



Richard Jackson
Engineering Consultants

GROUND INVESTIGATION REPORT

Land east of Bell Road, Ox Meadow, Bottisham,
Cambridgeshire

The Masters & Fellows of Peterhouse

May 2016 – Rev A

Project no: 47385

Document Review Sheet: -

Document prepared by: - Kay O'Reilly
on behalf of Richard Jackson Ltd

Date: - 13 / 05 / 2016

Document checked by: - David Wall
on behalf of Richard Jackson Ltd

Date: - 13 / 05 / 2016

Document Approved by: - David Wall
on behalf of Richard Jackson Ltd

Date: - 13 / 05 / 2016

Document Status

DRAFT

FINAL

Revision Status

Issue	Date	Description	Prepared	Checked	Approved
A	17.6.16	Various Paragraphs in the Introduction	SEC	MJD	MJD

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Title: GROUND INVESTIGATION REPORT
 Project: Land east of Bell Road, Ox Meadow, Bottisham, Cambridgeshire
 Client: The Masters & Fellows of Peterhouse
 Project No.: 47385 – Rev A

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Appendix A: Parameters Plan and Illustrative Masterplan

Appendix B: Ground Investigation Report (2011) #35488

1. Introduction

Richard Jackson Ltd have previously undertaken a phase one desk study and phase two intrusive investigation at a site located off Bell Road, Bottisham, Cambridgeshire, as detailed in ground investigation report reference 35488, dated September 2011.

The 2011 report was instructed by and prepared for Barratt Homes (Eastern Counties) Ltd, to support a detailed planning application for 50 residential units.

It is understood that the Client, The Masters and Fellows of Peterhouse, are planning to submit an outline planning application for a residential development in the northern part of the site.

Richard Jackson Ltd have been instructed by Bidwells Planning Division on behalf of the Client, to rebrand the 2011 ground investigation report for submission with the outline planning application. This report has been prepared in accordance with our fee proposal of 12th April 2016, reference 47385/MD.

It should be appreciated that Richard Jackson Ltd have not undertaken additional investigative works in the preparation of this report, nor, has a review or reinterpretation of the factual information presented in the 2011 report been carried out.

This report includes comments on the applicability of the 2011 ground investigation information with respect to a 2016 application for planning.

The above referenced 2011 ground investigation report, is presented in full in Appendix B and this report shall be read in conjunction with the 2011 ground investigation report and the limitations of use contained therein.

2. Proposed Development

It is proposed to develop the site for predominantly residential purposes, constructing circa 50 no. residential dwellings together with access roads, driveways, gardens and associated infrastructure. Allotment gardens are also proposed for the site.

A Parameters Plan and an Illustrative Masterplan is presented in Appendix A.

3. Comments on Previous Investigation

As noted in Section 1, Richard Jackson Ltd previously prepared a ground investigation report for the site dated September 2011, report reference 35488. A copy of this report is presented in Appendix B.

It should be appreciated that the 2011 ground investigation report was prepared for a larger parcel of land at Bell Road, Bottisham. The proposed development scheme is limited to the northern part of the 2011 investigation area.

The following sections offer comment on the applicability of our 2011 ground investigation report in respect of the 2016 planning application.

3.1. Phase One Desk Study

Section 2 of our appended ground investigation report, ref no. 35488 (2011) comprised a phase one desk study for the site. The desk study comprised a review of historical Ordnance Survey maps and environmental data for the site and surrounding area.

The data presented in this section remains applicable to the site and the current outline planning application.

It should however, be appreciated that five years have elapsed since this desk study was undertaken and we are unable to comment on changes in land use at the site or in the surrounding area which may have occurred in this time. Nor are we able to comment on pollution incidents which may have occurred in the general vicinity of the site during this period.

3.2. Factual Ground Investigation Information

Section 3 of the appended ground investigation report, ref no. 35488 (2011) presented the factual findings of intrusive investigations undertaken at the site including the following elements:

- Details of fieldwork undertaken;
- Results of in-situ infiltration testing;
- Summary of encountered ground conditions.

Since the publication of the ground investigation report, the British Standard BS5930:- 'Code of Practice for Site Investigations' (2015) has been updated. However, the investigative methods used during the 2011 investigation would remain compliant under BS5930 (2015) and thus are considered applicable for the 2016 outline planning application.

The infiltration assessment undertaken at the site in 2011, as detailed in Section 3.1.2 of report ref no. 35488, was undertaken in accordance with BRE Digest 365 'Soakaway Design' (2007) which remains currently applicable and thus the results of this testing are considered to be relevant for the 2016 outline planning application.

It should be noted that the 2011 investigation, ref no. 35488, covered an area larger than the current outline planning application area. The ground conditions encountered during the 2011 investigation were generally consistent across the site as a whole and thus the change in site boundary is unlikely to have any significant implications.

3.3. Geotechnical Assessment

Section 4 of the appended ground investigation report, ref no. 35488 (2011), provided a geotechnical assessment for the site. This geotechnical

assessment was based on the encountered ground conditions and associated geotechnical testing, which are considered to remain applicable, together with the proposed development scheme, which is no longer applicable, consequently certain parts of the geotechnical assessment are no longer considered to be applicable to the 2016 outline planning application. Table 1, below provides a summary.

Table 1: Summary of applicability of 2011 Geotechnical Assessment

Section	Comments on applicability
4.1 - Structural Foundations	<ul style="list-style-type: none"> The NABPs presented in our 2011 report are considered to remain applicable for the encountered soil type. Once building loads are known, further advice can be provided by Richard Jackson Ltd.
	<ul style="list-style-type: none"> The encountered soils were considered to be shrinkable and it was recommended that reference was made to NHBC standards. It will be necessary for reference to be made to the current version of the NHBC Standards Chapter 4.2 'Building near Trees' (2016) when designing foundations.
4.2 - Ground Floor Construction	<ul style="list-style-type: none"> The requirement for suspended ground floor slabs will need to be reconsidered in respect of the new proposed scheme and NHBC Standards (2016).
4.3.1 - Pavement Design	<ul style="list-style-type: none"> These sections are considered to remain applicable for the 2016 outline planning application.
4.3.2 - Drainage	
4.4 - Groundworks	
4.5 - Concrete Grade	

3.4. Geo-environmental Assessment

Section 5 of the appended ground investigation report, ref no. 35488 (2011) provided the results of chemical analyses undertaken on soil samples in the form of a geotenvironmental assessment.

The results of the chemical analyses were compared to screening criteria for the protection of human health which were applicable at the time of investigation, in order that an assessment of the contamination status of the site may be made.

In 2014, Land Quality Management Ltd (LQM) and the Chartered Institute of Environmental Health (CIEH) published 'Suitable 4 Use Levels' (S4ULs) for human health risk assessment. The S4ULs have been derived in accordance with UK legislation, national and Environment Agency policy using a modified version of the Contaminated Land Exposure Assessment (CLEA) software. The S4ULs are based on minimal or tolerable risk as described in SR2 (Environment Agency, 2009a).

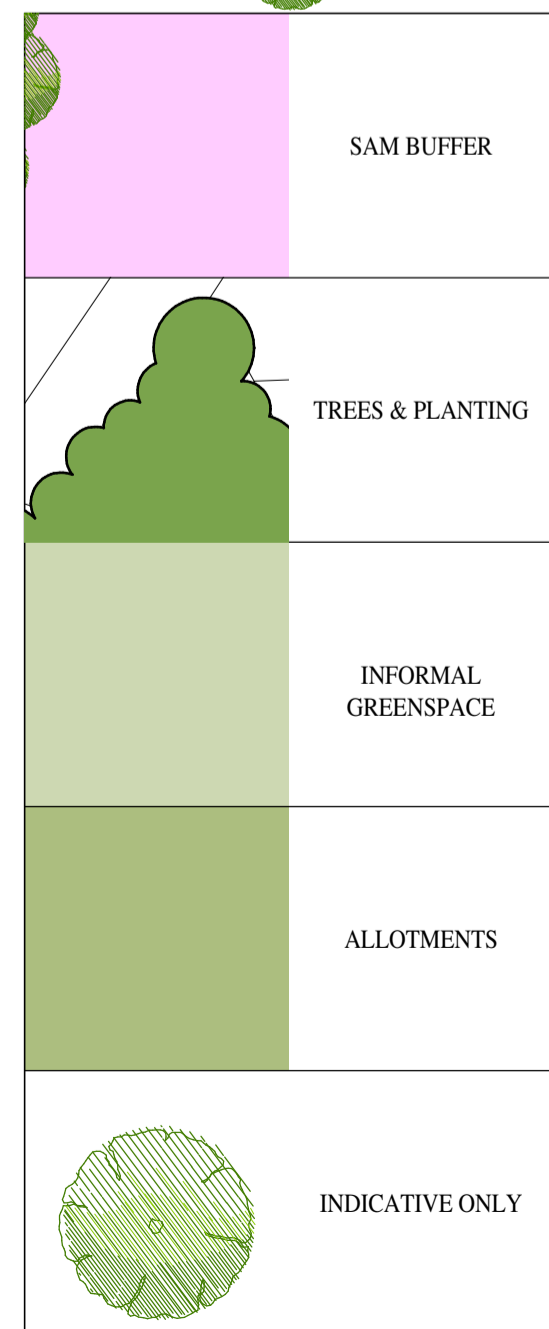
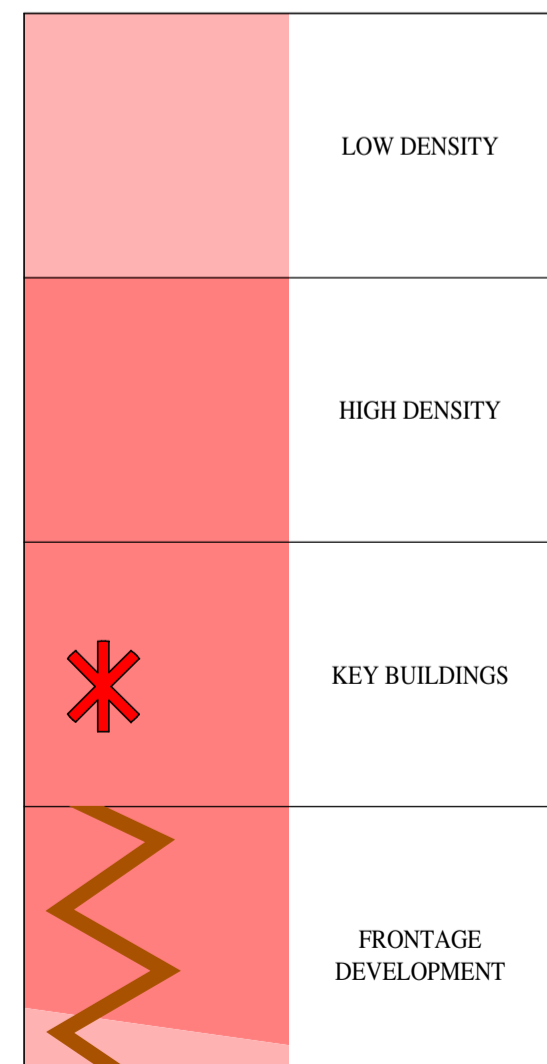
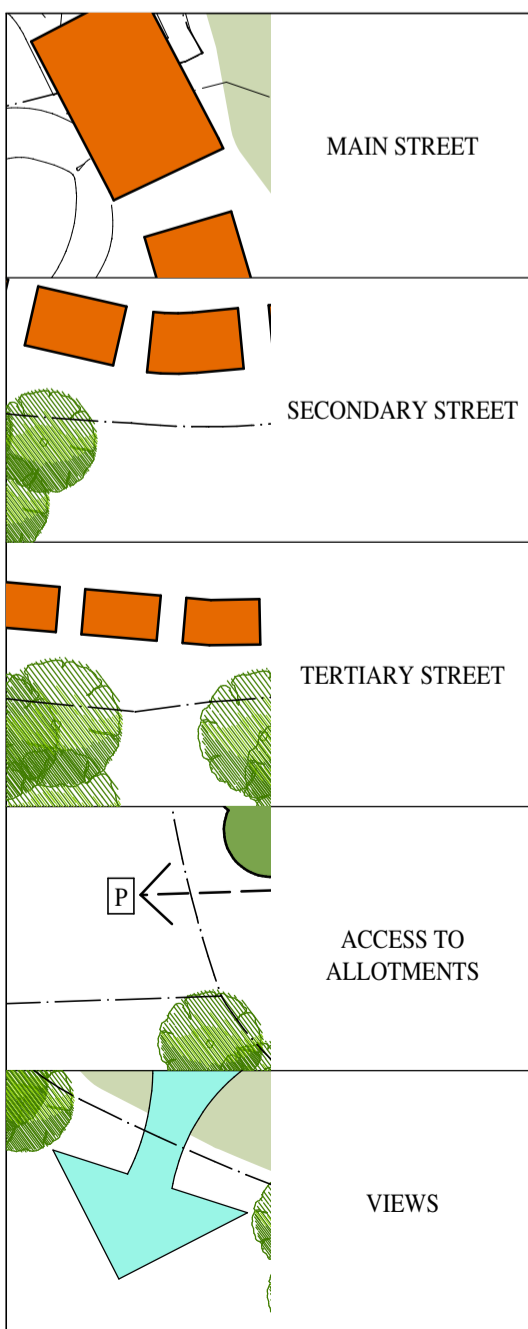
The S4ULs are intended to replace the 2nd edition of the LQM/CIEH Generic Assessment Criteria (GAC), which were used as screening criteria in the 2011 ground investigation report, ref no. 35488.

The S4ULs have also been used to replace the Environment Agency Soil Guideline Values (SGVs), which were defined in 2009 alongside updates to the CLEA methodology and software and which were also used as screening criteria in our 2011 ground investigation report.

As the new screening criteria have been developed and published since our 2011 ground investigation report was issued, it is considered that the risk assessment presented in Section 5 of the report is no longer applicable. It may be necessary for the results of the previously undertaken chemical analyses to be compared to currently applicable screening criteria in order that an assessment of the risk to human health may be made in respect of currently applicable standards.

