Pegasus Life Limited

79 Fitzjohn's Avenue, Camden, London

Enabling Works Specification – Revision 2

March, 2016

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Contents

FIGURES

APPENDICES

1. INTRODUCTION

Pegasus Life Limited is proposing to develop Arthur West House, 79 Fitzjohns Avenue, Hampstead, London NW3 6PA in the London Borough of Camden (LBC). This will include the demolition of the existing structure and the construction new six storey structure including a new basement level. The building will be of residential use.

Card Geotechnics Limited (CGL) was instructed by Gleeds Management Services Ltd on behalf of Pegasus Life Limited to prepare an Appendix to the Specification for Demolition and Enabling Works by MLM (the structural engineer for the project).

CGL prior involvement in the project was in support of the pre-planning stage to undertake a Basement Impact Assessment (BIA) for the proposed development to assess the potential impact on surrounding structures and hydrological and hydrogeological features. The aforementioned BIA has been revised (March 2016) to accommodate recent adjustments in design.

This report was originally prepared in October 2015 and included updated design information within an Addendum letter which was issued in December 2015. It has been further revised in March 2016 (current revision) to accommodate recent adjustments in design. Its scope is to outline the Enabling Works Specification (EWS) and set out supplemental guidance on the scope and requirements for below ground demolition and enabling works considerations for the specialist contractor to develop in tendering the works. It is not intended to be a prescriptive specification but more of a guide presenting solutions to retaining walls that the CDP designer can develop, enhance or substitute with his own more practical but safe solutions.

2. SITE INFORMATION AND CONSTRAINTS

2.1 Site location

The site is located at 79 Fitzjohns Avenue in the London Borough of Camden and is situated to the southwest of Hampstead Heath. The National Grid reference for the approximate centre of the site is 526446, 185514.

A site location plan is presented in Figure 1.

2.2 Site description

The site was previously occupied by a former hotel belonging to the Hyelm Group. The hotel included two five storey buildings, and was surrounded by planters and hard standing to the north-east and south-east. There was an area of soft landscaping to the west of the hotel.

There are four semi-detached houses with private gardens located approximately 5m to the north-west of the site along Fitzjohns Avenue. These are numbered 81-87. Fitzjohns Avenue runs along the north-eastern boundary of the site, and Prince Arthur Road bounds the site to the south-east. Two semi-detached houses are located approximately 25m north-west of the site fronting Ellerdale Road. The properties have private, south facing gardens that abut the site. A line of properties is situated approximately 30m south-east of the site, on the southern side of Prince Arthur Road. A tunnel and train line associated with the West Hampstead Thames Link is located approximately 300m south-east of the site.

The north-eastern and south-eastern site boundaries are occupied by hard standing and planters fronting the pavements of Prince Arthur Road and Fitzjohns Avenue respectively. The north-western boundary of the site is bounded by a brick wall that separates the site from the properties fronting Fitzjohns Avenue. The western corner of the site is bounded by fences and hedgerows.

A site layout plan is presented in Figure 2.

2.3 Proposed development

The proposed development comprises the demolition of the existing structure and construction of a six storey complex of residential buildings with lower ground floor and basement levels. The lower ground floor occupies most of the building's footprint whilst the lower basement level occupies the more central part of the site closest to Prince

Arthur Road. Albeit the lower ground floor is still essentially a single approximately 6m deep basement at the east boundary with Fitzjohns Avenue.

The lower basement will be formed at a level of approximately 94mOD and will be cut into the existing slope, with a maximum retained height of around 10m along a limited length of the south-eastern site boundary with Prince Arthur Road. Typically, the retained height of the lower basement excavation will be 6m. The retained height between pile cap formation level and street level typically varies between approximately 3m and 6m.

Proposed structural plans and sections are presented in Appendix A.

2.4 Site history

Ordnance Survey maps dating back to 1870 were previously reviewed by CGL to inform the BIA. The salient points are summarised below.

Mapping from the 1870's indicates that the area was used as agricultural and private land associated with *Mount Farm*. Some farm buildings were present approximately 50m to the north of the site, and there were trees approximately 100m to the south-west. The site was bounded to the east by *Church Place*, to the south by what appeared to be a garden, and to the west by a field. Several small paddocks were located approximately 100m south-west of the site and extended for approximately 200m in that direction. The map indicates two ponds approximately 300m south-west of the site.

The 1895 map indicates that the farm buildings were partially demolished and the farmland was redeveloped. A building occupied the northern end of the site, whilst the southern end was a private garden. Four semi-detached houses were built approximately 5m to the north of the site, and a further two were built approximately 30m to the west. *Prince Arthur Road* was built around this time and bounded the site to the south-east. The road that bounded the north-east of the site was named *Fitzjohns Avenue*.

There were no significant changes until 1935, when the map indicates a substantial development to the southern end of the site, with the presence of a large building orientated parallel to the existing Prince Arthur Road.

In 1955, the building towards the southern corner of the site was demolished; there was no further significant change noted until 1974, when a new building was built in its place.

Available aerial photographs show that by 1999, both buildings had undergone further development and extension to form one large building, which predominantly occupied the site. A further building had been built in the centre of the site, and hard standing formed a car park between the two buildings. Hard standing and planters were identified along the north-eastern, south-eastern, south-western site boundaries.

No further significant changes were noted between 1999 and present day.

2.5 Existing buildings

The site is currently occupied by a multi storey residential building with a single storey basement, built in the 1970s or 1980s, known as Arthur West House. The areas of the building adjacent to the roads are five storeys tall, with a single basement beneath the block onto Fitzjohns Avenue. Behind these taller areas the building reduces to one and two storeys covering the remainder of the site. The existing building is brick clad and is assumed to be concrete framed with RC hollow pot floors, although no record drawings of the existing structure are available. Local intrusive investigations will be carried out prior to demolition to establish if an existing concrete frame is prestressed or concrete encased steel, to inform demolition techniques. Basement retaining walls are expected to be reinforced concrete and foundations thought likely to be ground bearing as the presence of existing piles has not yet been verified by the extent of intrusive investigations undertaken on the site to date.

The only available drawings available are architectural plans and sections and these are included for reference purposes in Appendix B.

