ARBORICULTURAL CONSULTANTS

REPORT ON ARBORICULTURAL IMPLICATIONS OF SUBSIDENCE

INVESTIGATION AT

13 TORRIANO AVENUE,
LONDON
NW5 2SN.

REF: B1239944

PREPARED FOR

GAB ROBINS UK LTD
BUILDING SERVICES
1ST FLOOR,
REGENT HOUSE,
HUBERT ROAD,
BRENTWOOD,
ESSEX CM14 4JE

By

ARBORICULTURAL SOLUTIONS LLP.

19TH APRIL 2013

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1. Introduction

1.1. Instructions

1.1.1. We are instructed by GAB Robins Building Services of 1st floor, Regent house, Hubert Road, Brentwood, Essex CM14 4JE on behalf of AXA Insurance, to visit the above premises and report on trees within influencing distance of the property, more particularly, to consider the possible effects of tree root action on the sub-soil beneath the foundations. We are instructed to make recommendations to minimize any threat where appropriate.

1.2. Background Information

1.2.1. The owners had noticed damage of a type normally associated with foundation movement, this has recently significantly worsened. Insurers were made aware of the and, as a result, appropriate investigations were undertaken.

1.2.2. In this respect we confirm sight of:

- Trial Pit and Soil Investigation by Soiltech Surveys dated 30th November 2012.
- Site Investigation by Meridian Soils Limited dated 17th December 2012.
- Root identification letter from Tree Root Identification Limited dated 4th December 2012.

2. Summary of Investigations to Date

2.1. General

2.1.1. Data considered relevant has been taken from the documents detailed above.

2.2. Foundations

2.1.2. The investigations undertaken involved the excavation of three trial holes; TP1 adjacent to the front elevation of the basement level at junction between house and bay window; TP2 adjacent to the front steps at ground level; TP3 adjacent to the rear addition, rear elevation at ground floor.

2.1.3. Results from TP/BH1 indicate a 150mm concrete and brick rubble foundation at 400mm depth. The investigation notes that the brickwork and foundation appear to have been dug away. This is founded on stiff to very stiff friable mid brown mottled orange grey veined silty clay. The borehole was terminated at 4 metres depth.

2.1.4 Results from TP2 indicate a 300mm concrete and brick rubble foundation on made ground.

2.1.5. Results from TP/BH3 indicate a 300mm concrete foundation at 420mm depth. This is founded on stiff to very stiff friable mid brown mottled orange grey veined silty clay. The borehole was terminated at 4 metres depth.

2.3. Root identification

2.3.1. Numerous root samples were recovered for analysis. Samples from TP/BH1 (underside of foundation, root diameter 25mm and at depth 1 to 1.5 metres, root diameter of 4 mm) were identified as belonging to *Salix* (Willow) or *Populus* (Poplar) species. Starch tests were positive indicating the roots were recently alive though Richardson notes in a paper produced in the Arboricultural Journal 1995 (Vol 19 pp. 395-400) that the term 'recently' could even run into decades. Similar roots were recovered from the underside of the foundation in TP2, again identified as live *Salix* or *Populus* roots. The identification notes that *Salix* and *Populus* roots are indistinguishable under magnification.

2.3.2. Samples from TP/BH3 (adjacent to rear addition, root diameter 15mm and at depth 1 to 1.5 metres, root diameter of 2mm) were identified as belonging to *Aesculus* (Horse chestnut) species. Starch tests were positive indicating the roots were recently alive.

2.4. Soil plasticity

2.4.1. Samples from the borehole 1 subjected to laboratory analysis showed soils with Plasticity Indices of 52 to 54%; samples from borehole 3 showed soils with Plasticity Indices of 53 to 56%. These figures indicate soils of high shrinkage potential.

2.5. Soil desiccation

2.5.1. The Attenberg Limits were determined for three samples from borehole 1 and three from borehole 3. Samples were taken from 1, 2 and 3 metres depth. Results from all six samples indicated significant desiccation.

