased in concrete. Frequent live fine roots 1-5mm. (MADE GROUND).			0.20 (0.30)	
1.00	HPEN=1.5kg/cm2 D(3)	High strength orange-brown and grey mottled CLAY with frequent fine to medium flint gravel with frequent 1-5mm live roots. and a 10mm live root observed at 0.7m bgl (HEAD DEPOSITS)			0.50 (1.20)	
1.50	HPEN=2.5kg/cm2 D(4)					
2.00	HPEN=1.5kg/cm2 D(5)	Light orange and grey clayey GRAVEL. Gravel is fine to coarse sub-angular to sub-rounded flint gravel with occasional fine 1mm live roots. Decaying 3mm root observed at 2.1m bgl (HEAD DEPOSITS)			1.70 (0.70)	
2.50	HPEN=2.5kg/cm2 D(6)	High strength blue-grey closely to very closely fissured CLAY with occasional fine 1mm live roots (LONDON CLAY FORMATION)			2.40 (0.20)	
3.00	HPEN=2.5kg/cm2 D(7)	High strength closely to very closely fissured light grey and orange-brown mottled CLAY with rare fine live 1mm roots to 3.0m bgl (LONDON CLAY FORMATION)			2.60 (0.40)	
		End of Trial Pit at 3.00 m			3.00	

SAMPLES: D=disturbed B=bulk U=undisturbed TESTS: MAC=macintosh IVAN=vane HPEN=penetrometer SPT=split-spoon CPT=cone WATER=☐=strike ☐=rest OTHERS: (2.00)=strata

Stability: No instability encountered	Type: Machine Excavated Trial Pit	Ref: GE9185	Position: TP2
Ground water: No Groundwater Encountered	Method:	Start: 07/02/2012	Scale: 1:25
Plant:	Project: St Michael's Convent Phase 2	Finish: 07/02/2012	Size: -
Remarks:	Client: Linden Homes Southern Limited	Filled: -	Depth: 3.00mBGL
		Eng: EGMN	Level: -
		Drawn: NH	Figure: FIG
		Old: EGMN	Sheet: Sheet 1 of 1

SAMPLING & TESTING		STRATA DESCRIPTION	STRATA				
			Legend	mOD	mBGL	Water	S/Pipe
0.20	D(1)	Brown silty clay with frequent fine to coarse flint gravel and redbrick with sawdust and frequent live 1-5mm roots (MADE GROUND).			(0.70)		
0.50	D(2)						
1.00	HPEN=1.5kg/cm2 D(3)	High strength orange-brown and grey mottled silty closely fissured CLAY with frequent fine to coarse flint gravel with rare fine live roots. Live 2mm root observed at 1.4m bgl (HEAD DEPOSITS)			0.70		
1.00							
1.50	HPEN=3.1kg/cm2 D(4)	High strength light orange-brown and grey mottled closely fissured CLAY with occasional fine to coarse flint gravel and occasional fine live roots. Rare fine live roots observed from 2.3m bgl and rare decaying roots observed from 2.5m bgl (LONDON CLAY FORMATION)			(1.20)		
1.50							
2.00	HPEN=2.7kg/cm2 D(5)				1.90		
2.00							
2.50	HPEN=3.3kg/cm2 D(6)				(1.10)		
2.50							
3.00	HPEN=3.5kg/cm2 D(7)	End of Trial Pit at 3.00 m			3.00		
3.00							

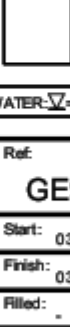
SAMPLES: D=disturbed B=bulk U=undisturbed TESTS: MAC=macintosh IVAN=vane HPEN=penetrometer SPT=split-spoon CPT=cone WATER=☐=strike ☐=rest OTHERS: (2.00)=strata

Stability: No instability encountered	Type: Machine Excavated Trial Pit	Ref: GE9185	Position: TP3
Groundwater: No Groundwater Encountered	Method:	Start: 07/02/2013	Scale: 1:25
		Finish: 07/02/2013	Size: -
Plant:	Project: St Michael's Convent Phase 2	Filled: -	Depth: 3.00mBGL
		Eng: EGMN	Level: -
Remarks:	Client: Linden Homes Southern Limited	Drawn: NH	Figure: FIG
		Old: EGMN	Sheet: Sheet 1 of 1

SAMPLING & TESTING		STRATA DESCRIPTION	STRATA			
			Legend	mOD	mBGL	Water
0.20	D(1)	Dark grey brown fine sandy clayey silt with occasional gravel to cobble sized flint brick and concrete fragments with roots and rootlets (MADE GROUND).			(0.20)	
0.50	HPEN=1.5kg/cm2	High strength orange brown and light grey mottled silty CLAY with occasional fine to medium flint gravel rare rootlets less than 1mm. Very closely fissured clay with occasional fine to coarse flint gravel from 1.5m bgl (HEAD DEPOSITS)			0.20	
0.50	D(2)					
1.00	HPEN=1.5kg/cm2					
1.00	D(3)				(2.20)	
1.50	HPEN=2.3kg/cm2	Orange brown medium to coarse sub-angular flint GRAVEL with an orange brown clay matrix (HEAD DEPOSITS)				
1.50	D(4)					
2.00	HPEN=1.5kg/cm2					
2.00	D(5)				2.40	
2.50	D(6)	End of Trial Pit at 2.80 m			(0.40)	
2.50						
					2.80	

SAMPLES: D=disturbed B=bulk U=undisturbed TESTS: MAC=macintosh IVAN=vane HPEN=penetrometer SPT=split-spoon CPT=cone WATER=V=strike W=rest OTHERS: (2.00)=strata

Stability:	Type: Machine Excavated Trial Pit	Ref: GE9185	Position: TP4
Ground water: No Groundwater Encountered	Method:	Start: 03/02/2013	Scale: 1:25
		Finish: 03/02/2013	Size: -
Plant:	Project: St Michael's Convent Phase 2	Filled: -	Depth: 2.80mBGL
		Eng: EGMN	Level: -
Remarks:	Client: Linden Homes Southern Limited	Drawn: EN	Figure: FIG
		Old: EGMN	Sheet: Sheet 1 of 1

