clancy consulting

Buildings

OUR REF: 2/8791 / LO / TOU / SSS
YOUR REF:

Energy

Environment

October 2, 2020

Infrastructure

7th Floor
Northumberland House
303 – 306 High Holborn
London
WC1V 7JZ

t: 020 3077 0970
f: 020 3206 0090

enquiries@clancy.co.uk

www.clancy.co.uk

Offices at:

Birmingham
Glasgow
Leeds
Liverpool
London
Manchester
Newcastle
Norwich
Prestwick
Reading

Statement of compliance

This documentation is submitted as part of an approval of details application to discharge Condition 14 attached to planning permission reference: 2019/3138/P at 115-119 Camden High Street, which requires details comprising a "Method Statement for Below Ground Structures".

Specifically, Condition 14 (Method Statement - Below Ground Structures) is worded as follows:

> "The development hereby permitted shall not be commenced until detailed design and method statements (in consultation with London Underground) for all of the foundations, basement and ground floor structures, or for any other structures below ground level, including piling (temporary and permanent), have been submitted to and approved in writing by the local planning authority which:
>
> - Provide details on all structures;
> - Accommodate the location of the existing London Underground structures and tunnels;
> - Accommodate ground movement arising from the construction thereof; and
> - Mitigate the effects of noise and vibration arising from the adjoining operations within the structures and tunnels.
>
> The development shall thereafter be carried out in all respects in accordance with the approved design and method statements, and all structures and works comprised within the development hereby permitted which are required by the approved design statements in order to procure the matters mentioned in paragraphs of this condition shall be completed, in their entirety, before any part of the building hereby permitted is occupied."

Clancy can confirm that the information provided partially satisfies the requirements of this Condition (No.14) pending further information from others and that it should be discharged accordingly in due course.

Clancy Consulting Ltd
Registered Office
Dunham Court
2 Dunham Rd
Altrincham
Cheshire
WA14 4NX
Registered in England
3693529

Prepared by:

Tugay Uzunoglu – MEng (Hons) GMICE
Structural Engineer.
for and on behalf of CLANCY CONSULTING LTD

Checked by:

Satpal Sagoo - BEng (Hons) CEng MIStructE
Divisional Director
for and on behalf of CLANCY CONSULTING LTD

CLANCY CONSULTING LTD

115-119 CAMDEN HIGH STREET

GROUND MOVEMENT IMPACT ASSESSMENT

REVISION 1

September 2019

Attention is drawn to the statement overleaf which should be read prior to using this report. The report has been prepared for the exclusive use of Geotechnical Consulting Group LLP's client and contains privileged information. Use of this report and disclosure of its content by and to unauthorised parties is strictly forbidden.

GEOTECHNICAL CONSULTING GROUP
52A Cromwell Road
London SW7 5BE
United Kingdom

Tel: +44 (0) 20 7581 8348
Fax: +44 (0) 20 7584 0157
Email: admin@gcg.co.uk

CLANCY CONSULTING LTD

115-119 CAMDEN HIGH STREET

GROUND MOVEMENT IMPACT ASSESSMENT

REVISION 1

September 2019

DISCLAIMER

REVISION HISTORY

Revision	Date	Description	Produced by	Reviewed by
Draft	05/19	Issued for comments	A.Gasparre Dott Ing. PhD DIC CEng MICE	Mike Crilly BSc MSc DIC
Rev 0	05/19	Typos amended	A.Gasparre Dott Ing. PhD DIC CEng MICE	Mike Crilly BSc MSc DIC
Rev 1	05/09/2019	Updated for the new scheme	A.Gasparre Dott Ing. PhD DIC CEng MICE	Mike Crilly BSc MSc DIC

CLANCY CONSULTING LTD

115-119 CAMDEN HIGH STREET

GROUND MOVEMENT IMPACT ASSESSMENT

REVISION 1

SEPTEMBER 2019

EXECUTIVE SUMMARY

A ground movement impact assessment has been undertaken for the site at 115-119 Camden High Street, where the existing building is to be demolished and replaced with a new structure with basement.

The new structure will be supported on piles and the new basement will be constructed within contiguous pile walls in the central part of the site.

The expected movements around the site have been estimated using linear elastic analyses and an empirical approach that is based on field measurements of movements from a number of basement constructions across London (CIRIA C760).

It is concluded that the only structure to be affected by ground movements around the site is likely to be 121-123 Camden High Street. Movements of the ground will be relatively small and, as a result, predicted building damage will not exceed Category 1: very slight.

CLANCY CONSULTING LTD

115-119 CAMDEN HIGH STREET

GROUND MOVEMENT IMPACT ASSESSMENT

REVISION 1

September 2019

TABLE OF CONTENTS **Page No.**

LIST OF FIGURES Page No.

1 Introduction

It is proposed to redevelop 115-119 Camden High Street replacing the existing building with a new multi-storey structure with basement.

Geotechnical Consulting Group LLP (GCG) have been commissioned to carry out a preliminary assessment of the impact of the proposed redevelopment on the surrounding buildings. Information on ground conditions have been obtained from record data in the area of the site.

Information on the project has been provided by Clancy Consulting, the structural engineers for the project.

The assessment of the impact of the proposal on utilities and other infrastructure is outside the scope of this report.

2 The site and the proposed redevelopment

The site is located on the west side of Camden High Street, at the junction with Delancy Street (Figure 1a).

It is approximately 16m wide and 38m long, stretching on a north-east to south-west direction between Camden High Street and Signmakers Yard, a 5m wide gated yard off Delancey Street.

The site is currently occupied by a two storey retail unit constructed between 1927 and 1930 on grounds originally occupied by a number of smaller shops. There is a 2.5m deep basement underneath the south-eastern area of the site.

Figure 2 shows plans of the ground floor and basement of the existing structure.

Tunnels of the London Underground (LU) Northern Line run underneath Camden High Street, at approximately 10m depth. The nearest of these tunnels is anticipated to run under or very close to the frontage of 115-119 Camden High Street. Their exact location is to be confirmed.

It is proposed to replace the existing structure with a new five storey building with a single level basement underneath its central part. The new basement will be approximately 27m x 16m in plan and its finished floor level will be approximately +25.3mOD, 3.5m below ground level. Figure 3 shows a plan of the proposed basement and a section through the site.

The front part of the existing basement will be backfilled.

It is understood that the new structure will be supported on piles and the new basement will be formed within contiguous pile walls. The basement will be constructed in a bottom up sequence, supporting the retaining walls with temporary props as excavation proceeds.

3 The surrounding structures

The proposed redevelopment and the excavation for the new basement could cause ground movements that could extend to the surrounding structures.

Given the location of the site and the size of the new basement, the only structure that could be affected by these movements is 121-123 Camden High Street, immediately to the north of the site. A brief description of this property is provided below.

Ground movements across Camden High Street, Delangey Road and Signmaker Yard could also affect utilities that might be running along these roads. However, the assessment of the impact of the development on utilities is outside the scope of this report.

3.1 No. 121-123 Camden High Street

The property is adjacent to the site to the north and includes a three storey masonry building with a single story extension and a patio at the rear. A single level basement is underneath the rear extension.

The building is approximately 10m wide and 36m long. It was constructed around 1950, but appears to have undergone refurbishment in 1994. Figure 4 shows plans of the ground and basement floors of the existing building.

For the purposes of this assessment it is conservatively assumed that the party wall is founded at 0.5m below ground level. It is assumed that the building is in good structural conditions.

4 Ground Conditions

The site is on ground sloping downwards from Penrose Hill and Regents Park at an approximate gradient of 1:60 (Figure 1a). The ground level at the front of the site is approximately +29mOD.

The ground and groundwater conditions have been established on the basis of record information only (British Geological Survey, BGS, maps and record boreholes). It is understood that a site-specific ground investigation is to be carried out at a later stage.

The 1:50,000 scale geological map (BGS, 1994, Sheet 256 – North London, Figure 5) shows that the site is underlain by London Clay over Lambeth Group, Thanet Sand and Chalk.

A number of BGS record boreholes are located within a radius of 250m from the site, as shown in Figure 6.

A deep borehole, about 250m to the south-east of the site, indicates that the London Clay is 28m thick and it is underlain by 25m of Lambeth Group and 6m of Thanet Sand. Chalk is present from -31mOD.

Other shallow record boreholes also suggest that the upper 5-8m of London Clay are weathered.

For the purposes of the ground movement assessment discussed in this report the stratigraphic profile and the soil parameters in Table 1 are adopted.

5 Hydrogeological conditions and hazards

The site is on the western side of the shallow valley of the former Fleet River, which used to flow north to south at a distance of about 700m to the east of the site (Figure 7).

The London Clay under the site is classified as 'unproductive aquifer' and its permeability is such that no significant horizontal groundwater flow is likely to exist across the site. Perched water could be present within superficial deposits above the clay.

