Basement Impact Assessment
Vine House, Hampstead NW3 1AB

Hydrogeology, Land Stability and Ground Movement Assessment

27 May 2020

MAUND GEO-CONSULTING

Produced for:

Croft Structural Engineers
Clock Shop Mews,
Rear of 60 Saxon Road
London SE25 5EH

Prepared by:

Julian Maund BSc PhD CEng MIMMM CGeol FGS
UK and Ireland Registered Ground Engineering Adviser

Maund Geo-Consulting Ltd
3 Coopers Square
Chipping Norton
OX7 5DG

T 07817018716
E julian.maund@gmail.com

MGC-BIA-19-34-V4

Report Title	Basement Impact Assessment	**Site Address**	Vine House, Hampstead, London NW3 1AB
Work Stage	Hydrogeology, Land Stability and Ground Movement Assessment	**Report Date**	May 2020
Brief Description of the Report Contents	Desk study and geotechnical interpretation of the ground and groundwater conditions, for a Basement Impact Assessment and Ground Movement Assessment		

Document Control Sheet

Project Title	Basement Impact Assessment Vine House, Hampstead, London NW3 1AB
Report Title	Hydrogeology, Land Stability and Ground Movement Assessment
Reference	MGC-BIA-19-34-V4
Revision	3
Status	Final
Control Date	27May 2020

Record of Issue

Issue	Status	Date	Author	
A	Draft	05/12/19	Julian Maund BSc PhD CEng MIMMM CGeol FGS Registered Ground Engineering Adviser	
B	Final	11/12/19	Julian Maund BSc PhD CEng MIMMM CGeol FGS Registered Ground Engineering Adviser	
C	Final (correction to Figure 5.2 caption)	23/03/2020	Julian Maund BSc PhD CEng MIMMM CGeol FGS Registered Ground Engineering Adviser	
D	Response to audit D1 dated 1/05/2020	27/05/2020	Julian Maund BSc PhD CEng MIMMM CGeol FGS Registered Ground Engineering Adviser	

Distribution

Organisation	Contact	Copies	Date
Croft Structural Engineers	Geoff Watson	1	27/05/2020
Campbell Reith	Kat Barker	1	27/05/2020

Contents

1 Non-Technical Summary

A basement impact assessment (BIA) has been undertaken for hydrogeology and land stability in general accordance with 'CPG Basements' (2018) for the site within the grounds of Vine House, Hampstead, London NW3 1AB, in the London Borough of Camden.

The proposed basement is located at Vine House, a detached house surrounded by gardens and driveway. The basement will extend below the footprint of the building to provide additional accommodation.

The BIA report considered relevant information from existing sources included in the 'Guidance for subterranean development' produced for the London Borough of Camden' (November 2010) and a Groundsure Enviro/Geo insight report with historical maps and BGS records.

A ground investigation at the site was undertaken by Ground and Water Ltd on 04/11/19 which comprised three boreholes to determine the ground conditions and two hand dug trial pits to expose wall footings. The boreholes were drilled to depth of between 5.45 and 8.45 m below ground level (bgl), while the trial pits were excavated to depths of 1.1 and 1.3 m bgl.

The ground investigation determined the ground conditions as a layer of Made Ground of a clayey sand with gravel of flint brick concrete and clinker from circa 125.3 m AOD between 0.9 and 2.1m bgl overlying the Bagshot Formation of gravelly sand, clayey sand and sandy clay.

Groundwater was not encountered during the ground investigation. Subsequent monitoring indicated no groundwater present to at least 4.95m bgl or circa 120.35 m AOD. An existing borehole 50 m to the west of the site indicated possible groundwater at 108m AOD.

An assessment of land stability has been made from the excavation and construction of the basement. Due to the predominantly granular nature of the geology heave is not anticipated. The foundation formation will be able to accommodate a maximum imposed load modelled as a conservative worse case from the retaining walls of 100 kPa with settlement of < 25 mm.

An arboricultural survey undertaken in June 2019 has determined that the basement will not impinge in root protection area from existing trees.

The proposed basement construction will comprise concrete underpins installed on a hit and miss principle.

A ground movement assessment has been undertaken for the host property, a Grade II listed building, and the neighbouring property of High Close House. The assessment has determined a Damage Assessment Category of less than 1 for High Close House and 1 for Vine House.

2 Introduction

2.1 Terms of Reference

Maund Geo-Consulting Ltd was instructed on 4 November 2019 by Croft Structural Engineers Ltd (Croft) to undertake the hydrogeology and geology sections of a Basement Impact Assessment (BIA) including a Ground Movement Assessment (GMA) for a proposed development at Vine House, Hampstead, London NW3 1AB. The hydrology section of the BIA is being undertaken separately by Croft.

2.2 Scope and Objective

This report has been written in general accordance with 'Camden geological, hydrogeological and hydrological study - Guidance for subterranean development' produced for the London Borough of Camden (LBC) by Arup (November 2010), hereafter referred to as the GSD. The guidance sets out the methodology for a risk-based impact assessment to be undertaken with regard to hydrology, hydrogeology and land stability in support of Local Plan Policy A5 (2017). The BIA comprises stages in which information is obtained to enable LBC to decide on the impact of the development for the planning application. The LBC Guidance CPG Basements (March 2018) requires a BIA to be undertaken for new basements in 5 stages:

1. Screening
2. Scoping
3. Site investigation
4. Impact assessment
5. Review and decision making (By LBC)

As a site investigation has already been undertaken as part of the BIA for Vine House (Factual Report included in Appendix B) the screening part of the assessment has been assessed based on existing information including the site investigation, so the project has been completed in the following sequence:

1. Desk Study of background information
2. Site Investigation including interpretation of ground conditions
3. Screening
4. Scoping
5. Impact Assessment

This report considers the hydrogeological and land stability elements of the BIA only. Hydrology is considered in a separate report by Croft Structural Engineers Ltd.

2.3 Author

This report has been prepared by Dr Julian Maund, director of Maund Geo Consulting Ltd, who is a chartered engineer and chartered geologist with over 35 years' experience. Dr Maund is a UK and Ireland Registered Ground Engineering Adviser and a member of the Association of Geotechnical Specialists.

2.4 Sources of Information

Background information has been derived from Groundsure Geo Insight and Enviro Insight reports obtained on 5/11/19 for the site (Appendix F). Geological information has been derived from on-line BGS sources (Geology of Britain Viewer) and the GSD. Mapping and aerial photography have been obtained from Google Earth. The full list of information is shown below in Table 2.1. Information is also derived from the site investigation undertaken specifically for the proposed development by Ground and Water Ltd on 4/11/19.

The following baseline data indicated in Table 2.1 have been referenced to complete the BIA in relation to the proposed development:

Table 2.1 Information type and sources

Information Type	Source
Site walkover	During SI on 4/11/19
Current/historical mapping	Groundsure Reports, Google Earth
Geological mapping	GSD
Underground tunnels	Groundsure
Hydrogeological data	Groundsure/GSD/EA
Current/historical hydrological data	Groundsure/GSD/EA/ LBC
Flood risk mapping	Groundsure/GSD EA/ LBC
Unexploded Ordnance	(http://bombsight.org)
Ground and groundwater conditions	Site Investigation

3 Desk Study - Background Information on the Site

3.1 Location

The site is located at Vine House Hampstead Square, NW3 1AB in the Hampstead Village area of the London Borough of Camden.

3.2 Description

The existing building comprises a three storey detached house occupying a central location in a garden off Hampstead Square as shown in Figure 3.1.

Figure 3.1 South Elevation (From Drawing VH-PP-11 2015)

3.3 Present use

Vine House is a residential dwelling and is currently occupied by the owner who is proposing the basement construction. The area of the proposed basement is below the entire footprint of the house and the garden room adjoining the east of the house.

3.4 Proposed use

The proposed development relevant to this BIA is understood to comprise a basement for provision of additional accommodation. The proposed basement measures approximately up to 23 m in an E-W direction and 12 m in an N – S direction as shown on the proposed basement plan SL50 in Appendix A.

3.5 Topography, geomorphology and drainage

The ground level at the site is at approximately 125.30 m AOD. No detailed topographical survey is currently available. The land in the vicinity of the site slopes down to west, south and east from the north, where Hampstead Heath forms an area of high ground at circa 135m AOD as indicated in Figure 3.2, forming a distinctive geomorphological feature.

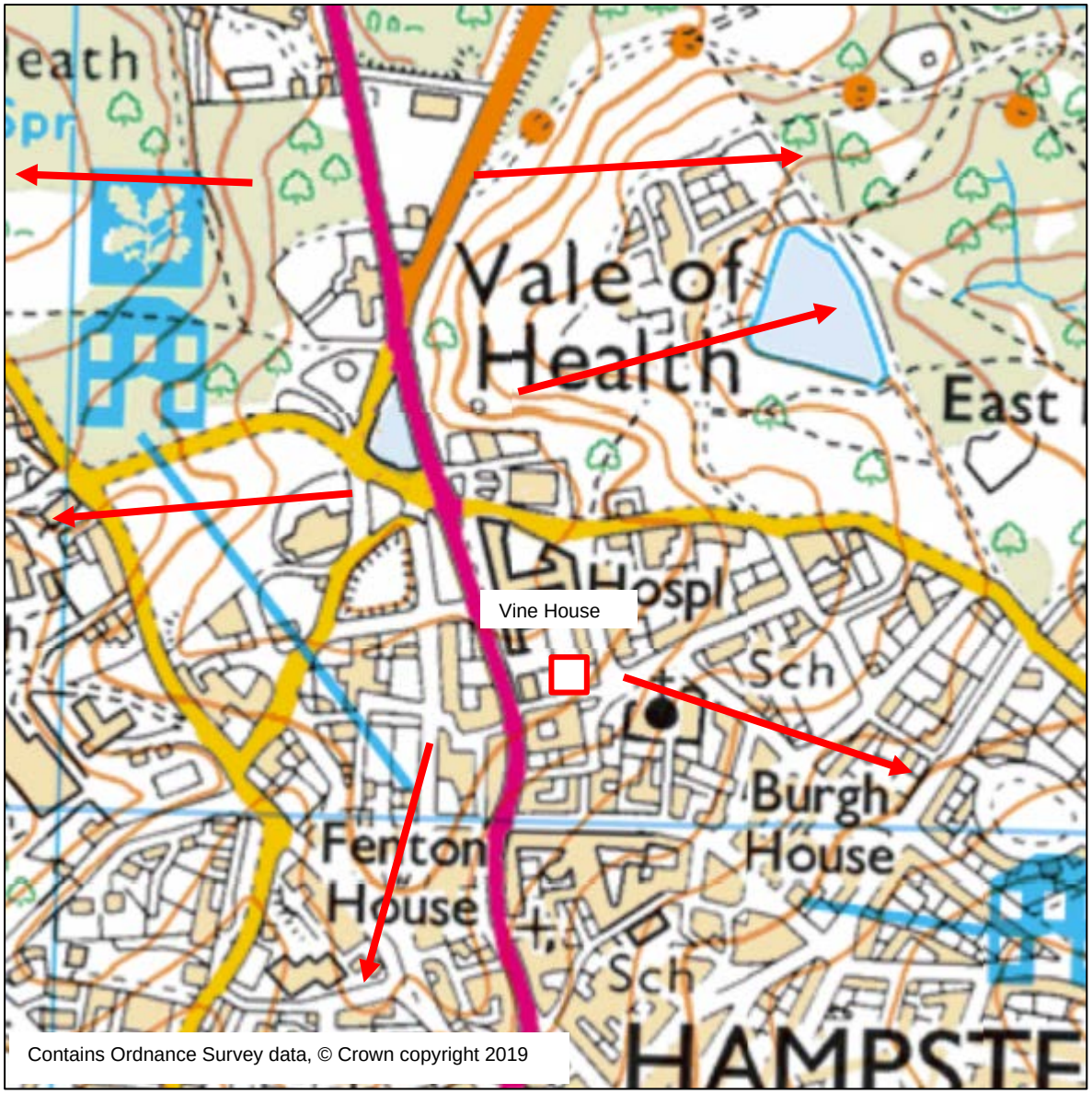

Figure 3.2 Regional topography at Vine House with arrows indicating direction of downwards slopes

Whitestone Pond is located about 200m to the north at approximately 129 m AOD and Vale of Health Pond 500m to the north east at approximately 110m AOD. Further Hampstead Ponds lie 1 km to the east of the site. These Ponds are on lower ground on lower ground between approximately 100 and 70m AOD.

The site itself is not within a Flood Zone. The nearest risk of surface water flooding is located 40m to the south west of the site, which is identified as a low risk from the UK Government Flood risk website https://flood-warning-information.service.gov.uk/long-term-flood-risk/map as indicated on the surface water flooding map in Figure 3.2 below.

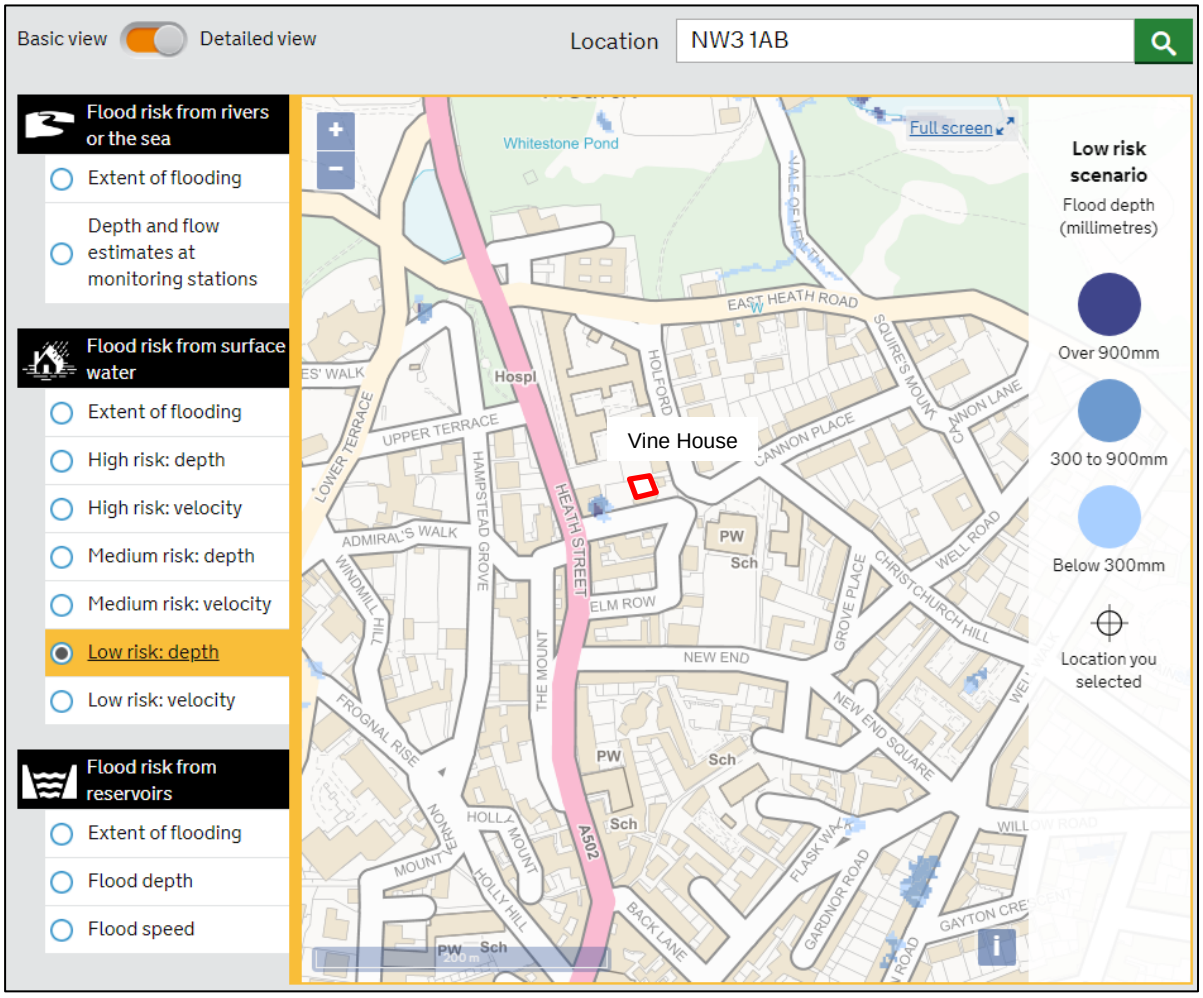

Figure 3.2 Surface water flooding

3.6 Geology

Geological information obtained from Figure 4 of the GSD at 1: 10 000 and the BGS website geological mapping at 1 50 000 scale shows the site to be directly underlain by the Bagshot Formation, which comprises a predominantly fine to coarse sand, locally clayey and gravelly. No superficial deposits are shown as indicated in Figure 3.3

A review of boreholes in the vicinity available from the BGS Geology of Britain Viewer indicates comparable geology. The closest existing available borehole is OF4 (BGS Ref. TQ/28NE/91) located at the corner of Hampstead Square and Heath Street, approximately 50m to the west of the site. The borehole indicates 600mm of Made Ground overlying sandy gravel and sandy clay to a depth of ~3m, then silty sand to a depth of ~9m (Bagshot

Formation), below which is stiff clay probably of the Claygate Member. OF4 is included in Appendix C.

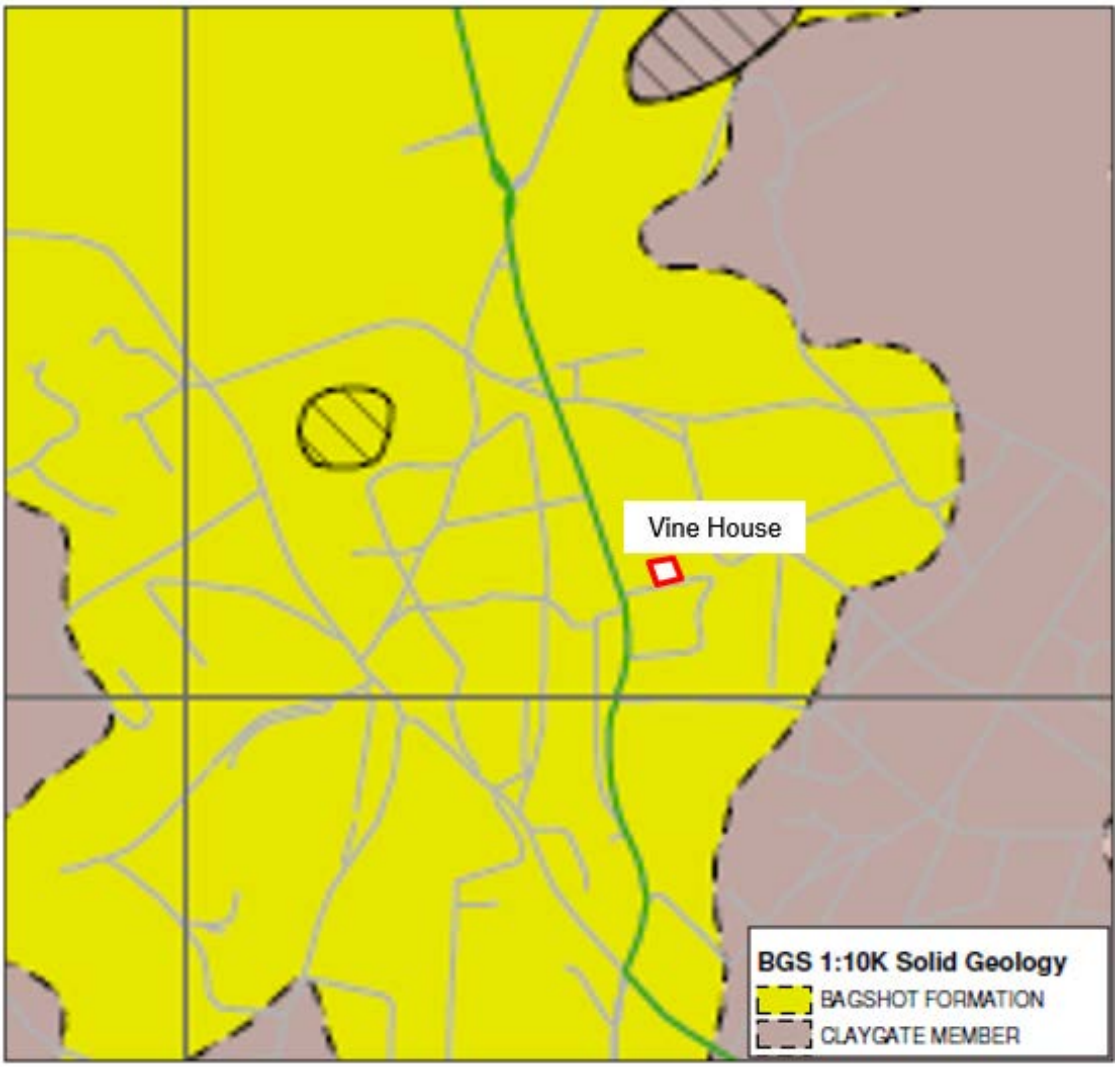

Figure 3.4 Geology

3.7 Hydrogeology/groundwater

The property is located on the Bagshot Formation, which is classified as Secondary (A) Aquifer. Figure 8 of the GSD confirms this classification.

The site does not lie within a ground water protection zone.

The site is located to the south of the Hampstead Heath surface water catchment and drainage as indicated in Figure 3.5 extracted from Figure 14 of the GSD.

3.7.1 Groundwater level

The ground investigation by Ground and Water at the site in November 2019 did not encounter groundwater to a depth of 8.45m (circa 120.35m AOD). Borehole OF4 indicated (included in Appendix C) wet sand at a depth of 17m or approximately 108m AOD.

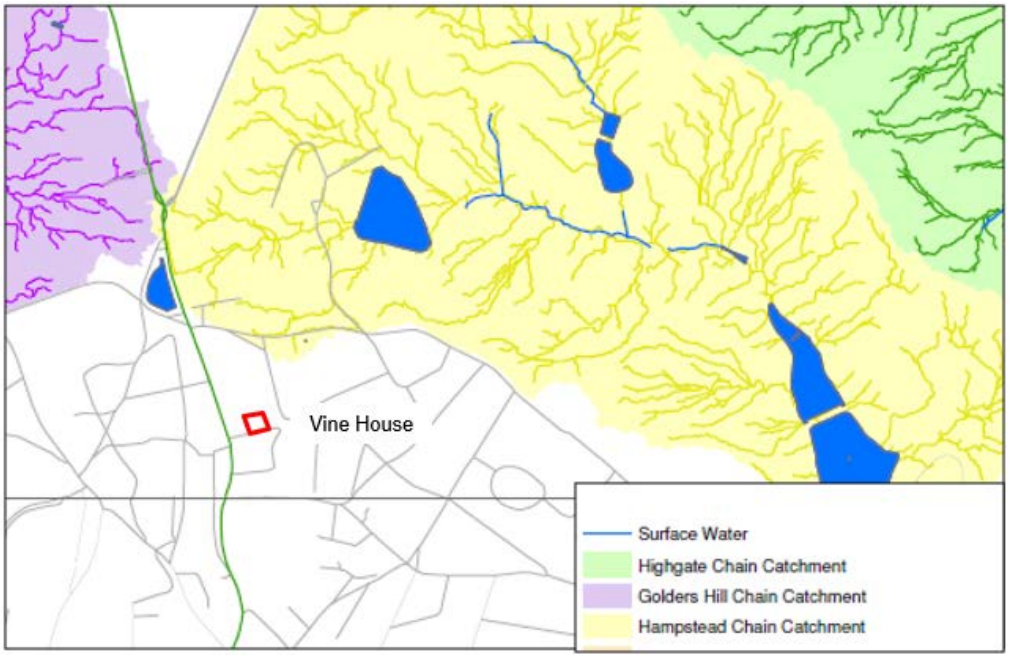

Figure 3.5 Surface water catchments

3.8 Natural Hazards

The Groundsure report (Appendix F) findings on natural hazards are summarised in Table 3.1

Table 3.1 Natural Hazards

Natural Hazard	Risk (Stated by BGS in Groundsure report)	Comment
Natural ground subsidence	Low	No records of subsidence in the vicinity
Shrink-Swell	Negligible	The site is underlain by the Bagshot Formation, a predominantly sandy material. This is an important factor giving a very low heave potential from the basement excavation.
Landslide	Very Low	The site itself is on level ground
Soluble Rock	Negligible	Not applicable to the site geology
Compressible Ground	Negligible	Not applicable to the site geology
Collapsible rock	Very Low	Not applicable to the site geology
Running Sand	Low	The clay content in the sand may make this a low risk
Radon	Not in a Radon affected area	No Radon protection measures are necessary

3.9 History of site

The Groundsure Insights Maps in Appendix E includes historical mapping surveys from 1870 to 2003. A Heritage Assessment Report by Archangel Heritage (reference AH0268 24/06/19) also provide historical information.

Vine House was constructed around 1715 and is now a Grade II listed property.

Vine House and the land within the property boundary has shown little change since 1870. A heritage assessment by Archangel Heritage (June 2019) indicates that the rear of the house was built in the late 18th century / early 19th century with the parapet being added in the 20th century; the curved bays at the sides were also added after the original construction.

The adjacent property to the north, High Close, appeared on the 1896 map. There was no apparent change to this property until after the 2003 map, where the property has been extended in recent years.

3.9.1 WW2 bomb sites

A record of known bomb sites is presented in Figure 3.6 from the website http://bobsight.org. While this does not claim to be a definitive record, it shows nothing recorded in the environs of the site. The lack of change of building development in the area of the site suggests no bomb related destruction occurred at the site.

Figure 3.6 WWII Bomb record

3.10 Underground features

The Groundsure Geoinsight Report (Appendix F) has not identified any mining, underground workings or natural cavities within at least 500 m of the site.

The Groundsure Geoinsight Report (Appendix F) has not identified any tunnels or railways within 50m of the site.

3.11 Other factors e.g. contamination and archaeology

The Groundsure Enviroinsight Report (Appendix F) has not identified any 'Environmental Permits, Incidents and Registers' or 'Landfill and Other Waste Sites' within at least 250 m of the site boundary.

The Groundsure Enviroinsight Report has identified one 'potentially contaminative use, 18 m from the site. This is Queens Mary Hospital to the NW of the site.

No specific archaeological investigation has been undertaken. The 'Groundsure' survey has not identified any known 'Environmentally Designated Sensitive Sites' within 250 m of the site.

4 Site Investigation

A site investigation was undertaken by Ground and Water Ltd on 04/11/19. A report of the site investigation comprising exploratory hole records and laboratory testing is included in Appendix B.

The site investigation comprised:

- 3 No. boreholes carried out using windowless sampler borehole methods to a depth between 5.45 to 8.45 m bgl,
- 2 No. hand dug trial pits to expose footings,
- The in-situ strengths of the subsoil encountered were assessed by means of SPTs at 1 m intervals,
- Disturbed soil samples were obtained from the boreholes for laboratory geotechnical and contamination testing and further examination.
- A 50 mm diameter groundwater monitoring well was installed to a depth of 5.0 m in BH WS3

The locations of the above exploratory holes are shown in Figure 4.1 below taken from the Ground and Water Factual report included in Appendix B.

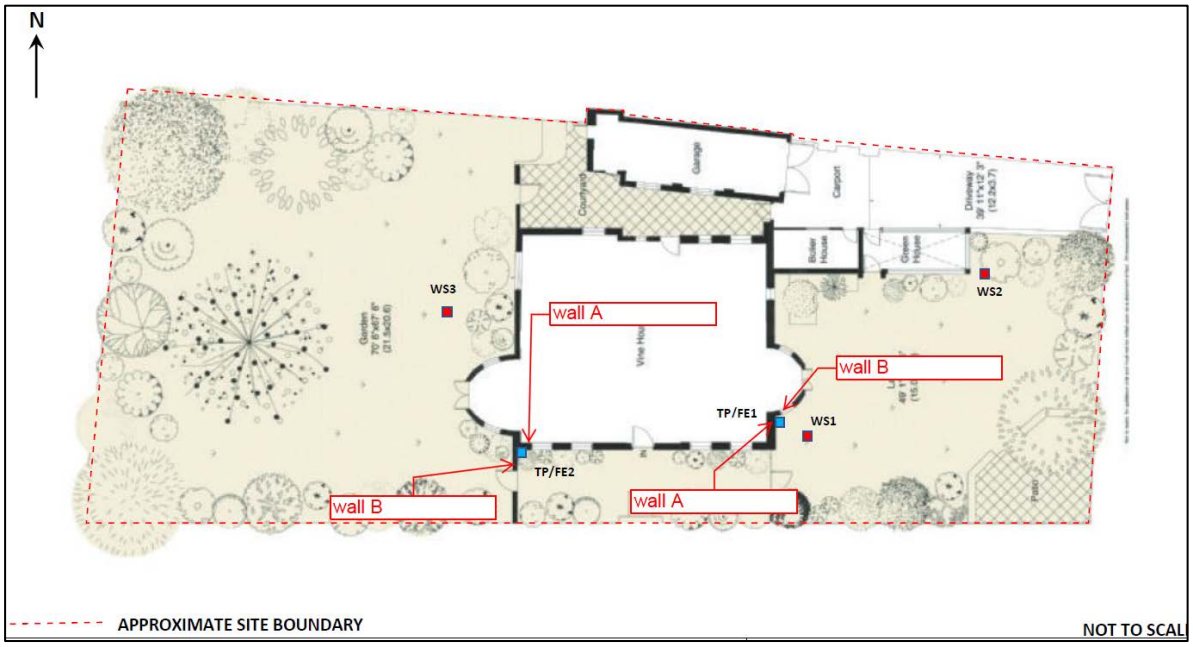

Figure 4.1 Exploratory hole locations

4.1 Details of laboratory tests

Laboratory tests to determine the geotechnical and contaminative properties of the soil were scheduled by Ground and Water Ltd and carried out K4 Soils Ltd and DETS Ltd generally in accordance with BS1377:1990 and UKAS. The tests included:

- 3 PSD (BS1377:1990)
- 1 Water soluble sulphate and pH (BS1377:1990)
- 3 Soil contamination tests which include:

Asbestos Screen, pH, Sulphate, total organic compound, metals, PAH and TPH. For a full list of contaminants refer to the factual report in Appendix B

5 Ground Conditions

5.1 Stratigraphy

The ground conditions encountered are summarised in Table 5.1 below. For a full description refer to exploratory records in Appendix B.

Table 5.1 Summary of ground conditions

Stratum	Description	Depth at top of Strata (mbgl)	Approx. level (m AOD)	Thickness of Stratum (m)	SPT N value
MADE GROUND	Dark brown silty gravelly clayey sand or sandy clay with gravel of flint, concrete, brick, claystone and clinker	0.00	125.30	0.9 to 2.1	1 to 12
Bagshot Formation	Orange to brown gravelly silty SAND	1.8 to 2.10	123.2 to 123.5	0.3 to 1.4	2 to 10
Bagshot Formation	Light Brown slightly clayey SAND, with occasional gravel and pockets of clay	2.1 to 3.5	120.3 to 123.2	Proven for 4.95	10 to 22

5.2 Groundwater

Groundwater was not reported during drilling to a depth of 8.45m.

