Garden House, Ellerdale Road

Basement Impact Assessment

For Two Storey Scheme

Prepared for

Mr Jon McElroy

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1.0 Introduction

In October 2014, the London Borough of Camden granted planning permission for a new house with a single storey basement on this site (planning reference 2012/6484/P).

The site has been purchased by Mr Jon McElroy who wishes to develop the site with a further basement on the same footprint as the consented scheme to give a two storey basement.

In engineering terms the new proposals differ from the consented scheme as follows:

- There is an additional basement storey
- The structure of the retaining walls in the consented scheme are in part a contiguous bored piled wall with an RC lining wall and in part underpinned boundary walls with an RC retaining wall. The new proposals provide a contiguous bored piled wall around the whole perimeter i.e. underpinning omitted.
- A drainage system has been added to ensure that any groundwater flows that exist are maintained.

This BIA describes the basement structural scheme design, an overall sequence of construction and considers the impact of the basement construction on adjacent properties, surface and groundwater flows and slope stability.

This report has been based on the following information:

- Historical maps and in house desk study
- Geological survey maps and BGS borehole records
- Proposed layout drawings by Knight Architects
- Site visits in November 2013 & January 2014
- A site investigation carried out by Charles Edward Limited in September 2015 (Appendix E)
- A site investigation carried out by Ground Engineering during January 2014 (Appendix F)
- A site investigation carried out by Albury S.I. Ltd in October 2012 (Appendix G)

In preparing the BIA reference has been made to the following London Borough of Camden documents:

- Camden Local Development Framework (LDF) Policy DP27
- Camden Planning Guidance – Basements and Lightwells CPG4
- Camden Geological, Hydrogeological and Hydrological Study – Guidance for Subterranean Development prepared by ARUP

Work by the following individuals has contributed to this BIA:

Alan Baxter Ltd	Hannah Butlin	MEng
	Fraser Godfrey	MEng DipArch
	Simon Bennett	MEng MICE MIStructE
	Michael Coombs	MSc DIC FIStructE
Geotechnical Consulting Group	Hugh StJohn	BSc PhD HonDSc
Ground Engineering Ltd	S. J. Fleming	MSc MCSM CGeol FGS
	J. E. M. Davies	BSc(Hons) MSc CGeol FGS

1.1 Site history

The site is located in the London Borough of Camden in the Fitzjohn and Netherhall Conservation area. For a site location plan and photos refer to Appendix A. The plot comprises an area of cleared garden surrounded by garden walls, a garden fence and by two adjoining properties. The site is accessed from the street via a passage adjacent to 1 Ellerdale Road.

The site remained undeveloped until 1870s when the surrounding properties, No. 1 Ellerdale Road and Nos. 81, 83, 85 & 87 Fitzjohn's Avenue were built, the gardens of which back onto the plot. These comprise load bearing masonry semi-detached five storey houses. Arthur West House appears to have built between 1965 and 1973 and has a one storey extension, the back wall of which adjoined the site. Arthur West House is currently being demolished prior to a new development commencing on the site. The single storey kitchen extension to No. 1 Ellerdale Road also appears to have been built in this period. For historical maps please refer to the section titled 'Historical Maps' in Appendix F.

1.2 Site geology

A 15.5m deep borehole has been completed as part of the site investigation undertaken in January 2014 (See Appendix F for full SI Report). This found that there is approximately 3m of made ground over a 1.7m thick layer of Head Deposit over the solid geology of the Claygate Member. The latter extended to at least 15.5m below ground level (86.3m AOD) where the borehole terminated. Based on the geology map this will overlay London Clay a few metres beneath the base of the borehole.

A stand pipe was installed in the borehole and the perched water table was found to range between 6.15m and 6.33m below ground level (95.47-95.65m AOD) over 4 monitoring visits in February and March 2014. A later reading in September 2015 identified the perched water table at 7.2m below ground level (94.6m AOD).

1.3 Form and condition of existing structures

The adjacent structures comprise several garden walls and the kitchen extension to 1 Ellerdale Road.

The garden wall between the site and No. 83 Fitzjohn's Avenue comprises a modern brickwork wall supported on an RC beam on concrete mini-piles. There is a joint between this wall and the back wall to the garden of No. 81 Fitzjohn's Avenue which comprises brickwork on mass concrete strip footings. Both of these walls appear to be in reasonable condition.

The site of Arthur West House, to the rear of the property, is being redeveloped and as part of this the existing buildings on the site are being demolished. It is now known as the Pegasus site. The new development on the site has planning permission and is currently proceeding. The rear wall of the proposed building will be set back approximately 7m from the boundary with the Garden House site whereas previously the back extension was right on the boundary. Arthur West House had a basement which was set back from the boundary with the Garden House by around 7m. The new development will have a basement which will be set back from the boundary by around 15m. There are no other basements adjacent to the site.

No wall exists between the plot and the garden of 1 Ellerdale Road, only a dilapidated fence. The single storey modern kitchen extension to 1 Ellerdale Road comprises load bearing

brickwork walls on an RC slab and beam arrangement which is founded on RC pad footings. The structure appears to be in reasonable condition.

Drawings summarising our understanding of the existing structures and details of the foundations of the adjacent walls are summarised on drawings 1706/01/S03-4 in Appendix D and drawing 1706/01/05 in Appendix A.

1.4 The proposals

The proposed new build comprises the following:

- Construction of a basement 8m deep within the site boundary approximately 8m x 12m on plan
- Construction of a half storey (1.5m) structure above ground (no change to the consented scheme)
- Construction of new garden walls between the site and the neighbouring properties.

This report relates to the proposed construction of the basement. The approach to the design of the new basement includes consideration of the following key items:

- Ground conditions
- Groundwater regime
- Surface flow and flooding
- Slope and ground stability
- The structure of the existing adjacent construction
- The effects on surrounding and adjoining properties
- An appropriate design and construction methodology

1.5 Characteristics of the Project

The structural retaining walls of the basement will take the form of a contiguous pile wall around the perimeter of the excavation propped by the floor slabs at each floor level. The site owner has made arrangements with the Pegasus site to the rear (formerly Arthur West House) to allow construction access via their site for part of the construction period (February/March 2016).

2.0 Screening (stage 1)

The purpose of the screening stage of the BIA is to identify any matters of concern which should be investigated further through the BIA process. The screening process has been undertaken as outlined in the Camden Planning Guidance – Basement and Lightwells CPG4 and the Camden geological, hydrogeological and hydrological study prepared by ARUP.

The screening flow charts given in GPG4 have been used and are provided in Appendix C. Several items in the screening checklists were identified as being relevant to this proposal and therefore a BIA is necessary. Those that have been identified as being relevant are discussed in the following Scoping Stage.

3.0 Scoping (stage 2)

The purpose of the scoping stage of the BIA is to define further the potential impacts identified within the screening stage as requiring additional investigation. The scoping stage has been undertaken as outlined in Camden Planning Guidance – Basements and Lightwells CPG4 and the Camden geological, hydrogeological and hydrological study prepare by ARUP.

3.1 Conceptual Ground model

To assist the scoping stage a conceptual ground model has been produced using the following;

- Information obtained during the screening stage of the BIA
- The site investigations conducted in October 2012, January 2014 and September 2015
- Readily available published data
- Application of hydrogeological principles

This is as follows.

Site location	Hampstead, London
Local geology	There is 3m of made ground over a 1.5m depth of Head Deposits over the Claygate Member. The surface of the London Clay is greater than 15.5m below ground level (at around 85m AOD based on the topographic and geological maps in the Appendices to the ARUP report and local borehole data). Beneath the thick London Clay is the Lambeth Group, Thanet Sands and Chalk which together make up the lower Aquifer.
Local ground levels	The site gently slopes to the west.
Local surface water or below ground water features	There are no local surface or below ground water features close to site. Ground level is approximately 101.8m AOD.
Local groundwater level	The site is located above a secondary aquifer in the bedrock geology. The London Clay is sufficiently thick that it isolates the strata of the Lower Aquifer from the secondary aquifer present on top of the London Clay. Perched groundwater was struck in the borehole (2014 site investigation) at a depth of 10.0m below ground level (91.8m AOD). Monitoring over the next 2 months found the groundwater level to be constant at approximately 6.2m below ground level (95.6m AOD) within the Claygate Member. Subsequent monitoring in September 2015 found the groundwater level to be at 7.2m below ground level (94.6m AOD).
Local surface finishes	The surrounding area is mostly soft landscaping in the back gardens of the neighbouring properties with the exception of Arthur West House (currently being demolished) and its surrounding paved areas and the extension to 1 Ellerdale Road. The surface of the site is soft landscaping.

Current local surface water pathway	A proportion of local rainfall will be retained in the near surface soil (made ground and topsoil) with a proportion evaporating into the atmosphere or being taken up by plant and tree root systems and some may percolate down and enter the groundwater system. The remaining water within the topsoil is likely to either sit within the made ground or, where possible, follow the natural gradient of the land, to the west, finding its way into more permeable layers. A further proportion of local rainfall will run off the hard surfaced areas adjacent to site into the main surface water sewers.

Using the above conceptual ground model, the potential issues identified during the screening stage are discussed further.

3.2 Hydrology (surface water flow and flooding)

3	Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	Yes, the area of hardstanding will be increased.	Y

The area of hardstanding on the site will be increased. In general this could affect the way rainfall and surface water are transmitted away from the site which may in turn affect the surface water received by aquifers, adjacent properties and nearby watercourses.

Currently the site is soft landscaped and therefore surface water from rainfall can infiltrate into the ground. Under the proposals this surface water will no longer be able to do this over the majority of this small site. Currently the site is surrounded by walls on all sides and therefore is relatively isolated from surrounding surface water flows.

The green roof will be used to attenuate water. This will allow water to be discharged into drains more slowly and over a longer period than would be the case without attenuation to reduce the site's contribution to peak flows. There is no change in relation to this from the previous scheme which has consent.

3.3 Hydrogeology (groundwater flow)

1	Is the site located directly above an aquifer?	The maps in Appendix F show the site is located above an aquifer within the Bedrock geology and Figure 8 in Arup's report – Camden Aquifer Designation Map - shows there to be a secondary aquifer under the site.	Y
1b	Will the proposed basement extend beneath the water table surface	Yes	Y

The level of groundwater has been measured using a standpipe monitored over a period of time. The water level has been found to be at around 6.2-7.2m below ground level (94.6-95.6m AOD). The proposed basement will extend below this level. This will be discussed later on in the impact assessment.

4	Will the proposed basement development result in a change in the area of hard surfaced / paved areas?	Yes the amount of hardstanding will increase as the new building will replace a soft landscaped area	Y

The amount of hardstanding will increase as the new building will replace a soft landscaped area. This will reduce the volume of rainfall seeping into the ground below and subsequently into underground aquifers. The effect of building on this small site will have a negligible effect on volume of surface water infiltrating into the groundwater below. It will have the same effect as the already consented building designed for the site.

3.4 Slope and ground stability

6	Will any tree/s be felled as part of the proposed development and/or any works proposed within any tree protection zones where trees are to be retained? (Note that consent is required from LB Camden to undertake any work to any tree/s protected by a Tree Protection Order or to tree/s in a Conservation Area if the tree is over certain dimensions).	There are no trees on site. 2 very low quality small trees in the garden of No. 81 Fitzjohn's Avenue are to be removed. Conservation area consent has already been granted for their removal. Part of the development is within the root protection zone of a nearby tree which is to be retained. An arboriculturalist has been appointed and confirmed that provided no excavation works are undertaken within 3.35m of the tree, the impact on the tree resulting from the proposed development will be negligible. Refer to Arboriculturalist's Report in Appendix H for more details.	Y

The two trees to be removed are small and will therefore not have a significant effect on the water within the soil. There is a garden wall on mass concrete foundations below ground between the site and the trees. The London Clay is well below the extent of tree roots, this combined with the size of the trees will not cause the ground to swell.

9	Is the site within an area of previously worked ground?	Historical records and Figure 3 from Arup's report, 'Camden geological map', indicate the site is not on worked ground, however the borehole records from the site investigation indicate there is approximately 3m of made ground beneath the site	Y

The formation level of the basement will extend beneath this and be founded in the strata below, therefore instability will not be an issue on this site. All boundary walls are to be demolished with the exception of the extension to No. 1 Ellerdale Road and part of the existing boundary wall founded on piles. A stiff, well propped, contiguous pile wall will be installed adjacent to the building thus maintaining stability of its foundations.

10	Is the site within an aquifer?	The maps in Appendix F show the site is located above an aquifer within the Bedrock geology and Figure 8 in Arup's report – Camden Aquifer Designation Map - shows there to be a secondary aquifer under the site.	Y

Refer to item 1 discussed in the hydrogeology (groundwater flow) screening.

13	Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Yes, the basement is being formed adjacent to neighbouring properties.	Y

The basement structure will sit on its own foundations and is separate from neighbouring structures' foundations. No underpinning is proposed as part of the scheme. There will be a settlement joint between the new structure and adjacent structures so differential foundation depths are not an issue.

3.5 Conclusions

In order to assess the impact of the potential issues identified in the scoping stage the following information is needed:

- Groundwater levels
- Geology
- Form and condition of the foundations to neighbouring structures

We can see that the previous site investigations (2012, 2014, 2015) have already provided this information, therefore there is no need for a further site investigation. The conceptual ground model is sufficient to undertake the impact assessment.

4.0 Site Investigation and study (stage 3)

Copies of the site investigation reports can be found in Appendices E, F and G. The investigation undertaken by Ground Engineering in January 2014, which includes a desk study, factual and interpretative reports is the most comprehensive, the results of which are discussed below.