2.6. Drainage Investigations

2.6.1. No drainage investigations have been undertaken.

2.7. Monitoring

2.7.1. No monitoring is being undertaken to our knowledge.

3. Report on Site Inspection

3.1. General

3.1.1. The site was visited by our representative, Fiona Critchley B.Sc. (Sp Hons), RFS (Cert Arb), F. Arbor. A. on 17th April 2013. Appropriate measurements were taken and a risk assessment carried out. Weather conditions were overcast with light winds.

3.2. Disclosure of Interests.

3.2.1. We have no connections with any of the parties involved in this case which could influence the opinions expressed in this report.

3.3. Trees and Other Vegetation

3.3.1. Three trees were recorded in the gardens of the adjacent property 15 Torriano Avenue. See amended Soiltech Site Plan for location of trees surveyed. Data on these trees is included in Appendix 1.

3.3.2. The information contained in this report covers only those trees that were examined, and reflects the condition of these specimens at the time of inspection. No samples of wood, roots, or soils were taken for analysis.

3.3.3. As the inspection was visual only, no guarantee, either expressed or implied, of the internal condition of the wood of the tree can be given? Furthermore, no warranty that problems or deficiencies may not arise in the future can be given.

3.4 Tree Preservation Orders and Conservation Areas

3.4.1. The Town and Country Planning (Tree Preservation) (England) Regulations 2012 allows for trees either as groups, or individuals, or as woodlands, to be protected by Tree Preservation Orders (TPO). These have the effect of preventing the cutting down, topping, lopping, uprooting, wilful damage or wilful destruction of trees except in certain circumstances, other than with the consent of the local planning authority.

3.4.2. A Conservation Area is an area designated by the Local Planning Authority as one of "special architectural or historic interest, the character or appearance of which it is desirable to reserve or enhance". Special controls exist with regard to

demolition and alteration of buildings; Listed Building Consent must also be obtained for any demolition, even if the building is not itself listed. Similarly, trees are given some protection with the requirement for the local authority to be given six weeks written notice before carrying out any work on trees; this gives the authority time to decide if a TPO is necessary.

3.4.3. Online checks have indicated that the property is not within a Conservation Area and that there is no TPO in place on the trees surveyed. However, this should be confirmed with London Borough of Camden Planning Services prior to undertaking any tree works.

3.5 Site Specific Observations

3.5.1. 13 Torriano Avenue is a semi-detached house, it is two storey with additional basement accommodation. The house is brick built under a pitched slate roof. The rear of the house was extended approximately fifteen years ago with a two storey, addition which is brick built under a flat roof.

3.5.2. The property was constructed circa 1890. It is approximately north facing and is situated on ground that slopes gently from west to east across the property.

3.5.3. The external damage noted indicated significant movement around the front steps and cracking to the lintel and brickwork above the rear basement level doors. Internally, there is extensive cracking throughout the property particularly at ceiling level. Many of the doors are now out of plumb and cannot be shut. There is also cracking between the main house and the rear extension suggesting the extension is rotating away from the main house.

4. Discussion

4.1. Trees and clay soils

4.1.1. Soils lose moisture by natural evaporative processes during the summer, and it is generally accepted that in average climatic seasons, the loss will be to depths of approximately 1.0m. It is for this reason that house foundations are recommended to be at depths of at least 900mm below ground level so they are at or below the level where natural seasonal moisture loss will have an influence on soil shrinkage.

4.1.2. In conditions of drought the degree of moisture loss will extend to far greater distances, often more than 1.5m producing conditions that may lead to movement of the foundations.

4.1.3. The hot dry Summer conditions of 2003, 2004 and 2006 and the dry Autumn and Winter conditions of 2009/2010 are generally considered to have given rise to an increased number of claims for subsidence damage and do not represent the expected average summer temperatures and rainfall.

