Arboricultural Impact Appraisal

Site: 106 Great Russell Street, London. WC1B 3NB

Client: Artemide c/o SDA Architects Ltd

Date: 20th September 2016

Reference: BA5499AIA

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VALIDATION STATEMENT FOR LPA REGISTRATION

This report contains the supporting tree information relating to the proposed construction on the rear elevation.

For Local Planning Authority (LPA) validation purposes, this report contains the following:

- An **Arboricultural Impact Appraisal** of the proposed development (Phase 1), detailing trees to be retained and the proposed protection measures (Impact Appraisal).
- An outline **Arboricultural Impact Appraisal** of the proposed development (Outline Scheme), detailing trees to be retained and the proposed protection measures (Impact Appraisal).
- Appended information on trees and protection methods (Appendices)

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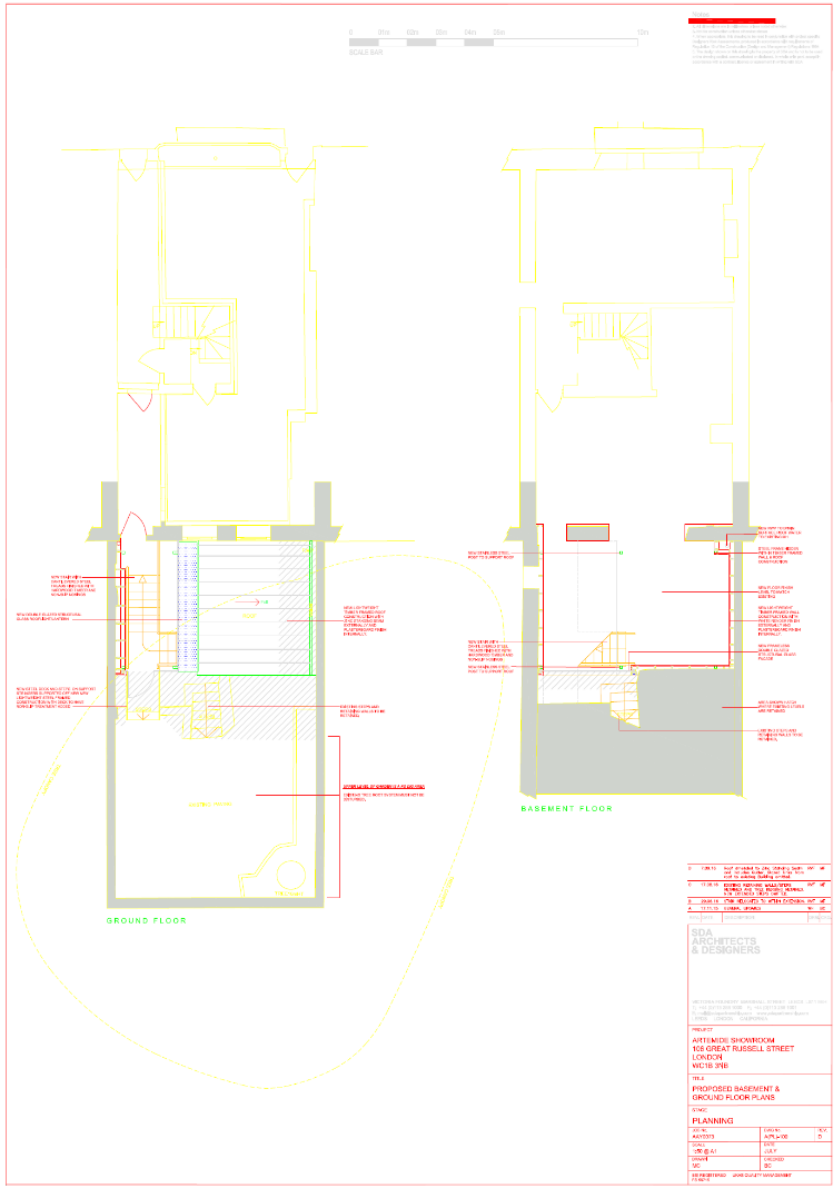
SUMMARY OF TREE INFORMATION

Tree Information. This assessment is based upon the appraisal of the tree included on the schedule shown on the Tree survey & Constraints Plan BA5499TS within Appendix F, which includes information on the trees condition and minimum protection requirements.

