Bernard Howard
c/o Chris Brown Structural Engineering
17 Heton Gardens
London
NW4 4XS

16 September 2011

Our Ref: 60560R1D1

Dear Mr Howard

Re: 37-39 Rudall Crescent: basement

Introduction

The following report has been written to support a planning application, for basement construction, coordinated by Chris Brown on your behalf and in relation to 37-39 Rudall Crescent, London Borough of Camden, NW3 1RR (NGR 526535, 185825, see figure 1).

In order for the application to be properly assessed the applicant must consider the issues set out in the Local Development Plan for the Borough and specifically address the section on basement development (Policy DP27). This document reports on a desk study considering the potential impact on surface water and groundwater of the proposed basement works. Slope stability is covered by a separate report. The implications of these concerns for this site are discussed and appropriate conclusions and recommendations given. It does not constitute a full geotechnical appraisal of the development.

In order to complete this report the authors have referred to the guidance document "Camden geological, hydrogeological and hydrological study: guidance for subterranean development" (Arup, 2011) and the methodology set out in Camden Planning Guidance on Basements (Camden, 2011).

The proposed basement works

The proposal is to create two separate basements beneath the two properties of 37 and 39 Rudall Crescent. Currently the property is built into a hillside with a slope of 5.7° from front to rear (see figure 2), resulting in a drop of 900mm in the interior of the property. The floor level of the houses at both front and rear is level with exterior ground level.

The proposed works will involve lowering the floor in the front of each property by 900mm and for a basement to be constructed under the front and part of the rear of the property, with an anticipated maximum excavation of 3m.

The completed basement of each house will be approximately 8 m^2 by 8 m^2 beneath the ground floor of the existing building with an additional 8 m^2 by 2 m^2 light well under the front of the property: a total of 180 m^2 of excavation (ref. Webb Architects Ltd 1083 Planning Drawing Draft). There is no intention to change the site drainage or create additional hard standing as part of these works.

Potential issues

Three principal issues related to subterranean conditions have been identified in the area comprising Camden and Hampstead Heath.

Hampstead's geology is characterised by swelling clay and the area is situated on the slopes of a hill. Therefore building subsidence can occur and, due to differential responses to seasonal swelling/shrinking cycles, can be exacerbated by new subterranean developments near existing houses. The local geological map (figure 1) shows the site to lie on the Claygate Member. This unit lies above the London Clay and beneath the Bagshot Beds (a sandy formation that crops out on Hampstead Heath).

Saturation of sub-surface formations by shallow groundwater can also cause instability. Where shallow groundwater is flowing through the sub-surface, it can be diverted or intercepted by excavation and the emplacement of impermeable sub-surface structures.

A number of ancient streams and watercourses occur in, and underlie, the Camden area. These may contribute to local ground instability via shallow groundwater.

The general ground conditions and details of these issues are well presented in Arup (2011).

Surface water

The potential impact on surface water has been considered as set out in Appendix E of Arup (2011) and the results are presented in Table 1 below.

Table 1 Impact of proposed basements works on surface water

Impact question	Answer	Justification	Reference
1) Is the site within the catchment of the pond chains on Hampstead Heath?	No	The site is not in this catchment, and is 500m distance from the nearest, southern-most pond on Hampstead Heath (Hampstead Pools).	Figure 14 (Arup, 2011)
2) As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	No	There will no change to landscaping or surface water drainage to sewers; the proposed works include a water closet and showers which may mean an increase in waste water to sewerage.	Chris Brown, personal communication and site plans.
3) Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	No	There will be no change to hard surfacing/paved areas due to the proposed works. Hard standing covers 80-90% of outside areas at the present time.	Chris Brown, personal communication and site plans.
4) Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourses?	No	No surface water on property or nearby; no change to run-off or rainwater infiltration since no alteration to hard/soft areas of landscaping.	OS mapping (http://www.ordnancesurvey.co.uk/oswebsite/getamap/) Barton[1], Lost Rivers Of London (Figure 2).

[1] Barton, N., 1992. The Lost Rivers of London, revised edition. Historical Publications Ltd. London.

5) Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	As above. No change to either run-off or infiltrating water is anticipated as a result of the development.	
6) Is the site in an area known to be at risk from surface water flooding, such as South Hampstead, West Hampstead, Gospel Oak and King's Cross, or is it at risk from flooding, for example because the proposed basement is below the static water level of a nearby surface water feature?	No	The site is not in these areas, or another area or street liable to flooding, and not close to a surface water feature. It is outside the area of a floodplain. The nearest surface water feature is 500 m to the northeast.	Figure 15 (Arup, 2011) Environment Agency flood mapping (http://www.environment-agency.gov.uk/homeandleisure/37837.aspx).

Groundwater

The impact on groundwater has been considered as set out in Appendix E of Arup (2011) and the results have been tabulated in Table 2 below.

Table 2 Impact of proposed basement works on groundwater

Impact question	Answer	Justification	Reference
1a) Is the site located directly above an aquifer?	Yes	The Claygate Member is designated a Secondary Aquifer according to Environment Agency classification	Figure 3 and 4 (Arup, 2011) and Figure 1 below.
1b) Will the proposed basement extend beneath the water table surface?	Not known	The Claygate Member has the potential to contain and transport water and the existence of groundwater at the site and the depth to the water table is uncertain; the basement works will extend to a maximum of 3m below the ground surface (see notes below this table).	Figure 3 and 4 (Arup, 2011) and Figure 1 below. Appendix A.
2) Is the site within 100m of a watercourse, well (used/disused) or potential spring line?	No	The site is about 600m distance from a water course (Tyburn River). This issues from two springs, the closest being around 600m to the southwest. The site is situated 150m from the boundary of the Claygate Member (which is sometimes water-bearing) and the London Clay proper (to the east). The site is around 200 m from the boundary of the Bagshot Beds and Claygate Member (to the west). Any productive wells in the area would be screened in the Chalk aquifer at depth and therefore the shallow excavation near the surface could not affect any wells even if present.	Barton (Figure 3), Figure1 and Figure 3 and 4 (Arup, 2011).

3) Is the site within the catchment of the pond chains on Hampstead Heath?	No	The site is not in this catchment.	Figure 14 (Arup, 2011)
4) Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	No	There will no change to hard surfacing/paved areas due to the proposed works.	Chris Brown personal communication and site plans.
5) As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?	No	There will be no additional recharge to the ground due to the proposed works.	Chris Brown personal communication and site plans.
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 and the nearest, southern-most of the Hampstead Heath ponds is 500m distant.	Figure 16, (Arup, 2011).

Discussion

The near-surface geological units in the area of Hampstead include the Bagshot Beds and Claygate Member, both permeable, which are recharged in their outcrop areas, mainly to the north of the site. Groundwater is likely to move down hill through these units, over the underlying London Clay, which does not transmit significant quantities of water. The groundwater emerges as seepages or springs that coalesce into local watercourses. The conceptual model of the site (figure 2) shows groundwater moving in accordance with this description, following the local topographic gradient from west to east (from the road side to the rear gardens) across the site.

The Claygate Member is described locally as a laminated silty sand or sand and clay or clayey sand. Three trial pits and one borehole were dug at 21 Well Walk, about 300m to the north (see figure 1 and Appendix A) and the excavations were found to be dry to 12m below ground, except a seepage that was reported at 2m in one trial pit. A borehole was installed to 4m depth at this site and water later recorded at a depth of 3.7m below ground level (Appendix A).

Geological logs studied from other local boreholes (Appendix A) sited a few hundred metres from the site did not report strikes of groundwater in the Claygate Member. However, there are no available records of water level monitoring in the shallow formations in these boreholes. Groundwater has been reported in the London Clay at around 6-9m below ground level. The Claygate Member at 21, Well Walk is at least 12m thick and is reported as being 17 to 24m thick in the area (BGS, 1994[2] and Ellison Et al, 2004[3]).

[2]British Geological Survey, 1994. Geological map for North London. England and Wales Sheet 256, Solid and Drift Edition. [3]Ellison, R.A., Woods, M.A., Allen, D.J., Forster, A., Pharoah, T.C., King, C., 2004. Geology of London. British Geological Survey.