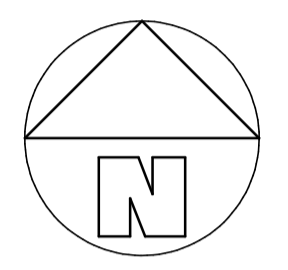
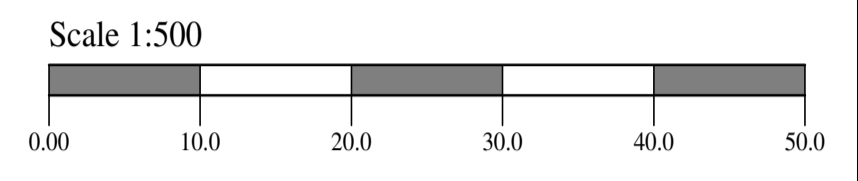
Appendix A

Parameters Plan & Illustrative Masterplan



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REVISIONS

REV	DATE
A	08/06/16

CLIENT:
Peterhouse Cambridge

PROJECT:
**RESIDENTIAL DEVELOPMENT
 LAND OFF BELL ROAD,
 BOTTISHAM.**

DRAWING TITLE:
PARAMETERS PLAN

SCALES - 1:500 @ A1 DATE - JUNE, 2016

ASD ARCHITECTURE Ltd
 16A Bridge Street · Halesworth · Suffolk · IP19 8AQ

Tel. (01986) 872250
 Fax. (01986) 872228
 enquiries@ASD-architecture.co.uk
 www.ASD-architecture.co.uk

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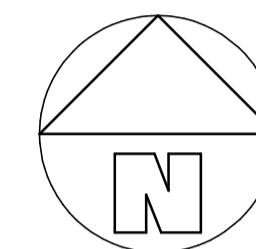
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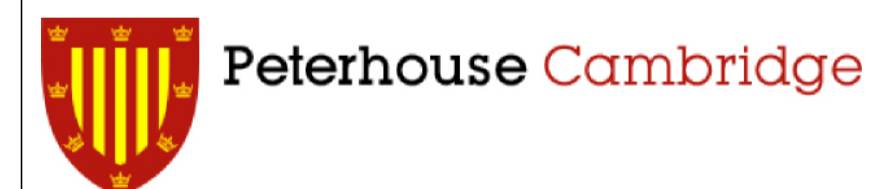
Scale 1:500



REVISIONS

REV	DATE

CLIENT:



PROJECT:

**RESIDENTIAL DEVELOPMENT
 LAND OFF BELL ROAD,
 BOTTISHAM.**

DRAWING TITLE:

ILLUSTRATIVE MASTERPLAN

SCALES - 1:500 @ A1

DATE - APR. 2016

ASD ARCHITECTURE Ltd
 16A Bridge Street · Halesworth · Suffolk · IP19 8AQ

Tel. (01986) 872250
 Fax. (01986) 872228
 enquiries@ASD-architecture.co.uk
 www.ASD-architecture.co.uk

JOB NO. 6936	DWG NO. SL01	REV. .
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Appendix B

Ground Investigation Report (2011) #35488

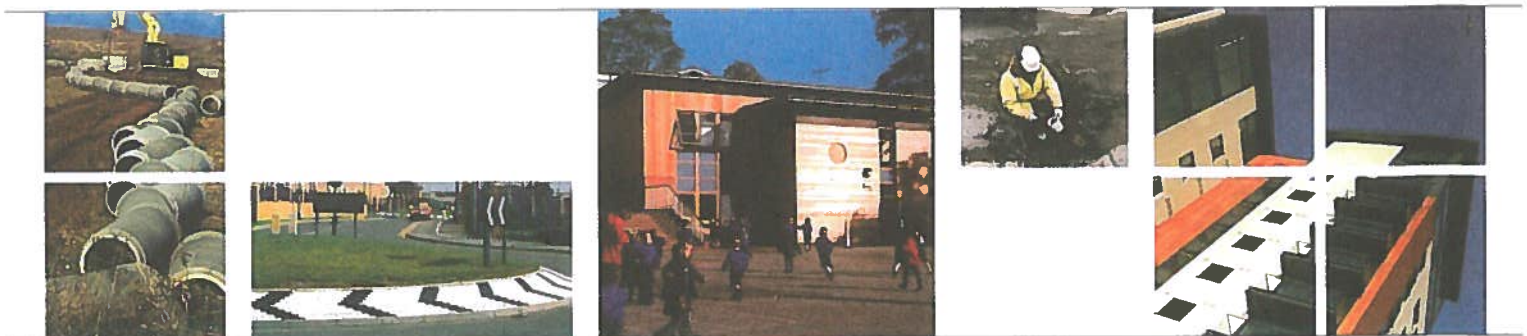
GROUND INVESTIGATION REPORT

Location: Bell Road, Bottisham, Cambridgeshire

Client: Barratt Homes (Eastern Counties)

Date: September 2011

Job no: 35488



CONSULTING CIVIL, STRUCTURAL AND GEOTECHNICAL ENGINEERS

26 High Street
Hadleigh
Suffolk
IP7 5AP



Tel: 01473 825300

GROUND INVESTIGATION REPORT

Bell Road, Bottisham, Cambridgeshire

Document prepared by:- Matthew Axton
on behalf of Richard Jackson Ltd

Signature:-



Date:- 28th September 2011

Document approved by:- Stephen Bullock
on behalf of Richard Jackson Ltd

Signature:-



Date:- 28th September 2011

Revision Status

Issue	Date	Description	Author	Approved

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EXECUTIVE SUMMARY

Purpose:	Phase One Desk Study to document the history and environmental setting of the site and surrounding area, together with intrusive investigations to establish the ground conditions, infiltration rate and contamination status.
Site Status:	Undeveloped agricultural field, with a number of trees and a pond in the north.
History:	Undeveloped throughout the historical period studied.
Geology, Hydrology and Hydrogeology:	West Melbury Marly Chalk is considered to outcrop beneath the site, which is considered to be a principal aquifer. A pond and a ditch both exist within the site.
Waste and Pollution:	No waste facilities or landfill sites are listed within 1000m. No significant pollution risks are located within 250m.
Preliminary Conceptual Model:	A very low risk of contamination affecting the site was established.
Fieldwork:	Nineteen trial pits, with associated in-situ testing and sampling. Trial pits TP1 to TP5 were utilised for soakaway testing. Geotechnical testing and chemical analysis were both also undertaken.
Ground Conditions:	Topsoil and Superficial Deposits of up to 1.20m in thickness overlying West Melbury Marly Chalk, which was considered to be have a low volume change potential.
Recommended Foundation Solutions:	Conventional spread foundations are considered appropriate, with a Nett Allowable Bearing Pressure (NABP) of 200kN/m ² . Foundations should be designed in accordance with NHBC chapter 4.2.
Ground Floor Construction:	Ground bearing floor slab construction is considered appropriate for the majority of the site, with suspended ground floor construction possible in the vicinity of trees.
Pavement Design:	A CBR value of 5% is recommended with a minimum construction of 450mm as chalk is frost susceptible.
Drainage:	Given the results of soakaway testing, an infiltration rate of 8×10^{-5} m/s is considered appropriate.
Concrete Grade:	A design sulphate class of DS-1 should be adopted, with an aggressive chemical environment for concrete of AC-1s.
Contamination:	Of the ten samples tested for a comprehensive range of contaminants and the four analysed for the presence of pesticides, none were encountered as elevated when compared to their appropriate screening value. It is therefore considered that the site may be developed without the need for remediation.

1. INTRODUCTION

Richard Jackson Limited received instruction to undertake ground investigation works in connection with a parcel of land adjacent to Bell Road, Bottisham, Cambridgeshire.

The works were instructed by the client; Barratt Homes (Eastern Counties).

The ground investigation comprised of a Phase One Desk Study Report, the purpose of which was to document the history and environmental setting of the site together with Phase Two intrusive investigations. The intrusive investigations comprised the forming of nineteen trial pits, five of which were used for soakaway testing, together with insitu testing, sampling, chemical analysis and geotechnical testing.

The report presents the findings of the desk study, and intrusive investigation and gives recommendations for use in the design and construction of the proposed scheme.

This report shall be read in conjunction with the limitations of use provided in Appendix G.

2. PHASE ONE DESK STUDY

2.1 Site Location and Description

The site located adjacent to Bell Road, Bottisham, Cambridgeshire and is currently an undeveloped field.

The approximate Ordnance Survey grid reference for the centre of the site is; TL 542 602. A site location plan is presented as Figure 1 in Appendix A.

The site is roughly rectangular, with maximum dimensions of approximately 500m east to west by 180m north to south. The northern boundary is formed by a tree belt approximately 10m in width, trees such as Prunus, Pine and Beech were noted, newly developed residential properties and their gardens lie beyond. Towards the east, the northern boundary is formed by trees such as Willow, Ash and Oak, beyond which an historic moat exists. The eastern boundary is formed by a dense belt of mature trees, beyond which is further undeveloped farm land. The southern boundary is also formed by a tree belt, containing trees such as Horse Chestnut, Conifer, Ash, Mapel and Beech. A break in the trees approximately halfway along this boundary forms the site entrance. Beyond the trees is a small grass verge, beyond which exists Newmarket Road. The western boundary is similarly formed by a tree belt, with trees such as Horse Chestnut, Silver Birch, Mapel and Beech further to the west of which lies Bell Road.

The site is an undeveloped, relatively level, recently harvested, agricultural parcel of land. A small ditch extends north to south across the site. An area to the north east is overgrown and contains a small pond, which was dry at the time of the investigation.

No visual or olfactory signs of contamination were noted.

2.2 Site History

Table 1, below gives a summary of the history of the site and surrounding area based on historical Ordnance Survey maps of the area.

Table 1: Summary of Site History

Ordnance Survey Map Date(s)	Scale(s)	On Site History	Surrounding Area History
1986 - 1903	1:2,500 / 1:10,560	There is a pond located in the northeast of the site.	Newmarket Road borders the site to the south, Bell Road to the west. A moat is present immediately north, at the sites eastern boundary. Farmland exists less than 100m to the north and east.
1926	1:2,500 / 1:10,560	No significant changes.	A tennis court has been developed along the eastern boundary.
1952 - 1966	1:10,560 / 1:10,000	No significant changes.	By 1952 the tennis court is absent, and there is evidence of development south of Newmarket Road. Further development north of the sites western boundary, with the construction of residences, 150m from the site.
1970 - 1978	1:2,500 / 1:10,000	No significant changes.	The developments south of Newmarket Road are no longer evident on maps from 1970. Residential developments are evident north of the farmland, approximately 100m to the north. Garages and works are evident approximately 200m to the north.
1992 - 2000	1:2,500 / 1:10,000	No significant changes.	Two pump houses have been developed, one less than 100m north of the sites western boundary, the other 150m north of the site, within the residential developments to the north. A river farm smokery exists 300m southeast of the site by 2000. A mast has also been erected by 2000, 180m southeast.
2006 - 2011	1:10,000	No significant changes.	A housing development immediately north of the western side of the site, means the nearest properties are now less than 50m.

2.3 Geology and Geological Hazards

The British Geological Survey 1:50,000 scale map of the area, sheet 188, Solid and Drift Edition indicates the area to be West Melbury Marly Chalk, with Totternhoe Stone evident in the southwest corner of the site.

BRE document 'Radon: Guidance on Protective Measures for New Buildings' 2007 does not indicate the site to be in an area where Radon Gas is likely to pose a risk.

2.4 Hydrology and Hydrogeology

The Chalk is recorded as a Principal Aquifer of high permeability. This high permeability aquifer is bordered in all directions except west, by a principal aquifer of intermediate permeability, which lies less than 100m from the site.

The site is not indicated to lie above a groundwater Source Protection Zone (SPZ).

The site is not indicated to lie in an area at risk from flooding from rivers or the sea.

The closest surface water features are indicated to be a pond and a ditch, both located within the site.

2.5 Waste

No active or historic landfill sites exist within 1000m according to the Environment Agency website.

2.6 Industrial Pollution

No pollution incidents, controls or licences are listed within 1000m.

2.7 Environmentally Sensitive Areas

No SSSI's, local or national nature reserves or country parks are located within 1000m, as shown on the Natural England Website, (www.natureonthemap.org.uk).

2.8 Preliminary Conceptual Model & Risk Assessment

2.8.1 Regulatory Regime

Contaminated Land is defined under Section 78A(2) of the Environmental Protection Act 1990, Part IIA as follows:

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

- a) *Significant harm is being caused, or there is significant possibility of such harm being caused, or*
- b) *Pollution of controlled waters is being or is likely to be caused.”*

Thus land can be defined as contaminated if it is causing significant harm or where substances in, on or under the land are polluting a controlled water or if there is a significant risk of this happening.

Part IIA of the Act introduces the concept of “pollutant linkages”. This is that in order for land to be considered to be contaminated there must be a contaminant or pollutant source, an exposure pathway by which that contaminant reaches a receptor and the receptor or target itself. If one or more of the elements is missing the land cannot be determined to be contaminated.

2.8.2 Potential Sources of contamination

Sources of contamination have been considered for both on and offsite activities as detailed below.

The site has remained undeveloped throughout the historic period studied. The surrounding area has had little development, with some residences having been developed to the north, and an electrical mast erected to the southeast.

It is therefore considered that potential contamination sources are negligible.

2.8.3 Potential Receptors of contamination

Potential receptors to contamination include humans, such as end users of the site, site workers, site maintenance workers and the general public.

Construction materials such as concrete and plastic drainage products would also be considered as a potential receptor through direct contact with contaminants.

Local flora may also be a potential receptor through uptake of contamination through roots.

Due to the nature of the underlying principal aquifer, and the on site ditch and pond, controlled waters may also be considered a potential receptor.

2.8.4 Preliminary Conceptual Model and Risk Assessment

It has been identified in the preceding sections that any sources of contaminants are negligible and hence the risk of contamination for the site and surrounding are considered to be very low.

3. **FACTUAL GROUND INVESTIGATION INFORMATION**

The findings of the intrusive ground investigation works are provided in the following section.

3.1 **Fieldwork**

The fieldwork was undertaken on the 17th and 18th August 2011 and comprised the forming of nineteen trial pits (TP1 to TP19), five of which were used for soakaway testing (TP1 to TP5). An exploratory hole location plan is presented as Figure 1 in Appendix A.

Where applicable, investigation techniques, sampling, logging of soils and insitu testing complied with the requirements of British Standard BS5930: 1990 – “Code of Practice for Site Investigations”.

3.1.1 **Trial Pits**

The trial pits were mechanically excavated to depths ranging from 2.0m (TP2) to 3.0m (TP8, TP14 and TP18). Disturbed samples were taken from throughout the depth of each trial pit, for possible future chemical analysis or geotechnical testing. Samples taken for chemical analysis were recovered in air tight plastic containers.

A Perth Penetrometer was used to assess the penetration resistance in granular soils. The number of blows to advance the perth penetrometer 300mm of a 450mm total drive was recorded and is given on the trial pit records as the penetration resistance ('N') value.

Trial pit records are presented in Appendix B, and give both descriptions and depths of strata encountered, together with details of samples taken, insitu tests and any other relevant information.

3.1.2 **Soakaway Testing**

Five of the trial pits (TP1 to TP5) were utilised as soakaway pits to enable an infiltration rate to be established for the soils. Each trial pit was filled with water on two occasions and the water level measured at regular intervals.

The results of the soakaway testing are presented in Appendix C, and summarised in Table 2 over.

Table 2: Summary of Soakaway Test Results

Trial Pit	Infiltration Rate (m/s) Test 1	Infiltration Rate (m/s) Test 2
TP1	1.52×10^{-6}	5.49×10^{-6}
TP2	4.34×10^{-6}	1.62×10^{-5}
TP3	9.96×10^{-6}	2.03×10^{-5}
TP4	1.07×10^{-5}	1.94×10^{-5}
TP5	3.03×10^{-5}	4.67×10^{-5}

3.2 Ground Conditions

As detailed in Section 2, the geological map of the area indicates the Lower Chalk to outcrop beneath the site, with Tottenhoe Stone Cambridge Greensand interbedding the Chalk in the southwest corner of the site.

The investigation encountered a sequence of strata, from ground level, as follows;

- Topsoil
- Superficial Deposits
- West Melbury Marly Chalk

3.2.1 Topsoil

Topsoil was encountered at the surface in all of the trial pits, the thickness of which ranged from 0.25m (various) to 0.35m (TP8). The Topsoil was typically found to comprise of a dark brown, sandy, gravelly clay.

3.2.2 Superficial Deposits

Soils interpreted for the purpose of this report as Superficial Deposits were encountered beneath the Topsoil in the majority of the trial pits, with the exception of TP1, TP3, TP8, TP11, to TP13 and TP16.

Where Superficial Deposits were recorded their thickness ranged from 0.15m (TP10) to 0.9m (TP19). The Superficial Deposits typically comprised of an orangey brown, clayey, gravelly fine to coarse sand or sandy gravelly clay.

