44 FROGNAL LANE
HAMPSTEAD
LONDON
NW3 6PP

BASEMENT IMPACT ASSESSMENT

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APPENDICES

EXECUTIVE SUMMARY

The Basement Impact Assessment (BIA) is prepared in accordance with London Borough of Camden's Planning Guidance - Basements and Lightwells (CPG4) including Camden Development Policies DP27 - Basements and Lightwells.

The Basement Impact Assessment is separated into five sections covering 1.0 Introduction, 2.0 Structural Appraisal, 3.0 Hydrogeological Review, 4.0 Drainage and Surface Water Flow Appraisal 5.0 Flood Risk Assessment, 6.0 Conclusions and 7.0 Designers Risk Assessment.

The Introduction provides the screening aspect with Figures 1, 2 and 3 noting Yes or No if the basement is likely to have any affect on the surrounding area and referenced to each of the relevant sections 2.0, 3.0, 4.0 and 5.0, within which are provided the scoping and details of potential impact and any mitigation measures with Recommendations and Conclusions within section 6.0.

A full Site Investigation and Topographic Survey have been undertaken which were reviewed against the site requirements along with local borehole records. These provide the necessary site specific data to undertake the BIA and to allow for the detailed design to be undertaken following Planning Approval.

The retention of existing structural elements over the new basement have been reviewed with an outline methodology included to demonstrate feasibility.

Existing site material is being utilised within the new construction with demolition material to be used as hardcore to assist the construction process. Existing top soil will be retained and reused. The consideration of SUDS on site for the surface water drainage system with inclusive storm water storage and restricted flow rates has been included.

The BIA concludes that the proposed basement works can be carried out safely and without adverse affect on the adjacent structures, local hydrogeology, surface water flow or increase local flooding risks. The risks noted within the BIA, even though they are only slight, can be further mitigated by diligent detailed design and implementation to include the installation of additional surface water drainage, careful detailed installation of temporary works, a suitable on site monitoring procedure and use of experienced contractors and an experienced design consultant team.

1.0 INTRODUCTION

1.1 This Basement Impact Assessment has been prepared by Taylor Whalley Spyra as requested by Charlton Brown Architects as part of the Planning Application for the proposed redevelopment of the site.

1.2 The information contained within this Basement Impact Assessment (BIA) has been produced to cover the information required within a BIA as set out by Camden Planning Guidance - Basements and Lightwells (CPG4) including Camden Development Policies DP27 - Basements and Lightwells.

1.3 The purpose of this Basement Impact Assessment document is to outline the key points for the safe construction of the proposed redevelopment of 44 Frognal Lane.

1.4 It also sets out how the neighbouring buildings and the local environment and amenity will be protected.

1.5 The topics covered within the BIA are Structural Stability & Movement Assessment, Method of Construction, Hydrogeological, Drainage & Surface Water Flow, Flood Risk and Temporary Works during basement construction.

1.6 This is not the final design information but is intended to demonstrate that each of the aspects of the design and construction has been carefully considered. All aspects will be subject to detailed design once Planning Approval is granted.

1.7 The Client is proposing to split the current single dwelling into two separate self contained dwellings. The work will also include to demolish parts of the existing structure on site, retain the main house external walls with the reconfiguration of internal walls to suit a revised layout and add an extension to provide two residential properties within, consisting of ground to second floor with a basement level set below the part of the existing ground level at the front of the property and extending out under the front garden (refer to Appendix B).

1.8 The existing property is three storeys consisting of ground, first and second floor set within the roof void and located on Frognal Lane near the corner of Frognal (refer to Appendix A).

1.9 The site is 57m long and 26m wide being rectangular in shape with some recesses for adjacent properties and orientated approximately North to South. To the North boundary is Frognal Lane. On the East boundary the nearest adjoining properties are 53 & 55 Frognal which is adjacent to the front of the East boundary and 49 & 51 Frognal adjacent to the rear of the East boundary with gardens between. On the West boundary is a private road providing the main site access with 40 Frognal Lane opposite. The South boundary is the house main rear garden with 42 and 43 Frognal Lane setback behind (refer to Appendix A).

1.10 The general basement area level is approximately 89.100 with the ground floor level approximately 93.600. The basement level will step down to approximately 87.300 to accommodate the swimming pool and associated pool plant area located to the sides of the basement.

1.11 The existing main building is being retained with internal structural alterations undertaken to revise the floor layouts. The existing extension at the front of the property is to be partially demolished with the front section to be retained over the new basement. This will require the installation of a temporary steel frame supported from internal piles whilst the basement is being constructed. Sheet piling is to be installed around the perimeter of the basement which will be braced with temporary waling and adjustable hydraulic propping beams. The east elevation where the new basement staircase is will require existing walls to be underpinned with reinforced pins installed instead of the sheet piling, again these will be braced with temporary waling and propping beams. This will form an open excavation which will allow the watertight basement structure to be constructed.

1.12 The new reinforced concrete basement box structure is designed to form the permanent support works for the retaining walls. Once the basement structure is completed the temporary supported structure over will then be re-supported off the new ground floor slab and the remainder of the above ground construction can be carried out.

1.13 The following screening stages in Figures 1, 2, and 3 are reviewed to see the effect of the basement on the surrounding area and the relevant scoping stages are noted in the adjacent contents items referenced to within this BIA report, which then outlines any possible impacts and any mitigation necessary to reduce the impact of the basement on the surrounding area.

Figure 1 - Subterranean (ground water flow) screening chart

Q 1a: Is the site located directly above an aquifer?	No	See Content 3.0
Q 1b: Will the proposed basement extend beneath the water table surface?	No	See Content 2.0, 3,.0, 4.0
Q 2: Is the site within 100m of a watercourse, well (used/disused) or potential spring line?	No	See Content 3.0,
Q 3: Is the site within the catchment of any Local pond chains?	No	See Content 3.0
Q 4: Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas?	Yes	See Content 4.0
Q 5: As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?	No	See Content 4.0
Q6: 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 or spring line.	No	See Content 2.0, 3.0, 4.0

Figure 2 - Land stability screening chart

Q 1: Does the existing site include slopes, natural or man made, greater than 7° ? (approximately 1 in 8)	No	See Content 2.0, 3.0
Q 2: Will the proposed re-profiling of landscaping at site change slopes at the property boundary to more than 7° ? (approximately 1 in 8)	No	See Content 2.0, 3.0
Q 3: Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7° ? (approximately 1 in 8)	No	See Content 2.0, 3.0
Q 4: Is the site within a wider hillside setting in which the general slope is greater than 7° ? (approximately 1 in 8)	No	See Content 2.0, 3.0
Q 5: Is the London Clay the shallowest strata at the site?	Yes	See Content 2.0, 3.0,
Q 6: Will any tree/s be felled as part of the proposed development and/or are any works proposed within any tree zones where trees are to be retained?	Yes	See Arboriculture Report
Q 7: Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	No	See Content 2.0
Q 8: Is the site within 100m of a watercourse or a potential spring line?	No	See Content 3.0, 4.0
Q 9: Is the site within an area of previously worked ground?	No	See Content 2.0, 3.0
Q 10: Is the site within an aquifer?. If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction?	No	See Content 3.0, 4.0
Q 11: Is the site within 5m of a highway or pedestrian right of way?	Yes	See Content 2.0
Q 12: Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	Yes	See Content 2.0,
Q 13: Is the site over (or with the exclusion zone of) any tunnels e.g. railway lines?	No	See Content 2.0,

Figure 3 - Surface flow and flooding screening chart

Q 1: Is the site within the catchment of any local ponds?	No	See Content 3.0
Q 2: As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route?	No	See Content 4.0
Q 3: Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas?	Yes	See Content 4.0
Q 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	See Content 2.0, 3.0, 4.0
Q 5: Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	No	See Content 3.0, 4.0, 5.0
Q 6: Is the site in an area identified to have surface water flood risk according to either the Local Flood Risk Management Strategy or the Strategic Flood Risk Assessment or is it at risk from flooding, for example because the proposed basement is below the static water level of nearby surface water feature?	No	See Content 3.0, 4.0, 5.0

1.14 The Client will appoint a Project Manager to oversee the nominated building contractor and will liaise with London Borough of Camden and local residents to ensure the impact of the proposals are fully understood and mitigated as far as possible.

1.15 Safety both on site and adjacent to the site is of paramount importance and the method of construction proposed has taken this into account.

1.16 Taylor Whalley Spyra are retained as consulting civil and structural engineers for the project. The company was formed in 1955 and is a private company wholly owned by the directors. Our expertise covers all building types and we have particular experience of working in Central London locations where sites have tight urban constraints. Related examples of this type of work are included on the following page.

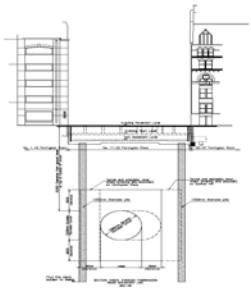
TYPICAL EXAMPLES OF DIFFICULT SUPERSTRUCTURE RETENTION AND SUBSTANTIAL BASEMENT CONSTRUCTION IN LONDON




16 Boltons Place, London
Formation of significant residential basements adjacent to and beneath existing

37 Loudon Road, London

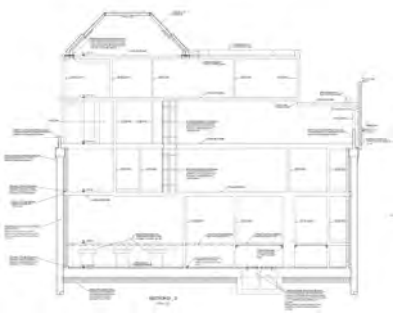

67 West Heath Road, London
New construction adjacent to existing buildings

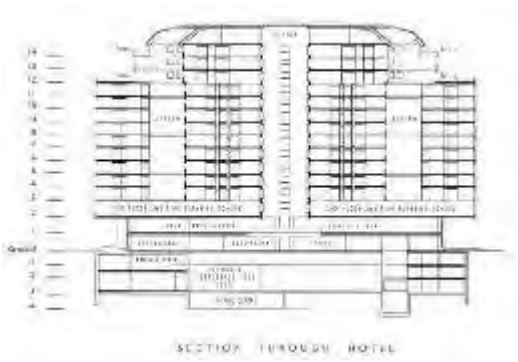
17-23 Farringdon Road, London
Construction of new retail, commercial and residential building over the proposed Crossrail link

60 Addison Road W14,
Facade retention over new basement

1 St Kildas Road N16
New single basement office facility



5, Cannon Lane, NW3
New residential double basement

Westminster Park Plaza, London
Construction of new luxury hotel by top-down method incorporating 4 basement levels

2.0 STRUCTURAL APPRAISAL

2.1 A review of how best to construct the basement was undertaken whilst retaining the existing extension above at the front of the site and it was concluded that the most efficient form of construction would be the installation of temporary piles supporting a steel frame to support the existing structure. This will then allow for the installation around the site of steel sheet piled walls and section of reinforced concrete underpinning all suitably propped to allow for the excavation of the ground with minimum movement adjacent structures. This is then followed by the construction of a rigid reinforced concrete basement slab, reinforced concrete walls with reinforced concrete cover slab, with 900mm of backfill over to cover the basement. The removal of the temporary props is phased as the work progress. Once installed the existing temporary supported walls above can be re-supported on the new ground floor slab and the temporary frame and piles removed.

2.2 In order to control ground movement proposed propping is at 0.50m and 3.7m below the top of the ground floor slab. The 450mm thick basement slab is at 4.3m. After this has reached the required design strength then the 3.7m prop is removed. The walls are cast to below the 0.50m prop then additional diagonal propping is added along the length of the wall to provide additional support whilst the high level props are removed to allow casting of the ground floor slab and the remainder of the perimeter downstand for the walls.

2.3 To the East boundary, 55 Frognal is a semi-detached property. The proposed basement is 8.6m away at its nearest point to the main house. Between is a single storey extension structure consisting of a timber flat roof supported off brick walls which is 500mm away from the basement. Section 1_1 on drawing 8600_SK03 shows the permanent and temporary works in this area (refer to Appendix C).

2.4 To the East boundary, 53 Frognal is a semi-detached property. The proposed basement is 8.5m away at its nearest point to the main house. Between is a single storey extension structure consisting of a timber roof supported off brick walls which is 2.9m away. Section 2_2 on drawing 8600_SK04 shows the permanent and temporary works (refer to Appendix C).

2.5 Frognal Lane is situated along the North boundary of the site from which part of the site can be accessed. The basement is set back from Frognal Lane by 2.2m to 1.2m at its closest point with the line of the boundary tapering away from the basement. There is one glazed lightwell along this elevation set at ground level. Section 3_3 on drawing 8600_SK05 shows the permanent and temporary works (refer to Appendix C).

2.6 To the West boundary is a private road from which the main site is accessed. The basement is set back from this road by 6.2m to 3.1m at its closest point with the line of the boundary tapering away from the basement. Section 4_4 on drawing 8600_SK06 shows the permanent and temporary works (refer to Appendix C).

2.7 All properties that are adjacent to the proposed development will fall within The Party Wall Act 1996 which will require building condition surveys to be undertaken.

2.8 The design of the basement and temporary support works is to be undertaken to minimise any structural disturbance to the adjoining properties or infrastructure. The nearest building adjacent to the proposed basement is 55 Frognal. The design of the sheet piling, reinforced concrete underpinning and basement box structure will incorporate an allowance for a surcharge loading to take into account the location and loads from the adjacent building foundations. An allowance will also be included to allow for any future surcharging of the adjacent ground next to the new basement. The sheet piling will be installed using a silent piler which installs the sheet piles using a push pull method resulting in minimal noise and vibration. This will minimise any structural disturbance whilst carrying out the works (refer to Appendix D).

2.9 As part of the design and to control ground movement, a scheme will be agreed as part of the party wall agreements to install a movement monitoring system to monitor movement and vibration during the course of the basement works. This will involve the location of monitoring nodes to be located along the surrounding ground, on the existing facade and also on adjacent property walls, where allowed as part of the party wall agreements. Readings will be taken at regular intervals and additional readings undertaken when specific works are planned that may be more prone to ground movement during the sheet piling / underpinning installation, excavation of ground works and removal of temporary propping.

2.10 The temporary propping system will be installed with hydraulic props to allow for any adjustment that may be required to control movement of ground adjacent to the sheet piling.

2.11 The analysis of the basement retaining walls and required temporary works scheme has been undertaken using Wallap Version 6.05 for this stage of the planning application and has confirmed that the movement can be limited to the adjoining properties as Very Slight, as categorised by Damage Category Chart (CIRCA C580). The initial design undertaken confirms that the category of movement indicated above can be achieved for the basement and with further detailed design improved upon.

2.12 There are three possible causes of ground movement; the installation of the temporary wall sheet piles/underpinning, the excavation of the basement and the adjustment of the ground under the net load changes. The only structure outside of the site which may be affected is the adjacent structures, the closest is a single level extension at 55 Frognal which is 0.5m away at its closest point from the proposed basement. The main wall of the house is set further back approximately 8.6m from the site boundary.

2.13 The installation of the sheet piles will result in some ground movement. CIRIA C580, which summarises empirical evidence on the effects of installing walls in London Clay, suggests that settlements are likely to fall within an envelop defined by 0.04% of the wall depth next to the wall, diminishing to zero at a distance of around 1 to 1.5 times the wall depth from the back of the wall i.e. in this case 1.5 to 2mm at the wall, decreasing to zero at 4.3 to 6.5 metres.

2.14 In our experience it is likely that a limited movement will take place with sheet piles, as they displace the ground with upward movement. If the wall is adequately constructed the movement at the wall to 55 Frognal will not exceed 1.5mm.

2.15 The process of excavation will result in the forward translation of the sheet pile retaining wall and rise of ground inside the basement as the overburden is removed. Provided that the wall is carefully propped the movement affecting the property next door can be limited to acceptable amounts. Based on the empirical evidence presented in the CIRIA C580 document, a 4.8 metre dig would result in a forward movement of the wall at the base of the excavation of around 0.2% of the excavation depth, i.e. around 10mm. The ground movement might extend to around 3 to 4 times the excavation depth from the back of the wall. The empirical data from the CIRIA document shows that the settlement behind the wall is unlikely to exceed 0.08% of the depth, i.e. around 3.75mm. The data also suggests that lateral movements lie within an envelop defined by 0.15% of the excavation depth at the back of the wall (i.e. 7.5mm) and zero at a distance of around 4 times the excavation depth. Lateral movement of the surrounding ground can be constrained by installing a stiff prop at a high level before significant excavation has taken place and within the Wallap calculations we have restricted the temporary sheet pile limit to 5mm maximum with the use of the high level props.

2.16 The possible effect in terms of damage to the structure of the adjacent property can be estimated based on the above values, assuming that any differential settlement under the building is largely likely to result in a small forward rotation of the structure towards the basement, as a result of a differential settlement of around 3.75mm across the structure (taking account of the effect of installing the sheet piles and the excavation). Table 1.1 below gives ranges of lateral strains associated with different degrees of damage. If it is assumed that the structure moves with the ground, and assuming that the structure is

around 4.5 metres wide, the estimated horizontal strain would, at most, be estimated from 5mm differential lateral movement over 4.5 metres, i.e. a lateral strain of just over 0.11%. This would put the damage in the 'slight' category.

Category of damage	Description of typical damage	Approximate crack width (mm)	Limiting tensile strain ε_{lim} (per cent)
0 Negligible	Hairline cracks of less than about 0.1 mm are classed as negligible	<0.1	0.0-0.05
1 Very slight	Fine cracks that can easily be treated during normal decoration. Perhaps isolated slight fracture in building. Cracks in external brickwork visible on inspection	<1	0.05-0.075
2 Slight	Cracks easily filled. Redecoration probably required. Several slight fractures showing inside of building. Cracks are visible externally and some repointing may be required externally to ensure weathertightness. Doors and windows may stick slightly.	<5	0.075-0.15
3 Moderate	The cracks require some opening up and can be patched by a mason. Recurrent cracks can be masked by suitable lining. Repointing of external brickwork and possibly a small amount of brickwork to be replaced. Doors and windows sticking. Service pipes may fracture. Weathertightness often impaired.	5-15 or a number of cracks > 3	0.15-0.3
4 Severe	Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Windows and frames distorted, floor sloping noticeably. Walls leaning or bulging noticeably, some loss of bearing in beams. Service pipes disrupted.	15-25 but also depends on number of cracks	>0.3
5 Very severe	This requires a major repair involving partial or complete rebuilding. Beams lose bearings, walls lean badly and require shoring. Windows broken with distortion, Danger of instability.	Usually > 25 but depends on number of cracks	

Damage Category Chart (CIRIA C580)

Table 1.1

2.17 In the long term the London Clay within which the basement is constructed will adjust to the changes that have taken place as a result of the net load changes and water pressure will build up on the underside of the slab. In this case there will be a net load reduction and there will be a tendency for the structure to rise a small amount. This readjustment may result in small upward movement of the surrounding ground, but this is unlikely to result in any significant effect on the adjacent structure.

2.18 Proposed Sequence of Works.

- Install within the site area around the basement zone and surrounding area a number of fixed monitoring nodes to monitor possible movement during the works.
- The existing main house is to be retained and internal layouts adjusted. Parts of the side extensions are to be retained with the installation of temporary piles and steel support frame and the remainder of the site is to be demolished and all foundations and drainage runs are to be grubbed out.

- The existing topsoil on site situated around the proposed basement area is to be scraped off and stored on site for re-use at a later stage.
- The sheet piling is to be installed with a Silent Piler similar to a Giken Rig which presses the sheet piles into the ground using the resistance of the adjoining installed sheet piles.
- Additional areas are to be underpinned in an agreed sequence with reinforced concrete underpins in maximum 1m wide bays to support existing walls where sheet piling access is restricted around the staircase that will form the access to the basement from the existing house.
- The ground is to be locally excavated by 1m to allow installation of the steel waling beams and adjustable hydraulic props at high level.
- The ground is then to be further excavated to allow installation of the steel waling beams and adjustable hydraulic props at low level.
- The ground is then to be excavated to formation level.
- The granular drainage channels with drainage pipes are to be installed.
- The basement slab build-up is to be installed and then the basement slab cast with 150mm high kickers for all the basement walls and internal columns.
- Install and cast all internal walls and columns to underside of ground floor slab level.
- Once the basement slab has gained the required design strength the sheet piling waling beams and adjustable props at low level are to be removed.
- The basement walls are then to be cast to 600mm below the underside of the high level waling beams.
- Once the basement walls have gained the required design strength, install temporary diagonal adjustable restraint props fixed to the wall and basement slab and then remove the high level sheet piling waling beams and props.
- The ground floor slab and wall downstands can then be cast.
- Once the ground floor slab has gained the required design strength the additional diagonal restraint props can be removed.
- During the construction period the sheet piling and surrounding ground will be monitored at regular intervals to confirm the construction tolerance stays within the agreed design parameters.
- The existing structure over can now be re-supported of the new ground floor slab and the temporary steel support frame carefully removed with the additional new areas of the proposed works constructed and where required supported back of the new ground floor slab and cantilevered as required.
- Continue with construction of the remainder of the structure over using traditional load bearing brick/blockwork, timber floors and steel framing with timber infill rafters.
- Install external works and reinstate top soil to landscaped areas.

2.19 During detailed design a review of uplift will be undertaken and if necessary tension piles will be installed and tied into the basement slab.

2.20 A full soil investigation has been undertaken by Risk Management ref RML 5349 dated December 2013, comprising two 12m deep boreholes, one 10m deep borehole with two deep trial holes. These confirm the ground conditions to be made ground 800 to 1800mm deep overlying on 6m of Weathered London Clay with London Clay confirmed to 12m deep.

2.21 Ground water seepage was not encountered in BH01 but encountered within BH 2 – 0.8m deep and BH3 - 4.9m deep. During subsequent return visits of 2/12/13 and 12/12/13 the boreholes piezometers were noted as follows BH1 - Dry, BH 2 - Dry & BH3 - Dry - refer to Appendix E.

2.22 This indicates that there is slight ground water seepage from the made ground within the Weathered London Clay which is silty clay with occasional gravel. The rate of slow seepage confirms that any ground water flow on site is considered to be very low and will not affect the proposed basement or adjoining properties.

2.23 The soil investigation and ground water monitoring undertaken to date confirm that the basement area will be above the ground water level and that localised site de-watering will not be required. If any is required whilst undertaking excavation it will be localised and designed to the specific site requirements with regard to ground water levels encountered

and flow rates. The water pumps would incorporate sediment filters so as not to remove any fines at the point of abstraction. This will not have an affect on the adjoining properties.

3.0 HYDROGEOLOGICAL REVIEW

3.1 The average existing site ground level is in the order of 93.5m OD and reasonably flat across the site (refer to Appendix F). The geology of the area is well known as summarised on the relevant geological sheets, being on the boundary zone with the Claygate member and London Clay formation. The site is located as indicated by the Soil Investigation, as being within the London Clay (refer to Appendix E & G).

3.2 The current policy implemented by the Environment Agency is to maintain water levels in the lower underlying chalk aquifer to those which currently exist, i.e. approximately -10m OD (refer to Appendix H).

3.3 It is unlikely therefore that the site will be influenced directly by these ground water levels. It may be expected that there will be a perched ground water level within the made ground formation as indicated by the Soil Investigation report ref RML 5349 dated December 2013.

3.4 Ground water seepage was not encountered in BH01 but encountered within BH 2 – 0.8m deep and BH3 - 4.9m deep. During subsequent return visits of 2/12/13 and 12/12/13 the boreholes peizometers were noted as follows BH1 - Dry, BH 2 - Dry and BH3 - Dry - refer to Appendix E.

3.5 This indicates that there is slight ground water seepage from the made ground within the Weathered London Clay which is silty clay with occasional gravel. The rate of slow seepage confirms that any ground water flow on site is considered to be very low.

3.6 The site is not within any ground water protection zone as reviewed with the Environment Agency maps and is classed by the EA as a minor aquifer zone with negligible permeability. This is mainly due to the ground conditions in the area being London Clay.

3.7 The main historic river path in the area is the Westbourne which is South of the site. There are two tributaries to the South that flow into the Westbourne. These will not be affected by the proposed basement works. As these waterways are below the site there is no potential threat to impediment of flow from the proposed development (refer to Appendix H).

4.0 DRAINAGE AND SURFACE WATER FLOW APPRAISAL

4.1 The existing site area is 1364m² consisting of 869m² of non-permeable hard standing and 495m² of permeable soft standing (refer to Appendix I).

4.2 The proposed site area is 1364m² built-up of 885m² of non-pervious hard standing and 479m² of pervious soft standing (refer to Appendix I).

	Hard Standing	Soft Standing	Green Roof (SW Retention)
Existing	869m²	495m²	0m²
Proposed	665m²	479m²	220m²

4.3 Initial calculations based on a 1:100 year event have been undertaken which show that the existing volume of surface water run off from the site is in the region of 28.6.m³ and the new surface water run off would slightly increase to 29.2m³ (refer to Appendix L).

4.4 The majority of the existing 869m² area of hard standing surface water run off flows to gullies located within the hard standing area and then discharges to the public sewer system in Frognal Lane.

4.5 The surface water drainage will be designed to discharge to the existing sewer in Frognal Lane at reduced 3l/s flow rate (l/s flow rate to be agreed with Thames Water). A non return valve will be installed at the last manhole within the site boundary (refer to Appendix J).

4.6 There is a slight increase in the surface water run off, with an increase in required on site storage due to the restricted discharge rate into the existing sewer of 3l/s. This can be compensated for with storage within the 220m² of green roof build-up and the two small attenuation chambers which will provide on-site storage and can be used to provide grey water for car washing and the irrigation of the landscaped areas. The depth and size of the attenuation chamber will be subject to site requirements suggested by the M & E Consultants (refer to Appendix K).

