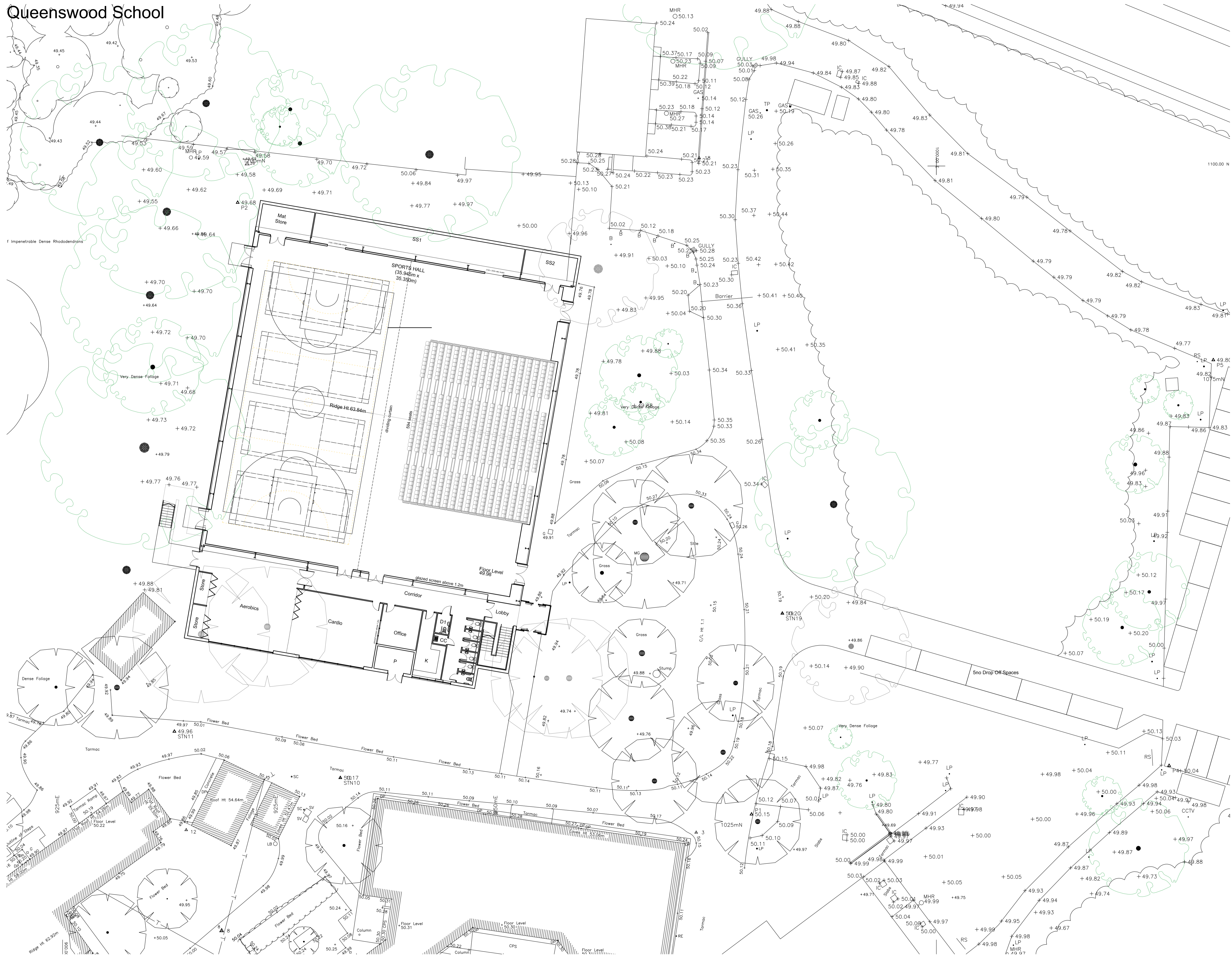
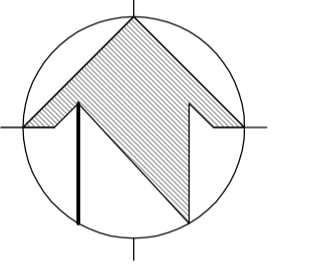
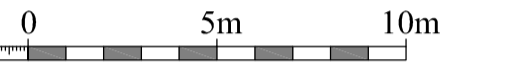


