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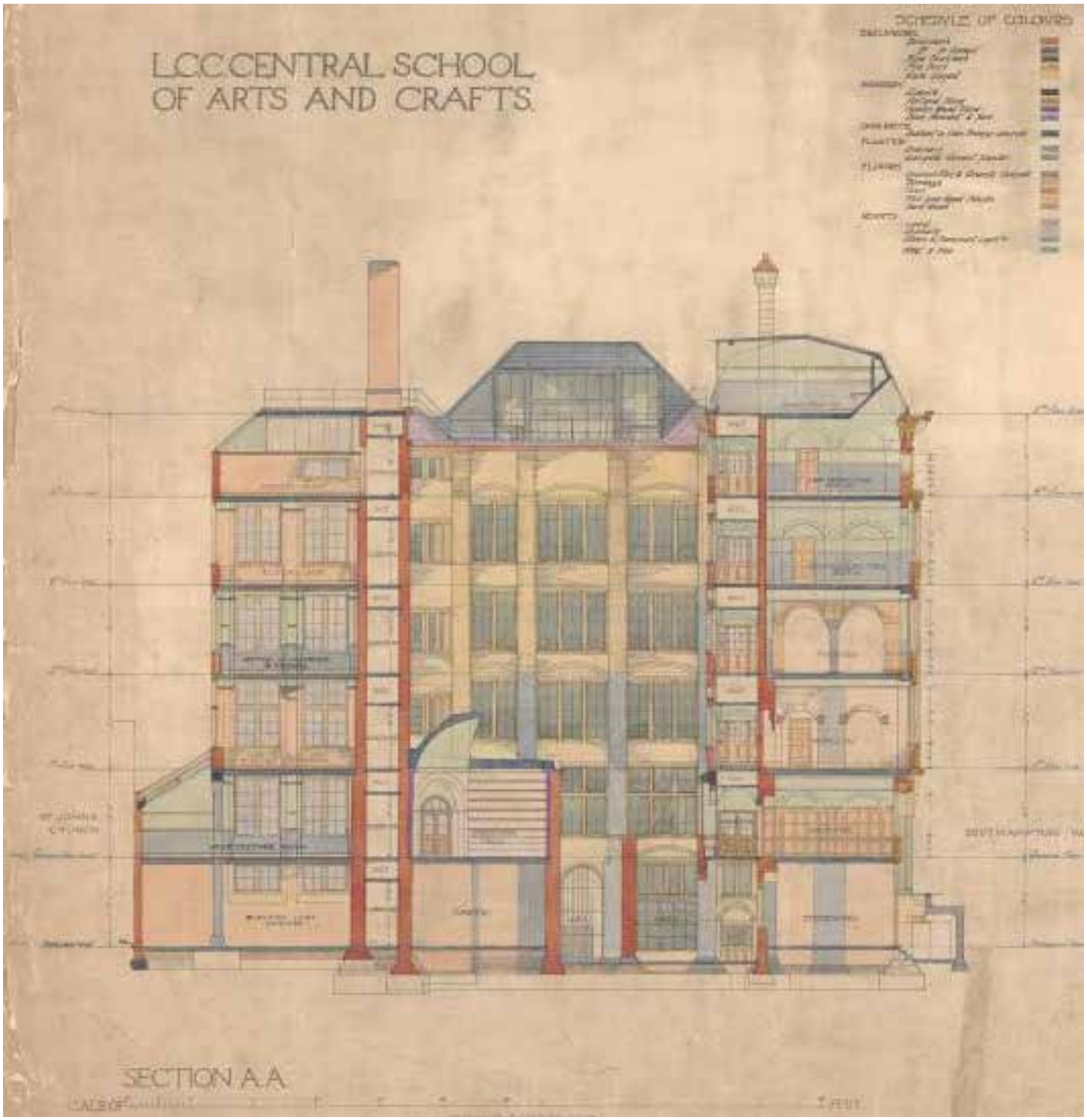
Project

Former CSM Site, Holborn

Title

Arboricultural Report and Impact Assessment



BS 5837 Arboricultural Report

& Impact Assessment

at

The Former Central Saint Martin's Site
Holborn
London
WC1V 6DW

Dated
17th April 2020

CROWN Consultants

Tree consultants throughout England and Wales

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1. Introduction

1.1. Instruction

1.1.1. We are instructed by Globalgrange Hotels Ltd to:

- Undertake an Arboricultural Survey at The Former Central Saint Martin's Site in Holborn and assess all trees potentially within influencing distance of proposed development within the site.
- Plot the trees on a Tree Constraints Plan and record the data in a Tree Data Schedule.
- Provide an overview of the site and any management recommendations.
- Determine if any of the trees are growing within a conservation area or are protected by a tree preservation order.
- Provide guidance for architects or developers to enable them to understand and design within the existing tree constraints.
- Assess the potential impact of the development proposals and provide guidance as to appropriate mitigation measures.
- Produce an Arboricultural Impact Assessment for submission to the local authority once the design has been finalised.

1.2. Scope and Purpose of the Report

1.2.1. This report is designed to accompany a planning application for development proposals at the above site. Its purpose is to assist and inform the planning process. It is produced according to the guidance and recommendations within *BS 5837: 2012 - Trees in Relation to Design, Demolition and Construction.*

1.2.2. The Impact Assessment specifies the principles to be adopted during construction and demolition that will minimise any impacts on trees. However, specific construction activities proposed within Root Protection Areas may need to be agreed in more detail if requested by the local authority at the reserved matters stage (for an outline planning applications) or via planning conditions.

1.3. References

1.3.1. We have liaised with the project architect throughout the writing of this report in order to attain an adequate understanding of the project to enable us to carry out an accurate assessment of the proposals.

1.4. Survey Details and Findings

1.4.1. A visual ground level inspection of all trees was undertaken on the 10th July 2018 by Ivan Button. No climbed inspections or specialist decay detection were undertaken. Details of how the survey was undertaken can be found in Appendix 1.

1.4.2. The findings of the survey are presented in The Tree Data Schedule which is provided as a separate document as well as being appended to the end of this document within Appendix 6. The vegetation is further discussed in Section 3.

1.4.3. The Schedule includes scaled tree images based on measurements recorded for stem diameter, crown spread, crown height and overall height. Their purpose is to indicate, at a glance, the relative dimensions of each tree.

1.4.4. A definition of the Retention Categories can be found in Appendix 1. All other terms used within the Tree Data Schedule are defined and explained in Appendix 2. A more detailed description of the survey method is detailed in Appendix 3.

1.5. Drawings

1.5.1. The tree locations shown on the accompanying plans which are reproduced in Appendix 6 are based on a measured plan of the site supplied to Crown Tree Consultancy. This plan had the tree positions already plotted. Where applicable, additional trees have been plotted by us according to measurements taken on site.

1.5.2. The *Tree Constraints Plan* shows the existing layout. For each tree the stem location is indicated and scaled according to its diameter, the canopy is indicated according to measurements taken along the four cardinal points of the compass. Root protection areas (RPAs) are indicated which are calculated according to the guidelines within BS 5837 (2012).

1.5.3. Where appropriate, the shapes of the RPAs have been amended to reflect actual site conditions or where trees have been heavily pruned. The 'original' RPAs are indicated as a dashed line whereas the amended RPAs are indicated as a solid line.

1.5.4. The *Impact Assessment Plan* indicates the tree constraints with the proposals overlaid. Where applicable, this plan shows where works are proposed in Root Protection Areas and which trees are to be pruned or removed. This plan accompanies the Impact Assessment which is to be found in Section 4.

1.6. Author

1.6.1. This report was compiled by Emma Hoyle FDSc (Arboriculture), ED (Forestry & Arboriculture), M. Arbor. A. Details of the author's experience that qualify her to produce such a report are detailed in Appendix 4.

2. Site Overview

2.1. Brief Description

2.1.1. The survey area encompasses a multi-storey, mixed-use commercial building (the site), situated within central London. Public highways and public footways surround the site on all sides. Fourteen street trees were included within our survey.

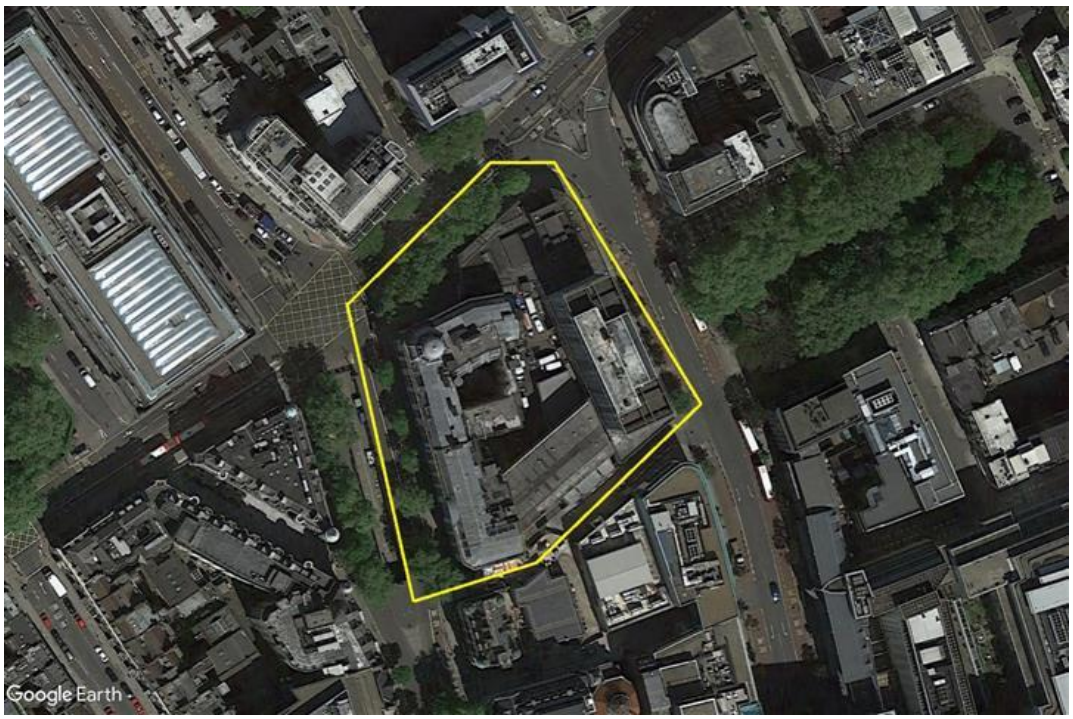
2.1.2. The Tree Constraints Plan and Tree Data Schedule (see Appendix 6) should be referred to for descriptions and locations of all trees.