The ground conditions comprise made ground over Head Deposits over Claygate Member. The top of the London Clay is greater than 15.5m below ground level. Groundwater was struck in the borehole at a depth 10.0m below ground level (91.8m AOD). Monitoring over the next 2 months (Jan/Feb 2014) found the groundwater level to be relatively constant at approximately 6.2m below ground level (95.6m AOD). Further monitoring undertaken in September 2015 found the groundwater level to be at 7.2m below ground level (94.6m AOD). The difference in levels can be attributed to the time of year. Early 2014 was one of the wettest periods of the last century and the subsequent monitoring was done just after the summer. The level of the top of the borehole was approximately 101.8m above Ordinance Datum.

The site investigation indicated the made ground contained elevated concentrations of lead and locally benzo[a]pyrene which exceeded the residential soil screening criteria. Ground Engineering Ltd have suggested that remediation of the soils beneath the site is only considered necessary in relation to the creation of new areas of gardens and soft landscaping as any new hardstanding, and building floors will prevent contact between any contaminated ground and the site end users. For any soft landscaping, soils will need to be removed and fresh topsoil used.

5.0 Impact Assessment (stage 4)

The impact assessment stage of the BIA describes the impacts of the proposed basement development on the environment and how this will be mitigated in the design and construction. For the factual and interpretative site investigation reports refer to Appendix F.

5.1 Ground Model

As discussed there is no need to update the ground model as there is sufficient information in the ground model set out in the scoping stage to undertake the impact assessment. This ground model is set out below.

Site location	Hampstead, London
Local geology	There is 3m of made ground over a 1.5m depth of Head Deposits over the Claygate Member. The surface of the London Clay is greater than 15.5m below ground level (at around 85m AOD based on the topographic and geological maps in the Appendices to the ARUP report and local borehole data). Beneath the thick London Clay is the Lambeth Group, Thanet Sands and Chalk which together make up the lower Aquifer.
Local ground levels	The site gently slopes to the west.
Local surface water or below ground water features	There are no local surface or below ground water features close to site. Ground level is approximately 101.8m AOD.
Local groundwater level	The site is located above a secondary aquifer in the bedrock geology. The London Clay is sufficiently thick that it isolates the strata of the Lower Aquifer from the secondary aquifer present on top of the London Clay. Perched groundwater was struck in the borehole (2014 site investigation) at a depth of 10.0m below ground level (91.8m AOD). Monitoring over the next 2 months found the groundwater level to be constant at approximately 6.2m below ground level (95.6m AOD) within the Claygate Member. Subsequent monitoring in September 2015 found the groundwater level to be at 7.2m below ground level (94.6m AOD).
Local surface finishes	The surrounding area is mostly soft landscaping in the back gardens of the neighbouring properties with the exception of Arthur West House (currently being demolished) and its surrounding paved areas and the extension to 1 Ellerdale Road. The surface of the site is soft landscaping.
Current local surface water pathway	A proportion of local rainfall will be retained in the near surface soil (made ground and topsoil) with a proportion evaporating into the atmosphere or being taken up by plant and tree root systems and some may percolate down and enter the groundwater system. The remaining water within the topsoil is likely to either sit within the made ground or, where possible, follow the natural gradient of the land, to the west, finding its way into more permeable layers. A further proportion of local rainfall will run off the hard surfaced areas adjacent to site into the main surface water sewers.

5.2 Further consideration of groundwater regime

Further analysis of the borehole records has suggested that rather than there being a groundwater table at 6.2-7.2mbgl (94.6-95.6m AOD), the ground here is impermeable but that below this at around 10 to 13mbgl (88.8-91.8m AOD)there is a more permeable layer containing water under pressure. The pressure within this layer has a head of around 4m hence giving a groundwater reading of 6.2-7.2mbgl in the borehole standpipe. Please refer to drawing 1706/02/31 in Appendix J.

It is common knowledge that the Claygate is impermeable but has pockets/lenses of more permeable material containing water, sometimes under pressure. Therefore, during the construction, the risk of water entering the excavation in any significant quantity is low. Therefore dewatering measures are unlikely to be needed but will be provided as a contingency measure to deal with any slight seepage.

The proposed development does not penetrate the layer containing groundwater. However the excavation will reduce the overburden pressure above, thus there is a risk of heave failure at the base of the excavation in the temporary case, caused by the groundwater pressures. The groundwater pressures will be monitored and relieved by drainage during construction if necessary.

5.2 Initial basement design

400mm diameter contiguous piled walls are required around the perimeter of the basement to resist hydrostatic and ground pressures. These would form the structure of the basement and an RC lining wall would be provided internally. The contiguous piled walls would cantilever out of the ground beneath. A cantilever wall would be beneficial in terms of construction as the site is quite tight and thus props would make access tricky. We undertook a ground movement and building damage assessment using this design and found the predicted damage to the kitchen extension to 1 Ellerdale Road (the closest structure) to be greater than Burland Category 2 which is not acceptable. Please refer to the calculations set out in Appendix L.

The basement will extend below the groundwater level measured in the site investigations. For reasons discussed in 5.1 we do not think there are any groundwater flows above the base of the basement. However some minor groundwater flows could be present. This could potentially affect the groundwater regime in the vicinity of the basement.

We therefore proposed several mitigation measures to reduce the effect of the scheme on the neighbouring structures. These are set our below.

5.3 Mitigation measures

- Provide high stiffness propping at frequent intervals to the retaining wall during construction. This will make the construction trickier for the contractor but will reduce movements caused by the excavation behind the retaining wall and reduce the effect of the basement construction on neighbouring properties. The retaining wall will be propped by the stiff RC floor slabs in the permanent case.
- In order to address any minor flows present, a permeable layer of single size aggregate concrete will be cast below the basement slab which will be detailed with vertical legs between the contiguous piles extending up to the to the measured water table. This will allow any minor groundwater flows to pass beneath the basement slab.

We have reassessed the ground movements, taking into account the mitigation measures, and concluded that the majority of the structures fall into Burland Category 0 (negligible) with the exception of No. 1 Ellerdale Road which falls into Burland Category 1 (very slight) and the kitchen extension to No. 1 Ellerdale Road and the garden wall founded on piles which both fall into Burland Category 2 (slight). Therefore the proposals do not cause structural damage to any surrounding structures. Refer to section 5.8 for further discussion. This is a conservative estimate and the aesthetic damage is likely to be less than this for reasons discussed in section 5.8.

The under-slab drainage will mitigate any affects the basement may have on the local groundwater regime as discussed in section 5.4.

5.4 Design of basement

Proposed structure drawings 1706/02/12-14 and 20-22 can be found in Appendix I.

The basement will be constructed using a contiguous bored piled wall around the whole perimeter of the excavation. In the permanent condition, the contiguous pile wall will be propped by the structural slabs at each floor level. The proposed retaining wall structure has been chosen to maintain the structural stability of adjacent structures during and after construction of the basement.

Following agreement between Mr Jon McElroy and his neighbours, the boundary walls will be demolished before construction proceeds including the southern corner of the boundary wall to 83 Fitzjohn's Avenue which is founded on mini piles.

Where boundary walls are to be demolished, new boundary walls will be constructed following the basement construction and will be founded on the basement structure. Where these adjoin existing walls, a joint will be provided between the new and existing construction to allow for differential settlement.

The extension to No. 1 Ellerdale Road is founded on RC pad footings which extend to approximately 2m below ground level (99.8m AOD). The stiff contiguous piled retaining wall, which will be set away from the extension, will support the ground on which the extension is founded during and after construction. Refer to the retaining wall calculations in Appendix L.

The propped contiguous bored piled wall will act as both temporary and permanent structure for the new basement. The pile line will be set back from the extension to No. 1 Ellerdale Road by 1000mm from the face of the wall to the centre line of the piles. This is a sufficient distance to enable the piles to be built without physical damage to the adjoining construction.

Following the installation of the piled wall and the capping beam, temporary propping will be installed before the basement excavation proceeds. Waling beams and further temporary props will be installed at each storey as the excavation progresses. How this will be carried out has been considered carefully and is shown in the sequence of construction drawings 1706/02/45-46 in Appendix K. Calculations for the design of the retaining wall can be found in Appendix L.

The basement will extend below the measured groundwater level identified in the site investigation. As discussed in section 5.2, we do not believe there is a groundwater table as such at 6.2m below ground level but rather there layer of material of low permeability at 10-13mbgl which contains water under pressure which has a head of around 4m. This head has been measured to be at 6.2m below ground level.

The Claygate member is a slightly sandy clay/silt, the permeability of which is low as demonstrated by the rate of ingress of groundwater into the borehole during the site

investigation. The site is located on top of a hill as shown in drawings 1706/02/02-03 in Appendix B. This suggests that there are no significant groundwater flows through this small site and thus the basement extending below the measured groundwater table will not impact the groundwater regime in such a way as to adversely affect the site's neighbours. Despite this, in order to address any minor flows that could be present, a permeable layer of single size aggregate concrete will be cast below the basement slab which will be detailed with vertical legs between the contiguous piles extending up to the to the measured water table. This will allow any minor groundwater flows to pass beneath the basement slab. Please refer to drawing 1706/02/30 in Appendix J.

In the permanent case the contiguous piled wall, lining wall and waterproofing (to the architect's details) will be designed to prevent water ingress into the basement. The basement slab will be designed to withstand hydrostatic uplift pressures and will span between the contiguous piled walls. Please refer to the associated calculations in Appendix L.

The basement will extend around a maximum of 8m below ground level (93.8m AOD). The site investigation has found the Claygate member to have medium volume change potential. Potential affects from heave will be addressed by using a heave protection layer to achieve a structural void below the basement slab.

CPG27 requires proposed basements to avoid cumulative impacts upon structural stability or the water environment. Even if neighbouring properties wish to construct a basement this will not adversely affect any minor groundwater flows present as the groundwater will still be able to pass beneath the basement slab through the permeable layer.

5.5 Sequence of construction for the basement

The structural proposals have been developed to suit normal construction techniques. A construction sequence for the basement and the temporary works required has been carefully considered and has been used for the purposes of undertaking the structural design and demonstrating that works can be executed with due regard to the local amenity. A sequence of construction for the basement is summarised below and illustrated in drawings 1706/02/45-46 in Appendix K.

Construction access will be through the Pegasus site to the rear of the property (formerly Arthur West House). The existing building on the site is currently being demolished and we understand our client has permission for construction access through here to build the basement. The sequence of construction has therefore been developed to suit.

The construction of the basement will require access to the edge of the neighbours' sites and demolition of the boundary walls for which we understand our client has agreement and permission.

Stage 1 – Enabling works

- Install tree protection
- Demolish boundary walls
- Install piling mat

Stage 2 – Piling

- Piling rig brought onto site via access through Pegasus site
- Install bored contiguous piled wall to perimeter of basement in areas shown on GAs

- Install temporary RC capping beam

Stage3 – Excavate and prop

- Excavate around 1m below ground level
- Install temporary props at capping beam level

Stage 4 – Further excavation and propping

- Excavate
- Install waling beam
- Install temporary props
- Repeat procedure at one storey intervals down to formation level of basement
- Monitor groundwater pressures beneath base of excavation, and relieve if necessary

Stage 5 – Cast B2 slab

- Install single size aggregate concrete drainage layer and heave protection layer
- Cast B2 slab
- Remove props at B2 level

Stage 6 – Cast B2 lining walls and B1 slab

- Cast single size aggregate concrete drainage layer between piles. Frequency to be confirmed on site
- Cast lining wall at B2 level
- Cast slab at B1 level
- Remove propping just above B1 level

Stage 7 – Cast B1 lining wall and break down piles

- Cast lining wall at B1 level
- Prop top of lining wall
- Install temporary shoring
- Excavate behind piles to underside of capping beam level
- Remove props and break down capping beam and top of piled wall

Stage 8 – Cast new capping beam with ground floor slab

- Cast new capping beam at lower level with ground floor slab, top of B1 lining walls and RC upstand
- Remove temporary shoring, backfill and compact
- Remove temporary props once ground floor slab cured

Stage 9 – Build superstructure

- Regrade garden as necessary
- Build superstructure

5.6 Programme

The spoil will be removed via the rear of the property using normal construction plant. The construction of the basement structure is expected to last around 5-7 months.

5.7 Construction Management Plan

- The Contractor will be required to submit his own Construction Management Plan and Site Waste Management Plan prior to work commencing on site. The contents of this plan must be in accordance with The London Borough of Camden's guidance and be agreed by them.
- The contractor will be required to demonstrate due diligence and commitment toward minimising environmental disturbance to local residents and will be required to complete the work in accordance with the Considerate Constructors Scheme standards.
- Noise, dust and vibration will be controlled by employing best practicable means as prescribed in legislation such as; The Control of Pollution Act, 1972; The Health & Safety at Work Act, 1974; The Environmental Protection Act, 1990; Construction Design and Management Regulations, 1994 and The Clean Air Act, 1993. Noise, vibration and dust monitoring is to be implemented.
- The contractor will need to produce a Traffic Management Plan. This should carefully consider vehicle movements and their impact on other road users, pedestrians, residents and the environment. Mitigation measures should be implemented where necessary.
- The work is to be carried out in one phase.
- The contractor will erect site hoarding to define the boundaries of the site
- Working hours to be restricted as required by the London Borough of Camden
- Vehicles should be washed and cleaned before leaving site and vehicles should not be left idling
- Measures should be adopted to prevent site runoff of water or mud
- Water to be used as a dust suppressant
- Skips should be covered
- All temporary works are to be designed by a qualified Temporary Works Coordinator
- Movements of surrounding buildings should be monitored throughout construction, the results reviewed and action taken to mitigate excessive movements.

5.8 Ground Movements and Structural Damage

An updated ground movement assessment in accordance with CIRIA C580 has been carried out and the impact of ground movements on nearby structures assessed in accordance with the Burland Categories of damage – see Appendix L.

Following the mitigation measures described in section 5.3, all structures fall into Burland Category 0 (negligible) with the exception of No. 1 Ellerdale Road which falls into Burland Category 1 (very slight) and the kitchen extension to 1 Ellerdale Road and the garden wall

founded on piles which both fall into Burland Category 2 (slight). Therefore the proposals do not cause structural damage to any surrounding structures. These categories are the same as for the consented scheme. Both the kitchen extension and garden wall appear to be in reasonable condition. This is a conservative estimate and the aesthetic damage is likely to be less than Burland Category 2 for the reasons set out below. There are no listed buildings within the zone of influence identified in the assessment.