2.6 Tree protection

The existing site contains a number of large trees but the majority of these and any smaller flora will be removed under the proposed scheme. The exception to this are the Holm Oak and Beech trees on Prince Arthur Road near the site boundary. These trees are to be maintained and the proposed construction works are not permitted to affect their stability and growth and will require tree protection measures. The specialist contractor should take due cognisance of the location and size of the existing trees and provide all necessary protection to those trees that are to be retained in accordance with current best practise.

A recent air spade trench excavation survey undertaken by a specialist contractor (18/03/2016) has indicated that there is no significant amount of major tree roots at the locations where the retaining structures are to be installed.

2.7 Buried services

No record drawings are available of the existing drainage within the site although Thames Water have provided asset records for the public sewers in Fitzjohns Avenue and Prince Arthur Road. A CCTV survey of the existing drainage was carried out in October 2014 by Survey Solutions. This establish the majority of the invert levels of the existing manholes and connections to the public sewer, although these were hampered in the South West of the site, probably due to tree root growth into the pipework. All existing pipework within the site to the last manhole will be removed entirely and replaced by the proposed drainage. The last existing manholes before connection to the public sewer may be retained in the proposed scheme to minimise disturbance to adjacent trees' roots.

2.8 Main contractor site logistics

The main contractor for the project is Vinci Construction – Building Division – London.

Vinci have submitted a draft Construction Management Plan (CMP) to Camden.

The intention is for an Enabling Works contractor to leave Vinci with as clear and un-obstructed site as possible at PPL's at 102.0m & 103.0mOD free from obstruction to piling, temporary propping clashing with pile locations or elements of permanent works by others. Vinci would then essentially introduce the temporary works framing as the main excavation works proceeds breaking the proposed CFA piles sequentially and safely as the basement dig progresses.

Further proposals are expected to be developed and provided by the follow up principal contractor and his temporary works engineer (TWE) as the project moves forward.

3. EXPECTED GROUND CONDITIONS

3.1 Existing site investigation

An intrusive investigation was undertaken in August 2014 by Ian Farmer Associates (Ian Farmer). The investigation comprised the excavation of three window sampler boreholes (BH1, BH3 & BH4) and two cable percussions boreholes (BH2 and BH5) to depths of between 11mbgl and 20mbgl. In-situ testing was undertaken and comprised Standard Penetration Tests (SPTs). Groundwater monitoring wells were installed within the boreholes BH2, BH4 and BH5 and the groundwater level was monitored on three occasions.

Three inspection pits were excavated in 2014 on the north-western site boundary to expose and record the existing foundations. The foundations are likely to be consistent with those of the neighbouring properties and the details have been used with the land stability assessment. The intrusive investigation at the time of the BIA was considered to be sufficient to generate the pre-planning phase ground model for the development.

3.2 Summary of expected ground conditions

With reference to the Ian Farmer intrusive investigation, the ground conditions beneath the site generally comprise a limited thickness of Made Ground over interbedded sands and clays of the Bagshot Formation and Claygate Member, over clay of the London Clay Formation. It is noted that the shallow soils are highly variable, comprising interbedded sands and clays and there is no clear differentiation between the granular Bagshot Formation and interbedded Claygate Member. The summary of ground conditions presented in the Ian Farmer investigation has been reproduced in Table 11 below.

Table 1. Summary of Ian Farmer investigation findings

Stratum	**Depth encountered (mbgl)**	**Thickness (m)**
Made Ground/possible Made Ground	0.0	0.25 to 1.8
Bagshot Formation	0.25 to 1.8	6.8 to 14.65
Claygate Member (London Clay Formation	8.5 to 14.9	>11.5 Proven to 20mbgl

Although not identified as such by Ian Farmer, soils with a description consistent with the London Clay Formation were encountered in borehole BH2 at approximately 86mOD and borehole BH5 at approximately 87.4mOD. The soils are described as stiff, fissured, dark grey, silty, sandy clay.

3.2.1 Expected groundwater level

Groundwater was encountered within the granular soils of the Bagshot Sand/Claygate Member at levels between **94.3mOD and 95.7mOD** and was measured during three separate monitoring visits in 2014. For design purposes, groundwater level has been taken at 96.0mOD.

It is anticipated that groundwater will be flowing towards the south within the Bagshot Formation/Claygate Member. This is considered to represent an unconfined perched aquifer above the Claygate Member.

Groundwater is likely to be approximately to be at or about the blinding level for the underside of the proposed lower basement slab and potentially 1-2m above the proposed pile cap level in the lower basement area.

Further monitoring visits are recommended before the piling design and temporary works design is finalised.

3.3 Recommendations for groundwater control

Observations on groundwater should be carefully recorded during excavation and appropriate mitigation strategies put in place prior to the first excavation. Groundwater has been encountered within the granular Bagshot Formation/Claygate Member at a depth above the proposed basement.

Should water bearing sand horizons/lenses be encountered at shallower depths than the proposed basement formation level (i.e. >98mOD), then some limited seepage into excavations may be encountered. Under such conditions, ‘running sands’ could potentially generate voids beneath adjacent structures and cause collapse of the excavated wall if unsupported. Although such conditions are not anticipated based on the available information, an effective contingency plan for shallow granular soils and/or shallow perched water and running sand conditions should be agreed with the contractor at the time of commencement. This will likely take the form of a temporary shoring system to prevent collapse and void formation. Such shallow water seepages are likely to be limited in volume and should be readily controlled with a sump pump. Prolonged groundwater lowering by pumping is not anticipated during the enabling works phase although a residual project risks going forward during the lower basement excavation below 96mOD although the proposed secant wall to the sub-basement will mitigate the need to control ground water by pumping.

Trench sheets, shoring and a pump will need to be available at all times during the works in case of such an event. There should also be preparation to use no fines concrete where appropriate should perched water be encountered during the enabling phase.

3.4 Basement impact assessment (BIA)

CGL previously prepared a pre-planning stage BIA report (Dec 2014) and addendum letter (March 2015) following revision to the original basement scheme. Following design revisions in the meantime, further updating of the report was required and undertaken in March 2016.

3.5 Recent trial pitting

Further detail of the recent extensive trial pitting undertaken on the site and recorded ahead of the demolition phase can be found in Appendix D.