Groundwater readings from post investigation monitoring on the site are shown in Table 5.2 indicating groundwater was not present to the depth of the monitoring installation.

Table 5.2 Groundwater monitoring in BH01

Date of monitoring	Groundwater Depth (metres below ground level – Approximately 125.3 m AOD)	Approximate Groundwater level (m AOD)
21/11/19	dry (to base of installation at 4.95m)	< 120.35
27/11/19	dry (to base of installation at 4.95m)	< 120.35

5.3 Consideration of the individual strata, with reference to the basement.

The anticipated formation level of the basement floor slab will be approximately 2.5 m bgl at 122.8 m AOD, within the Bagshot Formation. An excavation depth of 3.50 m is assumed for a ground movement assessment.

The overall ground model is illustrated in the conceptual model in Section 6.2 below.

5.3.1 Made Ground

Below existing ground level, the made ground has been described a dark brown silty gravelly clayey sand or sandy clay with gravel of flint, concrete, brick, claystone and clinker. Made ground encountered was 0.9 to 2.1m thick. This material may represent build-up of site levels around the house, although the reason for this is not apparent due to the lack of any significant changes in the site layout since the house was construction in 1715.

The description of the material indicates it is likely to display similar physical properties to the underlying Bagshot Formation, in terms of particle size distribution and stability.

The made ground is appears as an inert material with no visual or olfactory indications of contamination.

Contamination testing has been undertaken from WS1 at 0.3m, for a range of contaminants indicated in the laboratory test report included in Appendix B. The testing for Waste Acceptance Criteria, based on leachate testing, indicates the made ground comprises inert waste. However, an elevated level of lead was noted in WS1 at 0.3m with a concentration of 3980 mg/kg. From a single sample it is not possible to indicate if this is an exception, such as from a piece of lead flashing (it is noted in the Heritage Assessment Report (2019) that work to the roof was undertaken in 1952). As a precaution it is recommended that additional testing is undertaken prior to any excavation works. However, it is not considered to have any impact on the basement construction as the soil is not within the basement footprint itself.

5.3.2 Bagshot Formation

The Bagshot Formation (BF) was encountered during the site investigation at a depth from 0.9 to 2.1 m bgl to termination of BH01 at 8.45 m bgl. Upper layers of the BF have been described as more gravelly sand, in BH WS1 and WS2 before becoming a silty clayey sand. WS3 showed clayey sand directly below the made ground.

Particle size distribution tests for samples from WS1 at 2.5, 3.5 and 5.5 m bgl confirm the BF to have a sand content of 68.9, 79.3 and 85.2% respectively. The fines content (clay and silt < 63µm) was 7.8, 20.2 and 13.9% respectively.

SPT N values have been corrected for overburden pressure in accordance with BS EN ISO 22476-3: 2005 for sands. A plot of SPT $(N_1)_{60}$ values against depth is shown in Figure 5.1. The SPT $(N_1)_{60}$ plot shows values ranging between 3 and 25 in the BF, with a general pattern of N values increasing with depth to 6m, with decrease from 6 to 8m.

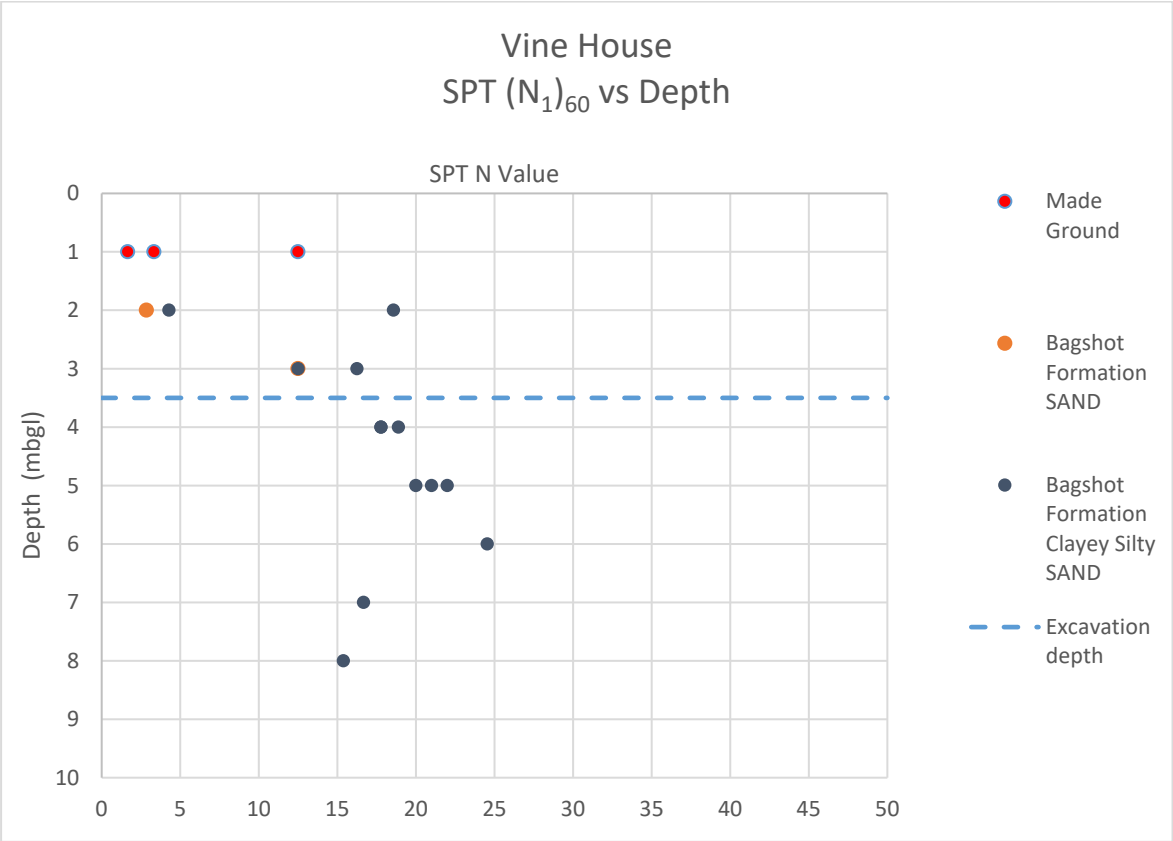

Figure 5.1 SPT $(N_1)_{60}$ values for the Made Ground and Bagshot Formation

Figure 5.2 shows the drained stiffness (Young's Modulus) profile based on correlation with SPT N values after Burland and Burbidge (in CIRIA C143, 1995) where E'/N = 2.0 MPa which is considered a cautious estimate of the characteristic value.

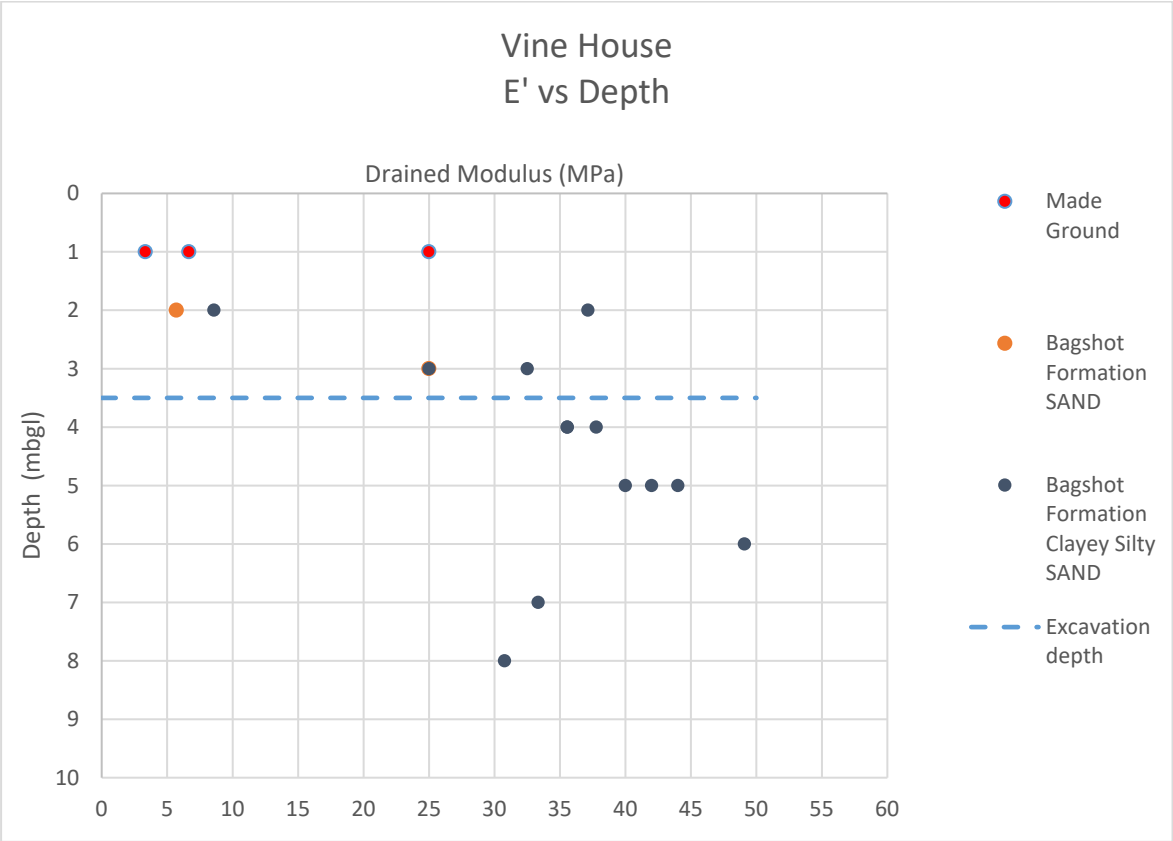

Figure 5.2 Relationship of stiffness with depth in Bagshot Formation

Poisson Ratio is taken as *v'* = 0.3 for the sand and clayey sand of the BF.

The characteristic values of geotechnical parameters are a cautious estimate in accordance with BS EN 1997, based on the data obtained from the ground investigation (Appendix B) have been summarised in Table 5.3 as follows:

Table 5.3 Geotechnical Design Parameters

Strata	Design Level m bgl / (mAOD)	Effective angle of shearing resistance MPa	Bulk unit weight kN/m³	Deformation Modulus (E') MPa	Poisson ratio v'	K_a	K_p
Made Ground (predominantly granular)	0 (~125.3)	28^0	17*	20	0.3	0.30	4.8
Bagshot Formation	2.0 (~123.3)	30^0	17*	37	0.3	0.30	4.8

Notes:

*BS8004 2015 (in the excavation zone)

Active and Passive pressure coefficients k_a and k_p from BS EN 1997-1 Annex C

The parameters in Table 5.3 are unfactored (Serviceability Limit State) and considered to be 'a cautious estimate'.

Active and Passive coefficients K_a and K_p are assumed the same for made ground and Bagshot Formation for wall design.

6 Geotechnical Assessment of Ground Conditions

6.1 Introduction

The information obtained from the ground investigation on the soil conditions in relation to the proposed basement construction has been assessed for impacts on existing building structures. The principle impacts are ground movements from the excavation for the basement. These movements are vertical and horizontal movements of the foundation formation level from isostatic readjustment from the excavation and possible vertical and horizontal impacts of existing structures from the basement underpin wall construction.

6.2 Presumed Bearing resistance

The foundation formation level of the basement will be at approximately 121.80 m AOD or 3.5 m below ground level. At the formation level a conservative angle of friction of 30^0 has been evaluated from the SPT profile. Wall loads provided by Croft Structural Engineers (Drawing 191025-SL-50 Rev1 in Appendix A) comprise the following shown in Table 6.1,

Table 6.1 Wall loading

Wall No.	Combined SLS kPa	Net Loading kPa	Adequacy Factor (DA1- 2)
1	100	40	>5
2	70	10	>5
3	100	40	>5
4	70	10	>5
internal walls	100	40	>5

The net loading allows for the removal of 3.5 m depth of soil (~60 kPa, based on a unit weight of 17 kN/m^3). The wall loads will be taken by the basement floor slab which will be initially 2m wide (Drawing 191025-SL-100 in Appendix A). Preliminary calculations indicate that there will be an adequacy factor (utilisation) of greater than 5 (EC7 DA1 Combination 2). This indicates the ground will accommodate the imposed load without significant (<25 mm) settlement. The actual settlement however will be determined from the net effect from the removal of soil during the basement excavation.

6.3 Effect of vertical ground movement from soil excavation

Dimensions of the excavation is based on Drawing 191025-SL-50, included Appendix A.

The ground model is based on the ground conditions assessment in Section 5. As the ground conditions below the excavation comprise the Bagshot Formation, which is a predominantly granular material (fines content ranging from 13.9 to 20.2% in test results from samples below the excavation), heave from unloading is expected to be negligible.

6.4 Effect of vertical ground movement from construction

The loading of the soil from the wall loads has been modelled using PDisp version 20.12. The loading imposed from the underpins will be carried by the underpin return, as well as additional loading from central columns and walls within the basement as indicated in Drawing 191025-SL-50.

These loads have been modelled by Pdisp as indicated in Figure 6.1, 6.2, 6.3 and 6.4.

The implication of ground movement on the impact on the neighbouring properties and the host property are considered in Sections 10 and 11.

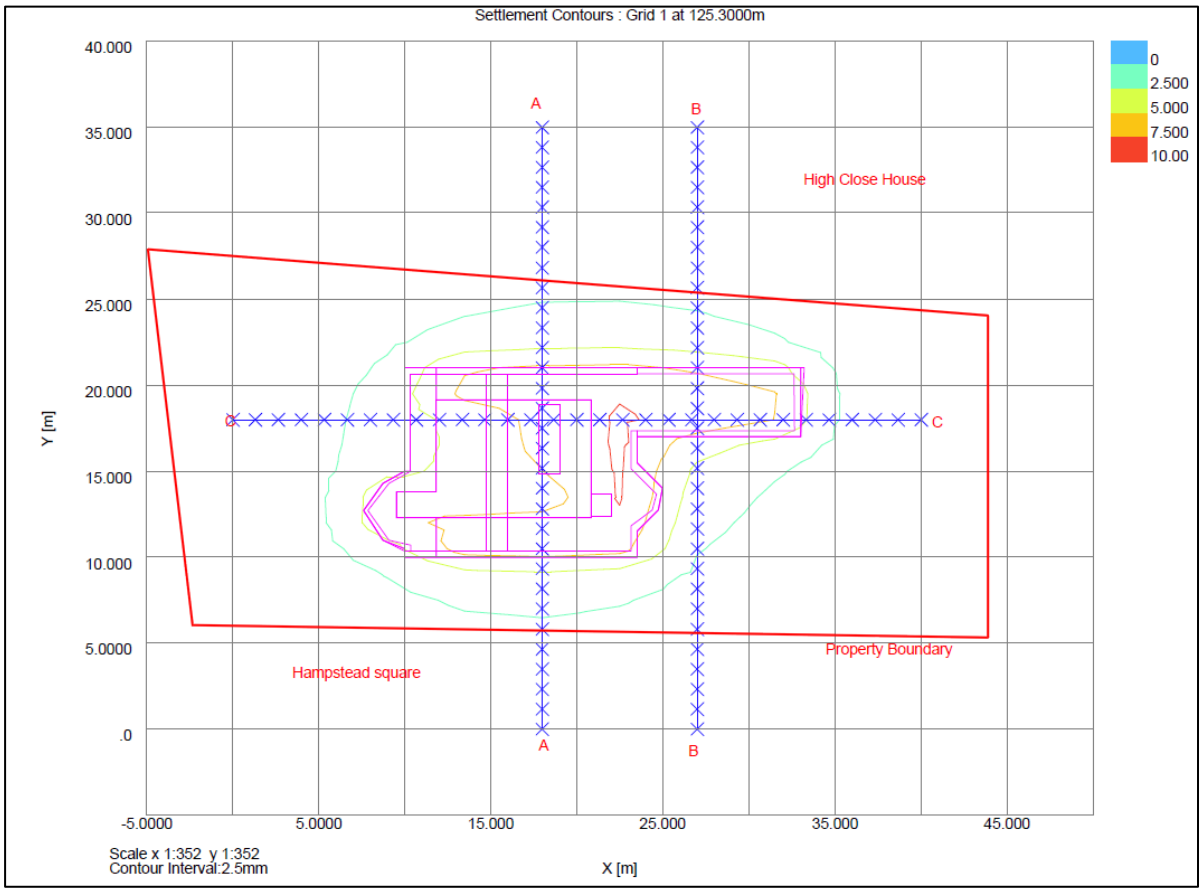

Figure 6.1 Vertical ground movements from wall loading

The plots indicate that the maximum settlement is approximately 9.2mm in the centre of the basement with approximately 6 to 8mm at the underpin walls. Away from the basement itself 2mm is indicated at the property boundary wall with the neighbouring property High Close House.

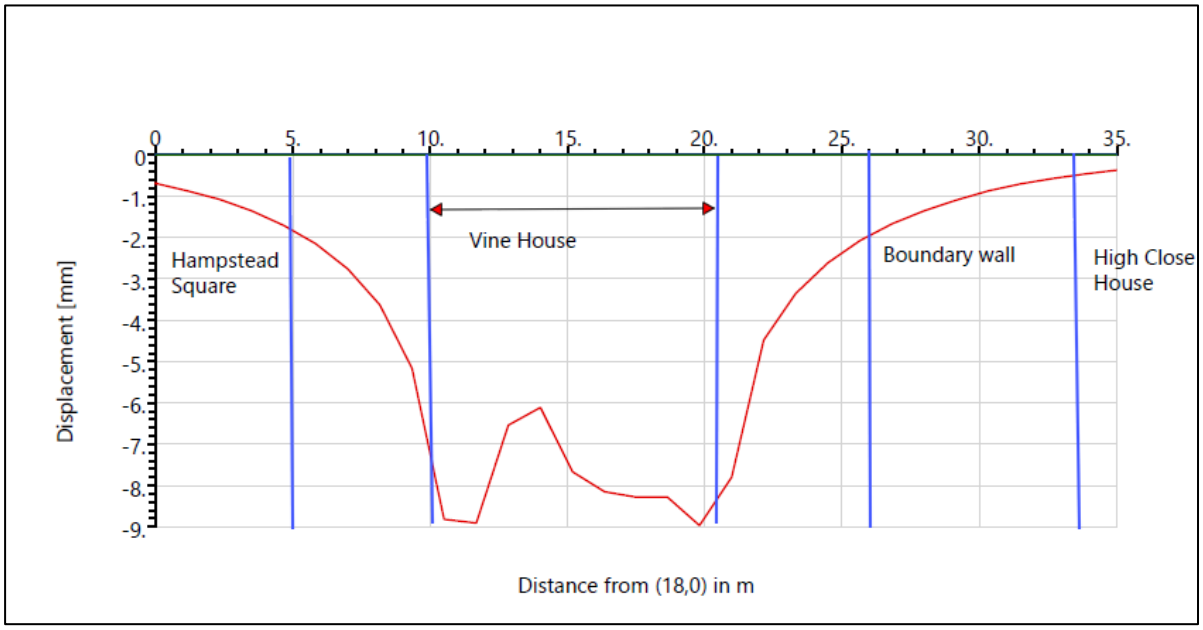

Figure 6.2 Cross Section A-A of vertical ground movements from wall loadings

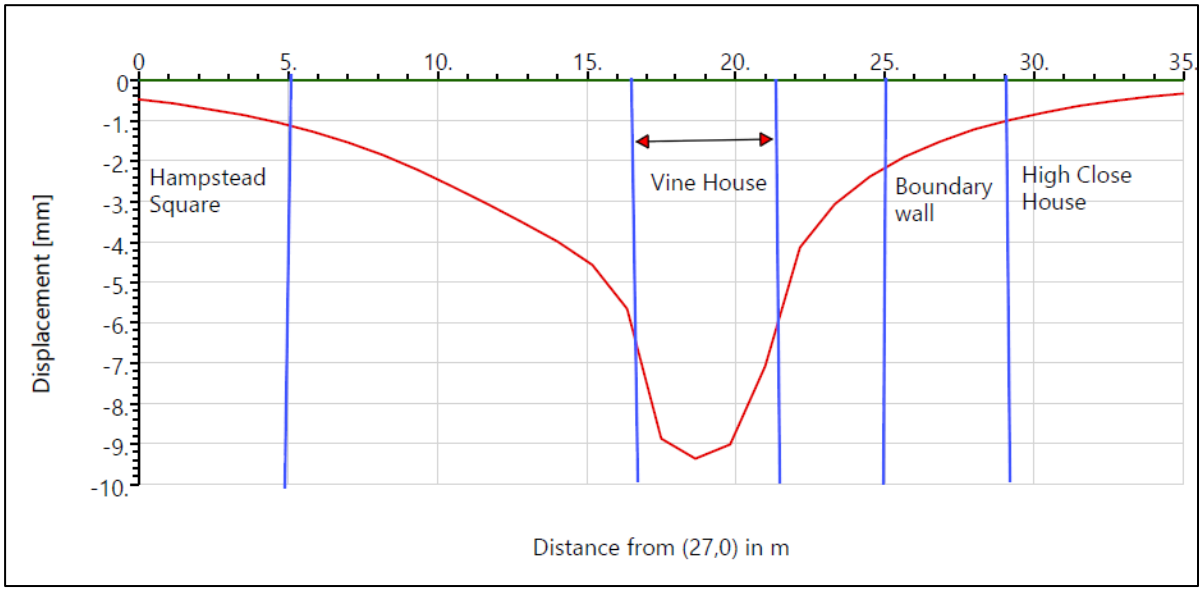

Figure 6.3 Cross Section B-B of vertical ground movements from wall loadings

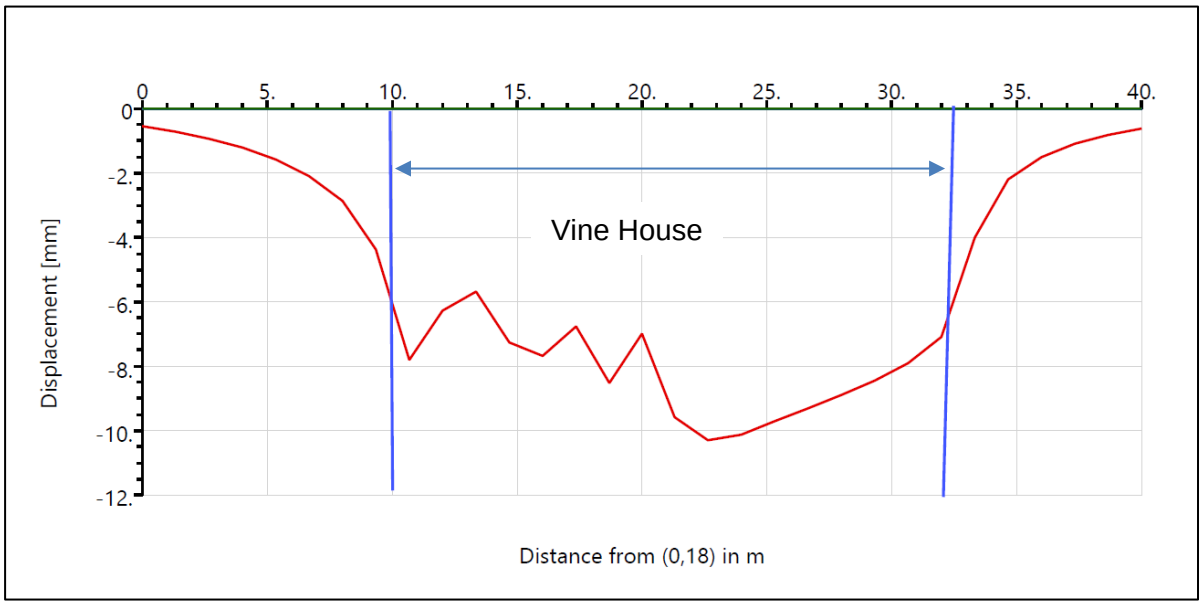

Figure 6.4 Long Section C-C of vertical ground movements from wall loadings

Full output of the PDisp model is included in Appendix E.

6.5 Sub –surface Concrete

The results of lab testing for sulphate and pH are summarised below in Table 5.1. The full analysis is included in Appendix B.

Table 6.1 Sulphate and pH categories

Sample depth	Sample ID	Soil Type	Sulphate S04 2:1 extract	pH	Sulphate Class (DS)	ACEC Class
0.3	WS1*	Made Ground	<0.01	6.2	DS-1	AC-2z
2.5	WS3+	Bagshot Formation	<0.01	4.7	DS-1	AC-3z
3.5	WS1+	Bagshot Formation	0.27	7.53	DS-1	AC1
6.0	WS1+	Bagshot Formation	<0.01	7.6	DS-1	AC1

* Tested to BS1377

+ Tested to BRE SD1

It is recommended that an overall design sulphate class of DS-1 and an Aggressive Chemical Environment for Concrete (ACEC) class of AC-2z is adopted for the basement slab and underpinning. If a concrete piled solution is to be adopted, then DS-1 AC-2z should also be adopted.

7 Screening

7.1 Introduction

Screening is undertaken as outlined in Section 6.2 of the GSD recommendations. It identifies if there are hydrogeological and land stability issues associated with the proposed development that requires detailed analysis and investigation. If there are no significant issues identified in the screening stage, then further stages are not required. The report follows the flow charts set out in CPG Basement (2018) and makes reference to the GSD.

7.2 Subterranean (Groundwater) flow

This section answers questions in Figure 1 of CPG Basements:

The source of information for the assessment of subterranean flow is from the GSD and a site-specific Groundsure Environmental Insight Report obtained on 5th November 2019 for Vine House (Appendices B and C) along with the ground investigation undertaken at Vine House on 4 November 2019 (Appendix B).

Table 7.1: Responses to Figure 1, CPG Basements

Question	Response	Action required
1a. Is the site located directly above an aquifer?	Yes. The site is underlain by the Bagshot Formation, which is classed as a Secondary (A) aquifer. Groundwater is	Assess the risk of impact of/to the basement
1b. Will the proposed basement extend beneath the water table surface?	No Groundwater monitoring shows no groundwater to a depth of at least 4.95 m	None

Question	Response	Action required
2. Is the site within 100m of a watercourse, well, or potential spring line?	No. There are no known wells or spring-lines within 100 m of the site	None
3. Is the site within the catchment of the pond chains on Hampstead Heath?	No. The site is not within the catchment of the ponds. As indicated in Figure 3.5	None
4. Will the proposed basement development result in a change in the proportion of hard surfaced/paved areas?	No The basement is entirely below the existing building	None
5. As part of site drainage, will more surface water than at present be discharged to ground (e.g. via soakaways and/or SUDS)?	No, the basement is entirely below the existing building.	None
6. Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond or spring lines?	No. There are no recorded local ponds or spring lines within 250 m of the site	None

a. Camden Geological, Hydrogeological, and Hydrological Study, Arup, 2010. (Fig. 8).
b. Camden Geological, Hydrogeological, and Hydrological Study, Arup, 2010. (Fig. 11).
c. Camden Geological, Hydrogeological, and Hydrological Study, Arup, 2010. (Fig. 14).

In summary, the site is located on the Bagshot Formation. Post investigation monitoring indicated that groundwater was not encountered to a depth of at least 4.95 m.

7.3 Slope / Land Stability

This section answers questions posed by Figure 2 in CPG Basements.

Table 7.2: Responses to Figure 2, CPG Basements

Question	Response	Action required
1. Does the site include slopes, natural or man-made, greater than about 1 in 8?	No. The site is on level ground	None
2. Will the proposed re-profiling of the landscaping at site change slopes at the property boundary to greater than about 1 in 8?	No.	None
3. Does the development neighbour's land including railway cuttings and the like with a slope greater than about 1 in 8?	No No railway is present with 500m of the site	None.
4. Is the site within a wider hillside setting in which the general slope is greater than about 1 in 8?	The site is located on a ridge of the Bagshot sands. The ground slopes away on the west, south and east sides, but the slopes are more than 50m from the site (see Figure 3.2)	None
5. Is the London Clay the shallowest stratum on site?	No	None
6. Will any trees be felled as part of the proposed development and/or are any works proposed within any tree protection zones where trees are to be retained	Three trees will be removed, because of damage to the existing building and or disease.	An arboricultural survey has been undertaken
7. Is there a history of shrink/swell subsidence in the local area and/or evidence of such at the site.	No records.	None

Question	Response	Action required
8. Is the site within 100 m of a watercourse or a potential spring line?	No [a,b].	None
9. Is the site within an area of previously worked ground?	No Made ground was encountered to a depth of 2.10m. However historical mapping shows no change in land use from at least 1870 to the present day therefore this is not worked ground as defined by CPG Basements.	Ensure appropriate PPE is used during construction. Confirm contamination status prior to undertaking excavation of the soil.
10. Is the site within an aquifer?	Yes. The site is underlain by the Bagshot Formation a Secondary (A) Aquifer	Assess the risk of impact of/to the basement
11. Is the site within 50m of the Hampstead Heath Ponds?	No.	None
12. Is the site within 5 m of a highway or pedestrian right of way?	Yes The existing house and proposed basement are 4m from a footway and 6m from the highway.	Assess the ground movement from the basement construction on the pedestrian walkway.
13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	The house is surrounded by a garden and is over 10 m from the neighbour's property	A ground movement assessment will be undertaken to assess impact (Burland Damage Assessment)
14. Is the site over (or within the exclusion zone of) any tunnels?	No.	None.

a. Camden Geological, Hydrogeological, and Hydrological Study, Arup, 2010. (Fig. 8).
b. Camden Geological, Hydrogeological, and Hydrological Study, Arup, 2010. (Fig. 11).
c. Camden Geological, Hydrogeological, and Hydrological Study, Arup, 2010. (Fig. 14).
d. Groundsure Report (Appendix C) September 2016

In summary, the proposed basement is located on level ground and will be founded within the Bagshot Formation, which is present from 0.9 to 2.1 m depth below the site surface.

8 Scoping

8.1 Introduction

This section considers the output from the screening survey where further actions are required. It considers the scope of information required in addressing these actions and what the potential impacts are of the basement construction. The existing ground conditions and the location of the basement can be summarised in a conceptual site model as indicated in Figure 8.1.