Water infiltrating the London Clay generally tends to flow vertically downwards at a very slow rate towards the lower aquifer, which, in the area of the site, is currently at approximately 60m bgl (i.e. approximately -30mOD, data from Environment Agency, 2018, Figure 8). The area of the site has been affected by water abstractions during the 19th and 20th Centuries and the water level in the lower aquifer has been rising since the second half of the last century, when the demand of water started to reduce. The current policy, coordinated by the Environment Agency, is to control groundwater level in the lower aquifer in order to maintain the integrity of underground structures and foundations in the London Clay. Therefore, the water levels in the deep aquifer are not expected to change in the future.

The proposed basement will be excavated within the London Clay and, given the nature of this deposits, it is not expected to have any adverse effect on the local hydrogeology.

6 Ground movement analyses

6.1 Background

It is currently envisaged that, having demolished the existing building and backfilled the front part of the existing basement, the internal piles and the contiguous piles around the perimeter of the basement will be installed. Excavation will then be carried out installing temporary props for the walls to complete the construction in a bottom up sequence.

Inside and outside the basement area ground movements during and after the works would be due mainly to:

- Demolition of the existing building
- Installation of piled walls
- Excavation for the new basement
- Construction of the new structure

The magnitude and distribution of the ground movements caused by these operations are a function of changes of load in the ground and workmanship. The way that the existing buildings around the site respond to these movements is dependent on their current conditions and the precautions that are taken to reduce the risk of building movements.

6.2 Estimated ground movements

6.2.1 Movements due to the demolition of the existing building

The demolition of the existing building would relieve pressures on the ground inducing it to swell.

These movements would be expected to mostly in the vertical direction.

They have been estimated using the OASYS program PDisp®. The program assumes a linear elastic behaviour of the soil and determines the changes in the vertical stresses and settlement/heave using a Boussinesq approach. Elastic vertical strains are calculated on the basis of the calculated stress changes and then integrated to obtain vertical movements. The calculations represent free field movements unaffected by the stiffness of structures and therefore are likely to be conservative. The soil parameters used for the analyses are summarised in Appendix 1.

The loads removed during demolition are estimated to be in the order of approximately 36kPa (i.e. 25kPa dead load and 11kPa live load) .

The load changes on the party wall with 121-123 Camden High Street are small and, given the conservative nature of the analysis, they are ignored at this stage.

The results of the analyses show that the demolition of the existing structure could induce ground heave up to 7mm in the middle of the building and 2 to 3mm around the edges and the party wall with 121-123 Camden High Street (Figure 9). In fact the effective movements along the party wall are likely to be smaller than predicted because they would be restricted by the stiffness of the wall, which is not modelled in the analysis.

6.2.2 Installation of contiguous pile walls

Record data of movements due to wall installation (CIRIA C760) are shown in Figure 10. The movements are highly dependent on the piling method and workmanship.

Horizontal movements are limited and very scattered and experience indicates that in practice they are negligible.

Settlements have large scatter over a distance of about 0.2 times the wall length behind the wall, then they reduce to less than 0.02% of the wall length and continue to reduce linearly with distance from the wall.

Using these record data and recent monitoring information (Ball et al., 2014), for the purposes of estimating overall settlements due to wall installation the curve marked in Figure 10b can be used.

The design of the pile wall has not yet been finalised, but, considering the proposed basement depth (4m) and the fact that the retaining walls will be propped during excavation, these walls could be assumed to be 8m long.

The expected settlements due to installation for these wall lengths would be less than 2mm immediately behind the walls and would reduce to zero at about 12m from the walls.

6.2.3 Movements due to excavation

The excavation would cause upward ground movements inside the excavated area as a result of the vertical change (reduction) of loads on the excavated surface and downwards movements outside the excavated area as a result of the deflections of the retaining walls due to the loss of horizontal support in front of them.

The ground movements inside the excavated area have been estimated using PDisp. The pressures removed as a result of excavation are approximately 80kPa. The results of the analyses show that at the end of the excavation the ground would move upwards by 14-16mm in the central part of the site and 8-10mm along the edges (Figure 11). These movements will be confined within the boundaries of the basement area, restricted by the basement walls. They are unlikely to affect adjacent structures.

Behind the retaining walls the ground would settle and move towards the excavation as the walls bend due to the reduction of lateral support in front of them. Empirical data based on the movements of ground behind retaining walls as a result of excavations in typical London ground conditions (CIRIA C760) show that the ground movements behind the excavation depend on the propping sequence and on the depth of the excavation (Figure 12).

Assuming a stiff support for the walls, the data in Figure 12 suggest that for a 4m deep excavation the maximum settlements are in the order of 3.5mm and the maximum horizontal movements are approximately 7mm.

These movements would occur behind long sections, at the corners they would be restricted to about half of the predicted values.

The ground behind the walls would tend to sag and therefore the maximum settlements would occur at approximately 2m behind the walls.

These movements would add to those due to the installation of the retaining walls.

Contour plots of the total predicted ground movements due to excavation only around the new basement area have been constructed and are shown in Figures 13 and 14.

It should be noted that these movements have been calculated at ground levels around the site, ignoring the presence of basements.

6.2.4 Long term movements

The loads of the new structure would be taken at depth into the ground through piles. Small settlements would be expected to occur across the site as the ground is loaded by the new structure. In the long term the ground will continue to swell as an effect of the net unload of pressures on the ground surface.

These movements are unlikely to affect the adjacent structure, but they should be taken into account in the design of the new building at the site.

The basement slab should be designed for the swelling pressures and suitable water pressures.

7 Discussion of results

7.1 Effects of ground movements on adjacent structures

Figures 12 and 13 show that the only structure that could be potentially affected by the predicted ground movements is 121-123 Camden High Street.

The potential damage to this structure can be estimated as suggested in CIRIA C760 by looking at the combined effects of the horizontal strains and the deflection ratio, which is the ratio between the maximum distortion of a structure and its length.

The demolition of the existing building at 115-119 Camden High Street could cause small upward movements of the party wall with 121-123 Camden High Road. These movements are unlikely to exceed 2mm and would be expected to occur mostly along the front part of the wall, which is at higher level. At the rear, where a basement exists, the movements are likely to be negligible. This could result in minor distortions that could cause localised cracks at the wall junctions.

The installation of the new retaining walls and the excavation for the new basement could cause settlements of the party wall that would in part compensate for the upward movements occurred during demolition.

Figures 12 and 13 show that the building on 112-123 Camden High Street could distort and move horizontally towards the new basement. Behind a long section of the proposed basement, a deflection ratio of approximately 0.01% and horizontal strains 0.04% could occur. These strains could cause damage that could be classified within Category 1 (very slight) in the Damage Category Chart shown in Figure 15.

In reality the stiffness of the building on 121-123 Camden High Street is such that ground movements would be restrained, resulting in potential damage lower than predicted.

7.2 Monitoring

It would be prudent to monitor movements during construction. Monitoring targets could be installed on the walls of the adjacent property and could be supplemented by precise levelling points, which tend to show less scatter than the monitoring targets. Base readings should be taken before work commences.

In the different stages of the construction movements could be small and maybe within the limits of the measurement accuracy. Therefore it is suggested that only overall trigger levels are applied to movements of the walls.

Based on the predictions discussed above, the following trigger levels on the horizontal and vertical movements of the retaining structure are suggested:

Trigger Level	Movements [mm]
green	<6
amber	7-10
red	>10

8 Slope stability issues

The Hampstead area and the surroundings are considered to be vulnerable to slope instability due to the ground conditions and the sloping gradient of the ground.

Potential land instability has generally been associated with slopes of 8° or greater both in the London Clay and in the Claygate Member (Deness et al., 1976; Ellison et al. 2004) although the mechanisms that could drive the potential instability are different in the two types of soils.

Figure 16 shows the areas that are prone to slope stability issues as mapped by the British Geological Survey (BGS) (Arup, 2010). The BGS mapping is based on factors such as geology and groundwater conditions, in addition to the slope angle.

The specific site conditions at 115-119 Camden High Street do not suggest that issues with general land stability exist.

The slope of the ground across the site is approximately 1.5^{o} and will not be altered. The new basement box will be formed within retaining walls and will be designed for the surcharge of the existing structures and the ground behind.

Given the hydrological conditions of the site, no significant increase in pore water pressure in the London Clay is expected that could cause instability of the ground.

9 Conclusions

The impact of the proposed basement construction on the surrounding structures has been assessed using empirical methods and linear elastic analyses.

The excavated area will be subjected to upward movements due to the net load changes following the demolition of the existing structure and the basement excavation. The design of the basement foundation should be carried out considering these load changes and the associated movements.

Providing that good workmanship and a robust construction sequence are used and that full support from high level is provided to the retaining walls during excavations, the basement construction is unlikely to cause settlements and horizontal strains that would induce other than limited damage to the surrounding structures.

Monitoring of movement during construction is recommended.

The proposal is not expected to have adverse impacts on the local hydrogeology.

10 REFERENCES

Arup (2010) Camden geological hydrogeological and hydrological study , London Borough of Camden

British Geological Survey (1998). North London, England and Wales Sheet 256. Solid and Drift Geology 1: 50,000.