4.7 The above ground drainage design for the foul water system will be gravity fed to the sewer in Frognal Lane. The foul water drainage below the basement slab will fall to a separate foul water pumping chamber that will allow for initial storage prior to pumping to the high level gravity pipe and then to the main sewer in Frognal Lane (refer to Appendix J).

4.8 The foul water discharge rate will be agreed with Thames Water but it is anticipated that it will be designed to maintain the existing site discharge flow rates into the public sewer.

4.9 There is a reduction in area of hard surface of 204m², but this will be offset with the attenuation chambers to the rear of the site and the 220m² storage within the green roof build-up over the basement area. This will be designed to meet existing surface water run off conditions and will reduce existing surface water discharge into the existing surface water main drainage system.

4.10 The profile of surface water inflow to adjacent properties or water courses will not be materially changed and the sizes of below ground pipes, the gradients and attenuation systems will be designed to maintain the existing site conditions and with the use of SUDS reduce the surface water discharge into the main drainage system.

4.11 The basement structure will be designed to allow for water to flow behind the walls and under the basement slab, where the installation of a number of granular stone drainage channels will allow ground water seepage to flow freely.

5.0 FLOOD RISK ASSESSMENT

5.1 Reference to the Environment Agency maps confirms that the site is not within a flood zone area and is not at risk of flooding from local rivers/water features and defines the area as having a very low risk of flooding due principally to its topography.

5.2 Reference to The North London Strategic Flood Risk Assessment, which London Borough of Camden is part of, confirms that the site is not at risk or in the vicinity of past surface water flooding, potential elevated groundwater, past flooded sewer incidents, past flooded ground water incidents or any main river/fluvial/tidal incidents.

5.3 The inclusion of SUDS on site and reduced surface water outfall flow rate of 3l/s will reduce the surface water run off from site and the discharge of surface water into the main drainage system. The affect of this is to reduce volume of site run off discharging into the main drainage system and reduce the effects of any possible flooding further down stream.

5.4 By virtue of the basement structure design, which will not restrict ground water flow and will allow groundwater to seep below and around the basement structure, this will not restrict ground water flow within any perched ground water.

5.5 The Soil Investigation undertaken on site notes the ground water seepage on site is considered to be very low.

6.0 CONCLUSIONS

6.1 Detailed analysis of the various aspects of construction has been undertaken to demonstrate how the level of sequencing will enable the development to be constructed safely with ground movements within acceptable levels.

6.2 The stability of the adjacent properties and surrounding ground will not be affected by the basement works with the influence of adjoining building foundation depths taken into account during the initial design process, as indicated on drawings 8600_SK03 - SK06 (refer to Appendix C). Within the design an allowance has been allowed for surcharge from adjoining buildings and roads. At the detailed design stage calculations will confirm working sizes of sheet piles, waling and propping which will keep ground movement within the specified design limits.

6.3 If required any temporary localized dewatering of the basement area will be reviewed, designed and monitored to reduce the water level locally to the area of works. The current water monitoring indicates it is likely that only local dewatering to the lowest area of basement for the pumping chambers may be required. Water levels will be monitored prior to the start of works.

6.4 Prior to commencement a full schedule of condition will be carried out to all relevant buildings as defined within The Party Wall Act 1996 where the excavations may be within the influence zone of existing foundations.

6.5 The desk top study carried out indicates that the construction of the new basement floor level will not lead to a cut off of natural ground water flow. Detailed designs will follow as part of the construction design. If any supplemental drainage is required it will be included as necessary to ensure that the current ground water equilibrium levels are maintained and that there is no increase in the risk of flooding.

6.6 The construction of the basement will be within the London Clay and is not envisaged as having a detrimental effect on the local or surrounding hydrogeological conditions.

6.7 There is a reduction in hard standing areas and with the incorporation of SUDS around the site as shown on the proposed site drainage layout drawing no. 8600_SK09 (refer to Appendix J) this will minimise the effects on the surrounding area and maintain the existing ground water conditions on site.

6.8 There will not be any increase in foul water flow from the site. This can be controlled by the use of a pumping chamber in the basement with in-built storage capacity to be pumped to match the existing flow rate from the site as to be agreed with Thames Water.

6.9 The surface water run off and subterranean flow from the site can maintain the existing site condition with the surface water drainage and green roof area over the basement being designed to maintain the existing site flow rates and with the further use of SUDS being implemented to reduce the surface water run off rates.

6.10 The granular drainage channels beneath the basement slab and around the basement walls will minimise any changes to the existing conditions along the adjoining properties.

6.11 Safety both on site and adjacent to the site is of paramount importance and the method of construction proposed has taken this into account.

6.12 The selection of the main contractor and sheet piling sub-contractor and designer of temporary works will be based on having previous experience constructing similar projects and a requirement to provide programmes and method statements detailing the final sequence of construction prior to carrying out works on site. The main contractor is to be registered with The Considerate Constructors Scheme.

6.13 One of the site requirements will be the selection of experienced site supervision staff and selection of plant and machinery based on minimising noise and vibration.

6.14 The project as currently envisaged is feasible in terms of the general construction process, structural stability, long term integrity of adjacent buildings and the existing site and surrounding infrastructure.

7.0 DESIGNER'S HAZARD AND RISK IDENTIFICATION

See report on following pages

For and on behalf of
TAYLOR WHALLEY SPYRA

SIMON LANE
BSc(Eng), CEng, FICE, FIStructE, FConsE

44 FROGNAL LANE,
HAMPSTEAD,
LONDON,
NW3 6PP,

Job No. 8600

DESIGNER'S HAZARD AND RISK IDENTIFICATION

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INTRODUCTION

The works to be carried out involve the splitting of the current single dwelling into two self contained dwellings which will include the refurbishment of the existing property and demolition of the existing extensions to the main building and the construction of a new below ground basement under the existing front garden (which will form part of the two separate dwellings) and side extension incorporating a swimming pool. There are a number of above ground extensions to be constructed of brick and block with timber floors and roof.

The new works involve some underpinning of the existing building to install the staircase access to the basement from the existing house and steel retention scheme to support parts of the existing structure and the installation of sheet piles with propping to allow the basement to be excavated and the installation of the RC basement slab and RC retaining walls with a RC concrete ground floor slab. The new walls above are to be brick/blockwalls construction with the existing structure where retained to be reinstated in brickwork to provide the permanent support back off the new RC ground floor slab, this will then allow the removal of the temporary steel frame.

Areas of the existing structure are to be temporarily supported and a steel frame bearing on temporary piles. This will allow the construction of the basement to be an open excavation which will be suitable propped at the required levels to allow for bottom up sequence of construction

The Main Contractor will be required to make particular reference to the Pre-contract Health and Safety Plan which summarises all salient points.

The designer's hazard identification sheets as contained within this document are generic to the site but also to a degree similar for all types of structural work undertaken.

Where possible unusual risks have been highlighted, it will be the Main Contractor's responsibility however to highlight any areas of the design which they feel could be improved upon with regard to safe construction and for themselves to become fully aware of the building and its environment and ask questions with regard to any health and safety aspects which are not clear, either within the pre-contract health and safety plan or within the contract documents.

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LOCATION/PROCESS	HAZARD	RISK	CONTROLS/ACTION
Generic risks	• Contractor competence • Inadequate site supervision • Inadequate contact programme	• Building stability • Damage to site and adjoining properties • Contract period overrun	• Competent tender process • Contractor to have proven track record of similar projects. • Contractor to have experienced site supervision team and experienced sub-contractors • Contractor to provide CV's of site management personnel • Contractor to provide Method statements & risk assessments • All works to be carried out to the agreed programme and sequence of phasing. Any changes to be adequately programmed and agreed prior to be carried out • Site monitoring and supervision • Removal of temporary propping scheme phased to coincide with bottom up construction of RC structure and removed only upon confirmation of required concrete design strength achieved and permission to be given by Project Engineer.
Working on a shared site and adjacent to: Other Public & Residential Buildings Public Footpaths and Roads	• Conflict with other contractors and subcontractors sharing the site. • Conflict with others site and building users • Conflict with others outside the site boundary.	• Personal injury. • Damage to property.	• Clear warning signs. • Safe routes for traffic and pedestrians. • Close liaison with other site users. • Appoint a Neighbour liaison Officer • Keep Local Neighbours informed of works on site that may effect them • Temporary hoarding. • Temporary crash deck and safety netting/bags
Cranes, Heavy lifting machinery	• Heavy machinery. • Falling debris. • Lifting and lowering of heavy loads near people / public.	• Being struck by machinery. • Machinery failure.	• Look-out in attendance. • Certified operators and certificates of maintenance for machinery. • Monitoring wind conditions. • Adequate outrigger spreaders to distribute loads

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LOCATION/PROCESS	HAZARD	RISK	CONTROLS/ACTION
Demolition works to exiting structure	• Falls. • Falling debris. • Falling materials. • Noise. • Dust. • Live services. • Asbestos/cement roof sheets. • Out of plumb walls. • Stability of walls. • Cutting and removing existing steelwork. • Removing timber floor. • Collapse of enveloping walls. • Fire/explosion. • Demolishing walls. • Debris, walls falling, falling objects onto adjoining property. • Working adjacent to footpaths and publicly accessible areas.	• Injury to operatives from falling debris. • Shock and injuries from live services. • Noise/hearing damage. • Contaminated material ingestion, eye/skin irritation. • Dust inhalation. • Fire/explosion. • Flammable materials and gases. • Confined spaces. • Vibration. • Collapse.	• Contractor to check and survey for any live services. • Contractor to prepare method statements. • Contractor to provide all appropriate and necessary temporary works and support. • Provide protection from falling debris and materials. • Contractor to provide all necessary and appropriate PPE. • Refer to Code of Practice – Demolition BS6187 latest edition. • Provide all scaffolding, access to works, including guardrails, toe boards – all erected, regularly checked and inspected by competent persons. • Dust to be kept to a minimum – damp down. • Noise to be controlled – refer to BS5228 – Noise, latest edition. Provide baffling screens to reduce noise • Dispose of waste safely to an approved source. • Check for asbestos/refer to asbestos survey. • Restrict personnel access in vicinity of demolition. • Vibration to be minimised. • Provide temporary shoring and propping to existing walls where required.
In-situ piling & Steel Sheet Piling	• Heavy machinery. • Deep shafts. • Site traffic. • Manoeuvring of large loads	• Being struck by machinery. • Falling down shaft. • Trip hazards • Machinery failure. • Aligning sheet piles • Danger to public and operatives when delivering ready mixed concrete.	• Look-out in attendance. • Open shafts to be covered over and clearly marked or cordoned off. • Provision of adequate access ramp and pile mat.

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LOCATION/PROCESS	HAZARD	RISK	CONTROLS/ACTION
Excavations for Basement, Building Foundations. Drainage, Services,	• Stability of excavations. • Heavy rain fall • Confined spaces. • Falls into excavations. • Underground services. • Fire/explosion • Contaminated soils. • Depth of excavation. • Underground drainage • Water in excavation. • Breaking out obstructions. • Noise from plant. • Contaminated water	• Injury to persons from collapsing excavations. • Damage to surrounding properties from excessive ground movement • Injury/illness of site operatives/ personnel, eye/skin irritation. • Injury or electrocution from services. • Flying materials and debris from breaking out. • Gas/fuel pipes/tanks/methane. • Falls. • Hearing damage. • Dust inhalation & ingestion. • Giardiasis Syndrome (Wells Disease etc.)	• Adequate design and provision of suitable temporary propping scheme / permanent works to support excavations. • Monitoring of ground movement by installation of movement and vibration sensor monitoring points on site and surrounding buildings • Properly sequenced phasing of excavation and propping • Installation of Ground Water well points to control Water ingress within excavated Basement • Leave soil formation 500mm above final excavation prior to excavation to final formation level • Refer CIRIA reports. • HSE guidance notes. • Undertake survey to determine location of existing underground services crossing site and those within immediate vicinity. • Check with statutory authorities for underground services and drainage. • Protective barriers to be provided around all excavations. • Provision of all PPE. • Provision of pumps etc. to remove excess water. • Check for contaminated subsoil's in excavations. • Disposal of contaminated materials to licensed tip. • COSHH assessment of materials. • Safe access to be provided with all necessary safety rails, harness, etc. • Investigate adjacent structures/ foundations. • Testing manholes, contaminated ground, etc for gas/methane. • Provide adequate personal cleaning facilities on site.

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LOCATION/PROCESS	HAZARD	RISK	CONTROLS/ACTION
Concrete works.	• Collapse of formwork/ shuttering/props. • Stability of framework. • Falls from heights. • Handling reinforcement. • Sharp edges. • Spillage of materials. • Falling objects/debris. • Overhead working. • Projecting reinforcement. • Cement/concrete. • Weight of wet materials. • Delivery of ready mixed concrete.	• Tripping. • Injury from collapsing formwork, shuttering/frames. • Manual handling/muscular- skeletal injuries. • Injury/illness/skin irritation/inhalation/ingestion. • Falls. • Fixing reinforcement. • Danger to public and operatives when delivering ready mixed concrete.	• Properly sequenced phasing of RC frame structure construction and removal of temporary propping scheme phased to coincide with bottom up construction of RC structure and removed only upon confirmation of required concrete design strength achieved • Allow for concrete in fluid state. • Provision of all PPE. • Adequate design and specification of temporary works and supervision and installation. • Adequate design and specification for formwork, propping and adequate supervision and checking of installation. • COSHH assessment of materials. • Refer to HSE guidelines/notes. • Provision of guardrails and barriers. • Refer to building advisory services publications. • Provision of adequate lifting facilities. • Provision of off-street standing ready mixed concrete lorries.
Construction of brick and block work.	• Stability of walls during construction. • Weights of materials and components. • Falls. • Falling objects, debris. • Cement. • Off-loading. • Manoeuvring blocks in position. • Dust, debris, drilling when cutting & chasing. • Projecting ties. • Sharp edges. • Noise.	• Falling walls – injury to personnel. • Manual handling/muscular-skeletal injuries. • Falling components and debris. • Control of off-loading. • Illness/injury/skin irritation/ inhalation/ingestion/ cuts/hearing damage. • Falls.	• Walls to be temporarily supported laterally during construction. • Provision of adequate and suitable lifting facilities. • Provision of adequate scaffold, scaffold access towers, ladders with appropriate guardrails, toe boards, etc. all to be checked and inspected regularly by competent person. • Mechanical sawing and cutting of block and bricks to size and cutting chases. • Provision of all appropriate PPE. • COSHH assessment of materials. • Protect ends of projecting ties.

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LOCATION/PROCESS	HAZARD	RISK	CONTROLS/ACTION
Steelwork Erection	• Weight of materials. • Sharp edges. • Raising and lifting material. • Site welding. • Site bolting. • Overhead working. • Cutting steelwork. • Falls from heights. • Manoeuvring steelwork into position. • Off/unloading materials.	• Control of off-loading materials, danger to operatives and general public. • Fire and explosion. • Falling materials, components, debris. • Manual handling/musculo-skeletal injuries.	• Refer to specification. • Protection against falling materials and components. • Protection from falling objects and debris. • Adequate and proper lifting facilities. • Hot work permits. • Adequate scaffolding, scaffold towers, including edge guards and guardrails. • Provision of all PPE. • Refer to British Standards and/or Codes of Practice for assembly and erection of steelwork. • Refer to HSE guidance notes and building advisory service publications. • COSHH assessment of paint and materials used for fire protection. • Provision of safety netting, harness, safety lines for erection of steelwork.
Construction and erection of timber framing.	• Stability of floors and walls during construction. • Power Tools/ cables • Weight of materials. • Falling objects, debris. • Sharp edges. • Raising and lifting material. • Dust, debris, drilling when cutting & chasing. • Site bolting/fixing. • Overhead working. • Cutting timber. • Falls from heights. • Manoeuvring timber into position. • Off/unloading materials.	• Falling walls – injury to personnel • Electrocution/ trip hazards • Control of off-loading materials, danger to operatives and general public. • Fire. • Falling materials, components, debris. • Illness/injury/skin irritation/ inhalation/ingestion/ cuts/hearing damage • Manual handling/musculo-skeletal injuries. • Falls/ Tripping	• Refer to specification. • Protection against falling materials and components. • Protection from falling objects and debris. • Adequate and proper lifting facilities. • Adequate scaffolding, scaffold towers, including edge guards and guardrails. • Provision of all PPE. • Refer to British Standards and/or Codes of Practice for assembly and erection of steelwork. • Refer to HSE guidance notes and building advisory service publications. • COSHH assessment of paint and materials used for fire protection. • Provision of safety netting, harness, safety lines for erection of timber.

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APPENDIX A

TWS - 8600_SK01 – SITE LOCATION PLAN INDICATING ADJOINING PROPERTIES

IMAGE 01

44 FROGNAL LANE

IMAGE 02

40 FROGNAL LANE

IMAGE 03

42/43 FROGNAL LANE

IMAGE 04

PRIVATE SITE ACCESS ROAD OFF FROGNAL LANE

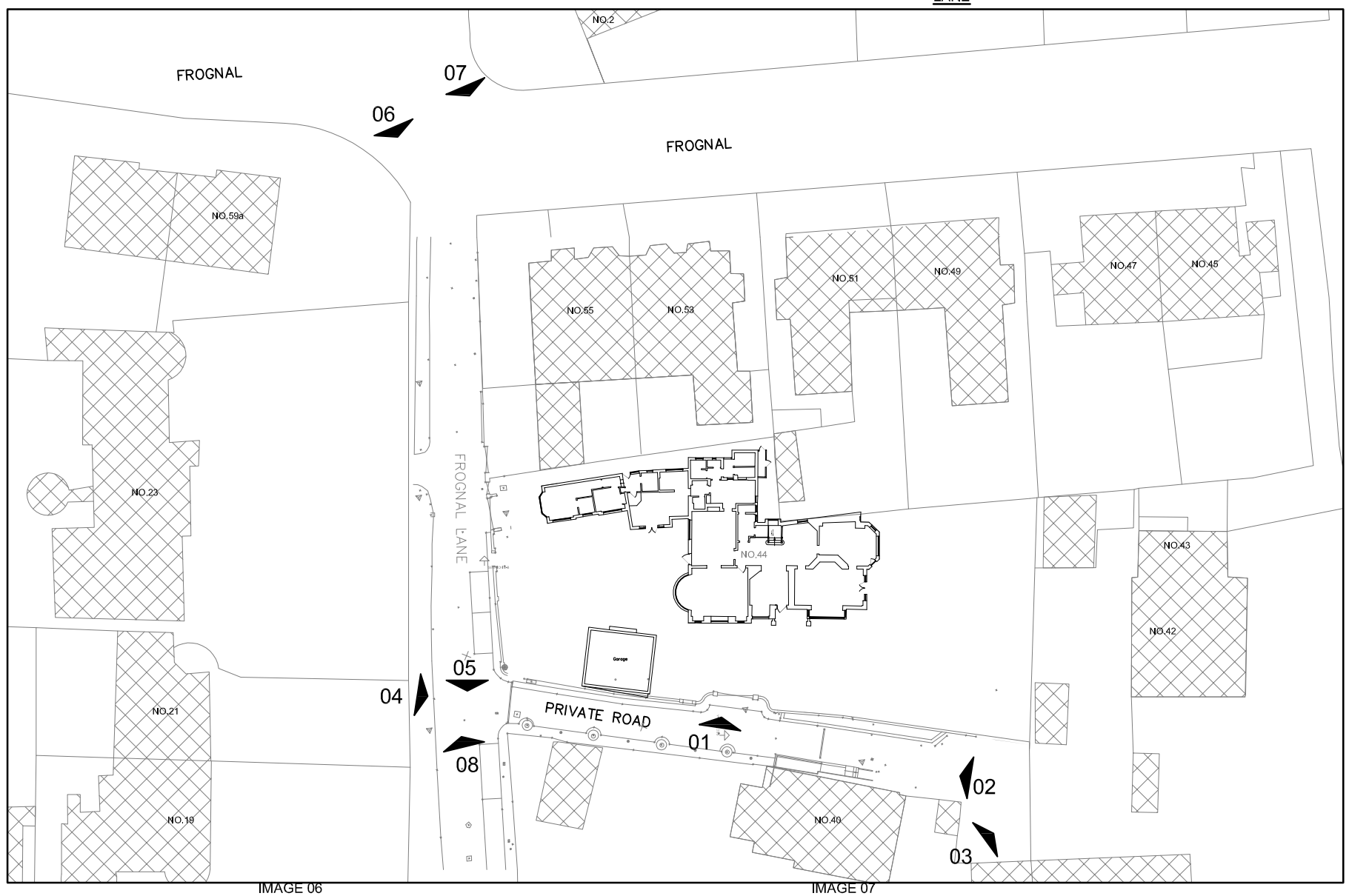

IMAGE 05

CORNER OF 40 FROGNAL LANE

IMAGE 06

CORNER OF 55 FROGNAL — FROGNAL LANE — CORNER OF 59a FROGNAL

IMAGE 07

53 FROGNAL — 55 FROGNAL

IMAGE 08

23 FROGNAL LANE — 44 FROGNAL LANE

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Contract

44 FROGNAL LANE,
HAMPSTEAD,
LONDON, NW3 6PP,

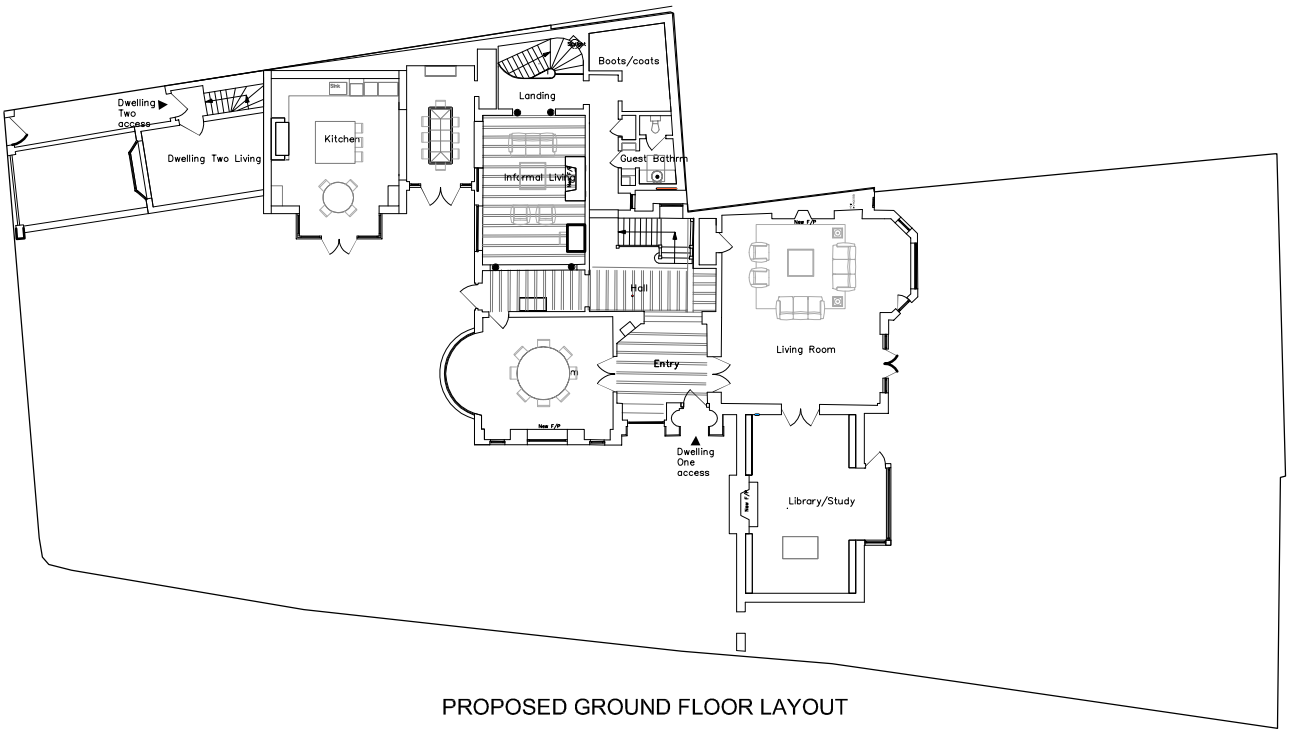
Title

SITE LOCATION INDICATING ADJACENT PROPERTIES

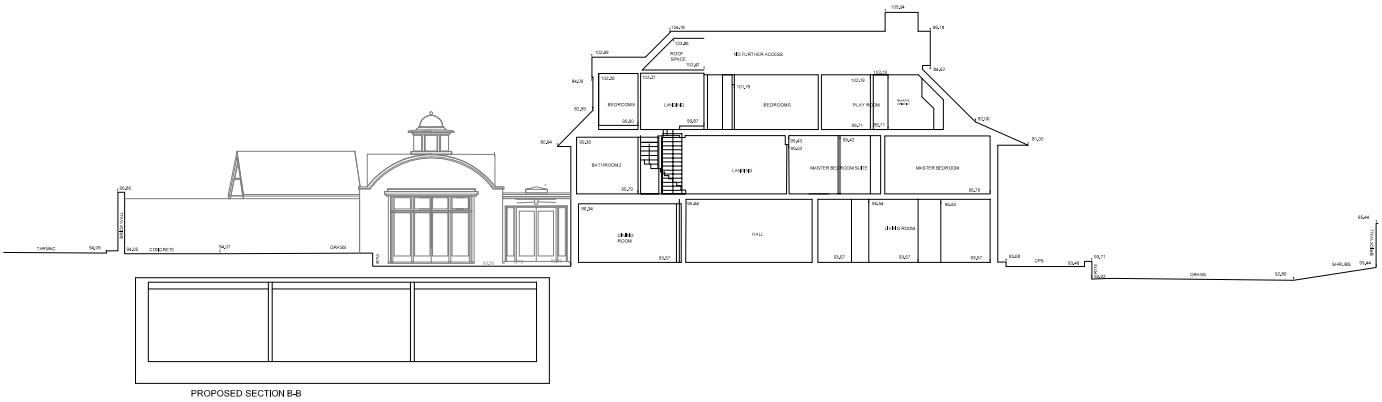
Scale	Date	Drawn
NTS	13.02.14	GB
Job No.	Drawing No.	Rev.
8600	SK01	A

