**YOLLES PARTNERSHIP LTD** 

**REGENT'S PLACE** 

**GEOTECHNICAL DESK STUDY** REPORT

June 2005

Version 1

### Regent's Place: geotechnical desk study

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**REGENT'S PLACE** 

## **GEOTECHNICAL DESK STUDY REPORT**

### Version 1

2

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Regent's Place: geotechnical desk study

## YOLLES PARTNERSHIP LTD

### **REGENT'S PLACE**

## **GEOTECHNICAL DESK STUDY REPORT**

### Version 1

## 1 INTRODUCTION

This desk study has been prepared for Yolles Partnership Ltd in connection with the proposed redevelopment of a site located at Regents Place, London NW1 ("the Site").

It is proposed to demolish the existing buildings and redevelop the site with residential and commercial facilities.

This report collects general topographical, geological and historical information for the Site from a number of sources, makes recommendations for future site investigation work and discusses geotechnical issues related to the proposed works.

This report has been prepared by the Geotechnical Consulting Group (GCG) for Yolles Partnership Ltd (Yolles) in connection with the redevelopment of the Site taking into account particular instructions and requirements. It is not intended for, and should not be relied upon by, any third party

### 2 THE SITE

### 2.1 Location

The site located in the London Borough of Camden at National Grid Reference TQ 291 824 as shown in Figure 1. The site is known as Regent's Place and comprises an area to the south of Drummond Street, west of Hampstead Road, east of Brook Street and north of Regent's Place as indicated in Figure 2. The Euston Tower is immediately south of the site.

The site is broadly rectangular, being around 120m east to west and 70m north to south.

### 2.2 Topography

The external ground is generally level; Ordnance Survey maps of the area indicate that the ground level in the vicinity of the site is around +27m to +28m above Ordnance Datum (mOD).

### 2.3 Present use

In general, the existing buildings on the site comprise educational and commercial premises.

The existing buildings on the site were generally constructed in the 1970s or early 1980s.

## 2.4 Proposed redevelopment

It is proposed to demolish the existing buildings on the site and to construct a new mixed-use development in its place, comprising residential, retail and commercial premises.

Current proposals suggest several new buildings will form the development. The new buildings are likely to be of up to around 22 above-ground storeys and include one or two levels of basement.

## 2.5 Neighbouring structures

The Euston Tower is immediately to the south of the site, while to the west there are new developments.

## 2.6 Nearby tunnels and deep services

London Underground Ltd (LUL)'s Northern Line tunnels run along Hampstead Road before veering east towards Euston Station with the result that they could be within

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around 10m in plan from the extent of the site. LUL's tunnel locations are indicated in Figure 3, while their response to a preliminary query is included in Appendix A.

British Telecom have confirmed that have no assets in the vicinity of the site that are likely to be affected by the development (see Appendix A). A response is awaited from Defence Estates.

## 2.7 Unexploded ordnance (UXO)

There is a risk in London of UXO occurring on sites being redeveloped, due to the city being bombed during World War 2, and to a lesser degree World War 1. However the construction of the basements for the buildings currently occupying the Site is likely to have removed the zone of soil with potential for containing unexploded ordnance. It can therefore be concluded that the risk of unexploded ordnance being present at the site is low.

### **3 SITE HISTORY**

### 3.1 Historic maps

Historical maps of the site have been obtained and examined covering a period from 1827 to 1999. Copies of a selection of these maps are included in Appendix A.

The earliest map examined, by Greenwood in 1827, shows the Site to be built, but it is not possible to infer the nature of the constructions from the map.

The Ordnance Survey County Series map of 1876 shows the Site to be occupied by a large number of residential buildings. Similarly, areas around the Site, such as Triton Square and Euston Centre, comprised mainly small residential buildings. At that time also, the Site was bounded by streets which have disappeared in the later development of the area, or were renamed at a later stage.

The Ordnance Survey County Series maps of 1896 and 1916 do not record any significant change since 1876.

The scale of the Ordnance Survey Plans of 1920, 1938 and 1951 is too small for any details to be noted, however the general layout of the site does not appear to have changed.