- It is generally accepted that the CIRIA guidance is conservative. This is discussed in the technical paper published in Ground Engineering dated September 2014 a copy of which has been included in Appendix M. The paper concludes that "installation movement predictions from CIRIA guidance can be significantly reduced for controlled contiguous piled wall installations".
- The basement excavation is relatively small on plan and the three structures identified as being subject to Burland Categories 1 and 2 damage are located at the corners of the excavation and set back from it. These structures will therefore be well propped in both directions on plan by the 400mm diameter contiguous piled wall and also the ground outside of the excavation. Therefore the actual ground movements seen in these corners will be less than predicted in the building damage assessment.
- The kitchen extension to 1 Ellerdale road comprises an RC slab on RC pad foundations. Unlike the majority of other structures in the area which generally comprise timber joisted floors on brickwork walls founded on either brick corbel or mass concrete foundations, the RC slab will have some tension capacity and is therefore more robust and less susceptible to cosmetic cracking than structures of unreinforced masonry construction.
- The boundary wall discussed above is founded on mini-piles. The length of these is unknown but the site investigation has confirmed that they extend at least a metre below ground level but are likely to be much deeper. The ground movement and building damage assessment assumes that this wall is founded at ground level and therefore the damage assessment is conservative.

The predicted building damage categories have been reduced as far as is reasonably practical given the proximity of the kitchen extension to 1 Ellerdale Road and boundary wall. Residual mitigation measures will include the following:

- Movements of adjacent structures will be monitored throughout the works and a contingency strategy will be in place should measured movements exceed predicted values or rationally designed trigger levels.
- The actual ground movements that will occur will be affected by the degree of propping and care taken during the construction. High levels of site supervision will be used to control workmanship.
- Making good of any minor cosmetic damage that might occur will be undertaken.

The structural proposals have been designed to provide stiff supports to the basement retaining walls in the temporary and permanent cases. The stiff RC contiguous piled wall, which will be propped by the ground and basement slabs, will limit ground movement in the permanent case. A carefully considered system of propping during construction, designed by the Contractor, will limit ground movement in the temporary case.

During the construction of the basement the contractor will be required to undertake monitoring of the groundwater levels and ground conditions encountered to ensure that the assumptions and findings from the BIA remain valid.

The distance of the piled retaining wall from the existing structure of 1 Ellerdale Road has been carefully considered to be sufficiently far away to allow for its construction without physical damage to the adjacent structures. Piling at these distances is common and well understood.

In summary, with careful sequencing and temporary propping as shown on the sequence of construction drawings, movements will be very small and will not result in structural damage to the adjacent walls or adjoining properties and aesthetic damage will be kept as low as is reasonably practical given the proximity of the adjacent structures to the excavation.

5.9 Impact of basement on groundwater, surface water and soil

The basement will extend below the perched groundwater level. The measures discussed in section 5.3, will mitigate the effect of this on the groundwater regime. Below this, any groundwater present can pass through the gaps between the contiguous piles.

Prior to and during the construction of the basement the contractor will be required to undertake monitoring of the groundwater levels and ground conditions encountered to ensure that the assumptions and findings from the BIA remain valid. Local dewatering measures will temporary lower the groundwater pressures slightly beneath the excavation, if necessary.

The building will have a green roof which will act as an attenuation device. There will be no changes to surface water runoff in comparison with the consented scheme.

The site investigation by Ground Engineering found elevated concentrations of lead and locally beno[a]pyrene in the made ground near the surface. All spoil from the excavation of the made ground will be disposed of offsite to a licenced tip in accordance with current good practice. For areas of soft landscaping, soil will be removed and fresh top soil used.

5.10 Impact of the proposed development on existing trees

There are no trees on the site. On the north-eastern side is a large mature ash tree growing in the rear garden of 83 Fitzjohn's Avenue. This tree has been subject to a root investigation by air spade at the early design stage of this project, and care was taken when constructing the boundary wall between the site and No. 85 Fitzjohn's Avenue to ensure that roots continue under the piled foundations.

Part of the development is within the root protection zone of the ash tree, which is to be retained. An arboriculturalist has been appointed and confirmed that providied no excavation works are undertaken within 3.35m of the tree, the impact on the tree resulting from the proposed development will be negligible. Any works to the front garden within the supervised area identified in the arboriculturalist's report, will be undertaken under the direct supervision of the appointed arboriculturalist.

There are two very low quality small trees growing in the garden of 81 Fitzjohn's Avenue. Conservation Area consent has already been granted for their removal.

For more information refer to arboroculturalist's report in Appendix H.

5.11 Baseline values vs. as constructed

The impacts of the proposals have been determined by comparing the baseline situation with the hypothetical as constructed basement situation. Refer to the table below.

Attribute	Baseline value	As constructed value
Groundwater levels	Perched groundwater was found around 6.2-7.2m below ground level	Groundwater remains around 6.2-7.2m below ground level as a hydraulic link will be provided across the basement in the design
Structural integrity of surrounding structures	Burland Category 0	Burland Category 2 or less. Following residual mitigation measures, Burland Category 0.
Contamination	Elevated concentrations of lead and locally benzo[a]pyrene in the made ground	Contaminated excavated material to be removed as discussed in section 5.9.

For completeness a table of all the potential impacts identified at the screening stage is presented below along with their baseline and as constructed properties.

Screening question	Baseline	As constructed	Discussion
Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas? Will the proposed basement development result in a change in the area of hard surfaced / paved areas?	Site soft landscaped	Area of hardstanding increased over the footprint of the building	No change from consented scheme. Green roof provided to attenuate rainwater. There will be a reduction in the volume of rainfall seeping into the ground below but over such a small site this will have a negligible effect.
Is the site located directly above an aquifer? Will the proposed basement extend beneath the water table surface? Is the site within an aquifer?	Perched groundwater found at approx. 6.2-7.2m below ground level (95.6m-94.6m AOD)	Groundwater remains at 6.2-7.2m below ground level (95.6m-94.6m AOD)	Mitigated by providing a hydraulic link provided across basement

Will any tree/s be felled as part of the proposed development and/or any works proposed within any tree protection zones where trees are to be retained? (Note that consent is required from LB Camden to undertake any work to any tree/s protected by a Tree Protection Order or to tree/s in a Conservation Area if the tree is over certain dimensions).	3 trees on adjacent sites close to the boundary	1 tree on adjacent sites close to the boundary	Part of the development is within the root protection zone of a nearby tree which is to be retained. An arboriculturalist has been appointed and confirmed that provided no excavation works are undertaken within 3.35m of the tree, the impact on the tree resulting from the proposed development will be negligible. Conservation area consent granted for removal of two poor quality trees.
Is the site within an area of previously worked ground?	3m of made ground	Contiguous piled wall installed and made ground removed over footprint of basement	No change from consented scheme. Stability of adjacent structures maintained.
Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	-	Differential depths of foundations created	New basement structure will sit on its own foundations and be separate from neighbouring structures. No underpinning proposed.

5.12 Conclusions

A basement impact assessment, as required for planning by the London Borough of Camden, has been undertaken by Alan Baxter Ltd with contributions from Geotechnical Consulting Group and Ground Engineering Limited for the proposed basement in the plot of land adjacent to 1 Ellerdale Road.

The engineering rationale and construction issues associated with the proposed construction of a new basement have been explored and summarised in this report. A structural scheme design has been prepared along with a construction sequence to demonstrate that the proposals are buildable with the right skill and care without causing detriment to the local groundwater regime, slope stability, surface water regime or adjacent structures.

The structural proposals and construction methodology for the proposed basement has been developed with due regard to the existing site constraints and site specific ground conditions. The structure has been designed to maintain the stability and integrity of the surrounding land and existing structures and reduce the aesthetic damage to nearby structures as far as is reasonably practical. Anticipated ground movements have been shown not to cause structural damage to the existing buildings. Ground movements are limited to acceptable values by a combination of the structural design, suitably designed temporary works and good workmanship.

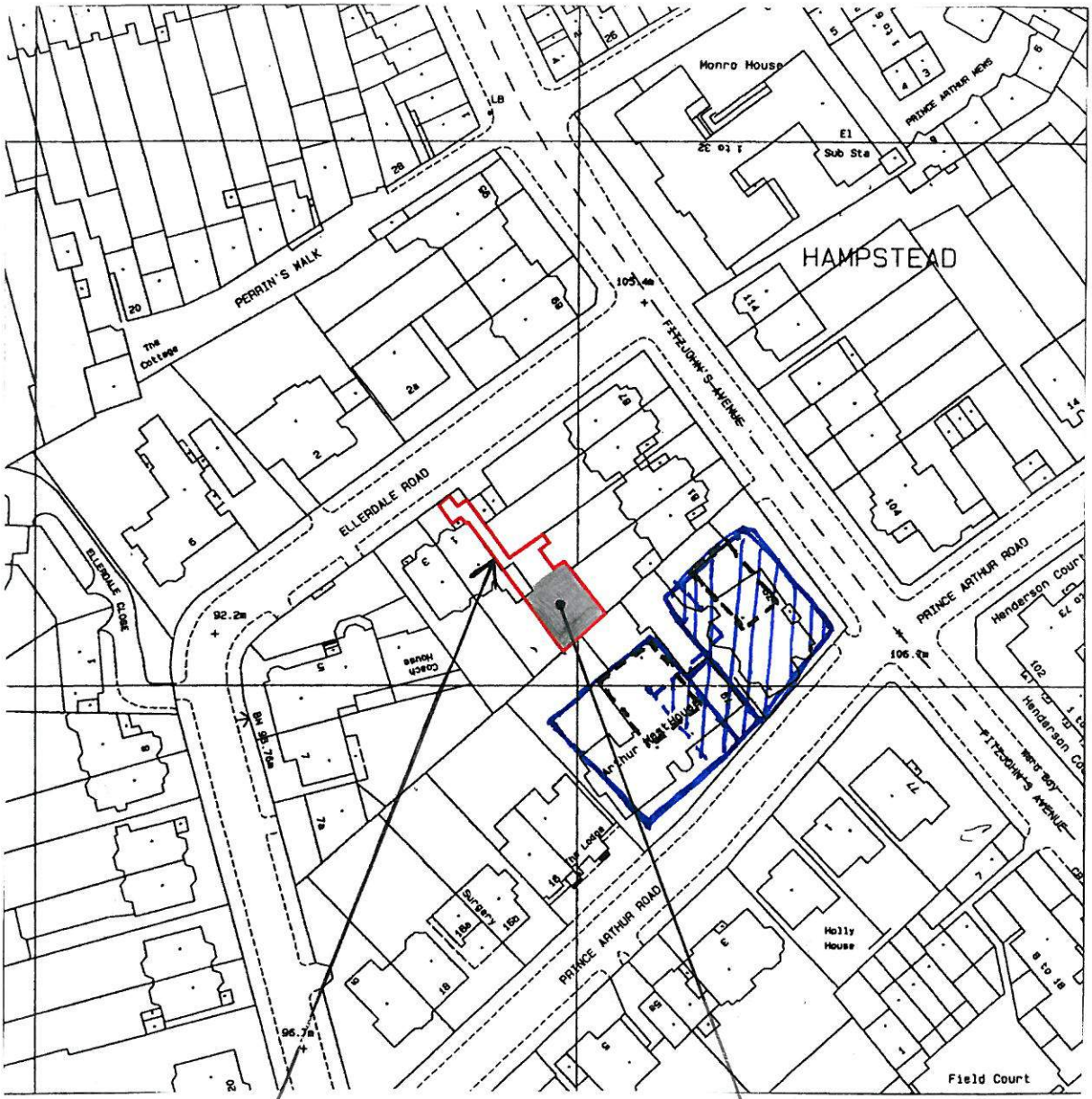
Prepared by	Hannah Butlin & Fraser Godfrey
Reviewed by	Michael Coombs & Simon Bennett
Issued	02 December 2015
Rev A Issued	07 December 2015

Appendix A – site plan & photos

- - - APPROX EXTENT OF BASEMENT TO ARTHUR WEST HOUSE (CURRENTLY BEING DEMOLISHED)

——— PROPOSED FOOTPRINT OF BUILDINGS TO REPLACE ARTHUR WEST HOUSE (GRANTED PLANNING PERMISSION)

///// APPROX EXTENT OF PROPOSED BASEMENT



SITE OUTLINED IN RED

EXTENT OF PROPOSED BASEMENT SHADED GREY

—	23.10.15	ISSUED WITH REPORT	HB
—	28.3.14	ISSUED WITH REPORT	HB

date	drawn	checked	scale (original - A4)	
MAR' 14	DK	SBe	1:1250	Alan Baxter

job	dwg.	drg. no.	rev.	
LAND BY 1 ELLERDALE ROAD	SITE LOCATION PLAN	1706/01/05	-	75 Cowcross Street London EC1M 6EL tel 020 7250 1555 email aba@alanbaxter.co.uk www.alanbaxter.co.uk

GARDEN TO 85
FITZJOHN'S AVENUE

GARDEN TO 83
FITZJOHN'S AVENUE

GARDEN TO 81
FITZJOHN'S AVENUE

THIS DRAWING IS BASED ON DIMENSIONAL SURVEY INFORMATION PROVIDED BY OTHERS. THE ARCHITECT CANNOT ACCEPT RESPONSIBILITY FOR THE ACCURACY OF THIS SURVEY INFORMATION.

THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL RELEVANT DRAWINGS, SPECIFICATIONS, SCHEDULES AND OTHER CONTRACT INFORMATION ISSUED BY THE ARCHITECT, STRUCTURAL ENGINEER, SERVICES ENGINEER AND ANY OTHER CONSULTANT EMPLOYED OR RETAINED BY THE EMPLOYER IN RESPECT OF THESE WORKS.