SAMPLING & TESTING		STRATA DESCRIPTION	STRATA				
			Legend	mOD	mBGL	Water	S/Pipe
0.20	D(1)	Grey brown silty clay with occasional fine to medium sub-angular flint gravel and roots less than 8mm (TOPSOIL).			(0.40)		
0.50 0.50	HPEN=2.3kg/cm2 D(2)	High strength orange-brown and light grey silty CLAY with occasional fine to medium flint gravel and rare roots less than 1mm (HEAD DEPOSITS)			0.40		
1.00 1.00	HPEN=2.0kg/cm2 D(3)				(1.10)		
1.50 1.50	HPEN=2.3kg/cm2 D(4)	Orange brown silty clayey flint GRAVEL with occasional cobble sized flint (HEAD DEPOSITS)			1.50		
2.00 2.00	HPEN=1.5kg/cm2 D(5)				(0.80)		
2.50 2.50	HPEN=2.3kg/cm2 D(6)	High strength grey and brown mottled closely fissured silty CLAY (LONDON CLAY FORMATION)			2.30		
					(0.60)		
		End of Trial Pit at 2.90 m			2.90		

SAMPLES: D=disturbed B=bulk U=undisturbed TESTS: MAC=macintosh IVAN=vane HPEN=penetrometer SPT=split-spoon CPT=cone WATER=☐=strike ☐=rest OTHERS: (2.00)=strata

Stability:	Type: Machine Excavated Trial Pit	Ref: GE9185	Position: TP5
Ground water: No Groundwater Encountered	Method:	Start: 03/02/2013	Scale: 1:25
		Finish: 03/02/2013	Size: -
Plant:	Project: St Michael's Convent Phase 2	Filled: -	Depth: 2.90mBGL
		Eng: EGMN	Level: -
Remarks:	Client: Linden Homes Southern Limited	Drawn: EN	Figure: FIG
		Old: EGMN	Sheet: Sheet 1 of 1

SAMPLING & TESTING		STRATA DESCRIPTION	STRATA				
			Legend	mOD	mBGL	Water	S/Pipe
0.20	D(1)	Tarmac over orange brown silty clay with abundant medium to coarse sub-rounded flint gravel (MADE GROUND).			(0.20)		
		Grey brown silty clay with occasional flint and brick gravel (MADE GROUND).			0.20 (0.20)		
0.50 0.50	HPEN=2.0kg/cm2 D(2)	High strength orange-brown and light grey mottled silty CLAY with occasional fine to medium flint gravel and rare rootlets less than 1mm (HEAD DEPOSITS)			0.40 (0.70)		
1.00 1.00	HPEN=1.5kg/cm2 D(3)				1.10 (0.30)		
1.50	D(4)			Orange brown medium to coarse sub-angular flint GRAVEL with an orange brown clay matrix (HEAD DEPOSITS)			1.40
		High strength grey and brown mottled closely fissured silty CLAY. Very closely fissured from 2.0-2.5m bg (LONDON CLAY FORMATION)					
2.00	D(5)				(1.40)		
2.50 2.50	HPEN=2.0kg/cm2 D(6)						
2.80		End of Trial Pit at 2.80 m			2.80		

SAMPLES: D=disturbed B=bulk U=undisturbed TESTS: MAC=macintosh IVAN=vane HPEN=penetrometer SPT=split-spoon CPT=cone WATER=strike rest OTHERS: (2.00)=strata

Stability:	Type: Machine Excavated Trial Pit	Ref: GE9185	Position: TP6
Ground water: No Groundwater Encountered	Method:	Start: 03/02/2013	Scale: 1:25
		Finish: 03/02/2013	Size: -
Plant:	Project: St Michael's Convent Phase 2	Filled: -	Depth: 2.80mBGL
		Eng: EGMN	Level: -
Remarks:	Client: Linden Homes Southern Limited	Drawn: EN	Figure: FIG
		Ord: EGMN	Sheet: Sheet 1 of 1

SAMPLING & TESTING		STRATA DESCRIPTION	STRATA				
			Legend	mOD	mBGL	Water	S/Pipe
0.20	D(1)	Tarmac over orange brown silty clay with abundant medium to coarse sub-rounded flint gravel (MADE GROUND).			(0.20)		
		Grey and brown mottled closely fissured silty CLAY (HEAD DEPOSITS)			0.20		
0.50	HPEN=2.0kg/cm2 D(2)	High strength orange-brown and light grey mottled silty CLAY with occasional fine to medium flint gravel and rare rootlets less than 1mm (HEAD DEPOSITS)			(0.20)		
					0.40		
1.00	HPEN=3.0kg/cm2 D(3)	Orange brown clayey medium to coarse sub-angular flint GRAVEL (HEAD DEPOSITS) Buried pipe, and ingress of water			(0.60)		
					1.00		
1.50	HPEN=2.5kg/cm2 D(4)	High strength grey and brown mottled closely fissured silty CLAY with rare 1mm roots. Very closely fissured from 2.3m bgl (LONDON CLAY FORMATION)			(0.40)		
					1.40		
2.00	HPEN=3.3kg/cm2 D(5)				(1.10)		
					2.50		
2.50	HPEN=2.5kg/cm2 D(6)	End of Trial Pit at 2.50 m					

SAMPLES: D=disturbed B=bulk U=undisturbed TESTS: MAC=macintosh IVAN=vane HPEN=penetrometer SPT=split-spoon CPT=cone WATER=strike rest OTHERS: (2.00)=strata

Stability:	Type: Machine Excavated Trial Pit	Ref: GE9185	Position: TP7
Ground water: No Groundwater Encountered	Method:	Start: 03/02/2013	Scale: 1:25
		Finish: 03/02/2013	Size: -
Plant:	Project: St Michael's Convent Phase 2	Filled: -	Depth: 2.50mBGL
		Eng: EGMN	Level: -
Remarks:	Client: Linden Homes Southern Limited	Drawn: EN	Figure: FIG
		Ord: EGMN	Sheet: Sheet 1 of 1