The Proposal. This arboricultural impact appraisal accompanies a full planning application for the creation of an extension. The scheme is detailed on the Plan 'Proposed Basement & Ground Floor Plans' provided by SDA Architects Ltd, an extract of which is copied opposite.

Drawing number A(PL)-100 Rev D.

This revised scheme has been used to assess the potential conflicts with the existing tree, which is detailed below and shown on the Implication Assessment Plan – in Appendix F.



Tree Losses. The design has been influenced by the condition of the tree and does not extend into areas occupied by the tree and the existing paving and steps have been retained.

The scheme does not require the removal of any trees. However, the current state of T1 bring its safety into doubt and therefore as a minimum some canopy remodelling is required.

Tree pruning to enable development. Minor crown remodelling is required to improve site safety a current requirement of the site along ensuring canopy clearance of nearby buildings, a current requirement of the site, a minimum of 1 meter would be sufficient.

Trees Protection: The scheme does not enter the Root Protection Area of the retained tree and does not offer a foreseeable risk, though protection methods should be used to restrict entry near the tree to avoid direct damage and / or the storage of materials within this hard paved area. Protection in line with BS5837:2012 will be required to avoid significant negative changes to the tree.

Protection can be achieved through erecting and maintaining Tree Protection Fencing for the duration of the project. Storage of materials should not be in this area to avoid the chance of contaminates / leachates entering through the paving areas.

This can if required be expanded upon within a conditional Arboricultural Method Statement.

Providing appropriate protection is installed and maintained, the proposed development can be undertaken and the risk to the tree can be controlled enabling the tree to continue to screen the area and help provide separation between the site and the neighbouring properties.

IMPACT ASSESSMENT

This arboricultural impact appraisal describes our assessment of how the proposal will affect the tree and any impact this will have on local amenity and character.

In addition to outlining tree protection measures to be adopted. The proposal will involve earth works, which are located close to the tree and occasionally within the Root Protection Area.

Elsewhere the creation of structures, hard surfacing and fencing will require the loss of tree rooting areas, though changes within the root protection areas of retained tree can be undertaken using sensitive methods.

Tree Constraints. Typically, trees can offer constraints to potential layouts. Ideally, the requirements of the trees and the proposal should be considered at the design stage. I have included a general guide to potential tree constraints in Appendix B.

Limiting Damage to Trees. Care has been taken regarding the retention of the large tree which has become enclosed within the existing development. Achieving successful further integration has required careful consideration during the design stages and has considered the constraints offered by the tree and follows the general guidelines, included in Appendix C.

General Risks to Trees. Any development process does have the potential to both damage the existing tree and compromise tree planting opportunities through the severance of roots or changes to the soil levels, volume or structure. I have included a general guide to potential tree damage in Appendix D.

Protection of Trees. The potential for conflicts between the proposal and the existing tree does exist. However, these foreseeable risks can be defended through the adoption of tree protection to help protect the Root Protection Area and to protect the stem of the tree during the works. In general, the tree protection requires protective fencing to prevent access, use and storage within the existing hard surfacing area during the development, primarily to prevent accidental direct damage to the stem and to prevent the possibility of spillages within the RPA.

Retained trees need to be considered as part of any site changes and protected from the potentially negative effects of alterations or construction. Where protection is not possible removal and replacement of a tree with a suitable landscaping scheme may help offset losses and improve the overall levels of screening and biodiversity.

Summary of the Impact on Trees and Local Character. My assessment of the proposal identifies that No trees will be removed to enable the proposed site changes.

The retained tree does require limited remedial pruning to help improve its condition and to prevent abrasion on nearby buildings this is a current requirement of the site.

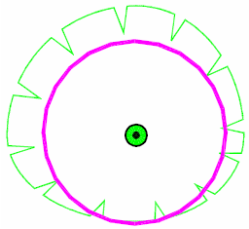
The retained tree will buffer the visual impact of the scheme and will limit the visual impact on the present character of the area.

The proposed changes may affect the retained tree if appropriate protective measures are not taken.