2.2. Coordinates

2.2.1. The site coordinates are 51°31'7.83"N 0° 7'13.01"W and the altitude is approximately 26m above sea level[1].

2.3. Survey Extent

2.3.1. The area indicated below[2] shows the extent of the survey).



[1] To access satellite imagery and street views of the site these co-ordinates may be entered into: http://maps.google.co.uk/

[2] Image taken from Google Earth and may not be current

3. Vegetation Overview (independent of proposals)

This section summarises all the recommendations within the Tree Data Schedule regardless of whether trees are to be retained, felled or pruned to facilitate the proposed development. It does not specify works that may be required to facilitate the development proposals. The protection status of the trees is also reported in this section.

3.1. Preliminary Management Recommendations

3.1.1. The trees were all deemed to be in an acceptable condition and no significant defects were observed. Consequently, no remedial works have been recommended.

3.2. Future Inspections

3.2.1. The table below suggests a schedule of future inspections based on the condition and location of each tree:

Inspection Frequency (years)	Tree Number
0.5	None
1	T1, T2, T3, T4, T5, T6, T7, T8, T9, T11, T12, T13, T14
1.5	None
3	T10

3.2.2. The trees should be inspected sooner if there is a noticeable decline in their condition, or following extreme weather events.

3.3. Tree Protection Status – Site Specific

3.3.1. On 18th July 2018, we were informed by the London Borough of Camden that:

- The western half of the site is within Kingsway Conservation Area. Trees which grow within the conservation area are believed to be T1 – T8 (our numbering system). The remainder of the site is not within a conservation area.
- There are no tree preservation orders affecting trees within the site.
- There are no tree preservation orders on trees immediately adjacent to the site.

3.4. Tree Protection – General Notes

3.4.1. Heavy fines exist for carrying out unauthorised works to protected trees so we advise that further checks are made before any tree-works are undertaken.

3.4.2. Where the works are proposed for reasons of safety or ill health, a report from a suitably qualified arborist will usually be required. Trees that are dead or imminently dangerous are technically exempt from protection, as are dead branches. If the tree work is not urgently necessary however, at least five working days notice of intention should be given to the local authority. In any case in would be prudent to take photographs before undertaking works without prior consent being granted. Unauthorised works to protected trees may result in a criminal prosecution and a large fine (unlimited).

3.4.3. Where trees are located in a conservation area (but not protected by a TPO), works are not permitted without first giving the local authority 6 weeks' notice of intention. During this time the local authority may elect to create a tree preservation order or to inform the applicant that they have no objection to the proposed works. If the local authority does not respond within 6 weeks, then the intended work may be undertaken. Note: the local authority cannot refuse consent for works to trees within a conservation area; they may only create a tree preservation order if they wish to have further control over what works are undertaken.

3.4.4. Where planning permission is granted and tree works have been approved as part of the planning consent, no further application is required in respect of protected trees and no further notice is required in respect of trees within a conservation area.

3.5. Species Present – Additional Information

3.5.1. The table below contains general information about the tree *species* (rather than the actual tree *specimens*) included in the survey. Its purpose is to assist readers who are unfamiliar with the characteristics of the various species.

Species	Typical Height at Maturity (m)	Typical Canopy Spread at Maturity (m)	General Notes
London Plane	30	20	Deciduous tree arisen in cultivation probably as a cross between the Oriental Plane and the American Buttonwood. Has attractive bark which peels off in small plates leaving a multicoloured flecked pattern. Very common as a street tree, especially throughout London where it dominates the streetscape. Often managed as a pollard in order to constrain its large size to more manageable proportions, especially where there are clay soils and adjacent buildings. Somewhat susceptible to the decay fungus Innonotus hispidus. Visit http://en.wikipedia.org/wiki/Platanus for more info.
Purple Norway Maple	10	10	Deciduous tree native to S. Norway, S. Sweden and across Europe. Red buds and light brown grooved bark distinguish it from sycamore in winter. Cultivars with dark red foliage are also popular. Visit http://www.pfaf.org/user/Plant.aspx?LatinName=Acer+platanoides for more info.
Swedish Whitebeam	14	12	Deciduous tree from Sweden Denmark and Poland, naturalised in Britain. Good autumn colour and summer berries. Often planted as a street tree. Usually single stemmed becoming multistemmed at 2m. Visit http://www.pfaf.org/user/Plant.aspx?LatinName=Sorbus+intermedia for more info.

3.5.2. The figures quoted regarding typical height and canopy spread should be treated as approximate. Actual heights and spreads vary according to several environmental factors such as soil conditions, climate and presence of competing vegetation. The figures quoted are not the maximum dimensions that the species may attain.

4. Arboricultural Impact Assessment

4.1. Overview

4.1.1. It is proposed to carry out external alterations and internal refurbishment to the Grade II* Lethaby Building and the partial demolition and extensions of the existing buildings to create a new hotel facility (Use Class C1). Flexible ground floor and basement uses for retail, office and a range of D1 / D2 uses including an exhibition hall, a lecture hall, a screening room and a spa and swimming pool. Creation of a new stand-alone block is also proposed and re-instatement of former Orange Street which leads diagonally north-westwards from Red Lion Square. The block will provide a cultural use at ground and first floor level and approximately 34 affordable housing units above, together with associated highway improvements, public realm, landscaping, cycling parking, bin storage and other associated works as indicated on the plans in Appendix 6. The existing layout is indicated in black, the footprint of the proposed ground floor layout is indicated in pale green and the basement is outlined with pale blue dashed line.

4.1.1. The table below summarises the potential impact on trees due to various activities.

Activity	Trees Potentially Affected
Tree Removal: Retention Category A	None
Tree Removal: Retention Category B	T12, T13 and T14
Tree Removal: Retention Category C	T11
Tree Removal: Retention Category U	None
Tree Pruning	T1, T2, T5, T9 and T10
RPA: Building Foundations	None
RPA: Other Foundations	None
RPA: New Hard Surface	None
RPA: Underground Services	None
RPA: Change of Ground Levels	None
RPA: Soil Compaction	Trees adjacent the construction area (preventable by installing tree protection measures)

4.1.2. Other potentially damaging activities often associated with construction sites include demolition or the careless use of plant machinery, hazardous materials, or fires. All of the above potential impacts are considered in detail throughout this section.

4.2. Tree Removal

4.2.1. All trees to be removed are indicated on the Impact Assessment Plan and listed below:

- **Retention Category A:** It is proposed to retain all five Retention Category A trees.
- **Retention Category B:** It is proposed to remove the following Retention Category B trees: T12, T13 and T14. These three trees require removal in order to facilitate a piling rig for the proposed construction works. I understand that other alternative options have been explored, yet this is most suitable location.
- **Retention Category C:** It is proposed to remove the following Retention Category C tree: T11. This 4m tall tree also requires removal to facilitate the piling rig.
- **Retention Category U:** Our survey did not identify any Retention Category U trees.

4.2.2. Details specific to each tree can also be found in the Tree Data Schedule.

4.3. Mitigation Planting

4.3.1. In order to mitigate against tree loss, a post-development planting scheme is proposed. The proposed planting scheme should incorporate tree species which provide year-round interest and species which are suitable for an urban environment.

4.4. Impact on Tree Canopies

4.4.1. The Impact Assessment Plan indicates that the canopies of T1, T2 and T5 growing in an eastern direction require some light pruning to create a clearance distance of 1.5m from the existing building walls. Such pruning shall provide clearance for the external refurbishments to take place.

4.4.2. The canopies of T9 and T10 growing in a south-eastern direction require pruning to create a clearance distance of 1.5m from the currently existing, and proposed building. Such pruning shall reduce the risk of accidental damage to branches occurring during construction and shall provide clearance from the proposed building walls.

4.4.3. All pruning works should be undertaken sympathetically (working to BS 3998: 2010 guidelines) to ensure the trees are not harmed or disfigured and to minimise any impact upon local visual amenity. All other tree canopies shall be unaffected by the proposals.

4.5. Impact on Tree Roots

4.5.1. **Building Foundations:**

4.5.2. No alterations are proposed to the existing building (including the basement) within the vicinity of trees T1-T6. Consequently, there shall be no disturbance to the rooting areas of these trees.

4.5.3. Adjacent to trees T8, T9 and T10, it is proposed to demolish the existing building, lower the floor level of the existing basement, and construct a new multi-storey building. Due to the existing basement and building foundations, it is considered unlikely that the roots of these trees shall extend beneath the basement where excavation is proposed. However, it is considered likely that the tree roots shall proliferate immediately adjacent to the foundations. It is therefore imperative that the foundations are installed in such a manner that the soils beyond the footprint of the building remain as undisturbed as possible.

4.5.4. Consequently, it is proposed to carry out the excavation in a manner that does not disturb the soils beyond the footprint of the existing basement which we understand shall be done using either contiguous piling, sheet piling, pinning or a similar method which restricts excavation to the existing footprint, in order to ensure very little to no impact upon tree roots.

4.5.5. **New Surfaces:**

4.5.6. No new surfaces are proposed within the Root Protection Areas of any trees.

4.5.7. **Underground Services:**

4.5.8. No underground services are to be installed through any Root Protection Areas.

4.5.9. **Changes in Ground Levels:**

4.5.10. No changes to ground levels are proposed over Root Protection Areas.

4.5.11. **Soil Compaction:**

4.5.12. The majority of tree roots lie within the upper soil horizons. This is because the availability of oxygen decreases with depth and roots need to breathe to stay alive. In

addition, nutrients are more readily available in the form of organic matter close to the soil surface.