SAMPLING & TESTING		STRATA DESCRIPTION	STRATA			
			Legend	mOD	mBGL	Water
0.20	D(1)	Tarmac over orange brown silty clay with abundant medium to coarse sub-rounded flint gravel (MADE GROUND).			(0.30)	
0.50	HPEN=1.5kg/cm2 D(2)	Grey and brown mottled silty clay with traces of tarmac (MADE GROUND).			0.30 (0.30)	
1.00	HPEN=1.5kg/cm2 D(3)	High strength orange-brown and light grey mottled silty CLAY with occasional fine to medium flint gravel and rare rootlets less than 1mm (HEAD DEPOSITS)			0.60 (0.60)	
1.50	HPEN=2.2kg/cm2 D(4)	Orange brown clayey medium to coarse sub-angular flint GRAVEL (HEAD DEPOSITS)			1.50 (0.40)	
2.00	HPEN=2.5kg/cm2 D(5)	High to very high strength grey and brown mottled closely fissured silty CLAY (LONDON CLAY FORMATION)			1.90 (0.90)	
2.50	HPEN=3.5kg/cm2 D(6)	End of Trial Pit at 2.80 m			2.80	

SAMPLES: D=disturbed B=bulk U=undisturbed TESTS: MAC=macintosh IVAN=vane HPEN=penetrometer SPT=split-spoon CPT=cone WATER=strike rest OTHERS: (2.00)=strata

Stability:	Type: Machine Excavated Trial Pit	Ref: GE9185	Position: TP8
Ground water: No Groundwater Encountered	Method:	Start: 03/02/2013 Finish: 03/02/2013	Scale: 1:25 Size: -
Plant:	Project: St Michael's Convent Phase 2	Filled: - Eng: EGMN	Depth: 2.80mBGL Level: -
Remarks:	Client: Linden Homes Southern Limited	Drawn: EN Ckd: EGMN	Figure: FIG Sheet: Sheet 1 of 1



APPENDIX B

Geotechnical Laboratory Results

Project Name: St. Michael's Phase 2					Samples Received: 15/02/2013		K4 SOILS 		
					Project Started: 28/02/2013				
Client: Geo-Environmental Services Ltd					Testing Started: 07/03/2013				
Project No: GE9185		Our job/report no: 14176			Date Reported: 11/03/2013				
Borehole No:	Sample No:	Depth (m)	Description	Moisture content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425 mm (%)	Remarks
TP1	-	1.00	Orangey brown slightly mottled grey slightly sandy clayey GRAVEL with occasional rootlets (gravel is fmc and sub-angular to angular)	23	55	25	30	40	
TP1	-	1.50	Brown and grey mottled gravelly CLAY with occasional taumac deposits (gravel is fm and sub-angular)	13					
TP1	-	2.00	Light brown slightly mottled blue grey silty CLAY with rare fine gravel	25	66	21	45	98	
TP1	-	2.50	Brown, blue and grey mottled slightly gravelly CLAY (gravel is fm and sub-angular)	25					
TP1	-	3.00	Brown mottled grey slightly silty CLAY	27	65	22	43	100	
TP2	-	1.00	Orange brown and blue grey mottled CLAY with occasional rootlets	35	72	23	49	100	
TP2	-	1.50	Light brown slightly orange brown mottled slightly sandy slightly gravelly CLAY (gravel is fm and sub-angular)	17					
TP2	-	2.00	Light brown gravelly CLAY (gravel is fmc and sub-angular)	19	67	22	45	26	
TP2	-	2.50	Brown and blue grey mottled slightly gravelly CLAY (gravel is fm and sub-angular)	27					
TP2	-	3.00	Brown silty CLAY	28	75	24	51	100	
TP3	-	1.00	Light brown slightly mottled blue grey slightly silty gravelly CLAY (gravel is fmc and sub-angular to sub-rounded)	25	64	22	42	40	
TP3	-	1.50	Brown and blue grey mottled slightly sandy slightly gravelly CLAY (gravel is fm and sub-angular)	20					
TP3	-	2.00	Brown and blue grey mottled slightly sandy slightly gravelly CLAY (gravel is fm and sub-angular)	33					
TP3	-	2.50	Light brown silty CLAY	27	74	26	48	100	
TP3	-	3.00	Brown and blue grey mottled slightly sandy slightly gravelly CLAY (gravel is fm and sub-angular)	31					
TP4	-	1.00	Light brown slightly mottled blue grey slightly gravelly silty CLAY (gravel is fm and sub-angular)	33	76	25	51	96	
TP4	-	1.50	Brown mottled grey slightly sandy slightly silty CLAY with traces of rootlets	28	62	23	39	100	
TP4	-	2.00	Orangey brown slightly mottled grey slightly sandy gravelly CLAY (gravel is fm and sub-angular to angular)	16	57	20	37	55	
TP4	-	2.50	Brown slightly clayey sandy GRAVEL (gravel is fmc and sub-angular)	14					
 Summary of Test Results BS 1377 : Part 2 : Clause 4.4 : 1990 Determination of the liquid limit by the cone penetrometer method. BS 1377 : Part 2 : Clause 5 : 1990 Determination of the plastic limit and plasticity index. BS 1377 : Part 2 : Clause 3.2 : 1990 Determination of the moisture content by the oven-drying method.									Checked and Approved Initials: K.P Date: 11/03/2013
Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU									
Test Results relate only to the sample numbers shown above. Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)									
All samples connected with this report, incl any on 'hold' will be stored and disposed off according to Company policy. Copy of this policy is available on request.									
MSF-11/16									

