Appendix C:

Groundwater Basement Impact Assessment

By

Chord Environmental Ltd.

Ref. Report No. 1131/R1

77-79 Charlotte Street

Groundwater Basement Impact Assessment

77-79 Charlotte Street
London
W1T 4PW

Site NGR: TQ 293 817

Prepared for:

Charlotte Street Property Ltd

Chord Environmental Ltd

Report no. 1132/R1

January 2015

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77-79 Charlotte Street
Groundwater Basement Impact Assessment

Site Address

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Document Control Sheet

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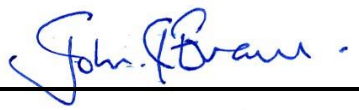
Prepared by:	John Evans MSc FGS CGeol	

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1 Introduction

1.1 Background

Charlotte Street Property Ltd is applying for Planning Consent to redevelop the site at 77-79 Charlotte Street, Fitzrovia, London. No 77-79 Charlotte Street is a five storey building with a single basement and light-well fronting onto Charlotte Street.

It is proposed to demolish the existing property and redevelop the site with the erection of a new six storey building with a double level basement (the Site). The proposed basement would involve excavation up to approximately 5.5m below existing basement levels.

Chord Environmental has been commissioned by MLM consulting engineers on behalf of Charlotte Street Property Ltd, to prepare a groundwater Basement Impact Assessment for the proposed development.

1.2 Scope and Approach

This report reviews the proposed development at 77-79 Charlotte Street within the context of the conceptual understanding of its site setting which has been informed through both desk study and site investigation findings. The report would identify potential groundwater impacts the development may have. Appropriate mitigating measures can then be developed and adopted to avoid or minimise these affects where identified.

Site investigation works have been undertaken by Soils Ltd. The work comprised a detailed Ground Investigation[1], and this assessment should be read in conjunction with the Soils Ltd site investigation report.

This report is limited to the groundwater flow component of the Basement Impact Assessment, as specified by the London Borough of Camden Planning Guidance CPG4[2] and their Guidance for Subterranean Development[3] supporting technical document. The Author of this report is a qualified Hydrogeologist, Chartered Geologist and Fellow of the Geological Society of London, as required by the Guidance.

[1] Summary of Ground Investigation Preliminary Findings – 77-79 Charlotte Street, London W1T 4PW. Soils Ltd. January 2015.

[2] London Borough of Camden Planning Guidance CPG4 Basements and lightwells

[3] Camden Geological, Hydrogeological and Hydrological study - Guidance for Subterranean Development. Ove Arup & Partners Ltd., November 2010

1.3 Limitations

The conclusions and recommendations made in this report are limited to those that can be made on the basis of the site information obtained from the client or other third parties and the results of the work should be viewed in the context of the range of data sources consulted. No liability can be accepted for information in other data sources or conditions not revealed by the information provided. 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 Chord Environmental.

2 Proposed Development

The Site (London, W1T 4PW, National Grid Reference TQ 293 817) is currently occupied by 77 and 79 Charlotte Street. The existing properties are currently used as commercial spaces. The site is bounded by Charlotte Street to the northeast and Tottenham Mews to the southwest, and the properties of No 73 and 75 Charlotte Street to the southeast and No 81 Charlotte Street to the northwest.

The proposal is to demolish the existing properties on the Site and construct a new six storey building with a double level basement. The basement formation level would be approximately 7.5m below existing ground levels, 5.5m below the existing basement level. The building footprint is proposed to remain similar to existing and the basement area would extend beneath the entire building footprint.

Contiguous pile walls would be constructed adjacent to Charlotte Street and Tottenham Mews and traditional underpinning will be undertaken beneath the party walls of 81 and 75 Charlotte Street.

3 Site Setting

The Site is located on Charlotte Street close to the junction of Tottenham Road in the Fitzrovia area of London, W1T 4PW.

3.1 Topography

The Site lies at an elevation of approximately 27m above ordnance datum (OD) on ground which falls away to less than 10m OD at the River Thames, c.1.7 km to the southwest and rises to an elevation of 134m OD on Hampstead Heath, c.5km north of the site. The ground is relatively level within and around the Site.

3.2 Hydrology and Drainage

The Site lies within the surface water catchment of the River Fleet, a tributary of the River Thames, and outside of the catchment of the Hampstead Heath chain of ponds. The Fleet is entirely covered and culverted and forms part of the surface water sewerage system, running beneath the Fitzrovia area to where it discharges into the Thames beneath Blackfriars Bridge. According to historic maps[4], a tributary of the Fleet rises c.500m to the north of the Site beneath the northern edge of Tottenham Court Road.

There are no surface water features marked on Ordnance Survey mapping (1:25,000 scale) within 1km of the Site. The site is not located within a Flood Zone as defined by the Environment Agency and Charlotte Street or adjoining roads have not been identified as at risk of surface water flooding as a result of sewer surcharging within the London Borough of Camden[5].