CIRIA C760 (2017). Guidance on embedded retaining wall design

GEA (2018). Desk Study & Ground Investigation Report– 58a Camden High Street

Ellison, R.A., Woods, M.A., Allen, D.J., Forester, A., Pharoah, T.C., and King, C. 2004. Geology of London: Special memoir for 1:50000 Geological sheets 256 (North London), 257 (Romford), 270 (South London), 271 (Dartford). British Geological Survey.

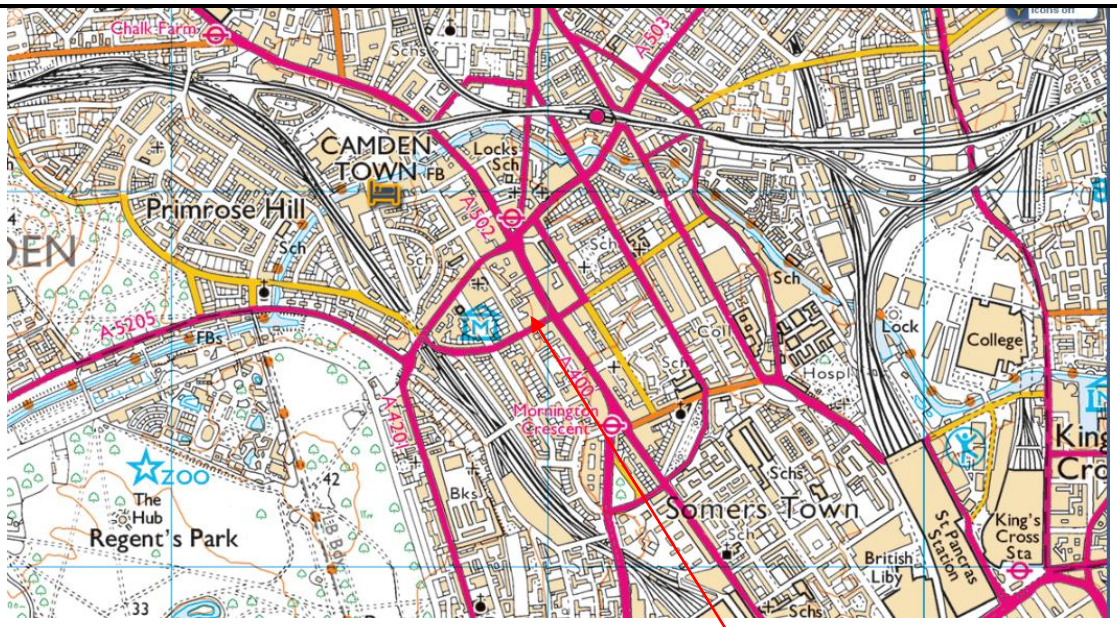
Denness, B and Riddols, B W., 1976. The influence of geological factors on slope stability in the London clay of south Essex, England. Bulletin of Engineering Geology and the Environment. Volume 13, Number 1, 37-40.

TABLES

Table 1: Assumed stratigraphic profile and soil parameters for analyses

Stratum	Level at top [mOD]	Undrained Stiffness Eu [MN/m^2]	Drained Stiffness E' [MN/m^2]
Made Ground	+29	-	10
London Clay	+27	10 +5.2z*	7.5+3.9z*
Lambeth Group	-1	-	130+3.9z
Thanet Sand	-26	-	300
Chalk	-31		

FIGURES



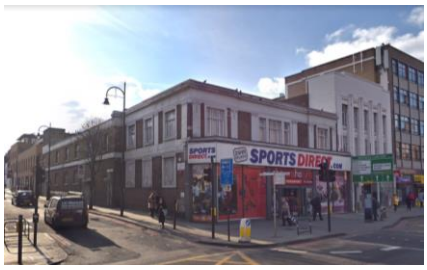
(a)

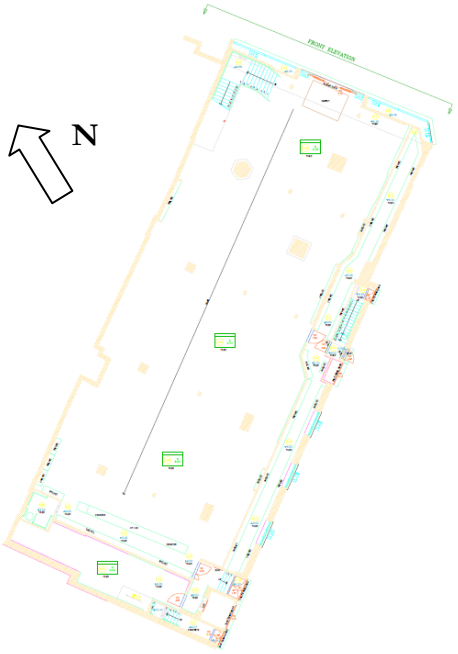
The Site

(b)

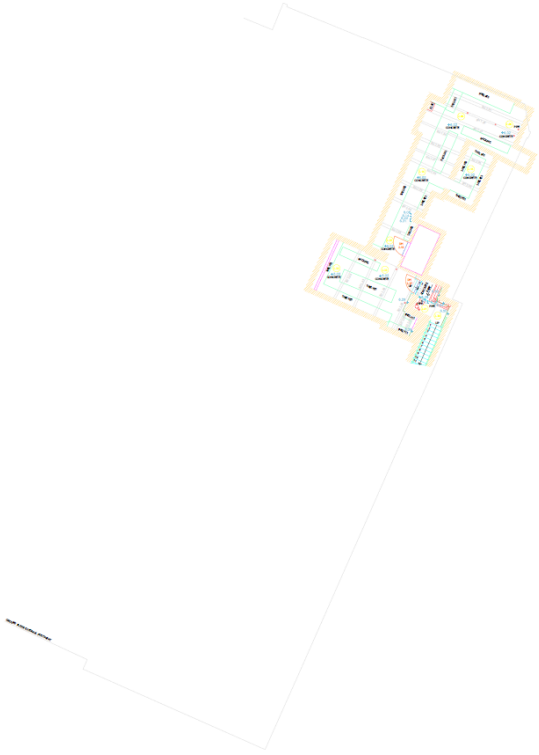
	Clancy Consulting Ltd 115-119 Camden High Street	**Figure** **1**
	The Site a) Location b) site layout	

(a)



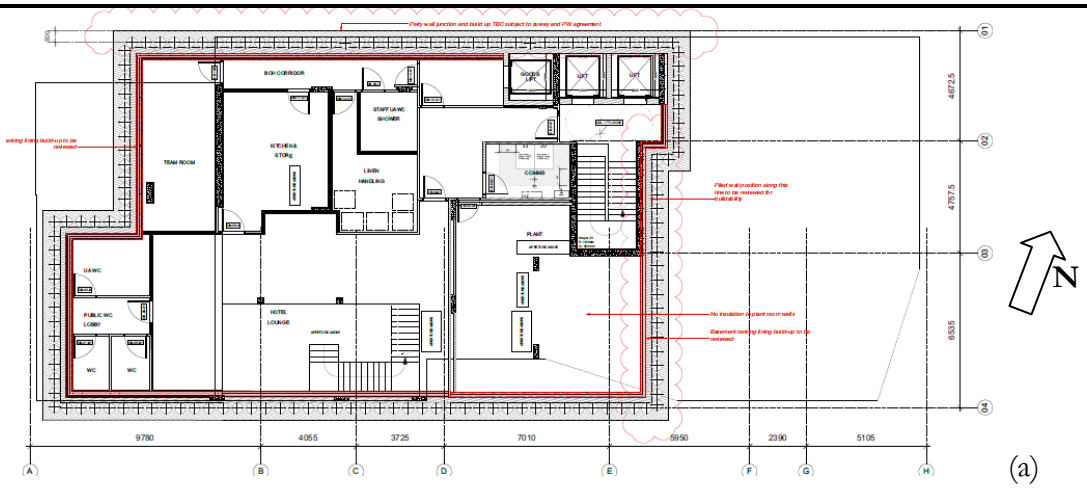


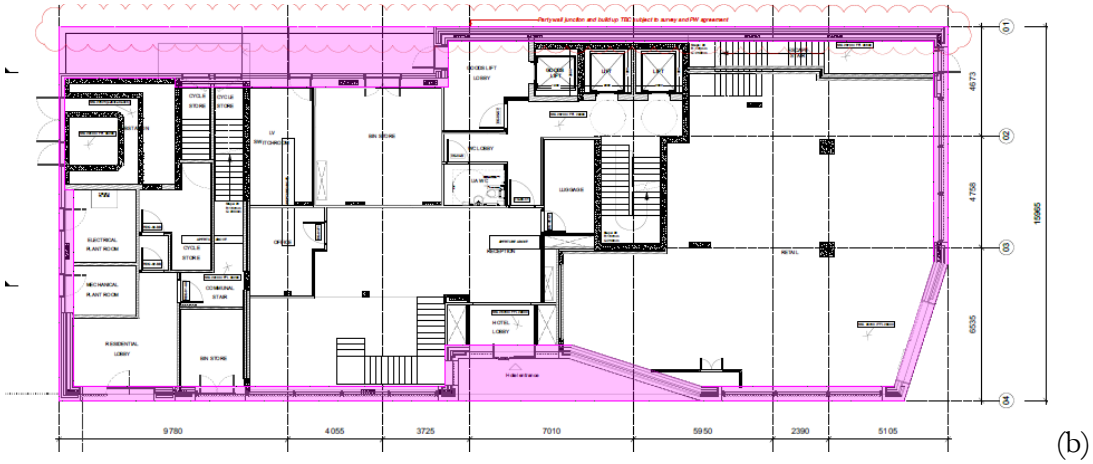
(b)