4.1.4. Much of the published data regarding the role of different tree species
In cases of subsidence damage to buildings and the distance from the building is taken from The Kew Root Survey 1989 by Cutler & Richardson.

4.1.5. However, Gasson PE & Cutler DF 1998 in a paper published in the Arboricultural Journal, noted ""There is increasing concern that data on tree root spread in 'Tree Roots and Buildings' (Cutler and Richardson, 1989) are open to misinterpretation by insurers, home owners and arboriculturists. Insurers have tended to use maximum root spread figures, which we believe to be statistically and biologically unsound."

4.1.6. They note that the maximum distance between tree and damage is statistically unlikely to happen with any regularity. Their conclusion suggests that very different figures are appropriate as safe distance - in general the distance which includes 75% of damage attributed to a particular species. For smaller species the 50% boundary is more appropriate whilst for particularly large growing species the 90% figure is sufficiently cautious.

5. Potential influence of species present

The following descriptions refer to only those trees considered to be within potential influencing distance of the property.

5.1. Tree1 Weeping willow (*Salix*)

5.1.1. Willow trees are recognised by a number of authorities as being of high water demand, with a fast growth rate and thought to have a moderately deep rooting habit on clay soils. Both young and old trees tolerate heavy pruning and crown thinning.

5.1.2. The Kew Root Survey noted that the maximum tree to damage distance recorded for willows was 40 metres. In 90% of cases the tree was closer than 18 metres and in 75% of cases the trees was within 11 metres. At a distance of 6.4 metres from the front elevation bay window this tree is considered to be within the zone of influence whereby the roots will be found around the foundations.

5.2. Tree 2 Horse chestnut (*Aesculus hippocastanum*)

5.2.1. Horse chestnut trees are recognised by a number of authorities as being of moderate water demand and are thought to be relatively shallow to moderately deep rooted on clay soils. The growth rate is fast under good conditions. Life expectancy is more than 100 years. Both young and old trees will tolerate heavy pruning or crown reduction.

5.2.2. The Kew Root Survey by Cutler & Richardson 1989 notes that the maximum tree to damage distance involving Horse chestnut was 23 metres, in 90% of reported cases the tree was closer than 15 metres and in 50% the tree was closer than 7.5 metres. At a distance of 12 metres from the rear elevation of the rear addition this tree is considered to be within the zone of influence whereby the roots will be found around the foundations.

5.3. Tree 3 Common ash (*Fraxinus excelsior*)

5.3.1. Ash trees are noted as being of moderate water demand, with a fast growth rate under good conditions. They can be deep rooted on clay soils and have a life expectancy well in excess of 100 years. Both young and old trees will tolerate heavy pruning and crown reduction.

5.3.2. The Kew Root Survey found the maximum tree to damage distance to be 21 metres. In 90% of cases the trees was closer than 13 metres and in 75% of cases the tree was within 13 metres of the property. At an estimated distance of 10 metres from the party boundary with number 15 rear elevation this tree is considered to be within the zone of influence whereby the roots will be found around the foundations.

6. Tree management

6.1 Risk Management

6.1.1. The main question in assessing the need for remedial action is whether failure to carry out such action would leave an unacceptable risk to persons or property. Topping or complete removal of the tree would remove all possibility of injury or damage, however, the concept of risk management is gaining acceptance on the part of tree owners and managers. If the risk is quantified as far as can be achieved with available methods appropriate decisions about remedial action can be taken. As with the assessment of hazards and risks, the decision whether or not to take remedial action must be made in the knowledge that there can never be an absolute guarantee of safety for trees or any other structures exposed to extremes of weather.

6.1.2. The choice of remedial action must be determined primarily by the need to remove or mitigate a hazard. Most forms of remedial action are directed towards defects in trees, the type and severity of treatment required can usually be determined by the nature of the defect and its estimated influence on the safety factor of the tree or the affected part of the tree.