The Ordnance Survey Plan of 1953 indicates that a few small businesses have been established in the area of the Site, including a garage and upholstery and joinery works. Also, some of the small residential buildings have been aggregated to form larger buildings.

The scale of the Ordnance Survey Plans of 1957 and 1968 is too small for any details to be noted, however by 1968 it appears that the area to the south of the Site has been rid of buildings, in preparation for the later construction of Euston Tower.

The Ordnance Survey Plan of 1969 now shows the area of the Site to have been completely transformed. All the existing buildings have been demolished and to the south Euston Tower has been constructed.

The Ordnance Survey Plan of 1970 shows that a few buildings have been constructed within the area of the Site in the vicinity of Euston Tower, such as Beatty House.

The Ordnance Survey Plans of 1973 and 1974 do not show any significant change to the layout of the area of the Site.

The Ordnance Survey Plan of 1977 shows an additional building constructed in the northern part of the Site, which is then designated on the Ordnance Survey Plan of 1982 as the Polytechnic of Central London Language School.

No further significant change was noted on the later Ordnance Survey Plans of 1987, 1991, 1993 and 1999.

A selection of historical maps are included in Appendix B.

### 3.2 Air photos

Air photos of the site dating from 1946, 1948, 1955, 1971 and 1991 have been obtained from the National Monuments Record. There are no indications of bomb or other damage on the earlier photographs. The layout of buildings on the site indicated by the photographs is consistent with the information from the maps described above.

### **GEOLOGY AND GROUND CONDITIONS** 4

### 4.1 **Geological maps**

The 1: 10,000 and 1:50,000 scale geological maps of the area (BGS, 1994) were examined. They show the site to be underlain by River Terrace Deposits (Lynch Hill Gravel), overlying London Clay. 'Brickearth' (Langley Silt) is recorded on these maps approximately 150m north-west of the Site and is unlikely to extend as far as the Site.

From the computer-generated contours of the base of London Clay supplied with the 1:50,000 geological map, it appears that the bottom of the London Clay horizon lies at an elevation of between -5m OD and 0m OD.

There is no published information or indication on the maps about faults, drift-filled ("scour") hollows or other notable geological features in the vicinity of the site.

### 4.2 Existing ground investigation information

### 4.2.1 Sequence of strata

The British Geological Survey (BGS) register of historical borehole logs was consulted and selected logs from boreholes found to be in the vicinity of the Site and of potential interest were obtained. Figure 4 shows the location of the BGS boreholes. Information from these boreholes is summarised below:

Stratum	Description	Approximate thickness (m)	Approximate level of top of stratum (mOD)
Made Ground	Variable ground including: brick, clay, gravel	1.2 to 3.05	26 to 29
River Terrace Deposits	e Very dense coarse gravely sand	3.05 to 4.8	23.5 to 27.8
London Clay	Firm, becoming stiff to very stiff dark grey silty clay, with occasional partings of fine sand	15 to 18.35 <sup>(1)</sup>	18.5 to 22.5
Lambeth Grou	very stiff fissured mottled grey and brown silty sandy clay	9.75 <sup>(2)</sup>	0 to 6.5
Thanet Sand		9.15 (2)	
Note 1: ti Note 2: ti	hickness of London Clay recorded in thicknesses of Lambeth Group and T nly	oorehole TQ28SE hanet Sand are fro	15 is 30.5m om borehole TQ28SE15

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Geotechnical Consulting Group

This is generally consistent with the inferred geology of the site and with the results of investigations carried out for the adjacent site (Regent's Place/ Triton Square). However, while the level of the top of the London Clay is relatively consistent, there is significant variation in the level of the top of the Lambeth Group in these investigations. Similarly, the results are relatively consistent with the ground conditions encountered at the University College Hospital (UCH) site, though again the level of the top of the Lambeth Group varied. LUL's geological long section along the line of the Northern Line in the vicinity of the site also indicate significant local variation in the level of the top of the top of the Lambeth Group.