# Queenswood School



NOTES:  
 Do Not Scale.  
 Report all discrepancies, errors and omissions.  
 Verify all dimensions on site before commencing any work on site or preparing shop drawings.  
 All materials, components and workmanship are to comply with the relevant British Standards, Codes of Practice, and appropriate manufacturers recommendations that from time to time shall apply.  
 For all specialist work, see relevant drawings.  
 This drawing and design are copyright of Clague LLP  
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Rev	Date	Description
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BALL HALL LIMITED  
**Ball Hall**

Project Title  
**Proposed New Sports Hall**  
 Queenswood School  
 Shepherds Way  
 Hatfield  
 Hertfordshire  
 AL9 6NS

Drawing Description

**Site Plan**

Scale  
**1:200 @ A1**  
 Date  
**Oct 2016**

Drawn by  
**LB**  
 Checked by

**CLAGUE ARCHITECTS**

62 Burgate, Canterbury  
 Kent CT1 2BH 01227 762060  
 1 Kinsbourne Court, Luton Road,  
 Harpenden, Hertfordshire AL5 3BL 01582 765102  
 4th Floor, 99 Charterhouse Street  
 London EC1M 6HR 0203 597 6112

CANTERBURY LONDON HARPENDEN

Drawing Number Revision

**22968A / 03**

## Proposed New Sports Facility

## **Appendix B**

Geotechnical & Environmental Associated Ltd, Ground Investigation Letter Report,  
J09020a/ML/1, October 2009.

20 October 2009



Our ref J09020a/ML/1

Tyttenhanger House  
Coursers Road  
St Albans  
AL4 0PG

Mr Joylon Antill  
Colin Toms and Partners  
Suffolk House  
54 High Street  
Sevenoaks  
Kent  
TN13 1XE

tel 01727 824666  
fax 01727 824777  
email mail@gea-ltd.co.uk  
web www.gea-ltd.co.uk

Dear Mr Antill

**Re: QUEENSWOOD SCHOOL, SHEPHERD'S WAY, HATFIELD, HERTFORDSHIRE**

Further to your instruction, on behalf of Queenswood School, we have now completed the ground investigation at the above site and this letter comprises our report on our findings. Copies of the borehole records and results of the geotechnical testing are enclosed, together with a site plan indicating the borehole locations. Contamination testing did not form part of the project brief, although a desk study of the site has been previously carried out by GEA (Report ref: J09020, dated February 2009) and is referred to where appropriate.

The conclusions and recommendations made in this letter are limited to those that can be made on the basis of the investigation. The results of the work should be viewed in the context of the range of data sources consulted, the number of locations where the ground was sampled and the number of soil samples tested; no liability can be accepted for information in other data sources or conditions not revealed by the sampling or testing. Any comments made on the basis of information obtained from the client or other third parties are given in good faith on the assumption that the information is accurate; no independent validation of such information has been made by GEA.

### **1.0 Purpose of Work**

Consideration is being given to the demolition of the existing sports hall and the subsequent construction of a new sports hall with the view of reusing the existing ground floor slab in the new development.

The principal technical objectives of the work carried out were as follows;

- to determine the ground conditions and their engineering properties;
- to assess the thickness and condition of the existing ground floor slab; and
- to provide information to assist with the reuse of the existing slab and the design of spread foundations.

### **1.1 Scope of Work**

In order to meet the above objectives a ground investigation was carried out which included four opendrive sampler boreholes, advanced using a Terrier rig to a maximum depth of 3.0 m, and four dynamic probes also advanced to a maximum depth of 3.0 m. The fieldwork was

carried out under the supervision of a geotechnical engineer from GEA. Two of the dynamic probes were located in the position of two of the boreholes and were advanced prior to boreholes. Standard penetration tests (SPTs) were carried out at regular intervals in two of the boreholes and disturbed samples were recovered for subsequent laboratory examination and geotechnical testing.