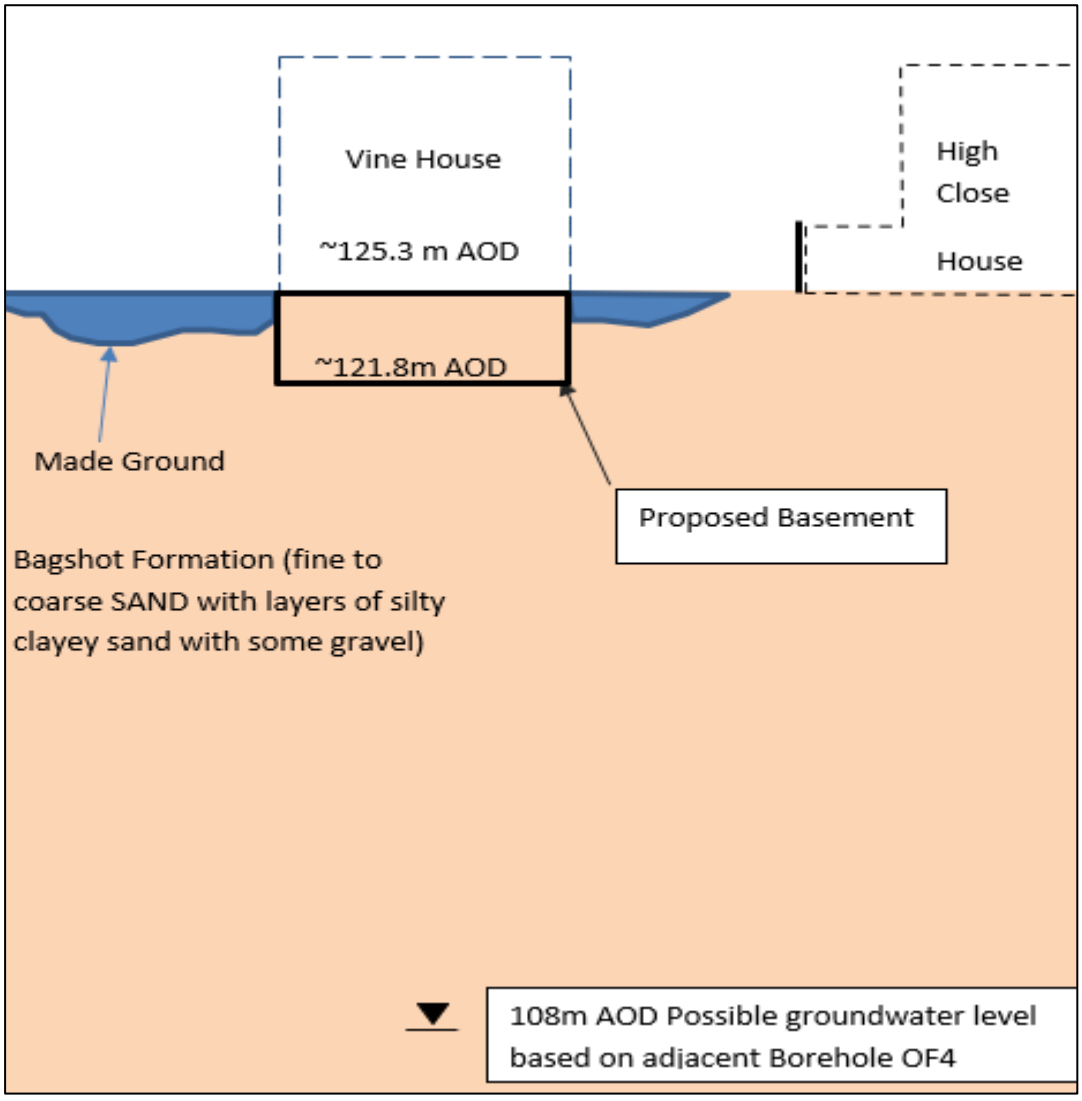

Figure 8.1 Conceptual Site Model (Not to scale, approx. m AOD)

There does not appear to be any requirement for groundwater mitigation measures for groundwater due to the depth of groundwater, as summarised in Table 8.1

Table 8.1 Summary of Scoping Requirements - Hydrogeology

Screening questions of concern - Hydrogeology	Potential Impact	Mitigation
1a. Is the site located directly above an aquifer?	Yes. The site is underlain by the Bagshot Formation, which is classed as a Secondary (A) aquifer. Groundwater is	Assess the risk of impact of/to the basement

The land stability issue relates to the ground movements resulting from the excavation within the London Clay Formation which will be addressed by a ground movement analysis as summarised in Table 8.2

Table 8.2 Summary of Scoping Requirements – Land Stability

Screening questions of concern – Land Stability	Potential Impact	Mitigation
6. Will any trees be felled as part of the proposed development and/or are any works proposed within any tree protection zones where trees are to be retained	Three trees will be removed, because of damage to the existing building and or disease.	An arboricultural survey has been undertaken
10. Is the site within an aquifer?	Yes. The site is underlain by the Bagshot Formation a Secondary (A) Aquifer	Assess the risk of impact of/to the basement

Screening questions of concern – Land Stability	Potential Impact	Mitigation
12. Is the site within 5 m of a highway or pedestrian right of way?	Yes The existing house and proposed basement are 4m from a footway and 6m from the highway.	Assess the ground movement from the basement construction on the pedestrian walkway.
13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?	The house is surrounded by a garden and is over 10m from the neighbour's property	A ground movement assessment will be undertaken to assess impact (Burland Damage Assessment) as a precaution

9 Impact Assessment

9.1 Groundwater

9.1.1 Groundwater level

The screening process has shown from borehole information that groundwater occurs at a depth of between at least 4.95m below ground level. An adjacent borehole OF4 located at the corner of Hampstead Square and Heath Street, approximately 50m to the west of the site indicates wet sand at 17m bgl or approximately 108m AOD. The basement construction will therefore have no impact on or be impacted by the flow of groundwater.

9.1.2 Impact on groundwater by any contamination from the made ground

The construction of the basement will remove made ground from the site if it is found that the made ground extends below the house.

The natural strata underlying the site will have variable permeability depending on the clay content. The low permeability layer associated with the clayey sand from 3.5 to 8.45m in BH WS1, and to the base of the shallower boreholes WS2 and WS3 will act as a barrier to leaching into ground water is therefore considered negligible.

9.2 Land Stability

The screening process has identified three issues which require an impact assessment listed below from Tables 7.2 and 8.2.

- Felling of trees,
- Presence of an aquifer
- Proximity to the highway and
- Proximity of an adjacent structure with differential depth of foundations.

9.2.1 Felling of Trees

Three trees have been identified in the arbicultural survey (Tree Sense 2019) that need to be felled. One of these is a Magnolia which is causing damage to the existing building. The other two trees are due to disease and are not related to the basement project. The survey also indicates root zones which need to be protected from compaction from construction plant. The root protection areas do not impinge on the proposed basement construction, as indicated in the tree constraints drawing in the arboricultural survey and included in Appendix A of this report.

9.2.2 Proximity of the basement to the highway

The proposed basement will be approximately 6.0 m from the highway kerb, and 4.0 m from the pedestrian pavement. Based on the PDisp analysis net movements are not considered significant for the pavement or associated infrastructure as a consequence of the granular geology and distance from the proposed basement to the highway.

9.2.3 Proximity to adjacent buildings

Vine House is a detached property surrounded by gardens. The nearest property is High Close House, which is approximately 3.6 to 5 m to the north of Vine House

The land stability issue relates to ground movement from the excavation and construction to form the basement, which is considered in Section 10. There are no other issues such as sloping or unstable ground which are considered significant.

9.2.4 Stability of Temporary Excavations

It is proposed that the basement retaining walls will be constructed using a hit and miss underpinning technique, with temporary propping supporting the excavation, which is set out in the Basement Method Statement issued by Croft and indicated in Drawing Nos. 191025-TW-100 & 200 included in Appendix A.

9.2.5 Groundwater Control

As discussed in Section 8.1.1 groundwater was not encountered. Although considered unlikely, if localised perched water seepages are encountered, they could be controlled by pumping to a tank prior to disposal by tanker to an approved facility.

9.2.6 Monitoring of groundwater and ground movements

Groundwater levels should be monitored before the works as a precaution. Monitoring of adjacent structures and the highway should be carried out before, during and after construction.

10 Ground Movement Assessment

10.1 Introduction

This section provides an assessment of ground movement that may result from the construction of the basement and to determine how these may affect the adjacent building structures as well as the host property which is a Grade II listed building.

The proposed construction sequence for the basement comprise the following elements for the main building:

- Phase 1 - Install underpins on a hit and miss basis below the perimeter wall; install props against a central soil mass.
- Phase 2 - excavate remaining soil mass below building, installing full width props as excavation progresses.
- Phase 3 – construct internal walls and columns from basement to ground floor level, then complete ground floor structure.

The construction sequence for the side extension will involve installing full-width cross props as the excavation progresses. There will be no central soil mound for propping against.

For details of the construction sequence refer to Drawing Nos. TW-100 & 200.

The house is surrounded by gardens and does not directly adjoin any neighbouring property. The geology of the soil is the Bagshot Formation which is a predominantly granular material.

10.2 Ground movement impact on neighbouring property High Close House

The location of the neighbouring property, High Close House is show in Figure 8.1 and Figure 10.1 which is approximately 3.5m from Vine House. High Close House is approximately 23.5m in length, including the single storey section between the wall and the main building.

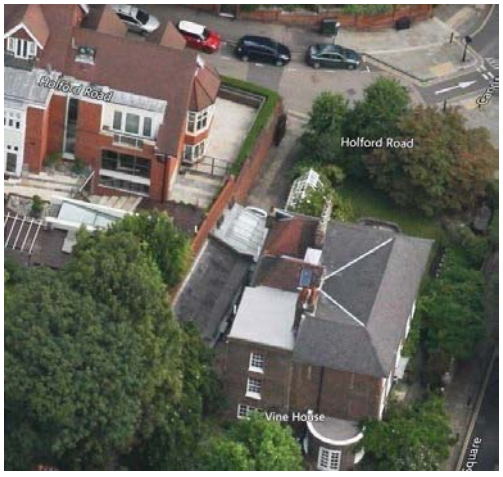

Figure 10.1 Oblique aerial view of Vine House and High Close House

The vertical ground movement at the boundary wall with High Close House from the loading of the basement underpins is 2mm settlement, which decreasing to zero 10.5m from the boundary.

In addition, it is possible that from the installation of the underpins there could be an anticipated 5mm horizontal and vertical movement associated with the excavation, construction and loading of the underpins as they are constructed. The movement will decrease with increasing distance from the underpin walls. The distance to negligible movement has been reviewed for embedded retaining walls in CIRIA C760, for both excavation and installation, which range between 1.5 and 4 times the wall height or excavation depth. In the case of underpins there is no such guidance. It is considered that 2 times wall height is a reasonable estimate, for both vertical and horizontal displacements particularly in granular soils where the attenuation of movement may be higher due to the immediate response to strain.

Taking into account the installation movements an additional 2.5mm of vertical movement (4.5mm total) and 2.5m of horizontal movement could be experienced at the boundary wall decreasing to zero 7m from the nearest Vine House retaining wall.

10.3 Ground movement impact on Host Property

The ground movements at the host property will arise from the loading of the ground from the underpin wall and from the internal columns and wall within the basement. The loading movements have been approximated from the Pdisp plots which his indicated in Figures 6.1, 6.2, 6.3 and 6.4. In addition, the vertical ground movement from the installation of the underpins has been included as shown in Figure 10.2 for a long section from west to east across the property and Figure 10.3 for south to north cross section. The plots assume that 5mm of settlement will arise at the underpin locations and decrease at a gradient of 1 on 2 away from the underpins. The plots show the maximum deflection strains from the movement. Horizontal ground movement has been taken as 5mm from the wall which is being installed.

11 Damage Assessment Category

11.1 Introduction

The calculated ground movements have been used to assess potential 'damage categories' that may apply to neighbouring property and host property due to the proposed basement construction. In additional the impact on the highway has been considered from ground movment. The methodology proposed by Burland and Wroth and later supplemented by the work of Boscardin and Cording has been used, as described in *CIRIA Special Publication 200* and *CIRIA C760*. General damage categories are summarised in Table 11.1 below:

Table 11.1: Classification of damage visible to walls (reproduction of Table 6.4, CIRIA C760)

Category	Description	Approx. Crack Width (mm)	Limiting tensile Strain ε_{lim} (%)
0 (Negligible)	Negligible – hairline cracks	<0.1	0.0 – 0.05
1 (Very slight)	Fine cracks that can easily be treated during normal decoration	<1	0.05 – 0.075
2 (Slight)	Cracks easily filled; redecoration probably required. Some repointing may be required externally.	<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.	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.	15-25 but also depends on number of cracks	> 0.3
5 (Very Severe)	This requires a major repair involving partial or complete re-building.	> 25 but also depends on number	

11.2 Damage Assessment Categories for neighbouring property High Close House

Table 11.2 incorporates superimposed horizontal and vertical movements derived from the wall deflection and settlement due to excavation as outlined in Section 10. The assessment is based on the assumption of the geology being a granular material. The assessment has been based on the limiting tensile strain for Category 1 of a strain of up to 0.075%. Table 11.2 indicates a Damage Category of less than 1. The Damage Category is shown graphically in Figure 11.3 appropriate for a overall length/height ratio of 2 for the building.

Table 11.2: Summary of ground movements and corresponding damage category High Close House

Adjacent Property	High Close House
Building width - L (m)	23.5
Building overall height - H (m)	11
L/H = 0.5 (approximated for plotting)	0.5
max deflection (Δ) in metres (from Fig 10.1)	0.0035
Δ/L (%)	0.015
εlim	0.075
Δ/L/εlim	0.075
length to negligible horizontal movement 2x wall height (m)	7
δh_{max} (m)	0.005
δh (m)	0.0025
δh/L (%) = εh	0.011
Damage Category	**<1**

11.3 Impact on Highway/Footway at Hampstead Square

The Pdip model show a possible 2mm of vertical ground movement at the boundary with the highway. The vertical and horizontal movements from installation are approximately 1mm. It is not anticipated this will have any adverse effect on the footway/highway.

11.4 Damage Assessment Categories for Vine House

The Damage Assessment Category for the host property Vine has been considered as it is a Grade II listed building.

Table 11.2: Summary of ground movements and corresponding damage category 15 Lyncroft Gardens

Host Property Vine House	West East Section	North -South Section
Building width - L (m)	22.5	11
Building height - H (m)	11	11
L/H (approximated for plotting)	2	1
max deflection (Δ) in metres (from Fig 11.4)	0.004	0.0024
Δ/L (%)	0.018	0.022
εlim	0.075	0.075
Δ/L/εlim	0.24	0.29
Length to negligible horizontal movement (m) 2x wall height (m)	7	7
δh_{max} (m)	0.005	0.005
δh (m)	0.005	0.005
δh/L (%) = εh	0.022	0.045
Damage Category	**<1**	**1**

Table 11.3 incorporates superimposed horizontal and vertical movements derived from the wall deflection and settlement due to excavation as outlined in Section 10. The assessment is based on the assumption of the geology being a granular material. The assessment has

been based on the limiting tensile strain for Category 1 of a strain of 0.075 %. Table 11.3 indicates a Damage Category of less than 1 and 1. The Damage Category is shown graphically in Figure 11.2 and 11.3 appropriate for an overall length/height ratio of 1 for the width and 2 length of the building. An overall Damage Category of 1 is considered applicable to Vine House.

12 References

Boscardin, M.D., and Cording, E.G., (1989). *Building response to excavation induced settlement*. J Geotech Eng, ASCE, 115 (1); pp 1-21

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BS 1377:1990. British Standard Methods of test for soils for Civil engineering purposes. British Standards Institution.

BS 5930: 2015. *Code of practice for Ground Investigation.* British Standards Institution.

BS EN 1997-1 Eurocode 7 Geotech Design Part1 General Rules- inc. corrigendum Feb 2009

BS EN 1997-2 Eurocode 7 Geotechnical Design Part 2 Ground Investigation and Testing – inc. corrigendum 2010

BS 8002: 2015 Earth Retaining Structures

BS 8004: 2015 Code of practice for Foundations

BGS Geology of Britain Viewer (*http://mapapps.bgs.ac.uk/geologyofbritain/home.html)*

Camden Development Policy DP27 – Basement development.

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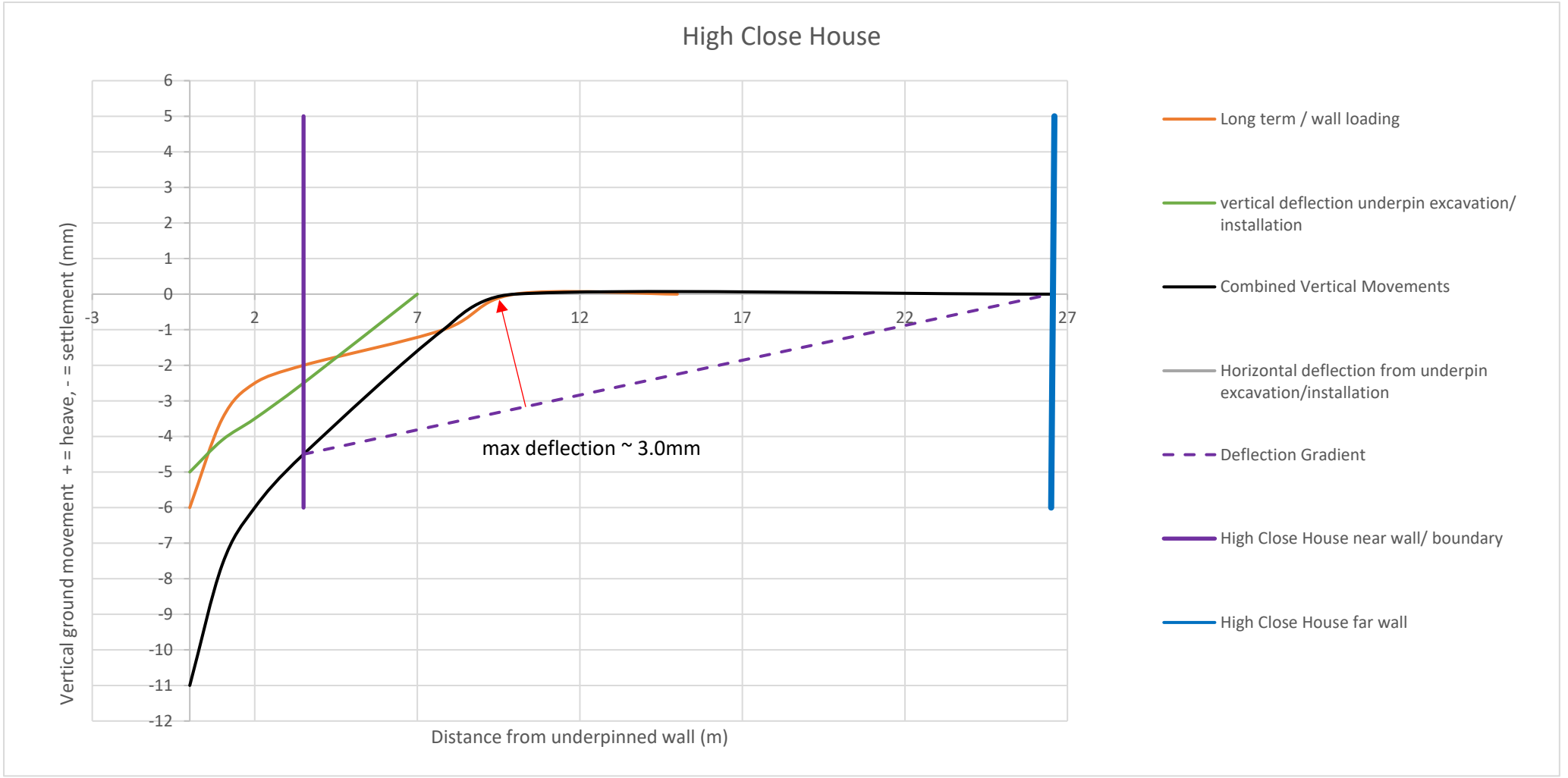
CIRIA C760 Guidance on Embedded retaining wall design 2017.

Heritage Assessment Vine House Hampstead. Archangel Heritage_JPW_2019_V3_FINAL June 2019

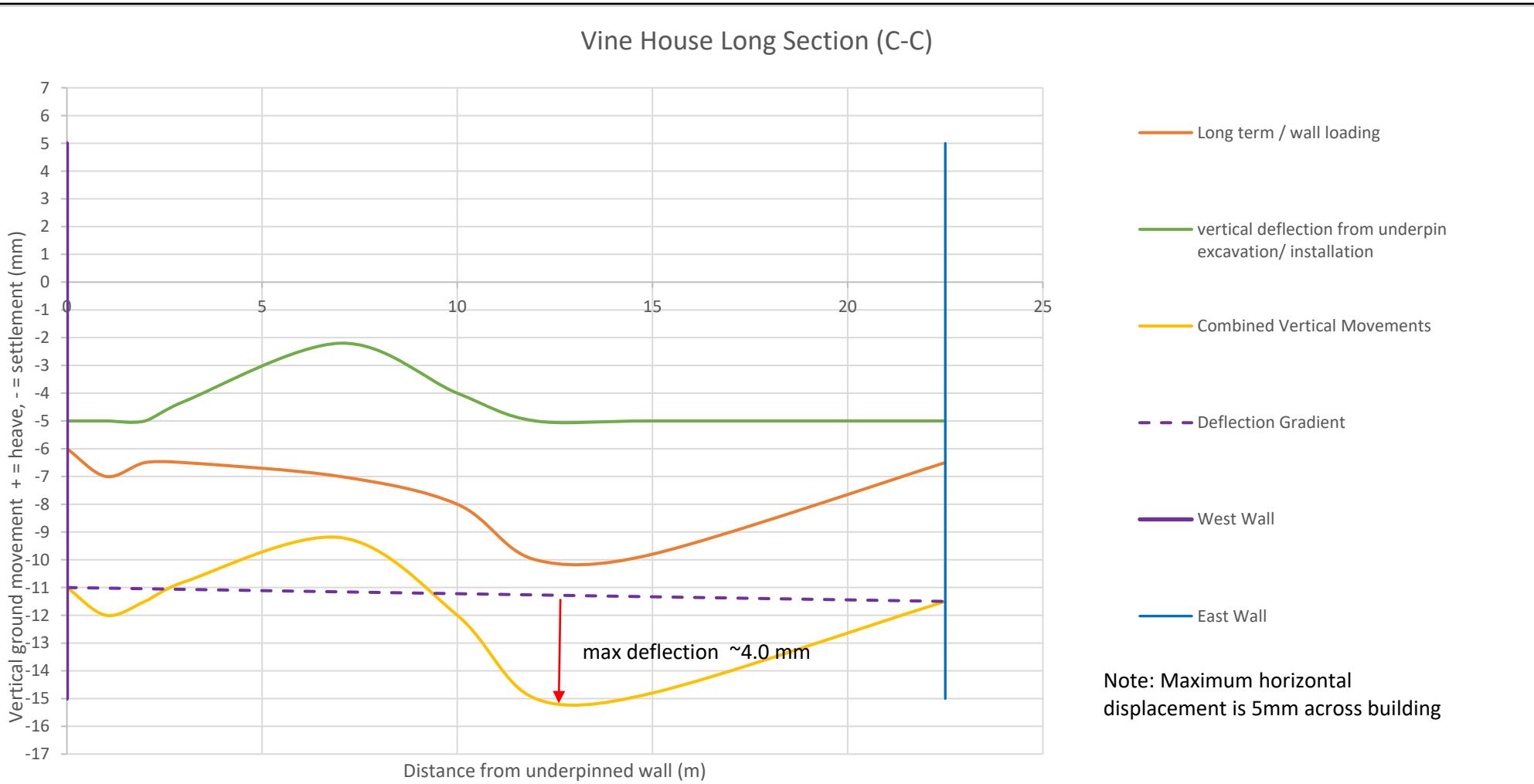
Vine House- Arboricultural report. Tree Sense Ltd 21/06/19

Figures



Client		Project
Croft Structural Engineers Ltd.	MAUND GEO-CONSULTING	Vine House, NW3 1AB

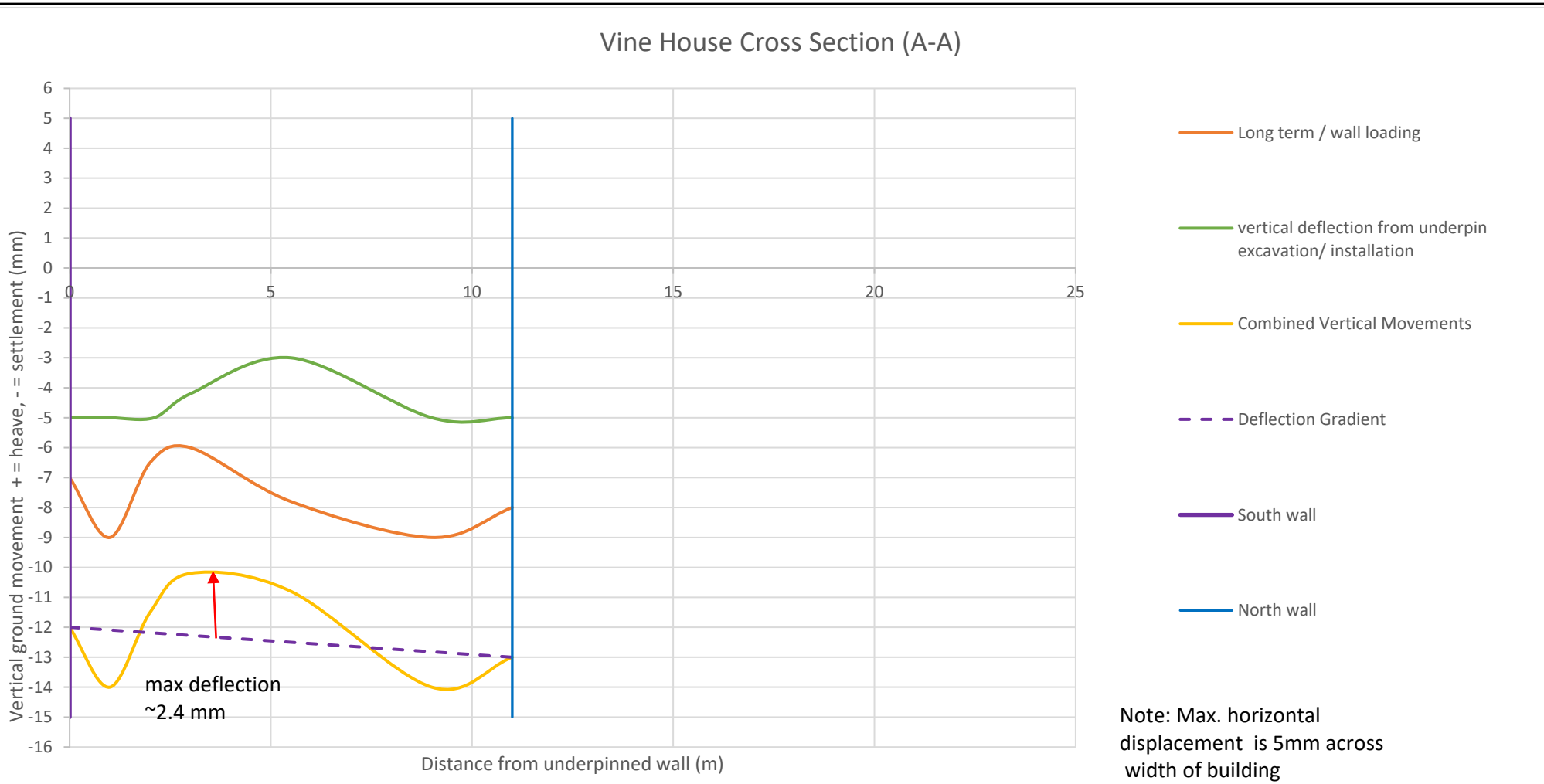
Job No.	Title	Figure
MGC/19/34	Combined Vertical Movements Section, High Close House	10.1



Note: Maximum horizontal displacement is 5mm across building

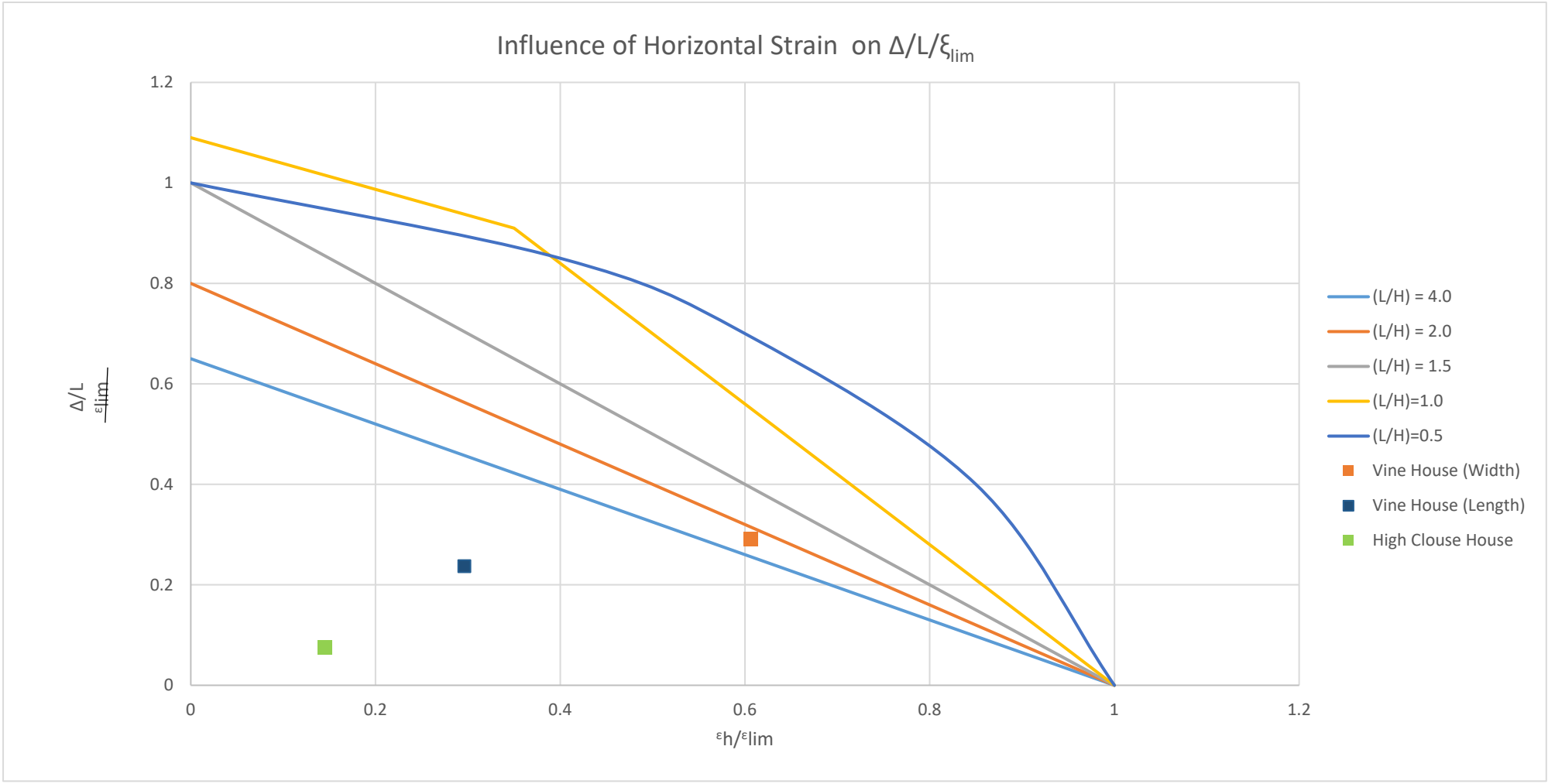
Client		Project
Croft Structural Engineers Ltd.	MAUND GEO-CONSULTING	Vine House, NW3 1AB