4.5.13. Healthy soils contain about 25% air space between solid particles. Increased loading of the soils caused by construction activity causes air to be squeezed out as the soil becomes compacted preventing roots from breathing. Even an increase in pedestrian activity may cause some soil compaction.

4.5.14. It is important therefore that ground compaction and soil disturbance over Root Protection Areas should be avoided during the construction phase. This may be done by installing protective fencing and ground protection measures which should be approved and conditioned by the local authority.

4.6. Demolition Activities

4.6.1. In order to avoid inadvertent damage to tree roots, branches or stems, care shall need to be taken when demolishing the building close to trees T7, T8, T9 and T10. The walls should be demolished inwards onto the building footprint in a direction away from adjacent trees. Machinery operatives shall need to be made aware of this requirement and tree protection measures shall need to be installed prior to commencement of demolition.

4.7. Hazardous Materials

4.7.1. All hazardous materials (including cement and petrochemical products) will need to be controlled according to COSHH regulations in order to ensure there is no detrimental impact on tree health. Provision shall need to be made to ensure that cement and cement run-off are contained outside of all Root Protection Areas.

4.8. Cabins and Site Facilities

4.8.1. Consideration should be given to the location of any site welfare facilities in terms of potential impact on trees. Where it is proposed to install cabins or site facilities in Root Protection Areas, the project arborist should be consulted and approval obtained from the local authority.

4.8.2. There is limited room for the siting of cabins and storage of materials / spoil during the construction phase so the logistics of the development shall need to be well organised to ensure that there is adequate space outside of the Tree Protection Zones for construction activity.

4.9. Impact of Retained Trees on the Development

4.9.1. No tree canopies shall be closer to the proposal than they are to the existing building so the proposal shall not result in an increase in the perceived nuisance afforded by the trees.

4.10. Summary

4.10.1. In order to facilitate a piling rig for the proposed development, three Retention Category B trees (T12, T13 and T14) and one Retention Category C tree (T11) require removal. A post development planting scheme is proposed to mitigate against tree removal and to ensure tree cover is maintained throughout, and around the site.

4.10.2. Trees T1, T2, T5, T9 and T10 require pruning to create a clearance of 1.5m from the existing and proposed building walls. Because the existing buildings are already very

close to the canopies of these trees, similar pruning would be required at some point in the future, regardless of the development proposals.

4.10.3. No new hard surfacing is proposed within in Root Protection Areas.

4.10.4. No new building foundations are proposed within Root Protection Areas. However, when lowering the level of the existing basement adjacent to T8, T9 and T10, excavation works shall be carried out in a manner that does not disturb any of the soils beyond the footprint of the existing building.

4.11. Arboricultural Method Statement

4.11.1. BS 5837 recommends that a detailed methodology is agreed in the form of an Arboricultural Method Statement which shall ensure that trees are well protected during the construction phase. This should detail all tree protection measures and limitations on construction activity. All of the issues raised within this Impact Assessment should be covered by the Method Statement.

4.11.2. So long as the protection measures are well specified and carefully implemented, there shall be no long term detrimental impact on the health of the adjacent trees.

5. Photographs

Refer to the Tree Constraints Plan for photo locations

Photo 1.

Photo 2.

Photo 3.

Photo 4.

Photo 5.

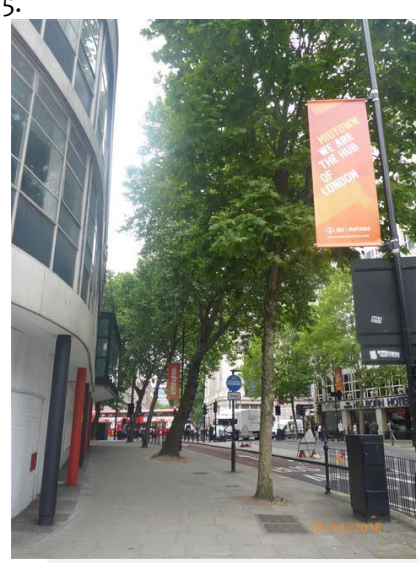
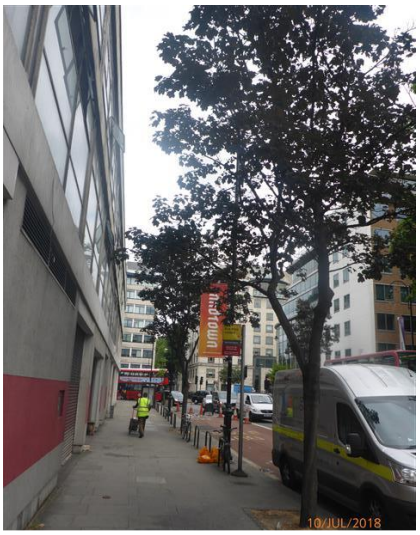


Photo 6.

Photo 7.

Photo 8.



Appendix 1: BS 5837: 2012 – Guidance Notes

This Standard prescribes the principles to be applied to achieve a satisfactory juxtaposition of trees and structures. It sets out to assist those concerned with trees in relation to design, demolition and construction to form balanced judgements.

It acknowledges the positive contribution trees may offer to a site, as well as the negative aspects of retaining inappropriate trees. It addresses the negative impacts that construction activity may have upon trees and offers mitigation strategies to minimise these impacts.

The Standard suggests a three stage approach to ensure best practice is followed when developing close to trees:

A1.1 Stage 1: Survey Details and Notes

A ground level visual survey was undertaken. No climbed inspections or specialist decay detection were undertaken. Only trees with a stem diameter over 75mm, which lie within the site boundary or relatively close to it, were included.

Where applicable, trees with significant defects have been highlighted and appropriate remedial works have been recommended. However, this report should not be seen as a substitute for a full Safety Survey or Management Plan which are specifically designed to minimise risk and liability associated with responsibility for trees.

Wherever practicable dimensions were obtained using diameter tapes, logger's tapes, distometers and clinometers. Where obstacles prevent accurate measurement, dimensions are estimated. Trees on privately owned third party are surveyed from the best available vantage point and observations relating to the condition of these trees should be treated accordingly. All height measurements should be regarded as approximate.

Data is recorded for each tree and is presented in a Tree Data Schedule. Each tree is allocated a Retention Category according to its size, amenity value, condition and safe useful life expectancy. The categories are allocated independently of development proposals. Our interpretation of the Retention Categories is explained below:

A1.1.1 Retention Categories

A Category: Trees of high quality and amenity value. Usually, mature trees with a significant life expectancy which would enhance any development. Retention of these trees is strongly encouraged.

B Category: Trees of moderate quality and amenity value. Usually these are maturing trees or younger trees with exceptional form. Retention of these trees is desirable though the removal of occasional specimens may be acceptable.

C Category: Trees of low quality or small specimens with a relatively low amenity value. These trees are not considered to be a material planning constraint and their removal will generally be seen as acceptable in order to facilitate development.

U Category: Trees of such low quality that their removal is recommended regardless of development proposals.

A1.1.2 Occasionally trees are borderline and do not fall neatly into one of the categories A, B or C. In such cases we apply a superscript (**+/-**) such that:

C^{+} Indicates borderline C/B, though Category C is deemed to be most appropriate.

B^{-} Indicates borderline C/B, though Category B is deemed to be most appropriate.

A1.1.3 The British Standard suggests that each of the A, B and C categories may be further subdivided (A1, A2, A3, B1, B2, B3 etc) such that subcategory 1 denotes mainly arboricultural values, subcategory 2 denotes mainly landscape values and subcategory 3 denotes mainly cultural values (including conservation). Multiple subcategories may be used.

Our experience suggests that these subdivisions lack clarity and can be confusing. Within this report subcategories are **not** denoted. Where appropriate, the use of phrases such as '*Part of a formal group'*, or '*Has a high ecological value', or 'Offers good screening to the site'* are incorporated into the observation section of the Tree Data Schedule. We believe this conveys all relevant landscape and cultural information without any confusion.

A1.1.4 **Tree Constraints Plan (TCP).** This indicates the position, crown spread, Retention Category and Root Protection Area of each tree. It is used to inform where development may proceed without causing damage to trees.

A1.1.5 **Root Protection Area (RPA).** This is the area around each tree likely to contain the majority of roots. It should ideally remain undisturbed to avoid a detrimental impact on tree health. For single stemmed trees It is calculated according to the formula "radius of RPA" = "12 x stem diameter". Where a tree has more than one stem, the equivalent-single-stem diameter is usually recorded. This is calculated by adding the squares of the stems and then finding the square root of this total. The radius of the Root Protection Area is then calculated by multiplying the equivalent-stem-diameter by 12.

A1.1.5 **Shade Constraints.** The previous Standard (BS 5837 2005) suggested that shade constraints should be indicated on the TCP. This are denoted as a circle-segment drawn northwest to due east with a radius equal to the height of the tree. These do not represent the actual shade pattern which varies through the seasons. Rather, they indicate the area most shaded by the tree throughout the course of the year. Ideally habitable room windows should be located outside of these shade constraints. Where we consider it appropriate, we will include shade constraints information on our Impact Assessment Plan or Proposed Layout Plan.

A1.2 Stage 2: Arboricultural Impact Assessment

After the initial survey and the production of the Tree Constraints Plan, arborists and designers are encouraged to work together to establish a design proposal with minimal impact on the high quality trees. An assessment should be made of all possible impacts including the impact that the trees may have upon the proposal. The arborist may recommend mitigation strategies to minimise these impacts and help achieve a more harmonious juxtaposition between buildings and trees.

A1.3 Stage 3: Arboricultural Method Statement

This type of report specifies the measures necessary to protect trees against damage from construction activity. The Method Statement should be written in a manner that it may be conditioned and enforced by the local authority upon granting of planning permission. The site manager should be familiar with all aspects of the Method Statement and should ensure that all persons working on the site are aware of those aspects which appertain to their work. This includes service installation engineers and operators of plant machinery.

Appendix 2: Explanation of Tree Data & Glossary

This section explains the terms used in the **Tree Data Schedule** (see Section 3 and Appendix 6).