3.3 Geology

According to the British Geological Survey (BGS) 1:50,000 scale sheet for the area (Sheet 256, North London. 2006) and the associated geological memoir, The Geology of London (BGS 2004), the Site is underlain by the sandy gravels of the Quaternary Lynch Hill Gravel deposits which are River Terrace Deposits associated with the River Thames. The Lynch Hill Gravel deposits are in turn underlain by the Eocene London Clay, generally a stiff grey clay, which outcrops c.1km to the north of the Site.

The Hackney Gravel deposits adjoin the Lynch Hill Gravel deposits to the south and lie on a lower river terrace. The Lynch Hill Gravel Formation has been mapped by the BGS as being approximately 4.5m thick beneath the Site although the thickness of River Terrace Deposits is variable.

[4] The Lost Rivers of London: a study of their effects upon London and Londoners, and the effects of London and Londoners upon them. N. Barton. 1962.

[5] Map 22 Camden Flooding Map. North London Strategic Flood Risk Assessment. Mouchel. 2008.

The London Clay is shown to be approximately 20m in thickness, in turn underlain by c.10m of Lambeth Group sandy clays and c.10m of Thanet Sand Formation fine grained sands. The Cretaceous Upper Chalk, which underlies the Thanet Sands, is anticipated to be at a depth of c.40m beneath the Site.

Site specific geological data from the borehole drilled during the Soils Ltd site investigation[1], have established the presence of a 4.5m thickness of Made Ground beneath the existing basement level (25.17m OD). Coarse gravelly sand, likely to be the mapped Lynch Hill Gravel Formation, was proved to a depth of 6.9m (18.27m OD) where it was underlain by stiff dark grey clay to a depth of 25.0m, which correlates to the London Clay.

The Lynch Hill Gravels are likely to have been historically worked and removed to some extent in the area.

3.4 Hydrogeology

The Environment Agency classifies the Lynch Hill Gravel Member as Secondary A Aquifer, capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as Minor Aquifers.

The London Clay and Lambeth Group are classified as Unproductive Strata (formerly Non Aquifer), i.e. not capable of providing useable quantities of water. The Thanet Sands are classified as Secondary A Aquifer whilst the Cretaceous Chalk is classified as a Principal (formerly Major) Aquifer; however the Thanet Sands and Chalk are hydraulically confined and not generally used for drinking water supply in the central London area due to their poor water quality.

Groundwater beneath the Site is considered to be dominated by intergranular flow through the sands and gravels of the Lynch Hill Gravel Member. Historic maps indicate that a tributary of the River Fleet rose from the base of the Lynch Hill Gravel Member, flowing along the line of Euston Road.

The site investigation established groundwater at a depth of 3.95m beneath the existing basement (21.22m OD) within the Made Ground, approximately 5.95m beneath existing ground levels. Groundwater flow beneath the Site is anticipated to follow the topographic gradient toward the southeast and the River Thames.

4 Screening

The London Borough of Camden's CPG4 Guidance states that any development proposal which includes a subterranean basement should be assessed within a screening process to determine whether there is a requirement for a BIA to be undertaken.

4.1 Screening Assessment

Appendix E of the "Camden geological, hydrogeological and hydrological study" guidance document details six Basement Impact Assessment screening questions, each of which is stated and answered below:

- **Question 1a: Is the site located directly above an aquifer?**

  Yes. The Site is underlain by the Lynch Hill Gravel Member which is designated as Secondary Aquifer by the Environment Agency and considered capable of supporting local water supplies and baseflow to watercourses.

- **Question 1b: Will the proposed basement extend beneath the water table surface?**

  Yes. Based on the findings of the site investigation, the basement would extend beneath the monitored water table surface (i.e. saturated Lynch Hill Gravel Member). The proposed basement formation level (c.20m OD) would be approximately 1.22m beneath monitored groundwater levels (21.22m OD).

- **Question 2: Is the site within 100m of a watercourse, well (used/disused) or potential spring line?**

  No. There are no current, or known historic, surface water features mapped within 100m of the site.

- **Question 3: Is the site within the catchment of the pond chains on Hampstead Heath?**

  No. The Site is outside the catchment of Hampstead Heath ponds. Refer to Section 3.2.

- **Question 4: Will the proposed development result in a change in the proportion of hard surfaced / paved area?**

  No. The site is currently all hard paving and the proposed building footprint would essentially remain the same.

- **Question 5: As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to ground (e.g. via soakaways and/or SUDS)?**

  No. It is anticipated that the use of a SUDS orientated drainage scheme on this site would not be feasible due to the limited space available.

- **Question 6: Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond (not just the pond chains on Hampstead Heath) or spring line?**

  No. There are no local ponds or spring lines present within 100m of the Site.