It should be noted that a number of the descriptions of the Superficial Deposits within the geotechnical testing results vary from those on the trial pit records. This is likely due to the size of the sample provided to the laboratory.

3.2.3 West Melbury Marly Chalk

The West Melbury Marly Chalk was encountered in all of the trial pits beneath the Superficial Deposits, or where these were absent beneath the Topsoil, the thickness of these deposits remained unproven.

The Chalk was typically recovered as a light grey structureless melange of between 20% and 90% harder intact fragments within a clay and silt matrix.

Eight samples of the Lower Chalk Formation were tested for their Atterberg limits in line with BS1377: 1990: Part 2, clauses 3.2, 3.3 and 3.4. The results are summarised below in Table 3.

Table 3: Summary of Atterberg Limit Tests

Depth (m bgl)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
0.45	27	16	11
0.50	38	21	17
0.55	34	20	14
0.55	37	21	16
1.00	39	21	18
1.20	29	18	11
1.60	32	19	13
2.80	32	20	12

3.2.4 Groundwater

Groundwater was encountered in just one of the trial pits (TP19) at a depth of 2.8m, the rate of inflow was recorded as very slow.

4. **GEOTECHNICAL ASSESSMENT**

The development is due to comprise of seventy-nine, two, three and four bed houses with associated infrastructure, gardens and planned open space. The ground conditions have been found to comprise of Topsoil over Superficial Deposits, which in turn overlay the West Melbury Marly Chalk.

4.1 Structural Foundations

The site and ground conditions are considered suitable for the use of conventional spread foundations bearing on the Chalk.

A Nett Allowable Bearing Pressure (NABP) of 200kN/m² is considered suitable for foundations bearing upon the Chalk, based on the results of insitu testing. The NABP is the permissible increase in vertical stress at the level of the underside of the foundation, above existing overburden pressure, which may be calculated on the basis of a soil density of 19kN/m³.

At the above NABP settlement is considered unlikely to exceed 20mm. Settlement in granular material will likely comprise of immediate settlement, while settlement in cohesive material will likely comprise a small amount of immediate settlement and a larger portion of consolidation settlement, which will occur over a long period of time.

A minimum foundation depth of 0.8m is considered suitable for the site, based on the following provisos.

All Topsoil and Superficial Deposits should be penetrated and foundations extended at least 150mm into undisturbed Chalk.

The Chalk is a shrinkable material, and therefore, where influenced by trees, foundations will need to be designed in accordance with NHBC Standards Chapter 4.2 "Building near Trees" 2010. The Chalk should be considered as having a low volume change potential.

4.2 Ground Floor Construction

Where foundation depth exceeds 1.5m due to the presence of shrinkable soils, suspended ground floor construction should be adopted.

Given that the Chalk has a low volume change potential only and that trees were generally restricted to the margins of the site, it is considered likely ground bearing floor slabs will be suitable in the majority of cases. Suspended ground floor construction may be required in the vicinity of trees.

4.3 External Works

4.3.1 Pavement Design

The investigation identified that the subgrade for pavement construction is likely to comprise of either the Superficial Deposits, which typically comprised a clayey, gravelly sand with frequent chalk gravel or the Chalk.

A CBR test was undertaken on a combined bulk sample, in accordance with BS1377: Part 4: 1990: 7.4. The results on the top and the bottom of the sample varied from 19% to 26%. Further reference has been made to the Cambridgeshire County Council document "Housing Estate Road Construction Specification" dated January 2011, which states a CBR value of 5% should be adopted for chalk.

We therefore recommend a CBR value of 5% should be adopted.

Given that the subgrade is likely to mostly consist of chalk, which is susceptible to frost, a minimum pavement construction of 450mm should be adopted.

Once the formation level for the new pavements has been achieved, proof rolling should be carried out using a heavy roller, and any soft areas revealed should be excavated and a greater depth of subbase provided.

Exposed subgrades will likely deteriorate rapidly on exposure to wet weather and should be shaped to shed water. Subbase should be placed as soon as possible to minimise the exposure of the subgrade to adverse weather conditions.

4.3.2 Drainage

As discussed in Section 3, soakaway tests were undertaken in five of the trial pits, with results ranging from 9.96×10^{-6} to 1.07×10^{-5} , which is indicative of good drainage characteristics.

Soakaway drainage may therefore, be considered appropriate, if soakaway drainage is adopted an infiltration rate of 8×10^{-5} should be used.

Where soakaways are to be adopted in the chalk, these should be located at least 10m from any structure due to the risk of solution features being formed.

4.4 Groundworks

The stability of any Made Ground or granular deposits must not be relied upon in unsupported excavations. Safe working conditions must be provided at all times where persons are required to work in excavations.

Heavy plant and stockpiles of material should not be permitted close to the edges of open excavations.

Based on the observations made during fieldwork, groundwater is unlikely to be encountered in excavations for foundations or services.

Further reference should be made to CIRIA Report No.97, "Trenching Practice" 1992.

4.5 Concrete Grade

Sulphate contents and pH value determinations were carried out by the analytical laboratory. Water soluble sulphate contents returned values ranging from less than 10 mg/l SO₄ to 36 mg/l SO₄. The pH values ranged from 7.7 to 8.4.

Therefore, in accordance with Part 1 of the BRE Special Digest 1 "Concrete in Aggressive Ground" 2005, a Design Sulphate Class of DS-should be adopted for the site. An Aggressive Chemical Environment for Concrete (ACEC) classification of AC-1s may be adopted as groundwater was not encountered at a depth where foundations are likely to extend to.

5. **GEO-ENVIRONMENTAL ASSESSMENT**

The purpose of this section is to provide an assessment of the contamination status of the site. To aid in this, ten samples of soil have been analysed for the broad suite of contaminants detailed below.

<i>Arsenic</i>	<i>pH</i>
<i>Cadmium</i>	<i>Total Sulphate</i>
<i>Chromium</i>	<i>Water Soluble Sulphate</i>
<i>Copper</i>	<i>Total Phenols</i>
<i>Nickel</i>	<i>Total Cyanide</i>
<i>Lead</i>	<i>Sulphide</i>
<i>Mercury</i>	<i>Polycyclic Aromatic Hydrocarbons (PAHs)</i>
<i>Selenium</i>	<i>Total Petroleum Hydrocarbons (TPH)</i>
<i>Zinc</i>	<i>Organic Matter Content</i>

Four of the samples were also analysed for their pesticide concentrations.

The laboratory analysis was undertaken by the Environmental Laboratory Limited, a UKAS and MCerts accredited laboratory.

5.1 Reference Criteria

In 2009 the Environment Agency published updates to the Contaminated Land Exposure Assessment (CLEA) methodology and software (version 1.06). CLEA has been developed to help estimate the risks to people from contaminants in soils. In addition to the above, the Environment Agency have also published Soil Guideline Values (SGVs) for a number of potential contaminants.

SGVs are currently in the process of being revised by the Environment Agency using the updated CLEA model.

The substances to have SGVs published based upon the new CLEA model are arsenic, cadmium, mercury, nickel, phenols, selenium, BTEX (Benzene, Toluene, Ethylbenzene and Xylenes) and a range of dioxins, furans and dioxin-like PCBs.

These values have been adopted where appropriate and adapted by Richard Jackson Ltd, using the CLEA software, to reflect site specific conditions, including the Soil Organic Matter (SOM), where these are significantly difference form the values used to derive the SGV.

It is understood the site is to be developed for residential purposes, therefore SGVs for residential use with plant uptake have been adopted for this site. A SOM of 0.6% has been used where applicable.

There are currently no SGVs for Polycyclic Aromatic Hydrocarbons (PAH), or Total Petroleum Hydrocarbons (TPH), Toxicology data and physical parameters for the above are provided in "Generic Assessment Criteria for Human Health Risk Assessment, 2nd Edition" produced by the Chartered Institute of Environmental Health and Land Quality Management Ltd. This data has been added to the CLEA software, with a SOM of 0.6% again adopted, to develop screening values. Only the three most hazardous PAHs, benzo(a)Pyrene, dibenz(a,h)anthracene and naphthalene have been considered on this occasion.

Generic Assessment criteria have also been provided for chromium, copper and zinc in the above document, and these have been adopted for a residential land use.

Generic assessment criteria have again been provided for three pesticides; Aldrin, Dieldrin, Endosulfins. These have been adopted for a SOM of 1% and a residential land use.

In the absence of newly published SGV or comprehensive toxicology and physical parameter data, the SGV created using the old CLEA methodology has been adopted for lead.

A summary of the Tier One screening values is given in Table 4, over.

Table 4: Tier One Screening Values

Contaminant	Origin of screening value	Concentration (mg/kg)
Arsenic	SGV ¹	32
Cadmium	SGV ¹	10
Chromium	GAC ²	3000
Copper	GAC ²	2330
Nickel	SGV ¹	130
Lead	SGV ¹	450
Selenium	SGV ¹	350
Mercury	SGV ¹	170
Zinc	GAC ²	3750
Benzo(a)pyrene	CLEA ³	0.72
Dibenzo(a,h)Anthracene	CLEA ³	0.68
Naphthalene	CLEA ³	2.2
Total Phenols	CLEA ³	156
TPH Aromatic C ⁵ -C ⁷	CLEA ³	61
TPH Aromatic C ⁷ -C ⁸	CLEA ³	94
TPH Aromatic C ⁸ -C ¹⁰	CLEA ³	28
TPH Aromatic C ¹⁰ -C ¹²	CLEA ³	47
TPH Aromatic C ¹² -C ¹⁶	CLEA ³	87
TPH Aromatic C ¹⁶ -C ²¹	CLEA ³	160
TPH Aromatic C ²¹ -C ³⁵	CLEA ³	728
TPH Aliphatic C ⁵ -C ⁶	CLEA ³	59
TPH Aliphatic C ⁶ -C ⁸	CLEA ³	134
TPH Aliphatic C ⁸ -C ¹⁰	CLEA ³	33
TPH Aliphatic C ¹⁰ -C ¹²	CLEA ³	163
TPH Aliphatic C ¹² -C ¹⁶	CLEA ³	125
TPH Aliphatic C ¹⁶ -C ³⁵	CLEA ³	5720
Sulphide	Assumed Value	250
Aldrin	GAC ²	1.7
Dieldrin	GAC ²	0.69
Endosulfins	GAC ²	2.8

¹ SGV, for residential use with plant uptake.

² Value derived for site specific use using Generic Assessment Criteria for Human Health Risk Assessment.

³ Value derived by RJ Ltd using the CLEA software and published input data at a SOM of 0.6%.

5.2 Discussion of Analysis Results

Results of the chemical analysis are presented in Appendix E, and summarised in Table 5, below.

Table 5: Results of Chemical Analysis

Contaminant	No of Samples Tested	Range of Concentrations (mg/kg)	No of samples exceeding screening value
Arsenic	10	5.5 – 10.4	0
Cadmium	10	<0.5	0
Chromium	10	15 – 23	0
Copper	10	8 – 17	0
Nickel	10	16 – 21	0
Lead	10	13 – 38	0
Selenium	10	<0.5 – 1.1	0
Mercury	10	<0.5	0
Zinc	10	36 – 51	0
Benzo(a)pyrene	10	<0.5	0
Dibenzo(a,h)Anthracene	10	<0.5	0
Naphthalene	10	<0.5	0
Total Phenols	10	<1	0
TPH Aromatic C ⁵ -C ⁷	10	<0.01	0
TPH Aromatic C ⁷ -C ⁸	10	<0.01	0
TPH Aromatic C ⁸ -C ¹⁰	10	<5	0
TPH Aromatic C ¹⁰ -C ¹²	10	<5	0
TPH Aromatic C ¹² -C ¹⁶	10	<5	0
TPH Aromatic C ¹⁶ -C ²¹	10	<5	0
TPH Aromatic C ²¹ -C ³⁵	10	<5	0
TPH Aliphatic C ⁵ -C ⁶	10	<0.01	0
TPH Aliphatic C ⁶ -C ⁸	10	<0.01	0
TPH Aliphatic C ⁸ -C ¹⁰	10	<5	0
TPH Aliphatic C ¹⁰ -C ¹²	10	<5	0
TPH Aliphatic C ¹² -C ¹⁶	10	<5	0
TPH Aliphatic C ¹⁶ -C ³⁵	10	<5	0
Sulphide	4	<2	0
Aldrin	4	<0.01	0
Dieldrin	4	<0.01	0
Endosulfins	4	<0.01	0

From the above, it is evident that none of the samples analysed contained any potential contaminants at levels which may pose a risk to human health.

Although it should be recognised that the above screening values relate to human health only, the low levels of potential contaminants and the lack of any PAH or TPH above the laboratory detection limits indicates no significant risk to the underlying aquifer, the pond or the ditch exists.

The levels of potentially phytotoxic elements are also at levels below that which may be considered to pose a significant risk to local flora.

Therefore, it may be concluded that the site may be developed without the need for any remediation.

5.3 Waste Disposal

A significant amount of waste will be generated from excavation works. There may be opportunities for reuse of the material on site. There is, however, likely to be some waste to be disposed of off-site.

Waste removed from the site must be classified according to the analytical methods and criteria recommended by the Landfill (England and Wales) (Amendment) Regulations 2004 and 2005. The regulations set new acceptance criteria for wastes to be disposed of at landfill sites with effect from 16 July 2005.

The analysis of the results obtained from the ground investigation gave an indication of the levels of contaminants in the soils to be potentially excavated.

Whilst the chemical analysis results provide an indication of contaminant levels, these do not indicate how waste soils to be removed from the site are classified.