4. CONSTRUCTION SEQUENCING

4.1 Generally

This section sets out the preferred construction sequence for enabling works as indicated on the CGL Drawings included within Appendix C.

In summary, the enabling works scheme is based on hybrid steel kingposts (KP's) plunged in un-cased concrete filled borings and the use of a silent piling rig to install sheet piles as indicated on the drawings. It is anticipated that the Kingpost piles could be installed using a conventional low tech auger attachment fitted to a 25/35T excavator. The adjacent sheet piling to the Fitzjohns boundary would be designed with a single walling level and installed by a silent pile press (Tosa rig or similar). The intention is for the specialist contractor undertaking the enabling works to leave the main contractor (Vinci) or the appointed groundworker with as 'clean' a site as possible at preferred piling platform levels of 103.0mOD and 102.0mOD free from obstruction to the main piling rig(s), clutter or propping free without need for or elements of permanent works to be built in advance by others.

Vinci or the appointed groundworker would then be expected to sequentially introduce the temporary works framing as the bulk dig excavation proceeds subsequently breaking down the piles the CFA installed piles as reduced level dig proceeds. The sacrificial pile breakdown will be aided by de-bonding sleeves installed to the main reinforcement.

For ease of reference the Section references used formerly in Symmetry's drawings for demolition and enabling works (Appendix A) are repeated by CGL as follows.

4.2 General Sequence

A general overview of the anticipated enabling works sequence is as follows:-

- Demolish existing building to above existing surrounding ground level (mOD varies);
- Install the various earth support methods as described below;
- Remove below ground structure as specified;
- Re-fill to specified levels (102.1mOD & 103.3mOD);

- Lay Geogrid & 6F2 piling platform (102.5mOD & 103.7mOD), test and sign off piling platform (at which point the EW contractor leaves site and Vinci arrive with piling rig).

4.3 Party wall section 1-1

1. Install granular fill for the formation of the piling platform sub-base (up to 102.15mOD).

2. Install king post wall piles.

3. Install geogrid at 102.15mOD and form top level of piling platform at 103.0mOD.

4. Install CFA piles (foundations).

5. Excavate to pile cut-off level (98.7mOD) for the installation of the pile cap. Create a berm to support the excavation, prior to the installation of the raking prop at 103.0mOD, which will be supported on the pile cap.

6. Form lower ground floor slab on top of the pile cap.

4.4 Party wall section 2-2

The anticipated sequence is as follows:-

1. Prior to demolition advancing – core through existing Level 0 slab at 104.85mOD at each proposed KP locations;

2. Demolish all above ground structure and other slabs not giving support to neighbouring property or the highway;

3. Auger 600mm diameter holes, Install KP's tight against existing retaining wall (GL H) and foundation and C35 concrete as shown;

4. Dry pack residual gaps to face of existing retaining wall (where retained);

5. Weld steel cleats inside webs to support MGF panels hung by its 'ears' at the required height to retain the piling platform fill material;

6. Sever the remaining slabs from the existing retained remnant of the existing RC retaining wall, break out in a controlled hit, fill and miss sequence removing all obstructions to main piling assumed at 1m below existing squash court FFL at

101.232m OD thus a planned excavation level of ~100.2mOD. Note: - this assumes that all sheetpiling to Sections 3-3 and 4-4 is already in place.

7. Reusing site won excavated material and demolition arisings back fill existing basement initially to existing garage car parking level 103.15 mOD in 300mm compacted layers taking care not to over-compact within 1- 2m of MGF panelling ;
8. Install Tensar Triax 160 geogrid at 102.6mOD and fill with 400mm of 6F2 piling platform material over the geogrid to a PPL of 103.0mOD.
9. Undertake plate bearing tests as specified by piling contractor;
10. The excavation and build sequence will be developed with the main contractor but for KPW design and estimating purposes the deepest adjacent planned excavation level can be assumed as 98.7mOD at Sections 1-1 and 2-2 accounting for the construction of the pile caps along with a temporary framing level of 103.0mOD.

4.5 Fitzjohn's Avenue – Section 3-3 (Northwest corner of site)

1. Install sheet pile wall (toe level at 98mOD).
2. Excavate to 100.625mOD forming a berm to support the sheet pile wall.
3. Form piling platform to 103.0mOD as described in Sections 4.3 and 4.4 above.
4. Install foundation piles.
5. Install horizontal props at 103.0mOD.
6. Continue excavation to pile cut-off level for the installation of the pile caps (99.5mOD).
7. Install pile caps and floor slab (top of slab at 100.625mOD).
8. Build lower ground floor level walls and provide temporary support (raking prop) before removal of horizontal prop.
9. Remove raking prop once the construction of the upper slab is complete (see Appendix C, CGL-TW-12, Stage 9).

4.6 Fitzjohns Avenue – Section 4-4

The anticipated sequence is as follows:-

1. Demolish all above ground structure and other slabs that are otherwise not giving support to neighbouring property or the highway;

2. Grub up remaining tree roots and stumps that obstruct the proposed line of sheet piling;

3. Set up an agreed reaction stand at a safe location, note that it may be necessary to back prop or part fill the existing basement to achieve this;

4. Using a silent piler to press in PU18^{-1} sheet piles or equivalent to a minimum toe level of 97.4mOD and top of sheet pile (TOS) level of 106.2mOD (depending on whether there is actually space for the safe excavation of a leader trench without undermining the boundary wall and footpath) or otherwise keep high with a TOS of 107.3m OD thus maintaining safe edge protection;

5. A berm will be initially required to support excavation to a minimum elevation of 100.625m OD. Following the installation of horizontal and raking props the excavation will be continued to 100.2mOD for the construction of the secant pile capping beam. The raking prop will be supported by the secant pile wall which will be installed to enable the construction of the lower level basement.

6. Reusing site won excavated material and pileable demolition arisings back fill existing basement initially to existing garage car parking level 338.64ft (103.15 mOD) in 300mm compacted layers taking care not to over-compact within 1- 2m of MGF panelling ;

7. Install Tensar Triax 160 geogrid at 102.6mOD and fill with 400mm of 6F2 piling platform material over the geogrid to a PPL of 103.0mOD.