IN THE CASE OF NEW WORKS, ALL DIMENSIONS SHOWN ARE TO THE FACE OF MASONRY, METAL OR TIMBER STUD FRAMING, OR THE CENTRE LINE OF STRUCTURAL STEEL MEMBERS, UNLESS NOTED OTHERWISE.

DO NOT SCALE FROM THIS DRAWING. REPORT ANY DISCREPANCIES, CONFLICTS, ERRORS OR OMISSIONS TO THE CA AND SEEK DIRECTIONS BEFORE PROCEEDING.

CONFIRM ALL DIMENSIONS AND LEVELS ON SITE PRIOR TO COMMENCING WORK. IF IN DOUBT, ASK!

UNSTABLE TREES OVERHANGING THE GARDEN HOUSE TO BE REMOVED IN ACCORDANCE WITH AGREED METHOD STATEMENT

OWNERSHIP BOUNDARY

ARTHUR WEST HOUSE

EXISTING TREE

PARKING SPACE OWNED BY 1 ELLERDALE ROAD (shown hatched) (NOT PART OF SITE)
Access is NOT permitted across this space under any circumstances.

GARAGES

NEW DWELLING WALL TO BE CONSTRUCTED WITHIN EXISTING PARTY FENCE WALL TO BE RETAINED AND UNDERPINNED

THE GARDEN HOUSE SITE

NEW PARTY FENCE WALL

DASHED LINES INDICATE LOCATION OF PROPOSED NEW WALL ABOVE GROUND FLOOR LEVEL.

Temporary fence

Extent of req. underpinning to wall

Temporary decking & balustrade to be removed

RAMP UP

Existing bollard to be retained.

Temporary bin position during works.

Brick Wall 51.87 (TOW)

C/B & Trellis Fence 52.20 (TOF)

C/B & Trellis Fence

ELLERDALE ROAD

1 ELLERDALE ROAD

3 ELLERDALE ROAD

GARDEN TO 1
ELLERDALE ROAD

KEY PLAN

REV	DETAILS	BY	CHKD	DATE
P3	NOTE ON SITE BOUNDARY CHANGED TO OWNERSHIP BOUNDARY. ISSUED FOR COMMENT	GP	JB	25.03.14
P2	PROPOSED NEW WALLS SHOWN. ISSUED FOR COMMENT	GP	JB	25.03.14
P1	PLANNING ISSUE	SR	JB	03.12.12

DRAWING STATUS:
PRELIMINARY
DO NOT SCALE OFF THIS DRAWING

BURRELL | FOLEY | FISCHER | LLP
BURRELL FOLEY FISCHER · ARCHITECTS & URBAN DESIGNERS
ISIS HOUSE · 67 - 69 SOUTHWARK STREET · LONDON · SE1 0HX
E: mail@bff-architects.co.uk · W: www.bff-architects.co.uk
T: 020 7620 6114

JOB:
THE GARDEN HOUSE
1 ELLERDALE ROAD, HAMPSTEAD

FOR:
GEORG AND BABETTE GALBERG

AT:
15 C CLEVELAND SQUARE
LONDON, W2 6DG

DRAWING TITLE:
EXISTING SITE PLAN

DATE	SCALE
26.05.11	1:100@A3
DRAWN BY	CHECKED BY
SR	JB
JOB NO	DWG NO
BFF.777 (B)	AL(0)100.P3

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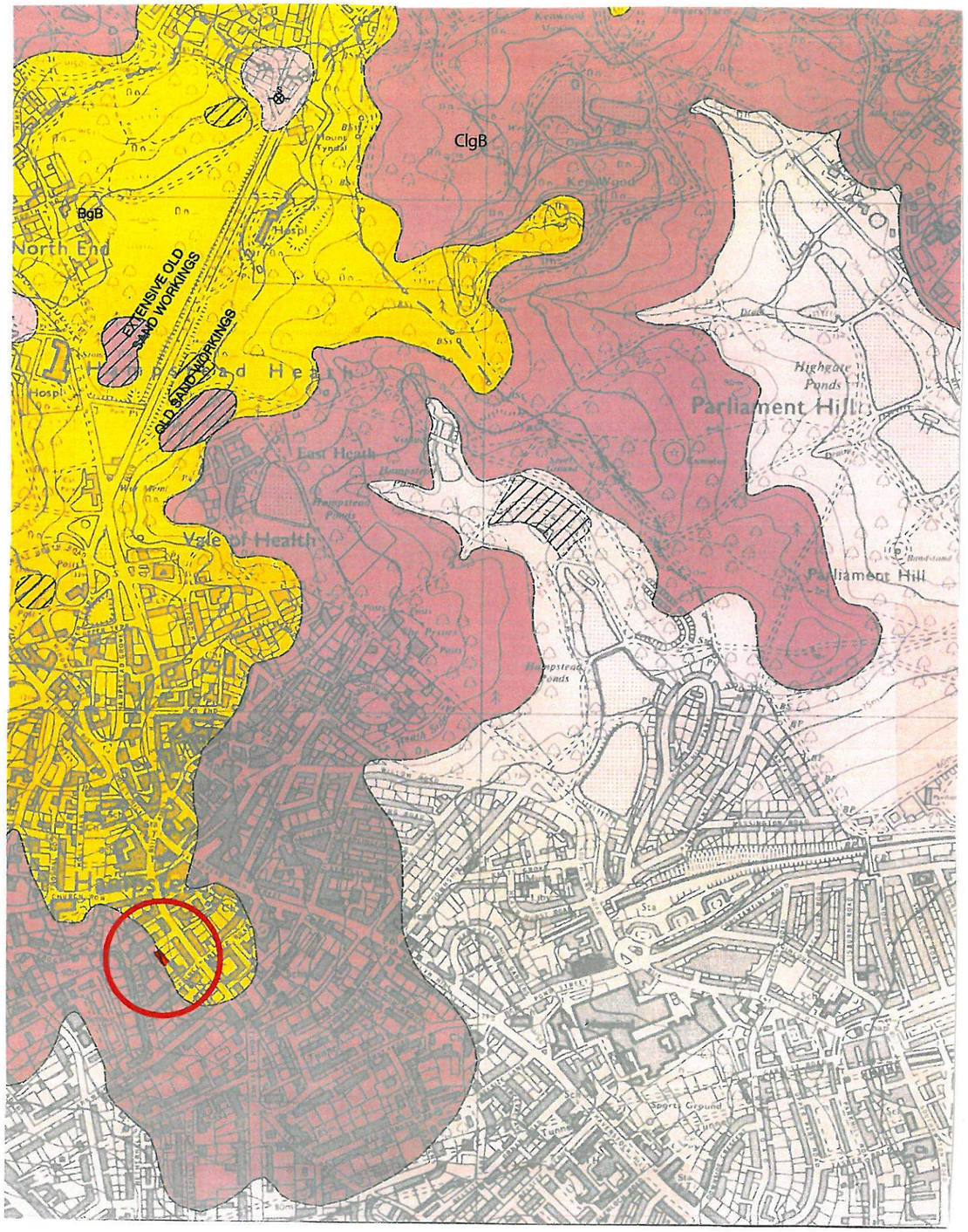
Appendix B – geology map



KEY

DRIFT
ARTIFICIAL DEPOSITS AND WORKED GROUND

Worked Ground	Mainly gravel pits, reservoirs and cuttings
Made Ground	Mainly general refuse, embankments and spoil tips
Worked Ground and Made Ground	Backfilled quarries

QUATERNARY DEPOSITS

Dollis Hill Gravel	River Terrace Deposits Gravel, sandy and clayey in part
Till	Chalky and silty sandy clay with flints and other erratics
Stanmore Gravel	Pebble gravel, sandy and clayey in part

The Dollis Hill Gravel is a deposit of a north-easterly flowing river, the Mole-Wey tributary of the pre-diversionary River Thames.

The Quaternary Deposits listed above are not necessarily in order of superposition

FOR SOLID SEE GENERALIZED VERTICAL SECTION

Geological boundary, Artificial and Quaternary Deposits

Geological boundary, Solid

Depths and thicknesses are given in metres

NOTES

A thematic map showing the distribution of boreholes lodged in the BGS National Geological Records Centre is available from BGS, Keyworth, Nottingham, NG12 5GG.

A database containing geological notes and bore details for this 1:10 000 sheet is held at BGS, Keyworth.

SCHEMATIC INTERRELATIONSHIPS OF THE QUATERNARY DEPOSITS
(not to scale)

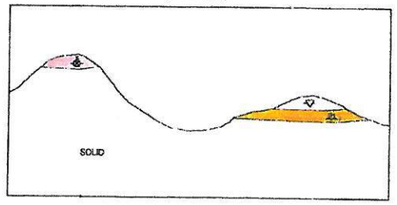


Diagram showing incidence of six-inch London New Series (L n) County geological sheets in relation to TQ28NE

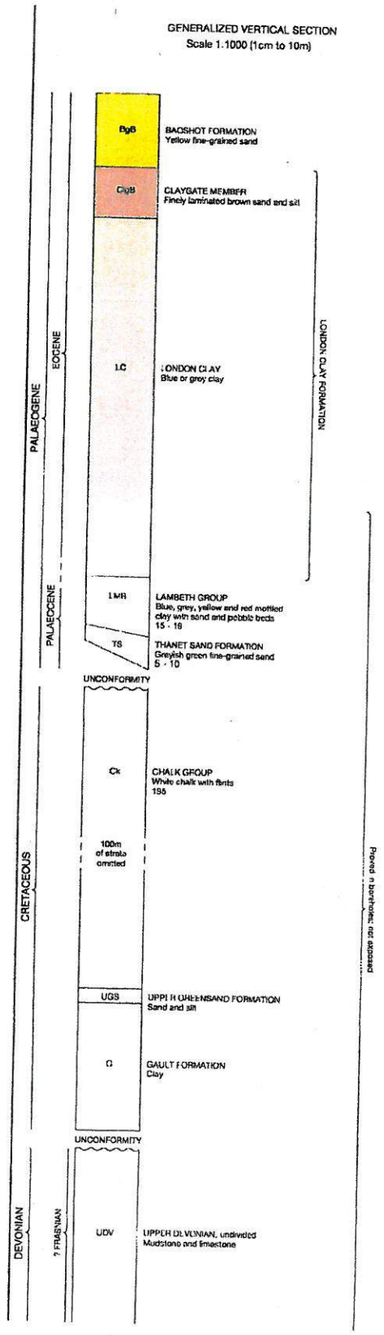
L n 1NE	L n 2NW
L n 1SE	L n 2SW
L n 4NE	L n 5NW

Diagram showing adjoining 1:10 000 National Grid Sheets

TQ29SW	TQ29SE	TQ39SW
TQ28NW	TQ28NE	TQ38NW
TQ28SW	TQ28SE	TQ38SW

SHEET No.	VERSION No.	PLOT FILE GENERATION DATE
TQ28NE	2	16/06/2008

GENERALIZED VERTICAL SECTION
Scale 1:1000 (1cm to 10m)



notes

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECT'S AND ENGINEER'S DRAWINGS AND THE SPECIFICATION.

2. SOURCE : TQ28NE, 1999.

23.10.15	ISSUED WITH REPORT	HB
28.3.14	ISSUED WITH REPORT	HB

job
LAND BY 1 ELLERDALE ROAD

title
GEOLOGY MAP

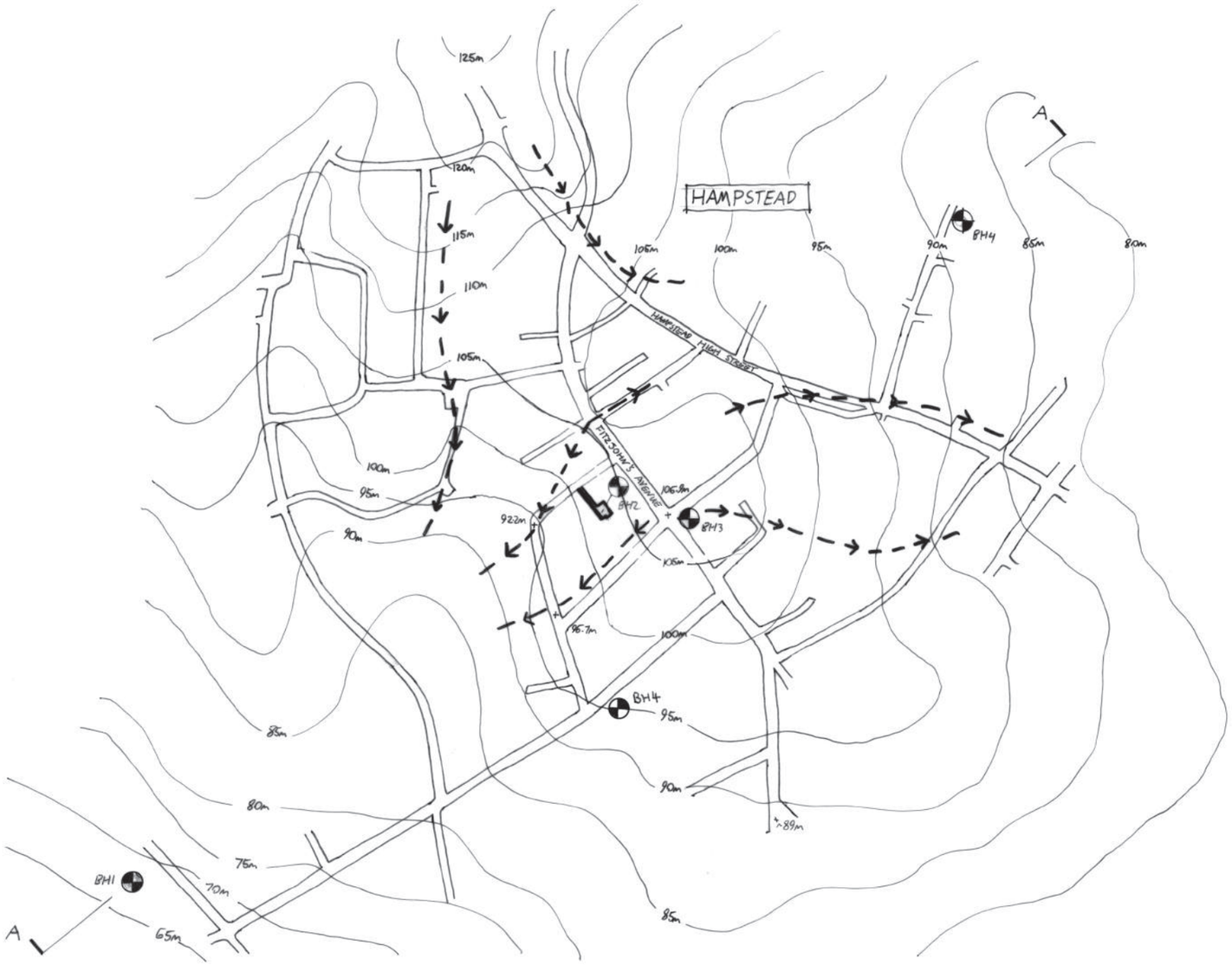
drawn: DK
checked: SBe
date: MAR' 14
scale (original - A3): N.T.S