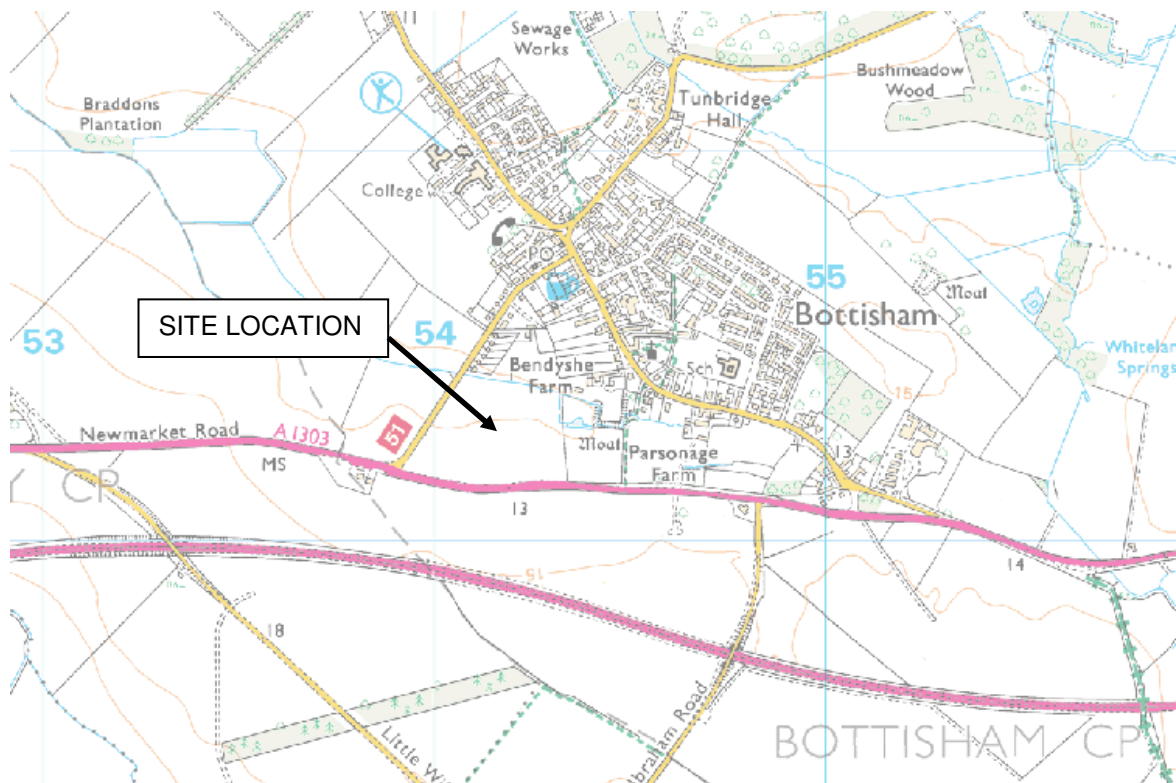
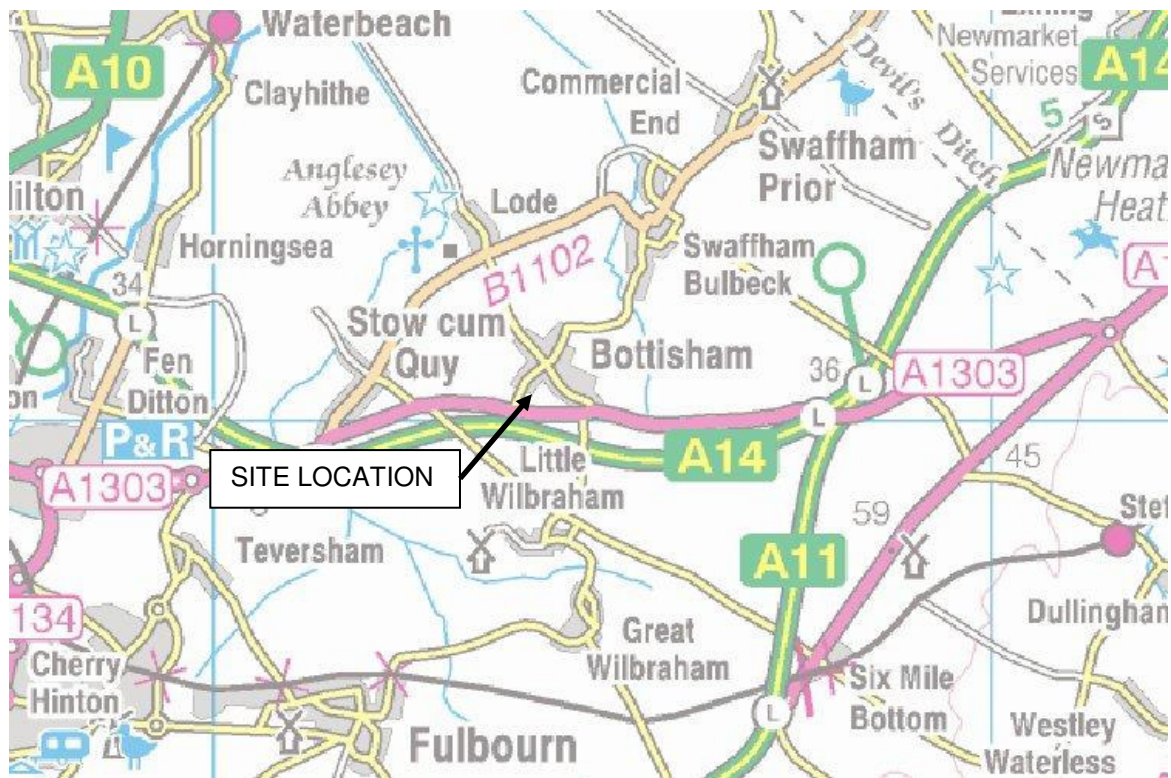
5.4 General

As with any sampling exercises, the sampling process is representative, and it is possible that areas of contamination may be found during the redevelopment of the site, although the risk of this is considered to be very low. Excavations on the site should be supervised and any areas of suspected contamination should be assessed by a competent professional and subjected to further analysis if necessary.

It should be noted that all remediation proposals are subject to the approval of the Local Authority. It would be prudent to involve the regulatory bodies early in the development of the scheme and before construction commences in order that all requirements are met.

APPENDIX A

Site & Exploratory Hole Location Plan



Produced from Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery
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richardjackson
intelligent engineering

consulting civil and structural engineers
26 High Street, Hadleigh, Ipswich, Suffolk, IP7 5AP
Tel: 01473 825300 Fax: 01473 825350

Bell Road, Bottisham, Cambridgeshire


FIGURE 1

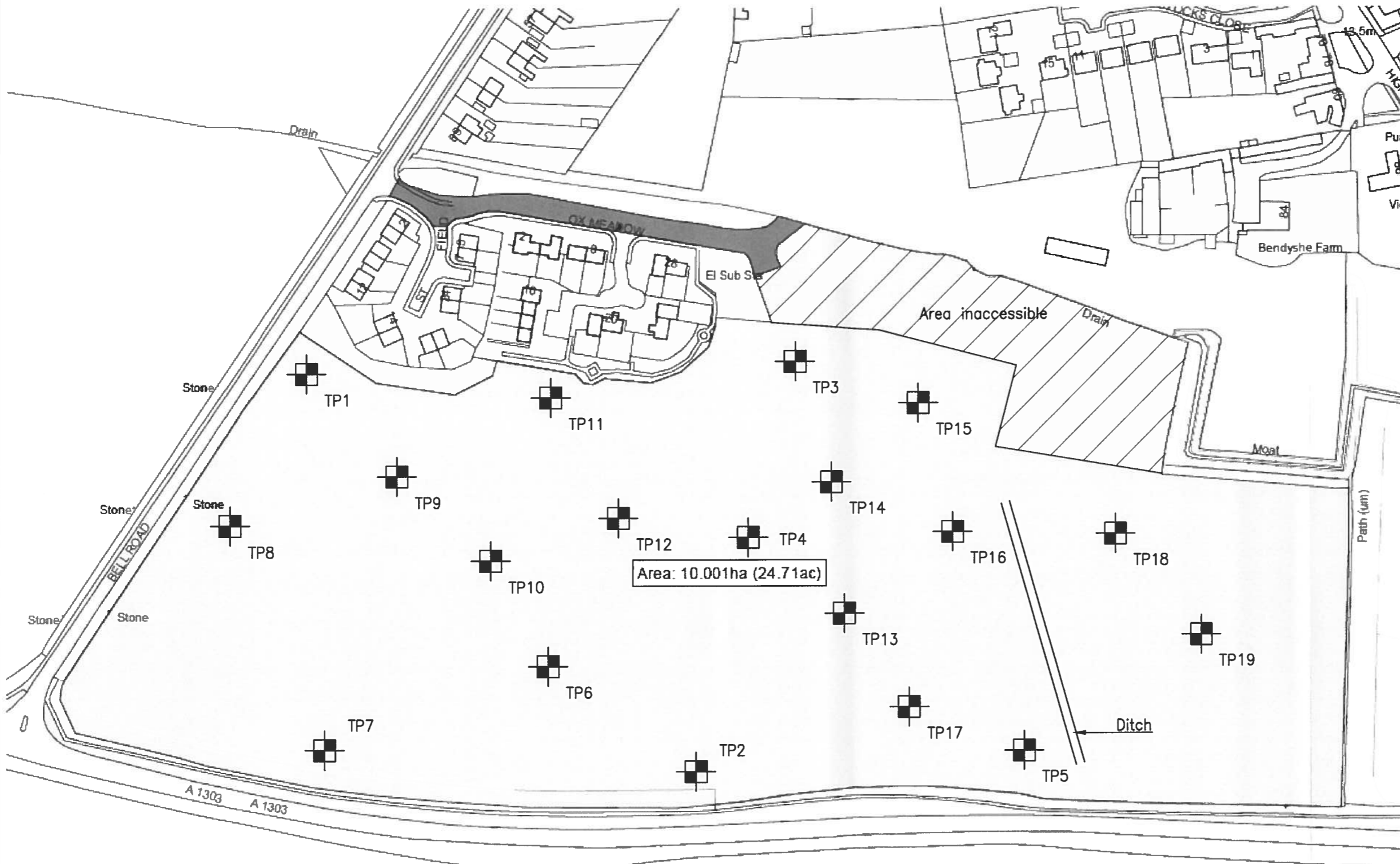
SITE LOCATION PLAN

SCALE: N.T.S.

JOB NO: 35488

Key

 : TP1 – TP19
(Trial pit location)



REV	DATE	DESCRIPTION	DRAWN	CHKD
REVISIONS				

This drawing is to be read in conjunction with all other Engineer's drawings and all other project information. Any discrepancy between the Engineer's drawings and other project information is to be reported to the Engineer immediately.



Project
**BELL ROAD
 BOTTISHAM
 CAMBRIDGESHIRE**

Title
EXPLORATORY HOLE LOCATION PLAN

Client
**BARRATT HOMES
 (EASTERN COUNTIES)**

Scale NTS @ A3	Drawn C. SMITH	Date SEPT 2011
Job Manager S. BULLOCK	Checked <i>MA</i>	Approved <i>MA</i>

jackson


25 High Street, Hadleigh, Ipswich, Suffolk IP7 5AP Tel: 01473 825300
 2 Melvern House, Meridian Gate, 189 Marsh Wall, London E14 9YT Tel: 020 7446 9910
 York House, 3 Station Court, Station Rd, Great Shelford, Cambs CB22 5NE Tel: 01223 314794
 6 The Old Church, St. Matthews Road, Norwich, Norfolk NR1 1SP Tel: 01603 230240
 Email Address: mail@rj-is.co.uk Web Site: http://www.richardjackson.co.uk



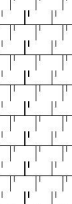

Drawing No.
35488/1/FIG02

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<input type="checkbox"/> TENDER	<input type="checkbox"/> CONSTRUCTION	<input type="checkbox"/> AS CONSTRUCTED

APPENDIX B

Trial Pit Records

Project Name: Bell Road	Project No. 35488	Co-ords: - Level: -	Date 17/08/2011
Location: Bottisham	Dimensions: -		Scale 1:25
Client: Barrat Homes, Eastern Counties	Depth 2.20m		Logged By MA

Samples & In Situ Testing			Depth (m)	Legend	Stratum Description
Depth (m)	Type	Results (kNm2)			
0.10	D		0.30		TOPSOIL (Dark brown, sandy, gravelly Clay. Gravel is fine to medium flint.)
0.70	D				Light grey and mottled yellow, structureless CHALK recovered as 50% intact chalk and 50% clay silt matrix.
1.50	D		1.00		... Becoming light grey only at 1.0m ... Perth penetrometer at 1.0m, N=10
2.10	D		2.00		
			2.20	Trialpit Complete at 2.20 m	
			3.00		
			4.00		


Remarks:
Trial Pit Stable



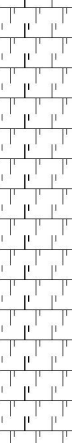
Groundwater: No groundwater encountered

Sample Type/Test Key:
 IVN () Hand Vane (kN/m²)
 W Water Sample
 D Disturbed Sample
 B Bulk Sample
 ▽ Ground Water Level

Penetration Tests:
Np = Perth Penetrometer



Project Name: Bell Road	Project No. 35488	Co-ords: - Level: -	Date 17/08/2011
Location: Bottisham	Dimensions: -		Scale 1:25
Client: Barrat Homes, Eastern Counties	Depth 2.00m		Logged By MA

Samples & In Situ Testing			Depth (m)	Legend	Stratum Description
Depth (m)	Type	Results (kNm2)			
0.15	D		0.30		TOPSOIL (Dark brown, sandy, gravelly Clay. Gravel is fine to medium flint.)
0.45	D				Stiff, light orange brown, very sandy, gravelly CLAY. Gravel is fine to medium flint and chalk.
1.10	D		2.00		Light grey mottled light yellow, structureless CHALK recovered as 80% intact chalk and 20% clay silt matrix.
2.00	D			... Perth penetrometer at 1.0m N=46 ... Becoming light grey only at 1.0m	
Trialpit Complete at 2.00 m					


Remarks:
Trial Pit Stable







Groundwater: No groundwater encountered

Sample Type/Test Key:
 IVN () Hand Vane (kN/m²)
 W Water Sample
 D Disturbed Sample
 B Bulk Sample
 Ground Water Level

Penetration Tests:
Np = Perth Penetrometer



Project Name: Bell Road	Project No. 35488	Co-ords: - Level: -	Date 17/08/2011
Location: Bottisham	Dimensions: -		Scale 1:25
Client: Barrat Homes, Eastern Counties	Depth 2.10m		Logged By

Samples & In Situ Testing			Depth (m)	Legend	Stratum Description
Depth (m)	Type	Results (kNm2)			
0.20	D		0.25		TOPSOIL. (Dark brown, sandy, gravelly clay.)
0.70	D				Very light grey CHALK. Recovered as a structureless melange of approximately 80% harder intact fragments within a silt and clay matrix.
1.05	IPP	52 Np Blows/300mm	1.00		
1.60	D				
2.10	D		2.00		
			2.10		
Trialpit Complete at 2.10 m					
			3.00		
			4.00		


Remarks:




Groundwater:

Sample Type/Test Key:
 IVN () Hand Vane (kN/m²)
 W Water Sample
 D Disturbed Sample
 B Bulk Sample
 Ground Water Level

Penetration Tests:
 Np = Perth Penetrometer



Project Name: Bell Road	Project No. 35488	Co-ords: - Level: -	Date 17/08/2011
Location: Bottisham	Dimensions: -		Scale 1:25
Client: Barrat Homes, Eastern Counties	Depth 2.20m		Logged By

Samples & In Situ Testing			Depth (m)	Legend	Stratum Description
Depth (m)	Type	Results (kNm2)			
0.10	D		0.25		TOPSOIL. (Dark brown, sandy, gravelly clay.)
0.35	D		0.45		Orangey brown, slightly clayey, slightly gravelly fine to coarse SAND.
1.10 1.20	IPP D	68 Np Blows/300mm	1.00 2.00		Very light grey CHALK. Recovered as a structureless melange of approximately 70% harder intact fragments within a silt and clay matrix.
2.20	D		2.20		Trialpit Complete at 2.20 m
			3.00		
			4.00		


Remarks:







Groundwater:

Sample Type/Test Key:
 IVN () Hand Vane (kN/m²)
 W Water Sample
 D Disturbed Sample
 B Bulk Sample
 Ground Water Level

Penetration Tests:
 Np = Perth Penetrometer



Project Name: Bell Road	Project No. 35488	Co-ords: - Level: -	Date 17/08/2011
Location: Bottisham	Dimensions: -		Scale 1:25
Client: Barrat Homes, Eastern Counties	Depth 2.20m		Logged By

Samples & In Situ Testing			Depth (m)	Legend	Stratum Description
Depth (m)	Type	Results (kNm2)			
0.15	D		0.30		TOPSOIL. (Dark brown, sandy, gravelly clay.)
0.50	D		0.60		Firm light orange, very sandy, slightly gravelly CLAY. Gravel fine to medium flint.
0.70	D				Very light grey CHALK. Recovered as a structureless melange of approximately 80% harder intact fragments within a silt and clay matrix.
0.90	IPP	50 Np Blows/300mm	1.00		
1.50	D		2.00		
2.20	D		2.20		
Trialpit Complete at 2.20 m					
			3.00		
			4.00		


Remarks:




Groundwater:

Sample Type/Test Key:
 IVN () Hand Vane (kN/m²)
 W Water Sample
 D Disturbed Sample
 B Bulk Sample
 Ground Water Level