8. Undertake plate bearing tests as specified by piling contractor;

9. Thereafter the excavation and build sequence will be developed with the main contractor but for KPW design and estimating purposes the deepest planned adjacent excavation level can be assumed as 99.4mOD with a temporary framing level of ~103mOD. The build out stage is generally assumed as follows:-

- Undertake piling from 103.0m OD using CFA method with de-bonded piles;

- Excavate to 102.5mOD to install walling and corner braces at 103mOD;

- Excavate to 100.2mOD in main part of site leaving a soil berm as modelled;
- Construct thrust blocks or reaction pile caps with RC blisters and Install central raking props;
- Remove soil berm and excavate to 100.2mOD;
- Excavate for and construct caps followed by lower ground floor slab;
- Construct RC retaining wall leaving pockets for props;
- Re-prop wall with push-pull struts or construct ground floor slab to act as prop;
- Back- fill between retaining wall and sheet piles to underside of props and wallings;
- Remove props and wallings, make good pockets and fill to proposed sub-landscaping levels;
- Cut down sheet piles to suit landscaping and tree pit depth requirements

4.7 Prince Arthur Road – Sections 5-5

The anticipated sequence is as follows:-

1. Demolish all above ground structure and other slabs not giving support to neighbouring property or the highway;
2. Remove non-structural brick planters and brick wall linings from face of retaining walls and locally excavate to expose solid RC toe of retaining wall sequentially at each KP location concrete;
3. Core 650mm diameter clearance hole through at base of retaining slab at each proposed KP location – assumed 300mm thick RC;
4. Auger 600mm diameter holes, Install KP's tight in C35 concrete approximately 150-175mm off the face of existing retaining wall as shown and allow to reach design strength;
5. Introduce 50T jack to pre-deflect needles and insert mini UC walings and steel packing/shimming;

6. Demolish existing structure below 104mOD in short 3m sections on a hit, miss and fill basis, remove obstruction to wall piles and individual bearing piles near GL A and replace fill flush with top of concrete (TOC) of existing highway retaining wall at ~102.0m OD;

7. Reinstate ground level back to 103.4m OD in 300mm layers using site won pileable demolition arisings free draining and 75mm max size;

8. Install a layer of Tensar Triax 160 geogrid over the demolition fill and place 300 – 400mm of 6F2 piling platform material over the geogrid to a PPL of 103.0mOD.

9. Undertake plate bearing tests as specified by piling contractor;

10. The excavation and build sequence will be developed with the main contractor but for KPW design and estimating purposes the deepest adjacent planned excavation level can be assumed as 99.5mOD with a temporary propping level of ~104mOD. The build out stage is general assumed as follows:-

- Undertake piling from 103.0m OD using CFA method with de-bonded piles;
- Excavate general site levels to 100.2m leaving a soil berm as modelled breaking piles down to suit;
- Install trench sheeted and propped temporary works to construct capping beam, excavate and blind,
- Construct capping beam with RC propping blisters over;
- Install main basement propping and raking props as shown;
- With raking props in place excavate sequentially on a hit and miss basis whilst forming a RC skin wall between the KP piles by letter box shutter that underpins the existing retaining wall remnant;
- Excavate locally outside of capping beam in similar bays and install 150mm blinding concrete to act as prop to the base of the skin wall;
- Construct lower ground floor slab casting hard against skin wall but introducing a slip strip if needed;

- Construct RC retaining wall from lower ground floor to ground level leaving pockets out for struts;
- Complete remaining wall and verticals followed by ground floor slab;
- Remove temporary props and make good pockets;
- Cut down tops of KP's and stub wallings to accommodate proposed landscaping.

4.8 Prince Arthur Road – Section 6-6 (Lower basement)

1. Remove existing structure.
2. Fill to 103.6mOD and form piling platform for the secant piles at 104.0mOD.
3. Install secant piles. The required toe level for the proposed retained height is 89.0mOD (vertical loads have not been considered).
4. Maximum retained height along the part of the wall adjacent to Prince Arthur's Road is 10m.
5. Partial excavation to enable installation of capping beam, reinforced concrete corbels and horizontal props.
6. Excavate to 94.0mOD.
7. Install floor slab and construct wall.
8. Install top slab at 100.625mOD and remove horizontal props.
9. Install slab at 104.585mOD.

Sections 5-5 and 6-6, appear to be the most challenging sections of the site perimeter given the proximity of section 5-5 to deeper double basement and the retained height of section 6-6 which is approximately 10m. It is expected that in the excavation and build out stages that the perimeter length nearest Prince Arthur Road (east) and will require some close coordination with the main contractor. The excavation sequence may involve casting temporary RC skin walls in short approximately 3m wide bays as berm material is excavated between kingposts effectively under the existing retaining wall.

4.9 Prince Arthur Road – Section 8-8

Section 8 reverts to a comparatively simpler ground support section to resolve although consideration will need to be given to the tree root protection zone shown on the drawings whilst removing the existing below ground sub-structure. The proposed solution is the installation of a king post wall (KPW) with 600mm diameter piles spaced at 2.5m centres, similar to the other sections.

The anticipated sequence for the KPW option is as follows:-

1. Demolish all above ground structure and other slabs not giving support to neighbouring property or the highway;
2. Carefully remove existing part basement retaining wall in short 3m wide sections and refill on a hit and fill basis while providing support with raking props;
3. Auger 600mm diameter holes, install KPW's immediately outside line of proposed basement wall and part fill with concrete to circa ~100.5mOD (tbc);
4. Pile probe and excavate/site strip to underside of lower piling platform at 102.0m OD;
5. Lay Tensar Triax 160 geogrid over and place 300 – 400mm of 6F2 piling platform material over the geogrid to a PPL of 102.0mOD;
6. Undertake plate bearing tests as specified by piling contractor;

Thereafter the excavation and build sequence will be developed with the main contractor but for an un-propped KPW design and estimating purposes the deepest planned adjacent excavation level can be assumed as 99.4mOD.