Alan Baxter

75 Cowcross Street London EC1M 6EL
tel 020 7250 1555
email aba@alanbaxter.co.uk

www.alanbaxter.co.uk

drg. no.: 1706/01/06
rev.: -



PLAN
(1:2500)

notes

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND THE SPECIFICATION.
2. THE INFORMATION ON THIS DRAWING IS BASED ON THE FOLLOWING SOURCES;
   - A SITE INVESTIGATION CARRIED OUT BY GROUND ENGINEERING, JANUARY 2014.
   - BOREHOLE DATA FROM THE BRITISH GEOLOGICAL SURVEY.
   - GOOGLE EARTH AND GOOGLE STREET VIEW.
   - BING MAPS.
   - PLANNING APPLICATION 2012/3115/P

KEY

- —90m— CONTOURS
- THE SITE
- ASSUMED FLOW OF GROUND WATER
- BORE HOLE

28/10/15	ISSUED WITH REPORT	MB

job
GARDEN HOUSE, ELLERDALE ROAD

title
CONTOUR MAP AND ASSUMED GROUND WATER FLOW

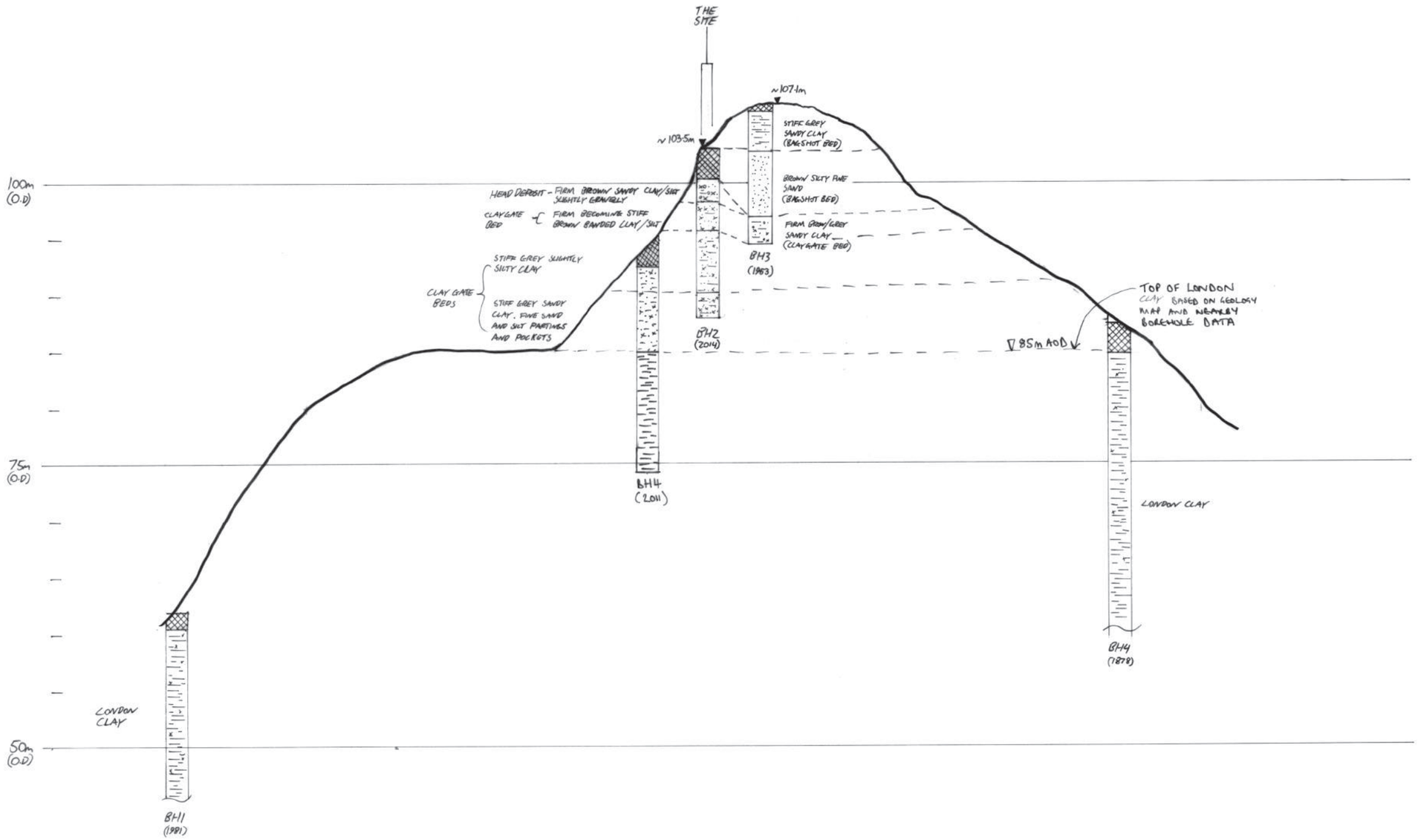
drawn	checked
FGo	SBe
date	scale (original - A1)
OCT '15	1:2500

Alan Baxter

75 Cowcross Street London EC1M 6EL
tel 020 7250 1555
email aba@alanbaxter.co.uk

www.alanbaxter.co.uk

drg. no.	rev.
1706/02/02	-



SECTION A-A

(VERTICAL SCALE 1:200, HORIZONTAL SCALE 1:2500)

notes

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND THE SPECIFICATION.
2. REFER TO 1706/02/02 FOR INFORMATION ON SOURCES.

KEY

GROUND PROFILE

ASSUMED GEOLOGY STRATA

	23/10/15	ISSUED WITH REPORT	HB

job
GARDEN HOUSE, ELLERDALE ROAD

title
ASSUMED GEOLOGICAL SECTION A-A

drawn: FGo | checked: SBe

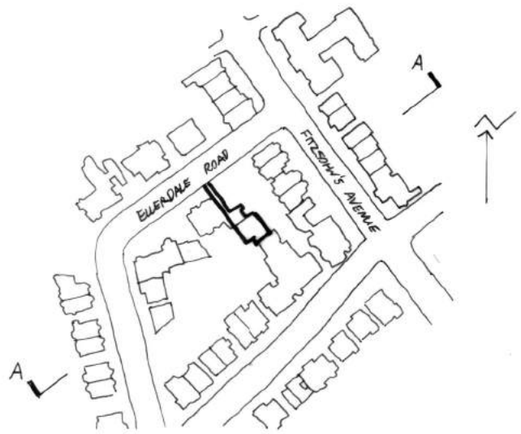
date: OCT '15 | scale (original - A1): H 1:2500 V 1:200

Alan Baxter

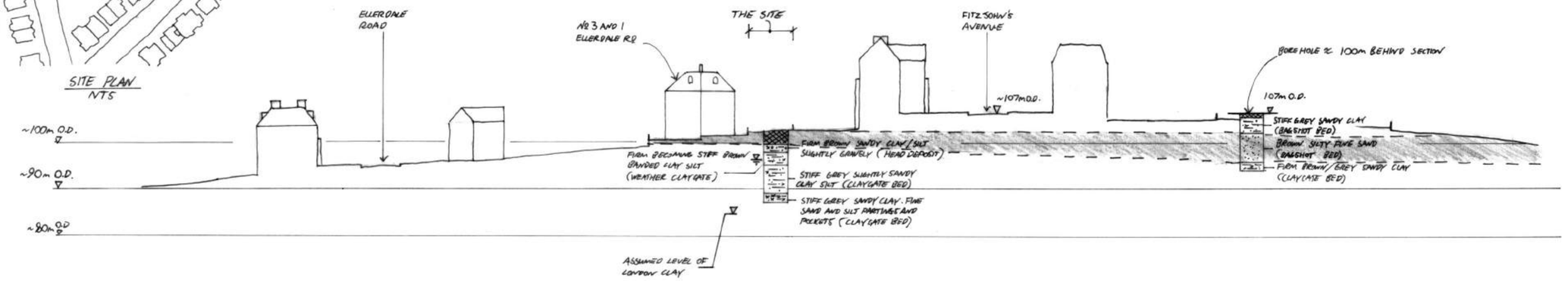
75 Cowcross Street London EC1M 6EL
tel 020 7250 1555
email aba@alanbaxter.co.uk

www.alanbaxter.co.uk

dtg. no. **1706/02/03** | rev. -



SITE PLAN
NTS



SECTION A-A
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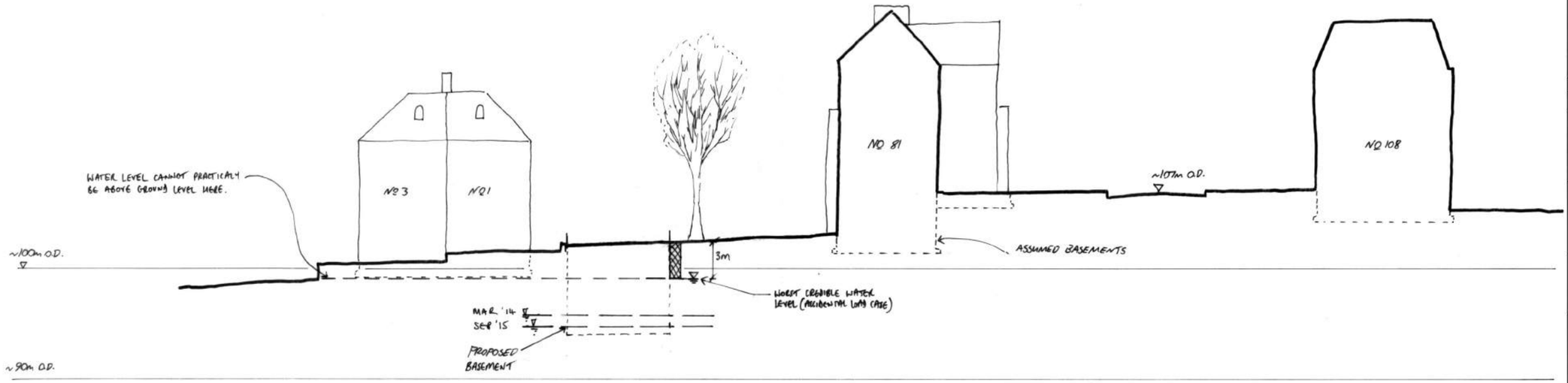


SECTION A-A
(1:200)

notes

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS' DRAWINGS AND THE SPECIFICATION.
2. REFER TO 1706/02/02 FOR INFORMATION ON SOURCES.

A	02.12.15	ISSUED WITH REPORT	HB
	23.10.15	ISSUED WITH REPORT	HB

job
GARDEN HOUSE, ELLERDALE ROAD

title
LOCAL GEOLOGY SECTION A-A

drawn	checked
FGo	SBe
date	scale (original - A1)
OCT '15	AS SHOWN

Alan Baxter

75 Cowcross Street London EC1M 6EL
tel 020 7250 1555
email aba@alanbaxter.co.uk

www.alanbaxter.co.uk

drg. no.	rev.
1706/02/04	A

Appendix C – Screening flowcharts

Appendix C – screening flowcharts

Hydrology (surface water flow and flooding) screening

	Screening flowchart question	Response	Scoping stage?
1	Is the site within the catchment of the pond chains on Hampstead Heath	No, the site is well removed from these ponds and outside the catchment area as shown on Figure 14 of Arup's hydro-geological study – Hampstead Heath Surface Water Catchments and Drainage.	N
2	As part of the site drainage, will surface water flows (e.g. rainfall and run-off) be materially changed from the existing route	No, these will be unaffected as the site is already effectively cut off from the wider landscape as it is surrounded by walls on all 4 sides.	N
3	Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?	Yes, the area of hardstanding will be increased.	Y
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, there will be no surface water flow off-site as a result of this proposal.	N
5	Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No, there will be no surface water flow off-site as a result of this proposal.	N
6	Is the site in an area known to be at risk from surface water flooding, such as South 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, refer to Figure 15 of Arup's hydro-geological study – Hydrogeological and Hydrological Study Flood Map.	N