APPENDIX B

TWS – 8600_SK02 - GROUND FLOOR LAYOUT & LONG BUILDING SECTION



PROPOSED GROUND FLOOR LAYOUT



PROPOSED LONG SECTION

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ARCHITECTS GROUND FLOOR PLAN AND LONG SECTION

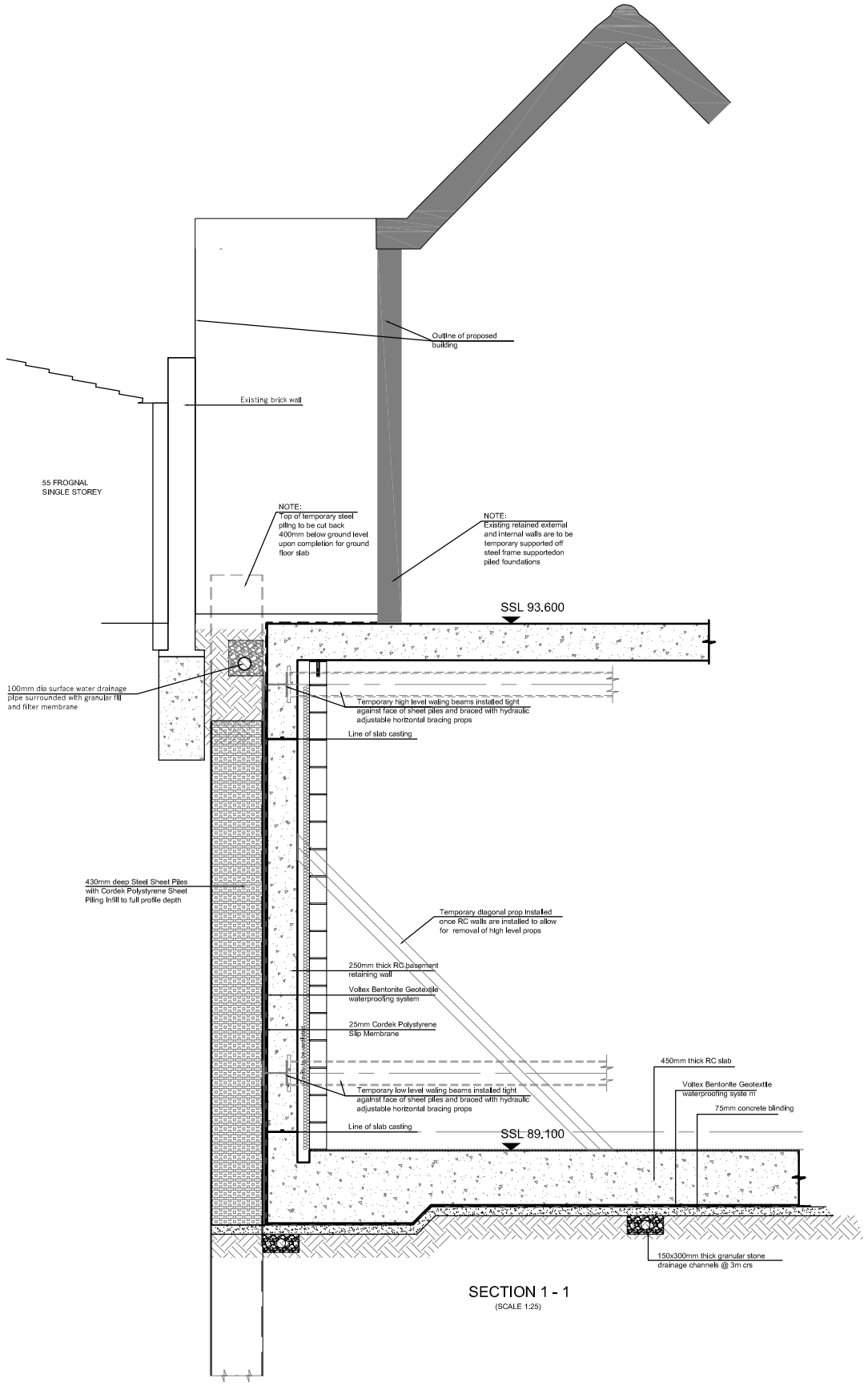
Drawing No. 8600_SK02 A

Scales NTS

Date 12.02.14

APPENDIX C

TWS - 8600_SK03 - SECTION 1 _ 1 - ADJACENT 55 FROGNAL
TWS - 8600_SK04 - SECTION 2 _ 2 - ADJACENT 53 FROGNAL
TWS - 8600_SK05 - SECTION 3 _ 3 - ADJACENT FROGNAL LANE PAVEMENT
TWS - 8600_SK06 - SECTION 4 _ 4 - ADJACENT PIVATE ROAD



SECTION 1 - 1
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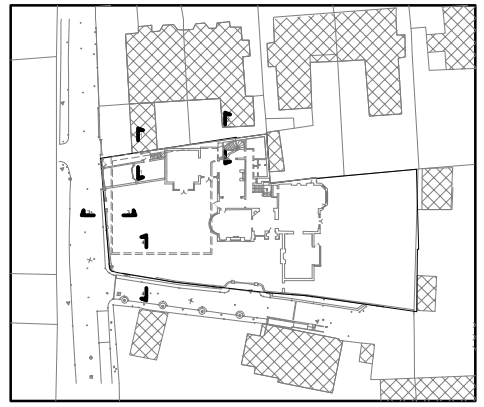
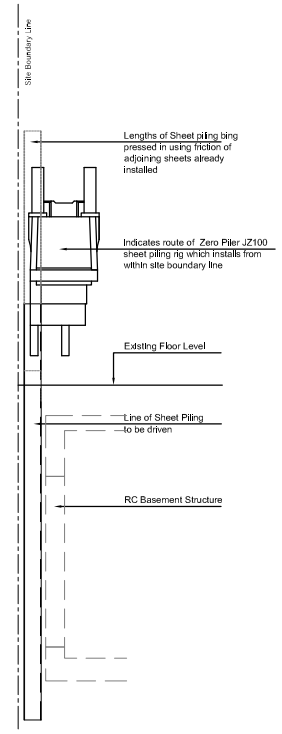


SECTION KEY PLAN
(NTS)

SAMPLE PICTURE OF BASEMENT WORKS DESIGNED BY TAYLOR WHALLEY SPYRA AT WEST HEATH ROAD, HAMPSTEAD, NW3
(NTS)

CONSTRUCTION METHOD SEQUENCE

- Install within the site area around the basement zone and surrounding area a number of fixed monitoring nodes to monitor possible movement during the works.
- The existing main house is to be retained and internal layouts adjusted Parts of the side extensions are to be retained with the installation of temporary piles and steel support frame and the remainder of the site is to be demolished and all foundations and drainage runs are to be grubbed out.
- The existing topsoil on site situated around the proposed basement area is to be scraped off and stored on site for re-use at a later stage.
- The sheet piling is to be installed with a Silent Piler similar to a Giken Rig which presses the sheet piles into the ground using the resistance of the adjoining installed sheet piles.
- Additional areas are to be underpinned in an agreed sequence with reinforced concrete underpins in maximum 1m wide bays to support existing walls where sheet piling access is restricted around the staircase that will form the access to the basement from the existing house.
- The ground is to be locally excavated by 1m to allow installation of the steel waling beams and adjustable hydraulic props at high level.
- The ground is then to be further excavated to allow installation of the steel waling beams and adjustable hydraulic props at low level.
- The ground is then to be excavated to formation level.
- The granular drainage channels with drainage pipes are to be installed.
- The basement RC slab build-up is to be installed and then the basement slab cast with 150mm high kickers for all the RC basement walls and internal columns.
- Install and cast all internal RC walls and columns to underside of ground floor slab level.
- Once the RC basement slab has gained the required design strength the sheet piling waling beams and adjustable props at low level are to be removed.
- The basement RC walls are then to be cast to 600mm below the underside of the high level waling beams.
- Once the basement RC walls have gained the required design strength, install temporary diagonal adjustable restraint props fixed to the RC wall and RC basement slab and then remove the high level sheet piling waling beams and props.
- The RC ground floor slab and RC wall downstands can then be cast.
- Once the RC ground floor slab has gained the required design strength the additional diagonal restraint props can be removed.
- During the construction period the sheet pilling and surrounding ground will be monitored at regular intervals to confirm the construction tolerance stays within the agreed design parameters.
- The existing structure over can now be re-supported of the new RC ground floor slab and the temporary steel support frame carefully removed with the additional new areas of the proposed works constructed and where required supported off the new ground floor slab and cantilevered as required.
- Continue with construction of the remainder of the structure over using traditional load bearing brick/blockwork, timber floors and steel framing with timber infill rafters.
- Install external works and reinstate top soil to landscaped areas.



SECTION INDICATE SHEET PILING INSTALLATION ADJACENT BOUNDARY LINE
(SCALE 1:50)

1. This Drawing to be read In conjunction with all other Engineers, Architects and Specialists drawings and specifications.
2. No dimensions are to be scaled from this drawing.
3. No deviation may be made from the details shown on this drawing without prior agreement of the Engineers.
4. Any discrepancy between this drawing and any other document should be referred Immediately to the Engineer.

Ref.	Revisions	By	Date
.	.	.	.

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SECTION 1 _ 1 SHOWING TEMPORARY/PERMANENT SUPPORT WORKS

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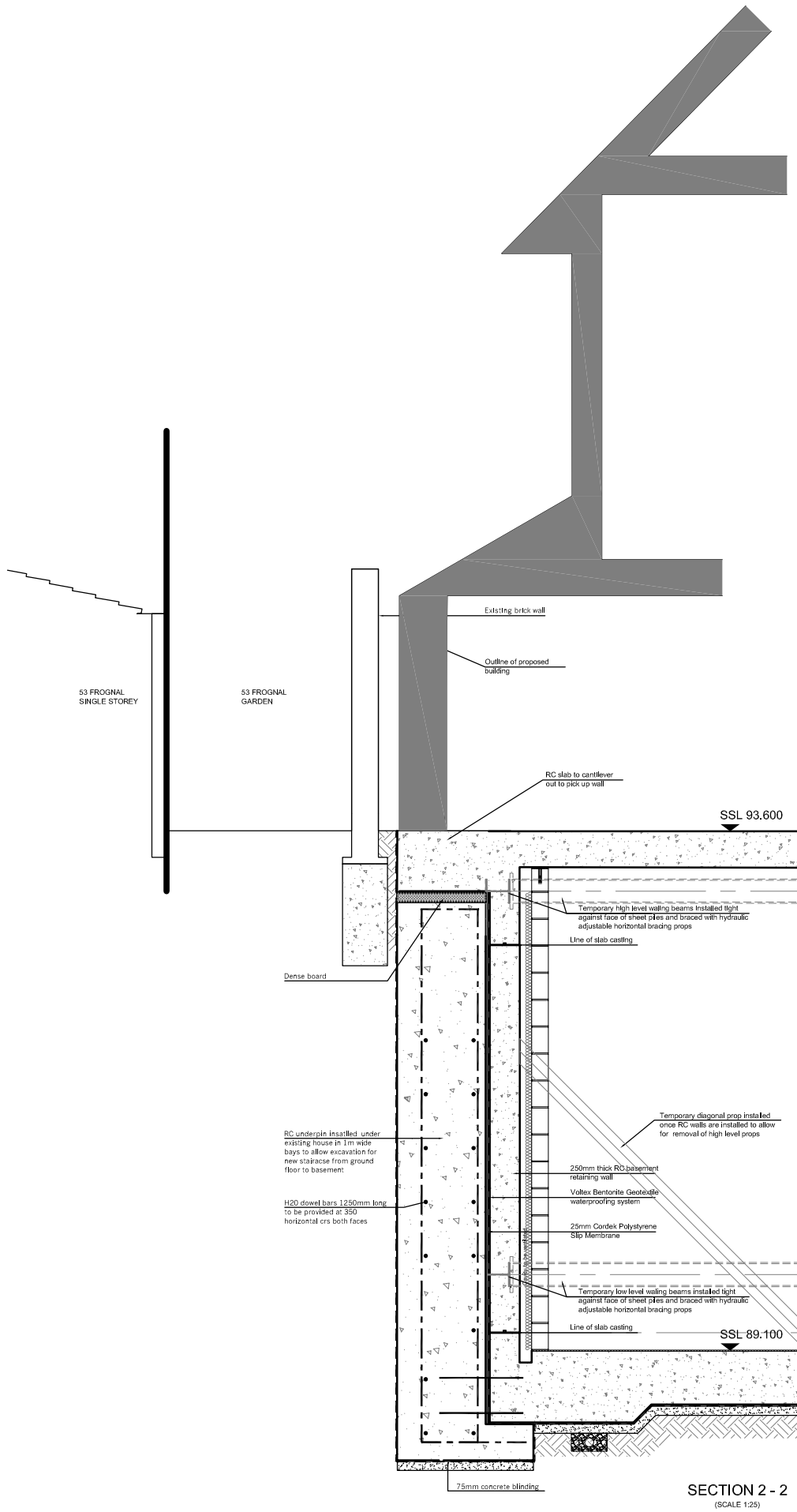
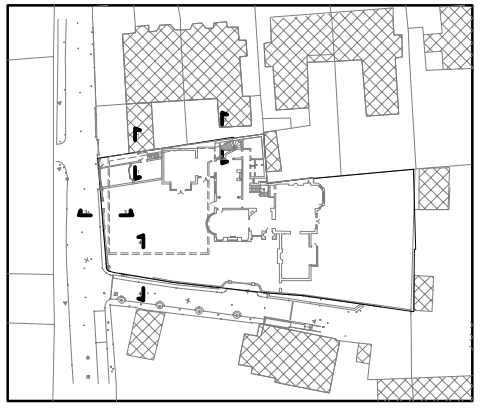
Scale at A1	Date	Drawn By
1:25	12/02/14	GB

Project No.	Drg No.	Rev.
8600	SK03	A



SECTION 2 - 2
(SCALE 1:25)

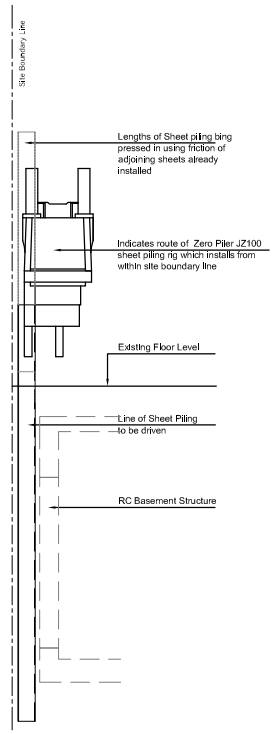


SECTION KEY PLAN
(NTS)

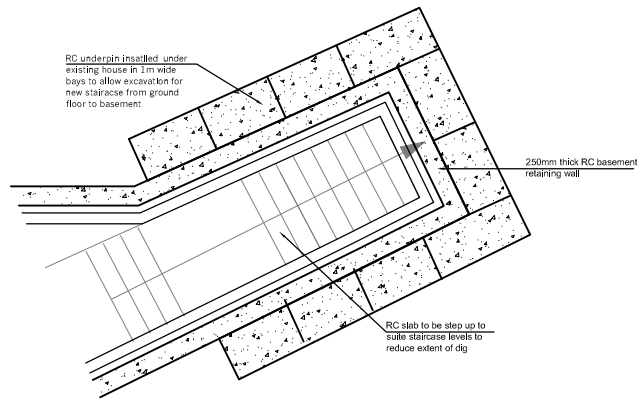
SAMPLE PICTURE OF BASEMENT WORKS DESIGNED BY TAYLOR WHALLEY SPYRA AT WEST HEATH ROAD, HAMPSTEAD, NW3
(NTS)

CONSTRUCTION METHOD SEQUENCE

- Install within the site area around the basement zone and surrounding area a number of fixed monitoring nodes to monitor possible movement during the works.
- The existing main house is to be retained and internal layouts adjusted Parts of the side extensions are to be retained with the installation of temporary piles and steel support frame and the remainder of the site is to be demolished and all foundations and drainage runs are to be grubbed out.
- The existing topsoil on site situated around the proposed basement area is to be scraped off and stored on site for re-use at a later stage.
- The sheet piling is to be installed with a Silent Piler similar to a Giken Rig which presses the sheet piles into the ground using the resistance of the adjoining installed sheet piles.
- Additional areas are to be underpinned in an agreed sequence with reinforced concrete underpins in maximum 1m wide bays to support existing walls where sheet piling access is restricted around the staircase that will form the access to the basement from the existing house.
- The ground is to be locally excavated by 1m to allow installation of the steel waling beams and adjustable hydraulic props at high level.
- The ground is then to be further excavated to allow installation of the steel waling beams and adjustable hydraulic props at low level.
- The ground is then to be excavated to formation level.
- The granular drainage channels with drainage pipes are to be installed.
- The basement RC slab build-up is to be installed and then the basement slab cast with 150mm high kickers for all the RC basement walls and internal columns.
- Install and cast all internal RC walls and columns to underside of ground floor slab level.
- Once the RC basement slab has gained the required design strength the sheet piling waling beams and adjustable props at low level are to be removed.
- The basement RC walls are then to be cast to 600mm below the underside of the high level waling beams.
- Once the basement RC walls have gained the required design strength, install temporary diagonal adjustable restraint props fixed to the RC wall and RC basement slab and then remove the high level sheet piling waling beams and props.
- The RC ground floor slab and RC wall downstands can then be cast.
- Once the RC ground floor slab has gained the required design strength the additional diagonal restraint props can be removed.
- During the construction period the sheet piling and surrounding ground will be monitored at regular intervals to confirm the construction tolerance stays within the agreed design parameters.
- The existing structure over can now be re-supported of the new RC ground floor slab and the temporary steel support frame carefully removed with the additional new areas of the proposed works constructed and where required supported off the new ground floor slab and cantilevered as required.
- Continue with construction of the remainder of the structure over using traditional load bearing brick/blockwork, timber floors and steel framing with timber infill rafters.
- Install external works and reinstate top soil to landscaped areas.



SECTION INDICATE SHEET PILING INSTALLATION ADJACENT BOUNDARY LINE
(SCALE 1:50)



UNDERPINNING AROUND STAIRCASE EXCAVATION
(SCALE 1:50)

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Ref.	Revisions	By	Date
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44 FROGNAL LANE
HAMPSTEAD,
LONDON,
NW3 6PP,

SECTION 2 _ 2 SHOWING TEMPORARY/PERMANENT SUPPORT WORKS

taylor whalley spyra
consulting civil and structural engineers
3 Dufferin Avenue, Barbican, LONDON EC1Y 8PQ
Tel (020) 7253 2626 Fax (020) 7253 2727
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Project No.	Drg No.	Rev.
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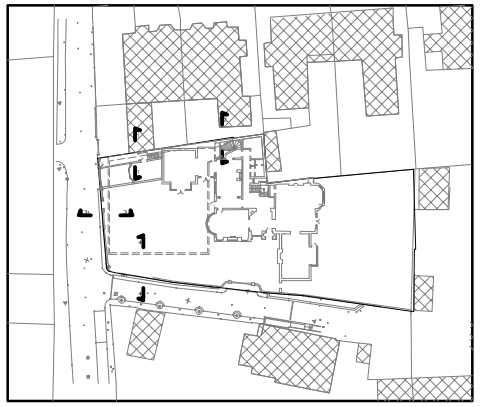
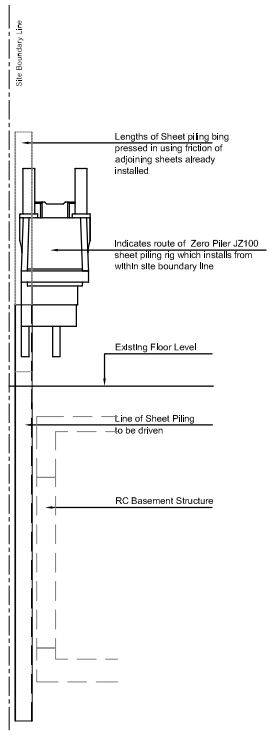


SECTION KEY PLAN
(NTS)

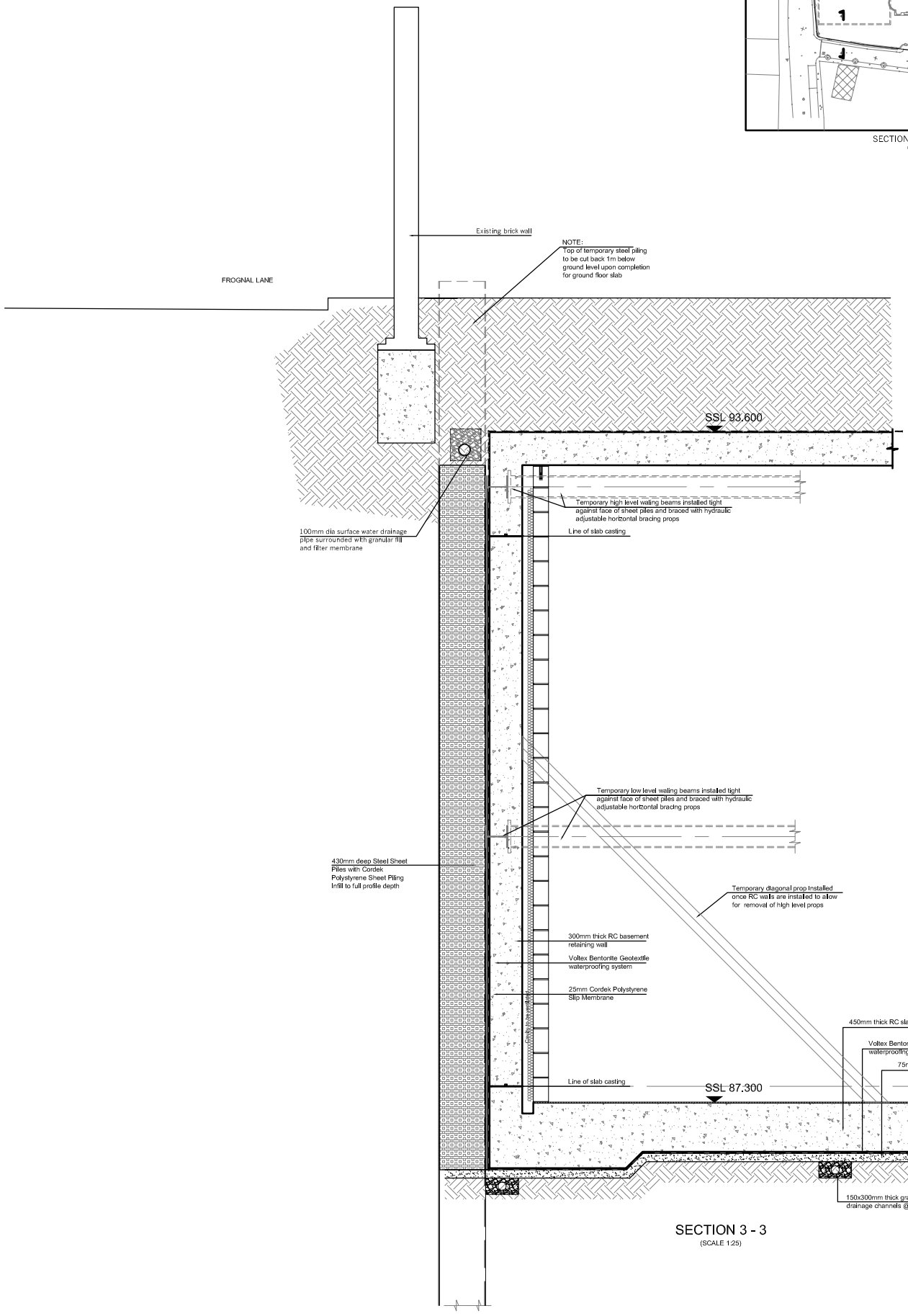
SAMPLE PICTURE OF BASEMENT WORKS DESIGNED BY
TAYLOR WHALLEY SPYRA AT WEST HEATH ROAD, HAMPSTEAD, NW3
(NTS)

CONSTRUCTION METHOD SEQUENCE

- Install within the site area around the basement zone and surrounding area a number of fixed monitoring nodes to monitor possible movement during the works.
- The existing main house is to be retained and internal layouts adjusted Parts of the side extensions are to be retained with the installation of temporary piles and steel support frame and the remainder of the site is to be demolished and all foundations and drainage runs are to be grubbed out.
- The existing topsoil on site situated around the proposed basement area is to be scraped off and stored on site for re-use at a later stage.
- The sheet piling is to be installed with a Silent Piler similar to a Giken Rig which presses the sheet piles into the ground using the resistance of the adjoining installed sheet piles.
- Additional areas are to be underpinned in an agreed sequence with reinforced concrete underpins in maximum 1m wide bays to support existing walls where sheet piling access is restricted around the staircase that will form the access to the basement from the existing house.
- The ground is to be locally excavated by 1m to allow installation of the steel waling beams and adjustable hydraulic props at high level.
- The ground is then to be further excavated to allow installation of the steel waling beams and adjustable hydraulic props at low level.
- The ground is then to be excavated to formation level.
- The granular drainage channels with drainage pipes are to be installed.
- The basement RC slab build-up is to be installed and then the basement slab cast with 150mm high kickers for all the RC basement walls and internal columns.
- Install and cast all internal RC walls and columns to underside of ground floor slab level.
- Once the RC basement slab has gained the required design strength the sheet piling waling beams and adjustable props at low level are to be removed.
- The basement RC walls are then to be cast to 600mm below the underside of the high level waling beams.
- Once the basement RC walls have gained the required design strength, install temporary diagonal adjustable restraint props fixed to the RC wall and RC basement slab and then remove the high level sheet piling waling beams and props.
- The RC ground floor slab and RC wall downstands can then be cast.
- Once the RC ground floor slab has gained the required design strength the additional diagonal restraint props can be removed.
- During the construction period the sheet piling and surrounding ground will be monitored at regular intervals to confirm the construction tolerance stays within the agreed design parameters.
- The existing structure over can now be re-supported of the new RC ground floor slab and the temporary steel support frame carefully removed with the additional new areas of the proposed works constructed and where required supported off the new ground floor slab and cantilevered as required.
- Continue with construction of the remainder of the structure over using traditional load bearing brick/blockwork, timber floors and steel framing with timber infill rafters.
- Install external works and reinstate top soil to landscaped areas.