Job No.	Title	Figure
MGC/19/34	Combined Vertical Movements Long Section, Vine House	10.2



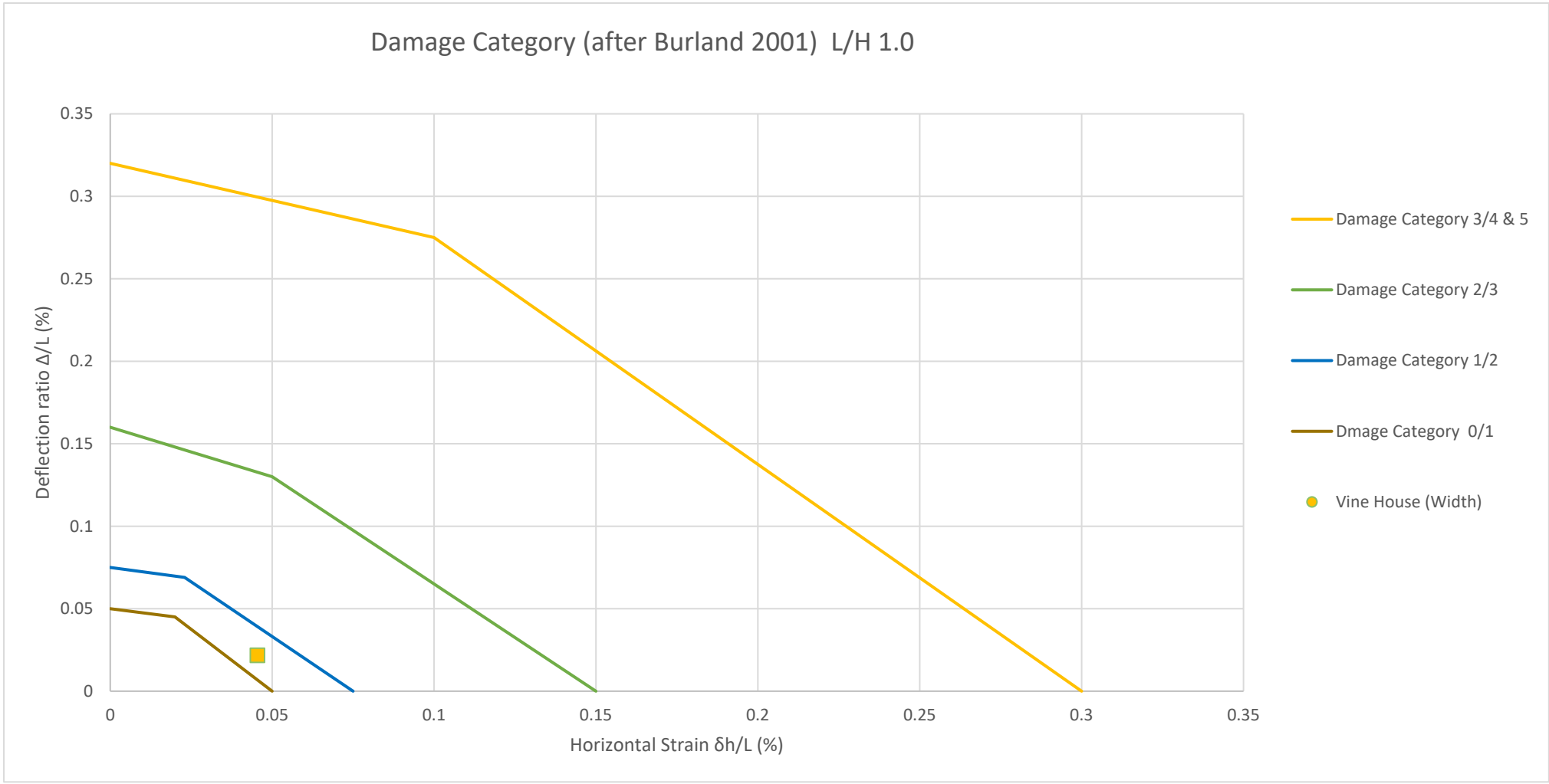
Client		Project
Croft Structural Engineers Ltd.	MAUND GEO-CONSULTING	Vine House, NW3 1AB

Job No.	Title	Figure
MGC/19/34	Combined Vertical Movements Section A-A, Vine House	10.3



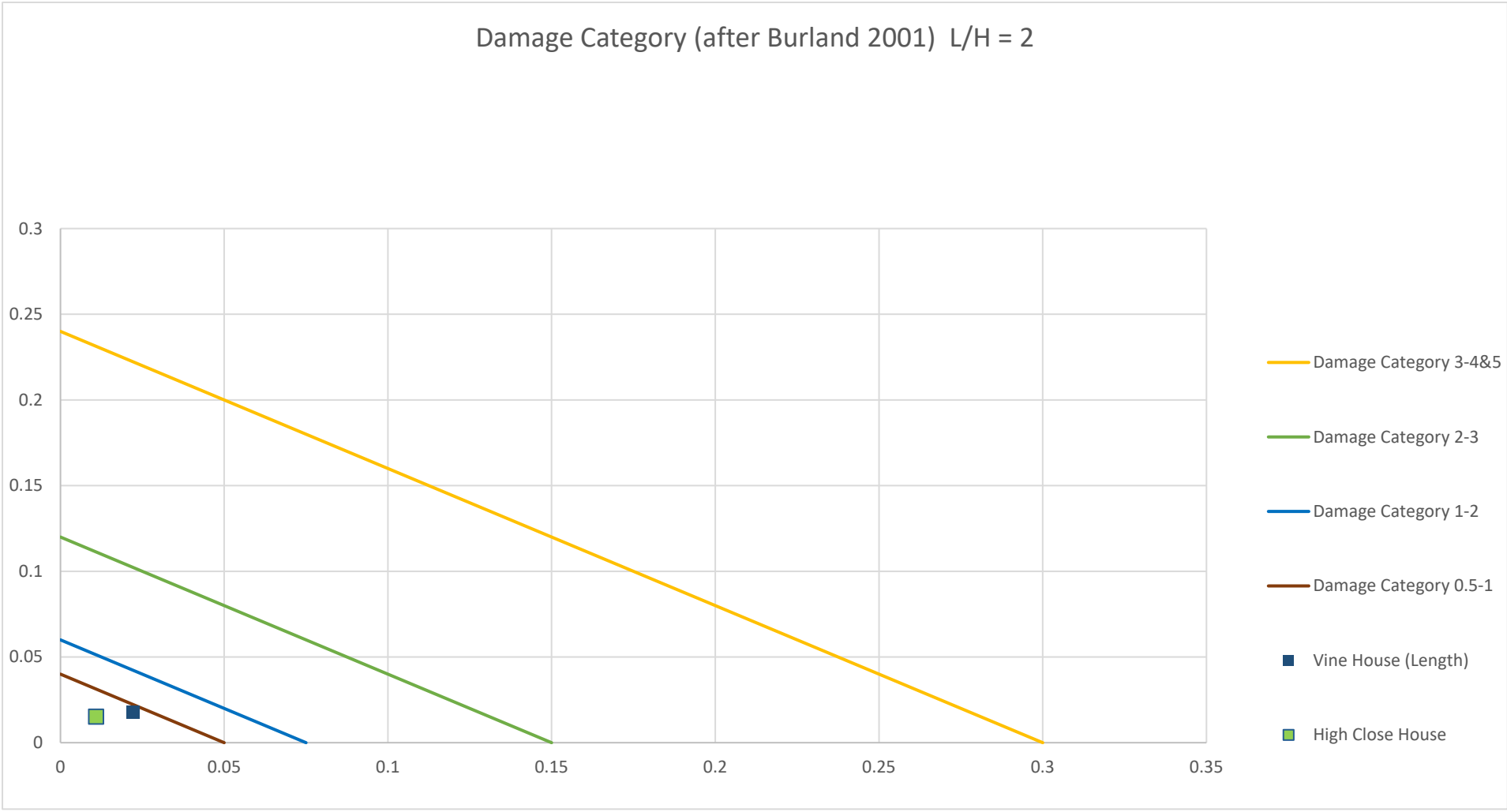
Client		Project
Croft Structural Engineers Ltd.	MAUND GEO-CONSULTING	Vine House, NW3 1AB

Job No.	Title	Figure
MGC/19/34	Influence of horizontal strain, Vine House	11.1



Client		Project
Croft Structural Engineers Ltd.	MAUND GEO-CONSULTING	Vine House, NW3 1AB

Job No.	Title	Figure
MGC/19/34	Damage Assessment Category Vine House Width	11.2

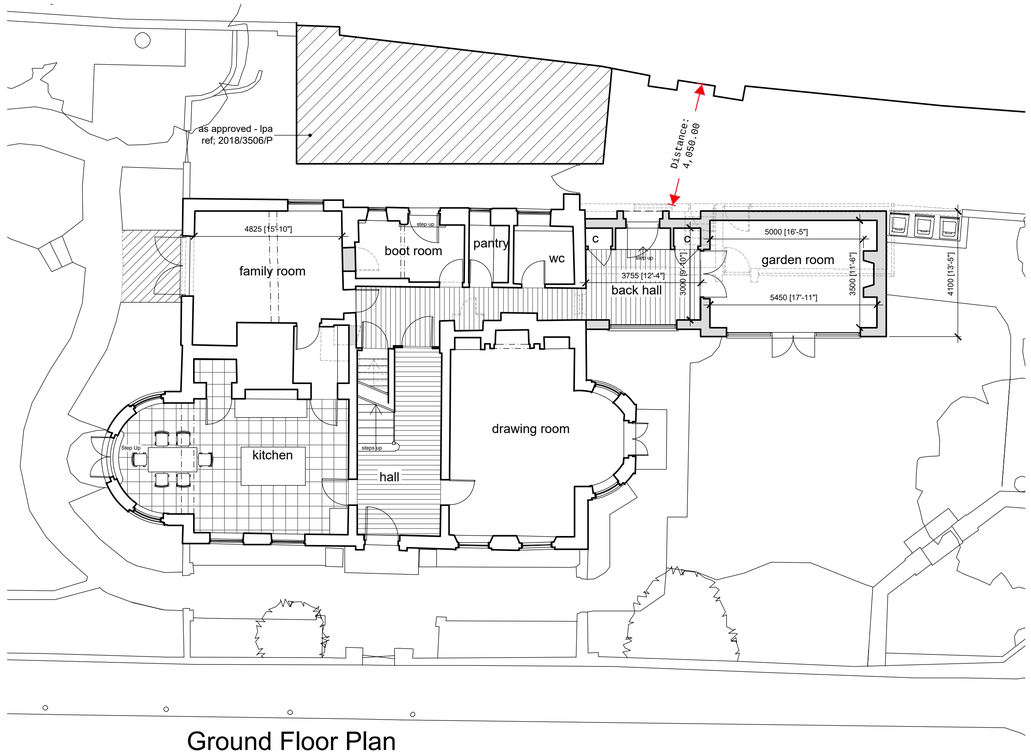


Client		Project
Croft Structural Engineers Ltd.	MAUND GEO-CONSULTING	Vine House, NW3 1AB

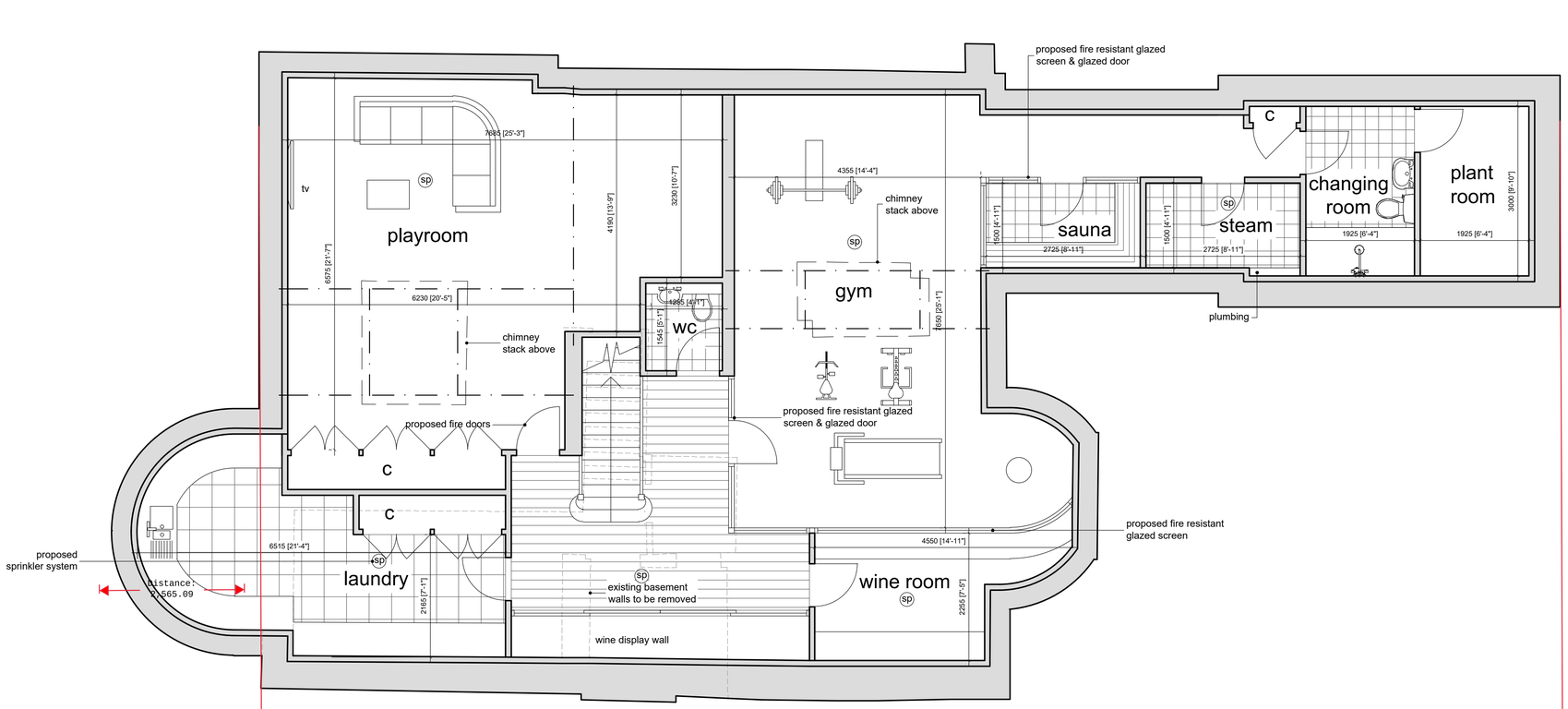
Job No.	Title	Figure
MGC/19/34	Damage Category Vine House (Length) and Neighbour	11.3

Appendix A Drawings

South Elevation/Section



Ground Floor Plan



Proposed Basement Plan

Distance: 23,009.26

notes:

any discrepancies should be reported immediately

all dimensions should be checked on site prior to commencement of work

site/survey based on ordnance survey information provided by prodat systems plc, (www.promap.co.uk) prodat does not guarantee that all past or current uses or features will be identified in the product

the product does not give details about the actual state or condition of the site nor should it be used or taken to indicate or exclude actual suitability or unsuitability of the site for any particular purpose, or relied upon for determining salability or value, or used as a substitute for any physical investigation or inspection.

drawings to be read in accordance with the dwelling emission rate (der/ter) calculation. the building must be built 'as designed' meeting the criteria set for air permeability.

note
when printing off pdf's.
it is the responsibility of the user to verify that the resulting prints are to scale on the appropriate sized sheet.
also that the scale bars on the plan measure correctly.

Date	Description	Rev

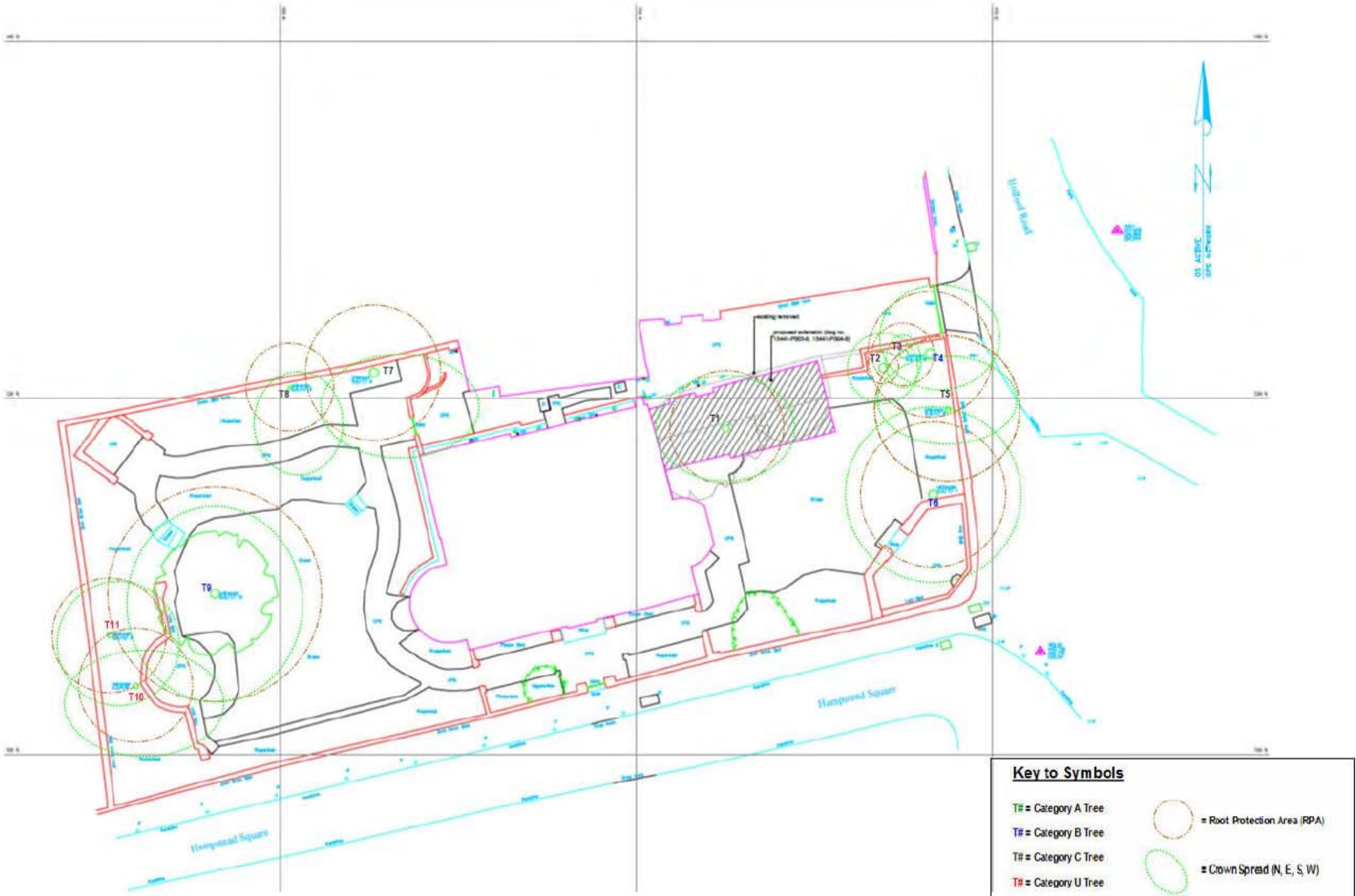
Hertford Planning Service
Architecture & Planning
Westgate House, 37-41 Castle Street,
Hertford, Herts SG14 1HH
Tel: 01992 552173 Fax: 01992 587643
Email: contact@hertfordplanning.co.uk
www.hertfordplanning.co.uk
Chartered Institute of Architectural Technologists

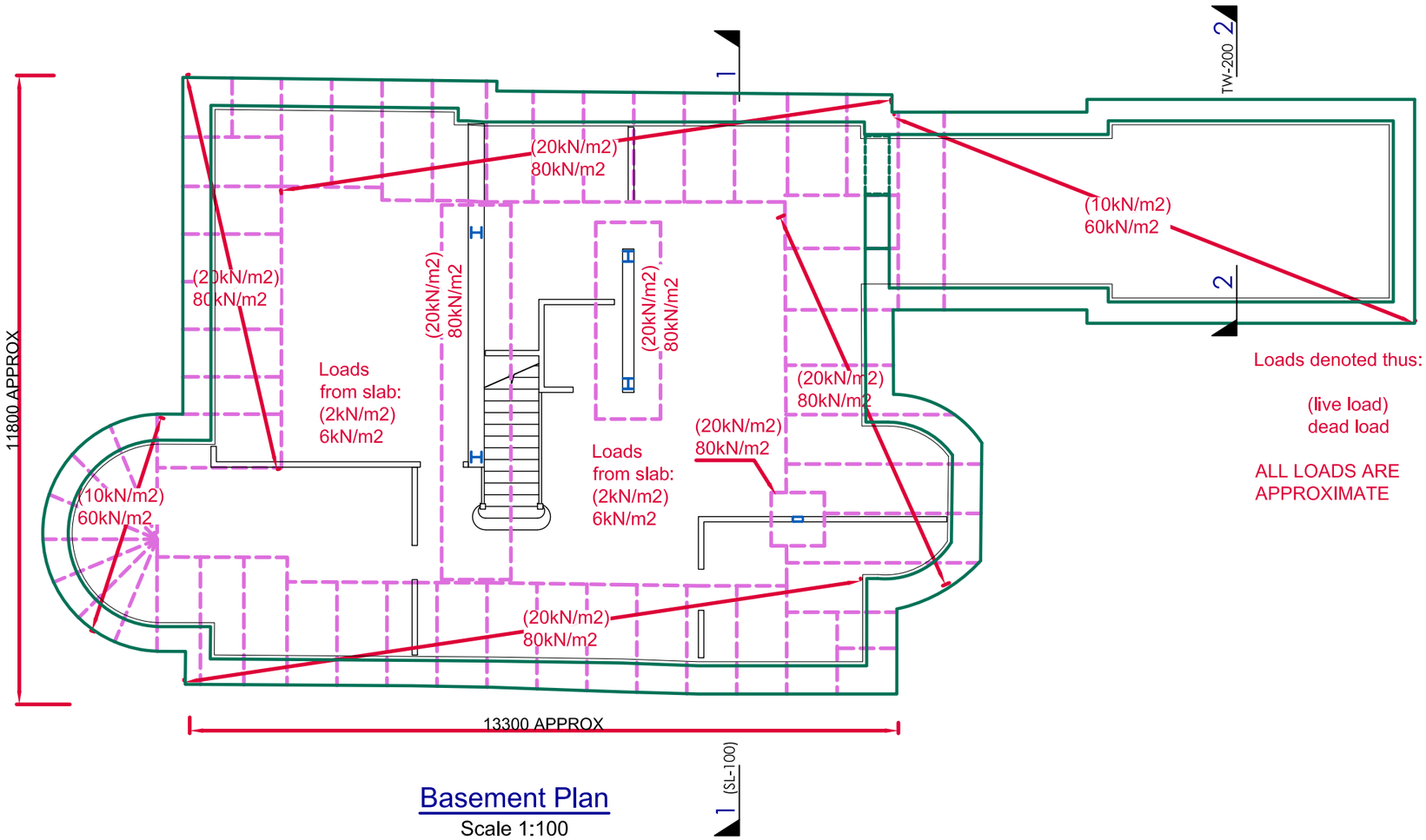
Description

Project	Vine House Hampstead Village NW3 1AB
Drawing	PROPOSED Basement Floor Plan & Section
Date	04/11/2019
Scale	1:50; 1:100
Sheet size	A1
Drawn	GPS

13441-P009-B

8.0 – Tree Constraints Plan (TCP)





Basement Plan

Scale 1:100

Loads denoted thus:

(live load)
dead load

ALL LOADS ARE APPROXIMATE

Rev	Date	Amendments
2	27.05.2020	Segmental pin boundaries revised
1	10.12.2019	Basement extent altered to latest Architect's proposals
-	25.11.2019	First issue for comment

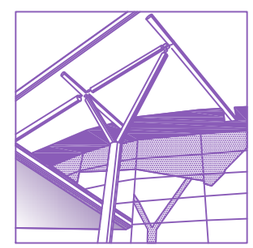
Job No.	Drawn	Scale
190925	GW	As shown @ A3
	Chk'd -	
Dwg No. SL-50	Rev. 2	Date Nov 2019

Client: Julia Gosmond

Project: Vine House, Hampstead Square, Camden, NW3 1AB

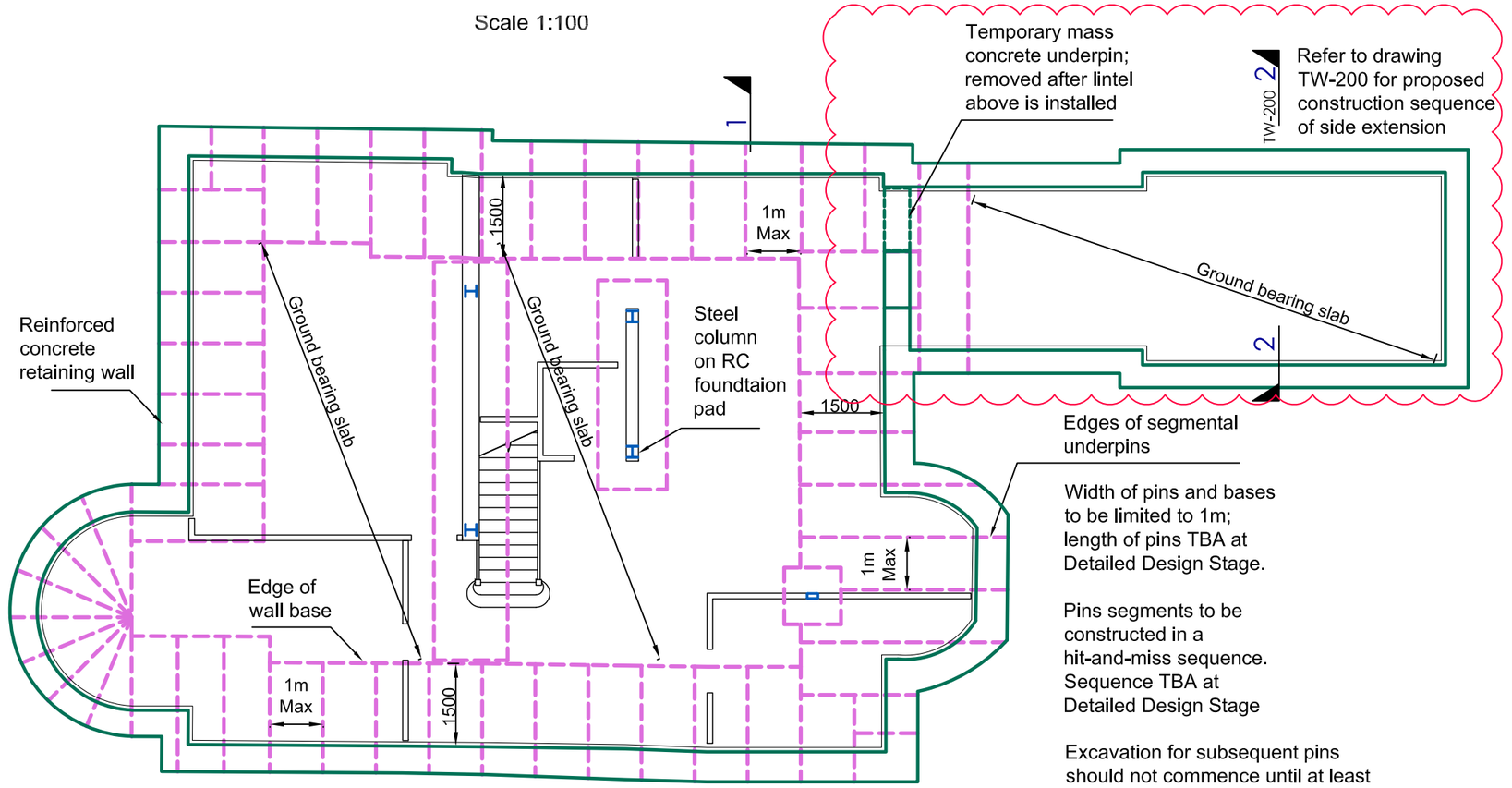
Title : Structural Loading

Croft Structural Engineers
Clockshop Mews,
r/o 60 Saxon Rd,
London, SE25 5EH.
020 8684 4744
www.croftse.co.uk



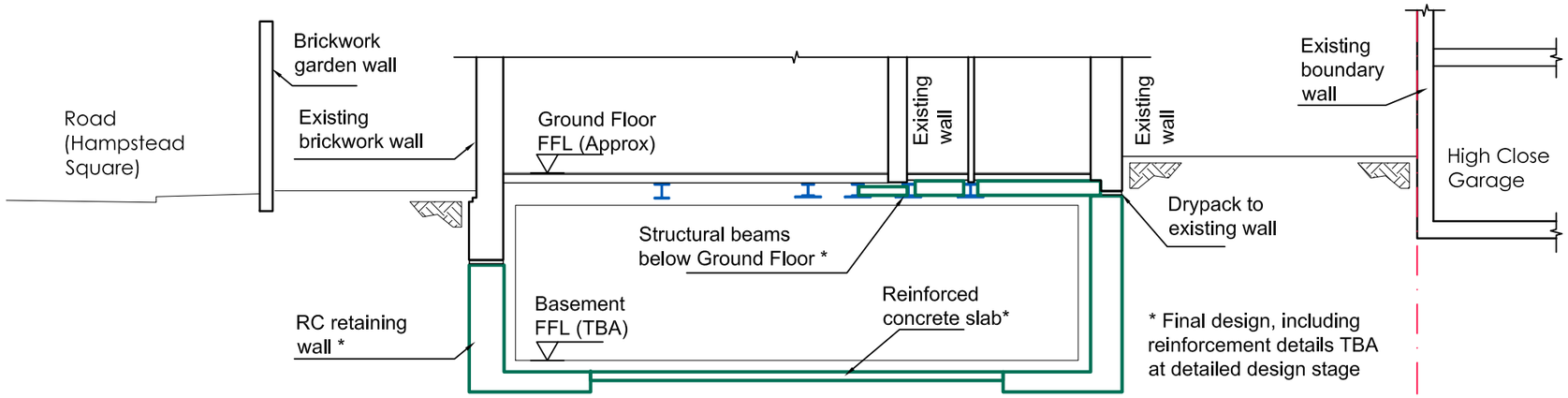
- PLANNING ISSUE - NOT FOR CONSTRUCTION

Scale 1:100



Basement Plan

Scale 1:100



Section 1-1

Scale 1:100

- PLANNING ISSUE - NOT FOR CONSTRUCTION

Rev	Date	Amendments
1	27.05.2020	Alterations to proposed construction of side extension
-	10.12.2019	First issue for comment