Penetration Tests:
 Np = Perth Penetrometer



Project Name: Bell Road	Project No. 35488	Co-ords: - Level: -	Date 17/08/2011
Location: Bottisham	Dimensions: -		Scale 1:25
Client: Barrat Homes, Eastern Counties	Depth 2.90m		Logged By

Samples & In Situ Testing			Depth (m)	Legend	Stratum Description
Depth (m)	Type	Results (kNm2)			
0.20	D		0.30		TOPSOIL. (Dark brown sandy, gravelly, clay. Gravel fine to medium flint.)
0.40	D				Orange clayey, gravelly, fine to coarse SAND. Gravel fine to medium flint and chalk.
0.90	D	44 Np Blows/300mm	1.00		Very light grey CHALK. Recovered as a structureless melange of approximately 80% harder intact fragments, within a silt and clay matrix. With rare flint. ... Occasional orange sand patches between 0.5m an 1.0m
1.00	IPP				
1.80	D				
2.80	D				
			2.90		Trialpit Complete at 2.90 m
			3.00		
			4.00		


Remarks:


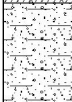



Groundwater:

Sample Type/Test Key:
 IVN () Hand Vane (kN/m²)
 W Water Sample
 D Disturbed Sample
 B Bulk Sample
 ▽ Ground Water Level

Penetration Tests:
 Np = Perth Penetrometer



Project Name: Bell Road	Project No. 35488	Co-ords: - Level: -	Date 17/08/2011
Location: Bottisham	Dimensions: -		Scale 1:25
Client: Barrat Homes, Eastern Counties	Depth 2.60m		Logged By

Samples & In Situ Testing			Depth (m)	Legend	Stratum Description
Depth (m)	Type	Results (kNm2)			
0.15	D		0.30		TOPSOIL. (Dark brown, sandy, gravelly, clay. Gravel fine to medium flint.)
0.45	D				Light orange, slightly clayey, slightly gravelly, fine to coarse SAND. Gravel fine to medium flint and chalk.
1.00 1.00	IPP D	52 Np Blows/300mm	0.65 1.00		Very light grey CHALK. Recovered as a structureless melange of approximately 80% harder intact fragments within a silt and clay matrix. With rare flint gravel. ... Occasional sand patches from 0.65m to 1.05m
1.90	D		2.00		
2.50	D		2.60		
Trialpit Complete at 2.60 m					
			3.00		
			4.00		


Remarks:




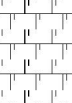


Groundwater:

Sample Type/Test Key:
 IVN () Hand Vane (kN/m²)
 W Water Sample
 D Disturbed Sample
 B Bulk Sample
 ▽ Ground Water Level

Penetration Tests:
 Np = Perth Penetrometer



Project Name: Bell Road	Project No. 35488	Co-ords: - Level: -	Date 17/08/2011
Location: Bottisham	Dimensions: -		Scale 1:25
Client: Barrat Homes, Eastern Counties	Depth 3.00m		Logged By

Samples & In Situ Testing			Depth (m)	Legend	Stratum Description
Depth (m)	Type	Results (kNm2)			
0.30	D		0.35		TOPSOIL. (Dark brown, sandy, gravelly clay. Gravel fine to medium flint.)
0.55	B		0.70		Very light grey and light orange, sandy CHALK. Recovered as a structureless melange of approximately 60% harder intact fragments within a silt and clay matrix.
1.10	IPP	60 Np Blows/300mm	1.00		Very light grey CHALK. Recovered as a structureless melange of approximately 80% harder intact fragments within a clay and silt matrix.
1.30	D				
2.30	D		2.00		
3.00	D		3.00		
					Trialpit Complete at 3.00 m
			4.00		


Remarks:






Groundwater:

Sample Type/Test Key:
 IVN () Hand Vane (kN/m²)
 W Water Sample
 D Disturbed Sample
 B Bulk Sample
 ▽ Ground Water Level

Penetration Tests:
 Np = Perth Penetrometer



Project Name: Bell Road	Project No. 35488	Co-ords: - Level: -	Date 17/08/2011
Location: Bottisham	Dimensions: -		Scale 1:25
Client: Barrat Homes, Eastern Counties	Depth 3.00m		Logged By

Samples & In Situ Testing			Depth (m)	Legend	Stratum Description
Depth (m)	Type	Results (kNm2)			
0.10	D		0.30		TOPSOIL. (Dark brown, sandy, gravelly, clay. Gravel fine to medium flint.)
0.55	B		0.60		Light orange mottled grey, very gravelly, clayey, fine to coarse SAND. Gravel fine to coarse chalk, fine to medium flint.
0.90 1.00	D IPP	48 Np Blows/300mm	1.00		Very light grey CHALK. Recovered as a structureless melange of approximately 80% harder intact fragments within a clay and silt matrix.
1.60	D		2.00		
2.60	D		3.00		
Trialpit Complete at 3.00 m					


Remarks:



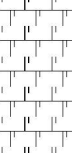


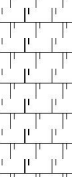
Groundwater:

Sample Type/Test Key:
 IVN () Hand Vane (kN/m²)
 W Water Sample
 D Disturbed Sample
 B Bulk Sample
 ▽ Ground Water Level

Penetration Tests:
 Np = Perth Penetrometer



Project Name: Bell Road	Project No. 35488	Co-ords: - Level: -	Date 17/08/2011
Location: Bottisham	Dimensions: -		Scale 1:25
Client: Barrat Homes, Eastern Counties	Depth 3.00m		Logged By

Samples & In Situ Testing			Depth (m)	Legend	Stratum Description
Depth (m)	Type	Results (kNm2)			
0.15	D		0.30		TOPSOIL. (Dark brown, sandy, gravelly, clay. Gravel fine to medium flint.)
0.35	D				Light orange, very clayey, gravelly fine to coarse SAND. Gravel fine to coarse chalk.
0.60	D				Very light grey CHALK. Recovered as a structureless melange of approximately 80% harder intact fragments within a clay and silt matrix.
1.10	IPP	46 Np Blows/300mm	1.00		
1.60	D		2.00		
2.40	D		3.00		
			3.00		Trialpit Complete at 3.00 m
			4.00		


Remarks:










Groundwater:

Sample Type/Test Key:
 IVN () Hand Vane (kN/m²)
 W Water Sample
 D Disturbed Sample
 B Bulk Sample
 ▽ Ground Water Level

Penetration Tests:
 Np = Perth Penetrometer



Project Name: Bell Road	Project No. 35488	Co-ords: - Level: -	Date 17/08/2011
Location: Bottisham	Dimensions: -		Scale 1:25
Client: Barrat Homes, Eastern Counties	Depth 3.00m		Logged By

Samples & In Situ Testing			Depth (m)	Legend	Stratum Description
Depth (m)	Type	Results (kNm2)			
0.10	D		0.25		TOPSOIL. (Dark brown, sandy, gravelly, clay. Gravel fine to medium flint, and fine brick.)
0.50	D				Very light grey CHALK. Recovered as a structutless melange of approximately 80% harder intact fragments, within a clay and silt matrix. With rare medium flint gravel.
0.95	IPP	34 Np Blows/300mm			
1.40	D				
2.80	D				
			1.00		
			2.00		
			3.00		
			4.00		
Trialpit Complete at 3.00 m					


Remarks:






Groundwater:

Sample Type/Test Key:
 IVN () Hand Vane (kN/m²)
 W Water Sample
 D Disturbed Sample
 B Bulk Sample
 Ground Water Level

Penetration Tests:
 Np = Perth Penetrometer




Project Name: Bell Road	Project No. 35488	Co-ords: - Level: -	Date 17/08/2011
Location: Bottisham	Dimensions: -		Scale 1:25
Client: Barrat Homes, Eastern Counties	Depth 3.00m		Logged By

Samples & In Situ Testing			Depth (m)	Legend	Stratum Description
Depth (m)	Type	Results (kNm2)			
0.20	D		0.30		TOPSOIL. (Dark brown, sandy, gravelly, clay. Gravel fine to medium flint.)
0.70	D				Very light grey CHALK. Recovered as a structureless melange of approximately 20% harder intact fragments within a silt and clay matrix.
1.00	IPP	20 Np Blows/300mm	1.10		Very light grey CHALK. Recovered as a structureless melange of approximately 80% harder intact fragments within a silt and clay matrix.
1.70	D		2.00		
2.70	D		3.00		
Trialpit Complete at 3.00 m					
			4.00		


Remarks:










Groundwater:

Sample Type/Test Key:
 IVN () Hand Vane (kN/m²)
 W Water Sample
 D Disturbed Sample
 B Bulk Sample
 Ground Water Level

Penetration Tests:
 Np = Perth Penetrometer



Project Name: Bell Road	Project No. 35488	Co-ords: - Level: -	Date 18/08/2011
Location: Bottisham	Dimensions: -		Scale 1:25
Client: Barrat Homes, Eastern Counties	Depth 3.00m		Logged By

Samples & In Situ Testing			Depth (m)	Legend	Stratum Description
Depth (m)	Type	Results (kNm2)			
0.10	D		0.25		TOPSOIL. (Dark brown, sandy, gravelly, clay. Gravel fine to medium flint.)
0.60	D				Very light grey CHALK. Recovered as a structureless malnage of approximately 90% harder intact fragments within a silt and clay matrix. ... Some sandy patches between 0.25m and 0.7m
0.95	IPP	52 Np Blows/300mm			
1.20	D				
2.20	D				
			1.00		
			2.00		
			3.00		
			3.00	Trialpit Complete at 3.00 m	
			4.00		


Remarks:






Groundwater:

Sample Type/Test Key:
 IVN () Hand Vane (kN/m²)
 W Water Sample
 D Disturbed Sample
 B Bulk Sample
 ▽ Ground Water Level

Penetration Tests:
 Np = Perth Penetrometer



Project Name: Bell Road	Project No. 35488	Co-ords: - Level: -	Date 18/08/2011
Location: Bottisham	Dimensions: -		Scale 1:25
Client: Barrat Homes, Eastern Counties	Depth 3.00m		Logged By

Samples & In Situ Testing			Depth (m)	Legend	Stratum Description
Depth (m)	Type	Results (kNm2)			
0.20	D		0.30		TOPSOIL. (Dark brown, sandy, gravelly, clay. Gravel fine to medium flint.)
0.50	B		0.60		Light orange, very gravelly, fine to coarse SAND. Gravel fine to coarse chalk.
1.00 1.00	IPP D	56 Np Blows/300mm	1.00		Light grey CHALK. Recovered as a structureless melange of approximately 80% harder intact fragments within a clay and silt matrix.
2.00	D		2.00		
3.00	D		3.00		
Trialpit Complete at 3.00 m					
			4.00		

Remarks:

Groundwater:

Sample Type/Test Key:
 IVN () Hand Vane (kN/m²)
 W Water Sample
 D Disturbed Sample
 B Bulk Sample
 Ground Water Level

Penetration Tests:
 Np = Perth Penetrometer



Project Name: Bell Road	Project No. 35488	Co-ords: - Level: -	Date 18/08/2011
Location: Bottisham	Dimensions: -		Scale 1:25
Client: Barrat Homes, Eastern Counties	Depth 3.00m		Logged By

Samples & In Situ Testing			Depth (m)	Legend	Stratum Description
Depth (m)	Type	Results (kNm ²)			
0.15	D		0.30		TOPSOIL. (Dark brown, sandy, gravelly, clay. Gravel fine to medium flint.)
0.35	D				Light orange, gravelly fine to coarse SAND. Gravel fine to coarse chalk and flint.
0.80	D		1.00		Light grey CHALK. Recovered as a structureless melange of approximately 80% harder intact fragments within a clay and silt matrix.
1.00	IPP	34 Np Blows/300mm			
1.80	D		2.00		
2.80	D				
			3.00		Trialpit Complete at 3.00 m
			4.00		


Remarks:


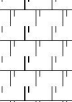


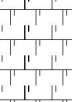

Groundwater:

Sample Type/Test Key:
 IVN () Hand Vane (kN/m²)
 W Water Sample
 D Disturbed Sample
 B Bulk Sample
 Ground Water Level

Penetration Tests:
 Np = Perth Penetrometer



Project Name: Bell Road	Project No. 35488	Co-ords: - Level: -	Date 18/08/2011
Location: Bottisham	Dimensions: -		Scale 1:25
Client: Barrat Homes, Eastern Counties	Depth 3.00m		Logged By

Samples & In Situ Testing			Depth (m)	Legend	Stratum Description
Depth (m)	Type	Results (kNm2)			
0.10	D		0.30		TOPSOIL. (Dark brown, sandy, gravelly, clay. Gravel fine to medium flint.)
0.60	D				Very light grey CHALK. Recovered as a structureless melange of approximately 80% harder intact fragments within a clay and silt matrix. ... with sandy patches between 0.3m and 0.5m
1.00	IPP	40 Np Blows/300mm	1.00		
1.60	D		2.00		
2.60	D				... becoming approximately 50% harder intact fragmets @2.4m
			3.00		
			3.00		Trialpit Complete at 3.00 m
			4.00		


Remarks:














Groundwater:

Sample Type/Test Key:
 IVN () Hand Vane (kN/m²)
 W Water Sample
 D Disturbed Sample
 B Bulk Sample
 ▽ Ground Water Level

Penetration Tests:
 Np = Perth Penetrometer



Project Name: Bell Road	Project No. 35488	Co-ords: - Level: -	Date 18/08/2011
Location: Bottisham	Dimensions: -		Scale 1:25
Client: Barrat Homes, Eastern Counties	Depth 3.00m		Logged By

Samples & In Situ Testing			Depth (m)	Legend	Stratum Description
Depth (m)	Type	Results (kNm2)			
0.20	D		0.30		TOPSOIL. (Dark brown, sandy, gravelly, clay. Gravel fine to medium flint.)
0.45	B				Very light grey and light orange, gravelly SAND. Gravel fine to coarse chalk and fine to medium flint.
0.95	IPP	36 Np Blows/300mm			Very light grey CHALK. Recovered as a structureless melange of approximately 80% harder intact fragments within a clay and silt matrix. With rare fine to medium flint gravel.
1.40	D		2.00		
					
					
					
					
2.40	D		3.00		
					
					
					
					
			3.00	Trialpit Complete at 3.00 m	
			4.00		


Remarks:


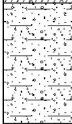




Groundwater:

Sample Type/Test Key:
 IVN () Hand Vane (kN/m²)
 W Water Sample
 D Disturbed Sample
 B Bulk Sample
 ▽ Ground Water Level

Penetration Tests:
 Np = Perth Penetrometer



Project Name: Bell Road	Project No. 35488	Co-ords: - Level: -	Date 18/08/2011
Location: Bottisham	Dimensions: -		Scale 1:25
Client: Barrat Homes, Eastern Counties	Depth 3.00m		Logged By

Samples & In Situ Testing			Depth (m)	Legend	Stratum Description
Depth (m)	Type	Results (kNm2)			
0.20	D	26 Np Blows/300mm	0.30		TOPSOIL. (Dark brown, sandy, gravelly, clay. Gravel fine to medium flint.)
0.45	D		0.70		Light brown, very clayey, gravelly fine to coarse SAND. Gravel fine to coarse flint.
0.90	D		1.00		Orangey brown, slightly gravelly, slightly sandy, silty CLAY. Gravel fine to coarse flint and chalk.
1.00	IPP		1.10		Very light grey CHALK. Recovered as a structureless melange of approximately 50% harder intact fragments and 50% soft clay.
1.30	D		2.00		
2.10	D	3.00	3.00		Trialpit Complete at 3.00 m
3.00	D		4.00		