6.1.3. Where trees or shrubs have been implicated in, or are suspected to have contributed to, or have the potential to cause foundation damage, there are two alternatives open to the tree owner: either removal of the plant to prevent further water demand, or management of the crown to reduce water demand. (By restricting leaf area available for transpirational water loss to the atmosphere.)

6.2. Felling

6.2.1. In considering this option, the age of the trees vis-à-vis the damaged structure must be assessed. Removal of a tree whose root system was occupying land prior to construction of a building may, if there is deep-seated and persistent desiccation, result in a re-wetting of the underlying soil to a volume greater than it held at the time of construction. This is known as ‘soil heave’ and can seriously damage foundations.

6.3. Crown Management

6.3.1. Crown management aimed at reducing a tree's water demand may be considered where building movements are mainly seasonal – indicating that the soil moisture deficit is not persistent, or where the soil moisture deficit is slight and likely to be rectified by water inputs (such as rainfall) over a comparatively short period of time. However, research shows that pruning does not permanently reduce soil water uptake. Many trees are able to quickly regenerate new leaves, and leaves remaining following pruning can increase their rate of transpiration.

6.3.2. In some cases water uptake can recover to pre-pruning levels within weeks. Only a regular pruning regime, carried out at short intervals, and over an extended period of time, can significantly reduce the long-term water uptake of trees.

6.3.3. The following criteria are also useful in assessing the potential efficacy of this type of management:

- That building foundation depth is sufficiently deep to cope with the decreased water demand resultant on pruning.
- That the foundations are close to the existing outer sphere of root influence.
- That the amenity value of the tree is considered adequate following pruning.
- That the tree is amenable to such treatment.
- Structural movement is mainly seasonal

6.3.4. In this instance the size of the trees close to the house indicates that they are younger than the property. Any risk of ground recovery must be a matter for the expertise of a structural engineer; however, from observations and reading of available information we feel that the danger of structural damage or heave consequent on soil recovery should not be a significant one, and that the trees and other vegetation could therefore be removed if necessary.

7. Conclusions

7.1.1. Soil investigations have demonstrated soils of high shrinkage potential beneath the foundations at both the front and rear of the house.

7.1.2. The soil samples tested have indicated significant desiccation at the front and rear of the house at the time the samples were retrieved.

7.1.3. Willow *(Salix)* roots were recorded in the boreholes at the underside of the foundations and to a depth of 2.5 metres at the front of the property; and Horse chestnut (*Aesculus*) roots were recorded in borehole 3 at the underside of the foundations and to a depth of 2.5 metres at the rear of the property. All roots sampled were noted as being live.

7.1.4. The investigations undertaken indicate that the damage observed at the property in question is likely to be subsidence as a result of clay shrinkage, due to the

extraction of moisture by vegetation.

8. Recommendations

8.1. **Tree 1**: Weeping willow in front garden of 15 Torriano Avenue Fell to ground level and grind out stump to prevent re-growth.

Tree 2: Horse chestnut in rear garden of 15 Torriano Avenue - Fell to ground level and grind out stump to prevent re-growth.

Tree 3: Common ash in rear garden of 15 Torriano Avenue - Fell to ground level and grind out stump to prevent re-growth.

8.2. General

8.2.1. Following implementation of the arboricultural recommendations detailed above, a period should be allowed for soil recovery, during which time the building should be monitored. Once it is felt that an acceptable degree of structural stability has been achieved, appropriate repairs should be put in hand. It is advised that monitoring (following repairs) be carried on over a full growing season to confirm that the measures are succeeding and whether additional vegetation management will be necessary.