Job No. 191025	Drawn GW / Chk'd -	Scale As shown @ A3
Dwg No. SL-100	Rev. 1	Date Dec 2019

Client: Julia Gosmond

Project: Vine House, Hampstead Square, Camden, NW3 1AB

Title : Structural Scheme Design: Basement

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London, SE25 5EH.
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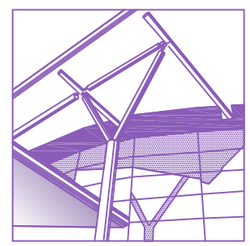
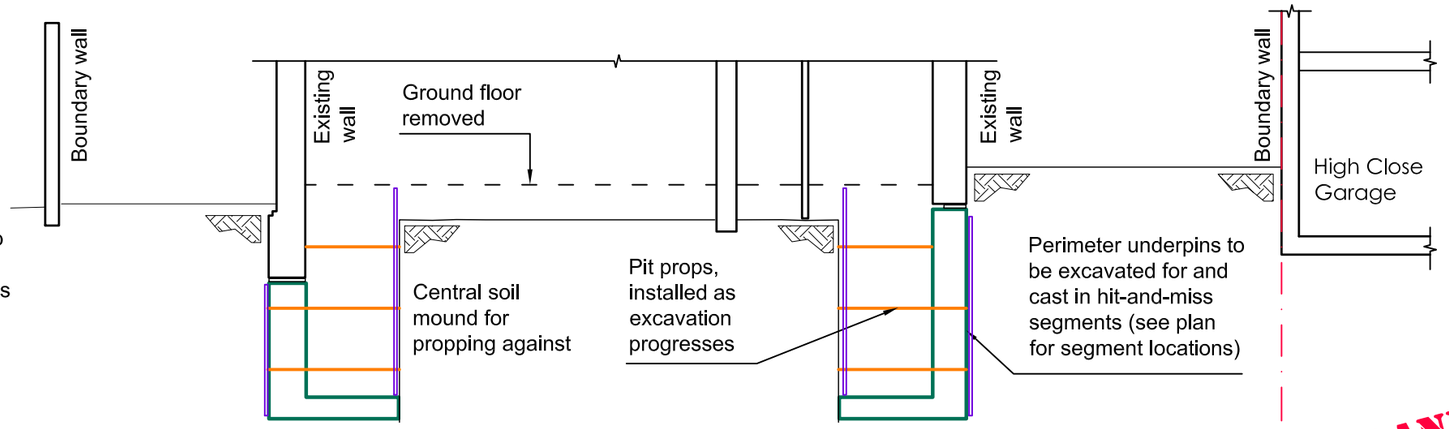


PHASE 1

1.3. Demolish ground floor and excavate to level of existing footings
1.4. Excavate pits and cast underpins in a hit and miss procedure (segmental outlines shown on plan)
  1.4.1. Install trench sheets against soil face; trench sheets around external perimeter to be sacrificial
  1.4.2. Prop pits against soil face via trench sheets as excavation progresses (props to be sacrificial and removed following similar procedures described in stage 2.2.2 on Drawing TW-200)
  1.4.3. Do not commence excavation for pin until at least 48 hours after drypacking for adjacent pin is complete (24hours minimum is possible if Conbextra 100 cement accelerator is added to dry pack mix)

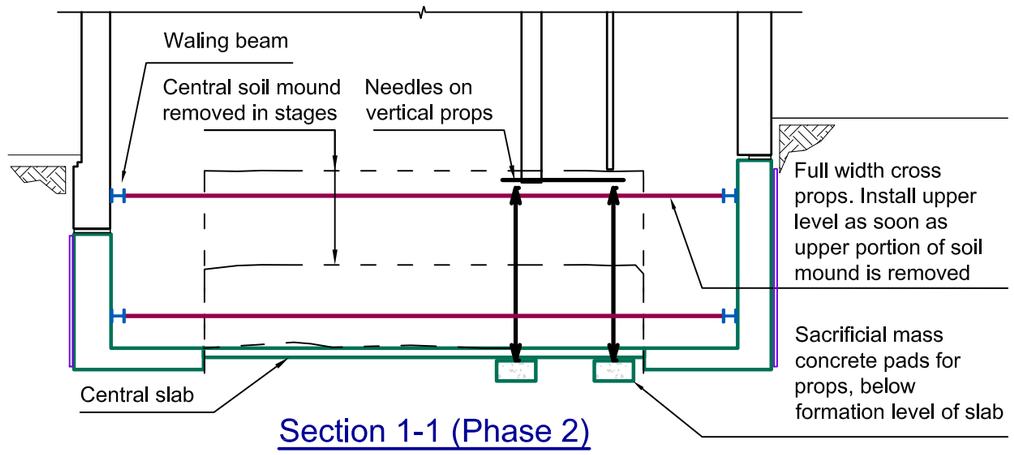


Section 1-1 (Phase 1)
Scale 1:100

- PLANNING ISSUE -
NOT FOR CONSTRUCTION

PHASE 2

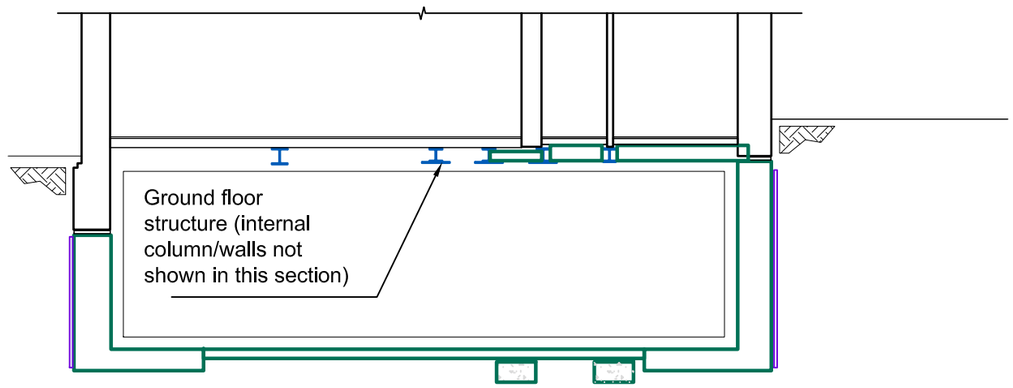
2.1. After perimeter underpins are complete, excavate remaining soil mass below building
  2.1.1. Initial horizontal props may be removed as excavation progresses
  2.1.2. Central soil mound to be removed in stages except where vertical propping to internal walls is required
  2.1.3. Install full width cross props before excavating to the next stage
2.2. Cast sacrificial pads and install needles and props to inernals walls as excavation progresses
  2.2.1. Full height of central soil mound may be removed locally at vertical propping locations
  2.2.2. Do not excavate more than 1mx1m in plan of soil without installing vertical props to the wall above
  2.2.3. As excavatnion progresses downwards for sacrifical pads, install additional horizontal pit props
2.3. After central soil mass is completely removed, construct internal concrete pads and floor slab
  2.3.1. Place below-slab drainage prior to placing reinforcement for slab



Section 1-1 (Phase 2)
Scale 1:100

PHASE 3

3.1. Proceed with construction of internal walls and columns from Basement to Ground Floor level
3.2. Complete Ground floor structure
3.3. After ground floor structure is complete, props may be removed.



Section 1-1 (Phase 3)
Scale 1:100

Rev	Date	Amendments
1	27.05.2020	Trench sheets shown; pit propping details clarified
-	10.12.2019	First issue for comment

Job No. 190925	Drawn GW / Chk'd -	Scale As shown @ A3
Dwg No. TW-100	Rev. 1	Date Dec 2019

Client: Julia Gosmond

Project: Vine House, Hampstead Square, Camden, NW3 1AB

Title : Temporary Works

Croft Structural Engineers
Clockshop Mews,
r/o 60 Saxon Rd,
London, SE25 5EH.
020 8684 4744
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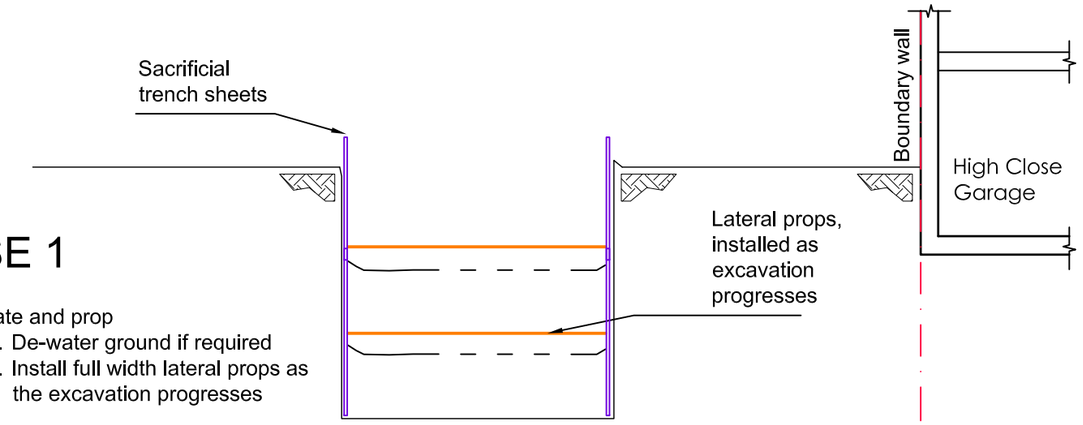
PHASE 1

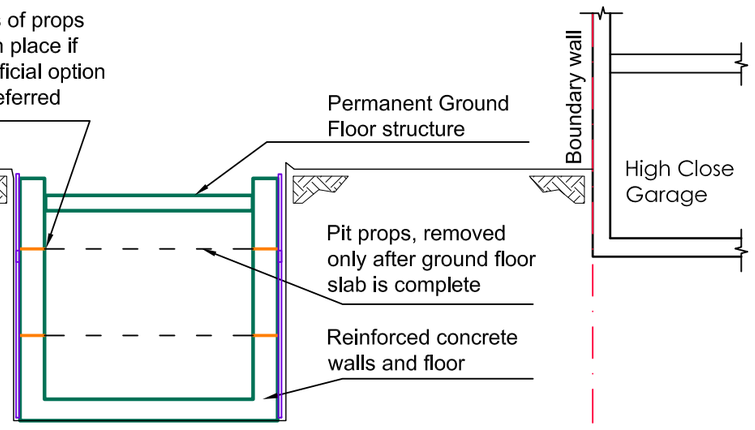
1.1. Excavate and prop
  1.1.1. De-water ground if required
  1.1.2. Install full width lateral props as the excavation progresses



Section (Phase 1)
Scale 1:100

PHASE 2

2.1. Place reinforcement and cast reinforced concrete retaining walls and floor
  2.1.1. Cast around around ends of props to allow for subsequent removal (formwork to be placed around prop head to eliminate contact with concrete);
  2.1.2. Alternatively props are to be sacrificial
2.2. Construct Ground floor slab
  2.2.1. Props may removed only after ground floor is complete (acting as a permanent high level prop); infill void in wall with concrete after prop is removed
  2.2.2. If props are sacrificial then cut and remove prop, leaving cast in segment in place
2.3. Proceed with structure above Ground level



Section (Phase 2)
Scale 1:100

- PLANNING ISSUE -
NOT FOR CONSTRUCTION

Rev	Date	Amendments
-	27.05.2020	First issue

Job No. 190925	Drawn GW / Chk'd -	Scale As shown @ A3
Dwg No. TW-200	Rev. -	Date May 2020

Client: Julia Gosmond

Project: Vine House, Hampstead Square, Camden, NW3 1AB

Title : Temporary Works

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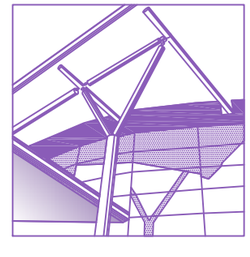
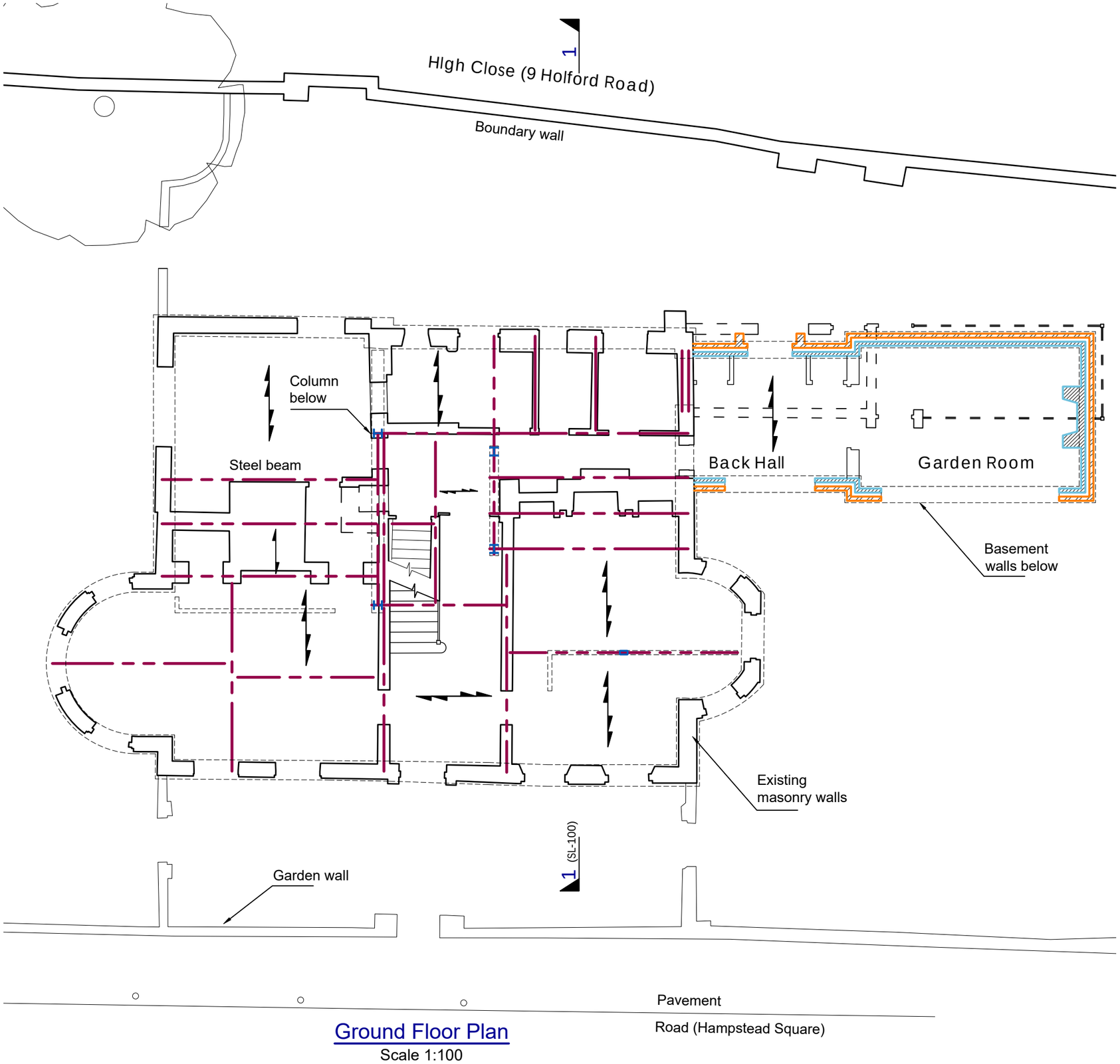




Ground Floor Plan

Scale 1:100

- PLANNING ISSUE - NOT FOR CONSTRUCTION

Rev	Date	Amendments
-	10.12.2019	First issue for comment

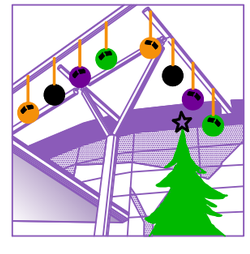
Job No. 190925	Drawn GW	Scale As shown @ A3
	Chk'd -	
Dwg No. SL-200	Rev. -	Date Nov 2019

Client: Julia Gosmond

Project: Vine House, Hampstead Square, Camden, NW3 1AB

Title : Structural Scheme Design: Ground Floor

Croft Structural Engineers
Clockshop Mews,
r/o 60 Saxon Rd,
London, SE25 5EH.
020 8684 4744
www.croftse.co.uk



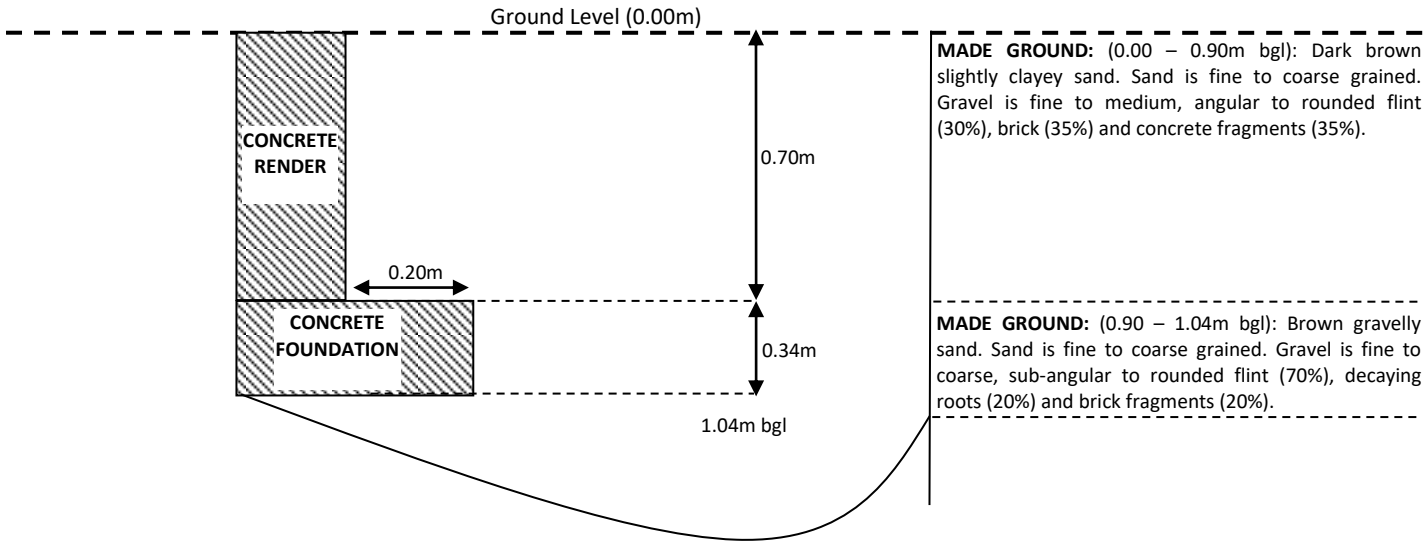
Appendix B Ground Investigation Report

APPROXIMATE SITE BOUNDARY

NOT TO SCALE

Project: Vine House, Hampstead Square London NW3 1AB		**Figure 1**
Client: Croft Structural Engineers	**Date:** November 2019	ground&water
Trial Hole Location Plan	**Ref:** GWPR3410	

TP/FE1 – Wall A



KEY:

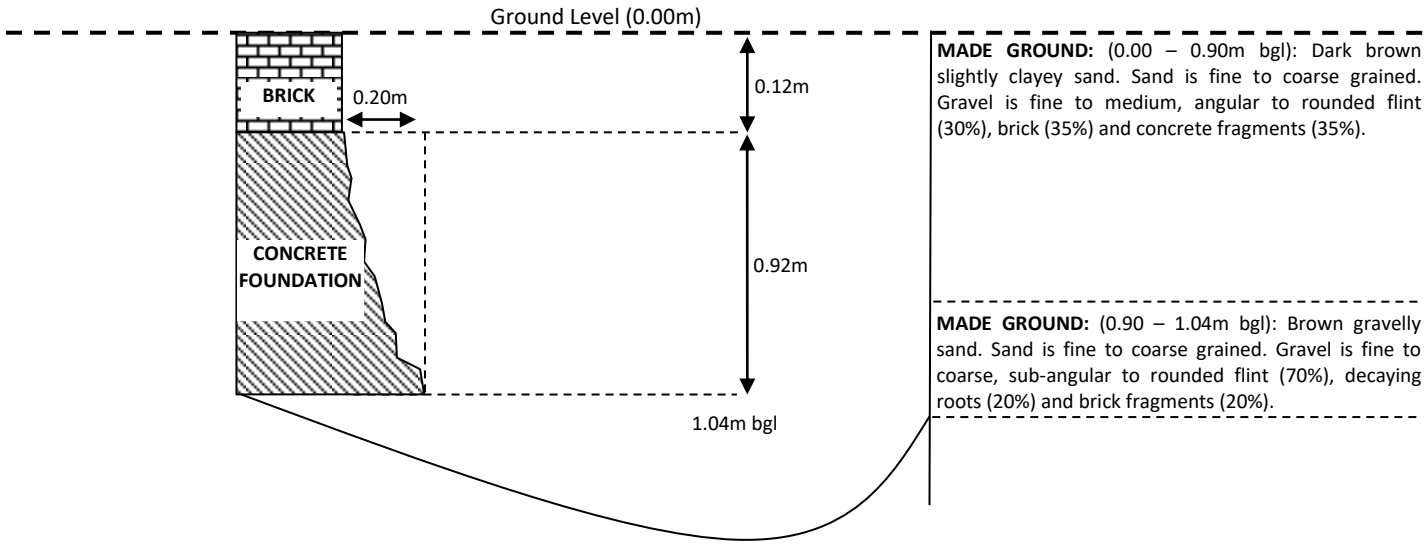
Brick

Concrete

NOT TO SCALE

Project: Vine House, Camden, London NW3 1AB		**Figure 6**
Client: Croft Structural Engineers	**Date:** November 2019	ground&water
Section Drawing: Foundation Exposure TP/FE1 – Wall A	**Ref:** GWPR3410	

TP/FE1 – Wall B



KEY:

Brick

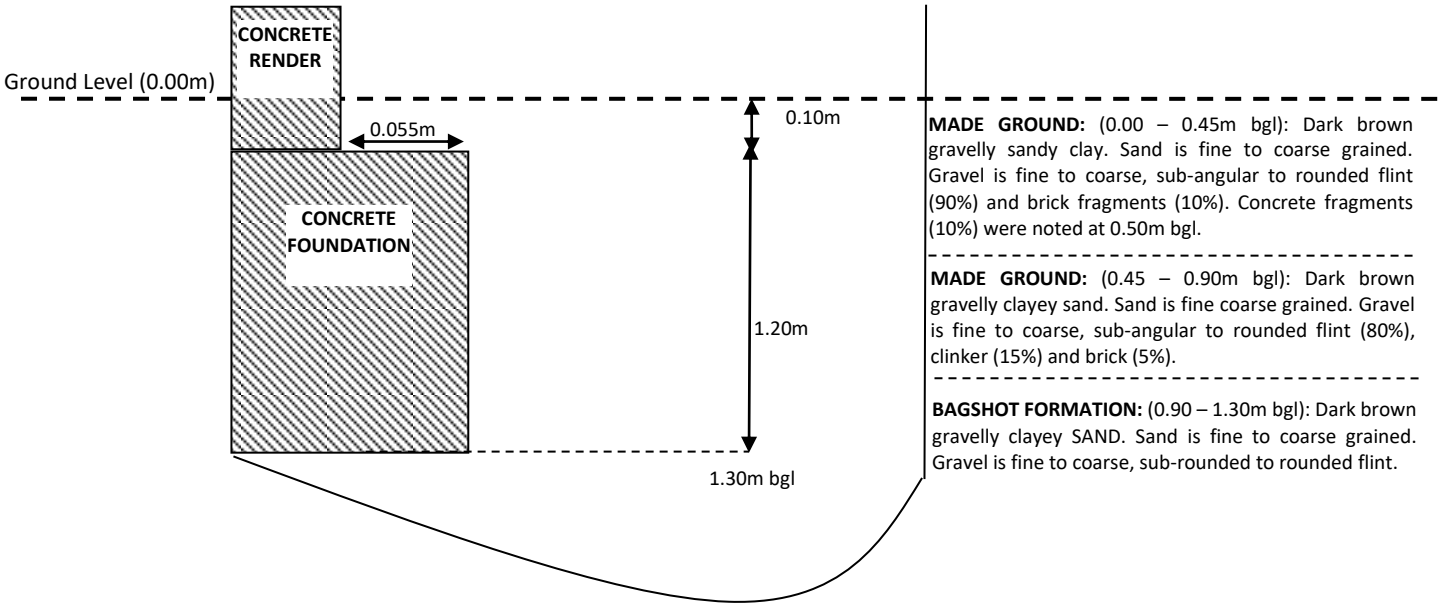
Concrete

NOT TO SCALE

Project: Vine House, Camden, London NW3 1AB	**Figure 7**
Client: Croft Structural Engineers	**Date:** November 2019
Section Drawing: Foundation Exposure TP/FE1 – Wall B	**Ref:** GWPR3410

ground&water

TP/FE2 – Wall A



KEY:

Brick

Concrete

NOT TO SCALE

Project: Vine House, Camden, London NW3 1AB	**Figure 8**
Client: Croft Structural Engineers	**Date:** November 2019
Section Drawing: Foundation Exposure TP/FE2 – Wall A	**Ref:** GWPR3410

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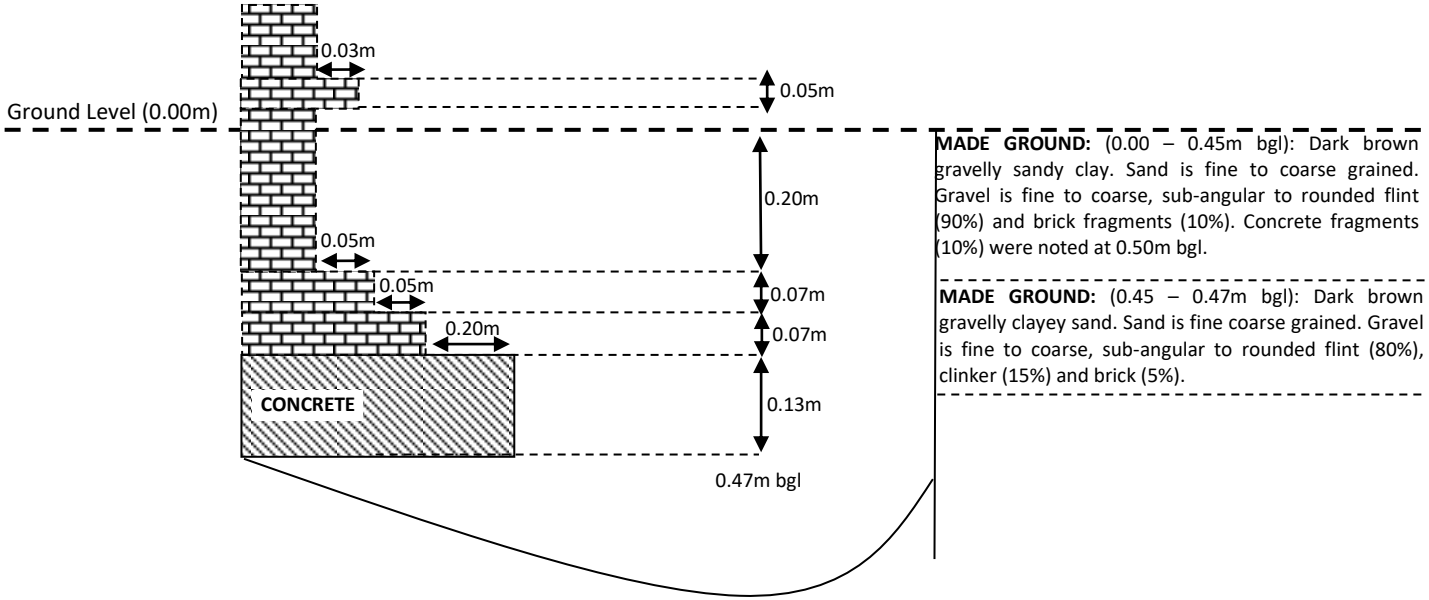
TP/FE2 – Wall B



MADE GROUND: (0.00 – 0.45m bgl): Dark brown gravelly sandy clay. Sand is fine to coarse grained. Gravel is fine to coarse, sub-angular to rounded flint (90%) and brick fragments (10%). Concrete fragments (10%) were noted at 0.50m bgl.

MADE GROUND: (0.45 – 0.47m bgl): Dark brown gravelly clayey sand. Sand is fine coarse grained. Gravel is fine to coarse, sub-angular to rounded flint (80%), clinker (15%) and brick (5%).

KEY:

Brick

Concrete

NOT TO SCALE

Project: Vine House, Camden, London NW3 1AB		**Figure 9**
Client: Croft Structural Engineers	**Date:** November 2019	ground&water
Section Drawing: Foundation Exposure TP/FE2 – Wall B	**Ref:** GWPR3410	

Percussion Drilling Log

Project Name: Vine House	Client: Croft Structural Engineers	Date: 04/11/2019
Location: London Borough of Camden, London NW3 1AB	Contractor:	
Project No. : GWPR3410	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS1	WLS		AA	1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	D					MADE GROUND: Dark grey slightly sandy gravelly silty clay. Sand is fine to coarse grained. Gravel is fine to coarse, angular to sub-rounded flint (40%), brick (20%), concrete (15%), claystone (10%) and clinker fragments (15%).
		0.50	D					
		0.80	D		0.80			MADE GROUND: Dark brown slightly gravelly clayey silty sand. Sand is fine to coarse grained. Gravel is fine to coarse, angular to sub-rounded flint (30%), brick (40%), claystone (10%) and clinker fragments (20%).
		1.00	D					
		1.00	SPT	N=2 (1,0/0,1,0,1)				
		1.50	D					
		2.00	D					
		2.00	SPT	N=2 (1,0/1,0,1,0)	2.10			BAGSHOT FORMATION: Orangish brown to brown gravelly silty SAND. Sand is fine to coarse grained. Gravel is fine to coarse, sub-angular to rounded flint.
		2.50	D					
		3.00	D					
		3.00	SPT	N=10 (1,1/2,2,3,3)				
		3.50	D		3.50			BAGSHOT FORMATION: Light brown slightly clayey silty SAND, with occasional pockets of clay. Sand is fine to medium.
		4.00	D					
		4.00	SPT	N=16 (3,3/4,4,4,4)				
		4.50	D					
		5.00	D					
		5.00	SPT	N=20 (4,4/5,5,5,5)				
		5.50	D					
		6.00	D					
		6.00	SPT	N=27 (6,6/6,7,7,7)				
		6.50	D					
		7.00	D					
		7.00	SPT	N=20 (4,4/5,5,5,5)				
		7.50	D					
		8.00	D					
		8.00	SPT	N=20 (5,5/5,5,5,5)				
					8.45			End of Borehole at 8.450m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Roots noted to a depth of 2.00m bgl. No groundwater was noted.