The geological unit is heterogeneous and characteristics of the soil are likely to vary even on a site-specific scale as shown by this investigation; the presence and extent of water-bearing strata within the Claygate Member beneath the site is therefore uncertain.

Ground water may present as a continuous surface (water table) at depth beneath the site, or may be "perched" in one or more discontinuous layers within sandy strata above interbedded clays.

We note that excavation is planned across the whole of the front of each house with an additional excavation for a light well at the front of the property, and this will come within 5 m of the road. We do not have information about the nature and position of any services beneath the road.

It is unknown whether neighbouring properties have basements, but as these were built at the same time as the properties in question (as a terrace) it is unlikely that they were built with basements. The elevation of their foundations may be slightly different due to the street being on a slight slope. The existence of nearby subterranean structures is relevant because they might be affected by any rise in groundwater levels and they might also combine with the proposed new basements to present a more significant barrier to the movement of any shallow groundwater.

As noted by Arup (2011, p35) the expected change in groundwater level upstream of an installed barrier to flow might be of the order of a few cm. If the barrier allows most of the flow to pass beneath it the impact would be reduced, and the impact is correspondingly greater as the length of the barrier increases.

In relation to potential swelling, which can take place when clay minerals in the fine-grained layers in the soil are hydrated and expand, this can take place in the unsaturated zone (above the water table); seasonal wetting and drying of the soil can cause differential movement in the soil.

As noted above, the Claygate Member is a heterogeneous unit and its characteristics are likely to vary within relatively short distances. The presence and dimensions of clay layering beneath the site are therefore uncertain.

Greater certainty about the presence and depth of any groundwater and additionally the heterogeneity of the Claygate Member would be provided by an intrusive investigation of ground conditions at the site.

The presence of hard standing and/or surface water drainage over much of the immediate area including the open areas of the site will reduce recharge into the soil at the site.

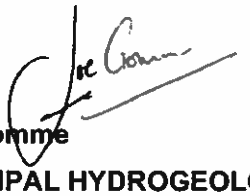
Before the construction is undertaken, we understand that a competent structural engineer will be engaged to design the excavation and underpinning works and to ensure that geotechnical aspects are addressed. The engineer's design will follow the guidance set out by Arup (2011) and relevant aspects of the Construction Design and Management (CDM) Regulations. The design will show clearly what perceived stability risks exist and what mitigation measures are necessary to control them. The contractor undertaking the works will be required to present a method statement that shows how he will fulfil the requirements of the design and implement any mitigation measures.

Conclusion

We have considered the potential impacts of the proposed basement development at 37 and 39 Rudall Crescent, as set out in Council guidance and using the information provided by Arup (2011) and by the architect's plans for the development.

From the available information, it seems possible that ground water is present beneath the site. This might be in the form of a continuous water table (likely to be relatively deep) or in the form of "perched" water. If such a flowing water body were intercepted by the basements the likely impact would be a rise of a few cm in the groundwater level to the west of the houses (and a corresponding slight decrease to the east). Given the topography and the nature of the soil no surface impact is considered likely, since any groundwater is likely to be much deeper than a few cm below the surface.