Hydrogeology (groundwater) flow screening

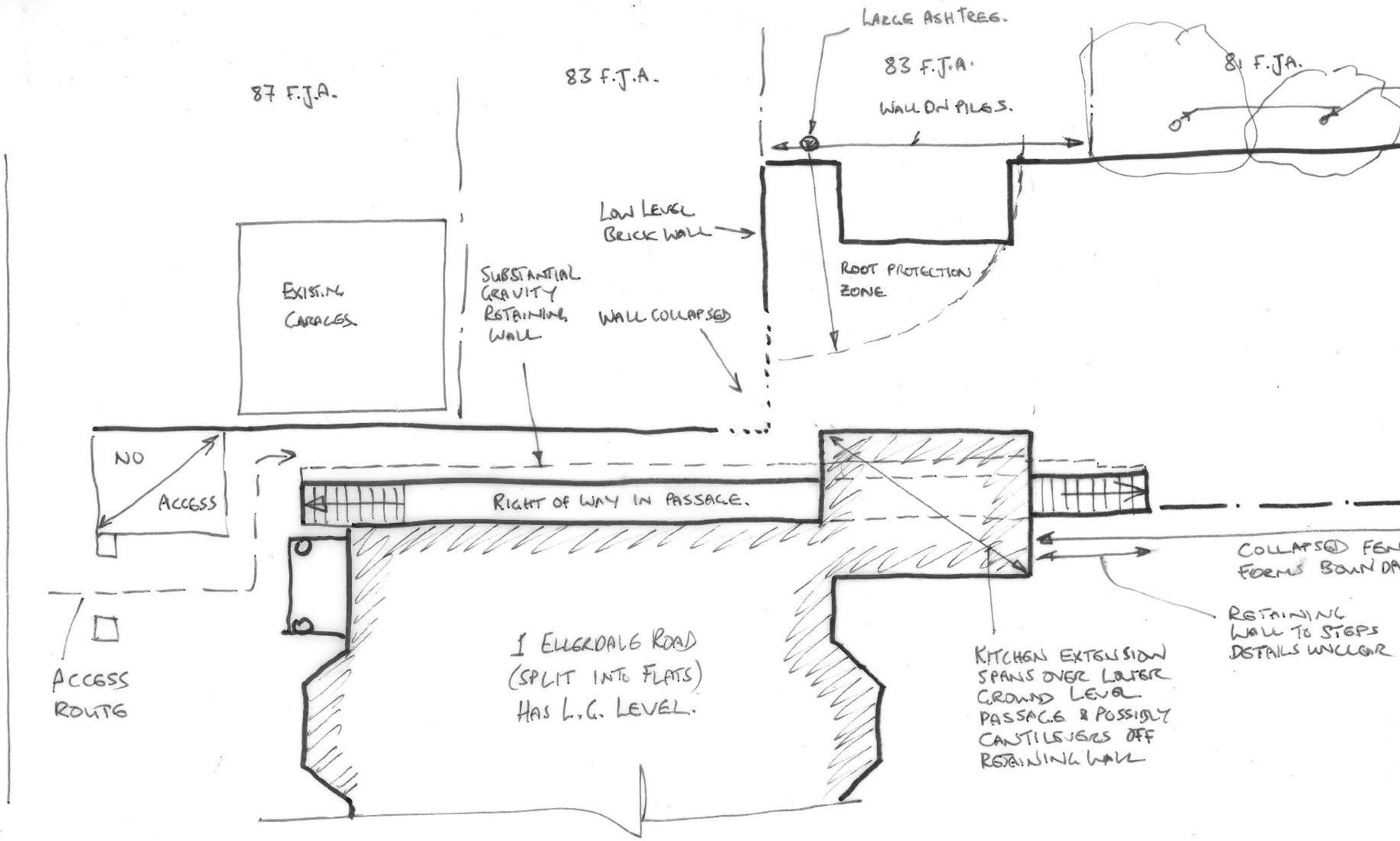
	Screening flowchart question	Response	Scoping stage?
1	Is the site located directly above an aquifer?	The maps in Appendix E show the site is located above an aquifer within the Bedrock geology and Figure 8 in Arup's report – Camden Aquifer Designation Map - shows there to be a secondary aquifer under the site.	Y
1b	Will the proposed basement extend beneath the water table surface	Yes	Y
2	Is the site within 100m of a watercourse, well (used/disused) or potential spring line?	The site is within 100m of a lost river of London which has since been diverted underground (Figure 11 – Arup report). However it is not within 100m a current watercourse, well or potential spring line. Refer to Figure 12 of Arup report and Appendix E.	N
3	Is the site within in catchment of the pond chains on Hampstead Heath?	No, as shown on Figure 14 of Arup Report – Hampstead Heath Surface Water Catchment and Drainage.	N
4	Will the proposed basement development result in a change in the area of hard surfaced / paved areas?	Yes the amount of hardstanding will increase as the new building will replace a soft landscaped area	Y
5	As part of the site drainage, will more surface water (e.g. rainfall and run-off) than present be discharged to the ground (e.g. via soakaways and/or SUDS)?	No, rainfall will be channelled into appropriate new drainage channels and eventually into surface water sewers as there is no space on site for of SUDS.	N
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, the elevation of the site is approximately 100m AOD making the underside of the excavation approximately 90m AOD and there are no ponds or spring lines close to or hydraulically connected to the site.	N

Slope and ground stability screening

	Screening flowchart question	Response	Scoping stage?
1	Does the existing site include slopes, natural or manmade, greater than 7°? (approximately 1 in 8)	No, Figure 16 of Arup Report – Slope Angle Map – and site observations confirm the site's gradient is less than 7°.	N
2	Will the proposed re-profiling of landscaping at site change slopes at the property boundary to more than 7°?	No, the proposal does not include landscaping that affects the boundaries	N
3	Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7°?	No, site observations and Figure 16 of Arup Report, have confirmed the neighbouring sites have a similar gradients.	N
4	Is the site within a wider hillside setting in which the general slope is greater than 7°?	No, Figure 16 of Arup Report – Slope angle map – and site observations confirm the wider gradient is less than 7°.	N
5	Is the London Clay the shallowest strata on site?	No, refer to Figure 3 of Arup Report – Camden Geological Map. The strata is shown as Bagshot Formation over Claygate Member over London Clay.	N
6	Will any tree/s be felled as part of the proposed development and/or any works proposed within any tree protection zones where trees are to be retained? (Note that consent is required from LB Camden to undertake any work to any tree/s protected by a Tree Protection Order or to tree/s in a Conservation Area if the tree is over certain dimensions).	There are no trees on site. 2 very low quality small trees in the garden of No. 81 Fitzjohn's Avenue are to be removed. Conservation area consent has already been granted for their removal. Part of the development is within the root protection zone of a nearby tree which is to be retained. An arboriculturalist has been appointed and confirmed that provided that no excavation works are undertaken within 3.35m of the tree, the impact on the tree resulting from the proposed development will be negligible. Refer to Arboriculturalist's Report in Appendix H for more details.	Y
7	Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	There is no evidence of this in the local area. This is not surprising as the site is well above the London Clay which is most susceptible to such effects.	N

8	Is the site within 100m of a watercourse or potential spring line?	The site is within 100m of a lost river of London which has since been diverted underground (Figure 11 – Arup report). However it is not within 100m a current watercourse, well or potential spring line. Refer to Figure 12 of Arup report and Appendix E.	N
9	Is the site within an area of previously worked ground?	Historical records and Figure 3 from Arup's report – Camden geological map indicate the site is not on worked ground, however the borehole records from the site investigation undertaken in October 2012 indicate there is approximately 3m of made ground beneath the site	Y
10	Is the site within an aquifer?	The maps in Appendix E show the site is located above an aquifer within the Bedrock geology and Figure 8 in Arup's report – Camden Aquifer Designation Map - shows there to be a secondary aquifer under the site.	Y
11	Is the site within 50m of the Hampstead Heath Ponds?	No, Figure 14 of Arup's report – Hampstead Heath Surface Water Catchments and Drainage – and Figure 13 – Hampstead Heath Map – indicate the site is not within 50m of the Hampstead Heath ponds.	N
12	Is the site within 5m of a highway or pedestrian right of way?	No, the proposed basement is further than 5m from the nearest highway/pedestrian right of way, refer to site location map in Appendix A.	N
13	Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Yes, the basement is being formed adjacent to neighbouring properties which do not have a basement.	Y
14	Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines?	No, based on our in-house information, the site is outside any exclusion zones.	N

Appendix D – existing structure drawings



notes

A	2.12.15	ISSUED WITH REPORT	HB
-	23.10.15	ISSUED WITH REPORT	HB
-	28.5.14	ISSUED WITH REPORT	HB
-	18.12.13	ISSUED FOR INFORMATION	RW

job
SITE BY 1 ELLERDALE RD., HAMPSTEAD

title
EXISTING SITE SUMMARY

drawn RW. | checked SBe

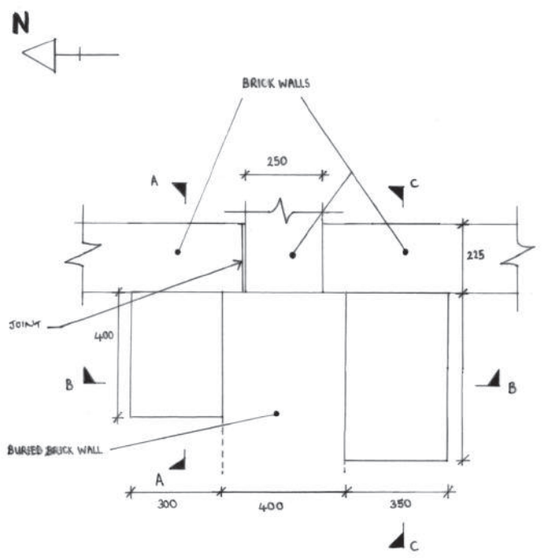
date DEC 13 | scale (original - A3) ~1:100

Alan Baxter

75 Cowcross Street London EC1M 6EL
tel 020 7250 1555
email aba@alanbaxter.co.uk

www.alanbaxter.co.uk

drg. no. 1706/01/01 | rev. A



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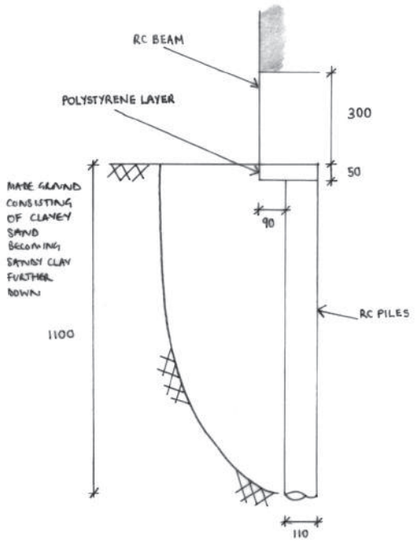

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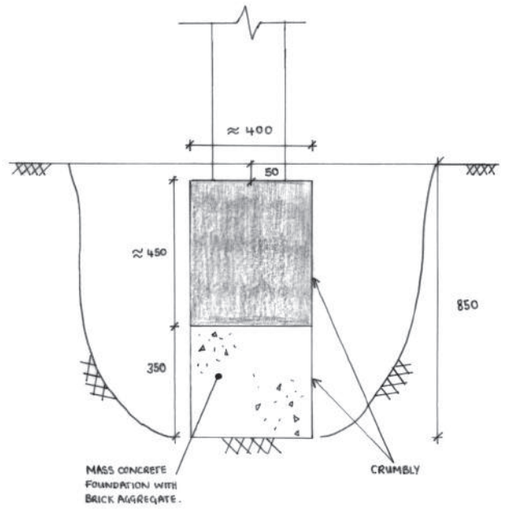

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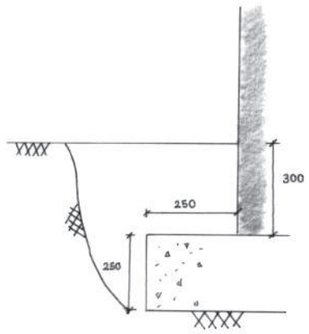
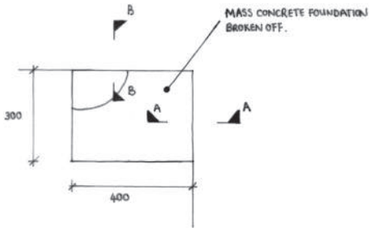


SECTION C-C

notes

1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND THE SPECIFICATION.
2. THIS DRAWING IS BASED ON LIMITED OBSERVATIONS MADE DURING A SITE INVESTIGATION UNDERTAKEN IN JANUARY 2014.