Project Name: St. Michael's Phase 2					Samples Received: 15/02/2013		K4 SOILS 		
					Project Started: 28/02/2013				
Client: Geo-Environmental Services Ltd					Testing Started: 07/03/2013				
Project No: GE9185		Our job/report no: 14176			Date Reported: 11/03/2013				
Borehole No:	Sample No:	Depth (m)	Description	Moisture content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425 mm (%)	Remarks
TP4	-	2.80	Brown grey mottled sandy gravelly CLAY (gravel is fm and sub-angular)	12					
TP5	-	1.00	Orangey brown and grey mottled slightly gravelly silty CLAY with occasional rootlets (gravel is fm and sub-angular to angular)	29	70	22	48	90	
TP5	-	1.50	Brown and blue grey mottled slightly sandy CLAY	30					
TP5	-	2.00	Brown mottled grey slightly gravelly CLAY (gravel is fmc and sub-angular to rounded)	24	68	24	44	60	
TP5	-	2.50	Brown mottled blue grey CLAY	24					
TP6	-	1.00	Light brown gravelly CLAY (gravel is fmc and sub-angular)	26	78	24	54	40	
TP6	-	1.50	Brown slightly blue grey mottled slightly sandy gravelly CLAY (gravel is fm and sub-angular)	15					
TP6	-	2.00	Light brown slightly mottled blue grey silty CLAY	25	67	23	44	100	
TP6	-	2.50	Brown mottled blue grey CLAY	28					
TP6	-	2.80	Brown mottled grey slightly silty CLAY with occasional rootlets	26	68	27	41	100	
TP7	-	1.00	Light brown slightly mottled blue grey slightly gravelly silty CLAY (gravel is fm and sub-angular)	30	81	26	55	96	
TP7	-	1.50	Brown mottled blue grey slightly sandy CLAY	32					
TP7	-	2.00	Brown mottled grey slightly silty CLAY with occasional rootlets and black flecks	27	67	26	41	100	
TP7	-	2.50	Brown blue grey mottled CLAY	28					
TP8	-	1.00	Brown and blue grey mottled slightly silty gravelly CLAY (gravel is fmc and sub-angular)	31					
TP8	-	1.50	Brown mottled grey slightly gravelly CLAY (gravel is fm and sub-rounded to sub-angular)	35	88	32	56	95	
TP8	-	2.00	Brown and blue grey mottled slightly silty slightly gravelly CLAY with occasional carbonaceous deposits (gravel is fm and sub-angular)	32					
TP8	-	2.50	Brown mottled grey silty CLAY	29	65	28	37	100	
TP8	-	2.80	Brown and blue grey mottled slightly silty CLAY	29					
 Summary of Test Results BS 1377 : Part 2 : Clause 4.4 : 1990 Determination of the liquid limit by the cone penetrometer method. BS 1377 : Part 2 : Clause 5 : 1990 Determination of the plastic limit and plasticity index. BS 1377 : Part 2 : Clause 3.2 : 1990 Determination of the moisture content by the oven-drying method.									Checked and Approved Initials: K.P Date: 11/03/2013
Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU									
Test Results relate only to the sample numbers shown above. Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)									
All samples connected with this report, incl any on 'hold' will be stored and disposed off according to Company policy. Copy of this policy is available on request.									
MSF-11/6									

Project Name: St. Michael's Phase 2					K4 SOILS 
Client: Geo-Environmental Services Ltd Project no: GE9185					
Our job no: 14176					
Borehole No:	Sample No:	Depth m	Description	pH	Sulphate content (g/l)
TP1	-	1.50	Brown and grey mottled gravelly CLAY with occasional tarmac deposits (gravel is fm and sub-angular)	8.0	0.16
TP2	-	2.50	Brown and blue grey mottled slightly gravelly CLAY (gravel is fm and sub-angular)	8.3	0.33
TP4	-	1.00	Light brown slightly mottled blue grey slightly gravelly silty CLAY (gravel is fm and sub-angular)	8.3	0.43
TP6	-	2.50	Brown mottled blue grey CLAY	8.3	0.37
TP7	-	1.50	Brown mottled blue grey slightly sandy CLAY	8.4	0.73
Date 11/03/2013	Summary of Test Results				Checked and Approved Initials : kp
	BS 1377 : Part 3 : Clause 5 : 1990				
	Determination of sulphate content of soil and ground water : gravimetric method				



APPENDIX C

Geochemical Laboratory Results



2683



2683

Unit A2
Windmill Road
Ponswood Industrial Estate
St Leonards on Sea
East Sussex
TN38 9BY
Telephone (01424) 718618
Facsimile (01424) 729911

THE ENVIRONMENTAL LABORATORY LTD

F.A.O. Gavin Roberts
Geo-Environmental Services Limited
28 Crescent Road
Brighton, East Sussex
BN2 3RP

Reporting Date: 10 April 2013

ANALYTICAL REPORT No. AR43702

Samples Received By: Laboratory Courier
Your Job No: GE9185
Your Order No: 1410
Site Location: St Michael's Phase 2
No Samples Received: 5
Date of Sampling: 08/02/13

This report was written by: Stuart Ballard

Authorised By;

Steve Knight
Reporting Manager

Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683)



THE ENVIRONMENTAL LABORATORY LTD

Unit A2, Windmill Road, Ponswood Industrial Estate, St Leonard's on Sea, East Sussex, TN38 9BY

Tel: 01424 718618 Fax: 01424 729911

ANALYTICAL REPORT No. AR43702

Location: St Michael's Phase 2



Your Job No: GE9185
Your Order No: 1410
Reporting Date: 10/04/13

F.A.O. Gavin Roberts
Geo-Environmental Services Limited
28 Crescent Road
Brighton, East Sussex
BN2 3RP

Soils	Characteristic	Sandy Clay loam	Sandy Clay loam	Sandy Clay loam	Sandy Clay loam	Sandy Clay loam
	Date Sampled	08/02/13	08/02/13	08/02/13	08/02/13	08/02/13
	TP/BH	TP1	TP3	TP5	TP7	TP8
	Depth (m)	0.20	0.50	0.20	0.50	0.20
	Our ref	66731	66732	66733	66734	66735
Stone Content	(%)	37	49	56	<1	58
Arsenic**	(mg/kg)	<5	<5	6.5	18.7	<5
Cadmium**	(mg/kg)	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium**	(mg/kg)	13	9	14	26	6
Lead**	(mg/kg)	28	11	24	18	5
Mercury**	(mg/kg)	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel**	(mg/kg)	10	4	16	17	7
Copper**	(mg/kg)	12	7	10	19	5
Zinc**	(mg/kg)	41	19	35	46	19
Selenium**	(mg/kg)	0.5	<0.5	<0.5	0.8	<0.5
Hexavalent Chromium	(mg/kg)	<2	<2	<2	<2	<2
Water Soluble Boron	(mg/kg)	<0.5	0.8	<0.5	<0.5	<0.5
Barium*	(mg/kg)	25	17	27	20	16
Beryllium*	(mg/kg)	<1	<1	<1	<1	<1
Vanadium**	(mg/kg)	20	16	25	53	10
pH Value**	(Units)	8.1	8.1	7.8	7.1	7.7
Total Sulphate	(% as SO ₄)	<0.05	<0.05	<0.05	0.15	<0.05
Water Soluble Sulphate	(mg/l as SO ₄)	<20	32	<20	25	<20
Water Soluble Chloride	(mg/l)	<20	<20	<20	<20	<20
Water Soluble Sulphate**	(mg/kg as SO ₄)	<40	63	<40	49	<40
Water Soluble Chloride	(mg/kg)	<40	<40	<40	<40	<40
Total Cyanide**	(mg/kg)	<1	<1	<1	<1	<1
Sulphide	(mg/kg)	<2	<2	<2	<2	<2
Elemental Sulphur**	(mg/kg)	<10	<10	<10	<10	<10
Total Monohydric Phenols**	(mg/kg)	<1	<1	<1	<1	<1
Total Organic Carbon	(%)	0.4	<0.1	0.2	0.1	<0.1