Yours sincerely



Joe Gomme

PRINCIPAL HYDROGEOLOGIST

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FIGURES

Figure 1 Site location and geology of surrounding area

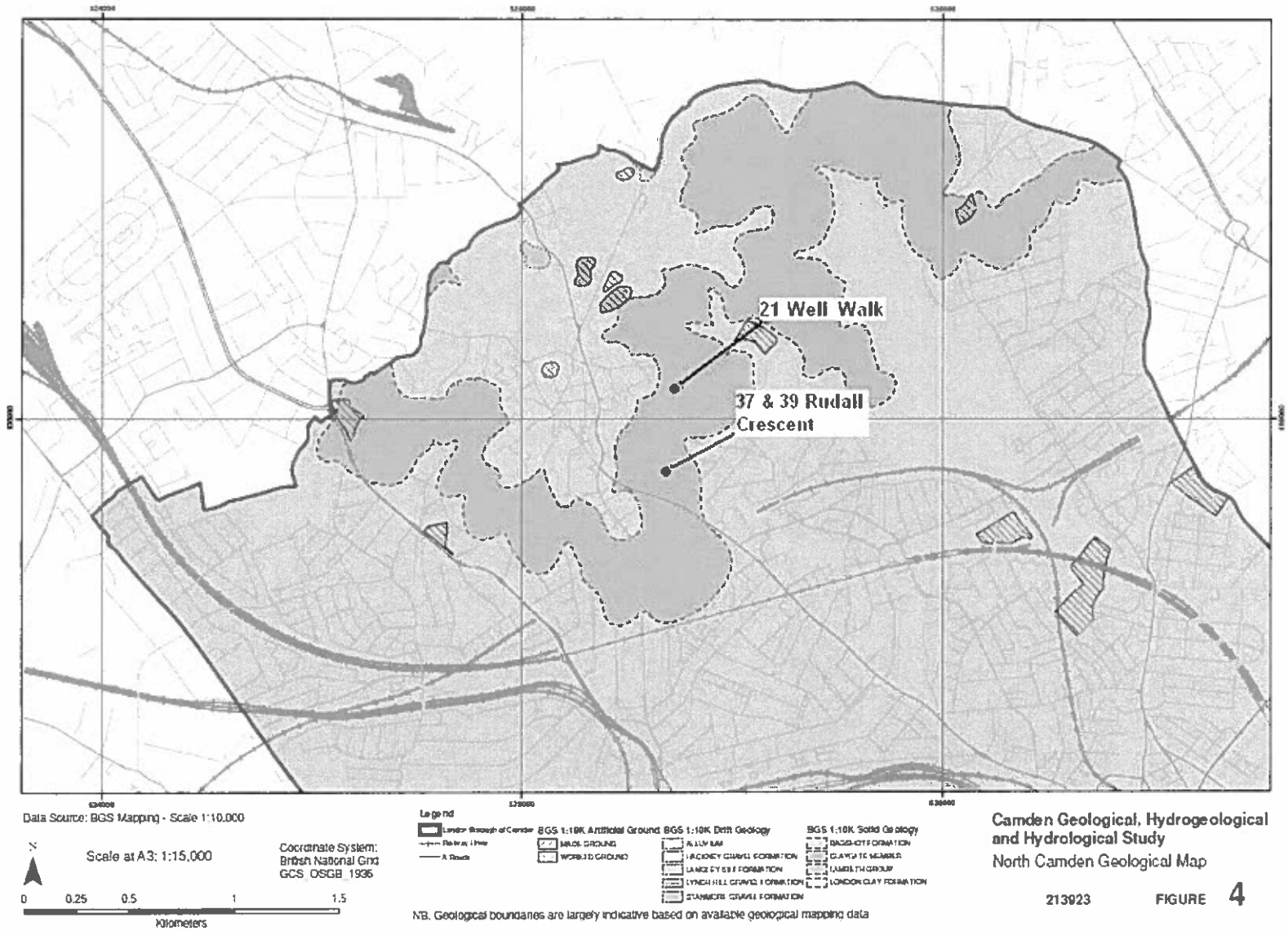