- Construct piling from PPL of 102.0m OD (assumed using CFA method);
- Excavate ground immediately in front of KPW's to suit panel width assumed at 3m wide, one at a time, inspecting for presence of significant tree roots;
- Cast concrete skin wall between flanges of posts with mesh reinforcement placed towards the excavation face (with 75mm cover);
- Excavate to underside of slab,Cellcore and blinding;

- Excavate for pile caps and adjacent core cap and construct caps;
- Construct lower ground floor slab followed by RC wall using skin wall panels as a back-shutter but de-bond at top to aid later removal of the top of the wall;
- Cut down to top of panels to a depth of 500-750mm to accommodate landscaping.

4.10 Prince Arthur Road – Section 9-9

The anticipated sequence at the party wall/boundary is as follows:-

1. Demolish all above ground structure and other slabs not giving support to neighbouring property or the highway;
2. Install PU12 or equivalent sheet pile wall with toe level at 98.0mOD;
3. Demolish existing lower ground floor level, providing adequate support in the process (similar to the previous sections).
4. Fill to 101.6mOD to form the piling platform sub-base;
5. Pile probe and excavate/site strip to underside of lower piling platform at 102.1m OD;
6. Install Tensar Triax 160 geogrid and form piling platform to 102.0mOD;
7. Undertake plate bearing tests as specified by piling contractor;
8. Install foundation piles;
9. Excavate to 99.6mOD for the construction of the pile caps, forming a berm to support the sheet pile wall;
10. After construction of pile caps, install raking props at 101.7mOD, to be supported by the foundation piles;
11. Continue with excavation to 99.6mOD and construct the rest of the pile caps;
12. Install floor slab and remove raking props.
13. Continue with the construction of the main structure.

4.11 Prince Arthur Road – Section 11-11

It is proposed that the excavations in section 11-11 will also be enabled by installation of a sheet pile wall with similar elevations and geometry to section 9-9, without the requirement of additional support, as there are no adjacent structures that could be affected.

5. GEOTECHNICAL DESIGN

5.1 Geotechnical parameters

Geotechnical design parameters for the ground conditions encountered have been derived based on the soil descriptions and in-situ testing within the available borehole records.

The geotechnical design parameters utilised within the analyses undertaken on WALLAP software package are outlined in Table 2 below. Owing to the variability of the retained soils, the WALLAP analysis has been undertaken assuming that the soils act in the drained condition which is considered reasonable as the soils are interbedded sands and clays which are likely to have a reasonably high mass permeability. The PDISP analysis however, has considered only clay materials which is a conservative account of the underlying soils for vertical ground movement analysis. The presence of sand beds within the Bagshot Formation/Claygate Member will facilitate the movement of water between the clays and sands and as such the soils are expected to behave in the drained condition during construction. This should be allowed for within the design calculations.

Table 2. Geotechnical design parameters for heave/settlement analysis

Stratum	Top of Stratum (mOD)	Bulk Unit Weight γ_b (kN/m³)	Undrained Cohesion c_u (kPa) [c']	Friction Angle ϕ' (°)	Young's Modulus (WALLAP), E_u [E'] (MPa)
Made Ground	102.2 – 106.2	18	-	30	[5z]
Firm Clay	101.0 – 105.2*	18	55[a] [0]	25[b]	55[c] [44]
Medium Dense Sand		19	-	32[d]	[20+3z][e]
Stiff Clay	87.4 – 93.6	19	75 [0]	25[b]	75 [60]

[a] *Based on Cu=4.5N$_{SPT}$ (Stroud), N=12*
[b] *Based on BS8002 for PI = 27%*
[c] *Based on E_u = 1000C_u, E'=E_u(1+v_u)/(1+v') after CIRIA R143*
[d] *Based on medium dense sand*
e Based on E'=2N
**Interbedded layers*

The above values are considered to be moderately conservative and are unfactored (Serviceability Limit State) parameters. WALLAP analyses outputs have been included within Appendix D and a summary of the results has been included within Appendix E.

6. PERFORMANCE SPECIFICATION

6.1 Materials

The specification for materials and workmanship shall remain as the detailed specifications prepared by the structural engineer except where varied with reference to the following:-

- General fill requirements – free draining, well graded, 75mm max size, concrete demolition arisings or re-used soils provided contamination and asbestos free and conforming to MLM earthworks specification;
- Geogrid for piling platforms – Tensar Triax 160 in accordance with manufacturer's recommendations;
- Piling Platform material – see section 6.4;
- Strength of existing brickwork (where relied upon shall be taken as 10N brick in class (iv) mortar;
- Strength of existing concrete (where relied upon) will be C30;
- Thrust Blocks – Generally un-reinforced GEN 3 Concrete or higher unless otherwise shown as reinforced based on RC35 as below;
- Pile concrete (permanent/temporary) – C28/35, AC-2/DS-2;
- Steelwork grade of Kingposts, wallings and props shall conform to BS5950 in S275;
- Steel reinforcement will be taken as high yield steel - characteristic strength 500N/mm^2;
- The wall piles will be designed to BS 8002, BS 8004, BS 8110 and Ciria Report 580 with 75mm cover.

6.2 Design loadings

6.2.1 Highways loading

A 10 kPa live load surcharge of will be provided for beyond the outside face of the existing or proposed temporary retaining wall. Self-weight of soil and road build will be considered. Any groundwater as detailed in the SI Report will be considered if un-drained conditions are appropriate.

Provision for accidental wheel loading on footway of a nominal point load of 100kN.

6.2.2 Accidental loading

An accidental impact load allowance of 10 or 25kN subject to risk assessment of size of excavation plant to be used (acting as a point load in the most onerous positions) should be allowed for all temporary works members with reference to CIRIA 580.

6.2.3 Party wall surcharge loading

Party wall line loads, level and actions are presented on the pre-planning structural Symmetries demolition enabling works and temporary works drawings.

6.2.4 Construction loads

Due cognisance should be given to loadings imposed on the ground from construction plant and vehicles.

Occasional visits to site by mobile cranes (or other similar equipment) together with their outrigger loads will be assessed for their impact on the existing basement retaining walls and temporary propping. Wherever possible it is intended that such loads will not directly surcharge the temporary works or retained structures or their affect shall be traded off against the general 10kPa live load allowance.

6.2.5 Accommodation gantry loads

Vinci propose to erect an accommodation support gantry along the Fitzjohns Avenue frontage to support two or three levels of site cabin. Without any further detail CGL have assumed that a 25kPa general surcharge will be applied to the ground adjacent the sheet piling during the stages of construction after piling is complete. During the enabling phase of removing the remnants of existing structure it is assumed that Highways surcharges of 10 kPa will apply only.