The borehole and dynamic probe locations were selected by GEA in accessible areas to obtain suitable coverage of the site with due regard to the proposed development whilst avoiding buried services.

## 1.2 Site Description

The site forms part of Queenswood School, which is located to the north of Potters Bar in Hertfordshire, approximately 2.5 km east of Brookmans Park railway station. It may be additionally located by National Grid Reference 526770,203393.

The site is located in the northern part of the school campus, which as a whole comprises approximately a dozen buildings arranged over an area of approximately 0.5 km<sup>2</sup>, and includes access roads, hardstanding for car parking, areas of soft landscaping and scattered woodland. The site itself is essentially level and roughly rectangular in shape, measuring approximately 60 m by 50 m, and is occupied by a 30 m by 30 m indoor tennis centre with an asbestos roof. Two temporary portacabins, used as classrooms, are located along the southern boundary of the site, whilst a row of two-storey terraced houses with private gardens is situated beyond the northern boundary. Woodland areas occupy the other boundaries and these, in addition to all the boundaries, are densely vegetated with small shrubs and bushes, which include rhododendron. Abundant deciduous trees, including oak, beech, chestnut and silver birch, also occupy the boundaries and reach heights of up to 20 m.

## 1.3 Summary of Previous Desk Study

A search of historical records showed that at the time of the earliest map studied, dated 1866, the site was undeveloped and formed part of Leggatts Wood. Shepherds Way, at this time called Sheephouse Hill, was present to the north and a collection of small buildings, denoted as Leggatts Farm, were located approximately 500 m to the southeast of the site. By 1934 Queenswood School had been constructed, although the site itself remained undeveloped until some time between 1954 and 1969 when a small building was constructed in the central eastern part of the site, along with what appears to be the existing portacabin units along the southern boundary. The small building was demolished and the existing building constructed on site by 1993. By this time the school as whole was much as it is seen today although it is understood that several structural changes and a few buildings, including the row of three terraced houses to the north of site, have been constructed in recent years.

As part of the previous desk study a search of public registers and databases was made via the GroundSure database and the information detailed in the report indicated that no reported pollution incidents had taken place nor are any waste transfer, waste management, waste disposal or landfill sites located within 1 km of the site. The desk study therefore concluded that the site has a low risk of contamination.

## 2.0 Ground Conditions

The Geological Survey map of the area (BGS sheet 239) indicates that the site is underlain by Pebble Gravel overlying the London Clay Formation. This was generally confirmed by the ground investigation in that, beneath the concrete slab and a moderate thickness of made ground, Pebble Gravel was encountered and proved to the maximum depth investigated, of 3.0 m.

The concrete slab was found to be between 140 mm and 160 mm in thickness with nominal 10 mm reinforcement throughout. Below the slab the made ground generally consisted of dark brown silty sand with gravel, brick and concrete rubble and extended to depths of between 0.5 m and 1.0 m.

The underlying Pebble Gravel initially comprised firm orange-brown silty very sandy clay with partings of grey silt, fine to coarse rounded to subangular gravel and rootlets, which extended to depths of between 1.0 m and 2.0 m. Below the clay, medium dense orange-brown mottled grey very clayey silty medium to coarse sand with fine to coarse rounded to angular gravel was encountered and extended to depths of between 2.6 m and 3.0 m, whereupon, in three of the boreholes, very dense pale grey or orange-brown slightly clayey silty medium to coarse sand and fine to coarse subrounded to angular gravel was encountered and extended to the maximum depth investigated of 3.0 m. The depth of the investigation was limited by the density of the sand and gravel.

The clay in Borehole Nos 1 and 4 was noted to be stiff between 1.2 m and 2.0 m and 1.0 m and 1.5 m respectively. Both boreholes were advanced in close proximity of several mature oak and chestnut trees and are thought to be partially desiccated, which has been generally confirmed in the results of the geotechnical testing. Laboratory testing has also indicated that the clay is of high volume change potential.