From these investigations, it is suggested that the following stratigraphy could be assumed for preliminary design, noting that there may be significant variation in the level of the top of the Lambeth Group on the site:

Stratum	Approximate thickness (m)	Approximate level of top of stratum (mOD)
Made Ground	3	+28
River Terrace Deposits	4	+25
London Clay	22	+21
Lambeth Group	16	-1
Thanet Sand	5	-16
Chalk	200	-23

## 4.2.2 Soil strength information

No strength information is available from the BGS borehole logs. However, for the London Clay, a report by Arup (2000) on the Triton Street boreholes suggests a design line of  $c_u = 75 + 6.4z$ , where z is the depth below the top of the London Clay. This is considered to be a reasonable value for preliminary design purposes.

A value of  $\varphi' = 35^{\circ}$  for the River Terrace Deposits is suggested for preliminary design.

## 4.3 Groundwater

Groundwater was recorded in two of the BGS boreholes examined, and its elevation was at approximately +21m OD, which broadly corresponds to the bottom of the River Terrace Deposits. In the Triton Square investigations, some boreholes encountered water in the River Terrace Deposits, at levels of up to around +23mOD, while some boreholes found the River Terrace Deposits to be dry.

At the UCH site, the River Terrace Deposits were found to be generally dry, though water was found to accumulate locally in depressions in the clay surface or due to leakage from services Water pressures in the London Clay and Lambeth Group strata are likely to be underdrained, as a result of historic pumping from the underlying chalk aquifer Simpson et al (1989). Reports by the Environment Agency (Environment Agency, 2004) give levels and rates of rise of the groundwater level in the Chalk/basal sands aquifer under London as a result of the reduction in rates of pumping from the aquifer in the mid-1960s. Interpolating from contour plots in these reports would suggest that, at January 2002, the water level in the lower aquifer was at about -37 to -38 mOD and dropping at around 0.5 to 1.0 m/year. There is pumping in progress as part of the GARDIT (General Aquifer Research, Development and Investigation Team) strategy to control groundwater levels. It is unclear how the water level will vary in the future

### Regent's Place: geotechnical desk study

### 5 DISCUSSION OF GEOTECHNICAL ISSUES

### 5.1 **Foundation options**

Given the size of the proposed buildings, it is likely that pile foundations will be required to limit total settlement of the taller buildings and to reduce differential movements between the taller buildings and the areas where there is a basement but no significant superstructure. However, there may be some buildings which could be supported by a raft or spread foundations.

It would appear that the existing buildings on the site are on spread foundations; therefore new piling would not be obstructed by existing piles.

Straight-shafted auger bored or continuous flight auger piles within the London Clay are likely to form the most economic solution, though these could be extended into the Lambeth Group or, possibly, the Thanet Sand if higher capacities were required. Preliminary pile design charts have been supplied to Yolles, who are investigating possible pile arrangements.

Towards the base of the London Clay, the basal beds tend to be a sandy clay or clayey sand. Depending on the groundwater regime, it may be advisable to avoid terminating the piles in this material or close to the London Clay/ Lambeth Group interface. As discussed above, there is the possibility of significant variation in the level of this interface; it may therefore be necessary to extend the piles into the Lambeth Group or Thanet Sand.

Suitable support to the excavation for the basement will be strongly dependent on the groundwater conditions in the upper aquifer. If the groundwater level is as high as is indicated in some of the Triton Square boreholes, it is likely that some form of cut-off (eg sheet pile or secant pile wall) will be required to prevent significant water ingress into the deeper, two-level basement excavations. However, it may be that the shallower, single-level, basement excavations could be formed in the dry, though this would require careful ground investigation and observations to confirm water levels prior to construction.

The development is potentially close enough to the Northern Line tunnels that it will be necessary to liaise with LUL.

### 5.2 Ground investigation

The main geotechnical aims of the ground investigations are to:

- Determine the stratigraphic profile across the site. In particular, the level of the top of the Lambeth Group appears to vary significantly locally; this may be significant for bored piles
- Obtain geotechnical parameters for foundation and retaining wall designs.
- Locate and describe some potential obstructions in the ground remaining from previous uses of the site.

penetrate into or near these strata.