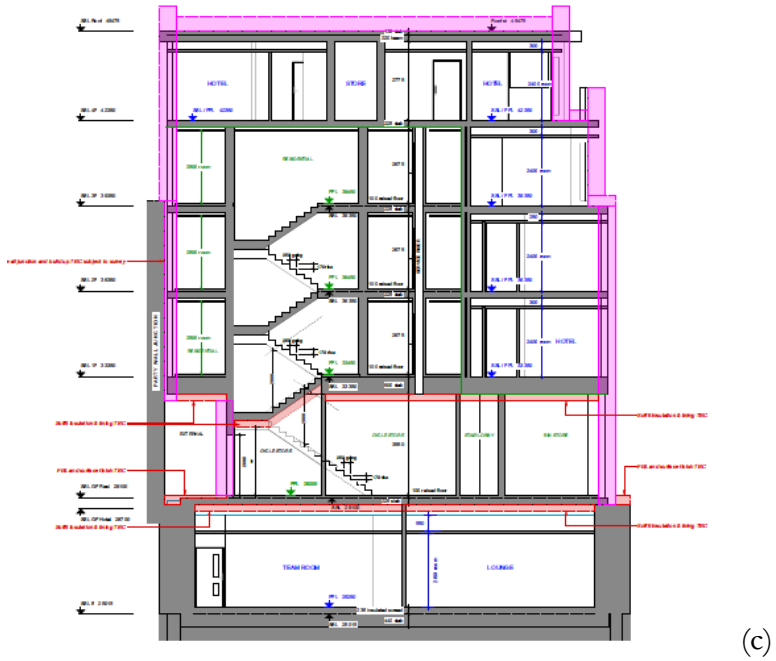


(c)

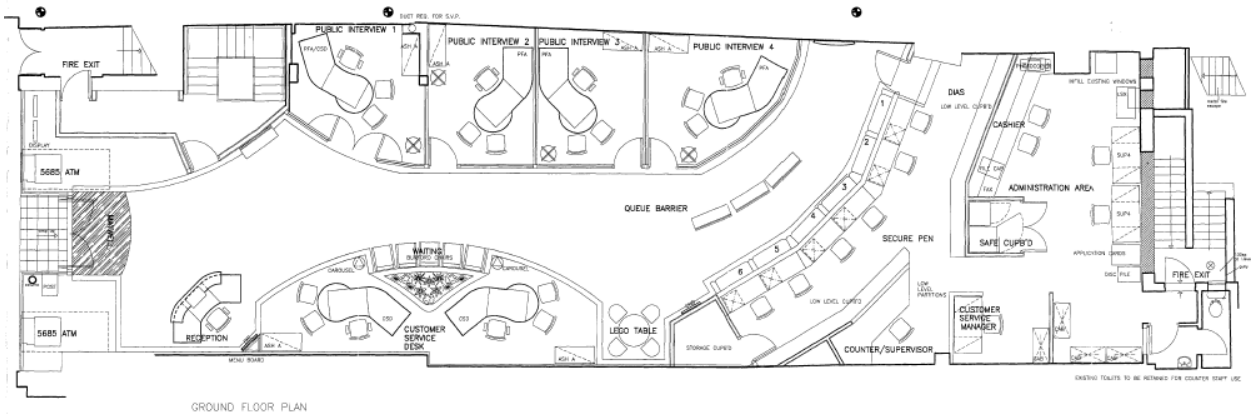
	Clancy Consulting Ltd 115-119 Camden High Street	**Figure** **2**
	The existing property (a) View (b) plan of ground floor (c) plan of basement	



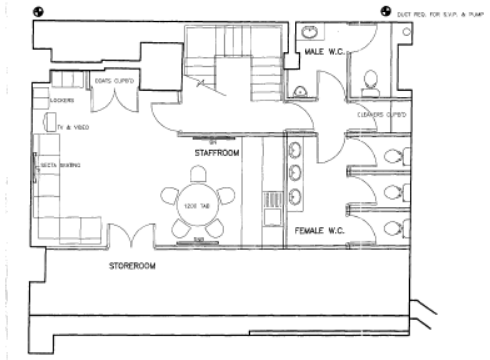




	Clancy Consulting Ltd 115-119 Camden High Street	**Figure** **3**
	The proposed structure (a) Plan of basement (b) plan of ground floor (c) north to south section	