A4.1 General Observations

A4.1.1 Numbering System: Each item of vegetation has its own unique number prefixed by a letter such that T1=Tree 1, G2=Group 2, H3=Hedge 3 and W4=Woodland 4, S5=Shrub 5.

A4.1.2 Age Categories:

Young	Usually less than 10 years old.
Semi-Mature	Significant future growth to be expected, both in height and crown spread (typically below 30% of life expectancy).
Early-Mature	Full height almost attained. Significant growth may be expected in terms of crown spread (typically 30-60% of life expectancy).
Mature	Full height attained. Crown spread will increase but growth increments will be slight (typically 60% or more of life expectancy).
Veteran	A level of maturity whereby significant management may be required in order to keep the tree in a safe condition.
Over Mature	As for veteran except management is not considered worthwhile.

A4.1.3 Species: Common names and Latin names are given.

A4.1.4 Height: Measured from ground level to the top of the crown.

A4.1.5 Stem Diameter: Taken at 1.5m above ground level where possible. On multi-stemmed trees this measurement may be taken at ground level, though usually an indication of the number of stems and average diameter is given, e.g. 3 x 30cm.

A4.1.6 Crown Height: Measured from ground level to the height at which the main crown begins. Where the crown is unbalanced it is measured on the side deemed to be most relevant. This is usually the side facing the area of anticipated development.

A4.1.7 Tree Diagram: This scaled drawing is computer generated based on measurements taken for stem diameter, crown height and spread, and overall height. It is designed to help the reader rapidly assess the data. It is not an accurate representation of the form of the tree.

A4.1.8 Crown Spread: Measured N, E, S & W, taken from the centre of the stem and usually rounded up to the nearest metre.

A4.1.9 Observations: If a tree's position is considered to be relevant it will be commented upon (e.g. overhanging a children's play area). Tree form and pruning history are also recorded along with an account of any significant defects. Defects and descriptive terms are dealt with in more detail at the end of this section.

A4.1.10 Recommendations: Usually based on any defects observed and intended to ensure that the tree is in an acceptable condition.

A4.1.11 Priority Scale: Depending upon the threat posed by the tree, and the likelihood of failure, recommendations should be carried out according to the following priority scale:

Urgent	To be carried out as soon as possible.
Very High	To be carried out within 1 month.
High	To be carried out within 3 months.
Moderate	To be carried out within 1 year.
Low	To be carried out within 3 years.

A4.1.12 Inspection Frequency: An interval of 6 months, 1 year, 1.5 years or 3 years is allocated before the next inspection is due. Wherever practical, consideration should be given to seasonal changes so that deciduous trees are not always surveyed in winter when they have no leaves, or in summer when leaves may obscure branches within the upper crown.

A4.1.13 Vigour: An indication of growth rate and the tree's ability to cope with stresses:

High	Having above average vigour.
Moderate	Having average vigour.
Low	Having below average vigour.
Very Low	Tree is struggling to survive and may be dying.

A4.1.14 Physiological Condition:

Good	Healthy and with no symptoms of significant disease.
Fair	Disease present or vigour is impaired.
Poor	Significant disease present or vigour is extremely low.
Very Poor	Tree is dying.

A4.1.15 Structural Condition:

Good	Having no significant structural defects.
Fair	Some defects observed though no high priority works are required.
Poor	Significant defects found. Tree requires monitoring or remedial works.
Very Poor	Major defects which will usually require significant remedial works or tree removal.

A4.1.16 Amenity Value:

Very High	Exceptional specimen, observable by a large number of people.
High	Attractive specimen, observable by a significant number of people.
Moderate	One of the above factors is not applicable.
Low	Unattractive specimen or largely hidden from view.

A4.1.17 Life Expectancy: The estimated number of years before the tree may require removal. Classified as (<10), (10 – 20), (20 – 40), or (40+).

A4.1.18 Retention Category: These are explained in detail in Appendix 1.

A4.2 Evaluation of Defects

A4.2.1 Cavities, wounds, deadwood etc are all evaluated as follows:

Major	Such that structural integrity is, or will become, compromised and the tree is, or will inevitably become, hazardous.
Significant	A defect that may over time become a major defect, though not necessarily so. This will depend on the vigour of the tree and its ability to deal with decay etc.
Minor	A defect that is not likely to compromise the tree's structural integrity.

General Glossary

Adaptive growth	**In tree biomechanics, the process whereby wood formation is influenced both in quantity and quality by the action of gravitational forces and mechanical stresses on the cambial zone.**
Aerobic	**Conditions in which oxygen is freely available, or to biomechanical processes that depend on the presence of oxygen.**
Anaerobic	**A condition marked by the absence of oxygen; Generally such areas are unsuitable for normal life and growth of plant tissues. These sites tend to be populated by bacteria capable of surviving low oxygen conditions often associated with Slime Flux.**
Arboriculture	**The culture and management of trees as groups and individuals primarily for amenity and other non-forestry purposes.**
Arborist	**A person possessing the technical competence through experience and related training to provide management of trees or other woody plants in a landscape setting. Generally involved with the development or management of trees for visual amenity or land management rather than the growth of trees for product or profit.**
Barrier zone	**A layer within an annual increment of wood which contains abnormal xylem cells, laid down by the cambium in response to wounding or other trauma.**
Body language	**In trees, the outward display of growth responses and or deformation in response to mechanical stress.**
Bole	**Or Trunk, the main stem of a tree below its first major branch.**
Bracket	**A type of fruiting body produced by various fungal species, plate like to hoof like in shape and often a one sided attachment to the wood or bark.**
Branch bark ridge	**A ridged area located at the union of a branch to a trunk or stem.**
Branch Collar	**Trunk tissue that forms around the base of a branch between the main stem and the branch, or between a main branch and a lateral branch. As a branch decreases in vigour or begins to die, the collar usually becomes more pronounced and completely encircles the branch.**
Brown Rot	**Form of decay where cellulose is degraded, while lignin is only modified.**
Buttress Root	**Roots that emerge from the base of the tree stem, normally large and well developed that rapidly reduce in diameter to create the Root Plate this offers structural support for the tree. Buttress roots divide rapidly forming the connection between the stem and the transport roots.**
Cabling Bracing	**Installing cables within the crown of a tree to prevent collapse.**
Callus	**Undifferentiated cells often formed at the edges of recent injuries. This tissue quickly becomes differentiated, forming cells of the type characteristic of that position on the tree (e.g. forming wood, bark, roots, etc.) see wound response tissue.**
Cambium	**A thin layer of actively growing and dividing cells, located between the xylem (sapwood) and bark of a plant; the part responsible for radial growth of a tree stem or branch.**
Canopy	**The topmost layer of twigs and foliage in a woodland, tree or group of trees.**
Canker	**A localised area of dead bark and cambium on a stem or branch, caused by fungal or bacterial organisms, characterised by woundwood development on the periphery. This may be annual or perennial.**
Cavity	**An open and exposed area of wood, where the bark is missing and internal wood has been decayed and dissolved.**
Chlorotic	**Also Chlorosis. A condition of the plant marked by yellowing of normally green foliage, often indicating nutrient deficiency or plant dysfunction.**
Clinometer	**Devices that measures vertical angles, and provides direct height measurements of objects by triangulation.**
Co-dominant stems/trunk	**Are forked branches or trunks of nearly the same size in diameter and lacking a normal branch union.**
Compacted soils	**Soils in which the air-space (oxygen space) has been reduced or eliminated, reducing water infiltration and percolation, reducing root presence and inhibiting new root development.**
Compartmentalisation	**The physiological process that creates the chemical and mechanical boundaries that act to limit the spread of disease and decay organisms.**
Compression Failure	**Localized buckling of fibres and other longitudinal elements produced by compression of wood along the grain; compression failures sometimes develop in standing trees.**
Compression Strength	**The ability of a material or structure to resist failure when subjected to compressive loading; measurable in trees using special drilling devices**
Compression Wood	**Abnormal wood formed on the lower side of branches and curved stems, with physical properties different from normal wood.**
Conservation Area	**In Great Britain, designated areas of architectural or historical interest, in which there are special procedures for planning applications. Additionally tree works cannot generally be undertaken without prior notification (Currently 6 weeks) to the relevant local planning authority. See also Tree Preservation Orders.**
Core Sample	**A sample of wood extracted from a trunk or branch, using an increment borer tool. The resulting core can be analysed for characteristics of growth, wood strength, structure, decay, and for species identification.**
Crotch	**The union of two or more branches; the auxiliary zone between branches.**
Crown	**The upper canopy of a tree, including upper trunk, scaffold branches, secondary branches, stems and leaves.**
Crown lifting / raising	**Crown Lift The removal of the lowest branches, usually to a given height. It allows more residual light and greater clearance underneath for vehicles etc.**
Crown reduction	**The reduction of a tree's height or spread while preserving its natural shape.**
Crown thinning	**The removal of some of the density of a tree's crown, usually 5-25% allowing more light through its canopy and reducing wind resistance.**
Deadwood (noun)	**Deadwood is often present within the crown or on the stems of trees. It may be an indication of ill health, however, it may also indicate natural growth processes. If a target is present beneath the tree, deadwood may fall and cause injury or damage and should be removed, otherwise deadwood can remain intact for conservation purposes (insects, fungi, birds etc.).**
Deadwood (verb)	**The removal of dead branches from a tree's canopy, usually of a specified size (in diameter).**
Decay	**Progressive deterioration of organic tissues, usually caused by fungal or bacterial organisms, resulting in loss of cell structure, strength, and function. In wood, the loss of structural strength.**
Decay Detection	**The assessment of decay within a tree has been traditionally difficult, but recent advances have made it possible to achieve accurate representations of the internal section of a tree in both 2D and 3D, removing doubt over the condition of the tree and allowing accurate management decisions.**
Defect	**In relation to tree hazards, any feature of a tree which detracts from the uniform distribution of mechanical stress, or which makes the tree mechanically unsuited to its environment.**
Defoliation	**The losing of plants foliage.**
Dieback	**Progressive death of buds, twigs and branch tissues, on individual limbs resulting in Deadwood, or throughout the canopy,**