SECTION INDICATE SHEET PILING INSTALLATION ADJACENT BOUNDARY LINE
(SCALE 1:50)



SECTION 3 - 3
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44 FROGNAL LANE
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SECTION 3 _ 3 SHOWING TEMPORARY/PERMANENT SUPPORT WORKS

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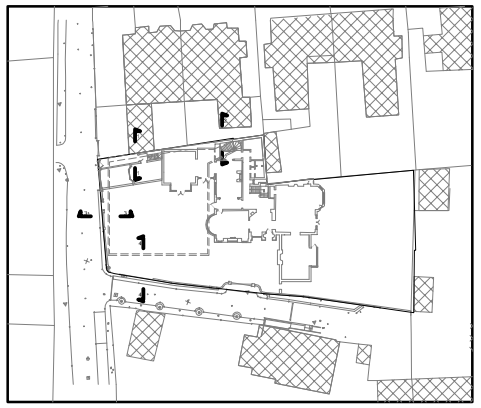

SECTION KEY PLAN
(NTS)

SAMPLE PICTURE OF BASEMENT WORKS DESIGNED BY
TAYLOR WHALLEY SPYRA AT WEST HEATH ROAD, HAMPSTEAD, NW3
(NTS)

CONSTRUCTION METHOD SEQUENCE

- Install within the site area around the basement zone and surrounding area a number of fixed monitoring nodes to monitor possible movement during the works.
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- The existing topsoil on site situated around the proposed basement area is to be scraped off and stored on site for re-use at a later stage.
- The sheet piling is to be installed with a Silent Piler similar to a Giken Rig which presses the sheet piles into the ground using the resistance of the adjoining installed sheet piles.
- Additional areas are to be underpinned in an agreed sequence with reinforced concrete underpins in maximum 1m wide bays to support existing walls where sheet piling access is restricted around the staircase that will form the access to the basement from the existing house.
- The ground is to be locally excavated by 1m to allow installation of the steel waling beams and adjustable hydraulic props at high level.
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- The RC ground floor slab and RC wall downstands can then be cast.
- Once the RC ground floor slab has gained the required design strength the additional diagonal restraint props can be removed.
- During the construction period the sheet piling and surrounding ground will be monitored at regular intervals to confirm the construction tolerance stays within the agreed design parameters.
- The existing structure over can now be re-supported of the new RC ground floor slab and the temporary steel support frame carefully removed with the additional new areas of the proposed works constructed and where required supported off the new ground floor slab and cantilevered as required.
- Continue with construction of the remainder of the structure over using traditional load bearing brick/blockwork, timber floors and steel framing with timber infill rafters.
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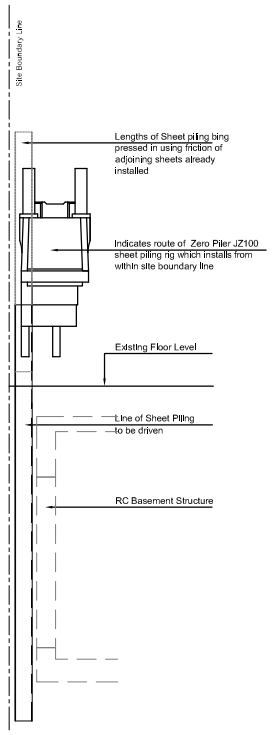
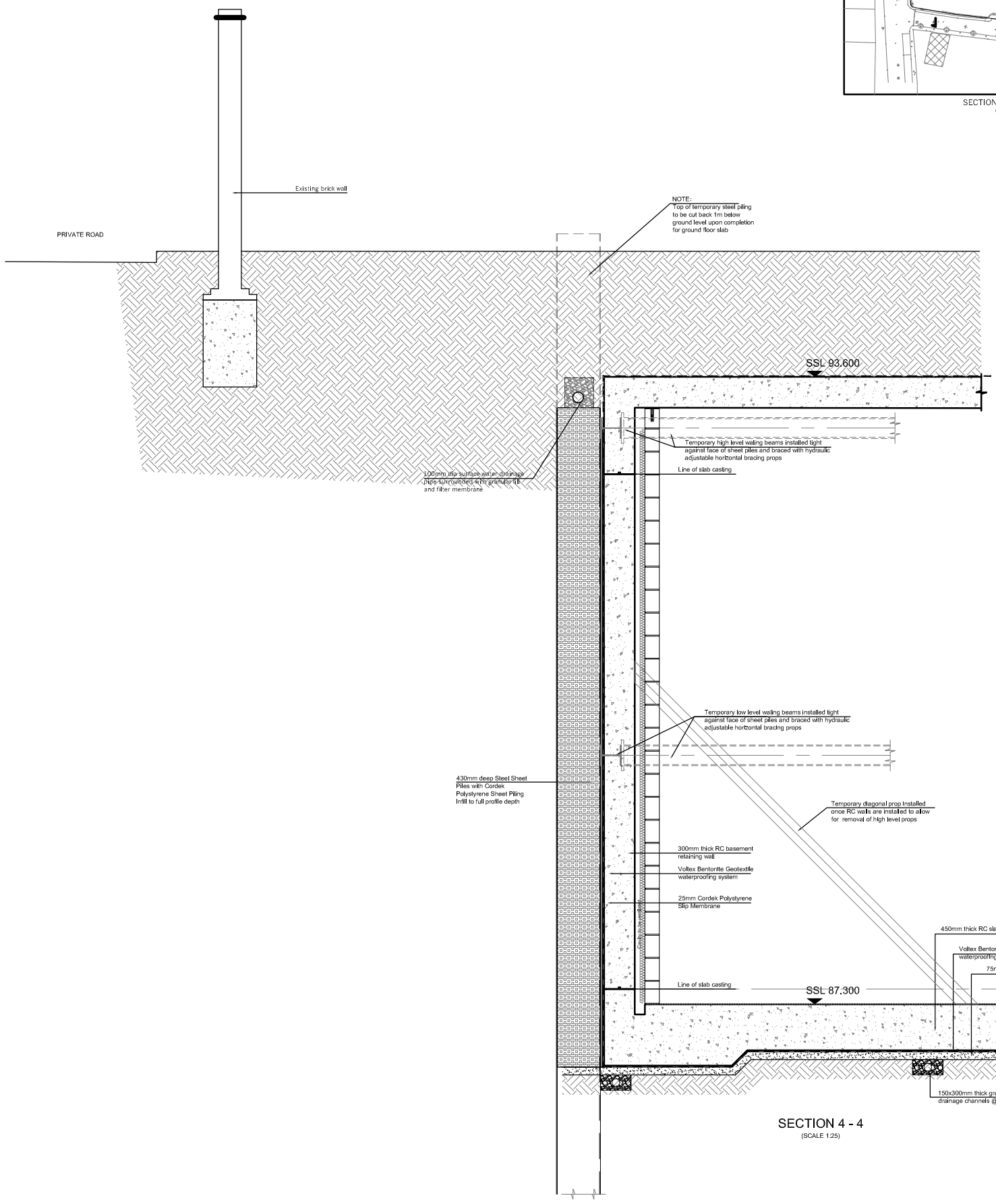


SECTION INDICATE SHEET PILING INSTALLATION ADJACENT BOUNDARY LINE
(SCALE 1:50)



SECTION 4 - 4
(SCALE 1:25)

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44 FROGNAL LANE
HAMPSTEAD,
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SECTION 4 _ 4 SHOWING TEMPORARY/PERMANENT SUPPORT WORKS

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Project No.	Drg No.	Rev.
8600	SK06	A

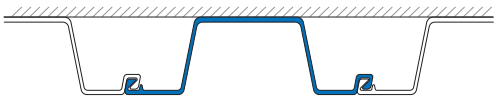
APPENDIX D

GIKEN SILENT U PILER UP150 SHEET PILING RIG

Construction Revolution Guide Vol. 3

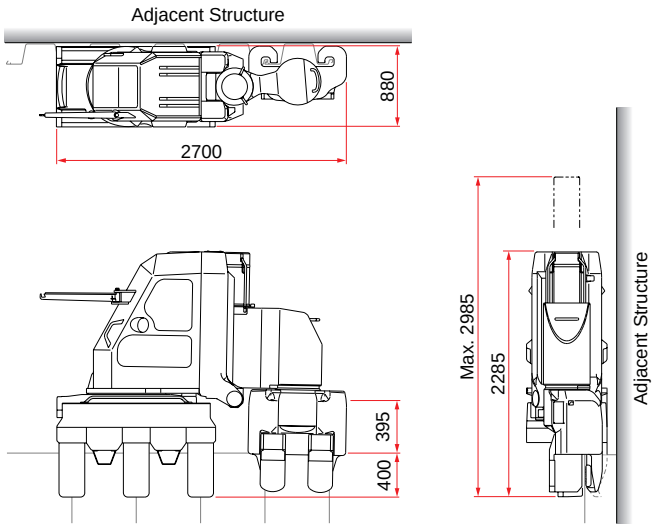
Machine Specifications

ZERO PILER JZ100

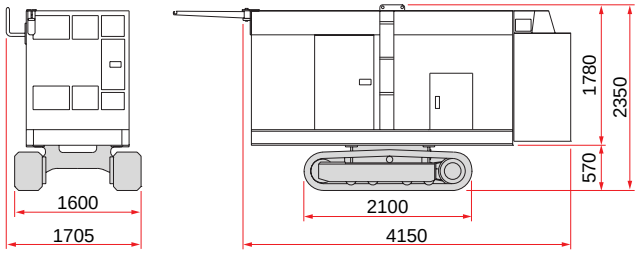


Zero Steel Sheet Pile **SM-J Profile**

Silent Piler

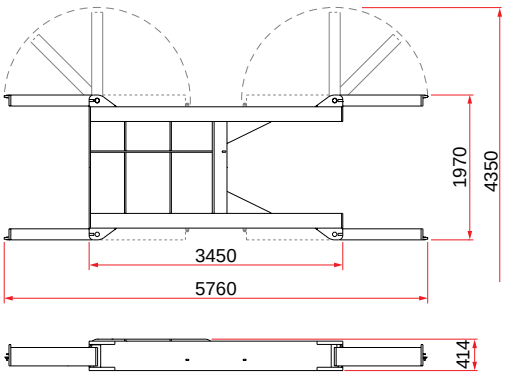


Power Pack



Crawler is optional.

Reaction Stand



SILENT PILER	
Sheet Pile Range	Zero Pile (SM-J Profile)
Max. Installation Force	1 000 kN
Max. Extraction Force	1 400 kN
Stroke	700 mm
Pressing-in Speed	1.5 - 35.2 m/min
Drawing-out Speed	1.1 - 26.0 m/min
Operation	Radio Control
Movement	Self-moving
Weight	7 700 kg
Power Pack	
Engine Unit Type	EU 200
Power Source	Diesel Engine
Rated Output	147 kW (200 PS)
Fuel Tank	350 L
Hydraulic Oil	550 L
Noise Level at 7m	69 dB (A)
Weight	4 900 kg
Crawler Type	GT1 (Optional)
Crawler Operation	Remote Control
Power Source	2 Pumps x 2 Motors
Moving Speed	1.4 km/h
Weight	1 000 kg
Total Weight	5 900 kg
Reaction Stand	
Weight	1 630 kg

* Specifications are subject to alteration without prior notice.

For further information on **The Giken Silent Piler**, please consult your nearest Giken office ;

U. S. A	Giken America Corporation	Tel. +1-407-380-3232	Fax +1-407-380-9411
The Netherlands	Giken Europe B.V. Head Office	Tel. +31-(0)36-532-8128	Fax +31-(0)36-532-7477
U. K.	Giken Europe B.V. London Office	Tel. +44-(0)20-8461-6620	Fax +44-(0)20-8461-6621
Germany	Giken Europe B.V. Berlin Office	Tel. +49-(0)30-4702-3380	Fax +49-(0)30-4702-3382
Singapore	Giken Seisakusho Asia Pte., Ltd.	Tel. +65-863-0330	Fax +65-863-1141
Japan	Giken Seisakusho Co., Ltd.	Tel. +81-(0)3-3528-1630	Fax +81-(0)3-3527-6055

APPENDIX E

RISK MANAGEMENT GEOTECHNICAL GROUND INVESTIGATION
REPORT REF RML 5349 DATED DECEMBER 2013

Unit 8, Paddock Barn Farm
Godstone Road, Caterham,
Surrey CR3 6SF
Tel: 01883 343572
Fax: 01883 344060
email: enquiries@riskmanagementltd.co.uk
Web: www.riskmanagementltd.co.uk

PROJECT No. RML 5349

PHASE I & PHASE II
SITE INVESTIGATION AT

44 FROGNAL LANE, HAMPSTEAD

ON BEHALF OF
Mrs. REBECCA McCOLL

CONTENTS

APPENDICES

1.0 INTRODUCTION & SCOPE OF WORKS

1.1 This report has been prepared by Risk Management Limited to the instructions of Charlton Brown Architects, on behalf of the Client Mrs. Rebecca McColl, under cover of their letter dated 11th November 2013.

1.2 The Consulting Engineers for the project were Messrs. Taylor Whalley Spyra.

1.3 The site under consideration was No. 44 Frognal Lane, Hampstead, London NW3 6PP.

1.4 The approximate six-figure grid reference for the site is 526060 E, 185470 N.

1.5 It is understood that the proposed development at this site will comprise a single-storey basement beneath the existing property.

1.6 Risk Management Limited have now been commissioned to carry out an investigation into the site comprising both a Phase I, *Non-Intrusive,* Desk Study and a Phase II, *Intrusive*, Site Investigation.

1.7 The Desk Study comprises a Walkover Survey, an Environmental Disclosure Report, and a Historical Map Search.

1.8 It should be noted that the current Desk Study is designed for geo-environmental purposes only and does not include Structural Surveys, Buried Services Surveys, Asbestos Surveys, Unexploded Ordnance Surveys or Invasive Plant Surveys for Japanese Knotweed, Giant Hogweed etc.

1.9 The *Intrusive* site investigation provides information on the sub-soil conditions at this site, together with laboratory testing and includes a land-borne gas monitoring survey and an assessment of the permeability of the underlying ground for soakaway purposes.

1.10 This report presents the work carried out and discusses the findings.

2.0 WALKOVER SURVEY

2.1 A Walkover Survey was carried out across the site on 26th November 2013.

2.2 The property lies in a largely residential area of Hampstead and is accessed via a tarmac access road from Frognal Lane. The house was two-storey but included accommodation at loft level. The front of the property is on the western side of the house with a large paved parking area. To the south of the property was a large lawn with numerous shrubs and trees mainly around the boundary to the property.

2.3 A brick built double garage was located to the north-west of the property and a large brick-built extension to the north-east. A further lawned area with landscaping and low walls was located in the northern part of the property, together with an old kennel and composting area in evidence. A double metal gate gave access directly from Frognal Lane along the northern boundary wall into a brick paved area.

2.4 The site was relatively level as was the immediate surrounding area. Further to the west the topography of the area began to slope down.

2.5 The northern boundary to the current site was formed by a brick wall, including the metal double gates, with Frognal Lane beyond and further residential properties to the north of that.

2.6 The eastern boundary to the current site was formed by a brick wall and hedges with rear gardens to properties along Frognal beyond and further residential properties to the east of that, including University College School further to the south-east.

2.7 The southern boundary to the current site was formed by a brick wall with residential properties beyond.

2.8 The western boundary to the current site was formed by a brick wall including a pedestrian and vehicular entrance to the main frontage of the house, and the tarmac access road beyond. Beyond the access road were further residential properties.

2.9 Plates 1 and 2, appended, show general photographs of the site taken at the time of the current Walkover Survey.

3.0 PHASE 1 ENVIRONMENTAL RISK ASSESSMENT

3.1 An EnviroCheck Report was commissioned for the current site covering an area of up to 1000m from the centre of the site.

3.2 Only criteria within 250m of the centre of the site are discussed in detail below but full results of all the search criteria up to 1000m from the centre of the site are summarised within the relevant pages of the appended EnviroCheck Report.

Geo-Environmental Hazards

3.3 The following table summarises the potential geo-environmental hazards and mitigation measures for this site.

Data Type	Hazard	Mitigation Measures for currently proposed development
Local Authority Pollution Prevention and Controls	The nearest Local Authority Pollution Prevention and Control is noted to be some 385m north-east of the current site.	None required.
Landfill & Waste Management Facilities	No Landfills or Waste Management Facilities are noted within the 0-500m search band.	None required.
Hazardous Substances	No hazardous substance usages are noted within the 0-1000m search band.	None required.
Coal Mining	The site lies in an area which would not normally be affected by coal mining activity.	None required.
Collapsible Ground Stability	"Very Low Hazard"	None required.
Compressible Ground Stability	"No Hazard"	None required.
Ground Dissolution	"No Hazard"	None required.
Landslide Stability	"Very Low Hazard"	None required.
Running Sand	"Very Low Hazard"	None required.
Swelling/Shrinking	"Moderate Hazard"	None required.
Radon	The site does not fall within shaded sections of Annexe A of BRE Report 211 (2007) "Radon: guidance on protective measures for new dwellings". Therefore, ***No Radon Protective Measures will be necessary in the construction of new buildings at this location***	None required.
Contemporary Trade Directory Entries	One Contemporary Trade Directory Entry is noted within the 0-250m search band. This relates to a rubbish clearance company on Redington Road, some 233m north-west of the current site.	None required.
Fuel Station Entries	No Fuel Stations are noted within the 0-500m search band.	None required.
Sensitive Land Use	No Sensitive Land Uses are noted within 1000m of the current site.	None required.

Hydrology and Hydrogeology

3.4 The following table summarises the potential **Hydrology and Hydrogeology** aspects for this site.

Data Type	Hazard	Mitigation Measures for currently proposed development
Discharge Consents	The nearest Discharge Consent to the current site is located some 612m north of the current site.	None required.
Nearest Surface Water Feature	No significant water surface features are noted within 1000m of the current property.	None required.
Water Abstractions	The nearest prosecution Water Abstraction is noted as being some 1377m south-east of the current site.	None required.
Groundwater Vulnerability	The appended Groundwater Vulnerability Map indicates the site is noted to lie over a 'Minor Aquifer'.	Contamination testing will be undertaken as part of the current Phase II *intrusive* site investigation.
Bedrock Aquifer Designations	The Bedrock Aquifer Designation is given as: 'Secondary Aquifer - A'	
Superficial Aquifer Designations	The Superficial Aquifer Designation is given as: 'No Data Available'.	
Source Protection Zones	The appended Environment Agency Groundwater Map indicates that the site does not fall over an Environment Agency Source Protection Zone.	
Flood Risk	The appended Environment Agency Groundwater Map indicates that the site does not fall within an Environment Agency Indicative Flood Plain.	None required.

4.0 HISTORICAL MAPS

4.1 The following ten historical plans covering the site are discussed below.

4.1.1 1871-1879 (1:2,500)

The current site falls within the 1879 portion of this plan which already shows the current site boundaries and the current house, although smaller than at the current date. The forerunner to Frognal Lane (End Lane) is already in place as is the access track, immediately to the west of the current property.

The surrounding area has a few largely residential properties shown at this time, including Frognal Hall to the north-east, with the remainder largely fields, particularly to the south and west.

4.1.2 1896 (1:2,500)

Some seventeen years later and this plan shows little change to the current site. Further residential properties have now been built around the current site as the area of Hampstead has expanded.

4.1.3 1915 (1:2,500)

Some nineteen years later, and during the first world-war, and the current property has been extended to the north with the small outbuilding also now shown along the eastern boundary.

Further residential properties have been built around the site and Frognal Lane is now named as such.

4.1.4 1934-1935 (1:2,500)

The current site falls within the 1934 portion of this plan, shortly before the start of the second world-war. This plan shows some further extensions to the current property which now appears in outline as found during the current Walkover Survey. The small garage is also shown on the western boundary.

The surrounding area has continued to expand with largely residential properties.

4.1.5 1954 (1:1,250)

Some twenty years later and little change is shown to the current site or immediate surrounding area.

4.1.6 1966-1971 (1:1,250)

The current site falls within the 1970 portion of this plan, some sixteen years later, and no significant changes have occurred on the current site.

4.1.7 1962-1979 (1:1,250)

The current site falls within the 1979 portion of this plan, some nine years later, and no significant changes are shown to the current site or immediate surrounding area.

4.1.8 1991 (1:2,500)

Some twelve years later and this plan again shows that little change has occurred to the site or immediate surrounding area.

4.1.9 2006 (1:10,000)

Some thirteen years later and this plan again indicates no significant change to the current site or immediate surrounding area.

4.1.10 2013 (1:10,000)

The plan of the current date shows once again that the site and its immediate surroundings are relatively unchanged with the current site boundaries as found during the current Walkover Survey.

5.0 FIELDWORK

5.1 All fieldwork was generally executed in accordance with the recommendations given in British Standard BS 5930:1999, "Code of Practice for Site Investigations", contamination sampling was undertaken in accordance with BS 10175 : 2011, "Code of Practice for the Investigation of Potentially Contaminated Sites".

5.2 Borehole locations were chosen by the Consulting Engineer and are shown on the appended Sketch Fieldwork Location Plan, Drawing No. RML 5349/1.

5.3 Fieldwork was undertaken on the 25th and 26th November 2013 and comprised the following.

Boreholes

5.4 Two percussion boreholes (BH1 & BH2), both to a depth of 12.00m below existing ground level, and one drive-in-sampler borehole (BH3) to a depth of 10.00m below existing ground level, have been carried out at this site.

5.5 The drilling rig used for boreholes BH1 & BH2 at this site was a Geo-Tool tracked drive-in-sampler rig which includes a 98mm diameter casing system driven into the ground with a series of 1 metre long metal tubes, varying in diameter from 80mm down to 35mm, driven through the casing to obtain disturbed samples at regular depth intervals.

5.6 1 metre long, relatively undisturbed, plastic liner samples were taken at 1 metre intervals down boreholes BH1 and BH2.

5.7 The Dynamic Probe employed within boreholes BH1 & BH2 comprises a weight of 63.6 kg dropping through a free-fall height of 762mm in accordance with British Standard BS 1377 : Part 9. The weight drives a 50mm diameter "split-spoon" sampler into the ground. The resistance to penetration is recorded for 6 consecutive 75mm increments with the SPT 'N' value calculated from an addition of the final four 4 readings.

5.8 Standard Penetration Tests (SPT's) were carried out at regular intervals within all the boreholes in order to provide information on the consistency of the material encountered.

5.9 Borehole BH3 was drilled using a drive-in-sampler comprising a series of 1 and 2 metre long metal tubes, varying in diameter from 80 mm down to 35 mm, driven into the ground using a mini-hydraulic breaker unit. The tubes are subsequently jacked out of the ground and side windows enable the tubes to be cleaned and small, disturbed, samples to be taken at regular intervals within each stratum.

5.10 The SPT's for borehole BH3 were interpolated from a Dynamic Probe test undertaken adjacent to the borehole and are presented on the borehole record sheet.

5.11 Upon completion of each borehole, a combined groundwater/gas monitoring standpipe was installed to a depth of 7.00m below existing ground level in boreholes BH1 & BH2 and 6.00m below existing ground level in borehole BH3.

5.12 The gas monitoring installations each comprised a 1 metre length of plain 19mm or 50mm diameter HDPE pipe followed by slotted geotextile wrapped HDPE pipe, capped at the base. A cement/bentonite seal was installed from 1.00m to ground level and each installation was finished with a gas valve on top of the pipe and a lockable stopcock cover concreted in flush with ground level.

5.13 Full details of all three borehole findings are given on the appended borehole record sheets and in-situ test results are given on the appended SPT versus Depth Profile.

Hand Excavated Trial Pits

5.14 Two trial pits (TP2 & TP3) were hand excavated against the side of the existing property as discussed below. The original location for trial pit TP1 was in an area along the side of the property where a drain ran parallel and close to the building. This trial pit was not excavated.

5.15 Full details of the trial pit sections, including photographs, are appended as Figures 1-4 as both trial pits had two sections as indicated on the appended Sketch Fieldwork Location Plan, Drawing No. RML 5349/1.

5.16 Trial Pit TP2, Section A, found the brick wall extended down some 660mm onto a concrete strip which extended out at least 550mm from the property.

5.17 Trial Pit TP2, Section B, found the brick wall again extended down some 660mm with three brick steps projecting out some 160mm onto a concrete strip which extended out at least 550mm from the property.