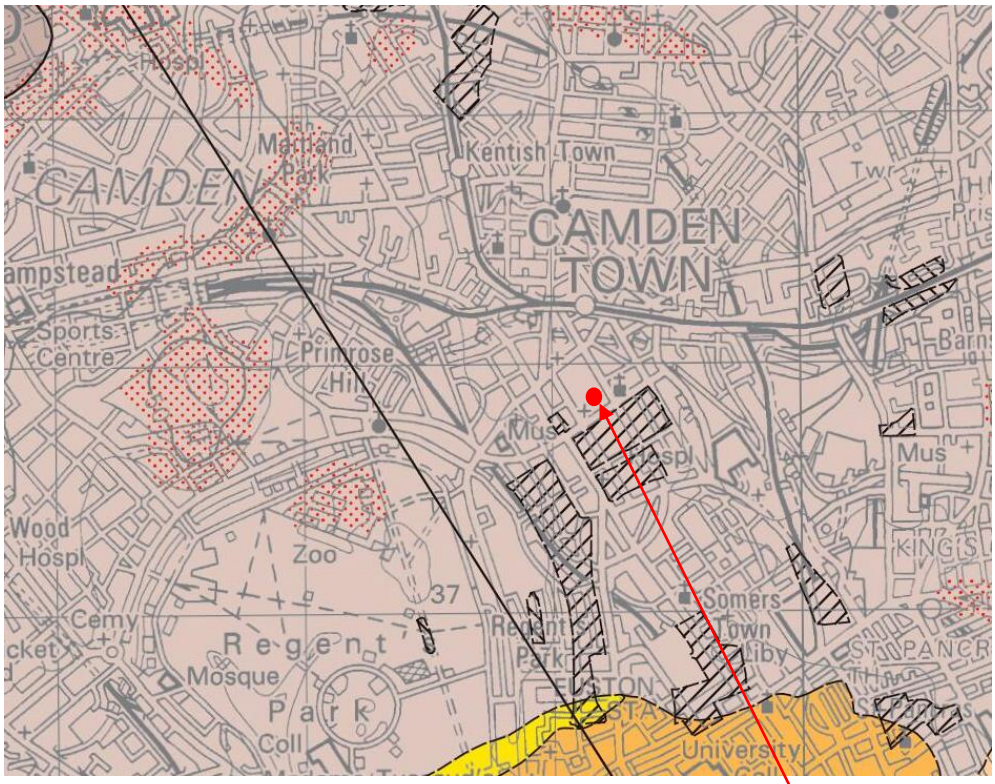


GROUND FLOOR PLAN

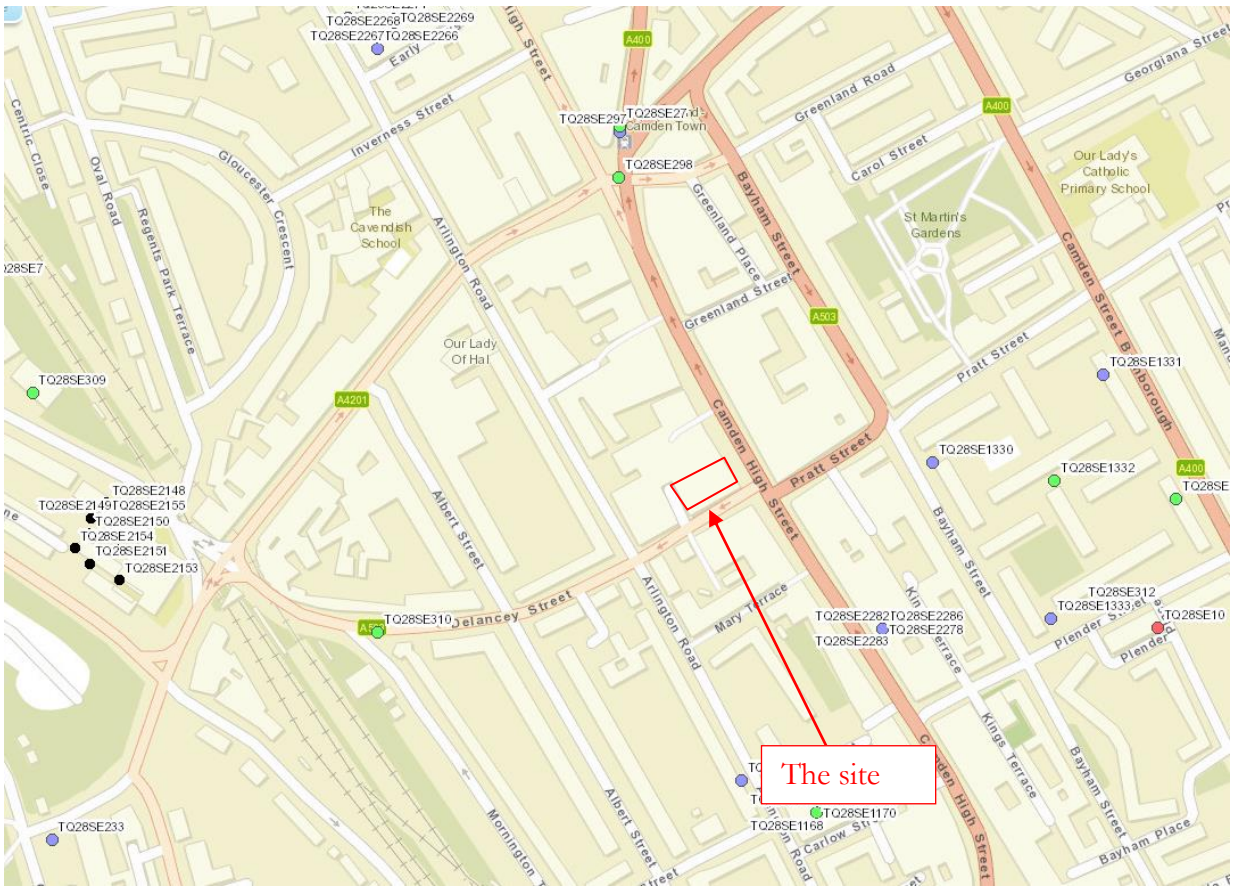


BASEMENT PLAN

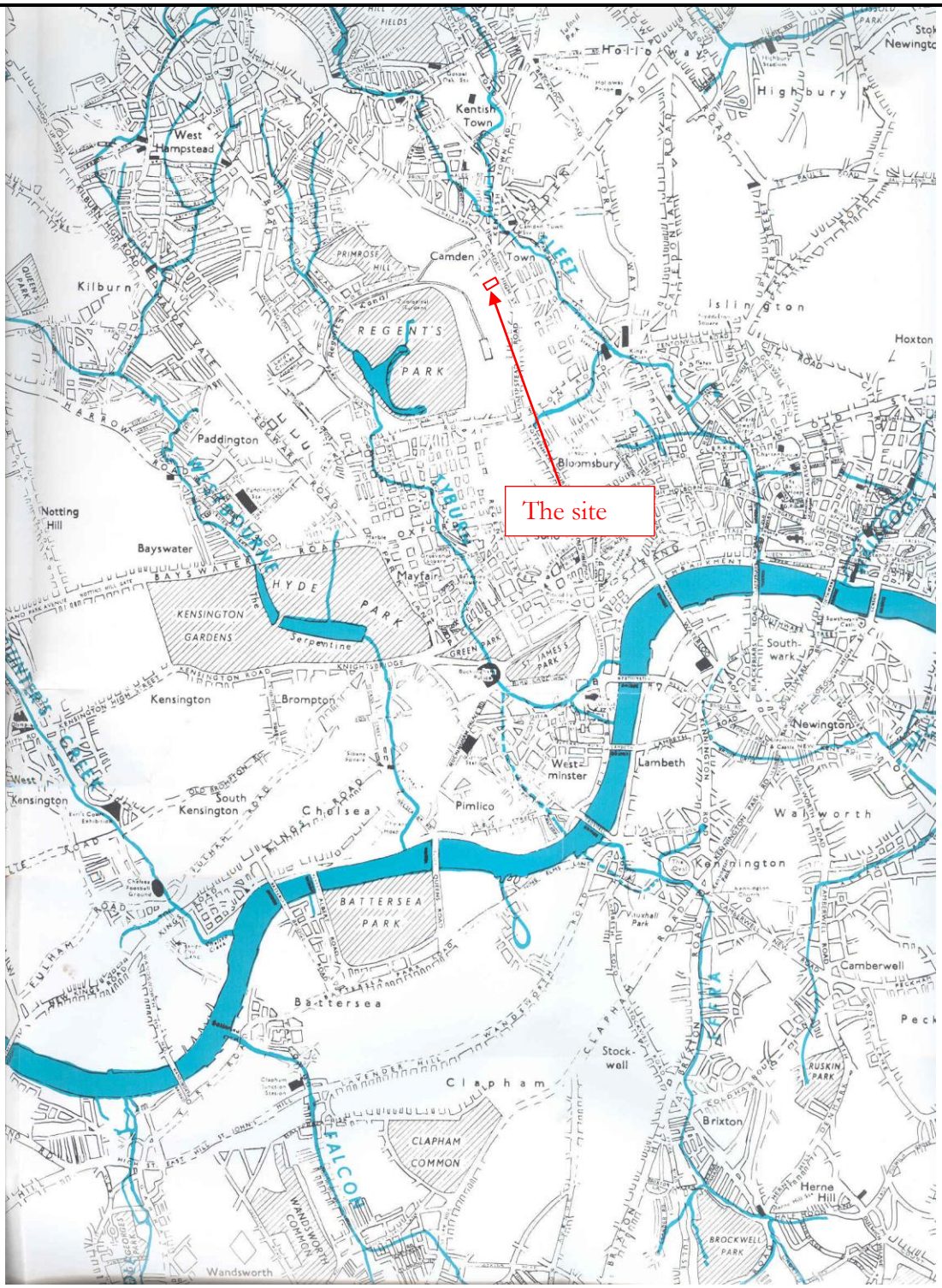
	Clancy Consulting Ltd 115-119 Camden High Street	**Figure** **4**
	121-123 Camden High Street Ground floor and basement plans	



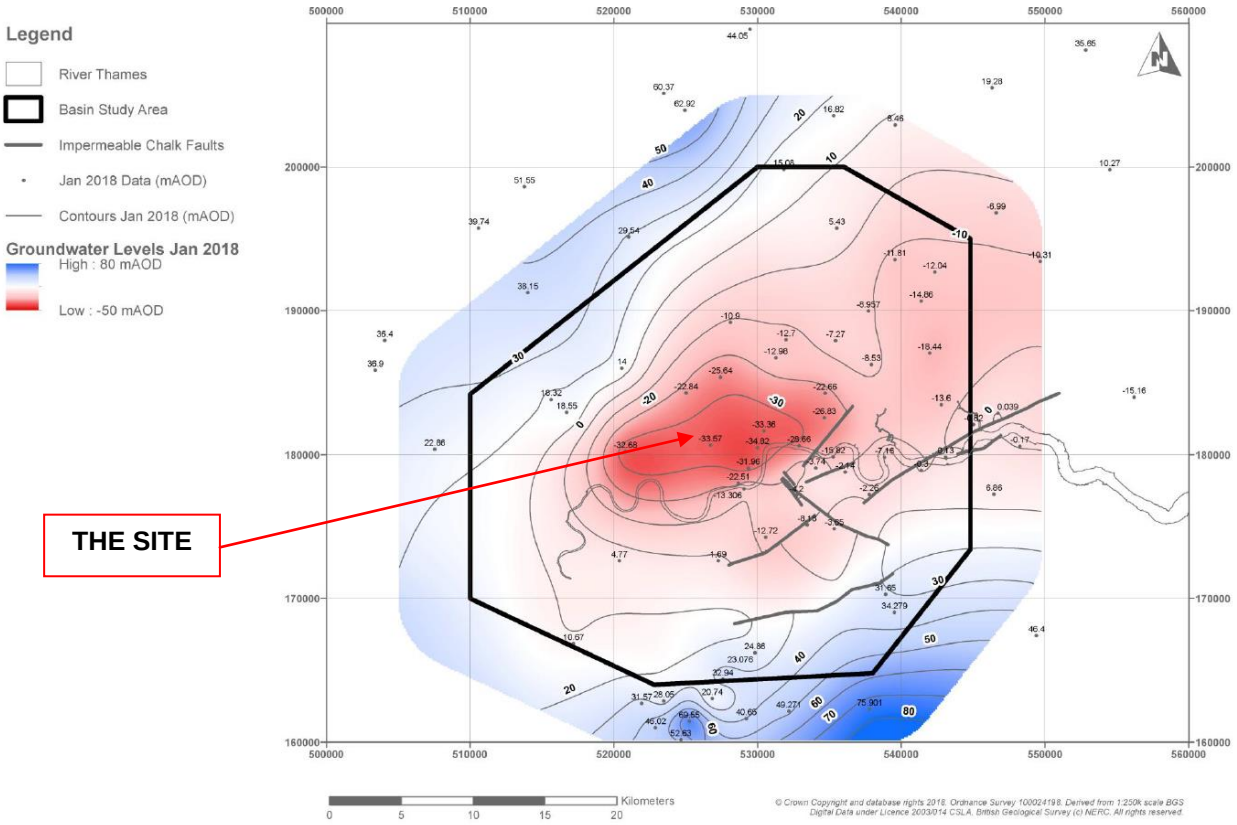
	Clancy Consulting Ltd 115-119 Camden High Street	**Figure** **5**
	Extract from The BGS Map North London, England and Wales Sheet 256. Solid and Drift Geology 1: 50,000.	