Percussion Drilling Log

Project Name: Vine House	Client: Croft Structural Engineers	Date: 04/11/2019
Location: London Borough of Camden, London NW3 1AB	Contractor:	
Project No. : GWPR3410	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS2	WLS		EM	1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	D					MADE GROUND: Dark brown/black gravelly sandy clay. Sand is fine to coarse grained. Gravel is fine to coarse, sub-angular to rounded flint (40%), concrete (40%) and brick (20%).
		0.50	D					
		0.80	D					
		1.00	D					
		1.00	SPT	N=1 (1,0/0,1,1,0)				
		1.50	D					
					1.80			
		2.00	D					BAGSHOT FORMATION: Orangish brown/brown gravelly SAND. Sand is fine to coarse grained. Gravel is fine to medium, sub-angular to rounded flint.
		2.00	SPT	N=3 (1,0/1,0,1,1)	2.10			BAGSHOT FORMATION: Brown gravelly sandy CLAY. Sand is fine to coarse grained. Gravel is fine to medium, sub-angular to rounded flint.
		2.50	D					
					2.90			
		3.00	D					BAGSHOT FORMATION: Light brown mottled orange slightly clayey SAND. Sand is fine to medium grained.
		3.00	SPT	N=10 (2,2/2,2,3,3)				
		3.50	D					
		4.00	D					
		4.00	SPT	N=16 (3,3/3,4,4,5)				
		4.50	D					
		5.00	D					
		5.00	SPT	N=21 (4,4/5,5,5,6)				
					5.45			End of Borehole at 5.450m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Roots noted to a depth of 1.00m bgl. No groundwater was noted.

Percussion Drilling Log

Project Name: Vine House	Client: Croft Structural Engineers	Date: 04/11/2019
Location: London Borough of Camden, London NW3 1AB	Contractor:	
Project No. : GWPR3410	Crew Name:	Drilling Equipment:

Borehole Number	Hole Type	Level	Logged By	Scale	Page Number
WS3	WLS		AA	1:50	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	D		0.40			MADE GROUND: Dark brown slightly sandy clayey silty gravel. Sand is fine to coarse grained. Gravel is fine to coarse, angular to rounded flint (65%), brick (15%), and concrete (20%) fragments.
		0.50	D					
		0.80	D		0.80			MADE GROUND: Brown slightly sandy gravelly silty clay. Sand is fine to coarse grained. Gravel is fine to coarse, angular to rounded flint (90%) and brick (10%) fragments.
		1.00	D					
		1.00	SPT	N=12 (2,2/3,2,3,4)				
		1.50	D					MADE GROUND: Brown very gravelly clayey silty sand. Sand is fine to coarse grained. Gravel is sub-angular to rounded fine to coarse flint (95%) and brick fragments (5%).
		2.00	D		2.00			
		2.00	SPT	N=13 (2,3/3,3,4,3)				BAGSHOT FORMATION: Light brown/ grey clayey SAND, with occasional pockets of clay. Sand is fine to medium.
		2.50	D					
		3.00	D					
		3.00	SPT	N=13 (2,3/3,3,3,4)				
		3.50	D					
		4.00	D					
		4.00	SPT	N=17 (3,3/4,4,4,5)				
		4.50	D					
		5.00	D					
		5.00	SPT	N=22 (3,4/5,5,6,6)				
					5.45			End of Borehole at 5.450m

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation

Remarks

Roots noted to a depth of 1.50m bgl. No groundwater was noted.

Trial Pit Log

Project Name: Vine House	Client: Croft Structural Engineers	Date: 04/11/2019
Location: London Borough of Camden, London NW3 1AB	Contractor:	
Project No. : GWPR3410	Crew Name:	Equipment:

Location Number	Location Type	Level	Logged By	Scale	Page Number
TP/FE1	TP		EM	1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	D					MADE GROUND: Dark brown slightly clayey sand. Sand is fine to coarse grained. Gravel is fine to medium, angular to rounded flint (30%), brick (35%) and concrete fragments (35%).
		0.50	D					
		0.80	D					
		1.00	D		0.90			MADE GROUND: Brown gravelly sand. Sand is fine to coarse grained. Gravel is fine to coarse, sub-angular to rounded flint (70%), decaying roots (20%) and brick fragments (10%).
					1.04			End of Borehole at 1.040m

1 2 3 4 5

Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks

Roots noted to a depth of 1.00m bgl. No groundwater was noted.

Trial Pit Log

Project Name: Vine House	Client: Croft Structural Engineers	Date: 04/11/2019
Location: London Borough of Camden, London NW3 1AB	Contractor:	
Project No. : GWPR3410	Crew Name:	Equipment:

Location Number	Location Type	Level	Logged By	Scale	Page Number
TP/FE2	TP		EM	1:25	Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	D					MADE GROUND: Dark brown gravelly sandy clay. Sand is fine to coarse grained. Gravel is fine to coarse, sub-angular to rounded flint (90%) and brick fragments (10%). At 0.50m bgl concrete fragments (10%) were noted.
		0.50	D		0.45			MADE GROUND: Dark brown gravelly clayey sand. Sand is fine to coarse grained. Gravel is fine to coarse, sub-angular to rounded flint (80%), clinker (15%) and brick fragments (5%).
		0.80	D					
		1.00	D		0.90			BAGSHOT FORMATION: Dark brown gravelly clayey SAND. Sand is fine to coarse grained. Gravel is sub-rounded to rounded fine to coarse flint.
					1.30			End of Borehole at 1.300m

1 2 3 4 5

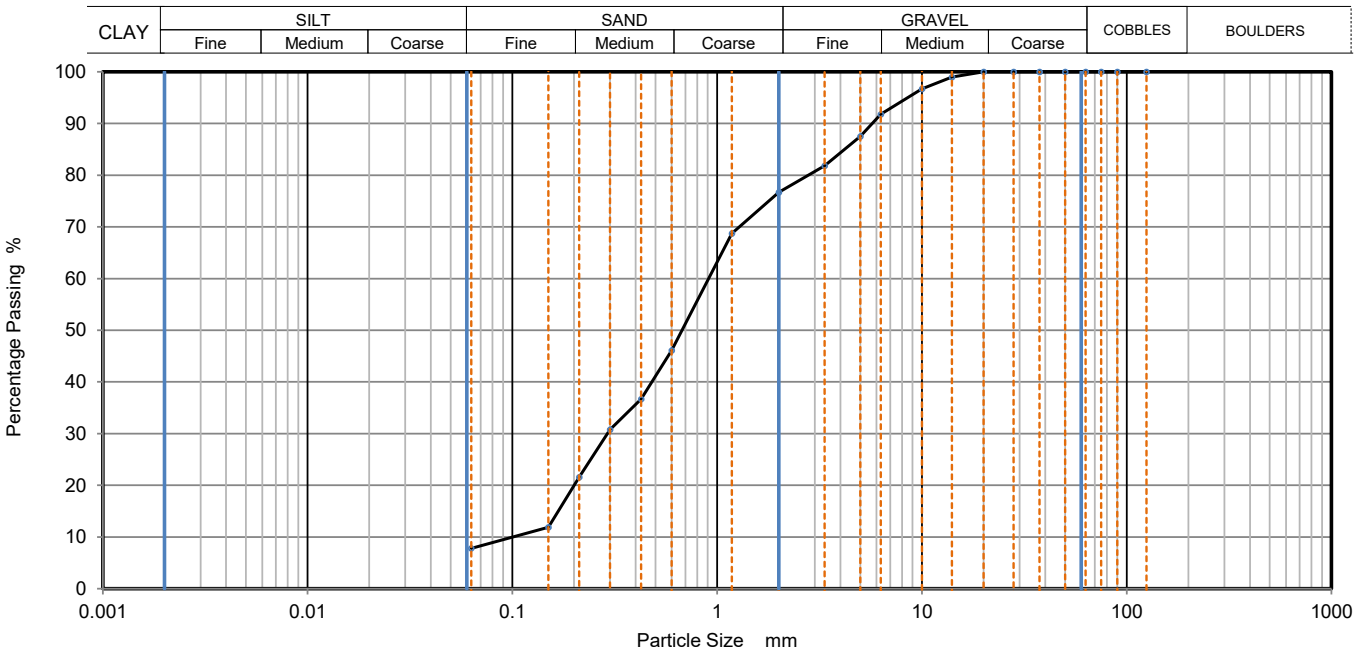
Dimensions		Trench Support and Comment			Pumping Data		
Pit Length	Pit Width	Pit Stability	Shoring Used	Remarks	Date	Rate	Remarks

Remarks

Roots noted to a depth of 1.00m bgl. No groundwater was noted.

PARTICLE SIZE DISTRIBUTION

Site Name	Vine House			Job Ref	27431
				Borehole/Pit No.	WS1
				Sample No.	-
Project No.	GWPR3410	Client	Ground & Water Ltd	Depth Top	2.50 m
Soil Description	Brown clayey very gravelly SAND (gravel is fm and sub-rounded to sub-angular)			Depth Base	- m
				Sample Type	D
				Samples received	11/11/2019
				Schedules received	11/11/2019
Test Method	BS1377:Part 2: 1990, clause 9.0			Project started	12/11/2019
				Date tested	20/11/2019



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	97		
6.3	92		
5	88		
3.35	82		
2	77		
1.18	69		
0.6	46		
0.425	37		
0.3	31		
0.212	22		
0.15	12		
0.063	8		

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	23.3
Sand	68.9
Fines <0.063mm	7.8

Grading Analysis		
D100	mm	
D60	mm	0.909
D30	mm	0.291
D10	mm	0.101
Uniformity Coefficient		9
Curvature Coefficient		0.93

Remarks

Preparation and testing in accordance with BS1377 unless noted below

K4 Soils Laboratory

Unit 8, Olds Close, Watford, Herts, WD18 9RU

Email: james@k4soils.com

Tel: 01923 711288

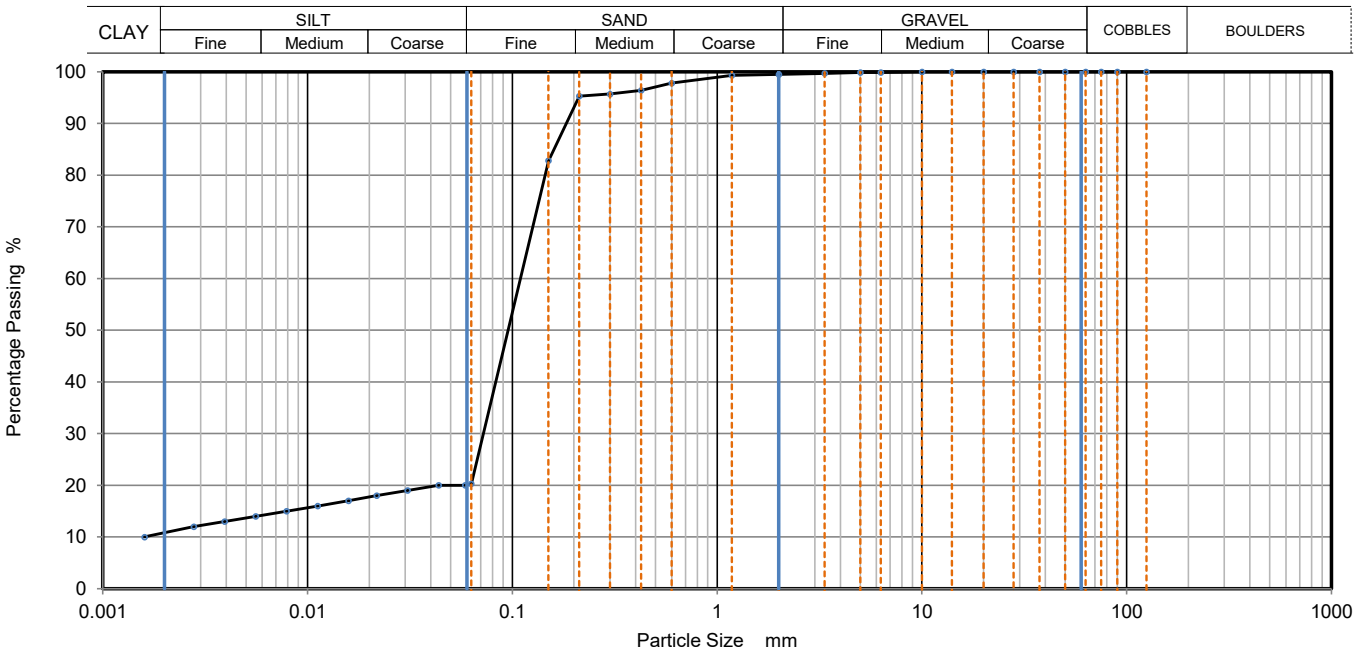
Checked and Approved

Initials: **J.P**

Date: 25/11/2019

PARTICLE SIZE DISTRIBUTION

Site Name	Vine House			Job Ref	27431
				Borehole/Pit No.	WS1
Project No.	GWPR3410	Client	Ground & Water Ltd	Sample No.	-
				Depth Top	3.50 m
Soil Description	Light brown silty clayey SAND with rare fine gravel			Depth Base	- m
				Sample Type	D
				Samples received	11/11/2019
				Schedules received	11/11/2019
Test Method	BS1377:Part 2: 1990, clause 9.0			Project started	12/11/2019
				Date tested	20/11/2019



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0587	20
90	100	0.0436	20
75	100	0.0308	19
63	100	0.0217	18
50	100	0.0158	17
37.5	100	0.0112	16
28	100	0.0079	15
20	100	0.0056	14
14	100	0.0039	13
10	100	0.0028	12
6.3	100	0.0016	10
5	100		
3.35	100		
2	100		
1.18	99		
0.6	98	Particle density	(assumed)
0.425	96	2.70	Mg/m3
0.3	96		
0.212	95		
0.15	83		
0.063	20		

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.5
Sand	79.3
Silt	9.5
Clay	10.7

Grading Analysis		
D100	mm	
D60	mm	0.109
D30	mm	0.0721
D10	mm	0.00164
Uniformity Coefficient		67
Curvature Coefficient		29

Remarks

Preparation and testing in accordance with BS1377 unless noted below

K4 Soils Laboratory

Unit 8, Olds Close, Watford, Herts, WD18 9RU

Email: james@k4soils.com

Tel: 01923 711288

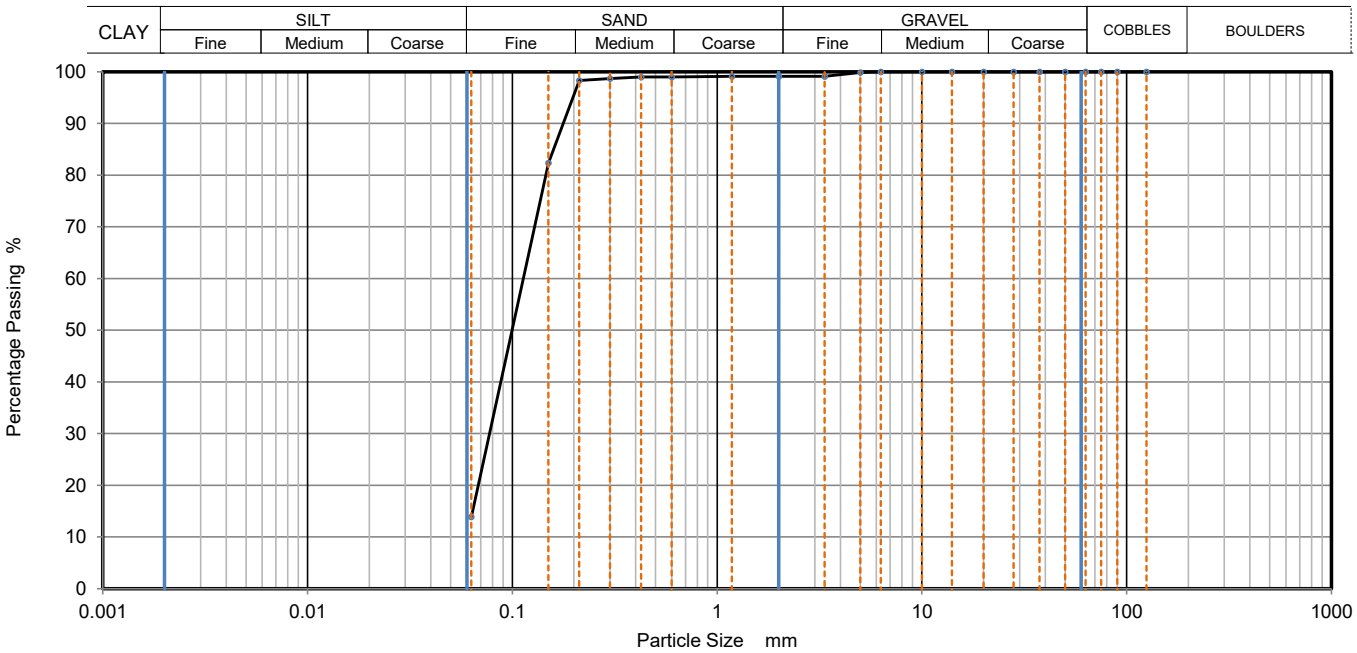
Checked and Approved

Initials: **J.P**

Date: 25/11/2019

PARTICLE SIZE DISTRIBUTION

Site Name	Vine House			Job Ref	27431
				Borehole/Pit No.	WS1
Project No.	GWPR3410	Client	Ground & Water Ltd	Sample No.	-
				Depth Top	5.50 m
Soil Description	Light brown clayey SAND with rare fine gravel			Depth Base	- m
				Sample Type	D
				Samples received	11/11/2019
				Schedules received	11/11/2019
Test Method	BS1377:Part 2: 1990, clause 9.0			Project started	12/11/2019
				Date tested	20/11/2019



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	99		
2	99		
1.18	99		
0.6	99		
0.425	99		
0.3	99		
0.212	98		
0.15	82		
0.063	14		

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	0.9
Sand	85.2
Fines <0.063mm	13.9

Grading Analysis		
D100	mm	
D60	mm	0.113
D30	mm	0.0772
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

K4 Soils Laboratory

Unit 8, Olds Close, Watford, Herts, WD18 9RU

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Date: 25/11/2019

UKAS TESTING 2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

Sulphate Content (Gravimetric Method) for 2:1 Soil: Water Extract and pH Value - Summary of Results
Tested in accordance with BS1377 : Part 3 : 1990, clause 5.3 and clause 9

Job No.	Project Name	Programme	
27431	Vine House	Samples received	11/11/2019
		Schedule received	11/11/2019
Project No.	Client	Project started	12/11/2019
GWPR3410	Ground & Water Ltd	Testing Started	19/11/2019

Hole No.	Sample				Soil description	Dry Mass passing 2mm	SO3 Content	SO4 Content	pH	Remarks
	Ref	Top m	Base m	Type		%	g/l	g/l		
WS1	-	3.50	-	D	Light brown silty clayey SAND with rare fine gravel	100	0.23	0.27	7.53	

Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU
Tel: 01923 711 288
Email: James@k4soils.com

Checked and Approved
Initials **J.P**
Date: **25/11/2019**

2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

Aaron Abu
Ground & Water Ltd
2 The Long Barn
Norton Farm
Selborne Road
Alton
Hampshire
GU34 3NB

DETS Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 19-15842

Site Reference:	Vine House, Comden, London, NW3 1AB
Project / Job Ref:	GWPR3410
Order No:	None Supplied
Sample Receipt Date:	11/11/2019
Sample Scheduled Date:	11/11/2019
Report Issue Number:	1
Reporting Date:	15/11/2019

Authorised by:

Dave Ashworth
Technical Manager

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

Soil Analysis Certificate						
DETS Report No: 19-15842	Date Sampled	04/11/19	04/11/19	04/11/19		
Ground & Water Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Vine House, Comden, London, NW3 1AB	TP / BH No	WS1	WS3	WS1		
Project / Job Ref: GWPR3410	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: None Supplied	Depth (m)	6.00	2.50	0.30		
Reporting Date: 15/11/2019	DETS Sample No	446511	446512	446513		

Determinand	Unit	RL	Accreditation					
Asbestos Screen (S)	N/a	N/a	ISO17025			Not Detected		
pH	pH Units	N/a	MCERTS	7.6	4.7	6.2		
Total Cyanide	mg/kg	< 2	NONE			< 2		
Total Sulphate as SO_4	mg/kg	< 200	NONE	680	< 200			
Total Sulphate as SO_4	%	< 0.02	NONE	0.07	< 0.02			
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	MCERTS	< 10	< 10	< 10		
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	MCERTS	< 0.01	< 0.01	< 0.01		
Total Sulphur	%	< 0.02	NONE	0.02	< 0.02			
Organic Matter	%	< 0.1	MCERTS			3.2		
Total Organic Carbon (TOC)	%	< 0.1	MCERTS			1.9		
Ammonium as NH_4	mg/kg	< 0.5	NONE	< 0.5	< 0.5			
Ammonium as NH_4	mg/l	< 0.05	NONE	< 0.05	< 0.05			
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	4	9			
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	2.2	4.6			
Water Soluble Nitrate (2:1) as NO_3	mg/kg	< 3	MCERTS	5	< 3			
Water Soluble Nitrate (2:1) as NO_3	mg/l	< 1.5	MCERTS	2.6	< 1.5			
Arsenic (As)	mg/kg	< 2	MCERTS			24		
W/S Boron	mg/kg	< 1	NONE			< 1		
Cadmium (Cd)	mg/kg	< 0.2	MCERTS			0.4		
Chromium (Cr)	mg/kg	< 2	MCERTS			18		
Chromium (hexavalent)	mg/kg	< 2	NONE			< 2		
Copper (Cu)	mg/kg	< 4	MCERTS			78		
Lead (Pb)	mg/kg	< 3	MCERTS			3980		
W/S Magnesium	mg/l	< 0.1	NONE	0.8	< 0.1			
Mercury (Hg)	mg/kg	< 1	NONE			2.3		
Nickel (Ni)	mg/kg	< 3	MCERTS			14		
Selenium (Se)	mg/kg	< 3	NONE			< 3		
Vanadium (V)	mg/kg	< 2	NONE			40		
Zinc (Zn)	mg/kg	< 3	MCERTS			140		
Total Phenols (monohydric)	mg/kg	< 2	NONE			< 2		

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Subcontracted analysis (S)

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Unit 1, Rose Lane Industrial Estate
Rose Lane
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Maidstone
Kent ME17 2JN
Tel : 01622 850410

Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 19-15842	Date Sampled	04/11/19				
Ground & Water Ltd	Time Sampled	None Supplied				
Site Reference: Vine House, Comden, London, NW3 1AB	TP / BH No	WS1				
Project / Job Ref: GWPR3410	Additional Refs	None Supplied				
Order No: None Supplied	Depth (m)	0.30				
Reporting Date: 15/11/2019	DETS Sample No	446513				

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1				
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1				
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1				
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1				
Phenanthrene	mg/kg	< 0.1	MCERTS	0.62				
Anthracene	mg/kg	< 0.1	MCERTS	0.13				
Fluoranthene	mg/kg	< 0.1	MCERTS	1.55				
Pyrene	mg/kg	< 0.1	MCERTS	1.35				
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.72				
Chrysene	mg/kg	< 0.1	MCERTS	0.61				
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.83				
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	0.27				
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.51				
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.43				
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1				
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.28				
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	7.3				

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30^{o}C

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Soil Analysis Certificate - TPH CWG Banded						
DETS Report No: 19-15842	Date Sampled	04/11/19				
Ground & Water Ltd	Time Sampled	None Supplied				
Site Reference: Vine House, Comden, London, NW3 1AB	TP / BH No	WS1				
Project / Job Ref: GWPR3410	Additional Refs	None Supplied				
Order No: None Supplied	Depth (m)	0.30				
Reporting Date: 15/11/2019	DETS Sample No	446513				

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01				
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05				
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2				
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2				
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3				
Aliphatic >C16 - C21	mg/kg	< 3	MCERTS	< 3				
Aliphatic >C21 - C34	mg/kg	< 10	MCERTS	< 10				
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21				
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01				
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05				
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2				
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2				
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2				
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3				
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10				
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21				
Total >C5 - C35	mg/kg	< 42	NONE	< 42				

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

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Rose Lane
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Maidstone
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Soil Analysis Certificate - BTEX / MTBE							
DETS Report No: 19-15842	Date Sampled	04/11/19					
Ground & Water Ltd	Time Sampled	None Supplied					
Site Reference: Vine House, Comden, London, NW3 1AB	TP / BH No	WS1					
Project / Job Ref: GWPR3410	Additional Refs	None Supplied					
Order No: None Supplied	Depth (m)	0.30					
Reporting Date: 15/11/2019	DETS Sample No	446513					

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2				
Toluene	ug/kg	< 5	MCERTS	< 5				
Ethylbenzene	ug/kg	< 2	MCERTS	< 2				
p & m-xylene	ug/kg	< 2	MCERTS	< 2				
o-xylene	ug/kg	< 2	MCERTS	< 2				
MTBE	ug/kg	< 5	MCERTS	< 5				

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30^{O}C

DETS Ltd
1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Waste Acceptance Criteria Analytical Certificate - BS EN 12457/2

DETS Report No: 19-15842		Date Sampled	04/11/19				Landfill Waste Acceptance Criteria Limits	
Ground & Water Ltd		Time Sampled	None Supplied				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Site Reference: Vine House, Comden, London, NW3 1AB		TP / BH No	WS1						
Project / Job Ref: GWPR3410		Additional Refs	None Supplied						
Order No: None Supplied		Depth (m)	0.30						
Reporting Date: 15/11/2019		DETS Sample No	446513						
Determinand	Unit	MDL							
TOC[MU]	%	< 0.1	1.9				3%	5%	6%
Loss on Ignition	%	< 0.01	6.50				--	--	10%
BTEX[MU]	mg/kg	< 0.05	< 0.05				6	--	--
Sum of PCBs	mg/kg	< 0.1	< 0.1				1	--	--
Mineral Oil[MU]	mg/kg	< 10	< 10				500	--	--
Total PAH[MU]	mg/kg	< 1.7	7.3				100	--	--
pH[MU]	pH Units	N/a	6.2				--	>6	--
Acid Neutralisation Capacity	mol/kg (+/-)	< 1	< 1				--	To be evaluated	To be evaluated
Eluate Analysis			10:1 mg/l			Cumulative 10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)		
Arsenic[U]			< 0.01			< 0.1	0.5	2	25
Barium[U]			0.07			0.7	20	100	300
Cadmium[U]			< 0.0005			< 0.005	0.04	1	5
Chromium[U]			< 0.005			< 0.05	0.5	10	70
Copper[U]			< 0.01			< 0.1	2	50	100
Mercury[U]			< 0.0005			< 0.005	0.01	0.2	2
Molybdenum[U]			< 0.001			< 0.01	0.5	10	30
Nickel[U]			< 0.007			< 0.07	0.4	10	40
Lead[U]			0.020			0.20	0.5	10	50
Antimony[U]			< 0.0050			< 0.05	0.06	0.7	5
Selenium[U]			< 0.005			< 0.05	0.1	0.5	7
Zinc[U]			0.006			0.06	4	50	200
Chloride[U]			< 1			< 10	800	15000	25000
Fluoride[U]			< 0.5			< 5	10	150	500
Sulphate[U]			2			20	1000	20000	50000
TDS			69			690	4000	60000	100000
Phenol Index			< 0.01			< 0.1	1	-	-
DOC			7.6			76.1	500	800	1000
Leach Test Information									
Sample Mass (kg)			0.11						
Dry Matter (%)			82.2						
Moisture (%)			21.8						
Stage 1									
Volume Eluate L10 (litres)			0.88						

Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and DETS Ltd cannot be held responsible for any discrepencies with current legislation
M Denotes MCERTS accredited test
U Denotes ISO17025 accredited test

DETS Ltd
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Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 19-15842	
Ground & Water Ltd	
Site Reference: Vine House, Comden, London, NW3 1AB	
Project / Job Ref: GWPR3410	
Order No: None Supplied	
Reporting Date: 15/11/2019	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
446511	WS1	None Supplied	6.00	8.7	Brown sandy clay
446512	WS3	None Supplied	2.50	8.9	Brown sandy clay
446513	WS1	None Supplied	0.30	17.8	Black loamy sand

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample [I/S]