8.3. Arboricultural Standards.

8.3.1. Implementation of works: Implementation of works: Any tree works should be done in accordance with the British Standard Recommendations for Tree work, BS 3998: 2010 or as modified by later research. Works should be undertaken by properly qualified and experienced tree contracting company as recommended by a local authority or one approved by the Arboricultural Association. A Register of Contractors is available from The Arboricultural Association Ullenwood Court, Ullenwood, Cheltenham, Gloucestershire, GL53 9QS, England Tel +44 (0) 1242 522152 Fax +44 (0) 1242 577766 Email: admin@trees.org.uk.

8.3.2. Statutory wildlife implications: Wildlife in this country is afforded protection under the Wildlife and Countryside Act 1981 as amended by the Countryside and Rights of Way Act 2000. Statutory protection is given to birds, bats and other species that inhabit trees. Tree work is governed by these statutes and advice should be sought from an ecologist before undertaking any works that may constitute an offence.

Report by: Fiona Critchley B.Sc. (sp. Hons), RFS (Cert Arb), Arbor. A. Tech Cert., F. Arbor. A.

Checked by: G. M. Causey B. Sc. (Hons), RFS (Cert. Arb), F. Arbor

Appendix 1: Tree Data – 13 Torriano Avenue, London NW5 2SN.

Tree No.	Species	Height (metres)	Crown Radius (metres)	DBH (mm)	Distance from property (metres)	Age Class	Vigour	Comments	Recommended Works
1	Weeping willow (*Salix spp.)*	15	5.5	600 Est	6.4 to front bay window	Mature	Normal	Within front garden of 15 Torriano Avenue Trunk forks at 2.5 metres Large limbs to north & east removed by neighbouring land owners Light scattered deadwood in crown Trunk bowed at ground level Decay pockets in pruning wounds Hanging broken branch on west side of crown Crown hitting front elevation of number 15	Fell to ground level & grind out stump

2	Horse chestnut (Aesculus hippocastanum)	18	7	750 Est	12 to rear elevation of extension	Mature	Below average	Within rear garden of 15 Torriano Avenue Bacterial wetwood flux on trunk at 1 metre height Trunk suckers Trunk forks at 4 metres height – possibly pollarded in past Forms 4 upright stems at 4 metres Well balanced crown Decay pockets on trunk Occluded wounds visible Possible New Bleeding Canker on trunk	Fell to ground level & grind out stump
3	Common ash (*Fraxinus excelsior*)	12	6	300 Est	10 to rear party boundary	Early mature	Normal	Within rear garden of 15 Torriano Avenue Dense ivy growth over trunks restricts inspection Multi-stemmed at ground level Crown overhanging roof of number 15.	Fell to ground level & grind out stump

Appendix 2: References

1. Tree No.

Given in numerical order, commencing at "1".

2. Species

Names given are 'common names' followed by the Latin name.

3. Height.

Measured approximately with the aid of a clinometer, given in millimetres.

4. Crown radius.

Measured approximately with the aid of a tape measure, given in millimetres.

5. Trunk diameter.

Measured at 1.5m above ground level using a diameter tape, given in millimetres. (If access is not possible the trunk diameter will be estimated and noted in the Tree Schedule).

6. Age class.

1. Young
2. Early mature
3. Mature

7. Distance from Structure.

Centre of trunk to nearest face or point of the building, (given in metres) measured using a laser rangefinder.

8. Estimated Safe Life.

Short	Less than 10 years
Medium	10 to 40 years
Long	Over 40 years

9. Vigour.

Based on the species in question

10. Comments.

Comments have been made relating to the following:

- Health or condition of the tree
- Safety of the tree, particularly close to actual or proposed public access
- Aesthetics of the tree where appropriate

11. References

The Kew Root Survey 1989 Cutler & Richardson
National House-Building Council Standards, Chapter 4.2., "Building near trees"
Arboricultural Practice Note 4, "Root Barriers and Building Subsidence" Marshall, Patch & Dobson 1997. *Arboricultural Advisory and Information Service*)
British Standard Recommendations for Tree work BS 3998: 1989
British Standard for Trees in relation to construction BS 5837: 1991
Tree Root Damage to Buildings 1998 P. G. Biddle
Arboriculture Research Note 36 89 TRL Tree Roots & Underground Pipes, G. Brennan, D. Patch & F.R.W. Stevens. 1989

Appendix 3: Legal Protection of Trees

Before work is carried out on any of the trees mentioned in this report, it is essential that the owner satisfy himself as to whether or not they have legal protection. Such protection is summarised briefly below:

Conservation Areas.