	extreme cases can result in Stag Heading.
Dripline	A projected line on the ground that corresponds to the spread of branches in the canopy; the farthest spread of branches.
Epicormic shoots	Fast growing, weakly attached shoots/branches that often grow as a response to stress factors upon a tree or branch removal.
Failure	In connection with tree hazards, a partial or total fracture within the wood tissue or loss of cohesion between roots and soil. (In total failure affected parts will snap or tear away completely, Partial failure there is a crack or deformation, which results in an altered distribution of mechanical stress.
Feeder Roots	Fine fibrous Water and nutrient absorbing roots located in the outer root system.
Flush-Cut	In trees and shrubs, a pruning cut close to the parent stem, which removes the branch bark ridge.
Foliage	The live leaves or needles of the tree; the plant part primarily responsible for photosynthesis.
Formative pruning	The trimming of a tree to remove weaknesses and irregularities which may lead to problems. The formative pruning operation is aimed at reducing the potential for future weaknesses or problems within the tree's crown.
Gall	An abnormal, disorganized growth of plant tissues, caused by parasitic or infectious organisms such as insects, fungi, bacteria, or viruses.
Girdling	In woody plants, any form of damage that destroys the bark and / or the Cambium all the way around the stem, branch or root, normally resulting in death of the damaged section.
Girdling Root	In woody plants, a root that grows across the buttress, or across other roots, eventually causing constriction of the radial growth.
Growth Increment	The incremental growth added as new annual ring develops each season over existing wood. This is seen as (growth) rings in cross-sections of wood.
Hazard beam	An upwardly curved branch in which strong internal stresses may occur without the compensatory formation of extra wood (longitudinal splitting may occur in some cases).
Heartwood	Inner non functioning tissues that provide structural support to trunk.
Heave	In relation to shrinkable clay soils, expansion due to rewetting of a volume of soil previously subjected to the removal or water by plant / trees following felling or root severance. Also in relation to root growth, the lifting of pavements and other structures by radial expansion. Also in relation to tree stability, the lifting of one side of a wind rocked root plate.
Herbicide	A chemical compound that causes the death of a plant.
Included Bark	Bark that becomes embedded in a crotch between branch and trunk or between co-dominant stems, usually found in narrow or tight crotches, and causes a weak structure.
Increment Borer	A tool that cuts and extracts a narrow cylinder of wood from a tree for analysis of the wood tissue and growth increments.
Leader	The primary terminal shoot or trunk of a tree.
Limb	A large lateral branch growing from the main trunk or from another larger branch.
Lion Tailing	Often the result of poor pruning practices; the main leader or branches are largely devoid of side branches, growth is restricted to the end of branches and is likely to suffer damage through end loading.
Lopping	In trees, a general term that related to the removal of branches from a tree.
Monitoring	Due to the relative life span of trees in relation to our own, long-term monitoring provides a valuable insight to the health of trees, identifying decline and or stabilisation and or improvement.
Mulch	A material laid over the root system of a tree to help conserve moisture within the soil. Additionally it may help control the development of weeds close to the tree.
Mycelium	A mass of growing filaments (hyphae) formed by fungi.
Mycorrhizae	The symbiotic relationship between roots and certain beneficial fungi. Mycorrhizae are the combined root / fungal growth.
Occluding tissue	The general tern of wood, cambium and bark that develop around the site of a wound on a woody plant
Pathogen	A microorganism that causes diseases within another organism.
Phloem	The principle conductive tissue that the products of Photosynthesis are transported around the plant
Photosynthesis	The process were light energy is used to create energy (Carbohydrate) for use within the plant.
Pollard	A term for a pollarded tree.
Pollard head	The swollen section of branch / stem that forms behind the pollarding cut.
Pollarding	The complete or partial removal of the crown of a young tree so as to encourage the development of numerous branches either for amenity or historically as fodder, repeated management is required cyclically to maintain the feature
Prune or Pruning	Selective removal of woody plant parts of any size, using saws, Loppers, Secateurs, or other pruning tools.
Reaction Wood	Wood with distinctive anatomical characteristics, formed in parts of leaning or crooked stems and in branches to provide additional strength / support. In hardwoods, tension wood usually forms. In conifers, compression wood is usually found.
Reaction Zone	A zone normally darker than surrounding wood that denoted the boundary often a defensive one between functional sapwood and dysfunctional or decaying wood.
Re-grading	The raising or lowering of a soil profile from its original grade.
Remedial pruning	The removal of old stubs, deadwood, epicormic growth, rubbing or crossing branches and other unwanted items from the tree's crown.
Resistograph	Invasive decay detection technique whereby the resistance offered by the timber to a spinning probe is measured and plotted.
Rib	In tree body language, a long narrow, axial protuberance which often over lays a crack.
Ring Barking	Artificial Girdling of the stem, to result in the death of a tree. May be used in habitat creation were the retention of dead standing trees is required.
Rod Bracing / Bolting	Traditionally, this has relied upon the Installation of steel rods or bolts through the stems or limbs, to reduce twisting or splitting of the wood. The installation of such features does require legal interpretation.
Root Barriers	Both Buildings and services can benefit from the installation of root barriers to protect a soil volume from the ingress of roots.
Root Collar	The basal area of the tree; transition zone from trunk to root. Also sometimes called trunk flare.
Root Plate	The primary support area for the tree; an area of the root system close to the base that structurally anchors the tree to the soil.
Root Rot	Either a general term for decay within the wood of the lower stem / buttress roots, or a disease in which the fine roots are killed.
Root System	The portion of the tree containing the root organs, including buttress roots, transport roots, and fine absorbing roots; all underground parts of the tree.
Root Zone	The area and volume of soil around the tree in which roots are expected. May extend to three or more times the branch spread of the tree, or several times the height of the tree.
Sail Area	That area or the tree subjected to wind load.

Sapwood	**Xylem wood tissue, usually light in colour, representing the outer growth rings of the wood. Usually living, reactive wood tissue, in a healthy tree. See heartwood**
Scaffold limbs / scaffold Branches	**The branches that from the main network framework of the crown of a tree.**
Senescent	**A decline in growth and vigour due to age or stress factors.**
Shrub	**A woody plat that branches at or close to the ground level and so does not have a single stem.**
Slime Flux	**Relating to a toxic condition from the spreading of bacteria or their products from a source of infection; characterized by malodorous gases, or salt deposits upon the bark. If these products enter the sap stream, localised vessel necrosis can result, usually associated with anaerobic conditions.**
Soft Rot	**A kind of wood decay, were a fungi degrades cellulose within the cell wall, without causing overall degradation.**
Soil Compaction	**The compression of soil, causing a reduction of pore space and an increase in the density of the soil. Air is squeezed out and nutrients become locked. Tree roots cannot grow in compacted soil.**
Sonic Decay Detection	**Non invasive method whereby sound waves are passed through the tree and the speed is measured. Slow speeds indicate decay and a tomography picture representing the inner stem is produced.**
Stag Heading	**In a tree, a state of dieback were dead branches protrude beyond the current living crown.**
Stress	**In plant physiology, conditions were one or more physiological functions Are not working within normal parameters.**
Stump Grinding	**The removal of a tree stump using a specialist grinding machine.**
Subsidence	**In relation to vegetation, the removal of water by plant growth resulting in localised shrinkage in the soil volume.**
Sucker	**Same as sprout.**
Suppressed	**Trees which are dominated by surrounding vegetation and whose crown development is restricted from above.**
Systemic	**Affecting the whole plant or organism. A systemic compound is carried throughout the entire plant to all parts through the vascular system.**
Target	**Any person or object within reach of a falling tree or part of a tree that may be injured or damaged.**
Target Pruning	**The pruning of a branch were the wound affects only branch material, often result in a target shaped wound.**
Tension Wood	**Reaction wood typically formed on the upper side of limbs or curved stems; characterized by lack of cell wall lignifications (higher ratios of cellulose to lignin).**
Tight Union / Tight Crotch	**Also, narrow crotch. A crotch with a narrow angle between branches, often having included bark.**
Tomography	**The comparison of sound or stress waves through the tree allows the creation of a 2D or 3D representation of the internal structure of a stem or branch section and highlights areas of damage. Virtually non-injurious.**
Topography	**The configuration of surface features, including the vertical and horizontal relationships of the ground and other features.**
Topping	**Cutting large limbs back severely, without regard to form or habit of the tree. Cuts are usually made between lateral branch nodes. This practice is extremely injurious to trees, and promotes decay and structural weakness within the crown.**
Tree	**A woody plant that typically has a single stem, at maturity has a height of a least 4 metres and a stem diameter at breast height of at least 75mm.**
Tree Preservation Order	**In Great Britain, an order made by the local planning authority, were consent must be gained before undertaking all but exempt works to a tree.**
Trunk Flare	**The basal area of the trunk that flares or widens, and merges with the main roots. See root collar**
Veteran Tree	**Veteran trees are often found in large parks or estates and commonly affected by extensive decay or have been subject to extensive works. These trees are retained for historical importance and often pose greater risk than normal, which is generally justified. They need careful management and often propping or bracing to support them, some require fencing to limit access.**
Vigour	**Active, healthy growth of plants: ability to respond to stress factors.**
Visual Tree Assessment (VTA)	**An assessment of the mechanical condition of trees based upon their 'body language'. Trees are dynamic and respond to faults / decay / environmental factors in various ways, these responses can be indicative of structural integrity.**
Wetwood	**An infection caused by bacteria living inside the plant tissues. The bacteria ferment the plant fluids, resulting in death of nearby cells, and often causing exudations of fluid from the bark, often referred to as a Slime Flux.**
White Rot	**A kind if wood decay were a fungi attacks the lignin within the wood matrix**
Wind loading	**Forces placed upon tree canopy, branches, trunk and roots of a tree under windy conditions.**
Wind Throw	**The failure of a tree due to wind loading.**
Witches Broom	**A deformed or unusual growth of twigs from adventitious buds, caused by insects, disease, or dieback of twigs and buds.**
Wood	**Secondary Xylem; the main structural support and water conducting tissue of trees and shrubs.**
Wound Response Tissue	**Also Occluding Tissue, Wound Wood or Callus. Differentiated wood tissue that grows around the margins of a wound or injury.**
Wound Wood	**Wood with atypical features, formed in the vicinity of a wound and a term to describe the occluding tissues around a wound**
Xylem	**Plant tissues with special function of translocation of water and dissolved nutrients.**

Appendix 3: Survey Methodology

A2.1 Ground level visual surveys are carried out using the *Visual Tree Assessment* technique described by Mattheck and Broeler (1994) and endorsed by the Arboricultural Association (LANTRA Professional Tree Inspection course, 2007).