Remarks:


Groundwater:




























Sample Type/Test Key:
 IVN () Hand Vane (kN/m²)
 W Water Sample
 D Disturbed Sample
 B Bulk Sample
 ▽ Ground Water Level

Penetration Tests:
 Np = Perth Penetrometer



Project Name: Bell Road	Project No. 35488	Co-ords: - Level: -	Date 18/08/2011
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Location: Bottisham	Dimensions: - Depth 3.00m		Scale 1:25
Client: Barrat Homes, Eastern Counties			Logged By

Samples & In Situ Testing			Depth (m)	Legend	Stratum Description
Depth (m)	Type	Results (kNm ²)			
0.20	D		0.30		TOPSOIL. (Dark brown, sandy, gravelly, clay. Gravel fine to medium flint.)
0.40	D				Light brown, very clayey, gravelly fine to coarse SAND. Gravel fine to medium flint.
0.60	D				Very light yellow, very clayey, silty, gravelly fine to medium SAND. Gravel fine to medium flint and chalk.
1.00	IPP	24 Np Blows/300mm	1.00		
1.40	D		1.20		Very light grey CHALK. Recovered as a structureless melange of approximately 80% harder intact fragments within a silt and clay matrix.
2.60	D		2.00		
			3.00		
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APPENDIX C

Soakaway Testing Results

**Bell Road, Bottisham,
Cambridgeshire**
Soil infiltration Rate (f) = $V_{p_{75-25}} / (a_{p_{50}} * t_{p_{75-25}})$

<u>Soakaway TP1 - Test 1</u>	
<u>Trial Pit Dimensions</u>	
Length (m)	1.95
Width (m)	0.5
Depth (m)	2.2
Effective Depth (m)	1.5
tp ₇₅ (mins)	1780
tp ₂₅ (mins)	55
<u>Calculations</u>	
V _{p₇₅₋₂₅}	0.73125
ap ₅₀	4.65
tp ₇₅₋₂₅	1725
f = 1.52E-06 m/s	

<u>Soakaway TP1 - Test 2</u>	
<u>Trial Pit Dimensions</u>	
Length (m)	1.95
Width (m)	0.5
Depth (m)	2.2
Effective Depth (m)	1.16
tp ₇₅ (mins)	510
tp ₂₅ (mins)	60
<u>Calculations</u>	
V _{p₇₅₋₂₅}	0.5655
ap ₅₀	3.817
tp ₇₅₋₂₅	450
f = 5.49E-06 m/s	

<u>Soakaway TP2 - Test 1</u>	
<u>Trial Pit Dimensions</u>	
Length (m)	1.9
Width (m)	0.5
Depth (m)	2
Effective Depth (m)	1.42
tp ₇₅ (mins)	715
tp ₂₅ (mins)	120
<u>Calculations</u>	
V _{p₇₅₋₂₅}	0.6745
ap ₅₀	4.358
tp ₇₅₋₂₅	595
f = 4.34E-06 m/s	

<u>Soakaway TP2 - Test 2</u>	
<u>Trial Pit Dimensions</u>	
Length (m)	1.9
Width (m)	0.5
Depth (m)	1.95
Effective Depth (m)	1.2
tp ₇₅ (mins)	209
tp ₂₅ (mins)	56
<u>Calculations</u>	
V _{p₇₅₋₂₅}	0.57
ap ₅₀	3.83
tp ₇₅₋₂₅	153
f = 1.62E-05 m/s	

**Bell Road, Bottisham,
Cambridgeshire**

<u>Soakaway TP3 - Test 1</u>	
<u>Trial Pit Dimensions</u>	
Length (m)	2
Width (m)	0.5
Depth (m)	2.1
Effective Depth (m)	1.61
tp ₇₅ (mins)	306
tp ₂₅ (mins)	38
<u>Calculations</u>	
Vp ₇₅₋₂₅	0.805
ap ₅₀	5.025
tp ₇₅₋₂₅	268
f = 9.96E-06 m/s	

<u>Soakaway TP3 - Test 2</u>	
<u>Trial Pit Dimensions</u>	
Length (m)	2
Width (m)	0.5
Depth (m)	1.9
Effective Depth (m)	1.15
tp ₇₅ (mins)	131
tp ₂₅ (mins)	9
<u>Calculations</u>	
Vp ₇₅₋₂₅	0.575
ap ₅₀	3.875
tp ₇₅₋₂₅	122
f = 2.03E-05 m/s	

<u>Soakaway TP4 - Test 1</u>	
<u>Trial Pit Dimensions</u>	
Length (m)	1.9
Width (m)	0.5
Depth (m)	2.3
Effective Depth (m)	1.53
tp ₇₅ (mins)	319
tp ₂₅ (mins)	75
<u>Calculations</u>	
Vp ₇₅₋₂₅	0.72675
ap ₅₀	4.622
tp ₇₅₋₂₅	244
f = 1.07E-05 m/s	

<u>Soakaway TP4 - Test 2</u>	
<u>Trial Pit Dimensions</u>	
Length (m)	1.9
Width (m)	0.5
Depth (m)	2.18
Effective Depth (m)	1.52
tp ₇₅ (mins)	164
tp ₂₅ (mins)	29
<u>Calculations</u>	
Vp ₇₅₋₂₅	0.722
ap ₅₀	4.598
tp ₇₅₋₂₅	135
f = 1.94E-05 m/s	

**Bell Road, Bottisham,
Cambridgeshire**

<u>Soakaway TP5 - Test 1</u>	
<u>Trial Pit Dimensions</u>	
Length (m)	1.85
Width (m)	0.5
Depth (m)	2.18
Effective Depth (m)	1.61
tp ₇₅ (mins)	111
tp ₂₅ (mins)	24
<u>Calculations</u>	
Vp ₇₅₋₂₅	0.744625
ap ₅₀	4.7085
tp ₇₅₋₂₅	87
f = 3.03E-05 m/s	

<u>Soakaway TP5 - Test 2</u>	
<u>Trial Pit Dimensions</u>	
Length (m)	1.85
Width (m)	0.5
Depth (m)	2.35
Effective Depth (m)	1.55
tp ₇₅ (mins)	72
tp ₂₅ (mins)	16
<u>Calculations</u>	
Vp ₇₅₋₂₅	0.716875
ap ₅₀	4.5675
tp ₇₅₋₂₅	56
f = 4.67E-05 m/s	

APPENDIX D

Geotechnical Testing Results



TEST REPORT.

ISSUED BY : SOIL PROPERTY TESTING LTD.

DATE OF ISSUE : 23/09/11 PAGE 1 of 15 Pages

Contract

Serial No.

Bell Road, Bottisham

S24869



CLIENT:

Richard Jackson Ltd
26 HIGH STREET
HADLEIGH
IPSWICH
SUFFOLK
IP7 5AP

Soil Property Testing

18 Halcyon Court, St Margarets Way,
Stukeley Meadows, Huntingdon,
Cams. PE29 6DG.

Telephone (01480) 455579 Fax (01480) 453619
Email SPTownend@btclick.com

SAMPLES SUBMITTED BY:

Richard Jackson Ltd

APPROVED SIGNATORIES:

- S.P.TOWNEND FGS
Technical Director
- W. JOHNSTONE
Deputy Technical/Quality Manager
- J.C.GARNER B.Eng (Hons.) FGS
Quality Manager

SAMPLES LABELLED:

Bell Road, Bottisham

DATE RECEIVED: 23/08/11

SAMPLES TESTED BETWEEN 23/08/11 and 23/09/11

REMARKS: For the attention of: Mr M Axton
Your Order Ref: 35488

- 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.



TEST REPORT.

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Contract
Bell Road, Bottisham

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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 (%)	Plasti- city Index (%)	Liqui- dity Index (%)	SAMPLE PREPARATION				Description	CLASS
								Method S/N	Ret'd 0.425mm (%)	Corr'd M/C <0.425mm	Curing Time (hrs.)		
TP4	1.20	D3	15	29	18	11		S	56(M)		24	Light grey marly slightly gravelly CHALK with harder intact marly chalk fragments from fine to coarse gravel size and rare decayed roots. Gravel is fine to coarse subangular and subrounded flint	CL
TP6	2.80	D5	16	32	20	12		S	80(M)		24	Light grey intact marly CHALK fragments from fine to coarse gravel size	CL
TP7	1.00	D3	17	39	21	18		S	23(M)		24	Light grey marly CHALK with harder intact marly chalk fragments from fine to coarse gravel size and rare decayed roots	CI
TP8	0.55	B2	18	34	20	14		S	40(M)		27	Light grey marly CHALK with harder intact marly chalk fragments from fine to coarse gravel size	CL
TP9	0.55	B2	16	37	21	16		S	21(M)		28	Light grey marly CHALK with harder intact marly chalk fragments of fine and medium gravel size and occasional recently active roots	CI
TP14	0.50	B2	16	38	21	17		S	9(M)		30	Light grey marly CHALK with harder intact marly chalk fragments of fine and medium gravel size and occasional recently active roots	CI
TP16	1.60	D3	17	32	19	13		S	89(M)		24	Light grey intact marly CHALK fragments from fine to coarse gravel size	CL
TP17	0.45	B2	10	27	16	11		S	30(M)		28	Light grey slightly gravelly marly CHALK with harder intact marly chalk fragments of fine and medium gravel size. Gravel is fine and medium flint	CL

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.

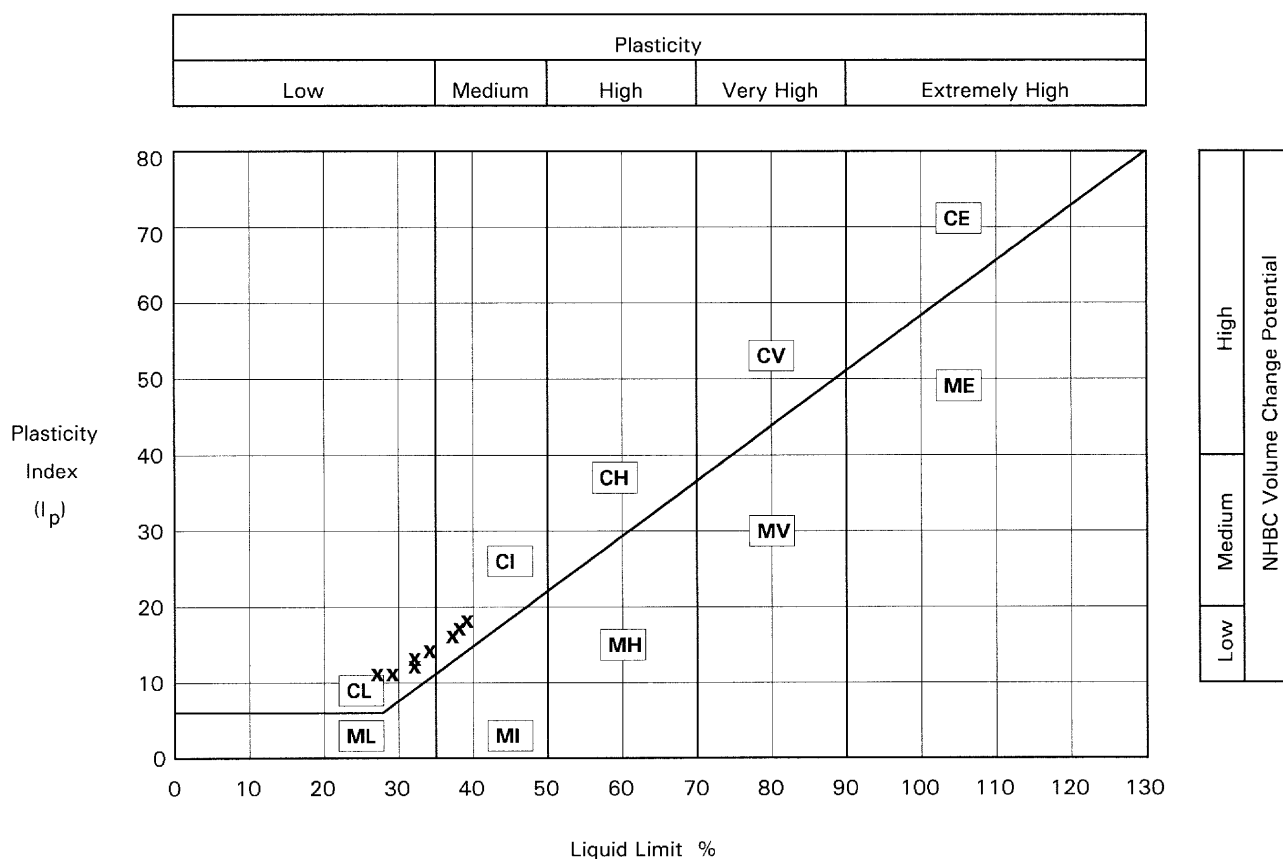
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Contract
Bell Road, Bottisham

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S24869

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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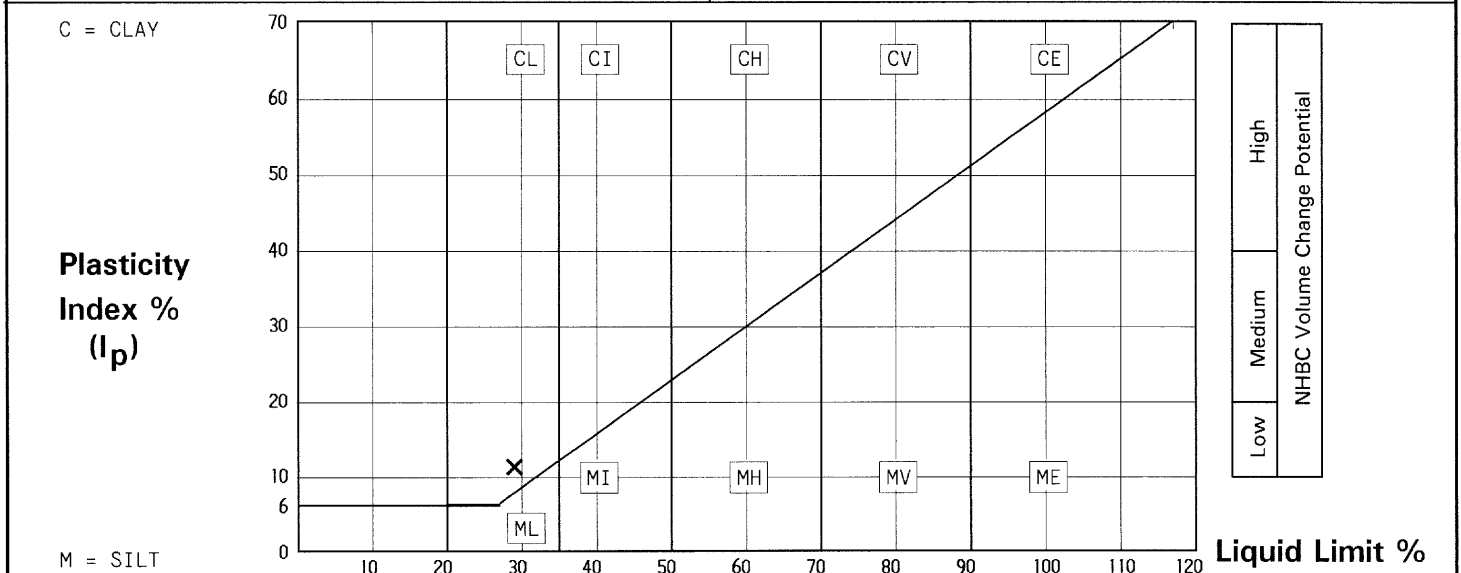
Serial No.
S24869



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
TP4	1.20	D3	15	Light grey marly slightly gravelly CHALK with harder intact marly chalk fragments from fine to coarse gravel size and rare decayed roots. Gravel is fine to coarse subangular and subrounded flint	

PREPARATION		Liquid Limit	29 %
Method of Preparation	Sieved Specimen	Plastic Limit	18 %
Sample retained 0.425 sieve (Measured)	56 %	Plasticity Index	11 %
Corrected moisture content for material passing 0.425mm	%	Liquidity Index	
Curing Time	24 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 $I'_p = I_p \times (\% \text{ less than } 425 \text{ microns}/100)$
CORRECTED MOISTURE CONTENT AND LIQUIDITY INDEX NOT REPORTED DUE TO MATERIAL TYPE - 40% RETAINED ON 2mm SIEVE



TEST REPORT.