Before work is carried out work on any tree over 7.5 centimetres in diameter (measured at 1.5m from ground level), growing in a Conservation Area designated under the Town and Country Planning Act 1990, the Local Planning Authority must be notified in writing. The Authority then has six weeks to consider the matter during which time Officers may make a Tree Preservation Order in respect of any trees that are the subject of the notification. After the six weeks has expired, if the Authority has made no objection, work can proceed.

Tree Preservation Orders.

Before any work is carried out on a tree which is the subject of a Tree Preservation Order made under the Town and Country Planning Act 1990, the permission of the Local Planning Authority must be obtained. Such application for permission must generally be by way of a formal Planning Application, which may necessitate consideration by the Planning Committee of the Authority (although many Authorities delegate powers to deal with routine matters to their professional Officers).

There are exceptions to the above broad outlines; however, in the current instance these do not apply.

Appendix 4: Tree Roots on Shrinkable Clay Sub-soils

Certain soils containing high proportions of the montmorillonite or miceaceous clays have the capacity to change in volume according to their water content. This is because water is absorbed into the inside of the clay particles when the soil is wetted and can be withdrawn by various outside factors.

One of the most important ways in which water is withdrawn is as a result of the action of plant roots. Roots extract water from the soil and convey it through the plant to the leaves where at is lost to the atmosphere - a process known as transpiration. All plants do this to varying degrees; even grass extracts considerable quantities of moisture from the soil.