Figure 2 Site Conceptual Model

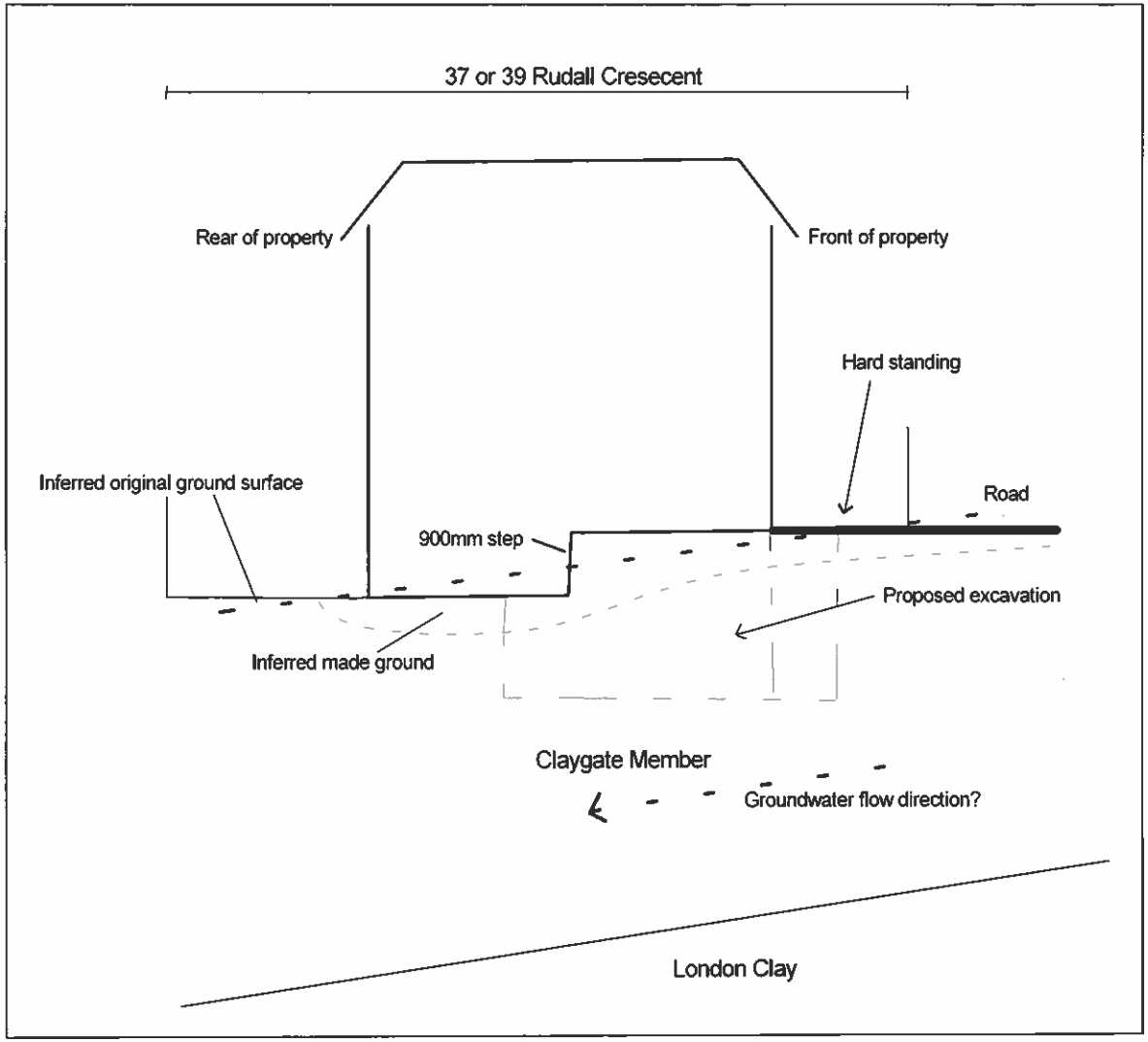
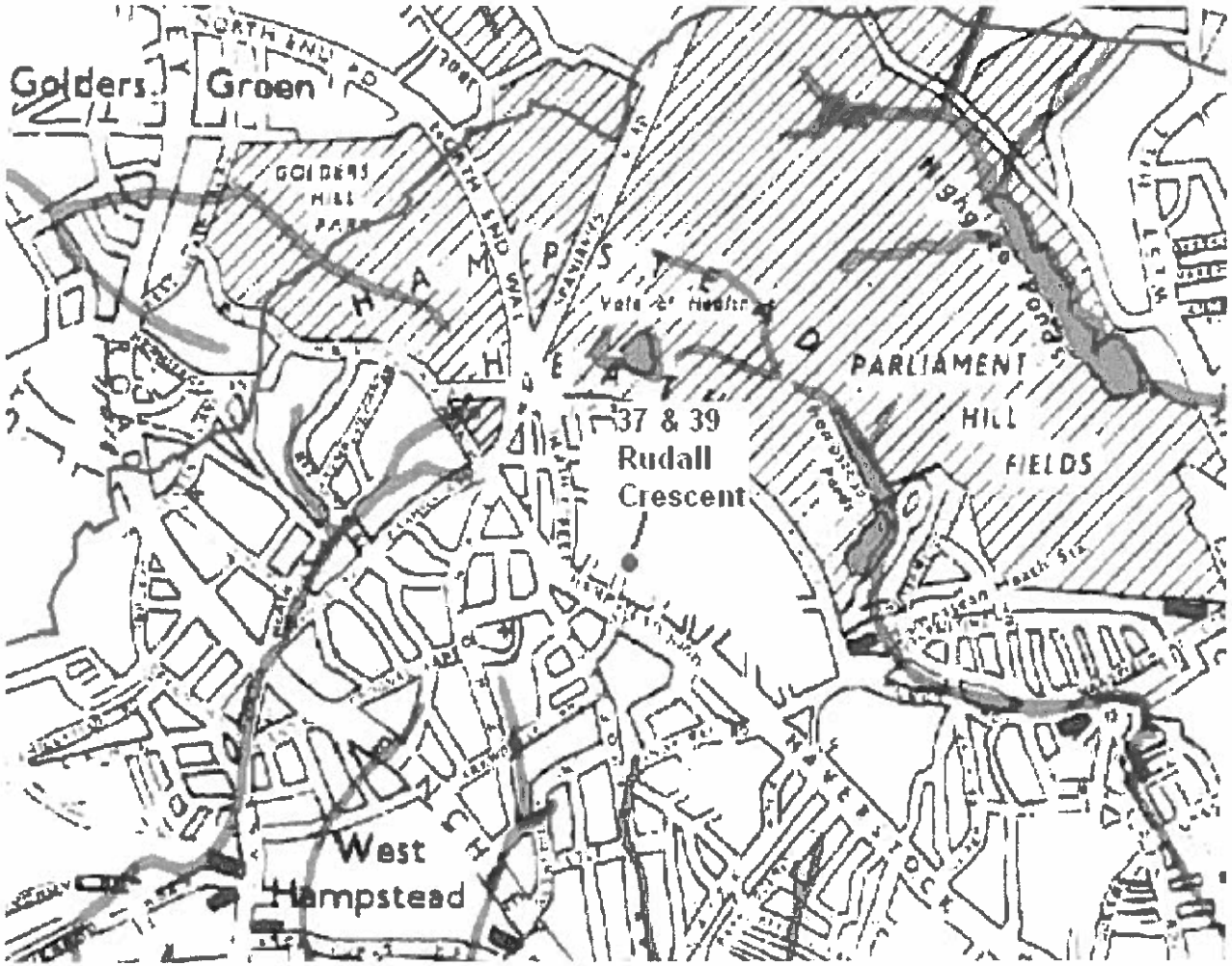
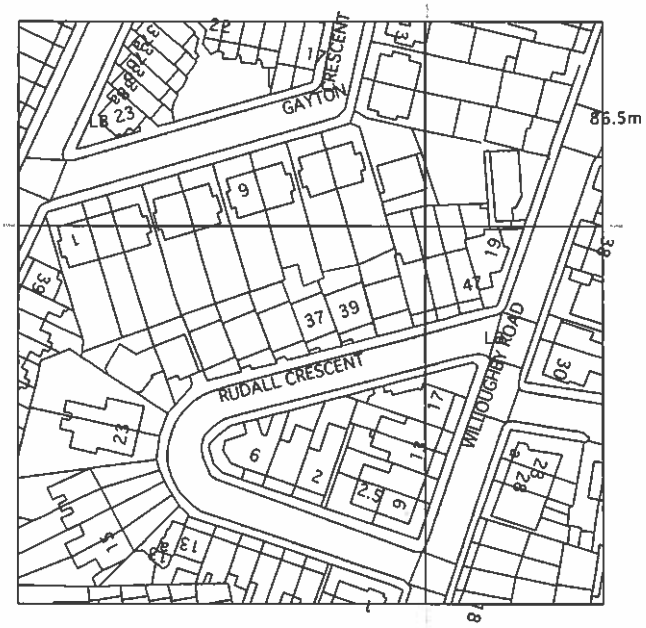


Figure 3 Extract from Barton's "The Lost Rivers of London"





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37 / 39 RUDELL CRESCENT

SITE LOCATION PLAN

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FOR PLANNING

1083.01.00(-)