The depth of the boreholes will be dictated by the foundation loading and proposed foundation solution. Cable percussive, or possibly rotary, boreholes to a depth of up to around 50m may be required. These should obtain U100 samples to assess the strength and compressibility properties of the London Clay and Lambeth Group, backed up by in-situ SPT tests. Similarly, SPT tests in, and laboratory tests on samples obtained from, the granular strata should provide information for retaining wall design.

The nature of the ground investigation can be better decided when the likely foundation solution is known. However, given the extent of the site, it is suggested that five boreholes spread over the footprint of the site should be considered. Standpipes installed in these boreholes will provide information on groundwater levels within the upper granular strata. Piezometers should be installed where water strikes are noted in granular facies within the Lambeth Group or within the Thanet Sand. This assumes that factual ground investigation information from the adjoining sites that form part of the Regent's Place development are made available.

• Determine the groundwater conditions in the granular strata. This will be particularly important in the River Terrace Deposits and may be significant in the Lambeth Group and Thanet Sand, if it is likely that piling will need to

## 6 SUMMARY

It is proposed to redevelop the site known as Regent's Place, comprising an area bounded by Drummond Street to the north, Hampstead Road to the east, Brook Street to the west and Regent's Place/Euston Tower to the south. The existing buildings on the site are to be demolished and a new mixed-use development built in its place, comprising residential retail and commercial premises.

LUL Northern Line tunnels run adjacent to the site.

The likely stratigraphy on the site is Made Ground / River Terrace Deposits / London Clay / Lambeth Group / Thanet Sand / Chalk. The thickness of the Made Ground is uncertain. The top of the London Clay is likely to be at a level of around +21mOD, while the top of the Lambeth Group is likely to be at around -1mOD. The level of the top of the Lambeth Group appears to vary significantly locally Groundwater level in the upper aquifer is likely to be close to the top of the London Clay; boreholes from an adjacent site suggest that the water level could be as high as +23mOD.

## 7 **REFERENCES**

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Simpson, B, Blower, T, Craig, R N & Wilkinson, W B. 1989. The engineering implications of rising groundwater levels in the deep aquifer beneath London. CIRIA Special Publication 69. London: CIRIA.

FIGURES



GEOTECHNICAL CONSULTING GROUP	Project: Regents Place
	Client: Yolles Partnership Ltd



Site location

Figure 1







APPENDIX A

Correspondence

# **BT** wholesale

Mike Crilly GEOTECHNICAL CONSULTING GROUP 1A Oueensberry Place London SW7 2DL



June 13, 2005

Your Ref: - 2191/25

Dear Mr Crilly

### **Regents Place**, London NW1 RE:

Thank you for your letter dated 25th May 2005 and accompanying site plans.

I can confirm that BT does not operate Deep Level Tunnels within the areas as indicated on your plans.

I have forwarded a copy of your letter and map to our BT National Notice Handling Centre formerly called Street Works Liaison Group (SWAMP) to provide details of other BT plant.

Should you require any further information with respect to deep level plant please do not hesitate to contact us.

### PLEASE NOTE OUR NEW CONTACT DETAILS BELOW

Yours faithful

BARRIE CORFIELD National Deep Level Tunnel Control & Heavy Civils Manager

# RECORDED

PPG05 Colombo House 50-60 Blackfriars Road London SE1 8NZ

tel 020 7803 5081 fax 020 7261 9072 mob 07850735665

e-mail barrie.corfield@bt.com

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## Transport for London London Underground

Department Infrastructure Protection Telephone 020 7027 9549 Fax 020 7027 9606 Reference 20403/RTEB/N098 Your Reference 2191/25 Date 3 June 2005

> Mr M Crilly Geotechnical Consulting Group Ltd 1A Queensberry Place London SW7 2DL

Dear Mr Crilly,

### Regent's Place, 15-31 Hampstead Road, NW1

Thank you for your letter of 25 May.