5.18 Trial Pit TP3, Section A, found the brick wall extended down some 720mm with two brick steps projecting out some 100mm onto a concrete strip which extended out 240mm from the property and founded at greater than 1.22m depth.

5.19 Trial Pit TP3, Section B, found the brick wall extended down some 740mm with three brick steps projecting out some 190mm onto a concrete strip which founded at greater than 1.20m depth.

Landfill Gas Monitoring

5.20 Following the initial site work, two return gas/groundwater monitoring visits were undertaken to the installations fitted within boreholes BH1, BH2 and BH3 on 2nd and 13th December 2013.

5.21 A third visit is to be scheduled for late January 2014 and the results from this will be given under separate cover.

5.22 The barometric pressure was recorded together with the level of Carbon Dioxide, Oxygen and Methane within the boreholes. In addition, gas flow measurements were taken and the depth to groundwater recorded.

5.23 Full details of the readings are included on the appended Gas/Groundwater Monitoring Record Sheet.

6.0 GROUND CONDITIONS

6.1 According to information published by the British Geological Survey (1:50,000 Series Sheet 256) North London the underlying geology at this site is shown as being London Clay of the Eocene Period. Claygate Beds are shown on or just to the north of the current site.

6.2 It is thought that the London Clay formation was deposited during a period of sea inundation in the area up to 200m in depth. The London Clay can be up to 150m thick beneath south Essex thinning across London to about 90m near Reading. The formation consists of mainly dark blue to brown grey clay containing variable amounts of fine-grained sand and silt. London Clay generally weathers to an orange-brown colour with pockets of silty fine sand. The formation is particularly susceptible to swelling and shrinking when subjected to moisture content changes. In addition, gypsum (selenite) crystals and pyrite nodules are commonly found throughout the formation.

6.3 Full details of the ground conditions encountered are presented on the borehole records appended to this report and can be summarised on the table below:

Depth From (m)	Depth To (m)	Description
0.00	0.10/0.20	Topsoil, Paving or Concrete
0.10/0.20	0.80/1.80	MADE GROUND
0.80/1.80	6.60/7.90	Weathered London Clay
6.60/7.90	12.00 +	London Clay

6.4 Groundwater was noted as seepages within the MADE GROUND at 0.80m depth in borehole BH2 and within the underlying Weathered London Clay at 4.90m depth in borehole BH3.

6.5 Roots were noted in the three boreholes up to at least 1.80m depth across the site.

7.0 LABORATORY TESTING

7.1 The following geotechnical and contamination tests have been carried out on samples recovered from the boreholes at this site.

7.2 Unless otherwise stated, the geotechnical tests have generally been carried out in accordance with the recommendations given in British Standard 1377:1990, "Methods of Test for Soils for Civil Engineering Purposes".

7.3 The chemical testing was carried out in accordance with standard industry methods in a UKAS approved laboratory which is also currently accredited in accordance with MCERTS for the majority of its testing. Further information regarding this accreditation is available on request together with a full list of test methods if required.

7.4 *Natural Moisture Content Tests*

The natural moisture contents have been determined for a total of nine samples and ranged between 16% and 31%.

7.5 *Atterberg Limits*

The Atterberg Limits have been determined for two samples of the more cohesive element to the superficial MADE GROUND and one sample of the underlying Weathered London Clay at this site.

Liquid limits (LL) ranged between 47% and 58%, the plastic limit (PL) between 14% and 18% and the plasticity index (PI) between 29% and 43%.

These results indicate that the samples tested would be classified as clay of 'intermediate' to 'high' plasticity (CI/CH) in accordance with the Casagrande geotechnical classification system.

In addition, the more cohesive element to the MADE GROUND would be classified as having a 'medium' shrinkage potential in accordance with the National House Building Councils (NHBC) classification system given in Part 4 of their Standards. The underlying Weathered London Clay would have a 'high' potential for swelling and/or shrinking.

7.6 *Quick Undrained Triaxial Compression Tests.*

The undrained shear strength has been determined in single-stage triaxial compression for seven 38mm diameter samples from the liners, re-moulded where necessary, all from borehole BH2.

The resulting mean shear stress (undrained cohesion) C_u value varied between 94 kN/m^2 and 249 kN/m^2 indicating that the material tested varied from 'stiff' to 'very stiff' in consistency.

The appended Undrained Shear Strength versus Depth profile plots the C_u values against depth at this site.

7.7 *pH and Sulphate Tests*

The pH and sulphate content has been determined for three samples recovered from the boreholes carried out across the site at various depths.

The pH was found to vary between 6.7 and 7.7 and the sulphate content, on a 2:1 water:soil extract, from <0.02 g/l to 2.67 g/l.

7.8 *Chemical Analysis*

Three samples of the superficial MADE GROUND have been selected and tested for a range of commonly occurring contaminants and indicators of contamination including those given by the Contaminated Land Exposure Assessment (CLEA).

The contamination suite undertaken at this site includes speciated **P**oly**A**romatic **H**ydrocarbon (PAH) and speciated **T**otal **P**etroleum **H**ydrocarbon (TPH).

8.0 DISCUSSION

PROPOSED DEVELOPMENT & SCOPE OF WORKS

8.1 As discussed in Section 1 above, it is understood that the proposed development at this site will comprise a single-storey basement beneath the existing property.

8.2 The current report comprises a *Non-Intrusive,* Desk Study and an *Intrusive*, Site Investigation.

DESK STUDY

8.3 The Desk Study has shown that the current property was already partly built in 1879 and was extended over the years up until the present day. The surrounding area was also gradually built up over the years with largely residential development as this area of Hampstead expanded.

8.4 No radon remedial measures would be required at this site. The site lies over a Secondary Bedrock Aquifer but does not lie over an Environment Agency 'source protection zone'. The site does not lie over an Environment Agency indicative flood plain.

8.5 The environmental search has not found any reason to preclude the currently proposed development.

FOUNDATION DESIGN

8.6 The current investigation has found a shallow layer of MADE GROUND across the site, up to 1.80m deep in parts, overlying Weathered London Clay grading to 'fresh' dark grey fissured London Clay at between 6.60m and 7.90m below existing ground level, which was not penetrated at 12.00m below existing ground level.

8.7 From the evidence of the boreholes, shallow foundation or service excavations deeper than about 1 metre may require support against collapse of sides in MADE GROUND in the short term and we would recommend that a contingency is made for this at this stage.

8.8 Groundwater was only noted as seepages at 0.80m depth in the MADE GROUND and at 4.90m depth in the Weathered London Clay during the current work. However, during times of very wet seasonal weather, some groundwater may be expected 'perched' in the MADE GROUND above the underlying Weathered London Clay. Therefore, where seasonal groundwater or surface water accumulates at the base of service or foundation excavations it is very important that these are kept dry by, for example, pumping from a sump, the foundation base is kept square and that any soft spots are replaced and compacted prior to pouring foundation concrete.

8.9 Further, we recommend that where groundwater or surface water flows into foundation excavations, 'blinding' concrete is used at the base of the foundation excavations and that foundation concrete is poured as soon as possible thereafter

8.10 For conventional strip or pad foundations, up to 1.25 metres in width, set at a depth of some 1.00m below existing ground level, an allowable bearing pressure of 125 kN/m^2 could be adopted. For conventional strip or pad footings at 2.00m depth the above noted allowable bearing pressure could be increased to 150 kN/m^2 and at 3.00m depth, 200 kN/m^2.

8.911 Settlement due to the above noted order of loading would not be expected to exceed 20-25mm the majority of which would be "long-term", occurring over a period of some 20-30 years after the construction period.

8.12 The results of the Atterberg Limit tests on the London Clay indicates that this would generally just fall into the 'high' shrinkage potential in accordance with the National House Building Councils (NHBC) classification system given in Part 4 of their Standards. Therefore, precautions against foundation sides in the form of compressible material will be required against foundation sides in the Weathered London Clay at this site where they fall within the 'zone of influence' of any past, existing or any proposed trees.

8.13 It should be noted that should ground conditions differing significantly from those described in our report be encountered during foundation excavation, then Risk Management Limited should be contacted immediately and that the above noted allowable bearing pressure or recommended foundation type may need to be altered accordingly.

BASEMENT

8.14 Assuming that the founding depth is about 3 to 3.5 metres below existing ground level, then, as discussed above, an allowable bearing pressure of 200 kN/m^2 could be adopted for conventional strip or pad footings. However, for a base slab the plan size of the basement, settlements due to a uniformly distributed load of this order would be likely to exceed 75mm. Therefore, to keep settlements to within acceptable limits any uniformly distributed load on the base slab itself should be kept to a maximum of 50 kN/m^2.

8.15 Note that once basement construction has been completed there is always a possibility that this will act as a local "sump" for surface groundwater and run-off. Therefore we would recommend that the basement construction is "tanked" to prevent any future problems with ingress of groundwater.

RETAINING STRUCTURES

8.16 The full design of temporary and permanent retaining structures is beyond the scope of this report. However, the following values are given as a guide to assist in the design of these structures in the London Clay encountered at this site.

Parameter	Value
Bulk Density (γ)	2.00 Mg/m^3
Dry Density (γ_d)	1.50 Mg/m^3
TOTAL STRESS DESIGN (Temporary Works Only)	
Undrained Cohesion (C_u)	90-250 kN/m^2 (see attached profile)
Undrained Angle of Internal Friction (ϕ_u)	0^o
Wall Adhesion – Active (c_w)	= 0.5 * C_u but max 50 kN/m^2
Wall Adhesion – Passive (c_w)	= 0.5 * C_u but max 25 kN/m^2
Rankine Active Earth Pressure Coefficient – (K_a)	1
Rankine Passive Earth Pressure Coefficient – (K_p)	1
EFFECTIVE STRESS DESIGN (Permanent Works)	
Effective Cohesion (c')	1 kN/m^2
Effective Angle of Internal Friction (ϕ')	20^o
Wall Adhesion – Active (c_w)	0 kN/m^2
Wall Adhesion – Passive (c_w)	0 kN/m^2
Wall Friction – Active (δ)	0.66ϕ'
Wall Friction – Passive (δ)	0.50ϕ'
Rankine Active Earth Pressure Coefficient – (K_a)	0.43
Rankine Passive Earth Pressure Coefficient – (K_p)	2.8

PILED FOUNDATIONS

8.17 Piled foundations at this site would need to be bored or driven to support the foundation loads mainly in adhesion within the underlying London Clay.

8.18 Given the nature of the ground conditions encountered, and the proximity to adjacent residential properties, a bored pile solution may be the most appropriate.

8.19 It is beyond our brief to provide a full and detailed pile design and the advice of a specialist piling contractor should be sought in this respect. However, the following table gives typical working loads for isolated bored piles into the London Clay of varying diameter to 10m below existing ground level.

Pile Type	Depth below existing ground level (m)	Diameter (mm)	Working Load (Tonnes)
Bored	10.00	0.30	20-25
Bored	10.00	0.45	35-40
Bored	10.00	0.60	55-60

8.20 In calculating the above working loads we have assumed an adhesion factor of 0.45 in the London Clay and a factor of safety of 2.5 on the sum of the skin friction and end bearing. In addition we have assumed that the top 3 metres of each pile is 'sleeved' to prevent 'heave' forces developing on the shaft.

8.21 Again, it is recommend that the advice of competent piling contractors is sought as to the most suitable pile type at this site and for confirmation of the order of working load achievable given the ground conditions encountered and the proprietary pile type selected.

8.22 Settlements of such piles can be expected to be small, typically less than 5-10mm.

BURIED CONCRETE

8.23 The results of the chemical tests at this site indicate that the soil would fall into Classes DS-1 and DS-3 of the Building Research Establishments (BRE) classification system.

8.24 The high levels are attributable to the presence of selenite crystals within the London Clay, and we would recommend that minimum Class DS-3 conditions are adopted for all foundation and pile concrete mix design in accordance with Building Research Establishments (BRE) classification system Special Digest Part 1:2005 "Concrete in aggressive ground". Sulphate resisting cement may therefore be required in pile concrete mix design.

LANDFILL GAS

8.25 During the return gas/groundwater monitoring visits, no methane and carbon dioxide levels up to 0.5% were found.

8.26 CIRIA Publication C665 "Assessing Risks posed by Hazardous Ground gases to Buildings (Revised 2007) includes the NHBC "Traffic Light" system.

8.27 The carbon dioxide level was below 5% and, in addition, no flow was registered. Therefore, in accordance with the NHBC "Traffic Light" system we would consider that the current site would be classified as GREEN and, therefore, no land borne gas remedial measures would be required at this site.

PRELIMINARY CONTAMINATION ASSESSMENT

8.28 Part IIA of the Environmental Protection Act 1990 contains the legislative framework for the regulation of contaminated land and this was implemented in the Contaminated Land (England) Regulations 2000. This legislation allows for the identification and remediation of land where contamination is causing unacceptable risks to human health or the wider environment. The approach adopted by the UK contaminated land policy is "suitable for use" which implies that the land should be suitable for its current use and made suitable for any known future use.

8.29 For this ***Preliminary Contamination Assessment*** the site has been modelled using the Source-Pathway-Receptor approach to produce a Conceptual Site Model.

Source	(substances or potential contaminants which may cause harm)
Pathway	(a linkage route between the source and receptor)
Receptor	(something which may be harmed by the source e.g. humans, plant, groundwater etc.)

8.30 Source

Three samples of the superficial MADE GROUND were selected and tested for a range of commonly occurring contaminants and indicators of contamination including those given by the Contaminated Land Exposure Assessment (CLEA).

The contamination suite undertaken at this site includes speciated **P**oly**A**romatic **H**ydrocarbon (PAH) and speciated **T**otal **P**etroleum **H**ydrocarbon (TPH).

8.31 Pathways

The pathways needing to be considered, as discussed above, will depend on the land usage, and will include for, example; soil ingestion, inhalation of vapour and dust, and consumption of home-grown vegetables, where this is applicable.

8.32 Receptors

From the results of the Desk Study and the intended end site use the following potential receptors have been identified.

- Workers on the site likely to come into contact with the soils.
- Future Users of garden areas.
- Any proposed additional vegetation.
- Neighbours.

8.33 It should be noted that the CLEA software has limited functionality and contains algorithms, which the EA has publicly expressed its intention to update. As a consequence of this, some of the screening values generated by the CLEA software may not adequately reflect specific site conditions and in some instances are unduly conservative. In addition, it should also be noted that the figures given in the appended table are based on a 6% soil organic matter content.

8.34 The DEFRA/EA model has been developed on the basis of many critical assumptions about possible exposure to soil contamination and the development of conceptual exposure models to describe different land uses as follows:

Residential with plant uptake	Mainly refers to residential gardens in which vegetables are grown.
Residential without plant uptake	Refers to areas which have gardens (e.g. blocks of flats) but without vegetable uptake.
Allotments	Areas allocated for Allotment usage.
Commercial/Industrial	Commercial/industrial usage where there are open areas which are not hard surfaced.

8.35 The Contaminated Land Exposure Assessment (CLEA) model was originally published in March 2002 as joint DEFRA/EA publications; Contaminated Land Research (CLR) Report CLR 10, with Reports CLR7, 8 and 9 as supporting documents, providing toxicity data and human tolerable daily intake (TDI) data to be used with this model. This model enabled the derivation of more site-specific values for contaminants present on a site, rather than the use of 'generic' values, which were previously used.

8.36 DEFRA/EA previously published a number of Soil Guideline Values (SGVs) for certain determinands, (common toxic metals), which were generic guideline criteria for assessing the risks to human health from chronic exposure to soil contamination for standard land-use functions. However, these were withdrawn in late 2008 and DEFRA/EA have now issued a new set of guidance documents. With regard to the Risk Management Limited standard suite of tests, currently SGV figures have only been issued for Arsenic, Cadmium, Mercury, Nickel, Phenols and Selenium.

8.37 In the absence of currently published SGV values for the remaining contaminants, Messrs. W. S. Atkins have derived ATRISK^{soil} Soil Screening Values (SSVs) based on the new 2009 guidance (SC050021/SR3 (the CLEA Report) and SC050021/SR2 (the TOX report)) for commercial/industrial, residential without homegrown produce, residential with homegrown produce and allotment land uses. These have been based on the default assumptions provided in the CLEA report which it is understand will be used in the development of future Soil Guideline Values by DEFRA and the Environment Agency. Atkins SSVs have been derived in line with the new guidance using CLEA model v1.04. As the inhalation of vapour pathway contributes less than ten percent of total exposure, this is unlikely to significantly affect the combined assessment criterion and the SSV values used are the combined assessment criterion given by CLEA if free product is not observed.

8.38 Neither CLEA or ATRISK currently publish values for Hexavalent Chromium. Therefore, both Total Chromium and Hexavalent Chromium values have been compared against the Land Quality Management/Chartered Institute of Environmental Health (LQM/CIEH) Generic Assessment Criteria published in 2009 and based on CLEA v1.04 with Total Chromium values based on Chromium III.

8.39 The SGV and SSV levels represent "intervention" levels above which the levels of contamination may pose an unacceptable risk to the health of site-users such that further investigation and/or remediation is required.

8.40 Total Petroleum Hydrocarbons are considered in accordance with the fractions proposed by The Environment Agency, drawing on the TPHCWG methodology. These are contained in Table 4.2 – Petroleum hydrocarbon fractions for use in UK human health risk assessment, based on Equivalent Carbon (EC) number, contained in Science Report P5-080/TR3, *The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils.*

8.41 At this site the contamination results have been compared against the ***Residential with plant uptake*** criteria.

ASSESSMENT OF RESULTS

8.42 From the samples tested at this site, no determinands exceeded the CLEA Soil Guideline Values (SGV) for ***Residential with plant uptake*** usage.

8.43 The sample from 0.50m depth in borehole BH1 in the rear garden had an elevated level of Lead when compared against the ATRISK Contaminated Land Screening Values (SSV) for ***Residential with plant uptake*** usage.

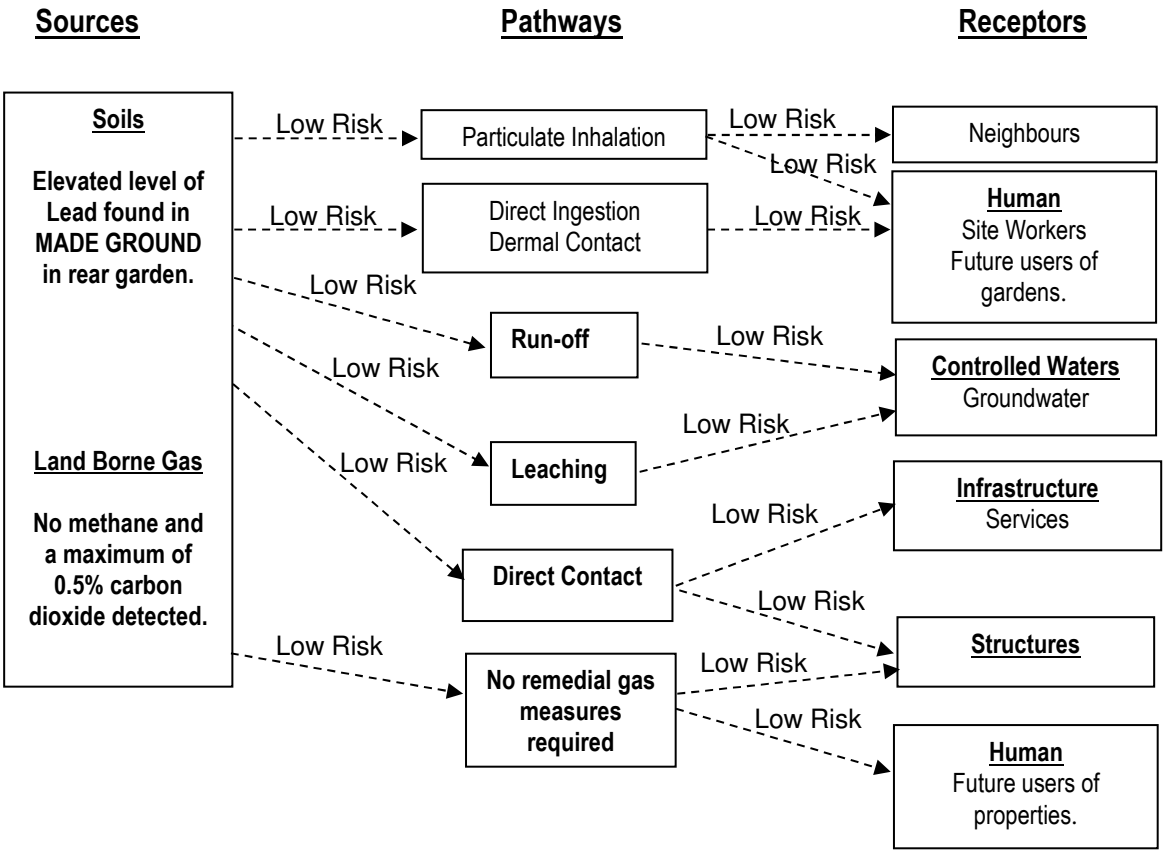
Discussion

Minimal contamination was therefore encountered for the proposed end usage as new basement. The elevated Lead level in the rear garden should be noted but is not considered detrimental to the currently proposed development.

Standard Health and Safety precautions should be taken with regard to ground workers at this site and these should include PPE equipment such as gloves, overalls etc. and normal washing facilities available on-site.

CONCEPTUAL SITE MODEL

8.44 The following diagram summaries the potential pollution linkages identified for this site in the form of a diagrammatic Conceptual Site Model (CSM).



8.45 As always, the above recommendations are based on a selected number of representative samples and further testing may be required if any significant contamination is suspected or encountered during ground works.

SOIL SAMPLES

8.46 All soil samples will be kept for a period of 28 days after the date of the invoice for this project unless otherwise notified to Risk Management Limited in writing. Should samples be required to be stored for longer than 28 days then a storage charge will be levied.

Prepared By : Malcolm S. Price B.Sc., M.Sc., M.I.C.E., C.Eng.
Director

Distribution : Taylor Whalley Spyra - 1 copy + pdf

The recommendations made and the opinions expressed in this report are based on the borehole records, examination of samples and the results of site and laboratory tests.

The report is issued on the condition that Risk Management Limited will under no circumstances be liable for any loss arising directly or indirectly from ground conditions between the boreholes or trial pits which have not been shown by the boreholes, trial pits or other tests carried out during the investigation.

In addition, Risk Management Limited will not be liable for any loss whatsoever arising directly or indirectly from any opinion given on the possible configuration of strata both between the borehole and/or trial pit positions and/or below the maximum depth of the investigation. Such opinions, where given, are for guidance only.

Groundwater levels may also vary with time from those reported during our site investigation due to factors such as tidal conditions, heavy pumping from nearby wells or seasonal changes.

No person other than the client to whom this report is addressed, shall rely on it in any respect and no duty of care shall be owed to any such third party.

Copyright of this Report remains with Risk Management Limited and in addition we will not accept any responsibility for the report and recommendations given until our invoice is settled in full.