& samples received in inappropriate containers for hydrocarbon analysis

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Maidstone
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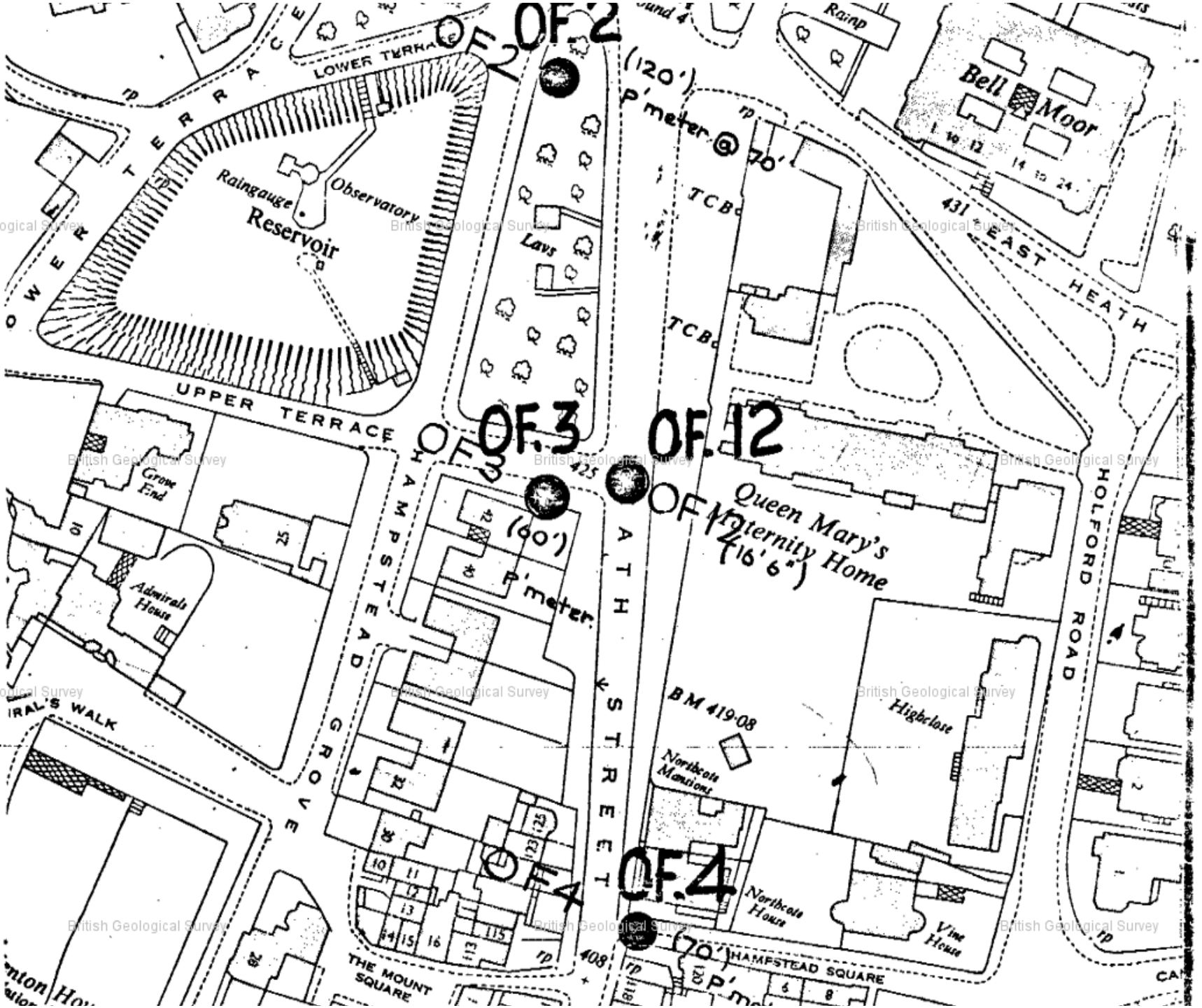
Tel : 01622 850410

Soil Analysis Certificate - Methodology & Miscellaneous Information
DETS Report No: 19-15842
Ground & Water Ltd
Site Reference: Vine House, Comden, London, NW3 1AB
Project / Job Ref: GWPR3410
Order No: None Supplied
Reporting Date: 15/11/2019

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

Appendix C Existing Exploratory Hole Records


OF.2
OF.2
(120')
P'meter @ 70'
Rainp
Bell Moor
LOWER TERRACE
TERRACE WEST
Raingauge
Observatory
Reservoir
Lavs
TCB
TCB
431
EAST HEATH
UPPER TERRACE
OF.3
OF.3
OF.12
425
Queen Mary's Maternity Home
(16'6")
Grove End
Admirals House
(60')
P'meter
HAMPSTEAD GROVE
HAMPSTEAD STREET
HOLFORD ROAD
BM 419·08
Highclose
Northcote Mansions
OF.4
OF.4
Northcote House
Vine House
(70')
HAMPSTEAD SQUARE
THE MOUNT SQUARE
408
IRAL'S WALK

TQ/28NE/91 0F4
2638 8609

RECORD OF BOREHOLE No: 01-4

Location : HAMPSTEAD SQUARE, HAMPSTEAD HEATH
Contract No. : 431
Type of Boring : Shell + Auger
Date (started) :

Borehole Dia : 8"
Casing :
Ground Level : 407.048'

Sheet 1 of 2

Depth of Casing	Water Level	SAMPLES Depth	Type	No.	STRATA Legend	Depth	Thickness	DESCRIPTION OF STRATA
						2·0	2·0	MADE GROUND / Topsoil
		2·6	D	1		4·0	2·0	Loose dark brown sandy GRAVEL (up to 1" rounded pebbles)
		5·0 (N=13)	D	2		6·0	2·0	Brown firm sandy CLAY matrix + abundant large fragments + pebbles
7·6	DRY	7·6	D	3		9·6	3·6	Abundant rounded hard 1" pebbles predominates over finer sand matrix.
30·0	DRY							
		10·0	U	4		10·6	1·0	Firm brown sandy CLAY
						12·0	1·6	Compact grey SAND
		12·6	D	5		13·0	1·0	Fine silty clayey SAND
		15·6	U	6				
		17·6	D	7				Fine dense silty SAND
		20·0 (N=32)	D	8			14·0	(especially wet towards base)
		22·0	D	9				
		25·0 (N=31)	D	10				
		27·6	D	11		27·0	1·0	Stiff/hard grey CLAY + little fine sand.
30·0	DRY	30·0	U	12		28·0	4·0	Firm brown sandy CLAY
		32·6	D	13		32·0		mottled brown + fawn mixture soft/firm silty CLAY + fine sand.
		35·0	U	14			9·0	(+ silty clayey SAND)
		37·6	D	15				
		40·0	U	16		(40·0)		

REMARKS:

SCALE 1"=5

Foundation Engineering Ltd.

TQ28NE/91
2538.8604 OF.4

RECORD OF BOREHOLE No 4

Location : HAMPSTEAD SQUARE, HAMPSTEAD HEATH
Contract No. : 431
Type of Boring : Shell + Auger
Date (started) : 5. 5. 65

Borehole Dia : 8"
Casing :
Ground Level : 407.048'

Sheet 2 of 2

Depth of Casing	Water Level	SAMPLES Depth	Type	No.	STRATA Legend	Depth	Thickness	DESCRIPTION OF STRATA
						(40·0)		more sandy.
						41·0		
						42·0	1·0	Compact brown SAND
		42·6	D	17				
								Silty clayey SAND
		45·0	D	18			5·0	(as D18+15)
		47·6	D	19		47·0		
						48·0	1·0	Golden brown/grey clayey SAND
(46·0)	DRY							
(48·0)	DRY	50·0	U	20			3·0	Firm grey / brown sandy CLAY
						51·0		
		52·6	D	21				
								Wet running silty micaceous brown fine compact SAND
		55·0	D	22			11·0	
		57·6	D	23				
		60·0 (N·64)	D	24				
		62·6	D	25		62·0		
						63·0	1·0	Grey micaceous firm silty CLAY, predom. over brown fine SAND
		65·0	U	26				
							7·0	
		67·6	D	27				Dark grey micaceous silty SAND
(70·0)	15·0	70·0	U	28		70·0		
						Borehole complete		

REMARKS:

Piezometer installed at 55·0"

SCALE 1" = 5'

Foundation Engineering Ltd.

Appendix D PDisp Output

Titles

Job No.: MGC-19-34
Job Title: Vine House Hampstead NW3 1AB
Sub-title: BIA and GMA
Calculation Heading:
Initials: JGM
Checker:
Date Saved:
Date Checked:
Notes:
File Name: vine house excavation and walls all.pdd
File Path: F:\OneDrive\Documents\Croft Structural Engineers\1-Vine House, London NW3 1AB\07-GIR- Vine House\PDISP

History

Date	Time	By	Notes
30-Nov-2019	13:11	Maund Geo Consulting	New
30-Nov-2019	14:44	Maund Geo Consulting	
30-Nov-2019	16:29	Maund Geo Consulting	
30-Nov-2019	16:38	Maund Geo Consulting	
15-May-2020	15:41	Maund Geo Consulting	
25-May-2020	20:12	Maund Geo Consulting	
26-May-2020	08:46	Maund Geo Consulting	
26-May-2020	09:54	Maund Geo Consulting	
26-May-2020	18:48	Maund Geo Consulting	
27-May-2020	18:26	Maund Geo Consulting	

Analysis Options

General
Global Poisson's ratio: 0.20
Maximum allowable ratio between values of E: 1.5
Horizontal rigid boundary level: 100.30 [m OD]
Displacements at load centroids: Yes
GSA piled raft data : No

Elastic
Elastic : Yes
Analysis: Boussinesq
Stiffness for horizontal displacement calculations: Weighted average
Using legacy heave correction factor: No

Consolidation
Consolidation : No

Soil ProfilesSoil Profile 1

Layer ref.	Name	Level at top [mOD]	Number of intermediate displacement levels	Youngs Modulus : Top [kN/m²]	Youngs Modulus : Btm. [kN/m²]	Poissons ratio	Non-linear curve
1	Made Ground	125.30	5	20000.	20000.	0.30000	None
2	Bagshot Formation silty clayey SAND	123.30	25	37000.	37000.	0.30000	None

Non-linear Curve Coordinates - Non-linear Curve 1

Point	Strain [%]	Factor

Soil Zones

Zone	Name	X min [m]	X max [m]	Y min [m]	Y max [m]	Profile
1	A	0.0	45.000	0.0	35.000	Soil Profile 1

Polygonal Load Data

Load ref.	Name	Position : Level [m]	Position : Polygon : Coords. [m]	Position : Polygon : Rect. tolerance [%]	No. of Rectangles	Value : Normal (local z) [kN/m²]
1	wall 1 100 kpa	125.30000	(10,10) (23.5,10) (23.5,11.5) (24.8,12.8) (25,14) (23.5,15.5) (23.5,17.4) (23.1,17.4) (23.1,15.2) (24.6,13.7) (24.4,12.8) (23.1,11.8) (23.1,10.3) (10,10.3) (10,10)	10.000	32	40.000
2	wall 2 80 kpa	125.30000	(23.5,17) (33,17) (33,21) (23.5,21) (23.5,20.6) (32.6,20.6) (32.6,17.4) (23.5,17.4) (23.5,17)	10.000	3	20.000
3	wall 3 10 kpa	125.30000	(23.5,20.6) (23.5,21) (10,21) (10,15) (10.3,15) (10.3,20.6) (23.5,20.6)	10.000	2	40.000
4	wall 4 60 kpa	125.30000	(10.3,15) (9.1,14.3) (7.85,12.7) (9.1,11) (10.3,10.7) (10.3,10.3) (10,10.3) (8.75,11) (7.6,12.7) (8.75,14.3) (10,15) (10.3,15)	10.000	33	20.000
5	internal wall 1 100 kpa	125.30000	(14.7,10.3) (16,10.3) (16,20.6) (14.7,20.6) (14.7,10.3)	10.000	1	40.000
6	internal wall 2 100 kpa	125.30000	(17.8,14.8) (19,14.8) (19,18.9) (17.8,18.9) (17.8,14.8)	10.000	1	40.000
7	internal wall 3 100 kpa	125.30000	(20.9,12.3) (22,12.3) (22,13.7) (20.9,13.7) (20.9,12.3)	10.000	1	40.000
8	basement floor slab 8 kpa	125.30000	(10,10) (23.5,10) (23.5,11.5) (24.8,12.8) (25,14) (23.5,15.5) (23.5,17) (33,17) (33,21) (10,21) (10,15) (8.75,14.3) (7.6,12.7) (8.75,11) (10,10.5) (10,10)	10.000	11	0.0
9	thin internal slab 8 kpa	125.30000	(9.5,12.3) (20.9,12.3) (20.9,19.1) (11.8,19.1) (11.8,13.8) (9.5,13.8) (9.5,12.3)	10.000	2	0.0
10	walls plus thick slab (assume 100 kpa	125.30000	(11.8,12.3) (20.9,12.3) (20.9,19.1) (11.8,19.1) (11.8,21) (33.2,21) (33,17) (23.5,17) (23.5,15.5) (25,14) (24.8,12.8) (23.5,11.5) (23.5,10) (11.8,10) (11.8,12.3)	10.000	9	40.000

Load ref.	Name	Position : Level	Position : Polygon : Coords.	Position : Polygon : Rect. tolerance	No. of Rectangles	Value : Normal (local z)
11	walls plus thick slab	125.30000	(11.8,13.8) (11.8,21) (10,21) (10,15) (8.75,14.3) (7.6,12.7) (8.75,11) (10,10.5) (10,10) (11.8,10) (11.8,12.3) (9.5,12.3) (9.5,13.8) (11.8,13.8)	10.000	10	40.000

Polygonal Loads' Rectangles

No.	Centre : Centre : x [m]	y [m]	Angle of local x from global X [Degrees]	Width x [m]	Depth y [m]
Load 1 : wall 1 100 kpa					
(Edge 1 optimal)					
1	16.57500	10.17500	0.0	13.150	0.35000
2	23.32500	10.98800	0.0	0.35000	1.9760
3	23.55000	11.84400	0.0	0.10000	0.58800
4	23.65000	11.93000	0.0	0.10000	0.56000
5	23.75000	12.01600	0.0	0.10000	0.53200
6	23.85000	12.10200	0.0	0.10000	0.50400
7	23.95000	12.18800	0.0	0.10000	0.47600
8	24.05000	12.27400	0.0	0.10000	0.44800
9	24.15000	12.36000	0.0	0.10000	0.42000
10	24.25000	12.44600	0.0	0.10000	0.39200
11	24.35000	12.53200	0.0	0.10000	0.36400
12	24.42500	12.63250	0.0	0.050000	0.41500
13	24.47500	12.74750	0.0	0.050000	0.54500
14	24.52500	12.86250	0.0	0.050000	0.67500
15	24.57500	12.97750	0.0	0.050000	0.80500
16	24.62500	13.09250	0.0	0.050000	0.93500
17	24.70000	13.50000	0.0	0.10000	1.6000
18	24.77500	13.55000	0.0	0.050000	1.3500
19	24.82500	13.65000	0.0	0.050000	1.0500
20	24.87500	13.75000	0.0	0.050000	0.75000
21	24.92500	13.85000	0.0	0.050000	0.45000
22	24.97500	13.95000	0.0	0.050000	0.15000
23	23.32500	16.16250	0.0	0.35000	2.3750
24	23.56389	15.08611	0.0	0.12778	0.70000
25	23.69167	14.95833	0.0	0.12778	0.70000
26	23.81944	14.83056	0.0	0.12778	0.70000
27	23.94722	14.70278	0.0	0.12778	0.70000
28	24.07500	14.57500	0.0	0.12778	0.70000
29	24.20278	14.44722	0.0	0.12778	0.70000
30	24.33056	14.31944	0.0	0.12778	0.70000
31	24.45833	14.19167	0.0	0.12778	0.70000
32	24.58611	14.06389	0.0	0.12778	0.70000
Load 2 : wall 2 80 kpa					
(Edge 1 optimal)					
1	28.07500	17.17500	0.0	9.1500	0.35000
2	32.82500	19.00000	0.0	0.35000	4.0000
3	28.05000	20.82500	0.0	9.1000	0.35000
Load 3 : wall 3 10 kpa					
(Edge 1 optimal)					
1	16.75000	20.82500	90.000	0.35000	13.500
2	10.17500	17.82500	90.000	5.6500	0.35000
Load 4 : wall 4 60 kpa					
(Edge 11 optimal)					
1	8.88079	14.35208	-55.923	0.060294	0.43876
2	9.14237	14.45624	-55.923	0.060294	1.3163
3	9.27497	14.46395	-55.923	0.075520	1.9134
4	8.70971	14.00346	-55.923	0.053865	0.81232
5	8.61034	13.87121	-55.923	0.053865	0.79206
6	8.51098	13.73896	-55.923	0.053865	0.77180
7	8.41161	13.60671	-55.923	0.053865	0.75155
8	8.31225	13.47446	-55.923	0.053865	0.73129
9	8.21288	13.34221	-55.923	0.053865	0.71103
10	8.11352	13.20996	-55.923	0.053865	0.69078
11	8.01415	13.07771	-55.923	0.053865	0.67052
12	7.91479	12.94546	-55.923	0.053865	0.65026
13	7.83989	12.82000	-55.923	0.070039	0.53187
14	7.78946	12.70133	-55.923	0.070039	0.31534
15	8.31556	11.86052	-55.923	1.9124	0.24463
16	8.90614	11.04643	-55.923	0.098054	0.25756
17	8.98467	10.98118	-55.923	0.098054	0.20829
18	9.07913	10.92860	-55.923	0.094887	0.20131
19	9.18950	10.88871	-55.923	0.094887	0.23663
20	9.29988	10.84881	-55.923	0.094887	0.27194
21	9.41025	10.80892	-55.923	0.094887	0.30726
22	9.52062	10.76903	-55.923	0.094887	0.34258
23	9.63100	10.72913	-55.923	0.094887	0.37789
24	9.74137	10.68924	-55.923	0.094887	0.41321
25	9.85175	10.64934	-55.923	0.094887	0.44853
26	9.96212	10.60945	-55.923	0.094887	0.48385
27	10.07249	10.56955	-55.923	0.094887	0.51916
28	10.15134	10.50899	-55.923	0.093791	0.47969
29	10.20417	10.44865	-55.923	0.065369	0.35213
30	10.26250	10.40919	-55.923	0.065369	0.21128
31	10.32083	10.36973	-55.923	0.065369	0.070427
32	9.80054	14.73750	-55.923	0.060294	0.93698
33	10.16685	14.91250	-55.923	0.060294	0.31233
Load 5 : internal wall 1 100 kpa					
(Edge 1 optimal)					
1	15.35000	15.50000	0.0	1.3000	10.300
Load 6 : internal wall 2 100 kpa					
(Edge 1 optimal)					
1	18.40000	16.85000	0.0	1.2000	4.0000
Load 7 : internal wall 3 100 kpa					
(Edge 1 optimal)					
1	21.42500	13.00000	0.0	1.1500	1.3000
Load 8 : basement floor slab 8 kpa					
(Edge 2 optimal)					
1	16.75000	10.25000	90.000	0.50000	13.500
2	16.43750	10.75000	90.000	0.50000	14.125
3	16.04044	11.25000	90.000	0.50000	14.919
4	16.05294	12.10000	90.000	1.2000	16.094
5	16.17148	12.72500	90.000	0.050000	17.107
6	16.48008	13.37500	90.000	1.2500	16.790
7	16.74609	14.15000	90.000	0.30000	16.208
8	16.86250	14.65000	90.000	0.70000	14.975
9	16.87500	15.25000	90.000	0.50000	13.750
10	16.75000	16.25000	90.000	1.5000	13.500
11	21.50000	19.00000	90.000	4.0000	23.000
Load 9 : thin internal slab 8 kpa					
(Edge 1 optimal)					
1	10.67500	13.05000	0.0	2.3500	1.5000
2	16.35000	15.72500	0.0	9.0000	6.8500
Load 10 : walls plus thick slab (assume 100 kpa					
(Edge 1 optimal)					
1	17.67500	10.75000	90.000	1.5000	11.650
2	17.87500	11.90000	90.000	0.80000	12.050
3	22.68750	12.52500	90.000	0.45000	3.6750
4	22.86250	13.37500	90.000	1.2500	4.0250
5	22.73750	14.37500	90.000	0.75000	3.7750
6	22.36250	15.12500	90.000	0.75000	3.0250
7	22.17500	16.25000	90.000	1.5000	2.6500
8	26.95322	18.07500	90.000	2.1500	12.206
9	22.50572	20.07500	90.000	1.8500	21.311
Load 11 : walls plus thick slab					

No.	Centre : x	Centre : y	Angle of local x from global X	Width x	Depth y
(Edge 2 Optimal)					
1	10.92500	17.40000	-180.00	1.8500	7.2000
2	9.75000	14.33000	-180.00	0.50000	1.0600
3	9.12500	12.68000	-180.00	0.75000	3.6600
4	8.63500	12.65500	-180.00	0.23000	2.9700
5	8.40500	12.66500	-180.00	0.23000	2.3100
6	8.17500	12.67500	-180.00	0.23000	1.6500
7	7.94500	12.68500	-180.00	0.23000	0.99000
8	7.71500	12.69500	-180.00	0.23000	0.33000
9	10.92500	11.15000	-180.00	1.8500	2.3000
10	9.75000	11.45000	-180.00	0.50000	1.7000

Displacement Lines

Name	X1 [m]	Y1 [m]	Z1 [m]	X2 [m]	Y2 [m]	Z2 [m]	Intervals [No.]	Calculate	Detailed Results
cross section1	18.00000	0.00000	125.30000	18.00000	35.00000	125.30000	30	Yes	Yes
cross section 2	27.00000	0.00000	125.30000	27.00000	35.00000	125.30000	30	Yes	Yes
long section	0.00000	18.00000	125.30000	40.00000	18.00000	125.30000	30	Yes	No

Displacement Grids

Name	Extrusion: Direction	X1 [m]	Y1 [m]	Z1 [m]	X2 [m]	Y2 [m]	Z2 [m]	Intervals Along Line [No.]	Extrusion: Distance [m]	Extrusion: Intervals Along [No.]	Calculate	Detailed Results
grid	Global X	0.00000	0.00000	125.30000	-	30.00000	125.30000	20	45.00000	10	Yes	Yes

Results : Immediate : Load Centres : Polygonal

Ref.	Name	x [m]	y [m]	z [mOD]	δz [mm]	Stress: Calc. Level [mOD]	Stress: Vertical [kN/m²]	Stress: Sum Princ. [kN/m²]	Vert. Strain [μ]
1	wall 1 100 kpa	19.57926	11.64500	125.30000	9.00533	125.13	39.878	87.804	0.0012750
2	wall 2 80 kpa	28.96578	19.00575	125.30000	8.80117	125.13	39.994	91.305	0.0012300
3	wall 3 10 kpa	14.81012	19.93988	125.30000	10.39857	125.13	73.176	146.98	0.0025517
4	wall 4 60 kpa	8.89817	12.41668	125.30000	6.69754	125.13	39.879	85.389	0.0013113
5	internal wall 1 100 kpa	15.35000	15.50000	125.30000	8.21339	125.13	39.738	82.474	0.0013459
6	internal wall 2 100 kpa	18.40000	16.85000	125.30000	8.54483	125.13	39.671	81.696	0.0013532
7	internal wall 3 100 kpa	21.42500	13.00000	125.30000	11.47500	125.13	79.264	160.58	0.0027435
8	basement floor slab 8 kpa	18.84163	16.04225	125.30000	8.13819	125.13	35.996	68.230	0.0013163
9	thin internal slab 8 kpa	16.04307	15.58032	125.30000	7.19099	125.13	13.686	38.622	310.28E-6
10	walls plus thick slab (assume 100 kpa	22.40291	16.54712	125.30000	10.29500	125.13	40.029	92.265	0.0012179
11	walls plus thick slab	10.44303	15.06023	125.30000	7.85422	125.13	45.344	98.187	0.0014745

Results : Consolidation : Load Centres : Polygonal

None

Results : Total : Load Centres : Polygonal

None

Results : Immediate : Displacement Data : Lines

Ref.	Name	x [m]	y [m]	z [mOD]	δz [mm]	Stress: Calc. Level [mOD]	Stress: Vertical [kN/m²]	Stress: Sum Princ. [kN/m²]	Vert. Strain [μ]
1	cross section1	18.00000	0.00000	125.30000	0.69335	125.13	23.865E-6	0.12029	-1.8027E-6
1	cross section1	18.00000	1.16667	125.30000	0.86480	125.13	38.267E-6	0.15539	-2.3283E-6
1	cross section1	18.00000	2.33333	125.30000	1.07973	125.13	65.010E-6	0.20640	-3.0918E-6
1	cross section1	18.00000	3.50000	125.30000	1.35125	125.13	119.09E-6	0.28411	-4.2539E-6
1	cross section1	18.00000	4.66667	125.30000	1.69804	125.13	241.82E-6	0.41004	-6.1348E-6
1	cross section1	18.00000	5.83333	125.30000	2.14863	125.13	571.36E-6	0.63295	-9.4571E-6
1	cross section1	18.00000	7.00000	125.30000	2.75212	125.13	0.0017328	1.0862	-16.181E-6
1	cross section1	18.00000	8.16667	125.30000	3.61834	125.13	0.0086924	2.2819	-33.664E-6
1	cross section1	18.00000	9.33333	125.30000	5.16874	125.13	0.20994	8.8251	-118.73E-6
1	cross section1	18.00000	10.50000	125.30000	8.81119	125.13	43.780	100.03	0.0013453
1	cross section1	18.00000	11.66667	125.30000	8.89979	125.13	39.862	87.249	0.0012823
1	cross section1	18.00000	12.83333	125.30000	6.53840	125.13	0.23699	9.5968	-128.55E-6
1	cross section1	18.00000	14.00000	125.30000	6.10874	125.13	0.045461	5.2863	-76.339E-6
1	cross section1	18.00000	15.16667	125.30000	7.67599	125.13	36.687	65.289	0.0014053
1	cross section1	18.00000	16.33333	125.30000	8.14517	125.13	37.380	71.733	0.0013537
1	cross section1	18.00000	17.50000	125.30000	8.26834	125.13	37.384	72.350	0.0013447
1	cross section1	18.00000	18.66667	125.30000	8.27755	125.13	35.106	66.372	0.0012863
1	cross section1	18.00000	19.83333	125.30000	8.95423	125.13	39.929	88.607	0.0012663
1	cross section1	18.00000	21.00000	125.30000	7.79484	125.13	39.281	80.742	0.0013421
1	cross section1	18.00000	22.16667	125.30000	4.46879	125.13	0.036684	4.2380	-61.186E-6
1	cross section1	18.00000	23.33333	125.30000	3.34028	125.13	0.0039189	1.6059	-23.834E-6
1	cross section1	18.00000	24.50000	125.30000	2.61382	125.13	0.0010263	0.86599	-12.923E-6
1	cross section1	18.00000	25.66667	125.30000	2.07967	125.13	388.73E-6	0.54171	-8.1004E-6
1	cross section1	18.00000	26.83333	125.30000	1.66807	125.13	180.23E-6	0.36840	-5.5143E-6
1	cross section1	18.00000	28.00000	125.30000	1.34380	125.13	94.978E-6	0.26457	-3.9624E-6
1	cross section1	18.00000	29.16667	125.30000	1.08511	125.13	54.687E-6	0.19754	-2.9595E-6
1	cross section1	18.00000	30.33333	125.30000	0.87708	125.13	33.606E-6	0.15189	-2.2762E-6
1	cross section1	18.00000	31.50000	125.30000	0.70892	125.13	21.710E-6	0.11954	-1.7917E-6
1	cross section1	18.00000	32.66667	125.30000	0.57247	125.13	14.593E-6	0.095889	-1.4374E-6
1	cross section1	18.00000	33.83333	125.30000	0.46150	125.13	10.133E-6	0.078148	-1.1716E-6
1	cross section1	18.00000	35.00000	125.30000	0.37107	125.13	7.2288E-6	0.064558	0.0
2	cross section 2	27.00000	0.00000	125.30000	0.48057	125.13	11.786E-6	0.082267	-1.2332E-6
2	cross section 2	27.00000	1.16667	125.30000	0.58777	125.13	17.006E-6	0.10034	-1.5040E-6
2	cross section 2	27.00000	2.33333	125.30000	0.71679	125.13	25.327E-6	0.12412	-1.8602E-6
2	cross section 2	27.00000	3.50000	125.30000	0.87190	125.13	39.153E-6	0.15605	-2.3381E-6
2	cross section 2	27.00000	4.66667	125.30000	1.05807	125.13	63.216E-6	0.19988	-2.9940E-6
2	cross section 2	27.00000	5.83333	125.30000	1.28090	125.13	107.16E-6	0.26145	-3.9147E-6
2	cross section 2	27.00000	7.00000	125.30000	1.54617	125.13	190.73E-6	0.34961	-5.2318E-6
2	cross section 2	27.00000	8.16667	125.30000	1.85855	125.13	351.85E-6	0.47662	-7.1264E-6
2	cross section 2	27.00000	9.33333	125.30000	2.21918	125.13	651.85E-6	0.65618	-9.8003E-6
2	cross section 2	27.00000	10.50000	125.30000	2.62354	125.13	0.0011876	0.90067	-13.433E-6
2	cross section 2	27.00000	11.66667	125.30000	3.06234	125.13	0.0021682	1.2234	-18.210E-6
2	cross section 2	27.00000	12.83333	125.30000	3.52019	125.13	0.0036467	1.6118	-23.940E-6
2	cross section 2	27.00000	14.00000	125.30000	3.98871	125.13	0.0048408	2.0266	-30.084E-6
2	cross section 2	27.00000	15.16667	125.30000	4.56181	125.13	0.0095439	2.8851	-42.656E-6
2	cross section 2	27.00000	16.33333	125.30000	5.67054	125.13	0.16761	8.1848	-111.88E-6
2	cross section 2	27.00000	17.50000	125.30000	8.86113	125.13	41.754	92.963	0.0013195
2	cross section 2	27.00000	18.66667	125.30000	9.36939	125.13	39.994	91.505	0.0012270
2	cross section 2	27.00000	19.83333	125.30000	9.01728	125.13	39.997	90.950	0.0012356
2	cross section 2	27.00000	21.00000	125.30000	7.08261	125.13	29.641	63.994	966.78E-6
2	cross section 2	27.00000	22.16667	125.30000	4.12948	125.13	0.030437	3.8507	-55.783E-6
2	cross section 2	27.00000	23.33333	125.30000	3.06947	125.13	0.0034550	1.4955	-22.207E-6
2	cross section 2	27.00000	24.50000	125.30000	2.39092	125.13	932.94E-6	0.80801	-12.060E-6
2	cross section 2	27.00000	25.66667	125.30000	1.89688	125.13	358.41E-6	0.50378	-7.5334E-6
2	cross section 2	27.00000	26.83333	125.30000	1.51922	125.13	166.99E-6	0.34135	-5.1094E-6
2	cross section 2	27.00000	28.00000	125.30000	1.22332	125.13	88.020E-6	0.24453	-3.6623E-6