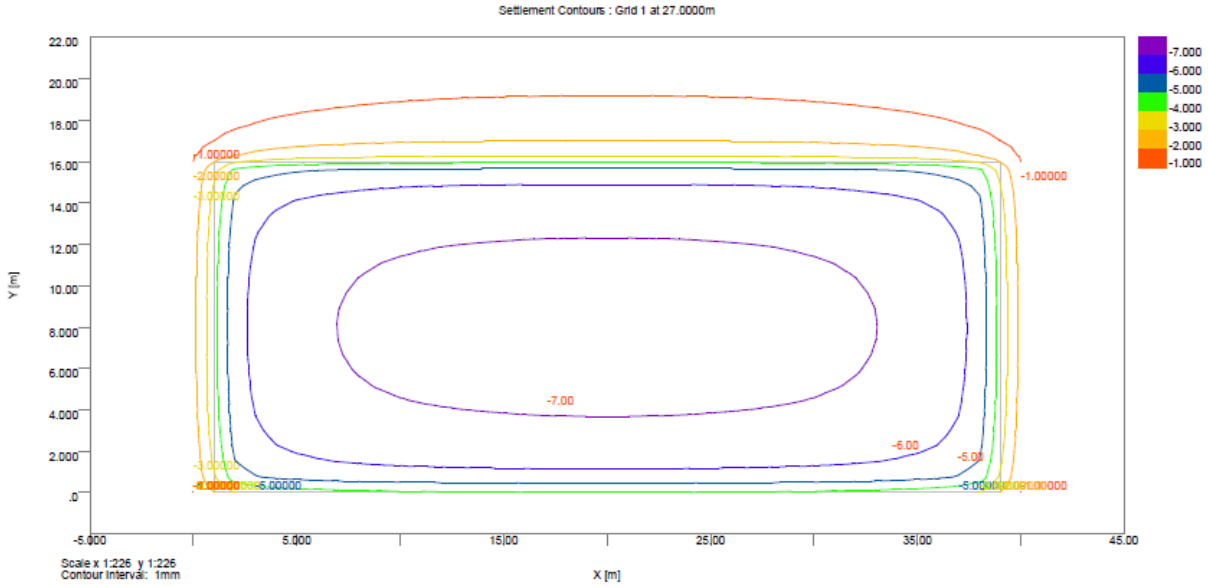
	Clancy Consulting Ltd 115-119 Camden High Street	**Figure** **6**
	Location of record boreholes	



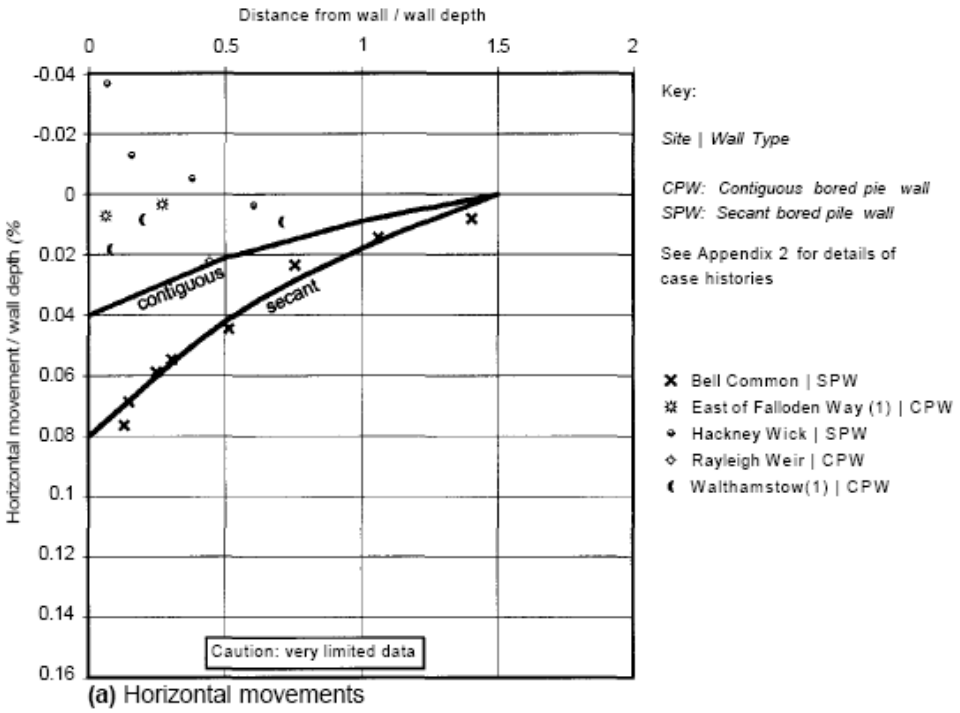
	Clancy Consulting Ltd 115-119 Camden High Street	**Figure** **7**
	Extract from Lost Rivers of London	

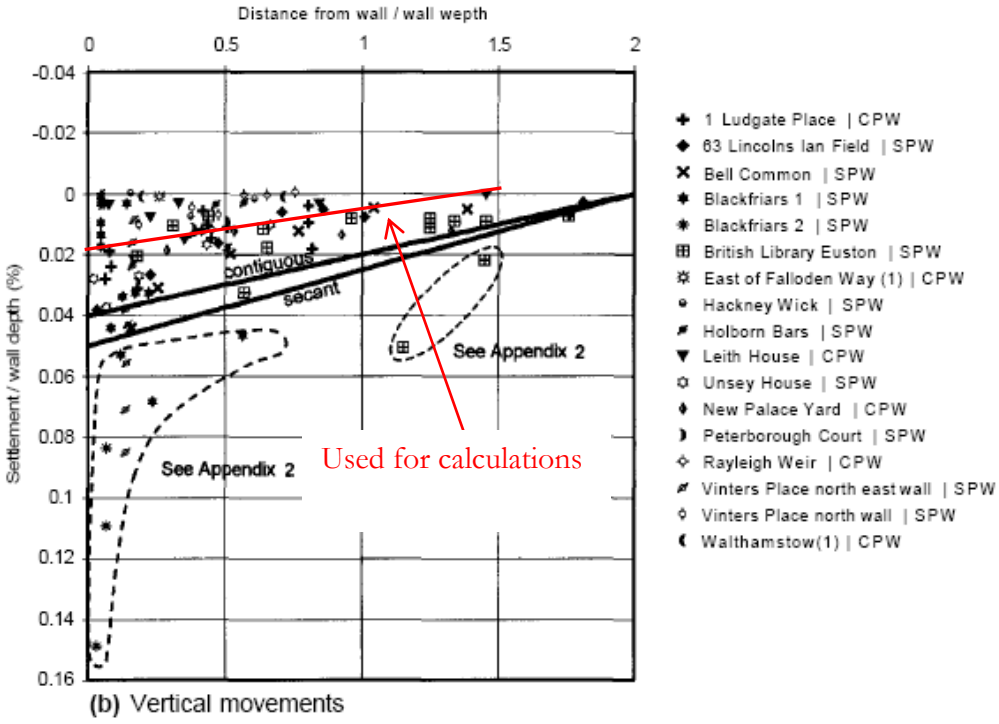


	Clancy Consulting Ltd 115-119 Camden High Street	**Figure** **8**
	Levels of deep aquifer Environmental Agency 2018	