No visual or olfactory evidence of contamination was observed in the made ground or natural soils during the investigation and contamination testing is not proposed at this stage.

Ground water was not encountered during the investigation.

### **3.0 Discussion**

Following the demolition of the existing building, it is proposed to redevelop the site by the construction of a new sports hall, which is to include the reuse of the existing ground floor slab.

#### **3.1 Spread Foundations**

Moderate width pad or strip foundations bearing on the firm sandy clay of the Pebble Gravel should be placed at a minimum depth of 1.0 m, assuming that restrictions are applied on the planting of shrubs in the vicinity of foundations, or at a depth of 1.5 m if there is unrestricted planting of shrubs in the new development, subject also to the further restrictions on new tree planting as detailed in the NHBC guidelines. Foundations at these depths may be designed to apply a net allowable bearing pressure of 120 kN/m<sup>2</sup>. This value includes an adequate factor of safety to protect against bearing capacity failure and should ensure that settlement remains within normal tolerable limits. Any foundations that span cohesive and granular soils should be nominally reinforced to protect against differential settlement.

Foundations will need to be deepened in the vicinity of existing and proposed trees in accordance with National House Building Council (NHBC) guidelines. High shrinkability clays should be assumed. Where trees are to be removed the required founding depth should be determined on the basis of the existing tree height if it is less than 50% of the mature height and on the basis of full mature height if the current height is more than 50% of the mature height. Where a tree is to be retained the final mature height should be adopted, with due allowance being made for future growth of the trees. The requirement for compressible material alongside foundations should be determined by reference to the NHBC guidelines.

Partial desiccation of the clay soils has been encountered to a depth of 2.0 m in close vicinity of several trees including oak and chestnut. However, given the close proximity of the trees to the existing building, and therefore the proposed development, it is likely that spread

foundations will need to extend to a depth greater than 2.5 m, based on NHBC guidelines. In any case all foundations should extend beyond the zone of desiccation and therefore it would therefore be prudent to have all foundation excavations inspected by a suitably experienced engineer. The required founding depth may make the use of spread foundations uneconomical and therefore a piled foundation solution may be the most appropriate foundation solution, although this should be reviewed once the proposals have been finalised. Additional investigation would be required to provide parameters for the design of piles.

### 3.2 **Ground Floor Slab**

Given the condition of the existing ground floor slab and the underlying ground conditions, it should be possible to reuse the existing slab in the development of the new sports hall, assuming that the proposed loading does not exceed the existing load. However, consideration will need to be given to the effects of the trees on the clay below the slab. Under current NHBC guidelines, ground floor slabs over clay soils in close proximity to trees should be suspended over a void. As the existing slab is ground bearing there is a risk of settlement as the trees continue to grow, although the provision of new and deeper spread foundations may restrict root penetration below the slab. The clay has been noted as partially desiccated and therefore consideration should be given to pollarding the surrounding trees in order to prevent further desiccation, or to the provision of a root barrier or an irrigated gravel-filled trench around the building to restrict root penetration.

### 3.3 **Excavations**

Accurate assessment of the likely ease and stability of excavations is not readily available from the investigation techniques used; however on the basis of the borehole findings it is considered that shallow excavations for foundations and services that extend through the made ground and into the Pebble Gravel are likely to remain relatively stable in the short term. Deeper unsupported excavations are however unlikely to remain stable. Where personnel are required to enter excavations, a risk assessment should be carried out and temporary lateral support or battering of the excavation sides considered in order to comply with normal safety requirements.

Inflows of ground water into shallow excavations are not generally anticipated; however areas of perched water may be encountered particularly in the vicinity of existing foundations. This should be readily dealt with using sump pumping.

### 3.4 **Effects of Sulphates**

Chemical analyses of selected soil samples have revealed moderate concentrations of soluble sulphate, corresponding to Class DS-1 and neutral pH conditions corresponding to AC-1s of Table C2 of BRE Special Digest 1:2005. The guidelines contained in the above digest should be followed in the design of any new foundation concrete.

We trust that this information is sufficient for your present requirements, but, please do not hesitate to contact us if we can be of any further assistance.