All results expressed on dry weight basis

** - MCERTS accredited test

* = UKAS accredited test

S.Bellard



THE ENVIRONMENTAL LABORATORY LTD

Unit A2, Windmill Road, Ponswood Industrial Estate, St Leonard's on Sea, East Sussex, TN38 9BY

Tel: 01424 718618 Fax: 01424 729911

ANALYTICAL REPORT No. AR43702

Location: St Michael's Phase 2



Your Job No: GE9185
Your Order No: 1410
Reporting Date: 10/04/13

F.A.O. Gavin Roberts
Geo-Environmental Services Limited
28 Crescent Road
Brighton, East Sussex
BN2 3RP

<u>Soils</u>	Characteristic	Sandy Clay loam	Sandy Clay loam	Sandy Clay loam	Sandy Clay loam	Sandy Clay loam
	Date Sampled	08/02/13	08/02/13	08/02/13	08/02/13	08/02/13
	TP/BH	TP1	TP3	TP5	TP7	TP8
	Depth (m)	0.20	0.50	0.20	0.50	0.20
	Our ref	66731	66732	66733	66734	66735
Naphthalene**	(mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene**	(mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene**	(mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene**	(mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene**	(mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene**	(mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene**	(mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene**	(mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
Benz(a)anthracene**	(mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene**	(mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b)fluoranthene**	(mg/kg)	<0.1	<0.1	0.1	<0.1	<0.1
Benzo(k)fluoranthene**	(mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)pyrene**	(mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno(123-cd)pyrene**	(mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenz(ah)anthracene**	(mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)perylene**	(mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
Total PAH**	(mg/kg)	<0.1	<0.1	0.1	<0.1	<0.1

All results expressed on dry weight basis

** - MCERTS accredited test

S.Bellard

THE ENVIRONMENTAL LABORATORY LTD

Unit A2, Windmill Road, Ponswood Industrial Estate, St Leonard's on Sea, East Sussex, TN38 9BY

Tel: 01424 718618 Fax: 01424 729911

ANALYTICAL REPORT No. AR43702

Location: St Michael's Phase 2



Your Job No: GE9185
Your Order No: 1410
Reporting Date: 10/04/13

F.A.O. Gavin Roberts
Geo-Environmental Services Limited
28 Crescent Road
Brighton, East Sussex
BN2 3RP

TPH CWG - Soil

Characteristic		Sandy Clay loam	Sandy Clay loam	Sandy Clay loam	Sandy Clay loam	Sandy Clay loam
Date Sampled		08/02/13	08/02/13	08/02/13	08/02/13	08/02/13
TP/BH		TP1	TP3	TP5	TP7	TP8
Depth (m)		0.20	0.50	0.20	0.50	0.20
Our ref		66731	66732	66733	66734	66735
Aromatic						
>EC ₅ -EC ₇	(mg/kg)	<0.01	<0.01	<0.01	<0.01	<0.01
>EC ₇ -EC ₈	(mg/kg)	<0.01	<0.01	<0.01	<0.01	<0.01
>EC ₈ -EC ₁₀	(mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
>EC ₁₀ -EC ₁₂	(mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
>EC ₁₂ -EC ₁₆	(mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
>EC ₁₆ -EC ₂₁	(mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
>EC ₂₁ -EC ₃₅	(mg/kg)	5.9	2.0	0.4	0.2	0.2
Aliphatic						
>EC ₅ -EC ₇	(mg/kg)	<0.01	<0.01	<0.01	<0.01	<0.01
>EC ₇ -EC ₈	(mg/kg)	<0.01	<0.01	<0.01	<0.01	<0.01
>EC ₈ -EC ₁₀	(mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
>EC ₁₀ -EC ₁₂	(mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
>EC ₁₂ -EC ₁₆	(mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1
>EC ₁₆ -EC ₂₁	(mg/kg)	<0.1	0.3	<0.1	<0.1	<0.1
>EC ₂₁ -EC ₃₅	(mg/kg)	1.4	0.1	<0.1	<0.1	<0.1
TPH (C ₅ - C ₃₅)	(mg/kg)	7.3	2.4	0.4	0.2	0.2

All results expressed on dry weight basis

S.Bellard



THE ENVIRONMENTAL LABORATORY LTD

Unit A2, Windmill Road, Ponswood Industrial Estate, St Leonard's on Sea, East Sussex, TN38 9BY

Tel: 01424 718618 Fax: 01424 729911

ANALYTICAL REPORT No. AR43702

Location: St Michael's Phase 2



F.A.O. Gavin Roberts
Geo-Environmental Services Limited
28 Crescent Road
Brighton, East Sussex
BN2 3RP

Your Job No: GE9185
Your Order No: 1410
Reporting Date: 10/04/13

Asbestos Identification

Sample ref:	TP1
Depth (m)	0.20
Our ref:	66731
#Description of Sample Matrix:	Sandy Clay loam
Result	No asbestos identified

Sample ref:	TP3
Depth (m)	0.50
Our ref:	66732
#Description of Sample Matrix:	Sandy Clay loam
Result	No asbestos identified

Sample ref:	TP5
Depth (m)	0.20
Our ref:	66733
#Description of Sample Matrix:	Sandy Clay loam
Result	No asbestos identified

Sample ref:	TP7
Depth (m)	0.50
Our ref:	66734
#Description of Sample Matrix:	Sandy Clay loam
Result	No asbestos identified