The 25kpa value will need verification in due course.

6.3 Deflection / movement limits

Please refer to the limits given in CGL's BIA. See also section 7.2 of this Specification.

6.4 Piling platform requirements

6.5 DESIGN

The piling mat design assumes a sub-base of medium dense granular made ground. If very soft material is encountered the material will need to be locally excavated and replaced with engineering compacted fill.

6.5.1 Design parameters

– comprise the following as provided:-

6.5.1.1 Loadings (to be verified by appointed piling sub-contractor):-

- Soilmec CM 70 CFA Piling Rig;
- BRE Load Case 1 – 191 kPa; L_1 = 3.010m; W_1 = 0.7m
- BRE Load Case 2 – 499 kPa; L_2 = 1.33m; W_2 = 0.7m
- General loading of ~ 450kPa for fully laden concrete trucks at each wheel location.

6.5.1.2 Ground Conditions & Imported Pile Mat Properties

It is considered likely that the immediate sub-grade under the piling mat is likely to be Made Ground previously forming the ground floor or sub-basement. The presence of hard (existing foundations) or soft spots will need to be verified and managed on site. The assumed soil parameters are as follows:-

- Angle of shearing resistance of Sub-grade = 29 degrees (assumed TBC);
- Bulk Density of sub-grade = 18KN/m^2

6.6 SPECIFICATION

6.6.1 Un-reinforced piling mat over natural ground

The piling mat should be laid to a minimum depth of **600 mm (where un-reinforced) at a Piling Platform Level [PPL] of ~ +102m OD (lower) and 103m OD (upper)** on site to the following specification:-

1. The sub-base should be stripped of topsoil to the required reduced level and vibro compacted with particular attention being paid to any soft spots as noted above.

2. Lorry loads of imported approved fill material must be tipped into stockpiles and spread evenly by mechanical plant.

3. Crushed concrete or hard stone approximating to 6F2 type spec with a maximum aggregate size of 75mm should be placed and vibro compacted in 150mm layers to the Specification for Highway Works. Crushed brick will not be suitable.

4. Granular material used for the working platform should be free of any organic material and should not contain more than 15% fines (i.e. not more than 15% by weight of particles of clay and silt size).

5. The granular material shall be free draining and the maximum particle size should not be greater than $2/3^{rd}$ of the thickness of the layers in which the material is compacted or 150mm whichever is the smaller.

6. The platform shall generally extend a distance 2.0m beyond edges of the rig tracks.

7. Please refer to BRE Good Practise Guide BR47. Note in particular the guidance given in installation and repair of the platform. It is particularly important to ensure that areas on site that =have undergone excavation and back filling are backfilled to the correct specification (compacting to 150mm layers). Following this procedure will minimise the risk of soft and hard areas on the site.

8. Following the pile mat installation, it a specific requirement that the mat be driven over by a fully laden eight wheeled truck or concrete wagon, to replicate worst case bearing pressures of the rig(s). This process will identify any areas of localised weakness that require placement of additional engineering fill.

9. If in doubt ask the CGL for further advice on the suitability of ground conditions.

6.6.2 Reinforced Piling Mat over loose fill/back-filled basements

Should it be considered advantageous, the site may decide to use a shallower piling mat depth of the same specification as above provided that Tensar Grid Triax 160 Geogrid is introduced providing at least 300mm cover is placed over the reinforcement.

The piling mat should be laid to a minimum depth of **400mm (reinforced) at a Piling Platform Level [PPL] of ~ +102mOD (lower) and 103mOD (upper)** on site as per the above specification, with the addition of the following laid strictly in accordance with the manufacturer’s instructions.

6.6.2.1 Reinforcement:-

1 layer of Tensar Triax 160 Geogrid reinforcement – as per attached data sheet

6.6.2.2 Pile Mat Testing Requirements

To be advised by piling sub-contractor

7. MONITORING REQUIREMENTS

7.1 General

The results of the ground movement analysis previously undertaken by CGL suggest that with good construction control, damage to adjacent structures generated by the assumed construction methods and sequence are likely to be (within Category 1) 'slight'. To ensure movements do not fall outside of that predicted, it is recommended that a formal monitoring strategy is implemented on site to observe and control ground movements during construction.

The monitoring system should operate broadly in accordance with the 'Observational Method' as defined in CIRIA Report 185[1]. Monitoring can be undertaken by using positional surveys compared to baseline values established before any excavation work is undertaken onsite. Regular monitoring of these positions will determine if any horizontal translation, tilt or differential settlement of the neighbouring structure is occurring as the construction progresses. Monitoring data should be checked against predefined trigger limits and can also be further analysed to assess and manage the damage category of the adjacent buildings as construction progresses.

7.2 Monitoring of adjacent structures

It is recommended that the following measures are implemented.

Before starting work, survey the existing state of structure to be kept in place to locate and record the magnitude and extent of all cracks, spalling, flaking and other irregularities of the fabric. The commencement condition survey record will be agreed with the PM.

The structural stability of the surrounding/adjacent properties is safeguarded by a system of movement monitoring.

The Contractor shall monitor the position and movements of the basement excavation perimeter, the elevations of the adjacent properties adjacent to the perimeter of the proposed excavation and structures retaining the public highway. The monitoring shall be undertaken by a specialist survey company. The monitoring system will have at least the

[1] Nicholson, D., Tse, Che-Ming., Penny, C., The Observational Method in ground engineering: principles and applications, CIRIA report R185, 1999.

following characteristics: monitoring positions (Targets) will be established within the proposed excavation and on the adjacent structures themselves.

1. The perimeter temporary/permanent works will be monitored at ground level, at intervals not exceeding 3-4m centres, measured from the targets installed on the sheet piling.

2. The existing facades will be monitored near ground level and at roof level, at intervals not exceeding 3m centres horizontally.

3. Monitoring points (targets) shall be firmly attached, to allow 3D position measurement, for the duration of the work, to a continuous and uninterrupted accuracy of -/+ 1mm. A suitable remote reference base/datum unaffected by the works will be adopted, one located at least 50m from the site.