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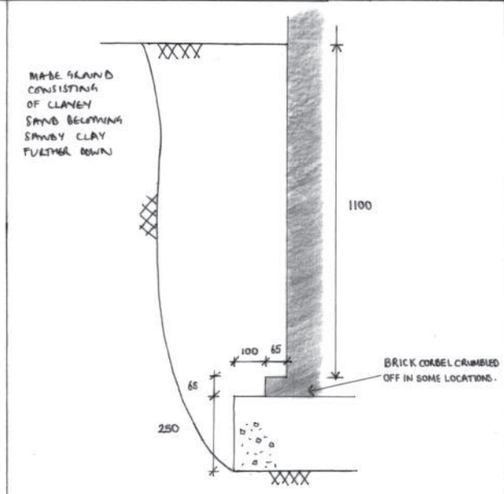

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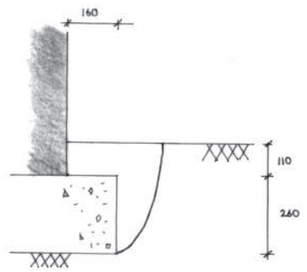

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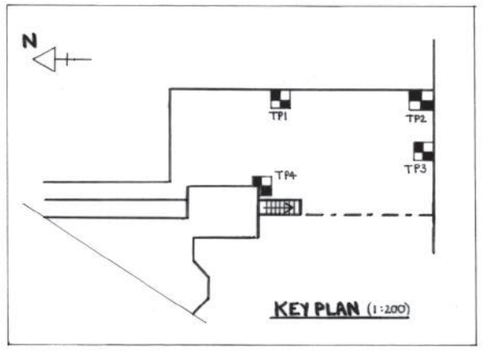

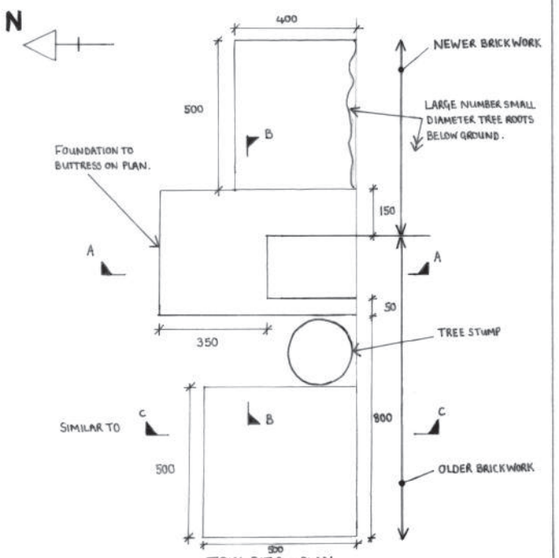

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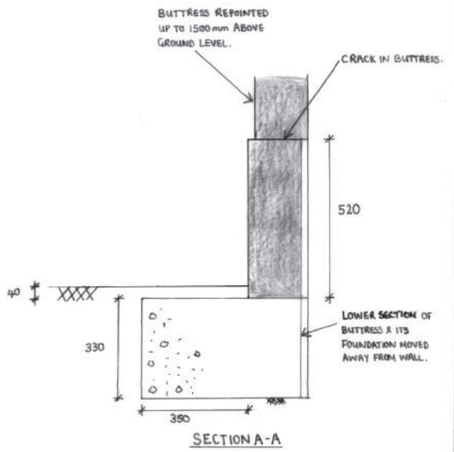

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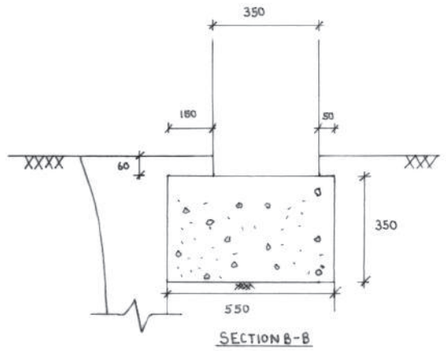

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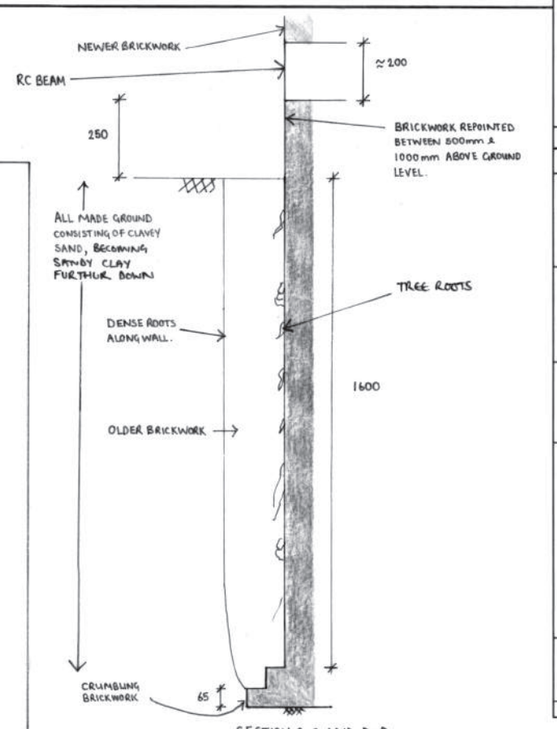

SECTION C-C AND D-D

	23.10.15	ISSUED WITH REPORT	HB
-	28.3.14	ISSUED WITH REPORT	HB

job
LAND BY 1 ELLERDALE ROAD

title
TRIAL PIT OBSERVATIONS
SHEET 1 OF 2

drawn	checked
EW	HB
date	scale (original - A1)
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Alan Baxter

75 Cowcross Street London EC1M 6EL
tel 020 7250 1555
email aba@alanbaxter.co.uk

www.alanbaxter.co.uk

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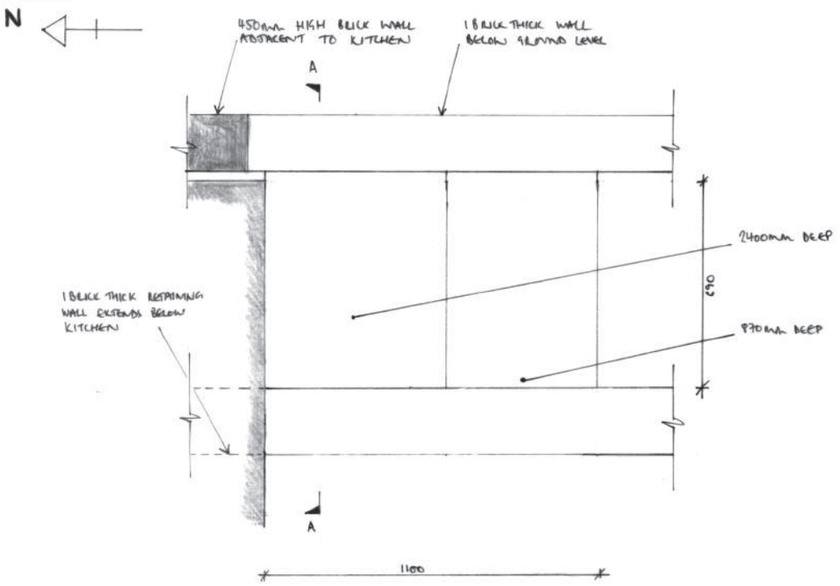
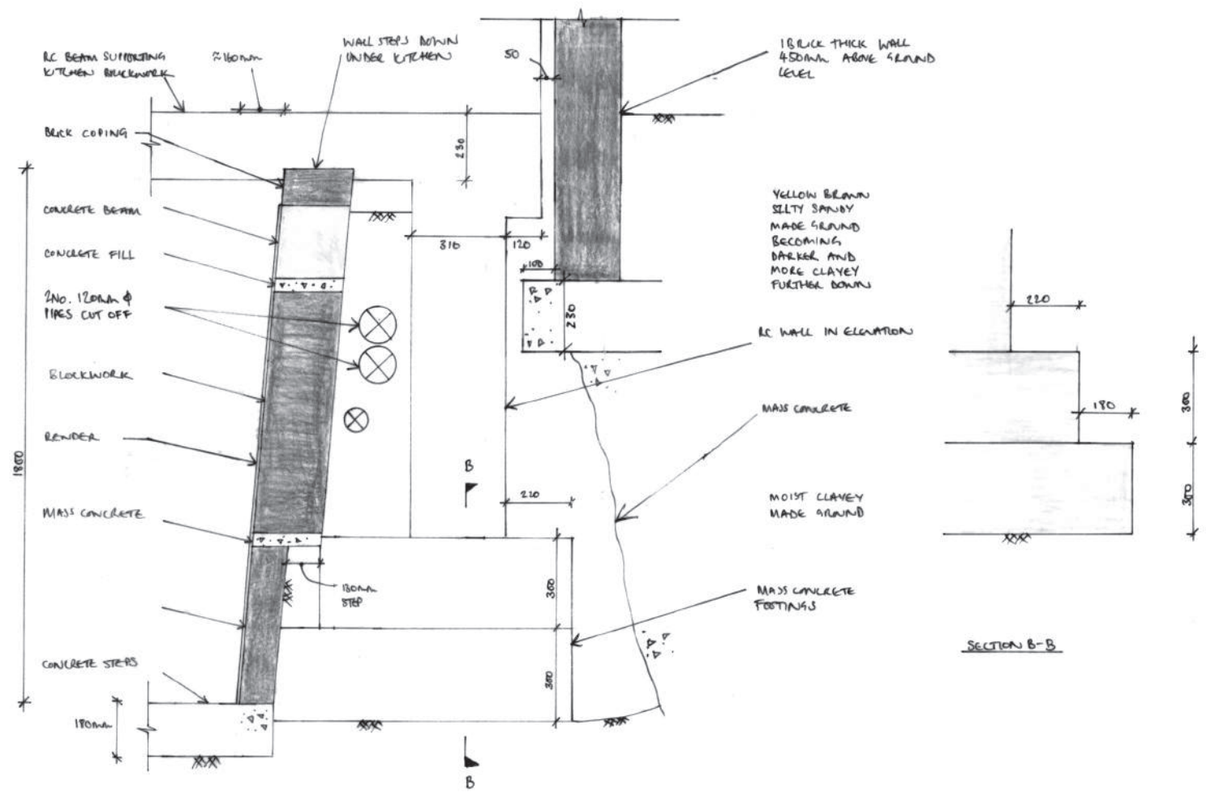


TRIAL PIT & PLAN

FOR KEY PLAN REFER TO 1706/01/S03



SECTION A-A

SECTION B-B

notes

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–	23.10.15	ISSUED WITH REPORT	HB
–	28.3.14	ISSUED WITH REPORT	HB

job
LAND BY 1 ELLERDALE ROAD

title
TRIAL PIT OBSERVATIONS
SHEET 2 OF 2

drawn	checked
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Alan Baxter

75 Cowcross Street London EC1M 6EL
tel 020 7250 1555
email aba@alanbaxter.co.uk

www.alanbaxter.co.uk

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Appendix E – site investigation report 2015

Soil Environment Services Ltd

GEOTECHNICAL SOIL SURVEY

Charles Edward Limited

1 Ellerdale Road

Hampstead

Soil Environment Services Ltd
September 2015

Our Ref: SES/CE/ER/1#1 **Date: 18th September 2015**

Client:

Charles Edward Limited
Grove House
Sheldon Way
Larkfield
Kent
ME20 6SE

GEOTECHNICAL SOIL SURVEY

1 Ellerdale Road

A report prepared on behalf of ***Soil Environment Services*** by:

Written by:

Janet Melville BSc MSC FGS *Engineering Geologist*

Checked by:

Dr Robin S Davies BSc PhD MISoilSci PGC *Contaminated Land Management*

INSTITUTE OF PROFESSIONAL SOIL SCIENTISTS

Soil Environment Services
Agricultural Land Classification, Contaminated Land Risk Assessment, Mineral Extraction Soil Planning
The Nanotechnology Centre, Herschel Building, Kings Rd, Newcastle upon Tyne NE1 7RU
Tel: 0191 243 0686 Fax: 0191 222 3528 Email: rd@soilenvironmentservices.co.uk
www.soilenvironmentservices.co.uk

CONTENTS

1. SCOPE OF WORKS

Soil Environment Services Ltd was instructed to conduct a factual ground investigation at:

Land at: 526355, 185486

1 Ellerdale Road, Hampstead, London, NW3 6BA

(Drawing SS/1)

…to determine the ground conditions for the proposed single storey residential development.

The planned works include soil survey and testing to provide a factual geotechnical assessment of soil conditions for the required ground-works and/or building construction in general accordance with EC7, BS5930 and BS1377.

The site investigation was carried out on the 2nd September 2015.

The planned scope of works as per detailed and specified within the agreed quotation comprised:

- 2 x boreholes to a maximum depth of 5 m or as dictated by ground conditions
- 2 x Dynamic probing or SPT and/ or Shear vane reading
- pH and sulphate analysis
- Atterberg limits analysis (plastic index)
- 1 x Factual report in general accordance with EC7 and BS5930

Variation to the above scope of works may be needed and beneficial given the ground conditions encountered during the site investigation. This will be detailed in **Section 3.1 – Completed Works.**

The accuracy of the geotechnical report is restricted to the initial scope of works and then the completed works. Also, variation in soil strength and composition may subsequently be encountered across the site during site works operations and/or ground preparation.

2. SITE SETTING

The site assessed for this investigation (Drawing 1) is currently part of the rear garden of the existing residential property at 1 Ellerdale Road. The site is accessed via a narrow walkway from Ellerdale Road, alongside the existing building.

1 Ellerdale Road is located on a hill which decreases in elevation with progression towards the southwest. The site as per this report is flat but appears to be at a slightly higher elevation than the garden area immediately to the west.

At present the site is comprised of a grassed lawn with no trees or shrubs. Numerous semi mature and mature trees are located on neighbouring land in close proximity to the proposed development, these are noted on the site plan (Drawing 1).

2.1 Surface conditions

At the time of survey the site was located within the soft landscaping of the rear garden of the adjoining property.

2.2 BGS/Soil survey mapped Geology and drift

The site is mapped by the BGS as being located on:

Drift
None recorded

Bedrock
Claygate Member: Clay, silt and sand. Sedimentary bedrock formed approximately 34 to 56 million years ago in the Palaeogene Period. Local environment previously dominated by shallow seas.

There are no borehole records held on the Geology Viewer website (mapapps.bgs.ac.uk) within 150 m of the site.

2.3 Drainage and hydrogeology

Surface water is likely to flow southwest down Ellerdale Road, following the gradient of the local topography.

The soils encountered during the ground investigation generally comprise granular overlying cohesive material therefore drainage is expected to be moderate. Ponding on site is considered unlikely due to the local topography.

3. GEOTECHNICAL SOIL SURVEY

3.1 Completed works

Site works

The BHs and LDP probes were located as in Drawing 1.

BH01 was drilled to refusal at 4.8 m BGL and BH02 was drilled to the scheduled depth of 5.0 m BGL. The corresponding LDPs reached 4.4 m BGL and 4.0 m BGL respectively.

3.2 General strata descriptions (full borehole logs in Appendix A)

The ground investigation encountered Made Ground comprising sandy silt and sand to a maximum proven depth of 1.2 m BGL (BH01), overlying the Claygate Member to a maximum proven depth of 5.0 m BGL.

3.3 In-situ testing

Testing on-site included either the use of the shear vane if possible in all boreholes (Table 1) and/or SPT or LDP/DP to depth as detailed.

Shear vane readings

Shear vane readings were not undertaken due to stone content and /or non-cohesive nature of the soils.

Light Dynamic Probe (LDP)

LDPs were undertaken at both locations.