Yours sincerely  
GEOTECHNICAL & ENVIRONMENTAL ASSOCIATES



Matthew Legg

*Encs*



Geotechnical & Environmental Associates

Tythenhanger House  
Coursers Road  
St Albans  
AL4 0PG

Site  
Queenswood School, Shepherd's Way, Hatfield,  
Hertfordshire

Number  
**BH1**

Excavation Method Opendrive Percussive Sampler	Dimensions	Ground Level (mOD)	Client Queenswood School	Job Number J09020a
	Location	Dates 21/08/2009	Engineer Colin Toms and Partners	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30	D1				(0.20) 0.20	Concrete slab with 10 mm reinforcement over coarse sand		
					(0.50)	Made Ground (dark brown silty sand with gravel, brick and concrete rubble)		
0.80	D2				0.70 (0.30)	Made Ground (orange-brown mottled grey silty sandy clay with gravel, roots and brick fragments)		
1.10	D3				1.00 (0.20)	Firm orange-brown silty sandy CLAY with partings of grey silt, fine to coarse rounded to subangular gravel and roots		
1.30	D4				1.20			
1.60	D5				(0.80)	'Stiff' orange-brown mottled grey silty sandy CLAY with partings of bluish grey silt, occasional fine to coarse rounded to subangular gravel, roots and reddish brown iron staining. Partially desiccated soil		
1.90	D7				2.00			
1.90	D6				(0.40)	Orange-brown mottled grey very clayey silty medium to coarse SAND with fine to medium angular gravel		
2.10	D8				(0.20)	Orange-brown mottled reddish brown slightly clayey silty coarse SAND		
2.70	D9				2.60 (0.25) 2.85	Orange-brown mottled grey slightly clayey silty medium to coarse SAND and fine to coarse subrounded to angular GRAVEL		
						Terminated at 3.00m		

Remarks Ground water not encountered. Borehole terminated due to the density of the sand and gravel.	Scale (approx)	Logged By
	1:50	ML
	Figure No. J09020a.BH1	



Geotechnical & Environmental Associates

Tytenhanger House  
Coursers Road  
St Albans  
AL4 0PG

Site

Queenswood School, Shepherd's Way, Hatfield, Hertfordshire

Number  
**BH2**

Excavation Method Opendrive Percussive Sampler	Dimensions	Ground Level (mOD)	Client Queenswood School	Job Number J09020a
	Location	Dates 21/08/2009	Engineer Colin Toms and Partners	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30	D1				(0.16)	Concrete slab with 10 mm reinforcement		
					0.16			
					(0.44)	Made Ground (orange-brown silty sand with brick and concrete rubble)		
					0.60			
0.70	D2					Firm orange-brown silty sandy CLAY with partings of grey silt, roots and occasional fine to medium angular gravel. Abundant partings of grey silt below 1.5 m		
1.00-1.45	SPT N=15	DRY	2,2/3,4,4,4		(1.40)			
1.30	D3							
1.60	D4							
2.00-2.45	SPT N=19	DRY	2,2/3,5,5,6		2.00			
2.10	D5				(0.40)	Medium dense grey mottled orange-brown very clayey silty medium to coarse SAND with occasional fine to medium rounded to subangular gravel and roots down to 2.2 m		
					2.40			
2.60	D6				(0.50)	Orange-brown becoming pale grey clayey silty initially medium becoming coarse SAND with fine to coarse rounded to subangular gravel		
3.00-3.45	CPT N=39	DRY	6,7/8,10,10,11		2.90			
					(0.10)			
					3.00	Dense pale grey mottled orange-brown slightly clayey silty medium to coarse SAND and fine to coarse subrounded to angular gravel		
						Complete at 3.00m		

Remarks Ground water not encountered.	Scale (approx)	Logged By
	1:50	ML
	Figure No. J09020a.BH2	