Ref.	Name	x [m]	y [m]	z [mOD]	δz [mm]	Stress: Calc. Level [mOD]	Stress: Vertical [kN/m²]	Stress: Sum Princ. [kN/m²]	Vert. Strain [μ]
2	cross section 2	27.00000	29.16667	125.30000	0.98805	125.13	50.605E-6	0.18239	-2.7325E-6
2	cross section 2	27.00000	30.33333	125.30000	0.79916	125.13	31.044E-6	0.14028	-2.1022E-6
2	cross section 2	27.00000	31.50000	125.30000	0.64652	125.13	20.030E-6	0.11055	-1.6570E-6
2	cross section 2	27.00000	32.66667	125.30000	0.52260	125.13	13.457E-6	0.088859	-1.3320E-6
2	cross section 2	27.00000	33.83333	125.30000	0.42170	125.13	9.3462E-6	0.072601	-1.0884E-6
2	cross section 2	27.00000	35.00000	125.30000	0.33935	125.13	6.6733E-6	0.060145	0.0
3	long section	0.00000	18.00000	125.30000	0.55579	125.13	21.074E-6	0.10102	-1.5139E-6
3	long section	1.33333	18.00000	125.30000	0.71912	125.13	36.916E-6	0.13623	-2.0410E-6
3	long section	2.66667	18.00000	125.30000	0.93140	125.13	69.868E-6	0.19093	-2.8595E-6
3	long section	4.00000	18.00000	125.30000	1.21005	125.13	146.53E-6	0.28143	-4.2119E-6
3	long section	5.33333	18.00000	125.30000	1.58165	125.13	356.94E-6	0.44513	-6.6538E-6
3	long section	6.66667	18.00000	125.30000	2.09267	125.13	0.0011255	0.78859	-11.756E-6
3	long section	8.00000	18.00000	125.30000	2.85397	125.13	0.0061968	1.7621	-26.029E-6
3	long section	9.33333	18.00000	125.30000	4.35702	125.13	0.20838	8.3019	-110.98E-6
3	long section	10.66667	18.00000	125.30000	7.81948	125.13	40.654	92.329	0.0012576
3	long section	12.00000	18.00000	125.30000	6.27960	125.13	4.3525	25.633	-101.58E-6
3	long section	13.33333	18.00000	125.30000	5.65829	125.13	0.046734	6.1688	-89.494E-6
3	long section	14.66667	18.00000	125.30000	7.25987	125.13	15.047	41.731	352.11E-6
3	long section	16.00000	18.00000	125.30000	7.68461	125.13	20.011	48.002	580.66E-6
3	long section	17.33333	18.00000	125.30000	6.78441	125.13	0.35264	11.533	-150.07E-6
3	long section	18.66667	18.00000	125.30000	8.53576	125.13	39.124	78.691	0.0013627
3	long section	20.00000	18.00000	125.30000	6.99018	125.13	0.11106	9.1136	-129.48E-6
3	long section	21.33333	18.00000	125.30000	9.58100	125.13	39.704	86.038	0.0012902
3	long section	22.66667	18.00000	125.30000	10.28535	125.13	40.004	92.214	0.0012171
3	long section	24.00000	18.00000	125.30000	10.13316	125.13	40.023	92.239	0.0012179
3	long section	25.33333	18.00000	125.30000	9.71092	125.13	40.010	91.336	0.0012306
3	long section	26.66667	18.00000	125.30000	9.30104	125.13	40.009	90.957	0.0012362
3	long section	28.00000	18.00000	125.30000	8.89452	125.13	40.008	90.728	0.0012396
3	long section	29.33333	18.00000	125.30000	8.45615	125.13	40.008	90.505	0.0012429
3	long section	30.66667	18.00000	125.30000	7.91823	125.13	40.007	90.113	0.0012488
3	long section	32.00000	18.00000	125.30000	7.10297	125.13	40.022	89.012	0.0012663
3	long section	33.33333	18.00000	125.30000	3.99701	125.13	1.6093	17.190	-153.25E-6
3	long section	34.66667	18.00000	125.30000	2.20684	125.13	0.0089123	1.7017	-24.946E-6
3	long section	36.00000	18.00000	125.30000	1.51187	125.13	0.0010795	0.61743	-9.1913E-6
3	long section	37.33333	18.00000	125.30000	1.09760	125.13	272.10E-6	0.31527	-4.7114E-6
3	long section	38.66667	18.00000	125.30000	0.81688	125.13	97.327E-6	0.19048	-2.8508E-6
3	long section	40.00000	18.00000	125.30000	0.61574	125.13	42.958E-6	0.12722	-1.9055E-6

Results : Consolidation : Displacement Data : Lines

None

Results : Total : Displacement Data : Lines

None

Results : Immediate : Displacement Data : Grids

Ref.	Name	x [m]	y [m]	z [mOD]	δz [mm]	Stress: Calc. Level [mOD]	Stress: Vertical [kN/m²]	Stress: Sum Princ. [kN/m²]	Vert. Strain [μ]
1	grid	0.00000	0.00000	125.30000	0.17145	125.13	3.2566E-6	0.036407	0.0
1	grid	4.50000	0.00000	125.30000	0.31454	125.13	7.4942E-6	0.058049	0.0
1	grid	9.00000	0.00000	125.30000	0.49135	125.13	14.951E-6	0.086972	-1.3036E-6
1	grid	13.50000	0.00000	125.30000	0.64039	125.13	22.068E-6	0.11216	-1.6809E-6
1	grid	18.00000	0.00000	125.30000	0.69335	125.13	23.865E-6	0.12029	-1.8027E-6
1	grid	22.50000	0.00000	125.30000	0.62790	125.13	19.452E-6	0.10778	-1.6155E-6
1	grid	27.00000	0.00000	125.30000	0.48057	125.13	11.786E-6	0.082267	-1.2332E-6
1	grid	31.50000	0.00000	125.30000	0.32001	125.13	6.0678E-6	0.057390	0.0
1	grid	36.00000	0.00000	125.30000	0.18972	125.13	3.0860E-6	0.038966	0.0
1	grid	40.50000	0.00000	125.30000	0.09884	125.13	1.5958E-6	0.026351	0.0
1	grid	45.00000	0.00000	125.30000	0.04168	125.13	0.0	0.017955	0.0
1	grid	0.00000	1.50000	125.30000	0.21244	125.13	4.3685E-6	0.042485	0.0
1	grid	4.50000	1.50000	125.30000	0.39899	125.13	11.482E-6	0.072314	-1.0840E-6
1	grid	9.00000	1.50000	125.30000	0.64040	125.13	26.160E-6	0.11622	-1.7416E-6
1	grid	13.50000	1.50000	125.30000	0.84822	125.13	40.889E-6	0.15589	-2.3357E-6
1	grid	18.00000	1.50000	125.30000	0.92128	125.13	44.233E-6	0.16799	-2.5170E-6
1	grid	22.50000	1.50000	125.30000	0.82823	125.13	34.942E-6	0.14727	-2.2067E-6
1	grid	27.00000	1.50000	125.30000	0.62223	125.13	18.990E-6	0.10647	-1.5958E-6
1	grid	31.50000	1.50000	125.30000	0.40665	125.13	8.6807E-6	0.070202	-1.0525E-6
1	grid	36.00000	1.50000	125.30000	0.23863	125.13	4.0960E-6	0.045711	0.0
1	grid	40.50000	1.50000	125.30000	0.12460	125.13	2.0048E-6	0.029897	0.0
1	grid	45.00000	1.50000	125.30000	0.05437	125.13	1.0034E-6	0.019816	0.0
1	grid	0.00000	3.00000	125.30000	0.25890	125.13	5.8946E-6	0.049642	0.0
1	grid	4.50000	3.00000	125.30000	0.50113	125.13	18.318E-6	0.091542	-1.3719E-6
1	grid	9.00000	3.00000	125.30000	0.83320	125.13	50.242E-6	0.16169	-2.4221E-6
1	grid	13.50000	3.00000	125.30000	1.12592	125.13	84.394E-6	0.22799	-3.4144E-6
1	grid	18.00000	3.00000	125.30000	1.22692	125.13	90.898E-6	0.24652	-3.6918E-6
1	grid	22.50000	3.00000	125.30000	1.09359	125.13	69.573E-6	0.21054	-3.1536E-6
1	grid	27.00000	3.00000	125.30000	0.80193	125.13	32.325E-6	0.14116	-2.1153E-6
1	grid	31.50000	3.00000	125.30000	0.51208	125.13	12.656E-6	0.086723	-1.3000E-6
1	grid	36.00000	3.00000	125.30000	0.29655	125.13	5.5042E-6	0.053901	0.0
1	grid	40.50000	3.00000	125.30000	0.15433	125.13	2.5375E-6	0.033984	0.0
1	grid	45.00000	3.00000	125.30000	0.06863	125.13	1.2040E-6	0.021856	0.0
1	grid	0.00000	4.50000	125.30000	0.31022	125.13	7.9633E-6	0.057950	0.0
1	grid	4.50000	4.50000	125.30000	0.62302	125.13	30.597E-6	0.11795	-1.7673E-6
1	grid	9.00000	4.50000	125.30000	1.08496	125.13	110.48E-6	0.23828	-3.5670E-6
1	grid	13.50000	4.50000	125.30000	1.50340	125.13	203.94E-6	0.35872	-5.3676E-6
1	grid	18.00000	4.50000	125.30000	1.64296	125.13	216.85E-6	0.38773	-5.8018E-6
1	grid	22.50000	4.50000	125.30000	1.45045	125.13	161.82E-6	0.32160	-4.8134E-6
1	grid	27.00000	4.50000	125.30000	1.02937	125.13	58.864E-6	0.19269	-2.8866E-6
1	grid	31.50000	4.50000	125.30000	0.63929	125.13	18.801E-6	0.10821	-1.6220E-6
1	grid	36.00000	4.50000	125.30000	0.36457	125.13	7.5111E-6	0.063926	0.0
1	grid	40.50000	4.50000	125.30000	0.18825	125.13	3.2406E-6	0.038703	0.0
1	grid	45.00000	4.50000	125.30000	0.08443	125.13	1.4469E-6	0.024078	0.0
1	grid	0.00000	6.00000	125.30000	0.36501	125.13	10.688E-6	0.067346	-1.0095E-6
1	grid	4.50000	6.00000	125.30000	0.76557	125.13	53.667E-6	0.15477	-2.3180E-6
1	grid	9.00000	6.00000	125.30000	1.41982	125.13	300.63E-6	0.38393	-5.7394E-6
1	grid	13.50000	6.00000	125.30000	2.03250	125.13	634.26E-6	0.63331	-9.4585E-6
1	grid	18.00000	6.00000	125.30000	2.22392	125.13	657.12E-6	0.67841	-10.133E-6
1	grid	22.50000	6.00000	125.30000	1.94430	125.13	488.61E-6	0.54740	-8.1792E-6
1	grid	27.00000	6.00000	125.30000	1.31607	125.13	116.02E-6	0.27216	-4.0749E-6
1	grid	31.50000	6.00000	125.30000	0.79134	125.13	28.454E-6	0.13642	-2.0445E-6
1	grid	36.00000	6.00000	125.30000	0.44380	125.13	10.468E-6	0.076354	-1.1446E-6
1	grid	40.50000	6.00000	125.30000	0.22646	125.13	4.1834E-6	0.044163	0.0
1	grid	45.00000	6.00000	125.30000	0.10162	125.13	1.7402E-6	0.026480	0.0
1	grid	0.00000	7.50000	125.30000	0.42094	125.13	14.089E-6	0.077526	-1.1620E-6
1	grid	4.50000	7.50000	125.30000	0.92707	125.13	98.384E-6	0.20618	-3.0864E-6
1	grid	9.00000	7.50000	125.30000	1.88364	125.13	0.0011895	0.72397	-10.782E-6
1	grid	13.50000	7.50000	125.30000	2.82447	125.13	0.0031697	1.3810	-20.509E-6
1	grid	18.00000	7.50000	125.30000	3.08001	125.13	0.0031657	1.4419	-21.422E-6
1	grid	22.50000	7.50000	125.30000	2.67431	125.13	0.0024813	1.1540	-17.148E-6
1	grid	27.00000	7.50000	125.30000	1.67409	125.13	247.25E-6	0.39848	-5.9611E-6
1	grid	31.50000	7.50000	125.30000	0.97140	125.13	43.997E-6	0.17393	-2.6061E-6
1	grid	36.00000	7.50000	125.30000	0.53544	125.13	15.050E-6	0.092070	-1.3801E-6
1	grid	40.50000	7.50000	125.30000	0.26886	125.13	5.4706E-6	0.050493	0.0
1	grid	45.00000	7.50000	125.30000	0.11992	125.13	2.0923E-6	0.029045	0.0
1	grid	0.00000	9.00000	125.30000	0.47463	125.13	17.955E-6	0.087821	-1.3161E-6
1	grid	4.50000	9.00000	125.30000	1.10022	125.13	184.21E-6	0.27575	-4.1243E-6
1	grid	9.00000	9.00000	125.30000	2.59901	125.13	0.0099203	1.8916	-27.730E-6
1	grid	13.50000	9.00000	125.30000	4.27563	125.13	0.060834	5.2458	-74.732E-6
1	grid	18.00000	9.00000	125.30000	4.58889	125.13	0.060054	5.2503	-74.851E-6
1	grid	22.50000	9.00000	125.30000	4.02130	125.13	0.055622	4.5378	-64.451E-6
1	grid	27.00000	9.00000	125.30000	2.11138	125.13	547.44E-6	0.59877	-8.9460E-6

Ref.	Name	x [m]	y [m]	z [mOD]	δz [mm]	Stress: Calc. Level [mOD]	Stress: Vertical [kN/m²]	Stress: Sum Princ. [kN/m²]	Vert. Strain [μ]
1	grid	31.50000	9.00000	125.30000	1.18340	125.13	70.485E-6	0.22519	-3.3733E-6
1	grid	36.00000	9.00000	125.30000	0.64082	125.13	22.695E-6	0.11258	-1.6872E-6
1	grid	40.50000	9.00000	125.30000	0.31504	125.13	7.2571E-6	0.057835	0.0
1	grid	45.00000	9.00000	125.30000	0.13891	125.13	2.5094E-6	0.031739	0.0
1	grid	0.00000	10.50000	125.30000	0.52187	125.13	21.722E-6	0.097169	-1.4561E-6
1	grid	4.50000	10.50000	125.30000	1.26781	125.13	329.84E-6	0.35953	-5.3715E-6
1	grid	9.00000	10.50000	125.30000	4.11366	125.13	0.97995	13.561	-139.72E-6
1	grid	13.50000	10.50000	125.30000	8.49774	125.13	43.789	100.47	0.0013393
1	grid	18.00000	10.50000	125.30000	8.81119	125.13	43.780	100.03	0.0013453
1	grid	22.50000	10.50000	125.30000	8.33776	125.13	43.813	99.918	0.0013491
1	grid	27.00000	10.50000	125.30000	2.62354	125.13	0.0011876	0.90067	-13.433E-6
1	grid	31.50000	10.50000	125.30000	1.43409	125.13	122.12E-6	0.29983	-4.4895E-6
1	grid	36.00000	10.50000	125.30000	0.76158	125.13	36.763E-6	0.14061	-2.1067E-6
1	grid	40.50000	10.50000	125.30000	0.36411	125.13	9.7583E-6	0.066311	0.0
1	grid	45.00000	10.50000	125.30000	0.15794	125.13	2.9920E-6	0.034498	0.0
1	grid	0.00000	12.00000	125.30000	0.55840	125.13	24.550E-6	0.10432	-1.5632E-6
1	grid	4.50000	12.00000	125.30000	1.40012	125.13	486.64E-6	0.43135	-6.4386E-6
1	grid	9.00000	12.00000	125.30000	6.69838	125.13	39.927	85.804	0.0013082
1	grid	13.50000	12.00000	125.30000	8.22740	125.13	38.967	80.768	0.0013213
1	grid	18.00000	12.00000	125.30000	8.55553	125.13	38.952	79.990	0.0013320
1	grid	22.50000	12.00000	125.30000	9.57692	125.13	40.084	93.482	0.0012032
1	grid	27.00000	12.00000	125.30000	3.19210	125.13	0.0025607	1.3301	-19.785E-6
1	grid	31.50000	12.00000	125.30000	1.73869	125.13	253.42E-6	0.42402	-6.3438E-6
1	grid	36.00000	12.00000	125.30000	0.89954	125.13	65.830E-6	0.18124	-2.7144E-6
1	grid	40.50000	12.00000	125.30000	0.41441	125.13	13.228E-6	0.075936	-1.1382E-6
1	grid	45.00000	12.00000	125.30000	0.17618	125.13	3.5287E-6	0.037217	0.0
1	grid	0.00000	13.50000	125.30000	0.58082	125.13	25.748E-6	0.10828	-1.6226E-6
1	grid	4.50000	13.50000	125.30000	1.46699	125.13	491.05E-6	0.44869	-6.6984E-6
1	grid	9.00000	13.50000	125.30000	6.65300	125.13	39.825	83.564	0.0013352
1	grid	13.50000	13.50000	125.30000	5.70974	125.13	0.044597	5.9143	-85.816E-6
1	grid	18.00000	13.50000	125.30000	6.14127	125.13	0.033212	5.3475	-78.054E-6
1	grid	22.50000	13.50000	125.30000	10.19379	125.13	40.164	94.773	0.0011891
1	grid	27.00000	13.50000	125.30000	3.78467	125.13	0.0043777	1.8402	-27.318E-6
1	grid	31.50000	13.50000	125.30000	2.13567	125.13	765.49E-6	0.68666	-10.250E-6
1	grid	36.00000	13.50000	125.30000	1.05591	125.13	133.32E-6	0.24393	-3.6503E-6
1	grid	40.50000	13.50000	125.30000	0.46320	125.13	17.839E-6	0.086439	-1.2954E-6
1	grid	45.00000	13.50000	125.30000	0.19257	125.13	4.0892E-6	0.039744	0.0
1	grid	0.00000	15.00000	125.30000	0.58751	125.13	25.236E-6	0.10876	-1.6298E-6
1	grid	4.50000	15.00000	125.30000	1.46627	125.13	362.30E-6	0.41551	-6.2092E-6
1	grid	9.00000	15.00000	125.30000	4.58332	125.13	0.40003	10.393	-129.89E-6
1	grid	13.50000	15.00000	125.30000	5.46209	125.13	0.028600	4.6487	-67.872E-6
1	grid	18.00000	15.00000	125.30000	7.45419	125.13	33.630	56.970	0.0013314
1	grid	22.50000	15.00000	125.30000	10.23972	125.13	40.043	92.703	0.0012123
1	grid	27.00000	15.00000	125.30000	4.46394	125.13	0.0079476	2.6821	-39.715E-6
1	grid	31.50000	15.00000	125.30000	2.74212	125.13	0.0049190	1.5270	-22.585E-6
1	grid	36.00000	15.00000	125.30000	1.22762	125.13	300.90E-6	0.34348	-5.1327E-6
1	grid	40.50000	15.00000	125.30000	0.50640	125.13	23.402E-6	0.096990	-1.4533E-6
1	grid	45.00000	15.00000	125.30000	0.20591	125.13	4.6194E-6	0.041881	0.0
1	grid	0.00000	16.50000	125.30000	0.57866	125.13	23.491E-6	0.10612	-1.5903E-6
1	grid	4.50000	16.50000	125.30000	1.41813	125.13	257.80E-6	0.37142	-5.5546E-6
1	grid	9.00000	16.50000	125.30000	4.04134	125.13	0.060663	5.0785	-72.235E-6
1	grid	13.50000	16.50000	125.30000	5.47170	125.13	0.029416	4.7621	-69.519E-6
1	grid	18.00000	16.50000	125.30000	8.16923	125.13	37.382	71.853	0.0013520
1	grid	22.50000	16.50000	125.30000	10.31473	125.13	40.058	92.652	0.0012140
1	grid	27.00000	16.50000	125.30000	5.95599	125.13	0.38545	11.158	-142.32E-6
1	grid	31.50000	16.50000	125.30000	4.20131	125.13	0.38159	9.9058	-123.78E-6
1	grid	36.00000	16.50000	125.30000	1.39619	125.13	660.76E-6	0.48580	-7.2440E-6
1	grid	40.50000	16.50000	125.30000	0.53876	125.13	28.977E-6	0.10600	-1.5882E-6
1	grid	45.00000	16.50000	125.30000	0.21504	125.13	5.0450E-6	0.043406	0.0
1	grid	0.00000	18.00000	125.30000	0.55579	125.13	21.074E-6	0.10102	-1.5139E-6
1	grid	4.50000	18.00000	125.30000	1.33663	125.13	200.29E-6	0.33096	-4.9514E-6
1	grid	9.00000	18.00000	125.30000	3.83005	125.13	0.058990	4.8180	-68.435E-6
1	grid	13.50000	18.00000	125.30000	5.71561	125.13	0.050586	6.3321	-91.694E-6
1	grid	18.00000	18.00000	125.30000	8.30655	125.13	37.374	72.498	0.0013419
1	grid	22.50000	18.00000	125.30000	10.25906	125.13	39.998	92.004	0.0012198
1	grid	27.00000	18.00000	125.30000	9.20013	125.13	40.008	90.893	0.0012372
1	grid	31.50000	18.00000	125.30000	7.46428	125.13	40.005	89.553	0.0012571
1	grid	36.00000	18.00000	125.30000	1.51187	125.13	0.0010795	0.61743	-9.1913E-6
1	grid	40.50000	18.00000	125.30000	0.55487	125.13	32.864E-6	0.11137	-1.6685E-6
1	grid	45.00000	18.00000	125.30000	0.21898	125.13	5.2886E-6	0.044115	0.0
1	grid	0.00000	19.50000	125.30000	0.52125	125.13	18.339E-6	0.094082	-1.4106E-6
1	grid	4.50000	19.50000	125.30000	1.22704	125.13	160.49E-6	0.29029	-4.3438E-6
1	grid	9.00000	19.50000	125.30000	3.50863	125.13	0.057566	4.4990	-63.743E-6
1	grid	13.50000	19.50000	125.30000	8.08875	125.13	39.307	82.543	0.0013168
1	grid	18.00000	19.50000	125.30000	8.82093	125.13	39.370	83.883	0.0013008
1	grid	22.50000	19.50000	125.30000	9.82924	125.13	39.998	91.690	0.0012245
1	grid	27.00000	19.50000	125.30000	9.20196	125.13	39.994	91.326	0.0012297
1	grid	31.50000	19.50000	125.30000	7.61905	125.13	39.992	90.130	0.0012475
1	grid	36.00000	19.50000	125.30000	1.51534	125.13	0.0011886	0.64347	-9.5749E-6
1	grid	40.50000	19.50000	125.30000	0.55102	125.13	33.438E-6	0.11139	-1.6687E-6
1	grid	45.00000	19.50000	125.30000	0.21720	125.13	5.2959E-6	0.043884	0.0
1	grid	0.00000	21.00000	125.30000	0.47782	125.13	15.484E-6	0.085916	-1.2877E-6
1	grid	4.50000	21.00000	125.30000	1.09472	125.13	121.37E-6	0.24592	-3.6809E-6
1	grid	9.00000	21.00000	125.30000	2.86954	125.13	0.032102	2.9094	-41.555E-6
1	grid	13.50000	21.00000	125.30000	7.26360	125.13	39.285	80.843	0.0013409
1	grid	18.00000	21.00000	125.30000	7.79484	125.13	39.281	80.742	0.0013421
1	grid	22.50000	21.00000	125.30000	8.01588	125.13	39.279	80.975	0.0013385
1	grid	27.00000	21.00000	125.30000	7.08261	125.13	29.641	63.994	966.78E-6
1	grid	31.50000	21.00000	125.30000	5.77163	125.13	29.638	63.052	980.71E-6
1	grid	36.00000	21.00000	125.30000	1.39391	125.13	859.61E-6	0.53693	-7.9981E-6
1	grid	40.50000	21.00000	125.30000	0.52695	125.13	30.366E-6	0.10578	-1.5847E-6
1	grid	45.00000	21.00000	125.30000	0.20972	125.13	5.0594E-6	0.042707	0.0
1	grid	0.00000	22.50000	125.30000	0.42857	125.13	12.676E-6	0.077100	-1.1557E-6
1	grid	4.50000	22.50000	125.30000	0.94971	125.13	83.401E-6	0.20047	-3.0017E-6
1	grid	9.00000	22.50000	125.30000	2.12302	125.13	0.0032819	1.0542	-15.600E-6
1	grid	13.50000	22.50000	125.30000	3.59105	125.13	0.016629	2.9024	-42.455E-6
1	grid	18.00000	22.50000	125.30000	4.07657	125.13	0.016425	3.0114	-44.103E-6
1	grid	22.50000	22.50000	125.30000	4.16815	125.13	0.016128	3.0281	-44.373E-6
1	grid	27.00000	22.50000	125.30000	3.76143	125.13	0.013930	2.7687	-40.625E-6
1	grid	31.50000	22.50000	125.30000	2.78307	125.13	0.012793	2.2590	-33.054E-6
1	grid	36.00000	22.50000	125.30000	1.19825	125.13	412.92E-6	0.37818	-5.6459E-6
1	grid	40.50000	22.50000	125.30000	0.48615	125.13	24.913E-6	0.095936	-1.4374E-6
1	grid	45.00000	22.50000	125.30000	0.19717	125.13	4.6226E-6	0.040704	0.0
1	grid	0.00000	24.00000	125.30000	0.37658	125.13	10.088E-6	0.068200	-1.0223E-6
1	grid	4.50000	24.00000	125.30000	0.80432	125.13	53.222E-6	0.15931	-2.3861E-6
1	grid	9.00000	24.00000	125.30000	1.80940	125.13	582.78E-6	0.50113	-7.4791E-6
1	grid	13.50000	24.00000	125.30000	2.49632	125.13	0.0016642	0.99718	-14.849E-6
1	grid	18.00000	24.00000	125.30000	2.89507	125.13	0.0017139	1.1011	-16.405E-6
1	grid	22.50000	24.00000	125.30000	2.95263	125.13	0.0016773	1.1116	-16.564E-6
1	grid	27.00000	24.00000	125.30000	2.65281	125.13	0.0015415	1.0277	-15.315E-6
1	grid	31.50000	24.00000	125.30000	1.94592	125.13	0.0012353	0.77070	-11.480E-6
1	grid	36.00000	24.00000	125.30000	0.99267	125.13	173.90E-6	0.25549	-3.8211E-6
1	grid	40.50000	24.00000	125.30000	0.43446	125.13	18.944E-6	0.084075	-1.2599E-6
1	grid	45.00000	24.00000	125.30000	0.18064	125.13	4.0617E-6	0.038088	0.0
1	grid	0.00000	25.50000	125.30000	0.32461	125.13	7.8525E-6	0.059687	0.0
1	grid	4.50000	25.50000	125.30000	0.66837	125.13	33.015E-6	0.12557	-1.8814E-6
1	grid	9.00000	25.50000	125.30000	1.23909	125.13	178.52E-6	0.29490	-4.4132E-6
1	grid	13.50000	25.50000	125.30000	1.83638	125.13	403.00E-6	0.50300	-7.5188E-6
1	grid	18.00000	25.50000	125.30000	2.14739	125.13	440.00E-6	0.57575	-8.6077E-6
1	grid	22.50000	25.50000	125.30000	2.18892	125.13	435.55E-6	0.58404	-8.7324E-6
1	grid	27.00000	25.50000	125.30000	1.95927	125.13	405.15E-6	0.53574	-8.0097E-6
1	grid	31.50000	25.50000	125.30000	1.44776	125.13	301.57E-6	0.39519	-5.9083E-6
1	grid	36.00000	25.50000	125.30000	0.80767	125.13	78.446E-6	0.17783	-2.6624E-6
1	grid	40.50000	25.50000	125.30000	0.37792	125.13	13.759E-6	0.072129	-1.0810E-6
1	grid	45.00000	25.50000	125.30000	0.16144	125.13	3.4580E-6	0.035105	0.0
1	grid	0.00000	27.00000	125.30000	0.27485	125.13	6.0253E-6	0.051878	0.0
1	grid	4.50000	27.00000	125.30000	0.54721	125.13	20.624E-6	0.099381	-1.4894E-6
1	grid	9.00000	27.00000	125.30000	0.96070	125.13	73.399E-6	0.19486	-2.9181E-6
1	grid	13.50000	27.00000	125.30000	1.37993	125.13	143.14E-6	0.30178	-4.5174E-6
1	grid	18.00000	27.00000	125.30000	1.61700	125.13	163.37E-6	0.35037	-5.2450E-6

Ref.	Name	x [m]	y [m]	z [mOD]	δz [mm]	Stress: Calc. Level [mOD]	Stress: Vertical [kN/m²]	Stress: Sum Princ. [kN/m²]	Vert. Strain [μ]
1	grid	22.50000	27.00000	125.30000	1.64824	125.13	163.83E-6	0.35651	-5.3370E-6
1	grid	27.00000	27.00000	125.30000	1.47253	125.13	151.40E-6	0.32450	-4.8577E-6
1	grid	31.50000	27.00000	125.30000	1.10009	125.13	109.54E-6	0.24168	-3.6181E-6
1	grid	36.00000	27.00000	125.30000	0.65016	125.13	39.378E-6	0.12906	-1.9334E-6
1	grid	40.50000	27.00000	125.30000	0.32139	125.13	9.7940E-6	0.061235	0.0
1	grid	45.00000	27.00000	125.30000	0.14091	125.13	2.8757E-6	0.031979	0.0
1	grid	0.00000	28.50000	125.30000	0.22883	125.13	4.5917E-6	0.044931	0.0
1	grid	4.50000	28.50000	125.30000	0.44258	125.13	13.203E-6	0.079445	-1.1908E-6
1	grid	9.00000	28.50000	125.30000	0.74614	125.13	35.994E-6	0.13804	-2.0682E-6
1	grid	13.50000	28.50000	125.30000	1.04718	125.13	63.375E-6	0.19995	-2.9952E-6
1	grid	18.00000	28.50000	125.30000	1.22589	125.13	74.280E-6	0.23247	-3.4823E-6
1	grid	22.50000	28.50000	125.30000	1.24957	125.13	75.238E-6	0.23683	-3.5475E-6
1	grid	27.00000	28.50000	125.30000	1.11601	125.13	68.801E-6	0.21474	-3.2166E-6
1	grid	31.50000	28.50000	125.30000	0.84319	125.13	49.589E-6	0.16298	-2.4415E-6
1	grid	36.00000	28.50000	125.30000	0.51910	125.13	21.716E-6	0.097155	-1.4559E-6
1	grid	40.50000	28.50000	125.30000	0.26809	125.13	6.9544E-6	0.051823	0.0
1	grid	45.00000	28.50000	125.30000	0.12019	125.13	2.3535E-6	0.028888	0.0
1	grid	0.00000	30.00000	125.30000	0.18741	125.13	3.4961E-6	0.038877	0.0
1	grid	4.50000	30.00000	125.30000	0.35408	125.13	8.7104E-6	0.064268	0.0
1	grid	9.00000	30.00000	125.30000	0.57892	125.13	19.820E-6	0.10247	-1.5358E-6
1	grid	13.50000	30.00000	125.30000	0.79809	125.13	32.358E-6	0.14122	-2.1162E-6
1	grid	18.00000	30.00000	125.30000	0.93204	125.13	38.404E-6	0.16331	-2.4471E-6
1	grid	22.50000	30.00000	125.30000	0.94996	125.13	39.155E-6	0.16634	-2.4925E-6
1	grid	27.00000	30.00000	125.30000	0.84905	125.13	35.493E-6	0.15080	-2.2597E-6
1	grid	31.50000	30.00000	125.30000	0.64820	125.13	25.807E-6	0.11693	-1.7523E-6
1	grid	36.00000	30.00000	125.30000	0.41132	125.13	12.908E-6	0.075314	-1.1289E-6
1	grid	40.50000	30.00000	125.30000	0.21979	125.13	4.9764E-6	0.043915	0.0
1	grid	45.00000	30.00000	125.30000	0.10020	125.13	1.9076E-6	0.025950	0.0

Results : Consolidation : Displacement Data : Grids

None

Results : Total : Displacement Data : Grids

None