The proposed scheme does pose a possible risk to the retained tree only if fencing is not in place, existing hard surfacing and steps are to be retained. However, if adequate precautions to protect the retained tree is implemented, there should be no significant impacts on the contribution of retained tree to local amenity or character of the wider setting.

Legislative Protection. I understand that the tree is protected by a Tree Preservation Order (TPO). The presence of a TPO can be expected upon development sites. It can however only be regarded as a material consideration, as can any other tree or significant natural feature, within the planning process and cannot be used as a means of preventing development. Any trees protected or otherwise, which are located on or close to the site can be expected to be regarded as a material consideration or offer a design constraint within the development process.

Retained Tree. The tree is highlighted with a green canopy, complete with a magenta circle to indicate the minimum Root Protection Area (RPA) as shown opposite and within the Arboricultural Impact Assessment Plan - Appendix F.



Risk offered by the proposal. The principal risk to the retained tree relates to the potential negative impact from direct impacts, storage of materials (contamination) no changes in levels are proposed, as the existing hard landscaping and steps are being retained, as shown in the proposed plan.

Removals to enable Development. The removal of trees to enable the scheme is not required.

The scheme can be readily defended, through changes to the scheme design and site organisation.

However, the current state of T1 is of particular concern and is not consider sustainable. In particular the internal condition of the stem and the stability of nearby structures brings it's the medium to long-term safety into doubt – Please see separate appended report.

Pruning / Trimming to enable Development. Canopy remodelling of T1 is required to provide improved safety and clearance of nearby buildings a current requirement of the site. These changes are highlighted in brown hatching on the Arboricultural Impact Assessment Plan - Appendix F.

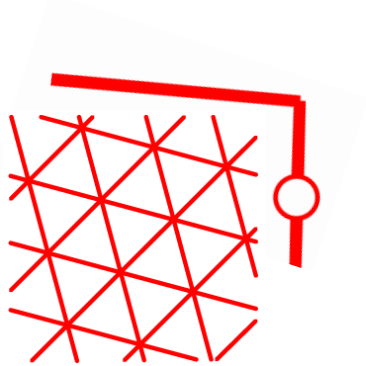
Reducing Risks to Trees. Potential conflicts between the proposal and the existing tree do exist as outlined in Table 1 below.

Table 1 – Possible Risk with Proposed Protection or Mitigation.	
Potential Risk	Suggested Solution
Material changes to the soil characteristic within the Root Protection Area (RPA).	Install Tree Protective Fencing prior to commencement to ensure no access to the RPA.
Construction access and storage close to the Root Protection Area (RPA)	No access to the RPA due to TPF1
Potential root severance during construction of Hard surfacing.	None expected due to no change in existing levels and retention of existing hard landscaping and steps.

The foreseeable risks associated with the retained tree can be readily defended through the creation of a **Construction Exclusion Zone (CEZ)** and controlling activity within the area close to the Root Protection Areas of the retained tree by installation of **Tree Protective Fencing (TPF)**.

The location of Construction Exclusion Zones is indicated by the wide red line representing the position of Tree Protective Fencing and the area of red net hatching as shown below and located on the Arboricultural Impact Assessment Plan BA5499AIA attached as Appendix F.

Access, within the **Construction Exclusion Zone** represented by the red net hatching and protected by Tree Protection Fencing indicated by the wide red line (both are shown opposite). The position of these areas are detailed on the Arboricultural Impact Assessment Plan BA5499AIA attached in Appendix F. Examples of protective fencing types are included on the plan, the final choice for these barriers should be agreed within an Arboricultural Method Statement.



The final details can be agreed within an Arboricultural Method Statement, which can detail access and activity within the construction exclusion zone, though it should be adequate to sign off that the installation of the fencing has been undertaken correctly.

Location of Services. Services are not proposed within the Root Protection Area of the retained tree.

Where there is not an alternative and they need to enter the RPA they can be readily defended by adopting low impact methods for installation. Ideally services that are required will be installed away from the tree.

Underground services near to the tree will need to be installed in accordance with the guidance given in BS5837 together with the National Joint Utilities Group Volume 4 [NJUG4]: 2007. Guidelines for the planning, installation and maintenance of utility apparatus in proximity to trees (Issue 2).