A2.2 Structural condition is assessed by inspecting the stem and scaffold branches from all angles looking for weak branch junctions or symptoms of decay. Particular attention is paid to the stem-base. Cavities are explored using a metal probe in order to assess the extent of any decay. If this is not possible further inspection is recommended in the form of a climbed inspection or using specialist decay detection equipment.

A2.3 The physiological condition is assessed by inspecting the stem, branches and foliage for symptoms of disease. The overall vigour of the tree is also taken into account.

A2.4 Where significant defects are observed, recommendations are made according to a scale of priority in order to reduce the likelihood of structural failure. The position of the tree and its potential targets are taken into account.

A2.5 Measurements are obtained using a diameter tape, clinometer, distometer and loggers tape. Where this is not practical measurements are estimated.

A2.6 Some trees are surveyed as groups, though this is usually avoided close to areas likely to be developed.

A2.7 Finally, a *Retention Category* is allocated as described in Appendix 1.1.1.

Appendix 4: Author's Qualifications

Qualifications & Experience of Ivan Button N.C.H. (Arb), FDSc (Arb), BSc (Hons), P.G.C.E., M. Arbor. A.

Between 1983 and 1995 Ivan worked primarily within the construction industry and received training in a broad range of practical building skills and general construction principles. During this time he obtained a BSc (Hons) at Leeds University followed by a P.G.C.E at The University of Wales.

In 1995, Ivan obtained a NCH (Arboriculture) at the University of Lincoln and became a member of the Arboricultural Association. He then worked for an Arboricultural Consultancy for one year before establishing a tree surgery and landscaping business in 1998. In 2005 Ivan commenced full time employment with a leading Arboricultural Association approved consultancy and soon adopted a senior role responsible for five consultants.

He obtained a FDSc in arboriculture at the University of Lancashire, which he passed with distinction and is now a Director and Principal Consultant of Crown Consultants Ltd. He is accredited as a LANTRA *Professional Tree Inspector*. A qualification produced in association with the Arboricultural Association and generally recognised as appropriate for all levels of tree inspection.

He is a member of the Consulting Arborist Society and is listed within their areas of professional expertise for QTRA and as an expert witness.

Ivan is a professional member of the Arboricultural Association and the International Society of Arboriculture and is a licensed Quantified Tree Risk Assessment user.

Ivan has undertaken professional expert witness training and has been registered as a Sweet and Maxwell Checked Expert Witness since 2008.

Throughout 2009 acted as the principal Tree Officer for Barnsley Metropolitan Borough Council.

Ivan has produced several hundred Arboricultural Reports for the purposes of Development, Safety, Management, Mortgage, Subsidence, Mitigation and Litigation.

Qualifications & Experience of Emma Hoyle FDSc (Arboriculture), ED (Forestry & Arboriculture), M. Arbor. A.
Emma is a qualified Arboricultural Consultant educated to Level 5 in Arboriculture at Askham Bryan College, is a professional member of the Arboricultural Association and is a LANTRA accredited *Professional Tree Inspector*. She has worked for Crown Tree Consultancy since 2015 and has since written numerous reports relating to all aspects of arboriculture including; planning and development, vegetation related subsidence, tree preservation orders and tree risk assessment. Emma regularly attends seminars and events in order to keep abreast with current knowledge and best practise in Arboriculture.

Prior to becoming an arboricultural consultant, Emma worked for two reputable tree surgery firms from 2008 and became an NPTC Qualified tree surgeon after completing a Level 3 Extended Diploma in Forestry and Arboriculture at Askham Bryan College. Emma also has experience in other areas of arboriculture such as forest clearance, tree planting, tree maintenance and landscaping.

Qualifications & Experience of Joe Taylor - MArborA, FdSc (Arboriculture)
Joe began his career in Arboriculture as a tree surgeon/climber. During his time as a tree surgeon, Joe has achieved City & Guilds NPTC qualifications in Chainsaw Maintenance and Cross Cutting, Tree Climbing and Rescue, Safe Use of Manually Fed Wood-chipper and Supporting Colleagues Undertaking Tree Related Operations.

Joe obtained a Foundation Degree in Arboriculture at Askham Bryan College in 2015 which he passed with merit. Joe is a professional member of the Arboricultural Association, the International Society of Arboriculture and the Royal Forestry Society and regularly attends industry related seminars in order to keep abreast of industry best practice.

Studying at Askham Bryan College reinforced Joe's passion for trees and drove his enthusiasm to learn more. Learning how trees interact with their surrounding environment and their importance within our urban and rural landscapes highlighted an interest in pursuing a career in consultancy.

Since working for Crown Tree Consultancy Joe has undertaken numerous surveys and produced numerous reports for the purpose of planning (BS 5837), tree condition surveys, subsidence risk assessments, root surveys and decay detection investigations.

Appendix 5: Further Information

Building Near Trees – General

National Joint Utilities Group publication # 10 (1995), *Guidelines for the Planning, Installation and Maintenance of Utility Services in Proximity to Trees. Downloadable at www.njug.demon.co.uk/pdf/NJUG%20Publication10.pdf*

NHBC Standards Chapter 4.2., *Trees and Buildings.*

Horticulture LINK project 212. (*University of Cambridge,* 2004), *Controlling Water Use of Trees to Alleviate Subsidence Risk.*

Tree Planting and aftercare

See www.trees.org.uk/leaflets.php# for downloadable leaflets on selecting a garden tree, planting, aftercare and veteran tree management.

British Standards

BS 5837: 2012. Trees in Relation to Design, Demolition and Construction – Recommendations.
Bs 3998: 2010. Recommendations for Tree Work.
BS 3936: 1992. Nursery Stock. Part 1: Specification for Trees and Shrubs.
BS 3936: 1992. Nursery Stock. Part 10: Specification for Groundcover Plants.
BS 4043: 1989. Transplanting Root-balled Trees.
BS 8004: 1986. Foundations.
BS 8103: 1995. Structural design of Low-Rise Buildings.
BS 8206: 1992. Lighting for Buildings.
BS 8545:2014. Trees: From nursery to independence in the landscape – Recommendations
BS 3882: 2007. Topsoil.
BS 4428: 1989. General Landscaping Operations (excluding hard surfaces).

Permission to do Works to Protected Trees / Tree Law

Forestry Commission (Edinburgh, 2003), *Tree Felling – Getting Permission*. Country Services Division - Forestry Commission. Downloadable at www.forestry.gov.uk/website/pdf.nsf/pdf/wgsfell.pdf/$FILE/wgsfell.pdf

Transport and the Regions (Department of the Environment, 2000), *Tree Preservation Orders, A Guide to the Law and Good Practice*. Downloadable at www.communities.gov.uk/publications/planningandbuilding/tposguide

C. Mynors, *The Law of Trees, Forests and Hedgerows* (Sweet and Maxwell, London, 2002)

Communities and Local Government website with numerous downloadable documents, from: http://www.communities.gov.uk/planningandbuilding/planning/treeshighhedges/

Lighting Levels

P.J. Littlefair, *B.R.E. 209: Site layout planning for daylight and sunlight A guide to good practice.* B.R.E. Bookshop, London.

British Standards Institution. Code of practice for day lighting. *British Standard* BS 8206: Part 2 (1992).

Chartered Institution of Building Services Engineers. *Applications manual: Window Design* (London, 1987).

NBA Tectonics. A study of passive solar housing estate layout. *ETSU Report* S-1126. Harwell, Energy Technology Support Unit (1988).

I.P. Duncan; D. Hawkes, Passive solar design in non-domestic buildings. *ETSU Report* S-1110. Harwell, Energy Technology.

P. J. Littlefair, Measuring Daylight, *BRE Information Paper 23/93 f3.50.* (Advises on measuring daylight under the real sky or an artificial sky, allowing for the changing nature of sky light).

High Hedges

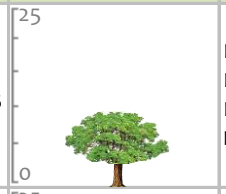
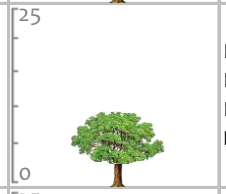
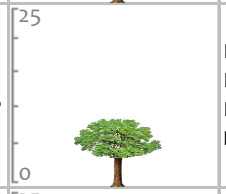
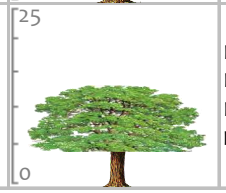
Communities and Local Government website with numerous downloadable documents, from: http://www.communities.gov.uk/planningandbuilding/planning/treeshighhedges/

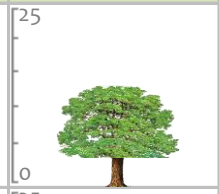
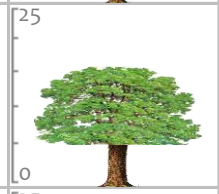
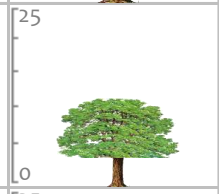
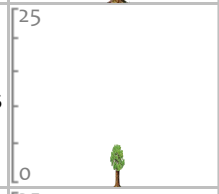
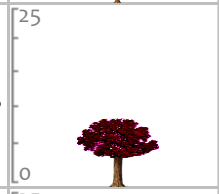
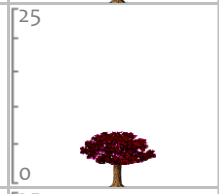
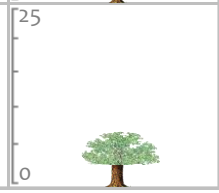
Tree Specific Websites

www.crowntrees.co.uk	Crown Tree Consultancy site containing useful information
www.trees.org.uk	Arboricultural Association
www.rfs.co.uk	Royal Forestry Society of England, Wales and N. Ireland
www.treehelp.Info	The Tree Advice Trust
www.woodland-trust.org.uk	The Woodland Trust
www.treecouncil.org.uk	The Tree Council

Appendix 6: Tree Data Schedule and Site Plan(s)

The Tree Data Schedule and any drawings accompanying this report follow this page. They are also provided as separate documents for ease of printing and screen viewing.