Profile data plots are detailed below

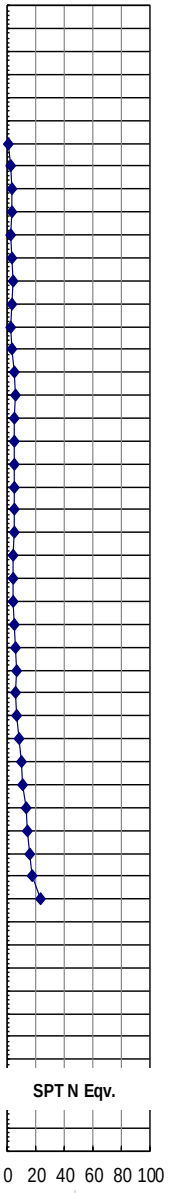
Light dynamic probe data sheet — DIN 4094

Hole ref: BH1 — Water depth (m):

Depth	Blow count	Torque	Torque adj. blows		SPT-N Eqv*	Depth
m bgl	N 10	N/m	N 10	N 30		m bgl
0.0	0		0			0.0
0.1	0		0			0.1
0.2	0		0			0.2
0.3	0		0			0.3
0.4						0.4
0.5						0.5
0.6						0.6
0.7						0.7
0.8						0.8
0.9						0.9
1.0						1.0
1.1	3		3	3	1	1.1
1.2	4		4	7	2	1.2
1.3	3		3	9	3	1.3
1.4	3		2	9	3	1.4
1.5	3		2	7	3	1.5
1.6	6		5	10	4	1.6
1.7	4		3	11	4	1.7
1.8	2		1	9	3	1.8
1.9	4		3	7	2	1.9
2.0	7	7	6	10	3	2.0
2.1	6		5	13	5	2.1
2.2	6		5	15	5	2.2
2.3	6		5	14	5	2.3
2.4	6		5	14	5	2.4
2.5	6		5	14	5	2.5
2.6	7		6	15	5	2.6
2.7	6		4	15	5	2.7
2.8	5		3	13	5	2.8
2.9	6		4	12	4	2.9
3.0	4	9	2	10	4	3.0
3.1	6		4	11	4	3.1
3.2	9		7	14	5	3.2
3.3	7		5	16	6	3.3
3.4	8		6	18	6	3.4
3.5	8		6	16	6	3.5
3.6	9		6	18	6	3.6
3.7	13		10	22	8	3.7
3.8	13		10	27	10	3.8
3.9	14		11	31	11	3.9
4.0	19	18	16	37	13	4.0
4.1	17		13	40	14	4.1
4.2	21		16	45	16	4.2
4.3	26		20	49	18	4.3
4.4	35		29	65	23	4.4
4.5						4.5
4.6						4.6
4.7						4.7
4.8						4.8
4.9						4.9
5.0		62				5.0

SPT N Eqv.

No readings taken in top 0.30 m bgl



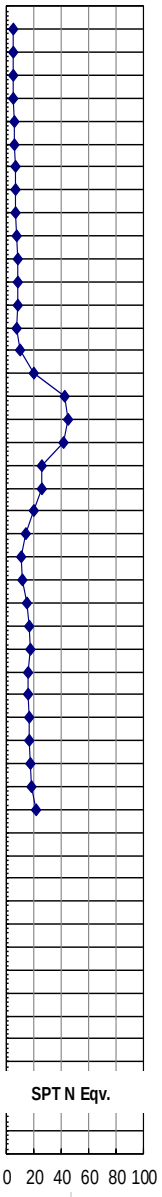
Light dynamic probe data sheet — DIN 4094

Hole ref: BH02 — Water depth (m):

Depth	Blow count	Torque	Torque adj. blows		SPT-N Eqv*	Depth
m bgl	N 10	N/m	N 10	N 30		m bgl
0.0	0		0			0.0
0.1	0		0			0.1
0.2	0		0			0.2
0.3	0		0			0.3
0.4	4		4			0.4
0.5	6		6			0.5
0.6	5		4	14	5	0.6
0.7	5		4	14	5	0.7
0.8	7		6	14	5	0.8
0.9	5		4	14	5	0.9
1.0	7	8	6	15	5	1.0
1.1	9		7	17	6	1.1
1.2	7		5	18	6	1.2
1.3	8		6	18	6	1.3
1.4	9		7	17	6	1.4
1.5	11		8	21	7	1.5
1.6	11		8	23	8	1.6
1.7	10		7	23	8	1.7
1.8	11		8	22	8	1.8
1.9	11		7	22	8	1.9
2.0	16	22	12	27	10	2.0
2.1	40		36	55	20	2.1
2.2	75		70	118	42	2.2
2.3	25		20	126	45	2.3
2.4	30		25	115	41	2.4
2.5	32		27	72	26	2.5
2.6	26		20	72	26	2.6
2.7	16		10	57	20	2.7
2.8	15		9	39	14	2.8
2.9	18		11	30	11	2.9
3.0	19	38	12	32	11	3.0
3.1	26		19	43	15	3.1
3.2	22		15	46	17	3.2
3.3	22		15	49	18	3.3
3.4	21		14	44	16	3.4
3.5	22		15	44	16	3.5
3.6	24		17	46	17	3.6
3.7	21		14	46	17	3.7
3.8	24		17	48	17	3.8
3.9	27		20	51	18	3.9
4.0	31	38	24	61	22	4.0
4.1						4.1
4.2						4.2
4.3						4.3
4.4						4.4
4.5						4.5
4.6						4.6
4.7						4.7
4.8						4.8
4.9						4.9
5.0						5.0

SPT N Eqv.

No readings taken in top 0.30 m bgl



3.3.1 Ground bearing

The minimum allowable bearing capacity (qa) encountered at BH01 for a 0.60 x 10 m footing would be **70 kN/m^2 at 1.5 m bgl, 100 kN/m^2 at 2.5 m bgl and 150 kN/m^2 at 3.0 m** (Ground bearing for shallow footings - Bowles, (after Meyerhof) 1976 (for 25 mm settlement)). For 0.3 m dia bored piles this would be **47.9 kN/m2 at 1.2 m bgl to 143 kN/m2 at 2 m bgl.** (Reese and Wright, 1977 (qp for drilled piles).

BH02 indicates the minimum allowable bearing capacity (qa) for a 0.60 x 10 m footing to be **280 kN/m^2 at 1.5 m bgl, 340 kN/m^2 at 2.5 m bgl and 315 kN/m^2 at 3.0 m.** For 0.3 m dia bored piles this would be **287.3 kN/m2 at 1.2 m bgl to 478.8 kN/m2 at 2 m bgl. .** (Reese and Wright, 1977 (qp for drilled piles).

All bearing capacities increase at depths below those detailed above.

It is recommended that consideration be given to the differences in bearing capacities and of the thickness of Made Ground across the site during the design phase.

Notes on bearing capacity calculations

The bearing value information constitutes an element of interpretation of the factual data as recorded on site. This requires choice of methods and formulae which are open to interpretation. Soil Environment Services use NovoSPT, a widely accepted software package, using typical formulae for these calculations. Appropriate formulae have been used given the soil type/s and data input into the software adjusted to site specific conditions.

Shear Failure safety factor	3
Soil type/s	SILT
Unit weight	15 kN/m^3
Groundwater depth	none
Shallow footing width	0.6
Preferred depth	~1.5 m bgl
Pile diameter	0.3 m
Borehole diameter	65 mm
Overburden correction	Liao & Whitman 1986

A number of interpretations of the factual data may be selected within the software and results offered for comparison. This will typically be either shallow and deep foundation options and different formulae for each of these options.

NovoSPT is a computer program for interpretation of Standard Penetration Test (SPT/ DCPT) and correlating blow counts (N) to soil properties based on more than 270 formulas. Novo Tech Software Ltd. #4188 Hoskins Road, North Vancouver, British Columbia, Canada. Soil Environment Services accept no responsibility for errors within NovoSPT software.

3.4 Groundwater

Groundwater was not encountered during the ground investigation undertaken on 2nd September 2015.

A monitoring well installed during a previous ground investigation was dipped during the investigation. The well was found to be to a depth of 10.20 m BGL with water at 7.20 m BGL. No further information pertaining to the existing borehole has been supplied to Soil Environment Services.

4. LABORATORY TESTING

4.1 Chemical testing

Samples obtained at depth indicated concern in BH01 with regards to sulphates and pH (Appendix B) and it is therefore recommended in accordance with BRE Special Digest 1 (2005) that the on site Design Sulphate Class is classified as DS-3. Subsequently all concrete construction should be of ACEC class DS-3, AC-2s with respect to the chemical environment for concrete.

4.2 Mechanical testing

With reference to NHBC Chapter 4.2, Building Near Trees, the following is considered likely to apply with regards the trees located on or near the site.

Volume Change Potential	Significant Trees	Tree Water Demand	Distance from Proposed Foundations (m)	Max Tree Height (m)	D/H	Foundation Depth (m)*
Low	Plane (T11)	Moderate	10	26	0.35	1.25
Low	Plum (T2)	Moderate	1	10	0.1	1.5
Low	Elder (T3)	Low	1	10	0.1	1.1

*The foundation depths are based on the soil volume change potential as determined from the borehole, the estimated distance between the proposed foundation and the corresponding tree.

5. SUMMARY AND CONCLUSIONS

5.1 General ground conditions

- Made Ground was encountered to a maximum proven depth of 1.2 m BGL, overlying the Claygate Member to a maximum proven depth of 5.0 m BGL.

- Groundwater was not encountered during the recent ground investigation. However an existing borehole indicated a groundwater level of 7.2 m BGL.

- Chemical testing indicated a design Sulphate Class of DS-3. Subsequently all concrete construction should be of ACEC class DS-3, AC-2s with respect to the chemical environment for concrete.

- The allowable minimum bearing capacity ranges upwards from 70 kN/m2 at 1.5 m depth and 100 kN/m2 at 2.5 m depth for a 0.6 m width footing or 143.6 kN/m2 for bored piles at 2 m depth based on information from BH01.

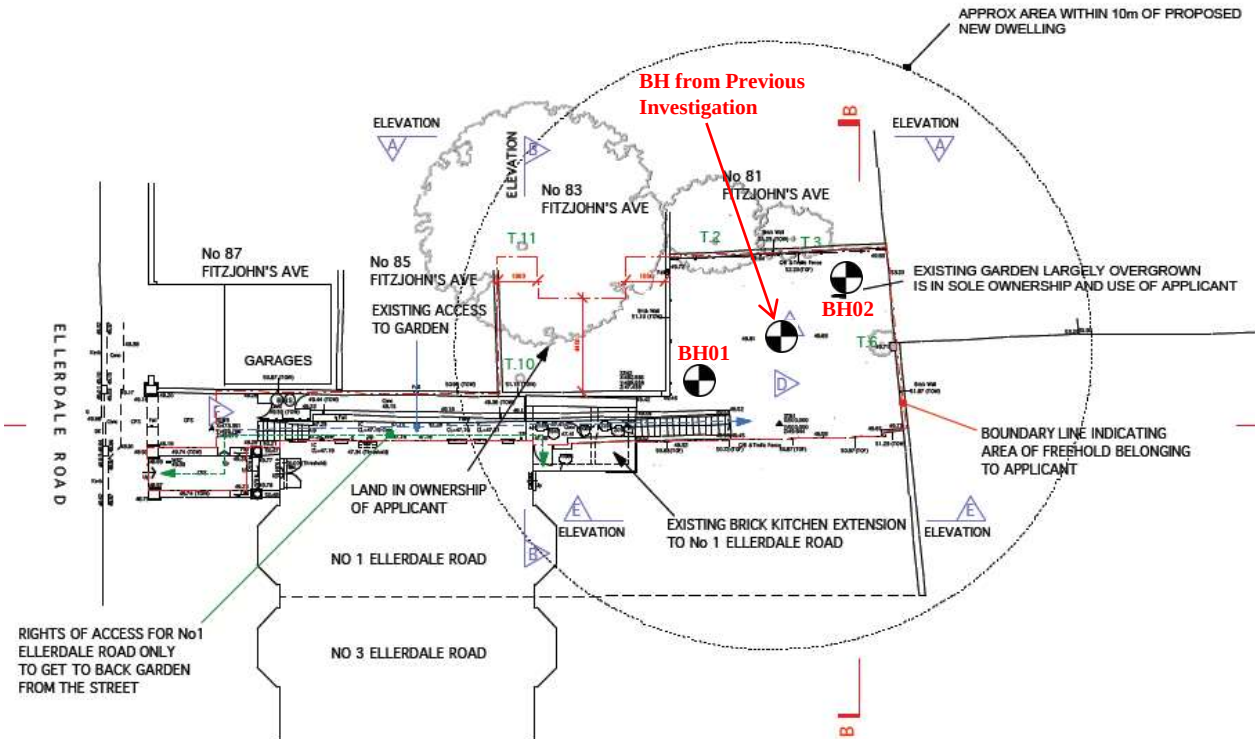
- Laboratory testing confirmed low plasticity with a maximum foundation depth of 1.5 m bgl required on the eastern boundary of the site.

Drawing 1

Borehole Locations

NOTES:		
- Borehole and LDP	Project: 1 Ellerdale Road	Client : Charles Edward Limited
	Drawing Title: borehole locations	Drawing No.: 1
	Scale: NA	Date: 1st September 2015

N



TREE NOTES

No	TYPE	APPROX TRUNK DIAMETER	APPROX CROWN SPREAD	APPROX HEIGHT	NOTES
T.1	LAUREL	150mm	4m	5m	Already removed
T.2	PRUNUS	300mm	3m	6m	
T.3	ELDER	150mm	3m	4m	
T.4	ELDER	150mm	1.5m	4m	Already removed
T.5	SHRUB	70mm	2m	2m	Already removed
T.6	FRAXINUS (SUCKER)	100mm	1m	3m	To be removed (Growing against wall)
T.7	(COLLAPSED)	100mm	3m	3m	Already removed
T.8	PRIVET	30mm	1.5m	3m	Already removed
T.9	PRIVET	30mm	1.5m	3m	Already removed
T.10	(STUMP)	800mm	NA	NA	To be removed
T.11	PLATANUS HISPANICUS	750mm	15m	18m	