Post Development Pressure. In light of the tree on the site, there is some potential conflict. In light of the site arrangement there will be some minor shading and in the long term canopy encroachment above the building.

However, this is not expected to be any appreciable post development pressure or seasonal nuisance from shading would not oblige the council to give consent for inappropriate tree works.

Where trees are located close to properties and particularly where canopies of trees extend above the roofline this can cause maintenance difficulties due to leaf and organic matter build up in the gutters and down pipes. This problem can be eased by the addition of filters in the gutters to restrict the access to leaves and small twigs. Several products are available popular systems are 'Gutterstuff Pro' http://gutterstuff.com , www.suraflow.co.uk and Hedgehog Gutter Brush' http://www.hedgehoggutterbrush.com which seem to help limit this issue..

Conclusion. The scheme does not require the removal of trees to provide sufficient space and any pruning will be limited and is a requirement of current site management, being limited to canopy remodelling.

In light of the current screening offered by the tree the overall visual impact for receptors from the overlooking apartments is low.

The retained tree will need to be considered as part of the site and protected at every stage of the scheme from the potentially negative effects of traditional construction. Foreseeable risks to the retained tree can be readily defended through the creation of a Construction Exclusion Zone and activity controlled within the area close to the Root Protection Areas by establishing and managing Tree Precautionary Zones.

The potential for conflicts between the proposal and the tree does exist, however, these risks can be defended through the adoption of careful excavation, minimal level changes, the adoption of low impact systems that allow air and water percolation into the soils below the new surfacing and general root zone improvement.

Providing access around the tree can be controlled and the construction method acknowledges the requirements of the retained tree, there are no significant arboricultural restrictions in respect of the proposal as the potential threats that do exist can be readily defended. The protection should be agreed within an Arboricultural Method Statement there should be no noticeable negative impact on the retained tree.

I conclude that a proposal to develop this site should be relatively straightforward and pose a manageable risk to the retained tree, providing appropriate protection methods are conditioned.

Ian Barnes F.Arbor.A, HND Arb, ND Ht/Arb, Tech.Cert (Arbor.A), MI Hort, CEnv
Registered Consultant Arboricultural Association - Chartered Environmentalist

APPENDICES

APPENDIX A - BRIEF QUALIFICATIONS AND EXPERIENCE OF IAN BARNES

Registration Schemes:
Arboricultural Association Registered Consultant – AARC (49)

Qualifications:
Higher Diploma in Arboriculture (H.N.D Arb)
National Diploma in Horticulture & Arboriculture (N.D.Ht/Arb)
Arboricultural Association Technicians Certificate (Tech.Cert. (Arbor.A))
International Society of Arboriculture – Tree Risk Assessment (TRAQ)

Membership grades by peer review:
Chartered Environmentalist (CEnv)
Corporate Member of Chartered Institute of Horticulture (MCI Hort)
Fellow of the Arboricultural Association (F.Arbor.A)
Professional member Consulting Arborist Society UK.

Practical experience:
I have worked in the Arboricultural Industry since 1987. Firstly as a climbing Arborist in both the public and private, sector, before becoming a gang foreman. I set up and ran my own Arboricultural contracting business for 15 years, though this is now under new ownership. I have developed an arboricultural consultancy practice since 1993, working throughout England for clients in both the public and private sector.

Continuing professional development:
As part of my ongoing education, I am a member of a range of related Arboricultural bodies. Including the Arboricultural Association (AA), International Society of Arboriculture (ISA), Royal Forestry Society (RFS), Forestry Contracting Association (FCA), and Consulting Arborist Society (CAS) of which I am a professional member. I am a corporate member of the Chartered Institute of Horticulture (MCI Hort) and a Fellow of the Arboricultural Association (F.Arbor.A). An inclusive member of the British Mycology Society (BMS) in addition to being a Chartered Environmentalist (CEnv).

I am a registered consultant of the Arboricultural Association. I regularly attend seminars and training events on issues relevant to Arboriculture these include events focusing on General Tree Management, Veteran Tree Management, Tree Health, Tree Pest management, Tree Diseases management, Trees Biology & Morphology, Tree Stability, Wind Loading of Trees, Tree Risk Assessment, in addition to keeping an upto date level of CPD.