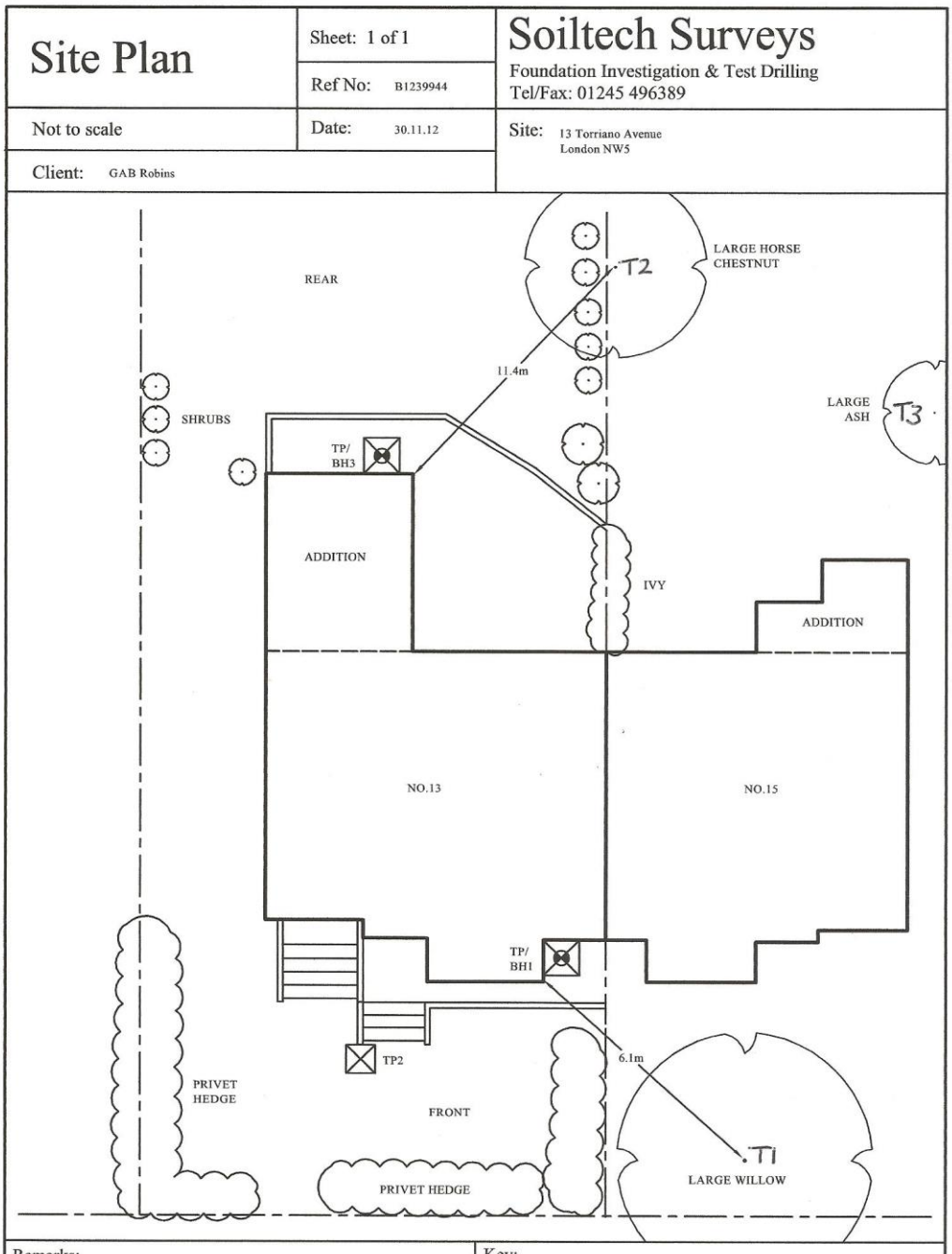
By virtue of their large size, trees have both a large rooting volume from which to extract water, and a large leaf area through which to lose it to the atmosphere. (Note: some trees, however, have developed in such a way as to minimize their water demand).

Problems arise when a tree which has a high water demand is growing on a soil containing a high proportion of shrinkable clay when there is a building close enough to be affected by the changes in soil volume consequent on increase and decreases in the soil water content.

Decreases in volume will lead to a settling effect during dry periods, causing structural damage to buildings in severe cases. This is known as subsidence. Felling the offending tree is not always the simple answer as an established tree may have been desiccating the soil on which a structure stands for many years before building took place. When the tree is felled, the drying stops, the soil re-wets and expands. This may cause a phenomenon known as 'ground heave', which can be very damaging to buildings.

Careful observations and monitoring over a period are often necessary to establish the causes of subsidence or heave in cases where a tree or trees may be implicated. The close proximity of a tree to a building will not necessarily result in structural damage to that building.

In many cases where trees have been implicated in such structural damage, it has been found that the structures had been built on foundations, which were unsuitable for shrinkable clay soils.


Site Plan
Sheet: 1 of 1
Ref No: B1239944
Not to scale
Date: 30.11.12
Client: GAB Robins
Soiltech Surveys
Foundation Investigation & Test Drilling
Tel/Fax: 01245 496389
Site: 13 Torriano Avenue
London NW5
REAR
T2
LARGE HORSE CHESTNUT
11.4m
SHRUBS
TP/ BH3
LARGE ASH
T3
ADDITION
IVY
ADDITION
NO.13
NO.15
TP/ BH1
TP2
6.1m
PRIVET HEDGE
FRONT
T1
LARGE WILLOW
PRIVET HEDGE
Remarks:
Tree identification not authenticated.
Key:
TP = Trial Pit
BH = Borehole
H = Approximate Height
G = Gulley
SVP = Soil vent pipe
IC = Inspection chamber
IL = Invert level
RWP = Rain water pipe