Geotechnical & Environmental Associates

Tythenhanger House  
Coursers Road  
St Albans  
AL4 0PG

Site  
Queenswood School, Shepherd's Way, Hatfield,  
Hertfordshire

Number  
**BH3**

Excavation Method Opendrive Percussive Sampler	Dimensions	Ground Level (mOD)	Client Queenswood School	Job Number J09020a
	Location	Dates 21/08/2009	Engineer Colin Toms and Partners	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.80	D1				(0.15)	Concrete slab with 10 mm reinforcement		
1.00-1.45	SPT N=25	DRY	2,4/5,6,7,7		0.15	Made Ground (brown silty sand with brick rubble)		
1.10	D2				(0.35)	Firm orange-brown silty sandy CLAY with partings of grey silt with roots, reddish brown staining and occasional fine to medium angular gravel		
1.90	D4				0.50			
2.00-2.37	CPT 50/220	DRY	9,15/15,18,17		(0.50)	Dense becoming very dense orange-brown very clayey silty medium to coarse SAND with fine to coarse angular to subrounded gravel		
2.50	D3				1.00			
3.00-3.25	CPT 25*/110 50/135	DRY	15,10/27,23		(1.40)	Orange-brown slightly clayey medium to coarse SAND with fine to coarse subrounded to angular gravel		
					2.40			
					(0.60)			
					3.00	Terminated at 3.00m		

Remarks Ground water not encountered. Borehole terminated due to the density of the sand and gravel.	Scale (approx)	Logged By
	1:50	ML
	Figure No. J09020a.BH5	

<b>Excavation Method</b> Opendrive Percussive Sampler	<b>Dimensions</b>	<b>Ground Level (mOD)</b>	<b>Client</b> Queenswood School	<b>Job Number</b> J09020a
	<b>Location</b>	<b>Dates</b> 21/08/2009	<b>Engineer</b> Colin Toms and Partners	<b>Sheet</b> 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.40	D1				(0.14) 0.14 (0.06) 0.20 (0.30) 0.50	Concrete slab with 10 mm reinforcement Made Ground (reddish brown coarse sand fill) Made Ground (brown silty sand with brick rubble)		
0.90	D2				(0.50) 1.00	Soft becoming firm below 0.8 m orange-brown mottled grey silty sandy CLAY with partings of grey silt, roots with dark reddish brown staining and occasional fine to medium rounded to subangular gravel		
1.10	D3				(0.50)			
1.50	D4				1.50	Firm to 'stiff' orange-brown mottled grey silty very sandy CLAY with roots and fine to coarse rounded to subangular gravel. Partially desiccated soil		
1.80	D5							
2.20	D6				(1.00)	Orange-brown mottled grey very clayey silty medium to coarse SAND with fine to coarse rounded to angular gravel		
2.80	D7				2.50 (0.20) 2.70 (0.30) 3.00	Pale grey mottled orange-brown slightly clayey medium to coarse SAND Pale grey slightly clayey medium to coarse SAND and fine to coarse subrounded to angular GRAVEL		
						Terminated at 3.00m		

<b>Remarks</b> Ground water not encountered. Borehole terminated due to the density of the sand and gravel.	<b>Scale (approx)</b>	<b>Logged By</b>
	1:50	ML
	<b>Figure No.</b> J09020a.BH3	