4. Points/targets shall be measured for 3D positioning. Before any works commence a base reading will be taken, then further measurement will be taken weekly during the period of basement excavation/construction and monthly during the course of the remainder of the works. A final reading is to be undertaken 6 months after the completion of all construction works.

5. All measurements shall be plotted graphically, to clearly indicate the fluctuation of movement with time. The survey company shall submit the monitoring results to the Engineer (MLM) and to the Adjoining Owners Party Wall Surveyors/Engineer within 24 hours of measurement, graphically and numerically.

6. The following trigger levels for movement are proposed for agreement. In the event of a trigger value being reached the Contractor will immediately stop any work that might cause further movement, assess the situation and propose alternative methods for proceeding, with definitive further movement limits for those later steps.

7. Trigger movement limits are proposed as follows:

A) Facades Horizontal movement/Facades Vertical or horizontal movement

Green Less than +/-4mm

Amber +/-6mm - All parties notified.

Red +/-8mm Works reviewed

B) Garden walls and excavation

Green Less than +/-6mm

Amber +/-9mm- All parties notified.

Red +/-*12*mm Works reviewed

C) Highways

Green Less than +/-15mm

Amber +/-20mm - All parties notified.

Red +/-25mm Works reviewed

7.3 Dust and noise

An air quality and noise monitoring programme will need to be developed and implemented for construction activities which will incorporate the following:-

- Visual assessments of dust emissions and deposition, recorded once per day at site boundary locations representative of the nearest receptors to active phases of the development. Outcomes of the assessments will need to be recorded in a site logbook.
- Dust deposition rates to be monitored at locations and frequency to be agreed with the Local Authority with trigger limits and an agreed action plan.
- Noise monitoring will need to be undertaken by the contractor as appropriate for the demolition and construction activities on site.

7.4 Control of temporary works

The temporary works will be installed, inspected and maintained under robust procedures and controls with reference to BS 5975:2008+A1:2011 and Vinci's procedures for the control of temporary works. Post demolition a visual inspection of the propping arrangement together with the surrounding pavements should be carried out daily by site staff. Walls should be monitored for movement periodically during all construction stages.

8. DESIGN RESPONSIBILITY

8.1 General requirements

The temporary works have been designed conceptually by CGL using simple structural analysis in SLS and ULS cases where appropriate using widely recognised Earth Pressure Coefficients derived from Rankine's theory or K_a, K_{ac} etc. derived in accordance with BS 8002:2015Method of analysis for ULS – ULS design values will be reduced in accordance with the recommended partial design factors within BS 8002:2015 and the stability of the wall analysed using the strength reduction method within the GEOSOLVE's software programme WALLAP.

It is intended that combined steel and concrete section properties of king piles until the concrete around the steel section will be broken. Thereafter, the actual properties of steel sections will be used for all steel walings, frames and props.

It is assumed that design development of the working construction drawings and details for construction will be undertake as a CDP by the Enabling Works Contractor with the Principal Contractor (Vinci) responsible for developing the sub-structure temporary works design.

Refer to Appendices E for the idealised sections that CGL have modelled in offering the conceptual solution shown in sketch form in Appendix C.

8.2 Design checking

It is expected that all temporary works undertaken by the enabling works would require a CAT 2 design check by a chartered engineer mirroring the requirements of LBC's Highways TA standard and the requirements of the Basement Management Plan required by the local authority under the Section 106 agreement with the developer.

Details of the CAT 2 Checking Engineer is to be confirmed.