BOREHOLE NO. BH1

Site : 44 Frognal Lane, Hampstead
Job No. : RML 5349
Method : Tracked GeoTool Rig
Date : 26th November 2013
Casing : 98mm to 2.00m
Sheet 1 of 2

(m)	Description	Strata Depth (m)	Legend	Ground water	Sample Depth (m)	Sample Type	Test	Remarks
0	Ground Level							
	Grass over TOPSOIL	0.10						
	MADE GROUND (orange-brown and brown silty sandy clay with brick fragments, crushed concrete, gravel and roots).				0.00-1.00	Liner1		
1					1.00		SPT	N = 6
		1.30			1.00-2.00	Liner2		
2					2.00		SPT	N = 17
					2.00-3.00	Liner3		
3					3.00		SPT	N = 17
					3.00-4.00	Liner4		
4	***Weathered London Clay*** Firm to stiff, brown silty CLAY, mottled grey with depth, and with occasional pockets of coarse orange-brown and grey silt, siltstone gravel and selenite crystals.				4.00		SPT	N = 17
					4.00-5.00	Liner5		
5					5.00		SPT	N = 19
					5.00-6.00	Liner6		
6					6.00		SPT	N = 21
					6.00-7.00	Liner7		
7					7.00		SPT	N = 26
		7.50			7.00-8.00	Liner8		
8					8.00		SPT	N = 27
					8.00-9.00	Liner9		
9					9.00		SPT	N = 28
	London Clay Stiff to very stiff, dark grey fissured silty CLAY, with occasional pockets of coarse grey silt, siltstone gravel, pyrites nodules and selenite crystals.				9.00-10.00	Liner10		
10					10.00		SPT	N = 23

Remarks : Groundwater not noted during boring.
: Standpipe installed to 7.00m depth.
:
:

Key: D - Disturbed sample
W - Water sample
B - Bulk sample
SPT Standard Penetration test
CPT- Solid Cone SPT
U - Undisturbed sample

RISK MANAGEMENT LIMITED
Unit 8 Paddock Barn Farm, Godstone Road, Caterham, Surrey CR3 6SF

BOREHOLE NO. BH1

Site	: 44 Frognal Lane, Hampstead	**Job No.**	: RML 5349
Method	: Tracked GeoTool Rig	**Date**	: 26th November 2013
Casing	: 98mm to 2.00m	**Sheet 2 of 2**	

(m)	Description	Strata Depth (m)	Legend	Ground water	Sample Depth (m)	Sample Type	Test	Remarks
11	***London Clay*** Stiff to very stiff, dark grey fissured silty CLAY, with occasional pockets of coarse grey silt, siltstone gravel, pyrites nodules and selenite crystals.				10.00-11.00	Liner11		
					11.00		SPT	N = 25
					11.00-12.00	Liner12		
12	End of Borehole	12.00			12.00		SPT	N = 28
13								
14								
15								
16								
17								
18								
19								
20								

Remarks : Groundwater not noted during boring.
: Standpipe installed to 7.00m depth.
:
:

Key: D - Disturbed sample
W - Water sample
B - Bulk sample
SPT Standard Penetration test
CPT- Solid Cone SPT
U - Undisturbed sample

RISK MANAGEMENT LIMITED
Unit 8 Paddock Barn Farm, Godstone Road, Caterham, Surrey CR3 6SF

BOREHOLE NO. BH2

Site : 44 Frognal Lane, Hampstead
Job No. : RML 5349
Method : Tracked GeoTool Rig
Date : 25th November 2013
Casing : 98mm to 2.00m
Sheet 1 of 2

(m)	Description	Strata Depth (m)	Legend	Ground water	Sample Depth (m)	Sample Type	Test	Remarks
0	Ground Level							
	Paving (80mm yorkstone paving over sand and type 1 gravel)	0.20			0.00-1.00	Liner1		
	MADE GROUND (brown and dark brown sandy clay with gravel and brick fragments)	0.80			1.00		SPT	N = 4
1					1.00-2.00	Liner2		
2					2.00		SPT	N = 9
					2.00-3.00	Liner3		
3					3.00		SPT	N = 10
					3.00-4.00	Liner4		
4	***Weathered London Clay*** Firm to stiff, brown silty CLAY, mottled grey with depth, and with occasional pockets of coarse orange-brown and grey silt, siltstone gravel and selenite crystals.				4.00		SPT	N = 21
					4.00-5.00	Liner5		
5					5.00		SPT	N = 22
					5.00-6.00	Liner6		
6					6.00		SPT	N = 24
					6.00-7.00	Liner7		
7					7.00		SPT	N = 26
					7.00-8.00	Liner8		
8		7.90			8.00		SPT	N = 26
					8.00-9.00	Liner9		
9					9.00		SPT	N = 29
					9.00-10.00	Liner10		
10					10.00		SPT	N = 31

Remarks : Groundwater seepage at 0.80m depth.
: Standpipe installed to 7.00m depth.
:
:

Key: D - Disturbed sample
W - Water sample
B - Bulk sample
SPT Standard Penetration test
CPT- Solid Cone SPT
U - Undisturbed sample

RISK MANAGEMENT LIMITED
Unit 8 Paddock Barn Farm, Godstone Road, Caterham, Surrey CR3 6SF

BOREHOLE NO. BH2

Site : 44 Frognal Lane, Hampstead

Method : Tracked GeoTool Rig

Casing : 98mm to 2.00m

Job No. : RML 5349

Date : 25th November 2013

Sheet 2 of 2

(m)	Description	Strata Depth (m)	Legend	Ground water	Sample Depth (m)	Sample Type	Test	Remarks
11	***London Clay*** Stiff to very stiff, dark grey fissured silty CLAY, with occasional pockets of coarse grey silt, siltstone gravel, pyrites nodules and selenite crystals.				10.00-11.00	Liner11		
					11.00		SPT	N = 34
					11.00-12.00	Liner12		
12	End of Borehole	12.00			12.00		SPT	N = 39
13								
14								
15								
16								
17								
18								
19								
20								

Remarks : Groundwater seepage at 0.80m depth.
: Standpipe installed to 7.00m depth.
:
:

Key: D - Disturbed sample
W - Water sample
B - Bulk sample
SPT Standard Penetration test
CPT- Solid Cone SPT
U - Undisturbed sample

RISK MANAGEMENT LIMITED
Unit 8 Paddock Barn Farm, Godstone Road, Caterham, Surrey CR3 6SF

BOREHOLE NO. BH3

Site : 44 Frognal Lane, Hampstead
Job No. : RML 5349
Method : Drive-in-Sampler
Date : 26th November 2013
Casing : 75mm/40mm
Sheet 1 of 1

(m)	Description	Strata Depth (m)	Legend	Ground water	Sample Depth (m)	Sample Type	Test	Remarks
0	Ground Level							
	Concrete	0.10			0.15	D1		
					0.50	D2		
	MADE GROUND (brown and dark brown silty sandy clay with gravel, brick fragments and roots)				1.00	D3	SPT	N = 3
1					1.50	D4		
		1.80			2.00	D5	SPT	N = 11
2					2.50	D6		
					3.00	D7	SPT	N = 12
3					3.50	D8		
	Weathered London Clay Firm to stiff, brown silty CLAY, mottled grey with depth, and with occasional pockets of coarse orange-brown and grey silt, siltstone gravel and selenite crystals.				4.00	D9	SPT	N = 18
4					4.50	D10		
					5.00	D11	SPT	N = 19
5					5.50	D12		
					6.00	D13	SPT	N = 25
6					6.50	D14		
		6.60			7.00	D15	SPT	N = 22
7					7.50	D16		
	London Clay Stiff to very stiff, dark grey fissured silty CLAY, with occasional pockets of coarse grey silt, siltstone gravel, pyrites nodules and selenite crystals.				8.00	D17	SPT	N = 23
8					8.50	D18		
					9.00	D19	SPT	N = 30
9					9.50	D20		
					10.00	D21	SPT	N = 34
10		10.00						

Remarks : Groundwater seepage at 4.90m depth.
: Standpipe installed to 6.00m depth.
: SPT's inferred from adjacent
: Dynamic Probe

Key: D - Disturbed sample
W - Water sample
B - Bulk sample
SPT Standard Penetration test
CPT- Solid Cone SPT
U - Undisturbed sample

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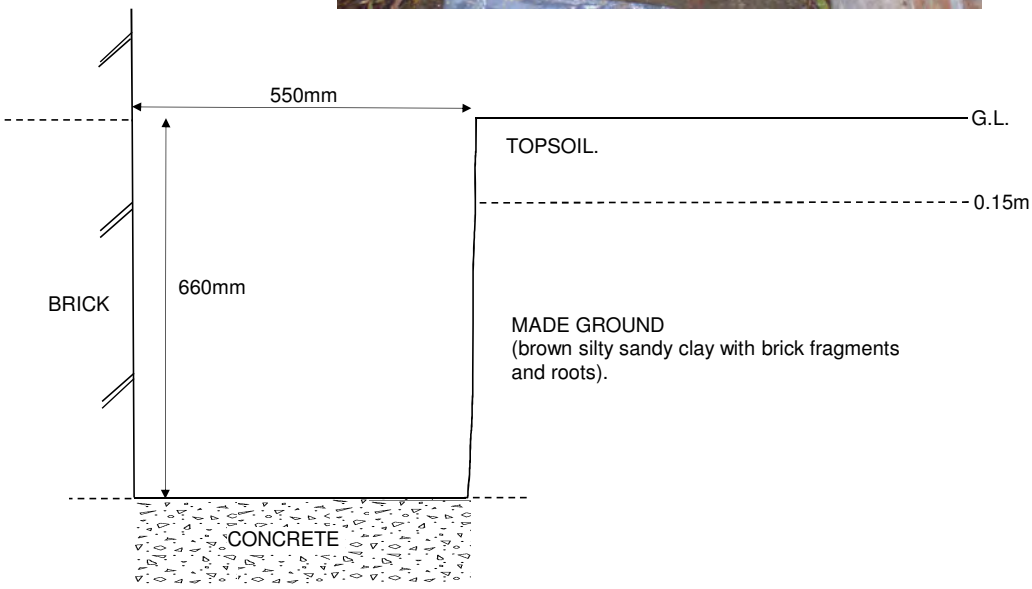
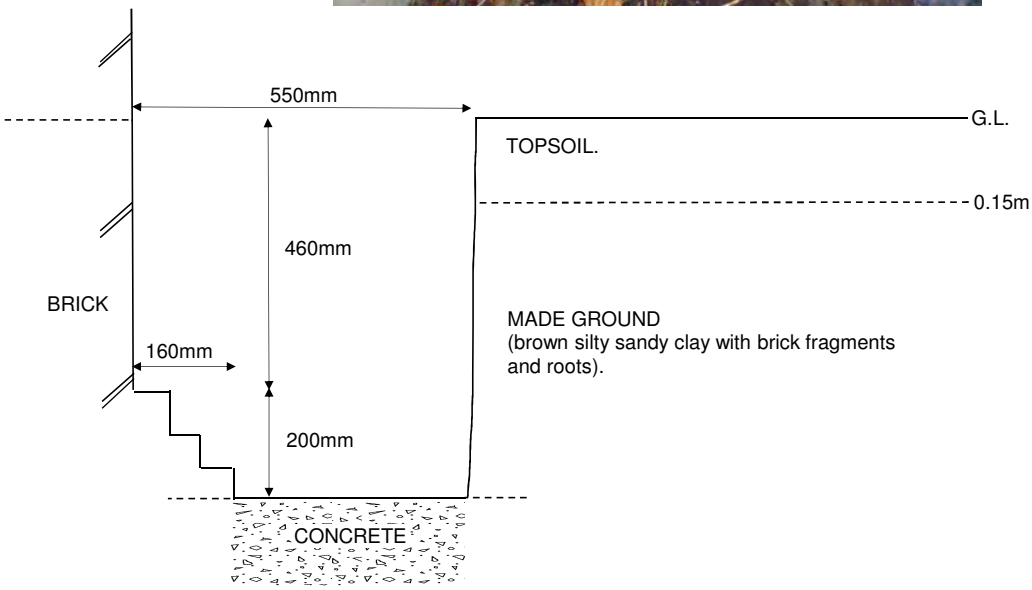
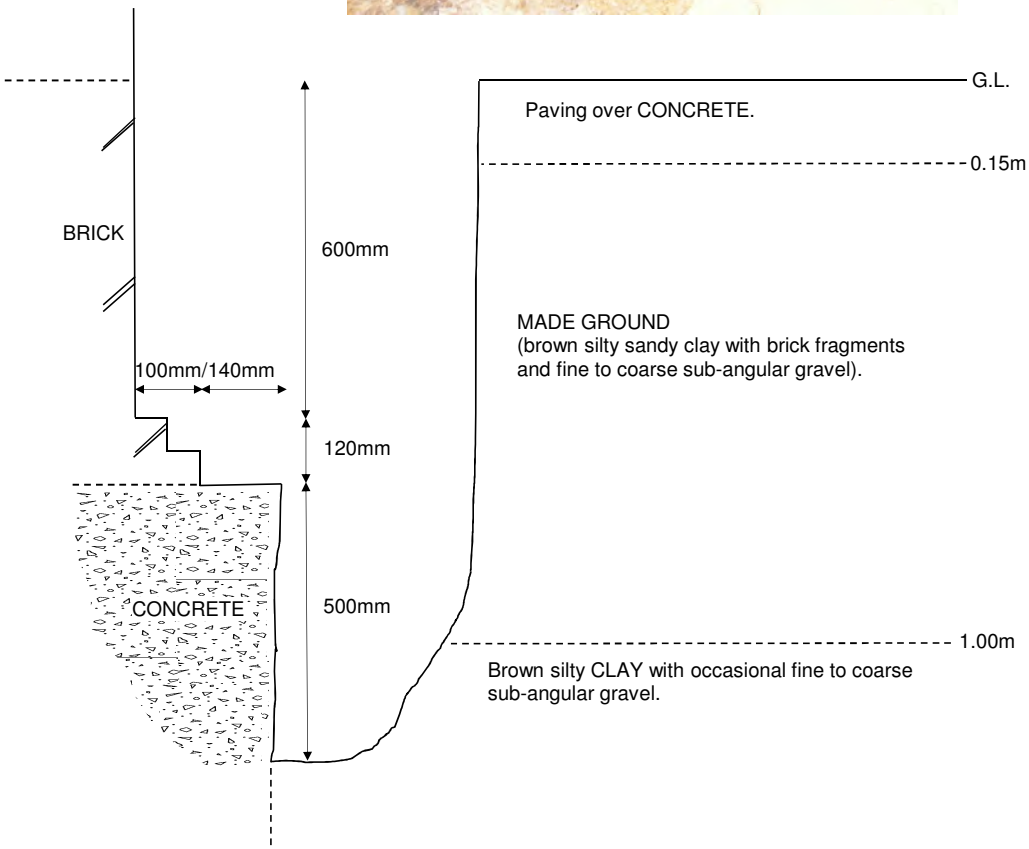
Unit 8 Paddock Barn Farm, Godstone Road, Caterham, Surrey CR3 6SF



Risk Management	Title : **TRIAL PIT 2 Section A**	
	Project Location : 44 Frognal Lane, Hampstead	
RECORD OF HAND EXCAVATED TRIAL PIT	Job No : RML 5349	Scale : Not To Scale
	Figure No. **1**	Date : 26th Nov. 2013



Risk Management	Title : **TRIAL PIT 2 Section B**	
	Project Location : 44 Frognal Lane, Hampstead	
RECORD OF HAND EXCAVATED TRIAL PIT	Job No : RML 5349	Scale : Not To Scale
	Figure No. **2**	Date : 26th Nov. 2013



Risk Management

Title : **TRIAL PIT 3 Section A**

Project Location : 44 Frognal Lane, Hampstead

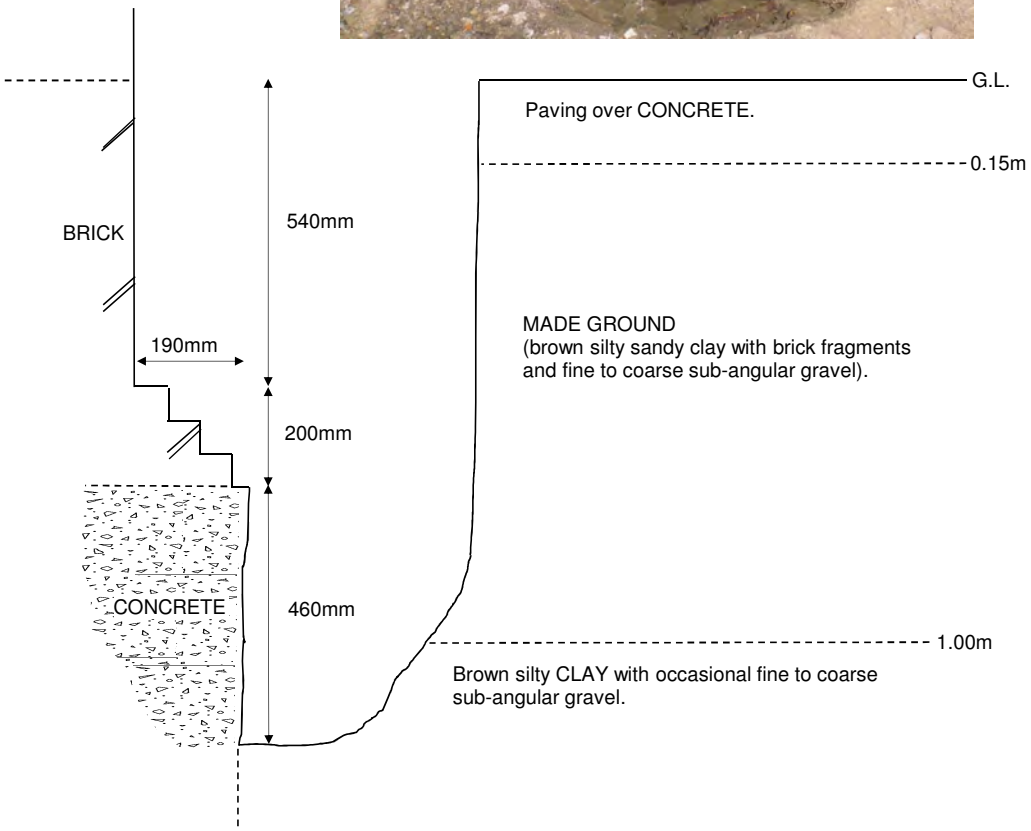
RECORD OF HAND EXCAVATED TRIAL PIT

Job No : RML 5349

Scale : Not To Scale

Figure No. **3**

Date : 26th Nov. 2013



Risk Management

Title : **TRIAL PIT 3 Section B**

Project Location : 44 Frognal Lane, Hampstead

RECORD OF HAND EXCAVATED TRIAL PIT

Job No : RML 5349

Scale : Not To Scale

Figure No. **4**

Date : 26th Nov. 2013

Standard Penetration Test (SPT) versus Depth Profile

Risk Management Limited
Tel : 01883 343572
Fax : 01883 344060

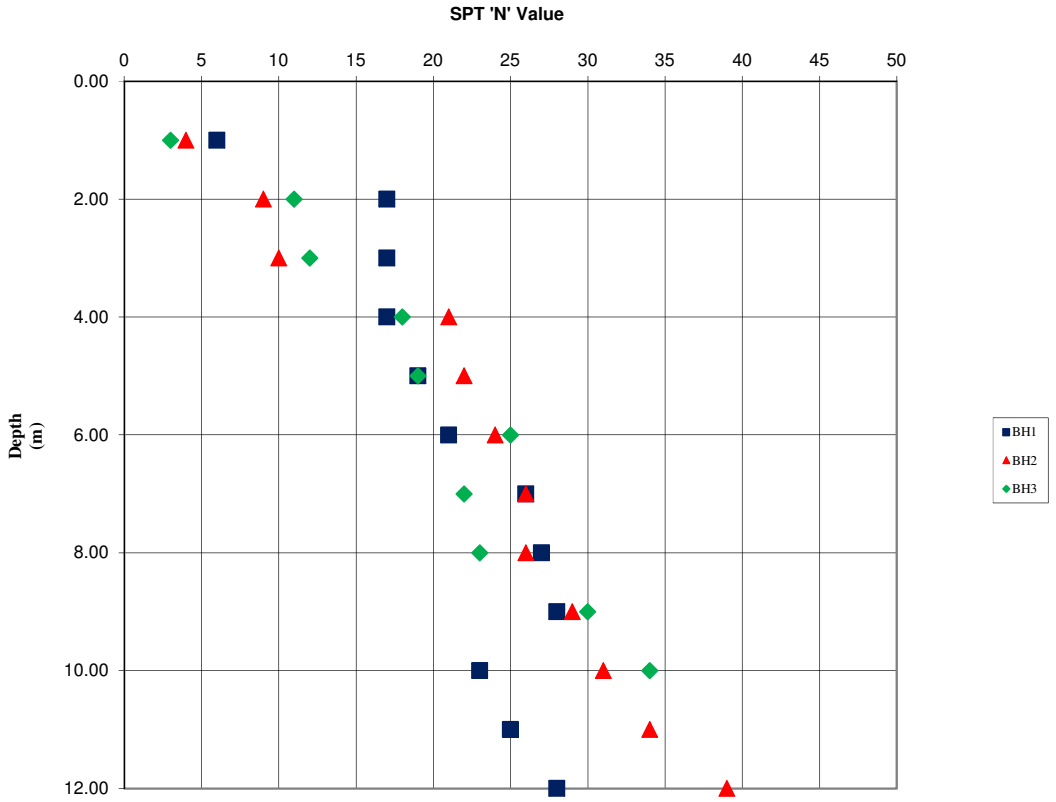
Project Name : 44 Frognal Lane, Hampstead

Job No. : RML 5349

Date : December 2013

BH1		BH2		BH3	
Depth (m)	SPT 'N' value	Depth (m)	SPT 'N' value	Depth (m)	SPT 'N' value
1.00	6	1.00	4	1.00	3
2.00	17	2.00	9	2.00	11
3.00	17	3.00	10	3.00	12
4.00	17	4.00	21	4.00	18
5.00	19	5.00	22	5.00	19
6.00	21	6.00	24	6.00	25
7.00	26	7.00	26	7.00	22
8.00	27	8.00	26	8.00	23
9.00	28	9.00	29	9.00	30
10.00	23	10.00	31	10.00	34
11.00	25	11.00	34		
12.00	28	12.00	39		

NB : SPT 'N' values greater than 50 reported as 50 above



PROJECT NAME : 44 Frognal Lane, Hampstead

PROJECT NO: RML 5349

Date	December 2013
Page	1 of 1

Sample Details				Classification Tests					Density Tests		Undrained Triaxial Compression Tests			Chemical Results				
BH No.	Depth (m)	Sample No.	Description	MC (%)	LL (%)	PL (%)	PI (%)	<425 mic (%)	Bulk (Mg/m^3)	Dry (Mg/m^3)	Cell Pressure kPa	Deviator Stress kPa	Mean Shear Stress kPa	pH	W/S SO_4 (g/l)	Total SO_4 (%)	Water SO_4 (g/l)	Other tests and comments
BH1	1.00	Liner1												6.7	<0.02			
	2.00	Liner 2	MADE GROUND (orange-brown and brown silty sandy clay with brick fragments, crushed concrete and roots)	16	54	14	40	71										Class CH
BH2	1.00	Liner1	Stiff, brown silty CLAY with pockets of orange-brown silt and selenite crystals.	19	58	15	43	100	2.18	1.82	20	187	94					Class CH
	2.00	Liner2	Stiff, brown silty CLAY with pockets of orange-brown silt and selenite crystals.	28					2.05	1.60	40	250	125	7.7	0.17			
	4.00	Liner4	Stiff, brown silty CLAY with pockets of orange-brown and grey silt and selenite crystals.	31					2.01	1.54	80	204	102					
	6.00	Liner6	Stiff, brown silty CLAY with pockets of orange-brown and grey silt, siltstone gravel and selenite crystals.	28					2.04	1.59	120	280	140					
	8.00	Liner8	Very stiff, dark grey, fissured, silty CLAY with pockets of grey silt and selenite crystals.	30					1.99	1.54	160	322	161					
	10.00	Liner10	Very stiff, dark grey, fissured, silty CLAY with pockets of grey silt, pyrites nodules and selenite crystals.	29					2.05	1.59	200	403	202					
	12.00	Liner12	Very stiff, dark grey, fissured, silty CLAY with pockets of grey silt, siltstone gravel and selenite crystals.	29					2.02	1.57	240	497	249					
BH3	1.50	D4	MADE GROUND (brown and dark brown silty sandy clay with gravel and roots)	19	47	18	29	74										Class CI
	5.00	D11												7.3	2.67			

SUMMARY OF GEOTECHNICAL TESTING

Risk Management

Contamination Test Results on Soil Samples

Risk Management

Date : December 2013 | Job No. : RML 5349 | Sheet 1 of 1

Location: 44 Frognal Lane, Hampstead

Borehole No.	Units	BH1	BH2	BH3				ATRISK Contaminated Land Screening Values (SSV) derived using CLEA v1.04 for 6% SOM			
Sample No.		D1	D1	D1							
Depth (m)		0.50	0.50	0.50							
Material Type		MADE GROUND	MADE GROUND	MADE GROUND				Residential with plant uptake	Residential without plant uptake	Allotments	Commercial / Industrial
Aliphatic Hydrocarbons (mg/kg)	>C5-C6	<0.1	<0.1	<0.1				259	261	1100	1100
	>C6-C8	<0.1	<0.1	<0.1				769	769	769	769
	>C8-C10	<0.1	0.3	<0.1				144	144	476	476
	>C10-C12	<0.1	<0.1	<0.1				297	297	297	297
	>C12-C16	<0.1	<0.1	<0.1				126	126	126	126
	>C16-C35	<0.1	<0.1	1.2				145000	146000	462000	>1000000
Aromatic Hydrocarbons (mg/kg)	>C5-C7	<0.01	<0.01	<0.01				0.33	0.998	0.07	95
	>C7-C8	<0.1	<0.1	<0.1				610	2710	120	4360
	>C8-C10	<0.1	<0.1	<0.1				177	233	64.5	3600
	>C10-C12	<0.1	<0.1	<0.1				389	1080	86.4	2190
	>C12-C16	<0.1	<0.1	<0.1				687	2040	160	925
	>C16-C21	0.1	<0.1	<0.1				804	1330	288	28400
	>C21-C35	0.2	<0.1	<0.1				1220	1330	1550	28400
TOTAL TPH		0.3	0.3	1.2							
Naphthalene	mg/kg	<0.5	<0.5	<0.5				8.71	9.22	23.4	22700
Acenaphthylene	mg/kg	<0.5	<0.5	<0.5				-	-	-	-
Acenaphthene	mg/kg	<0.5	<0.5	<0.5				2130	4770	612	106000
Fluorene	mg/kg	<0.5	<0.5	<0.5				1930	3100	725	72100
Phenanthrene	mg/kg	1.59	<0.5	<0.5				-	-	-	-
Anthracene	mg/kg	<0.5	<0.5	<0.5				18300	24000	10400	545000
Fluoranthene	mg/kg	1.71	<0.5	<0.5				2160	3210	924	72700
Pyrene	mg/kg	1.39	<0.5	<0.5				1550	2400	620	54500
Benz(a)anthracene	mg/kg	0.75	<0.5	<0.5				8.54	9.04	15.1	142
Chrysene	mg/kg	1.01	<0.5	<0.5				927	1010	1170	14300
Benzo(b)fluoranthene	mg/kg	0.63	<0.5	<0.5				9.86	10.3	18.6	144
Benzo(k)fluoranthene	mg/kg	0.93	<0.5	<0.5				100	104	227	1440
Benzo(a)pyrene	mg/kg	0.67	<0.5	<0.5				0.998	1.04	2.1	14.4
Indeno(123-cd)pyrene	mg/kg	<0.5	<0.5	<0.5				9.75	10.3	16.6	144
Dibenz(ah)anthracene	mg/kg	<0.5	<0.5	<0.5				1	1.03	2.57	14.4
Benzo(ghi)perylene	mg/kg	<0.5	<0.5	<0.5				103	104	342	1450
TOTAL PAH		8.68	<0.5	<0.5							
Cyanide (Free)	mg/kg	<1	<1	<1				34	34	34	34
pH	unit	6.2	7.2	7.5				-	-	-	-
Copper (Total)	mg/kg	41	26	15				4020	8370	1110	109000
Lead (Total)	mg/kg	447	74	24				322	444	160	6830
Zinc (Total)	mg/kg	119	50	50				17200	46800	3990	917000
								LQM/CIEH Generic Assessment Criteria			
Chromium (Total)	mg/kg	20.2	21.2	29.2				3000	3000	34600	30400
Chromium (Hexavalent)	mg/kg	<2	<2	<2				4.3	4.3	2.1	35
								CLEA Soil Guideline Values (SGV)			
Arsenic (Total)	mg/kg	18.1	14.7	11.8				32	32	43	640
Cadmium (Total)	mg/kg	<0.5	<0.5	<0.5				10	10	1.8	230
Mercury (Total)	mg/kg	1.0	<0.5	<0.5				170	170	80	3600
Nickel (Total)	mg/kg	12.8	15.1	16.2				130	130	230	1800
Phenols (Total)	mg/kg	<1	<1	<1				420	420	280	3200
Selenium (Total)	mg/kg	0.8	0.7	0.6				350	350	120	13000