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

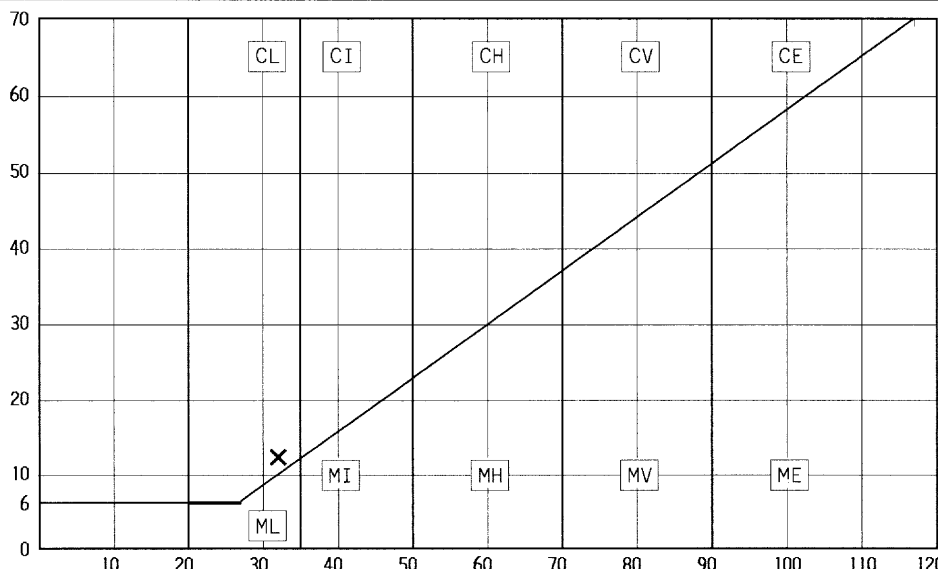
Borehole/ Pit No.	Depth m.	Sample	Moisture Content %	Description	Remarks
TP6	2.80	D5	16	Light grey intact marly CHALK fragments from fine to coarse gravel size	

PREPARATION		Liquid Limit	32 %
Method of Preparation	Sieved Specimen	Plastic Limit	20 %
Sample retained 0.425 sieve	(Measured) 80 %	Plasticity Index	12 %
Corrected moisture content for material passing 0.425mm	%	Liquidity Index	
Curing Time	24 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 × (% less than 425 microns/100)
CORRECTED MOISTURE CONTENT AND LIQUIDITY INDEX NOT REPORTED DUE TO MATERIAL TYPE - 74% RETAINED ON 2mm SIEVE



TEST REPORT.

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

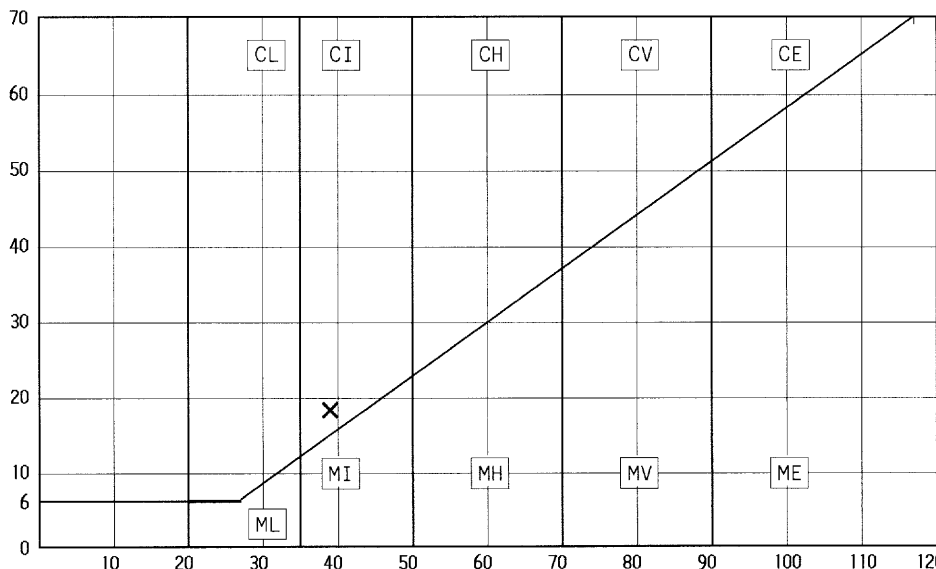
Borehole/ Pit No.	Depth m.	Sample	Moisture Content %	Description	Remarks
TP7	1.00	D3	17	Light grey marly CHALK with harder intact marly chalk fragments from fine to coarse gravel size and rare decayed roots	

PREPARATION		Liquid Limit	39 %
Method of Preparation	Sieved Specimen	Plastic Limit	21 %
Sample retained 0.425 sieve (Measured)	23 %	Plasticity Index	18 %
Corrected moisture content for material passing 0.425mm	%	Liquidity Index	
Curing Time	24 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)
CORRECTED MOISTURE CONTENT AND LIQUIDITY INDEX NOT REPORTED DUE TO MATERIAL TYPE - 22% RETAINED ON 2mm SIEVE



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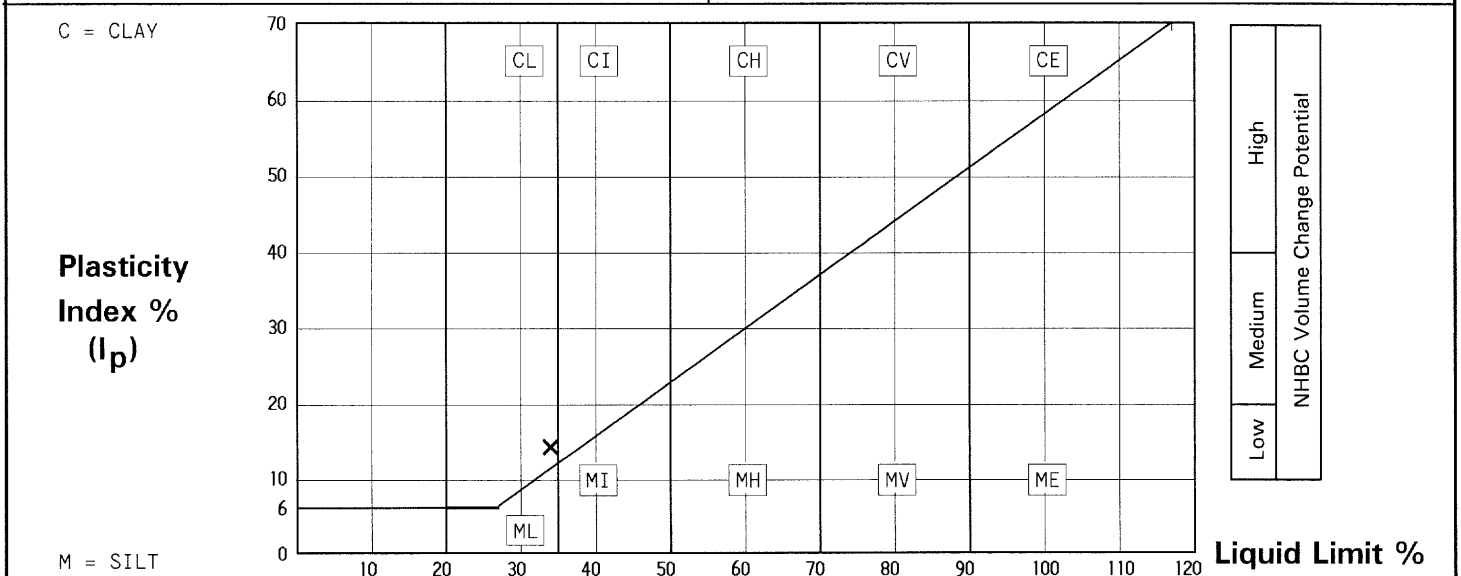
Serial No.
S24869



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
TP8	0.55	B2	18	Light grey marly CHALK with harder intact marly chalk fragments from fine to coarse gravel size	

PREPARATION		Liquid Limit	34 %
Method of Preparation	Sieved Specimen	Plastic Limit	20 %
Sample retained 0.425 sieve (Measured)	40 %	Plasticity Index	14 %
Corrected moisture content for material passing 0.425mm	%	Liquidity Index	
Curing Time	27 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)
CORRECTED MOISTURE CONTENT AND LIQUIDITY INDEX NOT REPORTED DUE TO MATERIAL TYPE - 37% RETAINED ON 2mm SIEVE



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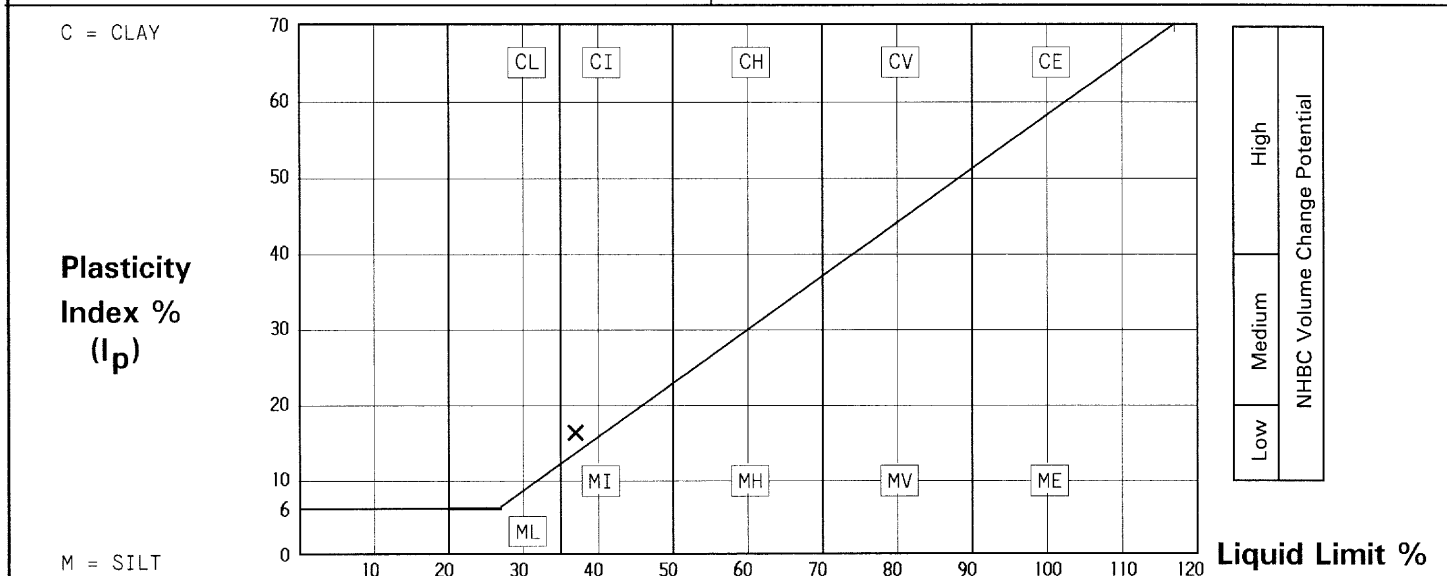
Serial No.
S24869



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
TP9	0.55	B2	16	Light grey marly CHALK with harder intact marly chalk fragments of fine and medium gravel size and occasional recently active roots	

PREPARATION		Liquid Limit	37 %
Method of Preparation	Sieved Specimen	Plastic Limit	21 %
Sample retained 0.425 sieve (Measured)	21 %	Plasticity Index	16 %
Corrected moisture content for material passing 0.425mm	%	Liquidity Index	
Curing Time	28 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)
CORRECTED MOISTURE CONTENT AND LIQUIDITY INDEX NOT REPORTED DUE TO MATERIAL TYPE - 17% RETAINED ON 2mm SIEVE



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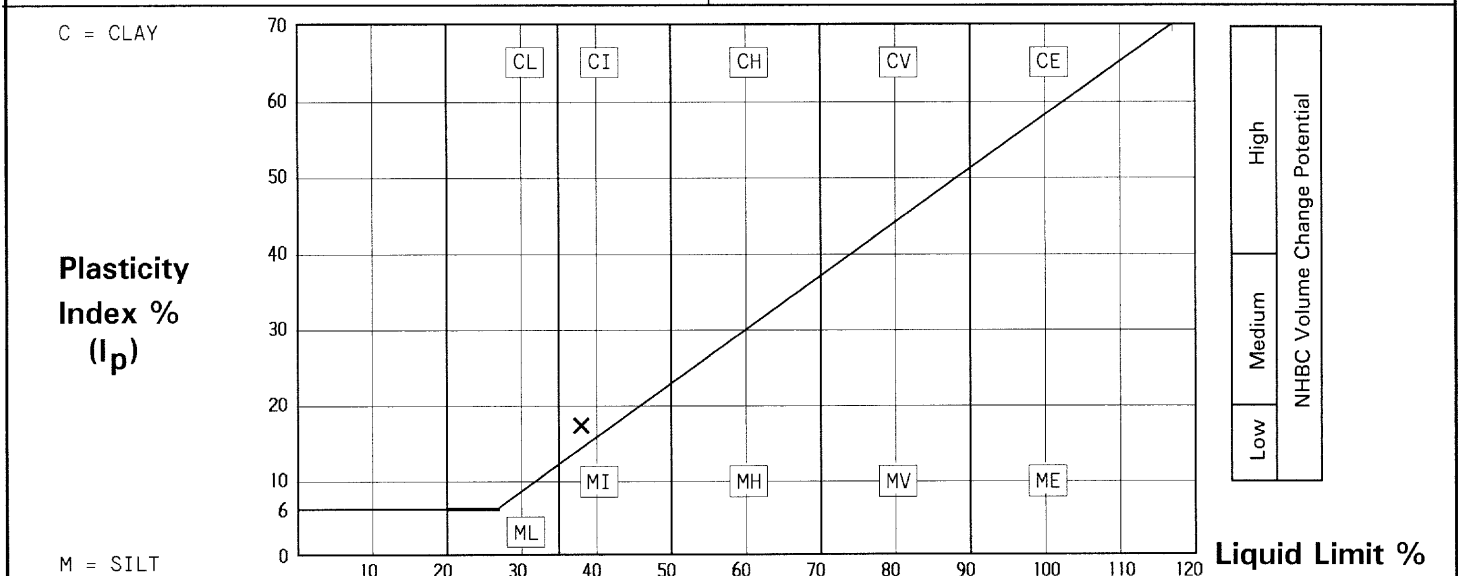
Serial No.
S24869



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
TP14	0.50	B2	16	Light grey marly CHALK with harder intact marly chalk fragments of fine and medium gravel size and occasional recently active roots	