**Geotechnical & Environmental Associates**

Tytenhanger House  
Coursers Road  
St Albans  
AL4 0PG

**Site**  
Queenswood School, Shepherd's Way, Hatfield,  
Hertfordshire

**Probe Number**  
**DP1**

**Method**  
Opendriller Percussive  
Sampler (Terrier rig)

**Cone Dimensions**

**Ground Level (mOD)**

**Client**

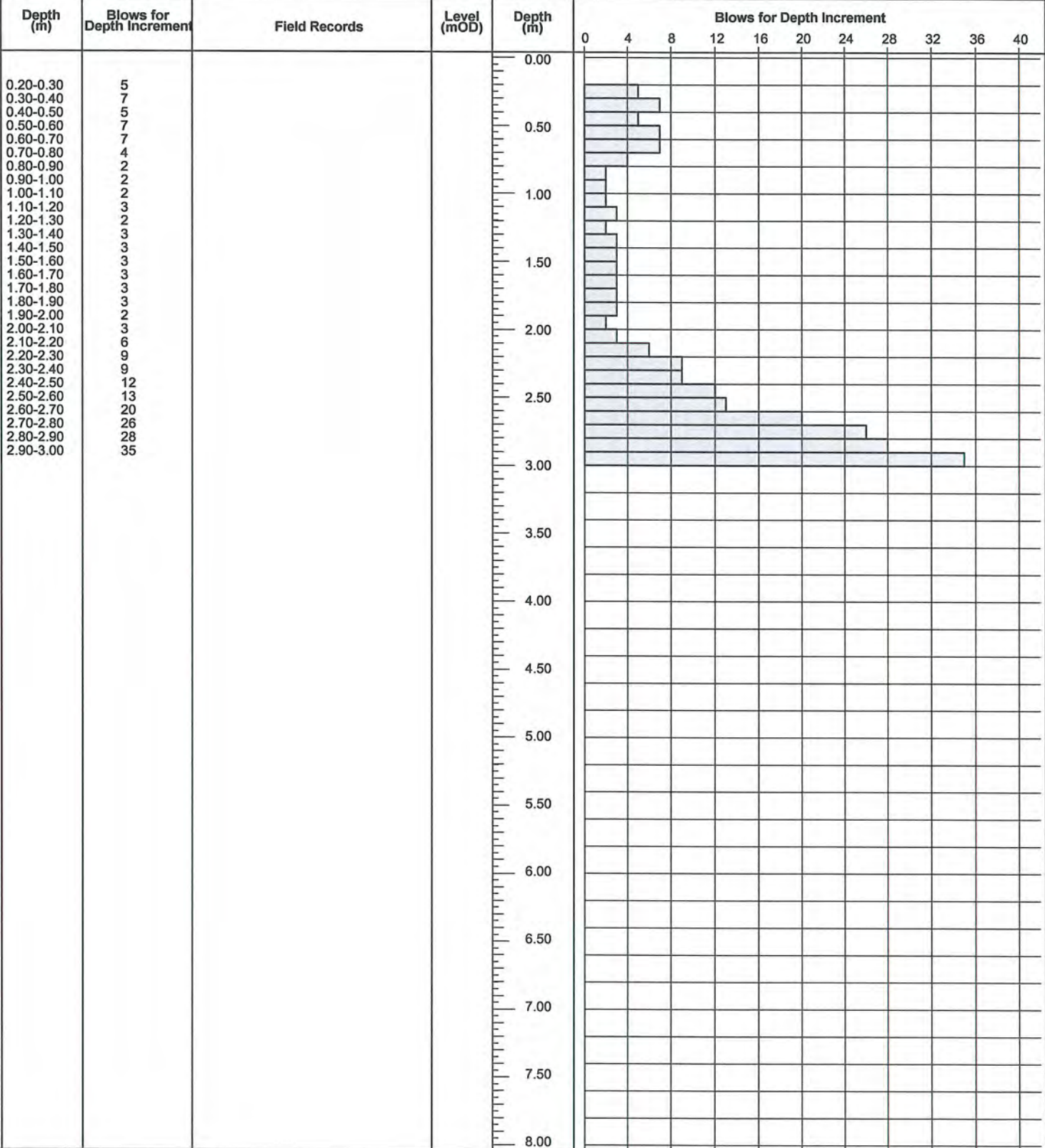
**Job Number**  
J09020a

**Location**

**Dates**

**Engineer**

**Sheet**  
1/1



**Remarks**

<b>Scale (approx)</b>	<b>Logged By</b>
1:40	ML

<b>Figure No.</b> J09020a.DP1
----------------------------------



Geotechnical & Environmental Associates

Tyttenhanger House  
Coursers Road  
St Albans  
AL4 0PG

Site  
Queenswood School, Shepherd's Way, Hatfield,  
Hertfordshire

Probe Number  
**DP2**

Method  
Opendriller Percussive  
Sampler (Terrier rig)

Cone Dimensions

Ground Level (mOD)