Key

PAH - Polyaromatic Hydrocarbons
TPH - Total Petroleum Hydrocarbons
- Not determined

Result exceeds ATRISK screening value
Result exceeds EQS/CIEH generic assessment criteria
Result exceeds CLEA Soil Guideline Value (SGV)

Moisture Content	%	12.68	14.93	13.65				-	-	-	-
Stones	%	27.74	26.72	22.27				-	-	-	-

Undrained Shear Strength versus Depth Profile

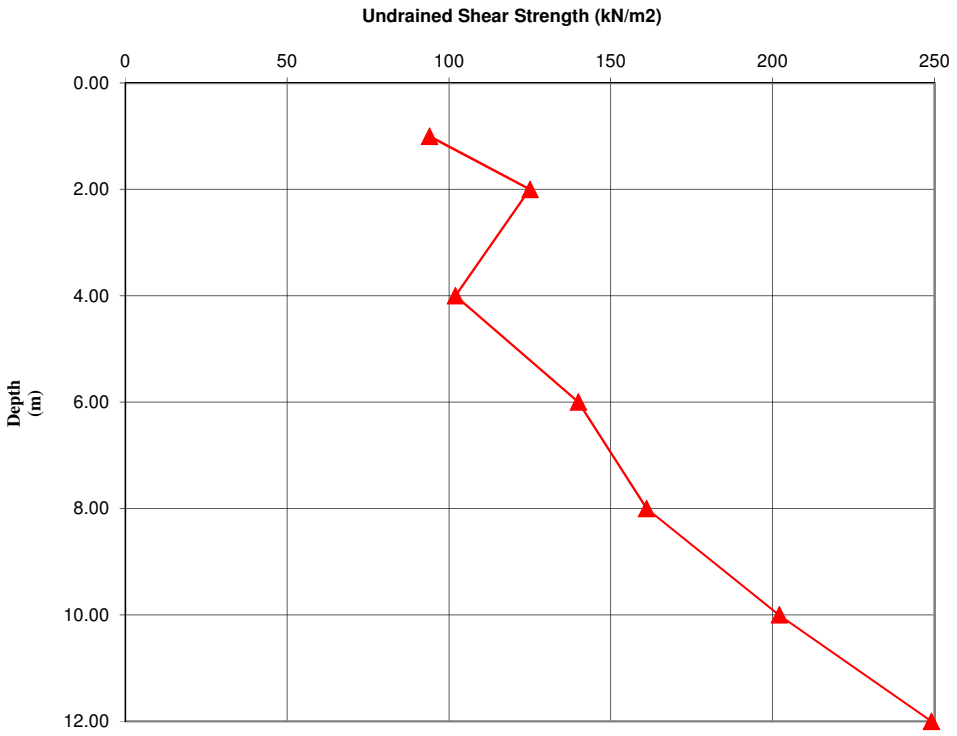
Risk Management Limited
Tel : 01883 343572
Fax : 01883 344060

Project Name : 44 Frognal Lane, Hampstead

Job No. : RML 5349

Date : December 2013

BH2	
Depth (m)	Shear Strength (kN/m^2)
1.00	94
2.00	125
4.00	102
6.00	140
8.00	161
10.00	202
12.00	249

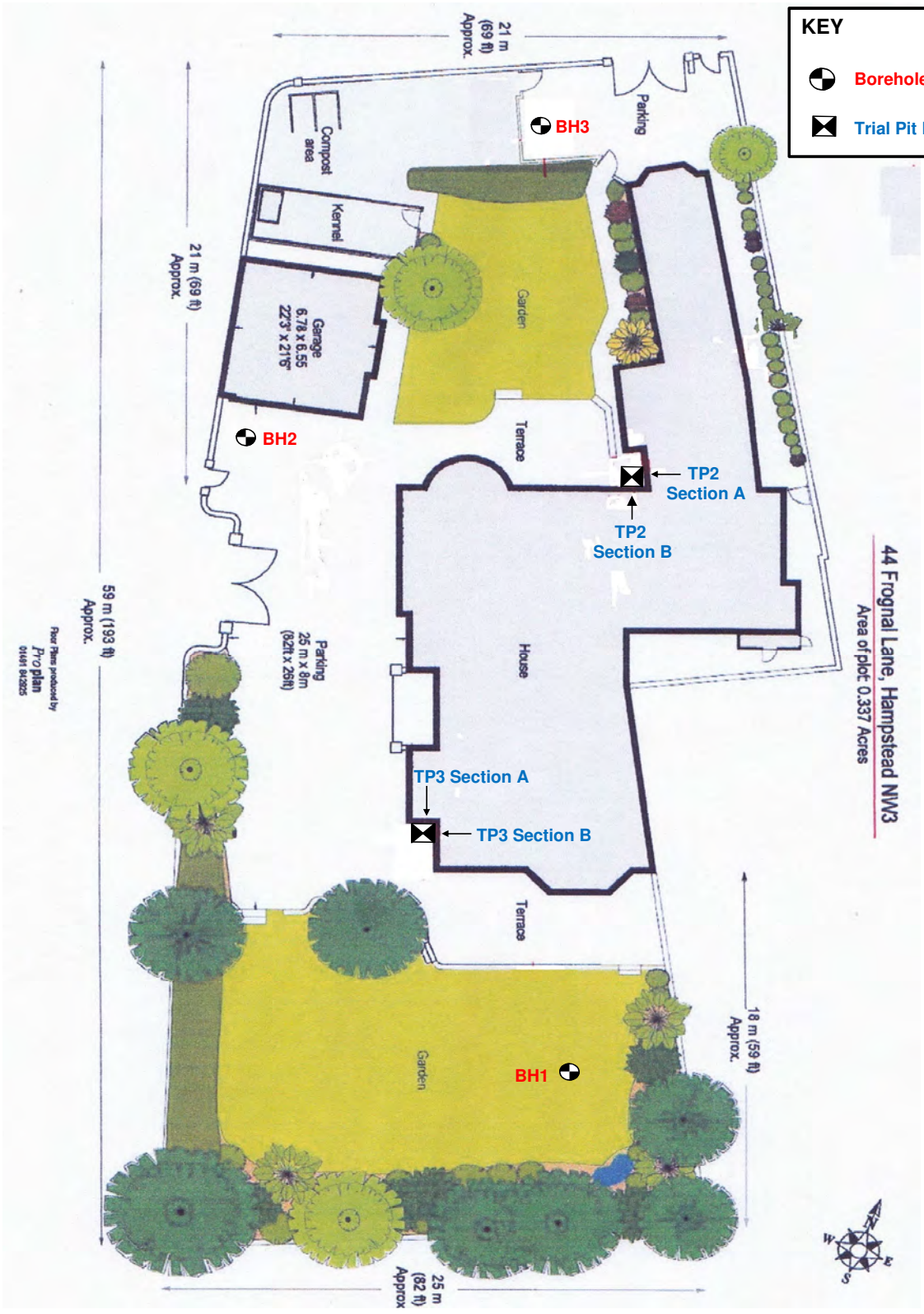


Risk Management Limited
Tel : 01883 343572 Fax : 01883

GROUNDWATER & GAS MONITORING

Project Name:	44 Frognal Lane, Hampstead	Project No. :	RML 5349
		Date :	December 2013

BH No.	Date	Pressure (mb)	Oxygen (%)	Carbon Dioxide (%)	Methane (%)	Methane LEL (%)	Flow Rate (l/hr)	Groundwater Level (m)
BH1	2/12/13	1025	20.4	0.3	0.0	0.0	0	'dry'
	13/12/13	1016	20.5	0.2	0.0	0.0	0	'dry'
BH2	2/12/13	1025	20.0	0.5	0.0	0.0	0	'dry'
	13/12/13	1016	19.9	0.5	0.0	0.0	0	'dry'
BH3	2/12/13	1025	20.2	0.2	0.0	0.0	0	'dry'
	13/12/13	1016	20.3	0.1	0.0	0.0	0	'dry'



Risk Management

Title : **SKETCH FIELDWORK LOCATION PLAN**

RISK MANAGEMENT LIMITED

Tel : 01883 343572
Fax : 01883 344060

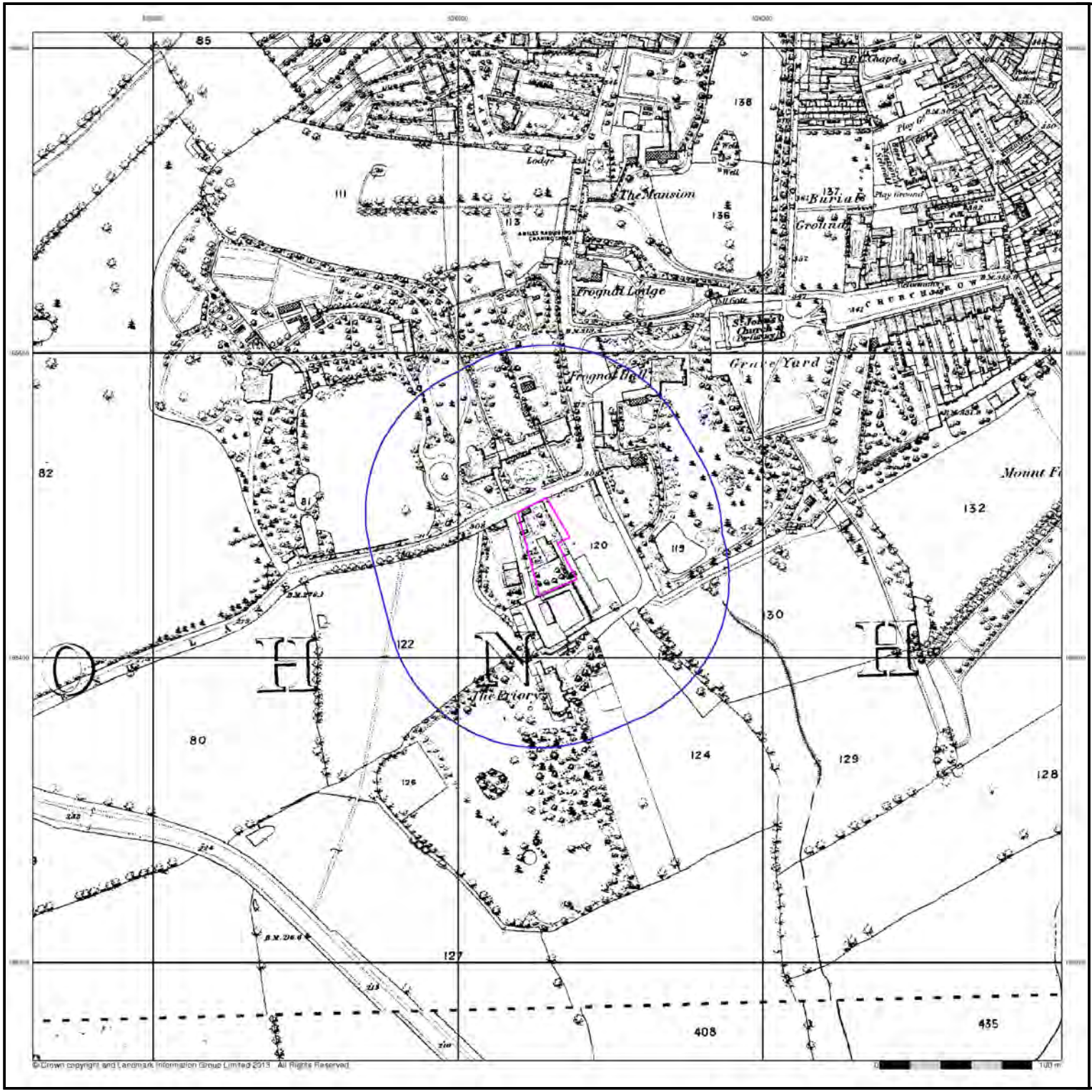
Project Location : 44 Frognal Lane, Hampstead

Report Date : December 2013

Scale : NTS

Drawn By : MSP

Drg. No. RML 5349 /1



Risk Management

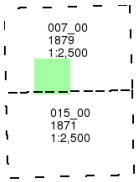
London

Published 1871 - 1879

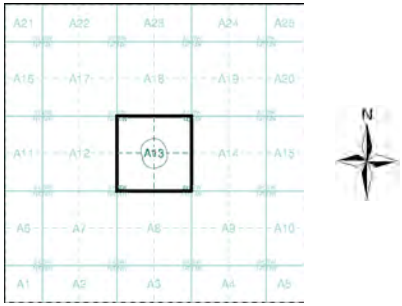
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

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Customer Ref:	RML 5349
National Grid Reference:	526060, 185470
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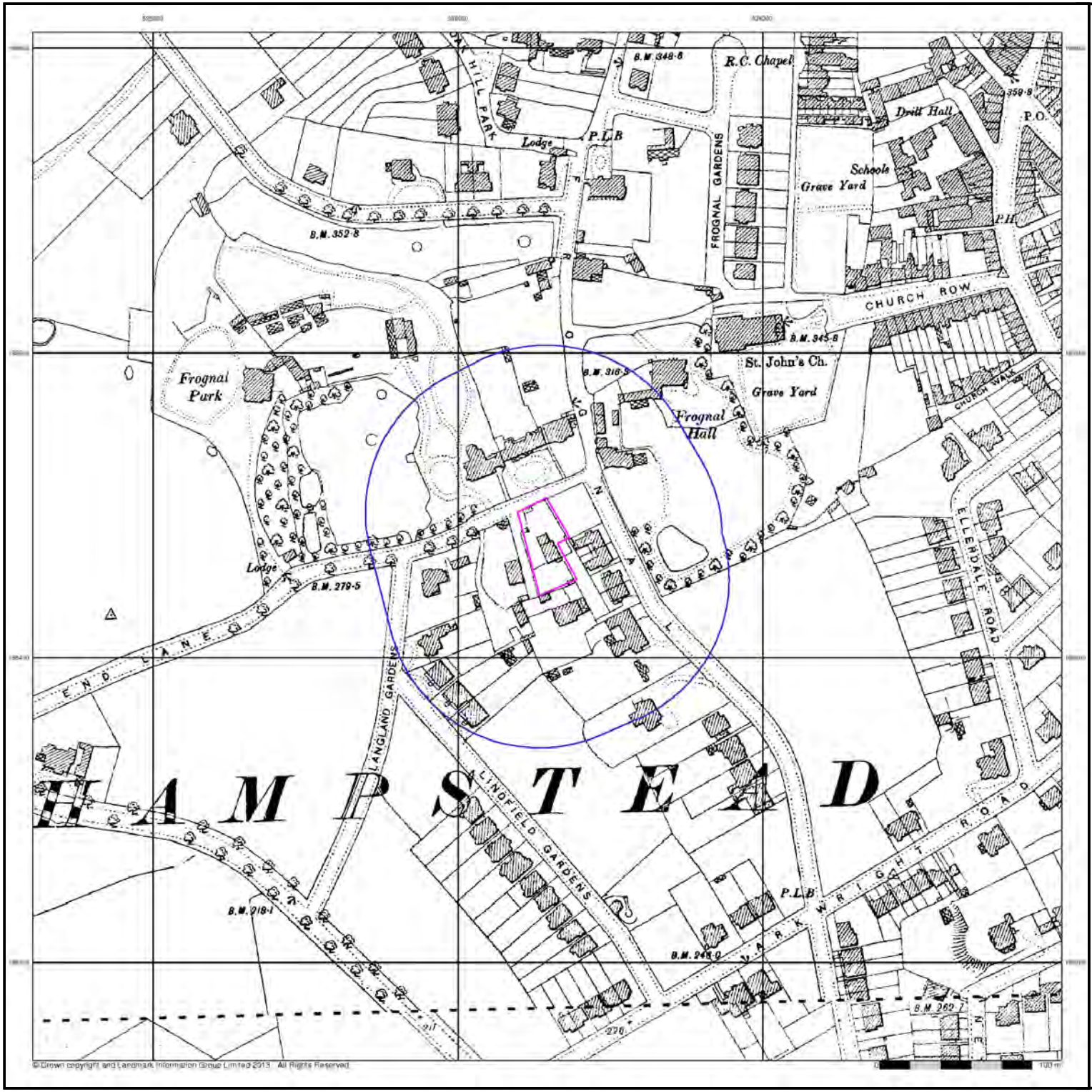
Site Area (Ha):	0.14
Search Buffer (m):	100

Site Details

44 Frognal Lane, LONDON, NW3 6PP



Risk Management

London

Published 1896

Source map scale - 1:2,500

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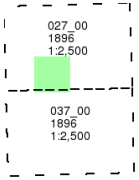
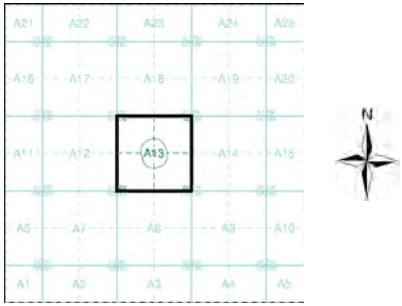
Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

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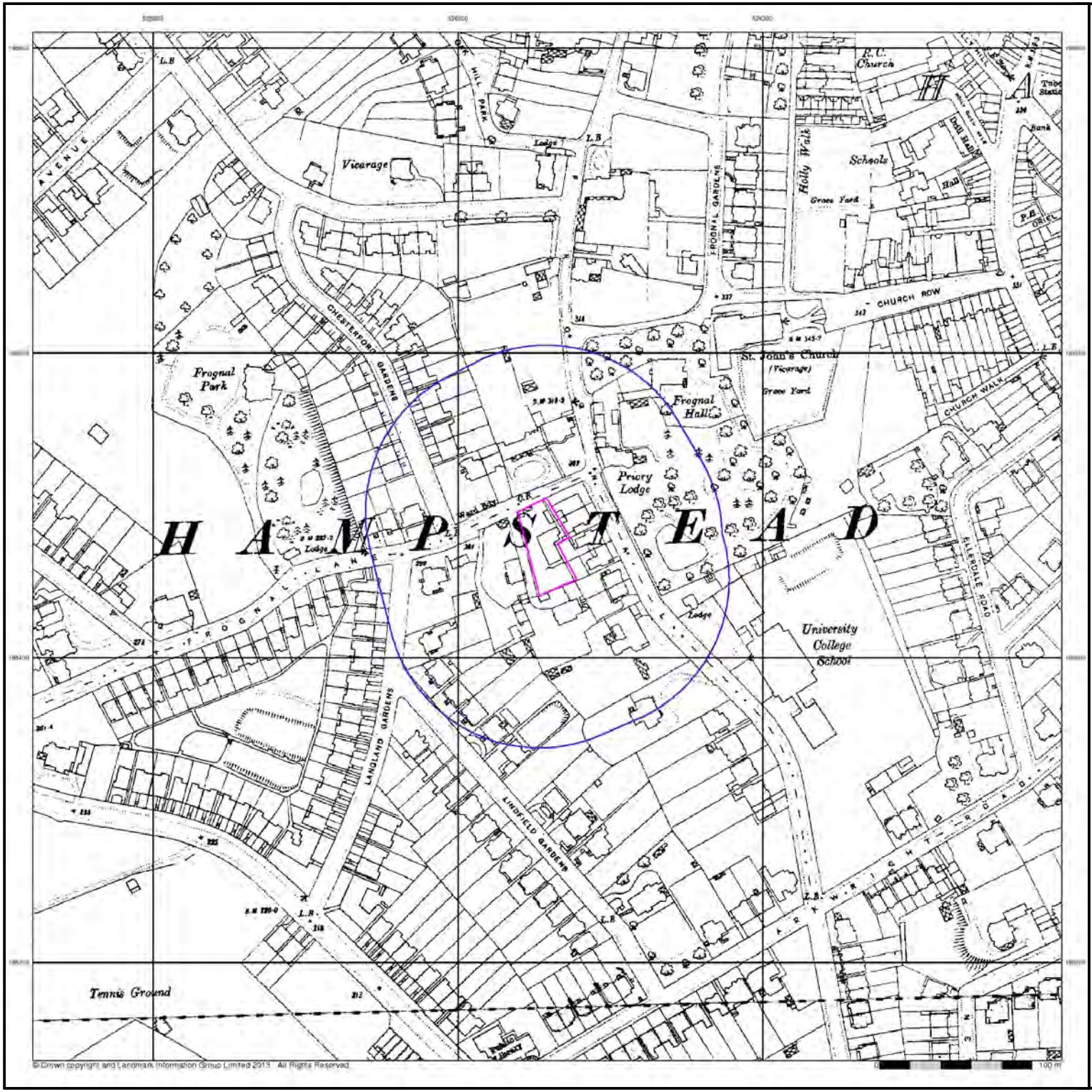
Customer Ref:	RML 5349
National Grid Reference:	526060, 185470
Slice:	A
Site Area (Ha):	0.14
Search Buffer (m):	100

Site Details

44 Frognal Lane, LONDON, NW3 6PP

Landmark Information Group

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



Risk Management

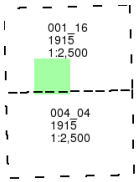
London

Published 1915

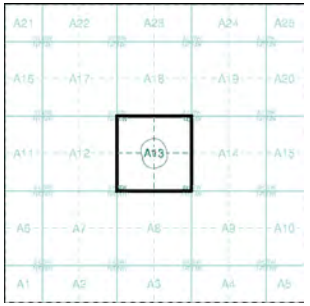
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

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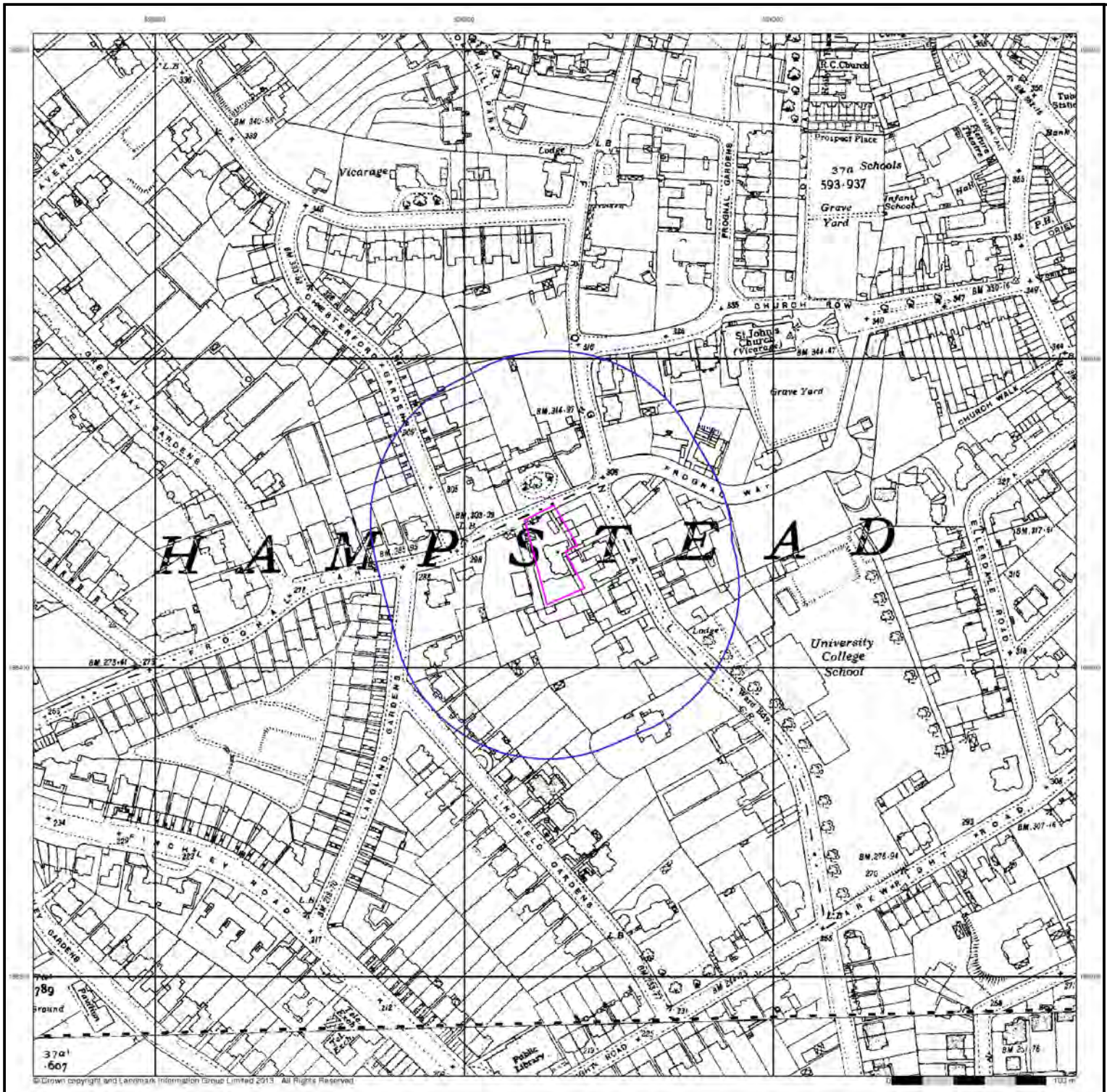
Customer Ref:	RML 5349
National Grid Reference:	526060, 185470
Slice:	A
Site Area (Ha):	0.14
Search Buffer (m):	100