4.2 Screening Conclusions

The screening exercise has identified the following potential issues which should be assessed:

1. The Site is underlain by the Lynch Hill Gravel Member, classified a Secondary Aquifer by the Environment Agency, capable of supporting local water supplies and baseflow to watercourses.
2. The proposed basement would extend beneath monitored winter groundwater levels beneath the Site.

5 Scoping Assessment

Scoping is the activity of defining in further detail the matters to be investigated as part of the basement impact assessment. Potential impacts should be ascertained for each of the matters of concern identified during the screening process.

The investigation of the potential impacts is undertaken through a site investigation. In this instance, a desk study and site investigation has been undertaken to establish ground conditions for geotechnical assessment purposes. The investigation included the installation of a groundwater monitoring standpipe to a depth of 7m beneath the existing basement level and approximately 9m beneath existing ground levels. This assessment relies upon the findings of the desk study and site investigation.

The following potential impacts have been identified:

Screening issue	**Potential Impact**
The Site is underlain by a Secondary Aquifer.	The proposed basement development may reduce groundwater recharge and could potentially impact on baseflow to watercourses or local private water supplies.
The proposed basement would extend beneath the water table.	The proposed basement may act as a barrier to groundwater flow causing a change in groundwater flow direction and/or levels. This could potentially impact on neighbouring properties and the baseflow to watercourses or local private water supplies.

6 Groundwater Impact Assessment

The screening process identified two potential groundwater impacts. The results of the desk study and site investigation have been used below to address these concerns and assess the likelihood of negative impacts occurring:

1. Reducing recharge and groundwater flow to watercourses and groundwater supplies.

Although the Lynch Hill Gravel Member is classified a Secondary Aquifer by the Environment Agency, it is not used for potable groundwater supplies in central London and there are no watercourses which are dependent on receiving baseflow from it. The River Terrace Deposits are associated with the Thames and groundwater within them discharges to it.

The site is currently covered in building footprint or hard standing and surface water drainage is directed toward the local surface water sewerage system which discharges to the Thames. The proposed basement construction would not alter this arrangement.

The proposed basement construction would therefore not result in a reduction to groundwater flow as a result of a reduction of groundwater recharge.

2. Altering of the groundwater flow regime as a result of the proposed basement development.

It has been established that the proposed basement is underlain by a designated Secondary Aquifer capable of supporting baseflow to watercourses and that the proposed basement would extend below currently monitored groundwater levels. The potential impact of the basement proposal is that the groundwater regime may be altered through the proposed basement acting as a barrier to groundwater flow causing groundwater levels to rise locally.

Monitored winter groundwater levels beneath the Site are recorded as being at 21.22m OD and within the Made Ground. The formation level of the basement would be 7.5m beneath current ground levels, at an elevation of 19.5m OD, and approximately 1.72m beneath monitored winter groundwater levels. The proposed basement would be completed within Made Ground and the Lynch Hill Gravel deposits, the base of which are at an elevation of 18.27m OD, approximately 1.2m beneath the basement formation level.

Groundwater movement within the Lynch Hill Gravel strata beneath the Site is controlled by intergranular flow which follows the fall of the topographic gradient toward the southeast and the River Thames. The hydraulic permeability of the gravelly sand deposits is very high. The proposed basement structure would be surrounded by these highly permeable gravelly sand deposits which would allow groundwater to flow easily around and beneath the basement structure without causing a significant change to groundwater levels.

The contiguous piled walls adjacent to Charlotte Street and Tottenham Mews would be orientated perpendicular to the direction of groundwater flow, therefore presenting the

least surface area against the direction of flow. The proposed basement structure would therefore not have any significant adverse effects on the groundwater flow regime beneath the Site.

3. Cumulative Effects.

The Guidance for the assessment of basement structures states that the cumulative effects on the groundwater regime from existing neighbouring basement structures should also be assessed.

81 Charlotte Street has a basement and lightwell similar in depth to the existing basement of 77 and 79 Charlotte Street. 73-75 Charlotte Street is currently being redeveloped and includes the construction of a single level basement which is approximately 3.95m below existing ground levels. Both of these basements are over 1.5m above monitored winter groundwater levels beneath the Site and would therefore not add to any cumulative effects on the existing groundwater regime.

Based on the findings of the site investigations and the existing groundwater flow regime, it is considered highly unlikely that the proposed development would result in a significant change in groundwater flow regime beneath the site.

7 Conclusions

A groundwater basement impact assessment of the proposed development has been undertaken. The assessment has been based on information and guidance published by the London Borough of Camden[3] and on site investigation information[1].

No potential adverse impacts or effects have been identified as a result of the assessment and it is concluded that the proposed basement development is highly unlikely to result in any significant changes to the existing groundwater regime beneath, or adjacent to, the Site.