Reference (G = Group, H = Hedge)	Age & Species	Height (m)	Crown Ht (m)	Diameter (cm)	Crown Spread (m) N / W / E / S	Scaled Tree Diagram (m)	Notes	Recommendations (Independent of any development proposals)		Vigour / Physiological Condition / Structural Condition	Amenity Value / Life Expectancy (yrs) / Retention Category
								Priority	Inspect Freq (yrs)		
T1	Young **London Plane** Platanus x hispanica.	9	3	22	N 3.5, W 4.5, E 3.5, S 4.5		Position: Street tree. Form: Single stemmed and vertical with a well-formed crown. History: No evidence of significant pruning. **Defects: No significant defects observed.**	No action required.	n/a / 1	High / Good / Good	High / 40+ / **B**
T2	Semi-Mature **London Plane** Platanus x hispanica.	9	3	19	N 4, W 2.5, E 3, S 5		Position: Street tree. Form: Single stemmed and vertical with a well-formed crown. History: No evidence of significant pruning. **Defects: No significant defects observed.**	No action required.	n/a / 1	High / Good / Good	High / 40+ / **B**
T3	Young **London Plane** Platanus x hispanica.	8	4.5	19	N 4, W 4, E 2.5, S 3		Position: Street tree. Form: Single stemmed and vertical with a well-formed crown. History: No evidence of significant pruning. **Defects: No significant defects observed.**	No action required.	n/a / 1	High / Good / Good	High / 40+ / **B**
T4	Semi-Mature **London Plane** Platanus x hispanica.	15	7	41	N 5, W 8, E 2.5, S 5		Position: Street tree. Form: Twin-stemmed at 4m with an unbalanced crown. History: Occasional pruning wounds due to crown lifting (now healed). **Defects: No significant defects observed.**	No action required.	n/a / 1	Moderate / Good / Good	High / 40+ / **A**
T5	Early-Mature **London Plane** Platanus x hispanica.	18	5	74	N 9, W 9, E 5, S 11		Position: Street tree. Form: Multi-stemmed at 5m with an unbalanced crown. History: No evidence of significant pruning. **Defects: No significant defects observed.**	No action required.	n/a / 1	Moderate / Good / Good	High / 40+ / **A**
T6	Early-Mature **London Plane** Platanus x hispanica.	15	4	68	N 8, W 8, E 7, S 4.5		Position: Street tree. Form: Multi-stemmed at 4m with a slightly unbalanced crown. History: No evidence of significant pruning. **Defects: No significant defects observed.**	No action required.	n/a / 1	High / Good / Good	High / 40+ / **A**
T7	Semi-Mature **London Plane** Platanus x hispanica.	13	5	45	N 9, W 4, E 8, S 8		Position: Street tree. Form: Single stemmed with a slight lean and a well-formed crown. History: No evidence of significant pruning. **Defects: No significant defects observed.**	No action required.	n/a / 1	High / Good / Good	High / 40+ / **A**

Reference (G = Group, H = Hedge)	Age & Species	Height (m)	Crown Ht (m)	Diameter (cm)	Crown Spread (m) N W E S	Scaled Tree Diagram (m)	Notes	Recommendations (Independent of any development proposals) Priority	Inspect Freq (yrs)	Vigour / Physiological Condition / Structural Condition	Amenity Value / Life Expectancy (yrs) / Retention Category
T8	Semi-Mature **London Plane** Platanus x hispanica.	13	4.5	34	N 7, W 6, E 4, S 2.5		Position: Street tree. Form: Single stemmed with a slight lean and a well-formed crown. History: No evidence of significant pruning. **Defects: No significant defects observed.**	No action required. n/a	1	Moderate / Good / Good	Moderate / 40+ / **B**
T9	Early-Mature **London Plane** Platanus x hispanica.	16	6.5	62	N 8.5, W 7, E 8, S 3.5		Position: Street tree. Form: Single stemmed with a slight lean and a well-formed crown. History: No evidence of significant pruning. **Defects: No significant defects observed.**	No action required. n/a	1	High / Good / Good	High / 40+ / **A**
T10	Semi-Mature **London Plane** Platanus x hispanica.	11	4.5	29	N 6, W 4, E 5, S 4		Position: Street tree. Form: Single stemmed and vertical with a well-formed crown. History: No evidence of significant pruning. **Defects: No significant defects observed.**	No action required. n/a	3	High / Good / Good	Moderate / 40+ / **B**
T11	Young **London Plane** Platanus x hispanica.	4	2.5	4	N 0.5, W 0.5, E 0.5, S 0.5		Position: Street tree. Form: Single stemmed and vertical with a compact crown. History: No evidence of significant pruning. **Defects: No significant defects observed.** Other: Still staked.	No action required. n/a	1	Moderate / Fair / Fair	Low / 40+ / **C**
T12	Semi-Mature **Purple Norway Maple** Acer platanoides.	8	4	23	N 3, W 3, E 2.5, S 4		Position: Street tree. Form: Single stemmed and vertical with a compact crown. History: No evidence of significant pruning. **Defects: No significant defects observed.**	No action required. n/a	1	Moderate / Good / Good	Moderate / 40+ / **B**
T13	Semi-Mature **Purple Norway Maple** Acer platanoides.	6	3	20	N 3, W 3, E 2, S 3		Position: Street tree. Form: Twin-stemmed at 2m with a balanced crown. History: No evidence of significant pruning. **Defects: No significant defects observed.**	No action required. n/a	1	Moderate / Good / Good	Moderate / 40+ / **B**
T14	Early-Mature **Swedish Whitebeam** Sorbus intermedia.	6	3	34	N 2.5, W 2.5, E 4, S 4		Position: Street tree. Form: Single stemmed and vertical with a balanced crown. History: Occasional pruning wounds due to crown lifting. No major visible defects. **Defects: No significant defects observed.**	No action required. n/a	1	Moderate / Good / Good	Moderate / 40+ / **B**

Tree Constraints Plan

(Existing Layout)

Photo 1

Photo 2

Photo 3

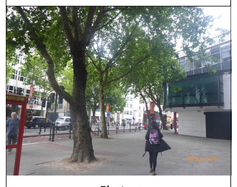


Photo 4

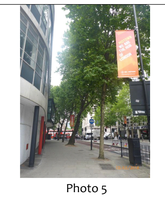


Photo 5

Photo 6

See the accompanying report for more photographs

Tree Ref.	Species	Height (m)	Root Protection Area		
			Radius (m)	m²	Square (m)
T1	London Plane	9	2.6	22	4.7
T2	London Plane	9	2.3	16	4.0
T3	London Plane	8	2.3	16	4.0
T4	London Plane	15	4.9	76	8.7
T5	London Plane	18	8.9	248	15.7
T6	London Plane	15	8.2	209	14.5
T7	London Plane	13	5.4	92	9.6
T8	London Plane	13	4.1	52	7.2
T9	London Plane	16	7.4	174	13.2
T10	London Plane	11	3.5	38	6.2
T11	London Plane	4	0.5	1	0.9
T12	Purple Norway Maple	8	2.8	24	4.9
T13	Purple Norway Maple	6	2.4	18	4.3
T14	Swedish Whitebeam	6	4.1	52	7.2

MN = Measured North:

Canopy spreads are sometimes measured to an approximate N defined by site features. Often more accurate, especially where rows of trees are not aligned N-S or E-W.

BS 5837 Root Protection Area (radius = 12xstem diameter)

Root Protection Area needing amendment due to site conditions, e.g. presence of existing road or building.

Root Protection Area having been amended to account for for site conditions

1 Photo 1

T1 = Tree No 1 G2 = Group No 2 H3 = Hedge No 3

Tree Retention Categories
Stems & canopies shown

Category A tree	Trees of high quality with an estimated life expectancy of 40+ years. Usually large trees with significant presence or smaller trees with excellent form. Retention of these trees is highly desirable.
Category B tree	Trees of moderate quality with a life expectancy of 20+ years. Usually maturing trees, or younger trees with good form. Retention of these trees is desirable though less than Category A trees
Category C tree	Unremarkable trees of low quality and merit. Individual specimens are not considered to be a material planning consideration.
Category U tree	Trees unsuitable for retention due to their very poor condition.

CROWN
Arboricultural Consultants
01422 316660

Drawing No:	CCL 10078 / TCP Rev: 1
Title:	Tree Constraints Plan (Existing Layout)
Site:	Southampton Row and Theobalds Road WC1V 6DW
Scale:	1:300
Paper Size:	A1

0 5 10 15m

Excerpts from the Arboricultural Impact Assessment

Overview

It is proposed to carry out external alterations and internal refurbishment to the Grade II* Lethaby Building and the partial demolition and extensions of the existing buildings to create a new hotel facility (Use Class C1). Flexible ground floor and basement uses for retail, office and a range of D1 / D2 uses including an exhibition hall, a lecture hall, a screening room and a spa and swimming pool. Creation of a new stand-alone block is also proposed and re-instatement of former Orange Street which leads diagonally north-westwards from Red Lion Square. The block will provide a cultural use at ground and first floor level and approximately 34 affordable housing units above, together with associated highway improvements, public realm, landscaping, cycling parking, bin storage and other associated works as indicated on the plans in Appendix 6. The existing layout is indicated in black, the footprint of the proposed ground floor layout is indicated in pale green and the basement is outlined with pale blue dashed line.

The table below summarises the potential impact on trees due to various activities.