I enclose a 1:1250 plan indicating the route and tunnel crown levels of the Northern Line tunnels in relation to this property although I must emphasise that this plan is indicative only and should not be used for design purposes.

There are a number of potential constraints on the redevelopment of a site that is situated close to Underground tunnels and infrastructure. The developer needs to demonstrate to the satisfaction of LUL engineers that the development will not have any detrimental effect on the tunnels either in the short or long term and the design must be such that the loading imposed upon the tunnel structure is not increased or removed. Boreholes and bored piling over or immediately adjacent to the tunnels must not be undertaken until details have been submitted to, and written approval obtained from, London Underground Ltd. Driven piles will not be permitted in the vicinity of LUL tunnels or other subsurface structures. Before any work (including demolition and ground investigation) starts on site, therefore, LUL engineers will need to see full details of your proposals, including the proposed foundation arrangement and loadings, so that the safety of the railway can be assured.

Yours sincerely,

**RTEBox** Information Manager

MAYOR OF LONDON



London Underground Chief Engineer's Directorate

84 Eccleston Square London SW1v 1PX

Phone 020 7222 5600 www.tfl.gov.uk/tube

# RECORDED

I ondon Underground Limited trading as London Underground whose registered office is 55 broadviay London SWIH OBD.

Registered in England and Wales, Company number 1900967

London Underground Limited is a company controlled by a local authority within the meaning of Parc V Local Government and Housing Act 1989. The controlling authority is Transport for London





Historic maps

**APPENDIX B** 

















Project No. L03037

Site Investigation

### SCOPE

Geotechnical & Environmental Associates (GEA) excavated 2No trial pits within the area of the proposed basement loading bay in May 2004.

Investigation brief was:-

- Trial pit within existing basement area
- Expose clay sub-strata.
- Assess ground water level
- Assess ground water inflow rates Assess stability of excavated soil face.

### RESULTS

For the 2 trial pit locations, the attached documents by GEA, confirm:-

- Sub soil types.
- Groundwater levels

Clay was encountered at OD 22.4m, a shallower depth than anticipated from records of boreholes elsewhere on the Regents Place site (OD 20.9m at BH11 and BH12). The clay exposed was firm and stiff.

Excavated soil faces were initially stable for the pit depths of upto 1.8m.

Groundwater was only encountered in TP1 at the top surface of the clay. Both pits were left open overnight and it was only in pit TP 1 that any water was recorded. Water inflow rate was small, less than one bucket full after 14 hours (overnight).

### SUMMARY

Clay subsoil exposed was firm and stiff, as expected from previous site investigations in the area; therefore foundations to be designed for a safe bearing pressure of 200 kPa (unfactored).

Excavated faces were initially stable for depths of 1.4 - 1.8m; temporary works to be designed accordingly.

Water was encountered at the top surface of the clay and ingress to the excavations was minimal; therefore probable that the water recorded in previous boreholes was the result of pools held in depressions in the clay. The conclusion is that generally there are no significant water flows across the site and that the volume of water likely to be encountered during the proposed basement excavation could be handled by local sump pumps.

YOLLES

REGENTS PLACE **BASEMENT LOADING BAY** 

SITE INVESTIGATION TRIAL PITS : MAY 2004

Client: **British Land** 

Structural Consultants: YOLLES PARTNERSHIP LIMITED Tabard House, 116 Southwark Street, London, SE1 0TA 020-7593-0098 Tel: 020-7593-0087 Fax:

Date	Revision	Status: Issued For
09-07-04	00	Information

Regents Place Project: Document: Drainage CCTV

## Project No. L03037

Site Investigation



Project No. L03037

Site Investigation

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Document: Drainage CCTV

Date:

09-07-04

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Project: Regents Place Document: Drainage CCTV

## Page 4

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	Remarks Seepage of ground wat Sides of trial pit remains collapse thereafter	er encountered at 1.6 m ed stable for approximately -	4 hours with partial

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## Project No. L03037

Site Investigation

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