Client

Job Number  
J09020a

Location

Dates

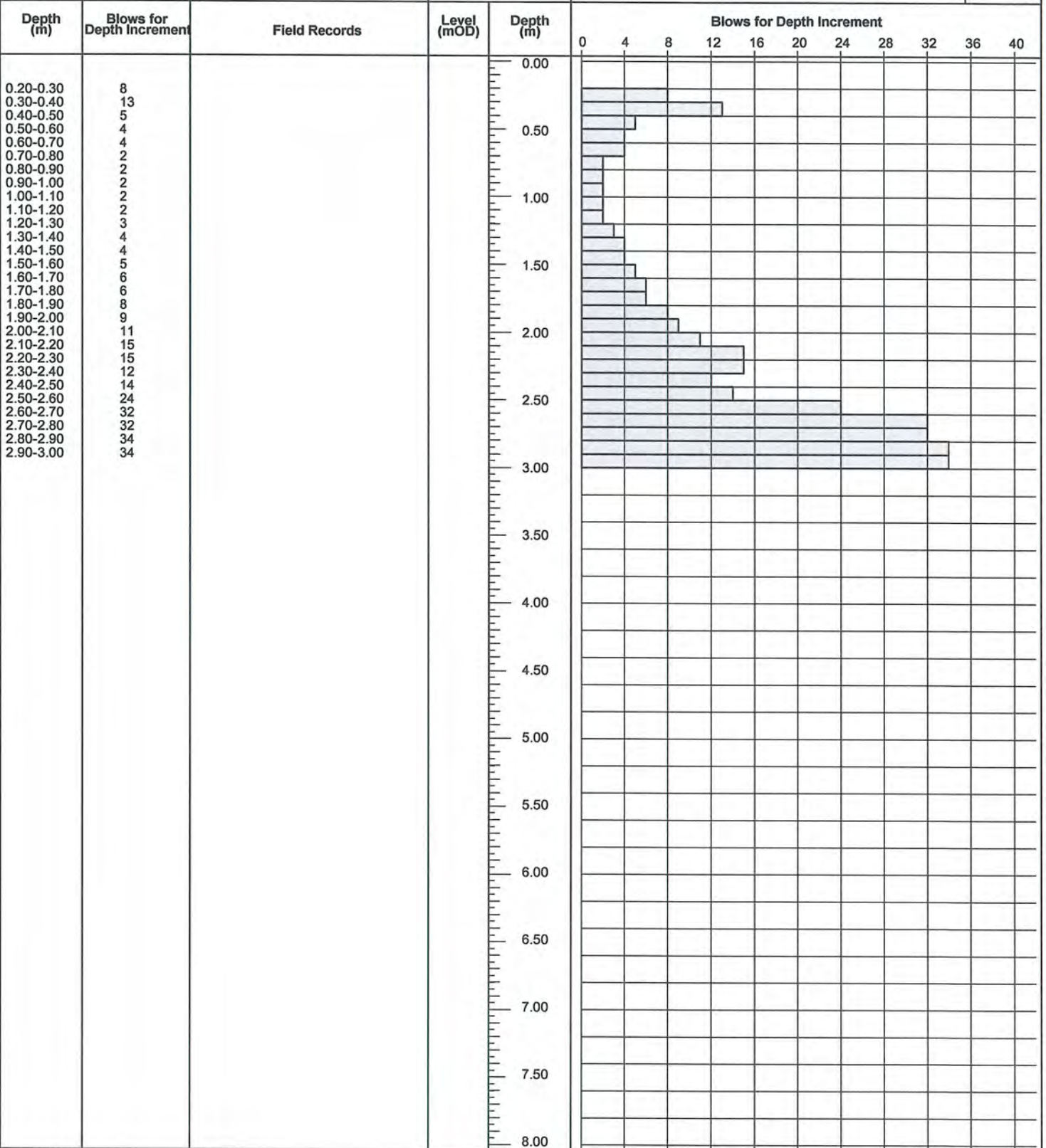
Engineer

Sheet  
1/1

Queenswood School

21/08/2009

Colin Toms and Partners



Remarks

Scale (approx)	Logged By
1:40	ML
Figure No.	
J09020a.DP2	