Sample ref:	TP8
Depth (m)	0.20
Our ref:	66735
#Description of Sample Matrix:	Sandy Clay loam
Result	No asbestos identified

*= UKAS accredited

Analytical result only applies to the sample as submitted by the client

Any comments, opinions or interpretations (marked #) in this report are outside UKAS accreditation (Accreditation No2683). They are subjective comments only which must be verified by the client

S.Ballard

THE ENVIRONMENTAL LABORATORY LTD

SAMPLE RECEIPT AND TEST DATES

Our Analytical Report Number AR43702
Your Job No: GE9185
Sample Receipt Date: 05/04/13
Reporting Date: 10/04/13

Registered: 05/04/13
Prepared: 06/04/13
Analysis complete: 10/04/13

TEST METHOD SUMMARY

PARAMETER	Analysis Undertaken on	Date Tested	Method Number	Technique
Arsenic**	Air dried sample	05/04/13	118	ICPMS
Cadmium**	Air dried sample	05/04/13	118	ICPMS
Chromium**	Air dried sample	05/04/13	118	ICPMS
Lead**	Air dried sample	05/04/13	118	ICPMS
Mercury**	Air dried sample	05/04/13	118	ICPMS
Nickel**	Air dried sample	05/04/13	118	ICPMS
Copper**	Air dried sample	05/04/13	118	ICPMS
Zinc**	Air dried sample	05/04/13	118	ICPMS
Selenium**	Air dried sample	05/04/13	118	ICPMS
Hexavalent Chromium	As submitted sample	09/04/13	110	Colorimetry
Water Soluble Boron	Air dried sample	05/04/13	202	Colorimetry
Barium*	Air dried sample	05/04/13	118	ICPMS
Beryllium*	Air dried sample	05/04/13	118	ICPMS
Vanadium**	Air dried sample	05/04/13	118	ICPMS
pH Value**	Air dried sample	05/04/13	113	Probe
Total Sulphate	Air dried sample	05/04/13	208	Colorimetry
Water Soluble Sulphate	Air dried sample	05/04/13	172	Ion Chromatography
Water Soluble Chloride	Air dried sample	05/04/13	172	Ion Chromatography
Total Cyanide**	As submitted sample	09/04/13	204	Colorimetry
Sulphide	As submitted sample	09/04/13	109	Colorimetry
Elemental Sulphur**	Air dried sample	05/04/13	122	HPLC
Total Monohydric Phenols**	As submitted sample	09/04/13	121	HPLC
Total Organic Carbon	Air dried sample	10/04/13	210	Automated IR Adsorption
Speciated PAH**	As submitted sample	08/04/13	133	Gas Chromatography
Carbon Banding (TPH)	As submitted sample	05/04/13	117	Gas chromatography
Asbestos*	As submitted sample	05/04/13	179	see note

Asbestos analysis qualitative only

Note:- Documented In-house procedure based on HSG 248 2005

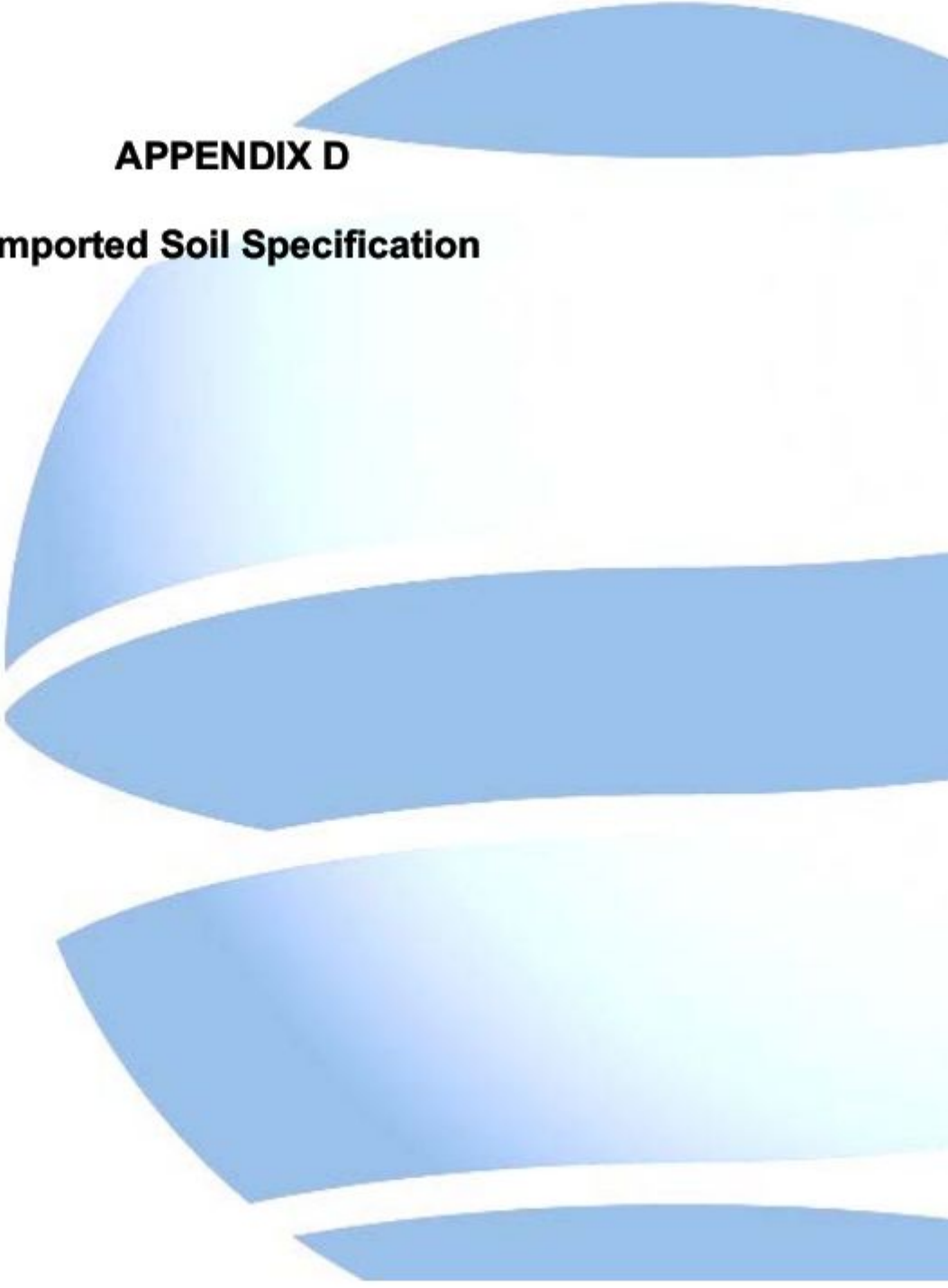
* = UKAS Accredited test

** - MCERTS Accredited test

Determinands not marked with * or ** are non accredited

MCERTS accreditation covers samples which are predominantly sand, clay, loam or combinations of these three soil types