Activity	Trees Potentially Affected
Tree Removal: Retention Category A	None
Tree Removal: Retention Category B	T12, T13 and T14
Tree Removal: Retention Category C	T11
Tree Removal: Retention Category U	None
Tree Pruning	T1, T2, T5, T9 and T10
RPA: Building Foundations	None
RPA: Other Foundations	None
RPA: New Hard Surface	None
RPA: Underground Services	None
RPA: Change of Ground Levels	None
RPA: Soil Compaction	Trees adjacent the construction area (preventable by installing tree protection measures)

Other potentially damaging activities often associated with construction sites include demolition or the careless use of plant machinery, hazardous materials, or fires. All of the above potential impacts are considered in detail throughout this section.

Tree Removal

All trees to be removed are indicated on the Impact Assessment Plan and listed below:

- **Retention Category A:** It is proposed to retain all five Retention Category A trees.
- **Retention Category B:** It is proposed to remove the following Retention Category B trees: T12, T13 and T14. These three trees require removal in order to facilitate a piling rig for the proposed construction works. I understand that other alternative options have been explored, yet this is most suitable location.
- **Retention Category C:** It is proposed to remove the following Retention Category C tree: T11. This 4m tall tree also requires removal to facilitate the piling rig.
- **Retention Category U:** Our survey did not identify any Retention Category U trees.

Details specific to each tree can also be found in the Tree Data Schedule.

Mitigation Planting

In order to mitigate against tree loss, a post-development planting scheme is proposed. The proposed planting scheme should incorporate tree species which provide year-round interest and species which are suitable for an urban environment.

Impact on Tree Canopies

The Impact Assessment Plan indicates that the canopies of T1, T2 and T5 growing in an eastern direction require some light pruning to create a clearance distance of 1.5m from the existing building walls. Such pruning shall provide clearance for the external refurbishments to take place.

The canopies of T9 and T10 growing in a south-eastern direction require pruning to create a clearance distance of 1.5m from the currently existing, and proposed building. Such pruning shall reduce the risk of accidental damage to branches occurring during construction and shall provide clearance from the proposed building walls.

All pruning works should be undertaken sympathetically (working to BS 3998: 2010 guidelines) to ensure the trees are not harmed or disfigured and to minimise any impact upon local visual amenity. All other tree canopies shall be unaffected by the proposals.

Impact on Tree Roots

Building Foundations:

No alterations are proposed to the existing building (including the basement) within the vicinity of trees T1-T6. Consequently, there shall be no disturbance to the rooting areas of these trees.

Adjacent to trees T8, T9 and T10, it is proposed to demolish the existing building, lower the floor level of the existing basement, and construct a new multi-storey building. Due to the existing basement and building foundations, it is considered unlikely that the roots of these trees shall extend beneath the basement where excavation is proposed. However, it is considered likely that the tree roots shall proliferate immediately adjacent to the foundations. It is therefore imperative that the foundations are installed in such a manner that the soils beyond the footprint of the building remain as undisturbed as possible.

Consequently, it is proposed to carry out the excavation in a manner that does not disturb the soils beyond the footprint of the existing basement which we understand shall be done using either contiguous piling, sheet piling, pinning or a similar method which restricts excavation to the existing footprint, in order to ensure very little to no impact upon tree roots.

Impact of Retained Trees on the Development

No tree canopies shall be closer to the proposal than they are to the existing building so the proposal shall not result in an increase in the perceived nuisance afforded by the trees.

Summary

In order to facilitate a piling rig for the proposed development, three Retention Category B trees (T12, T13 and T14) and one Retention Category C tree (T11) require removal. A post development planting scheme is proposed to mitigate against tree removal and to ensure tree cover is maintained throughout, and around the site.

Trees T1, T2, T5, T9 and T10 require pruning to create a clearance of 1.5m from the existing and proposed building walls. Because the existing buildings are already very close to the canopies of these trees, similar pruning would be required at some point in the future, regardless of the development proposals.

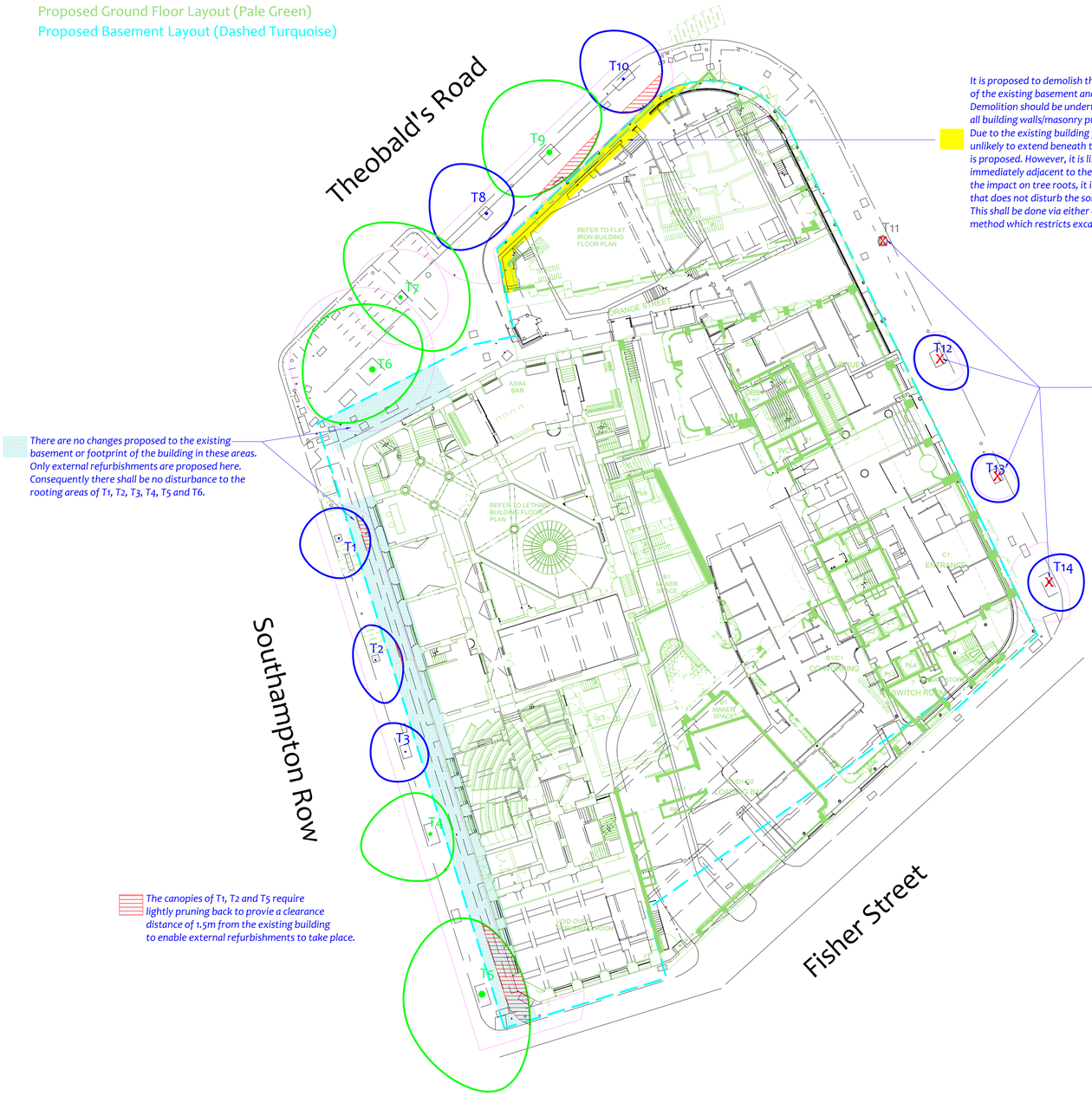
No new hard surfacing is proposed within in Root Protection Areas.

No new building foundations are proposed within Root Protection Areas. However, when lowering the level of the existing basement adjacent to T8, T9 and T10, excavation works shall be carried out in a manner that does not disturb any of the soils beyond the footprint of the existing building.

See Section 4 for a more detailed assessment

The canopies of T9 and T10 require pruning back to provie a clearance distance of 1.5m from the proposed building walls and to avoid any accidental damage to branches during construction works.

Proposed Ground Floor Layout (Pale Green)
Proposed Basement Layout (Dashed Turquoise)



It is proposed to demolish the existing building, lower the floor level of the existing basement and construct a new multi-storey building. Demolition should be undertaken from inside the building footprint and all building walls/masonry pulled in a direction away from adjacent trees. Due to the existing building foundations, the roots of T8, T9 and T10 are unlikely to extend beneath the existing basement to where excavation is proposed. However, it is likely that the roots of these trees will proliferate immediately adjacent to the existing basement footprint. In order to minimise the impact on tree roots, it is proposed to carry out the excavation in a manner that does not disturb the soils beyond the footprint of the existing basement. This shall be done via either contiguous piling, sheet piling, pinning or a similar method which restricts excavation to the existing footprint.

There are no changes proposed to the existing basement or footprint of the building in these areas. Only external refurbishments are proposed here. Consequently there shall be no disturbance to the rooting areas of T1, T2, T3, T4, T5 and T6.

Trees T11, T12, T13 and T14 require removal in order to facilitate a piling rig for the proposed development. We understand that a post-development planting scheme is proposed once the construction is complete in order to mitigate against tree loss.

The canopies of T1, T2 and T5 require lightly pruning back to provie a clearance distance of 1.5m from the existing building to enable external refurbishments to take place.

MN

Impact Assessment Plan

(Existing Layout with Proposals Overlaid)

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			Radius (m)	m²	Square (m)
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Drawing No:	CCL 10078 / IAP Rev: 1
Title:	Impact Assessment Plan (Existing Layout with Proposals Overlaid)
Site:	Southampton Row and Theobalds Road WC1V 6DW
Scale:	1:300 Paper Size: A1

CROWN
Arboricultural Consultants
01422 316660

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Impact Assessment Plan

(Existing Layout with Proposals Overlaid)

BS 5837 Root Protection Area (radius = 12xstem diameter)

Root Protection Area needing amendment due to site conditions, e.g. presence of exisitng road or building.

Root Protection Area having been amended to account for for site conditions

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X Tree to be removed to facilitate the proposal

X Tree to be removed due to its low quality

Proposed pruning

MN = Measured North:

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