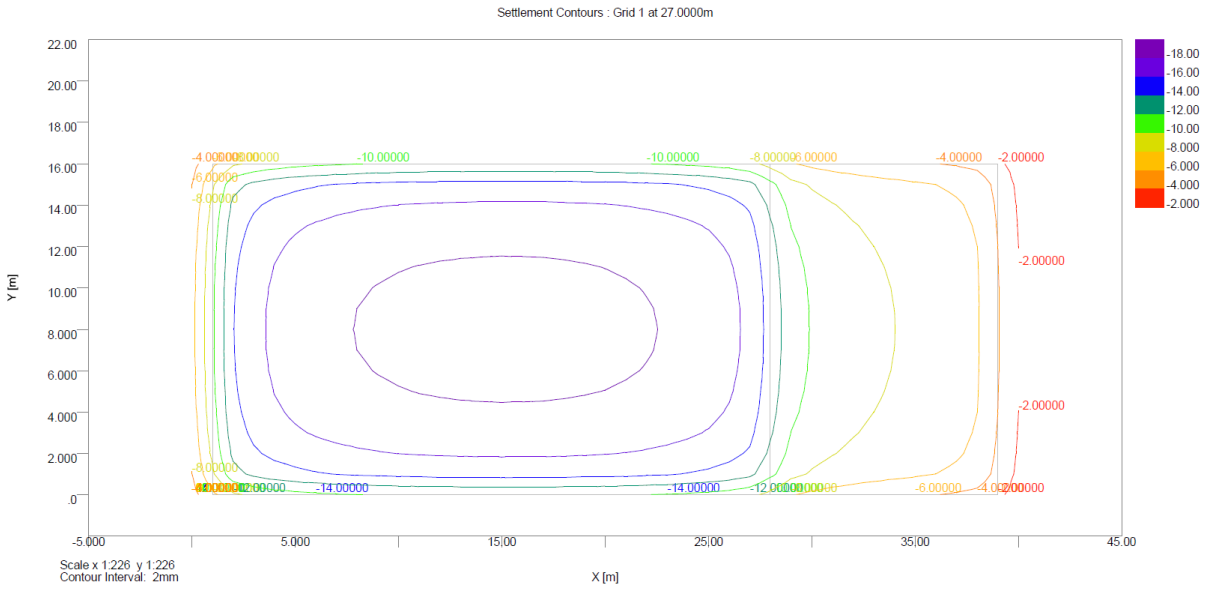


	Clancy Consulting Ltd 115-119 Camden High Street **Estimated ground movements due to the demolition of the existing building**	**Figure** **9**

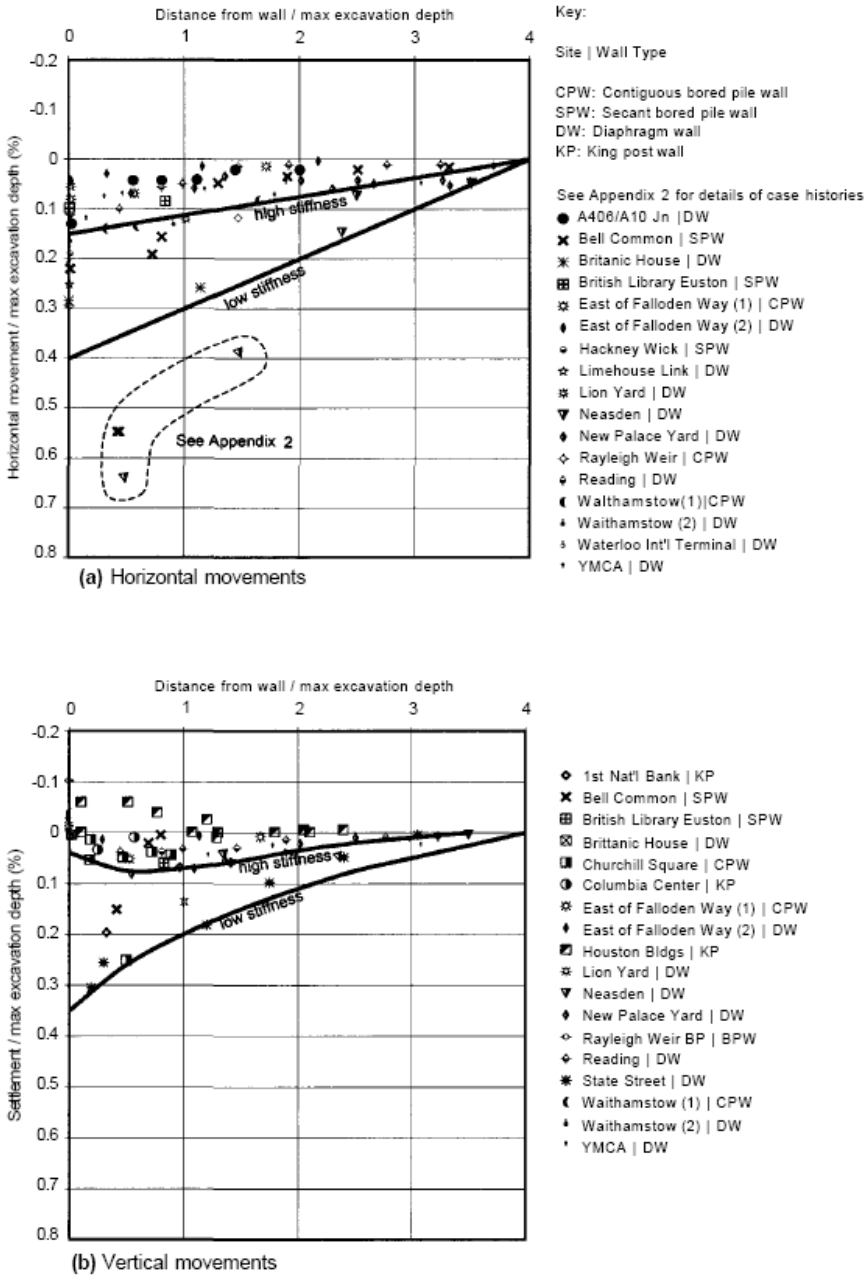




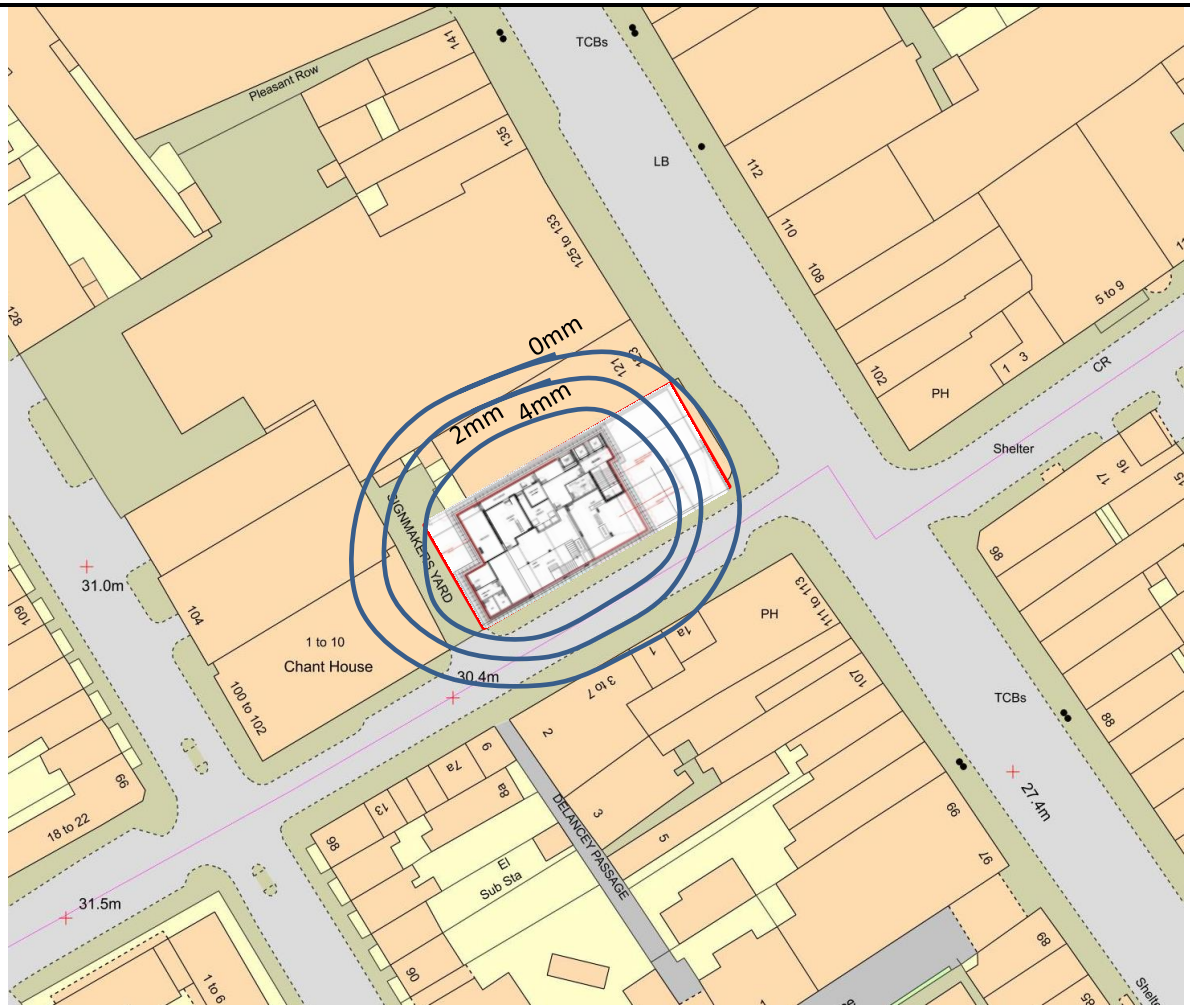
	Clancy Consulting Ltd 115-119 Camden High Street	**Figure** **10**
	Field measurements of ground movements due to bored pile wall installation in stiff clay (CIRIA C760)	