Any comments, opinions, or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683)



APPENDIX D

Imported Soil Specification



Geo-Environmental

IMPORTED SOIL SPECIFICATION

Document Reference	Imported Soil Specification
Site	GE9185 – Villa Gardens, Waterloooville
Issue Date	April 2013
Issue Version	1.0
Prepared By	Gavin Roberts (Geo-Environmental)

CONTENTS

1.0	Introduction	1
2.0	Chemical Composition	2
3.0	Nutritional Composition.....	7
4.0	Physical Composition.....	8
5.0	Source Requirements	9
6.0	Testing Rates.....	10



1.0 Introduction

This documents sets out the requirements for cover systems and imported materials for any project undergoing redevelopment or other works where capping work is required.

Within the specification reference has been made to topsoil and subsoil. Topsoil relates to the top layer of natural soil that can support healthy vegetation growth. Subsoil relates to the layer of soil immediately below the topsoil to the depth of the underlying broken rock or geological parent material.

The specification considers the chemical, nutritional and physical properties of soils that are to be imported onto site, in order to ensure materials used are suitable for their intended use and do not introduce any new hazard or pollutant linkage on to the site.



2.0 Chemical Composition

The chemical criteria listed below are based on published CLEA Soil Guideline Values (SGVs), generic assessment criteria calculated using UK policy compliant software or by reference to current guidance and best practice. From time to time these values may change in line with regulatory or UK policy changes. Such changes will require revision and re-issue of this document.

At the time of preparation, where SGVs have not been published, generic assessment criteria (GAC) published in 2009 by the Chartered Institute of Environmental Health and Land Quality Management have been used. Where SGVs or GAC are published for a range of Soil Organic Matter (SOM) values, these ranges and their respective SOM values have been presented and would be considered when assessing compliance with this Specification.

2.1 Method of Analysis

Samples should be analysed using UKAS or MCERTS accredited laboratories. For TPH analysis sample preparation must not include air drying.

2.1.1 Poly Aromatic Hydrocarbon (PAH)

The PAH analysis must include the EPA priority 16.

2.1.2 Total Petroleum Hydrocarbons (TPH)

The analysis for TPH should be undertaken on the 'as received' sample and not be subject to any pre-treatment and include aliphatic and aromatic carbon banding split.

2.2 Topsoil (0-300mm depth)

Table 1 provides a list of the maximum acceptable concentrations for imported topsoil.



Parameter	Maximum concentration (mg/kg)
Inorganic	
Arsenic (total)	<32
Boron (water soluble)	<291
Cadmium (total)	10 (SOM=6%)
Chromium (total)	<130
Copper (total)	<2330
Cyanide (total)	<250
Lead (total)	<450
Mercury (total inorganic)	<8
Nickel (total)	<130 (SOM=6%)
pH	5.5 – 7.8
Selenium (total)	<350 (SOM=6%)
Sulphate (total)	<2000
Zinc (total)	<3750
Organic	
Soil Organic Matter (SOM)	
Phenols (total)	<420 (SOM=6%)
Poly Aromatic Hydrocarbon (speciated)	See Table 1a
Total Petroleum Hydrocarbon (speciated)	See Table 1b

Table 1: Chemical Specification for Topsoil



	Maximum Concentration (mg/kg)		
	1% SOM	2.5% SOM	5% SOM
Acenaphthene	210	480	1000
Acenaphthylene	170	400	850
Anthracene	2300	4900	9200
Benz(a)anthracene	3.1	4.7	5.9
Benzo(a)pyrene	0.83	0.94	1.0
Benzo(b)fluoranthene	5.6	6.5	7.0
Benzo(ghi)perylene	44	46	47
Benzo(k)fluoranthene	8.5	9.6	10
Chrysene	6.0	8.0	9.3
Dibenz(ah)anthracene	0.76	0.86	0.9
Fluoranthene	260	460	670
Fluorene	160	380	780
Indeno(1,2,3CD)pyrene	3.2	3.9	4.2
Naphthalene	1.5	3.7	8.7
Phenanthrene	92	200	380
Pyrene	560	1000	1600

Table 1a: Topsoil Specification for Speciated PAH

	Maximum Concentration (mg/kg)		
	1% SOM	2.5% SOM	5% SOM
Aliphatic			
EC 5-6	30	55	110
EC >6-8	73	160	370
EC >8-10	19	46	110
EC >10-12	93	230	540
EC >12-16	740	1700	3000
EC >16-35	45000	64000	76000
EC >35-44	45000	64000	76000
Aromatic			
EC 5-7 (benzene)	65	130	280
EC >7-8 (toluene)	120	270	611
EC >8-10	27	65	151
EC >10-12	69	160	346
EC >12-16	140	310	593
EC >16-21	250	480	770
EC >21-35	890	1100	1230
EC >35-44	890	1100	1230
Aliphatic and Aromatic			
EC >44-70	1200	1300	1300

Table 1b: Topsoil Specification for Speciated TPH

2.3 Subsoil (300-1000mm depth)

Table 2 provides a list of the maximum acceptable concentrations for imported subsoil.