PREPARATION		Liquid Limit	38 %
Method of Preparation	Sieved Specimen	Plastic Limit	21 %
Sample retained 0.425 sieve	(Measured)	Plasticity Index	17 %
Corrected moisture content for material passing 0.425mm	%	Liquidity Index	
Curing Time	30 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)
CORRECTED MOISTURE CONTENT AND LIQUIDITY INDEX NOT REPORTED DUE TO MATERIAL TYPE - 6% RETAINED ON 2mm SIEVE



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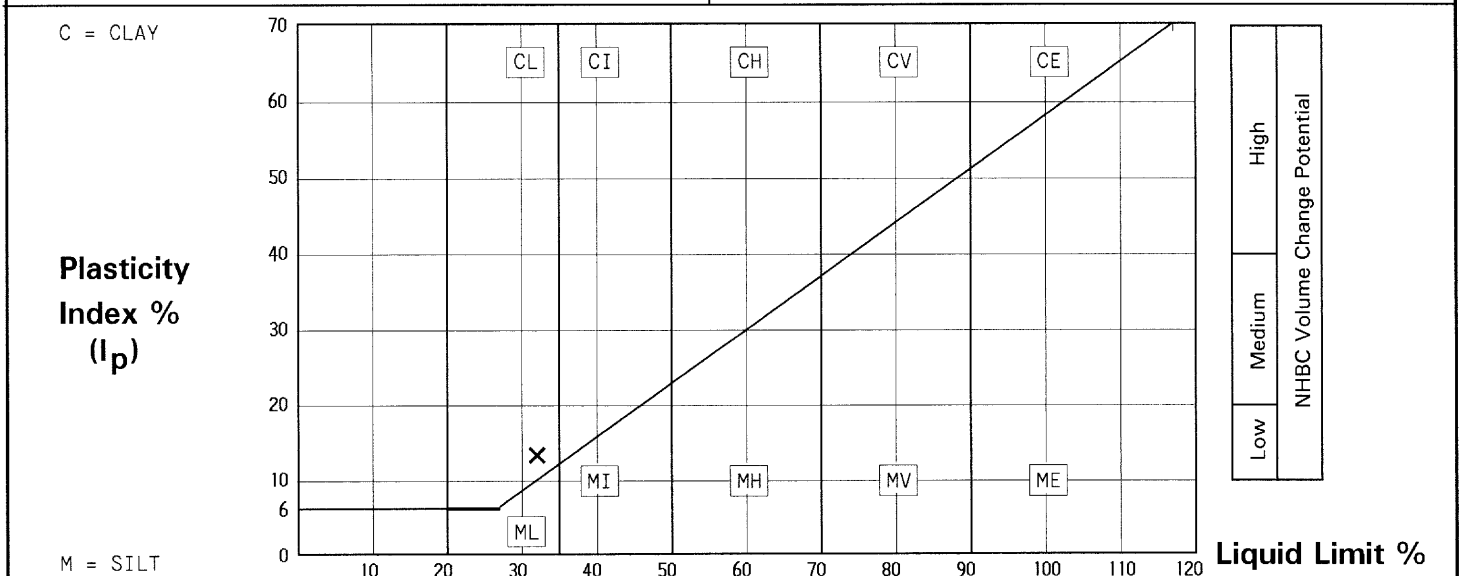
Serial No.
S24869



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
TP16	1.60	D3	17	Light grey intact marly CHALK fragments from fine to coarse gravel size	

PREPARATION		Liquid Limit	32 %
Method of Preparation	Sieved Specimen	Plastic Limit	19 %
Sample retained 0.425 sieve	(Measured) 89 %	Plasticity Index	13 %
Corrected moisture content for material passing 0.425mm	%	Liquidity Index	
Curing Time	24 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 $I'_p = I_p \times (\% \text{ less than } 425 \text{ microns}/100)$
CORRECTED MOISTURE CONTENT AND LIQUIDITY INDEX NOT REPORTED DUE TO MATERIAL TYPE - 86% RETAINED ON 2mm SIEVE



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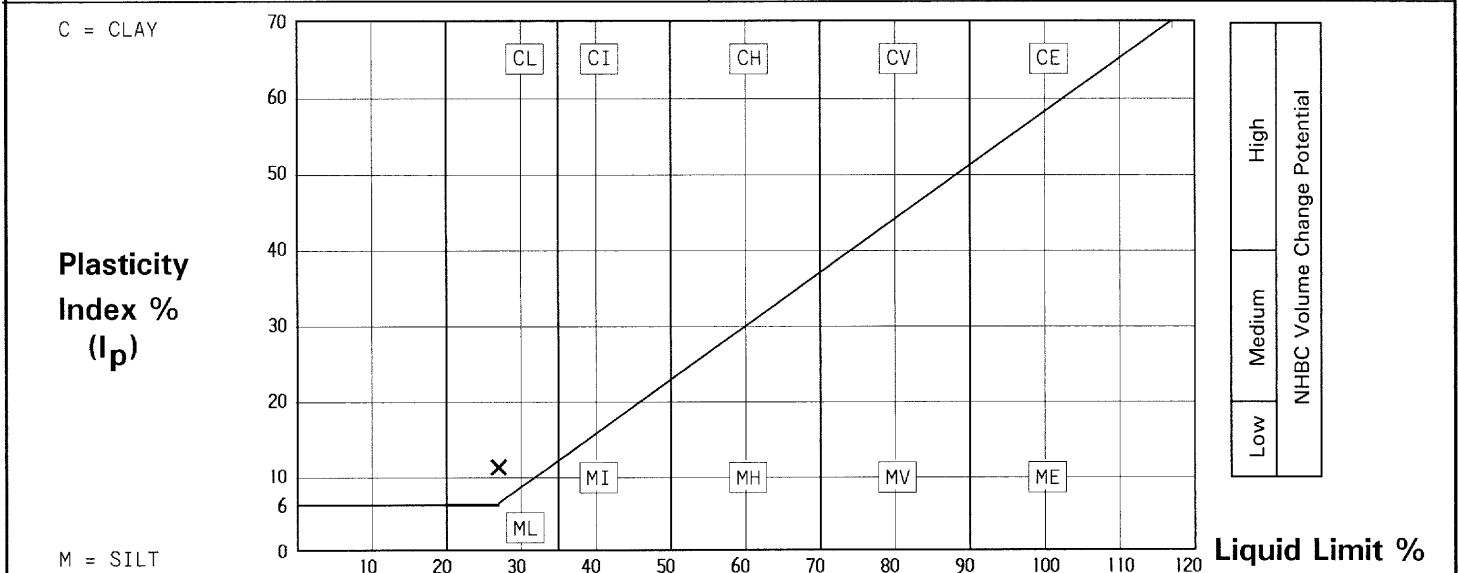
Serial No.
S24869



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
TP17	0.45	B2	10	Light grey slightly gravelly marly CHALK with harder intact marly chalk fragments of fine and medium gravel size. Gravel is fine and medium flint	

PREPARATION		Liquid Limit	27 %
Method of Preparation	Sieved Specimen	Plastic Limit	16 %
Sample retained 0.425 sieve (Measured)	30 %	Plasticity Index	11 %
Corrected moisture content for material passing 0.425mm	%	Liquidity Index	
Curing Time	28 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)
CORRECTED MOISTURE CONTENT AND LIQUIDITY INDEX NOT REPORTED DUE TO MATERIAL TYPE - 26% RETAINED ON 2mm SIEVE



TEST REPORT.

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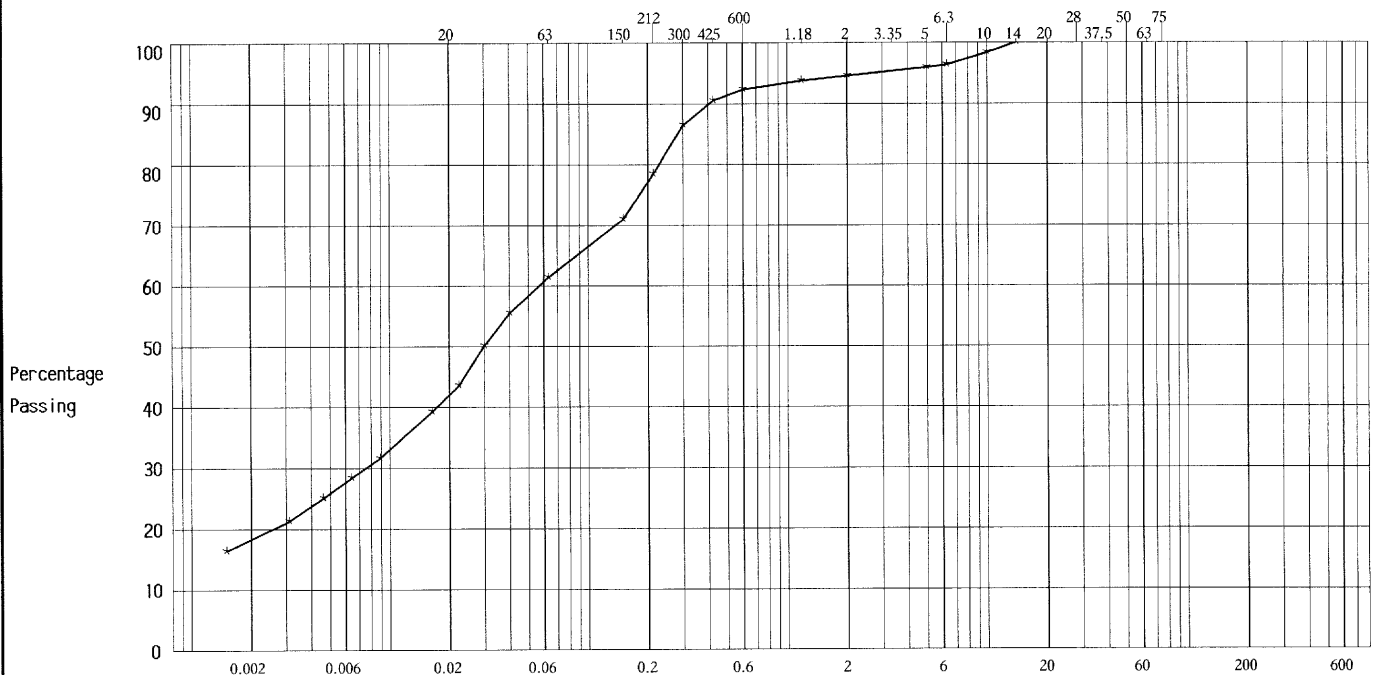


DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole/ Pit No.	Depth m.	Sample	Description	Remarks
TP18	0.90	D3	Light yellowish brown slightly gravelly slightly sandy silty CLAY with occasional recently active roots. Gravel is fine and medium flint and chalk	Description in terms of likely engineering behaviour BS5930:1999:41.4.4.1

Method of Test: Wet Sieve + Hydrometer Method of pre-treatment: NOT REQUIRED

Sieve Size	Size (microns)											Size (mm)														
	1.5	3.1	4.6	6.4	8.9	16	32	63	125	250	500	1.18	2	5	6.3	10	14	20	28	37.5	50	75				
Percentage by Mass passing Sieve	16	21	25	28	32	39	44	50	55	61	71	78	86	90	92	94	95	96	96	98	100	-	-	-	-	-



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

METHOD OF PREPARATION: BS 1377:PART 1:1990:7.3 & 7.4.5

METHOD OF TEST : BS 1377:PART 2:1990:9.2 + 9.5

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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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:

Plastic Limit (PL) for the fine fraction is obtained from testing of that proportion passing the 0.425mm sieve. A notional 5% MC is to be allowed for material retained on the 0.425mm sieve. This proportion is determined 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:

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

CALCULATIONS:

S24869 Bell Road, Bottisham.

COMBINED SAMPLE

PL, MC & % passing 0.425 taken as the average of the results from:

TP8 B2 @ 0.55m; TP9 B2 @ 0.55m & TP14 B2 @ 0.50m

77% passing 0.425mm therefore X=77

Plastic limit of specimen = 20.5%

Moisture content as received = 16.5%

Therefore calculated minimum moisture content for CBR specimen =

$$\frac{77(20.5+2) + (100-77)5}{100} = 18.5\%$$

Therefore moisture content adjustment required

Moisture Content after CBR test = 18.2%



TEST REPORT.

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Bell Road, Bottisham

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DETERMINATION OF CALIFORNIA BEARING RATIO (CBR)

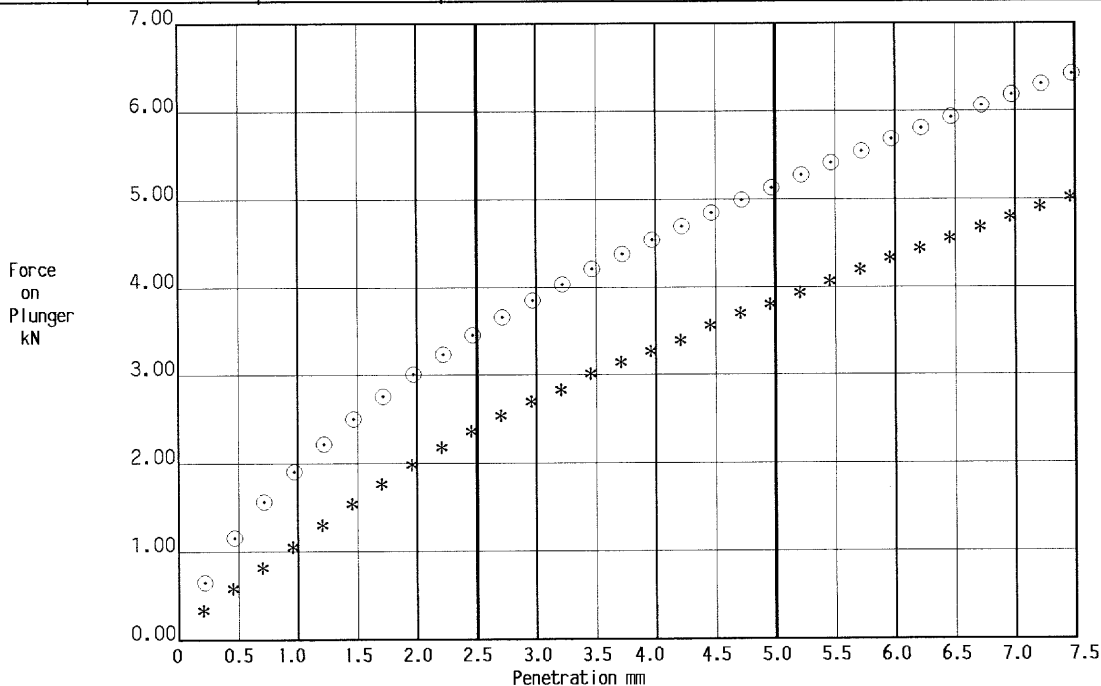
Borehole/ Pit No./ Chainage	Depth m.	Sample	Description	Remarks
TP	0.50 -0.55	COMB	COMBINED SAMPLE COMPRISING EQUAL PROPORTIONS OF TP8 B2 @ 0.55m; TP9 B2 @ 0.55m & TP14 B2 @ 0.50m	

Moisture Content % TOP: 18 BOTTOM: 18 Average: 18 Bulk Density Mg/m³ 2.02 Dry Density Mg/m³ 1.71

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 : 2
TOP	2.5	2.36	18	19		METHOD OF PREPARATION BS 1377:Part 4:1990 7.2.4 2.5kg Rammer Method.
*	5.0	3.80	19			
BOTTOM	2.5	3.46	26	26		Surcharge weights (kg) : 15
⊙	5.0	5.14	26			

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.

APPENDIX E

Chemical Analysis Results