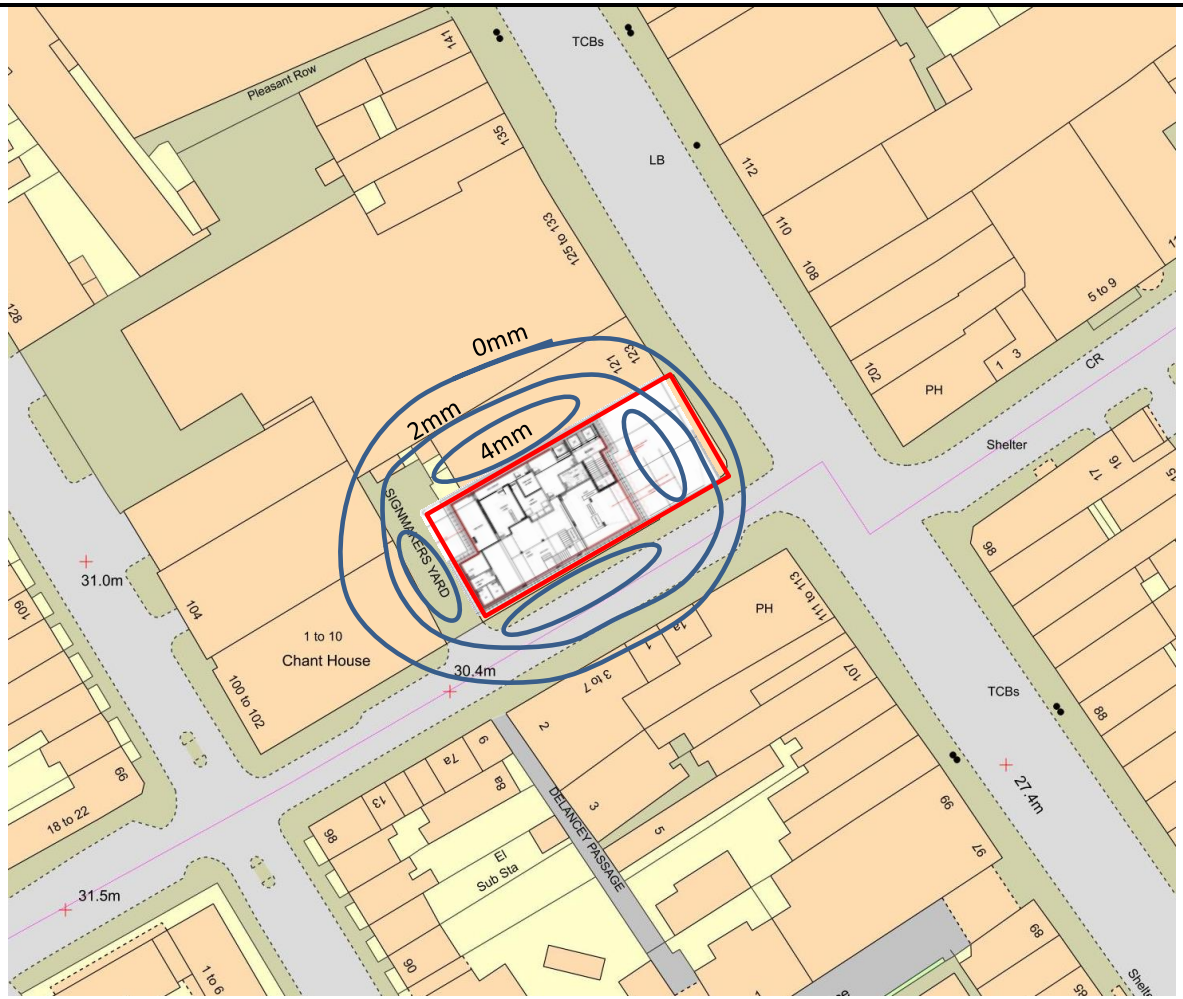
	Clancy Consulting Ltd 115-119 Camden High Street	**Figure** **11**
	Estimated ground movements at the end of excavation	



	Clancy Consulting Ltd 115-119 Camden High Street	**Figure** **12**
	Field measurements of ground movements due to excavation in front of wall in stiff clay (CIRIA C760)	



	Clancy Consulting Ltd 115-119 Camden High Street	**Figure** **13**
	Ground movements induced around the site Total horizontal movements behind retaining walls	



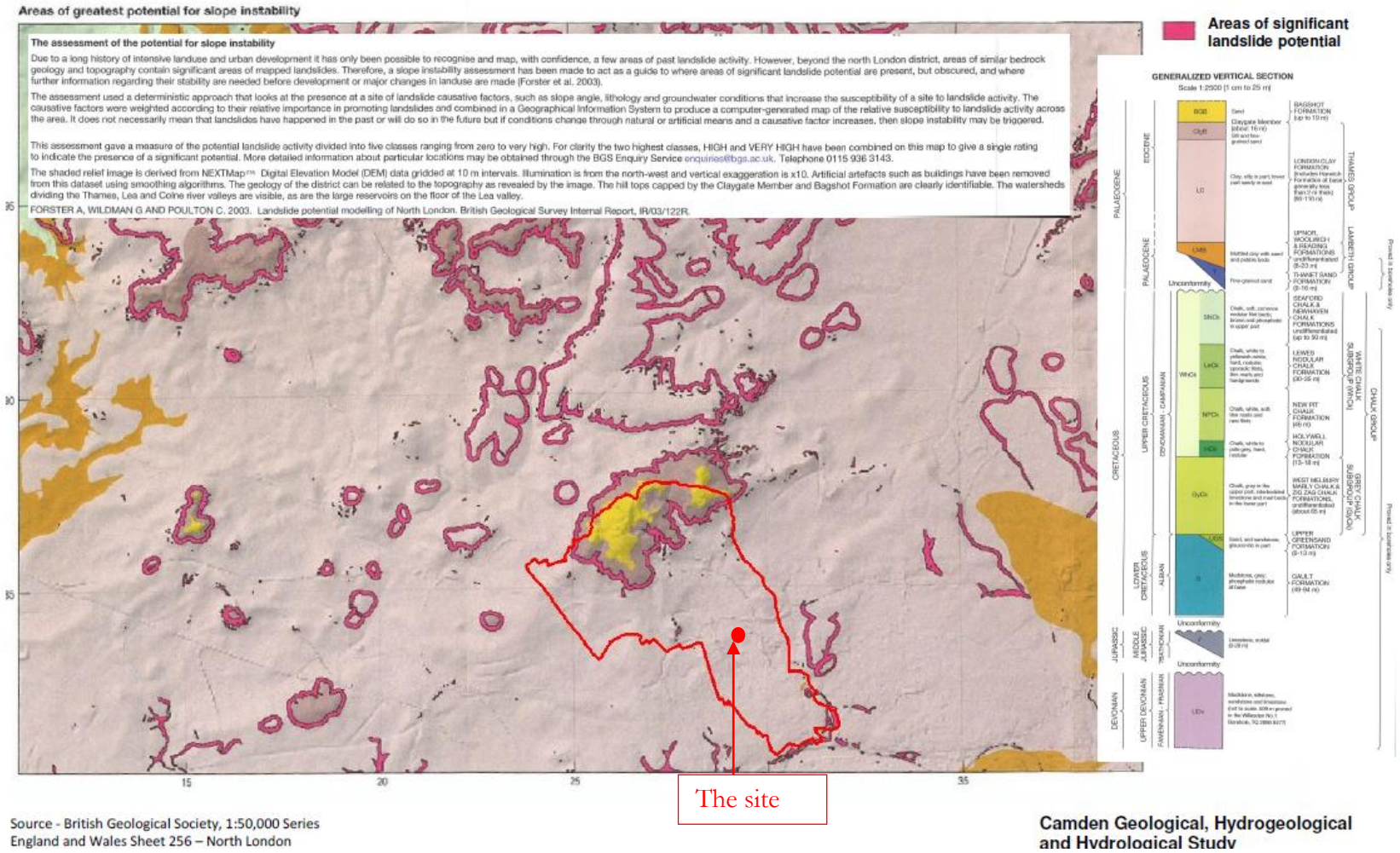
	Clancy Consulting Ltd 115-119 Camden High Street	**Figure** **14**
	Ground movements induced around the site Total vertical movements	

Category of damage	Description of typical damage (ease of repair is underlined)	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 linings. 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.	

Clancy Consulting Ltd
115-119 Camden High Street

Damage Category Table, Ciria C760

Figure
15



	Clancy Consulting Ltd 115-119 Camden High Street	**Figure** **16**
	Areas of significant landslide potential (Arup 2010)	