Site Details

44 Frognal Lane, LONDON, NW3 6PP

Landmark Information Group

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



Risk Management

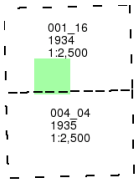
London

Published 1934 - 1935

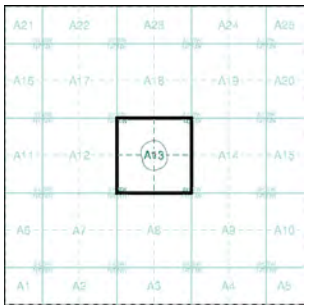
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number:	51572152_1_1
Customer Ref:	RML 5349
National Grid Reference:	526060, 185470
Slice:	A
Site Area (Ha):	0.14
Search Buffer (m):	100

Site Details

44 Frognal Lane, LONDON, NW3 6PP

Landmark Information Group

Tel: 0844 844 9952
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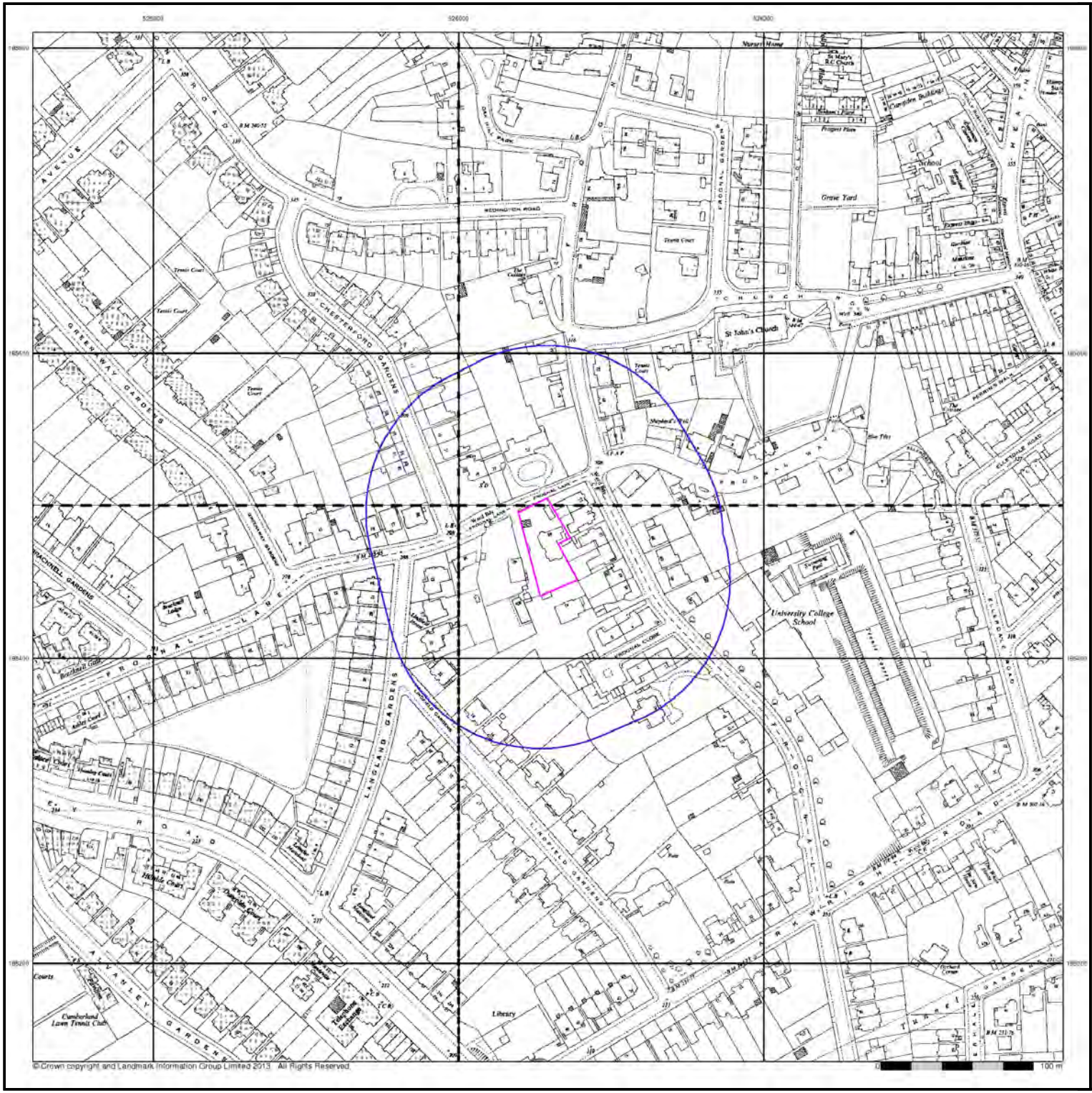
Web: www.envirocheck.co.uk



Risk Management

Ordnance Survey Plan

Published 1954

Source map scale - 1:1,250

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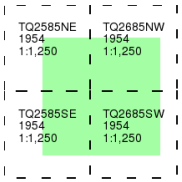
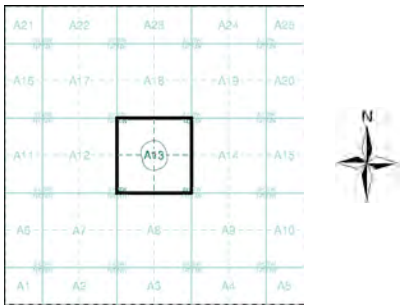
Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

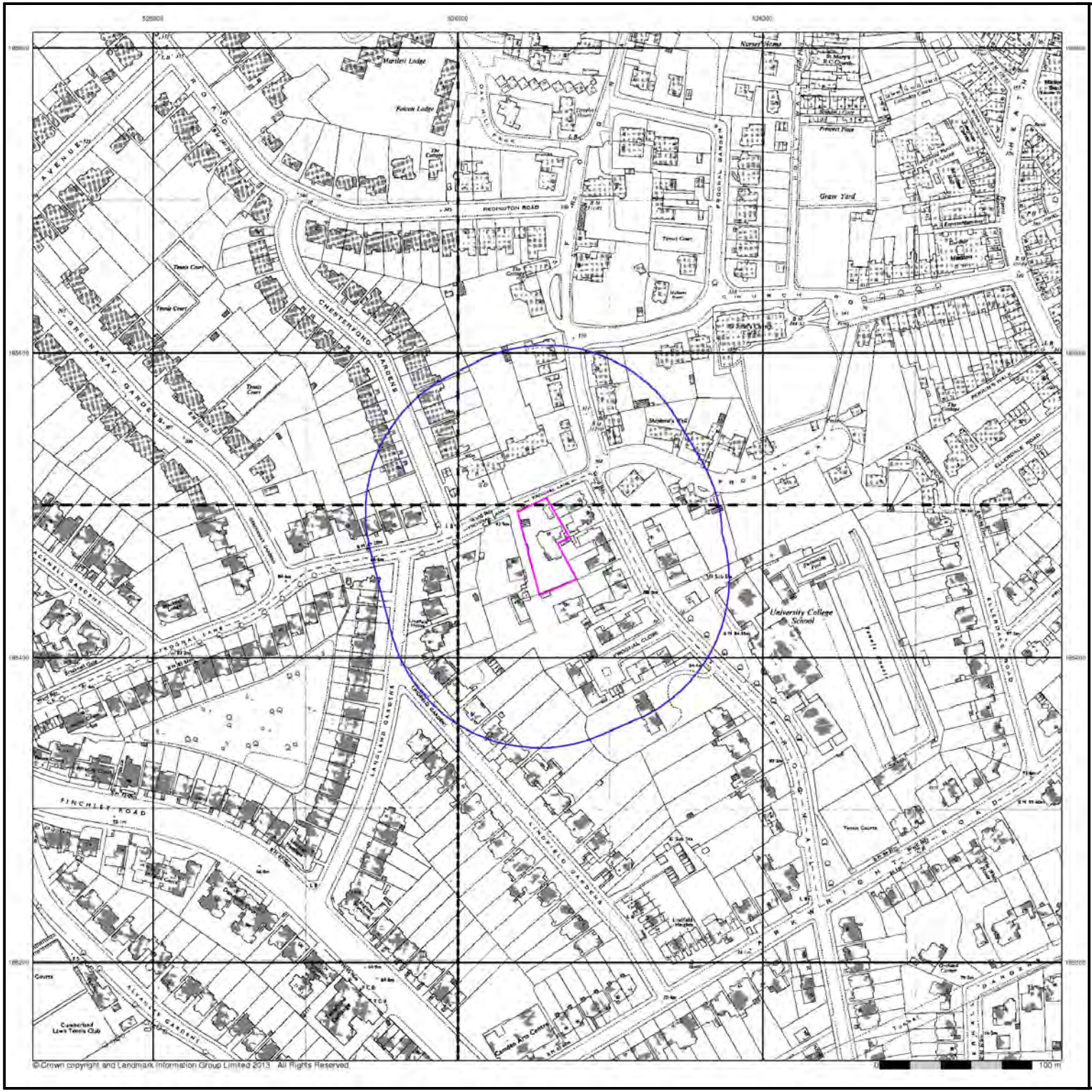
Order Number:	51572152_1_1
Customer Ref:	RML 5349
National Grid Reference:	526060, 185470
Slice:	A
Site Area (Ha):	0.14
Search Buffer (m):	100

Site Details

44 Frognal Lane, LONDON, NW3 6PP

Landmark Information Group

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



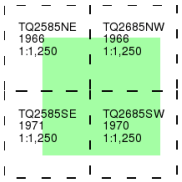
Ordnance Survey Plan

Published 1966 - 1971

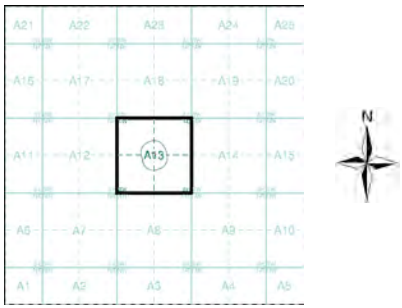
Source map scale - 1:1,250

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number:	51572152_1_1
Customer Ref:	RML 5349
National Grid Reference:	526060, 185470
Slice:	A
Site Area (Ha):	0.14
Search Buffer (m):	100

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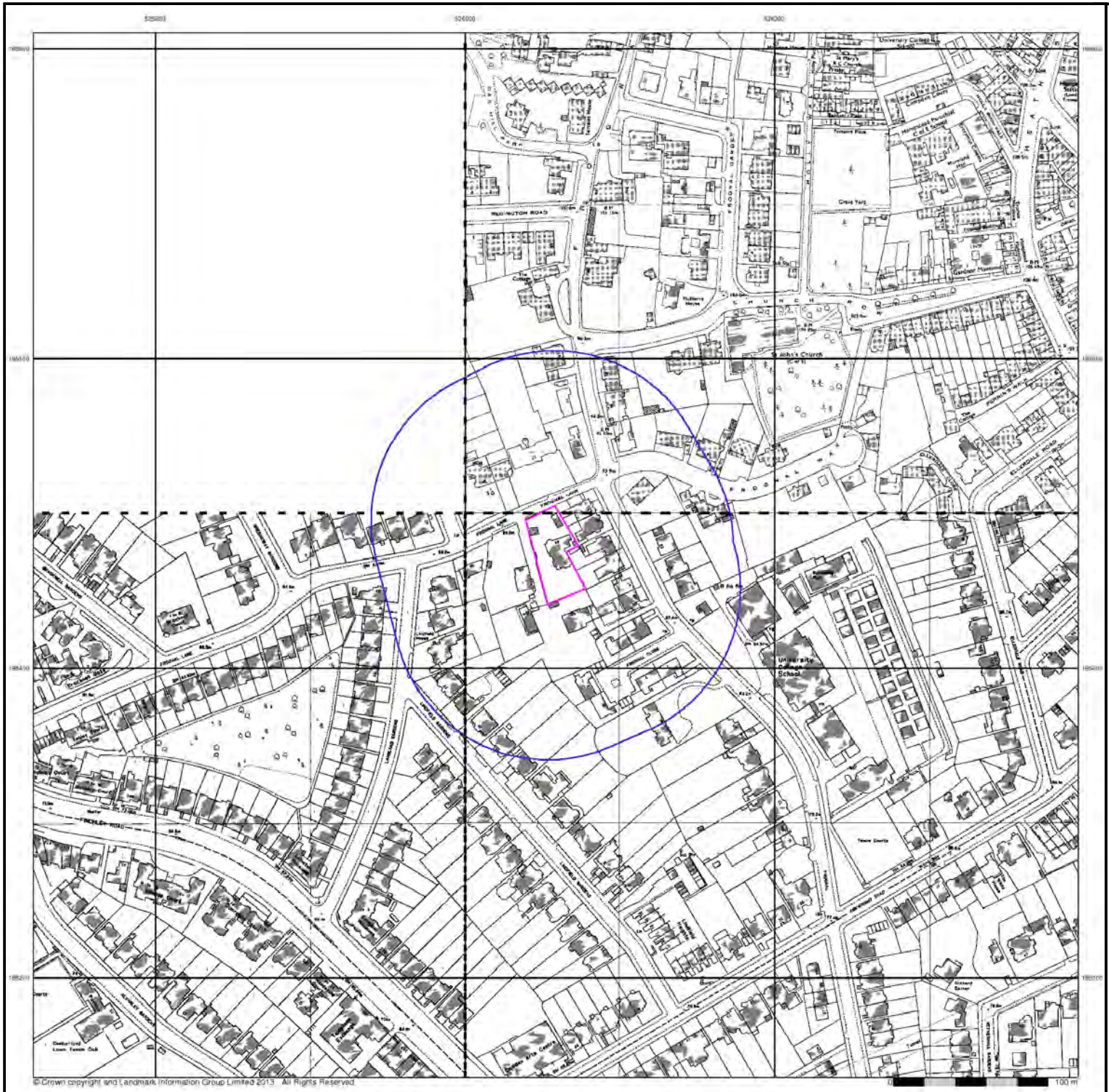


Risk Management

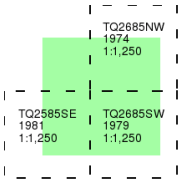
Ordnance Survey Plan

Published 1974 - 1981

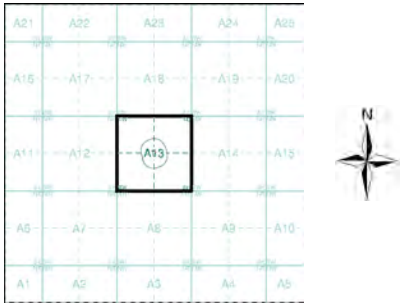
Source map scale - 1:1,250

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



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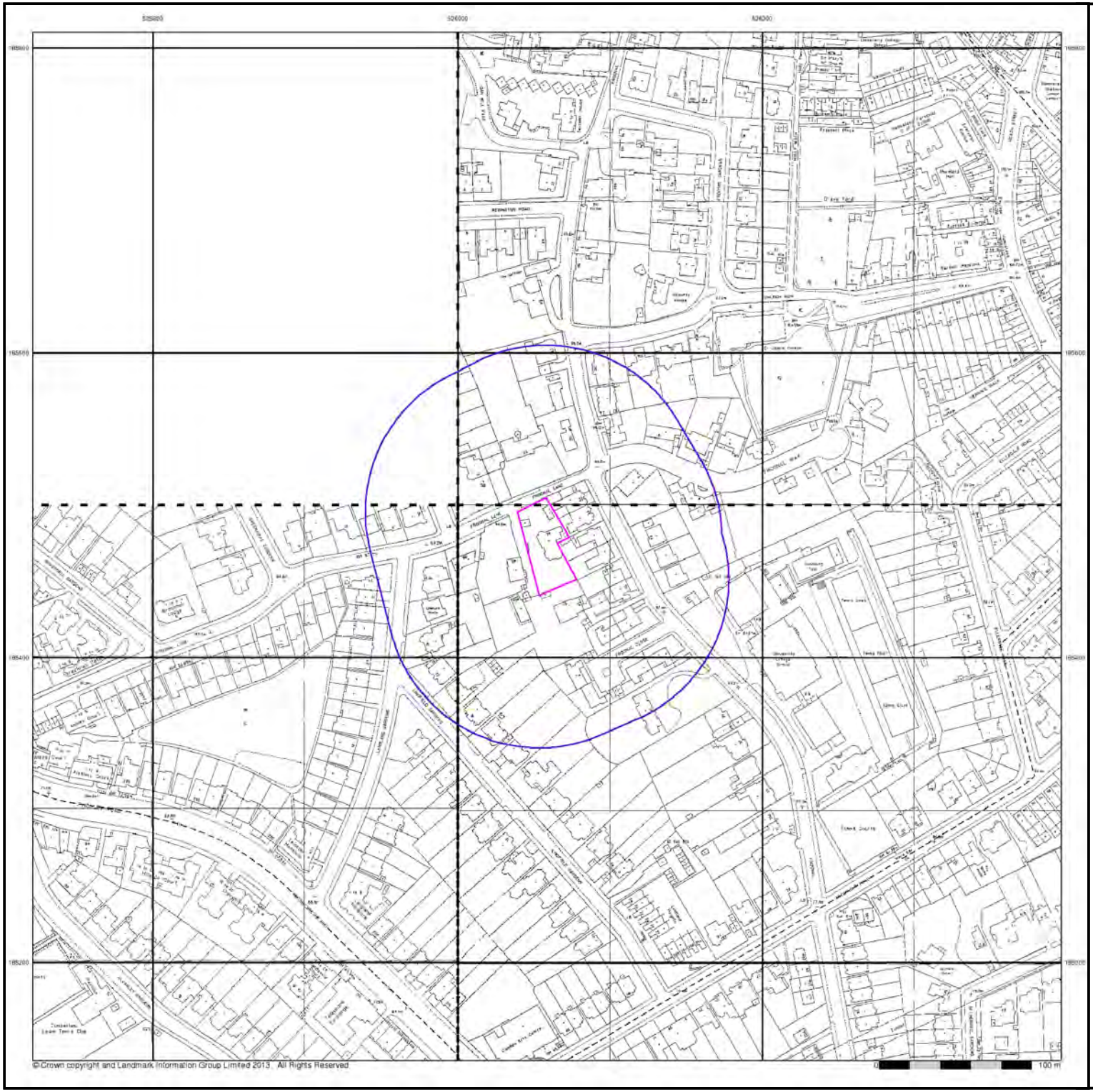


Risk Management

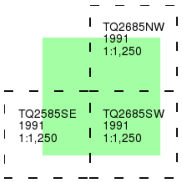
Large-Scale National Grid Data

Published 1991

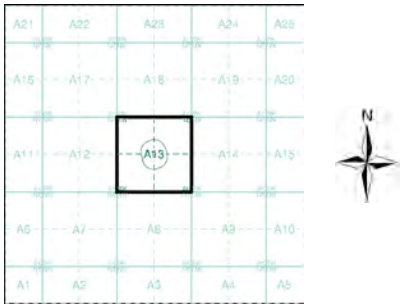
Source map scale - 1:1,250

'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the fore-runners of digital mapping and so provide detailed information on houses and roads, but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



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Risk Management

10k Raster Mapping

Published 2006

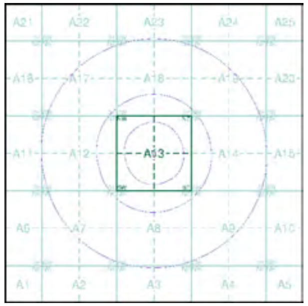
Source map scale - 1:10,000

The historical maps shown were produced from the Ordnance Survey`s 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

Map Name(s) and Date(s)

TQ28NW 2006 1:10,000	TQ28NE 2006 1:10,000
TQ28SW 2006 1:10,000	TQ28SE 2006 1:10,000

Historical Map - Slice A



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Order Number:	51572152_1_1
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National Grid Reference:	526060, 185470
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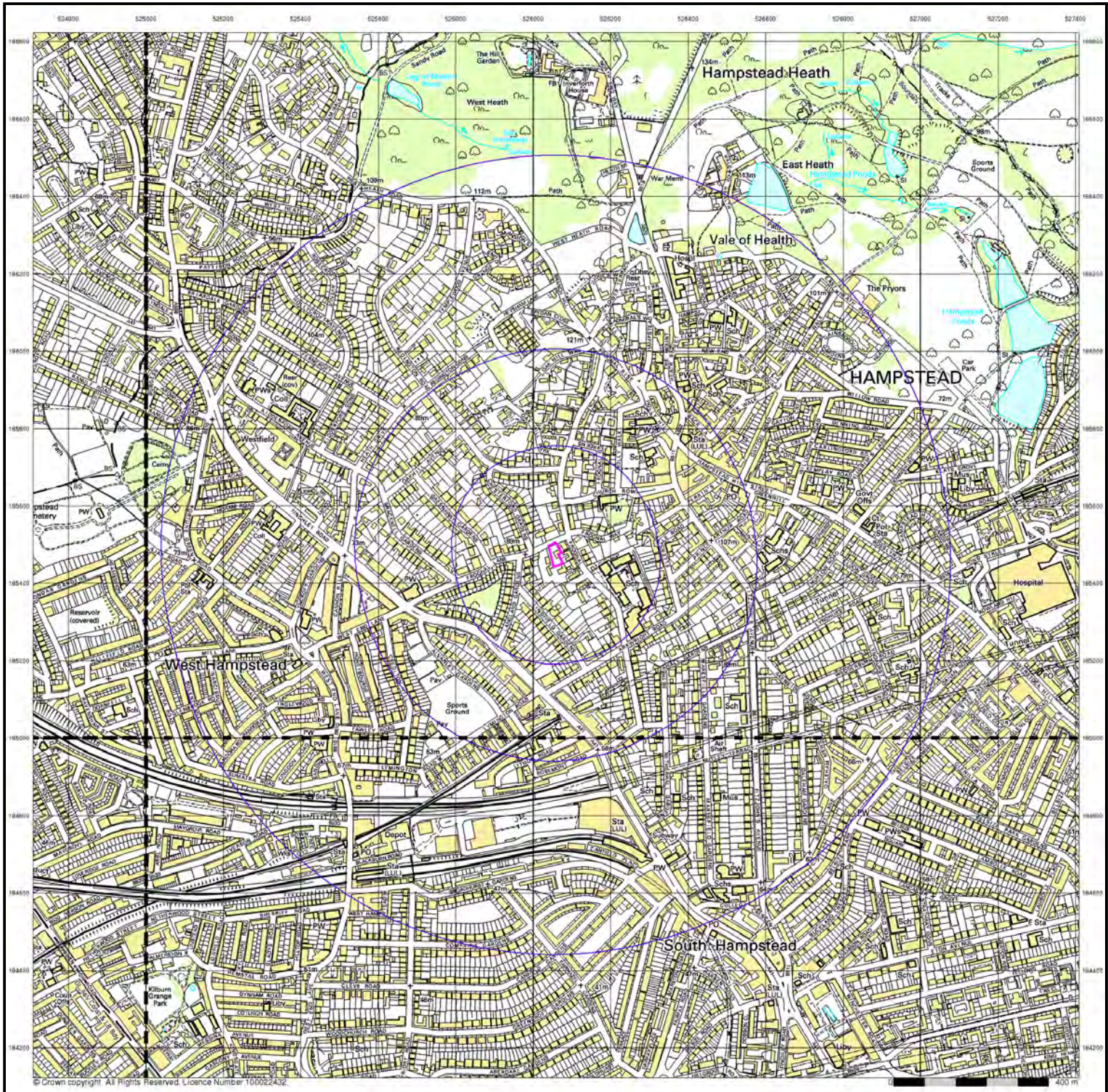


Risk Management

10k Raster Mapping

Published 2013

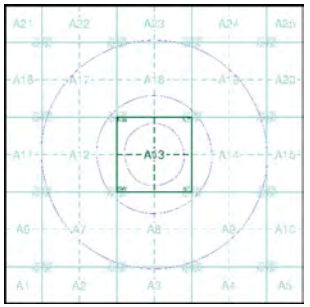
Source map scale - 1:10,000

The historical maps shown were produced from the Ordnance Survey`s 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

Map Name(s) and Date(s)

TQ28NW 2013 1:10,000	TQ28NE 2013 1:10,000
TQ28SW 2013 1:10,000	TQ28SE 2013 1:10,000

Historical Map - Slice A



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Risk Management	Title : **SITE PHOTOGRAPHS**	Scale : NTS Date : December 2013
RISK MANAGEMENT LIMITED Tel : 01883 343572 Fax : 01883 344060	Project Location : 44 Frognal Lane, Hampstead.	Plate **1** Job No : RML 5349

Risk Management	Title : **SITE PHOTOGRAPHS**	Scale : NTS Date : December 2013
RISK MANAGEMENT LIMITED Tel : 01883 343572 Fax : 01883 344060	Project Location : 44 Frognal Lane, Hampstead.	Plate **2** Job No : RML 5349