Parameter	Maximum concentration (mg/kg)
Inorganic	
Arsenic (total)	<32
Boron (water soluble)	<291
Cadmium (total)	10 (SOM=6%)
Chromium (total)	<130
Copper (total)	<2330
Cyanide (total)	<250
Lead (total)	<450
Mercury (total inorganic)	<8
Nickel (total)	<130 (SOM=6%)
pH	5.5 – 7.8
Selenium (total)	<350 (SOM=6%)
Sulphate (total)	<2000
Zinc (total)	<3750
Organic	
Soil Organic Matter (SOM)	
Phenols (total)	<420 (SOM=6%)
Poly Aromatic Hydrocarbon (speciated)	See Table 1a
Total Petroleum Hydrocarbon (speciated)	See Table 1b

Table 2: Chemical Specification for Subsoil



	Maximum Concentration (mg/kg)		
	1% SOM	2.5% SOM	5% SOM
Acenaphthene	210	480	1000
Acenaphthylene	170	400	850
Anthracene	2300	4900	9200
Benz(a)anthracene	3.1	4.7	5.9
Benzo(a)pyrene	0.83	0.94	1.0
Benzo(b)fluoranthene	5.6	6.5	7.0
Benzo(ghi)perylene	44	46	47
Benzo(k)fluoranthene	8.5	9.6	10
Chrysene	6.0	8.0	9.3
Dibenz(ah)anthracene	0.76	0.86	0.9
Fluoranthene	260	460	670
Fluorene	160	380	780
Indeno(1,2,3CD)pyrene	3.2	3.9	4.2
Naphthalene	1.5	3.7	8.7
Phenanthrene	92	200	380
Pyrene	560	1000	1600

Table 2a: Subsoil Specification for Speciated PAH

	Maximum Concentration (mg/kg)		
	1% SOM	2.5% SOM	5% SOM
Aliphatic			
EC 5-6	30	55	110
EC >6-8	73	160	370
EC >8-10	19	46	110
EC >10-12	93	230	540
EC >12-16	740	1700	3000
EC >16-35	45000	64000	76000
EC >35-44	45000	64000	76000
Aromatic			
EC 5-7 (benzene)	65	130	280
EC >7-8 (toluene)	120	270	611
EC >8-10	27	65	151
EC >10-12	69	160	346
EC >12-16	140	310	593
EC >16-21	250	480	770
EC >21-35	890	1100	1230
EC >35-44	890	1100	1230
Aliphatic and Aromatic			
EC >44-70	1200	1300	1300

Table 2b: Subsoil Specification for Speciated TPH

3.0 Nutritional Composition

The nutritional criteria listed below are based on BS 3882:2007 Specification for Topsoil. In the absence of published criteria, current guidance and best practice has been applied to derive appropriate criteria.

3.1 Topsoil & Subsoil

Table 3 details the minimum acceptable concentrations for imported topsoil and subsoil.

Topsoil/Subsoil	Parameter	Min Concentration
Topsoil	Phosphorous	16 mg/l
	Potassium	120 mg/l
	Magnesium	51 mg/l
	Nitrogen	0.15 %
Subsoil	Phosphorous	16 mg/l
	Potassium	120 mg/l
	Magnesium	51 mg/l
	Nitrogen	0.15 %

Table 3: Nutritional Specification for Topsoil and Subsoil

4.0 Physical Composition

The physical criteria listed below are based on BS 3882:1994 Specification for Topsoil. In the absence of published criteria, current guidance and best practice has been applied to derive appropriate criteria.

4.1 Topsoil

Table 4 details requirements for imported topsoil and subsoil.

Topsoil/Subsoil	Parameter	Specification requirements
Topsoil	Textural Classification	Sandy clay loam, sandy loam, loamy sand, sandy silt loam (as defined in BS 3882, Figure 1)
	Loss on Ignition	5-50%
	Maximum Stone content:	>2mm = 30% >20mm = 10% >50mm = 0%
Subsoil	Textural Classification	N/A
	Loss on Ignition	2-50%
	Maximum Stone content:	>2mm = 65% >20mm = 60% >50mm = 40%

NB: Topsoil and Subsoil must be free from glass, brick fragments etc.

Table 4: Physical Specification for Topsoil & Subsoil



5.0 Source Requirements

5.1 Topsoil and Subsoil

The following will be provided with all soils imported to site:

- Location of site which is clean and has no history of potentially contaminative uses.
- A site plan detailing the location and address of the source site.

5.2 Manufactured soils

Where natural soils are unavailable manufactured soils may be utilised the following should be provided:

- Details of the soil manufacturing process, including criteria for received soils, quality control procedure and validation protocol.
- Soils should be tested at a minimum ratio of one sample per 50m³.



6.0 Testing Rates and Compliance

6.1 Topsoil

Where natural sourcing is proposed, the provenance of the material shall be determined by confirmation of the source site's history to confirm no previous potentially contaminative use, coupled with analysis of soils at a minimum rate of 3No. samples per source site (up to 250m³) and 1 sample per 250m³ thereafter.

Where Topsoil is derived from a manufactured source, testing would be undertaken at a rate of 1 sample per 50m³.

With regards to physical and nutritional composition and minimum testing regime of 1 sample per 250m³ is recommended for either source.

6.2 Subsoil

Where the source of the material is known and a due diligence review has established no previous contaminative use associated with the proposed subsoil, validation sampling should be undertaken at a minimum rate of 3 sample per source (up to 250m³) and 1 sample per 250m³ thereafter.

Where the source of the material is not known the validation sampling should be undertaken at a minimum of 1 sample per 50m³.

6.3 Manufactured soils

Soils should be tested at a minimum ratio of one sample per 50m³.

6.4 Sample failure

In the event that a sample fails to meet the specified criteria for any parameter the Environmental Consultant should be contacted for advice on the suitability of the materials.

Further testing may be required to provide reassurance that the exceedances are not representative of the soil.

6.5 Timing

Sampling and analysis undertaken by a manufactured topsoil supplier shall be no earlier than two weeks from the date of import, any results which are older than two weeks will be deemed not to be representative of the soils to be imported and rejected.

Imported Soil Suppliers and Groundworks Contractors are required to take reasonably practicable measures to ensure that compliance with this Specification does not hinder formal completion of individual plots or developments.



6.6 General Compliance

All analytical suites shall correspond with the chemical and nutritional compliance criteria (as set out in Tables 1 to 3). The soil supplier shall ensure that the analytical limits of detection are equal or lower than the compliance values presented within this Specification. Where either testing suites or limits of detection do not comply with this Specification, the entire set of results shall be rejected.