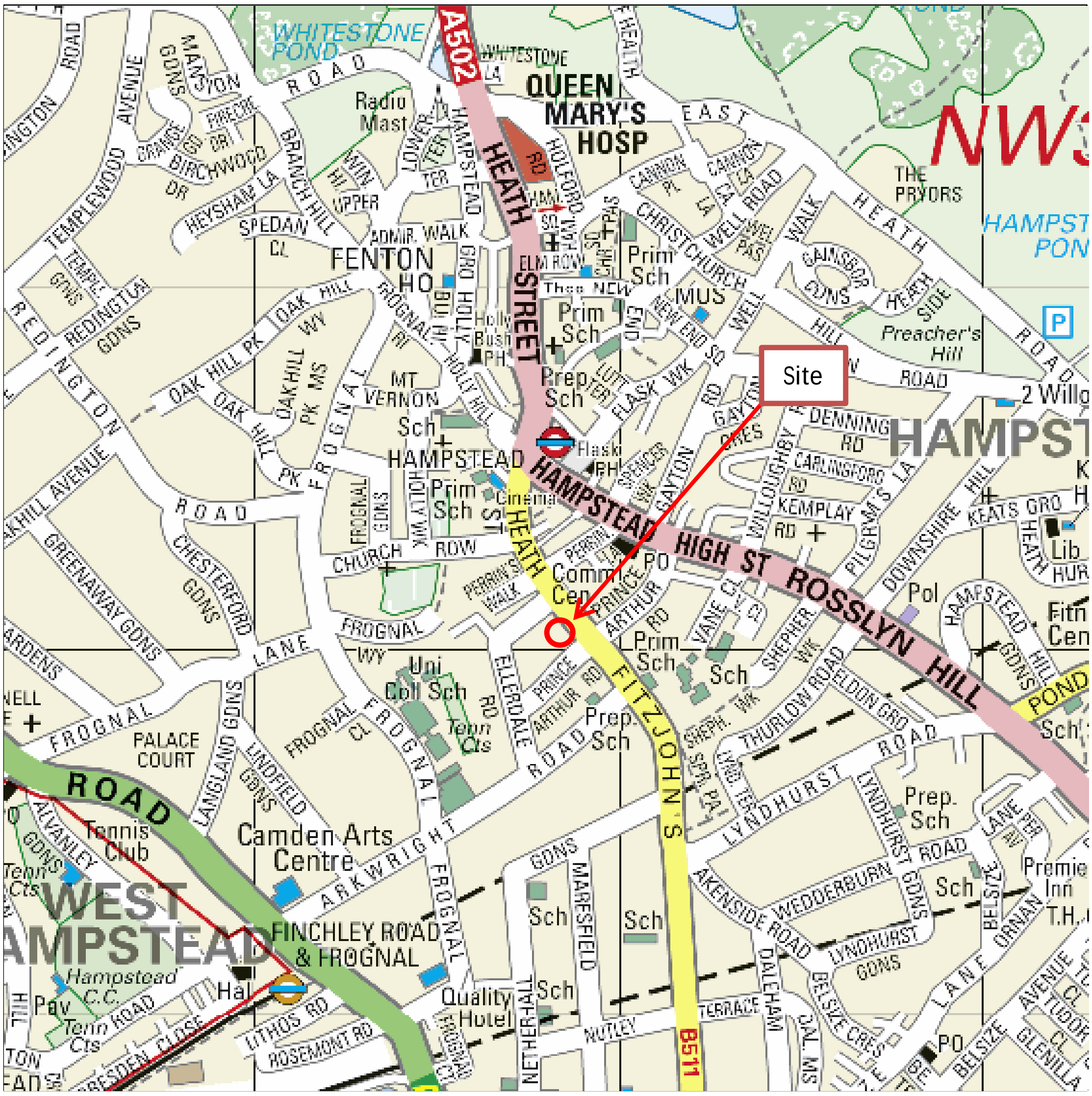
9. ALTERNATIVES

The specialist enables works contractor and his temporary works engineer are actively encouraged to offer alternatives to the method of earth retention and asset protection described in this EWS providing neither temporary stability or major impact with the temporary works occurs.

For example, alternatives may include any or combinations of the following:-

- Temporary dig and push multi-level framed trench sheeted cofferdam to facilitate removal of the squash court box;
- Buttressing piles or king piles to the sheet piled wall;
- High level walling and find a clear route for long corner braces to limit defection and subsequently bury these under the piling platform material;
- Revert to 600mm diameter restricted access mini piling rig installed contiguous wall piles with a designed soil berm in front;
- Buttressing piles to the alternative secant wall piles described above;
- Any other solutions preferred by the specialist contractor that is no way jeopardises the party walls or highway or compromises the permanent works.

FIGURES



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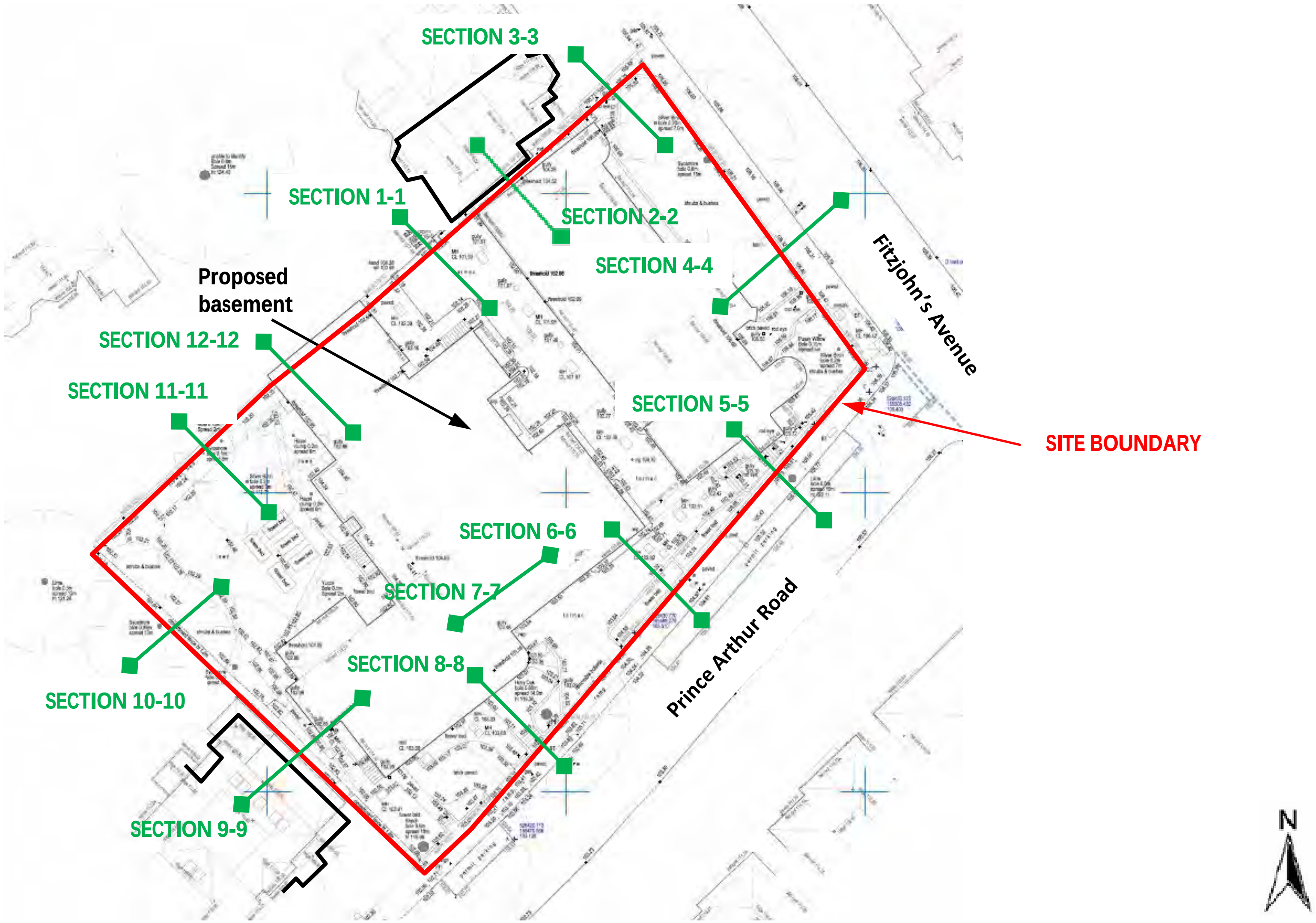
Client	Project	Job No
Pegasus Life Limited	**79 Fitzjohn's Avenue, Camden, London**	**CGL/09008**
CGL	Title **Site location plan**	**Figure 1**



NOT TO SCALE

Client	Project	Job No
Pegasus Life Limited	**79 Fitzjohn's Avenue, Camden, London**	**CGL/09008**
CGL	Title **Site layout plan**	**Figure 2**