I am a licensed user of the Quantified Tree Risk Assessment (QTRA) System and regularly attend updates, I am also ISA tree risk qualified (TRAQ). I am a trained user of Picus 'Acoustic' and electronic Tomography and have attended training to extend my knowledge in this area. I am trained in the use of thermal imaging as an aid to detecting defects in trees.

Relevant experience:
My career to date has involved me in a variety of tree care, dealing with trees in many different environments, and with differing management aims, these included: Tree planting schemes, including Woodland Design & Management, Detailed Health and Safety Appraisals, Tree inventories / population surveys, Management & selection on both proposed and active development sites, Advice upon trees in relation to structures, Additional areas of work such as Contract Specification & Management, Planning applications, Expert Witness. This has provided me with a range of experience, enabling me to comment upon trees and their management, in line with current best practice. Full CPD and training record can be forwarded upon request.

APPENDIX B - TREE CONSTRAINTS

Legal constraints. Trees can be protected by planning legislation in several ways. These include being located within a National Park or on a Site of Special Scientific Interest, located within the grounds of a listed building, conservation area or by being subject to a current Planning condition. In general, the main type of protection for trees adopted by the Local Planning Authority (LPA) on potential development sites is the Tree Preservation Order (TPO).

The protection of trees is a duty of the LPA under the Town and Country Planning act 1990 and aims to encourage rational discussion and consideration of trees within the design process. The following guidelines are proposed to encourage rational discussion and consideration of trees within the design process. Legislation indicates that protection should be used to protect healthy trees that are likely to have a reasonable safe useful life expectancy. Generally, those classified with a condition rating of (A) Excellent & (B) Good are worthy of a TPO. Those classified (C) Fair are generally poorer and therefore unlikely to qualify for a TPO on grounds of poor appearance, management issues or unlikely to have a sufficient safe life expectancy. Those trees classified (U) are Unsuitable for retention, generally contain structural defects, have a short safe useful life expectancy or are dangerous and therefore would not qualify for a TPO as indicated within the legislation.

The presence of a TPO should be expected upon development sites for the above reasons. It can however only be regarded as a material consideration, as can any other tree or significant natural feature, within the planning process, and cannot be used as a means of preventing development. Any trees protected or otherwise, which are located on or close to the site can be expected to be regarded as a material consideration or offer a design constraint within the development process.

General Constraints posed by existing trees. The constraints imposed by trees, both above and below ground should inform the site layout design, although it is recognized that the competing needs of development mean that trees are only one factor requiring consideration.

Certain trees are of such importance and sensitivity as to be major constraints on development or to justify its substantial modification. However, care should be taken to avoid misplaced tree retention; attempts to retain too many or unsuitable trees on a site can result in excessive pressure on the trees during demolition or construction work, or post-completion demands for their removal.

Our tree survey schedule in Appendix C and the tree survey plan BA5179TS in Appendix H includes the relevant constraint information, plotted around each of the categories A, B and C trees and included information on shading and the minimum Root Protection Area (RPA), in addition to a suggested limit for construction.

Typically, development should endeavour to retain category A & B trees and category C trees where they can be either improved and included in low risk areas or help improve biodiversity.

Ideally, structures should be located outside areas of shading and the recommended construction limit (Minimum Root Protection Areas plus an additional 2 metres) of trees to be retained should inform the development. However, in some cases the existing site layout has impacted on the trees in particular when existing structures or hard-surfacing extend or have been installed in the root protection areas. To help understand this I have colour coded the principal Structures, Hard Surfacing, Services, Earthworks and areas of High water content on the tree survey plan BA5179TS in Appendix H.

However, where there is an overriding justification for construction within the RPA, technical solutions might be available that prevent damage to the tree(s). If operations within the RPA are proposed additional information can be provided to demonstrate that the tree(s) can remain viable and offer mitigation measures such as but not limited to, improvements to the soil environment that is to be used by the tree for growth.

APPENDIX C - DESIGN CONSIDERATIONS

Care is needed regarding the retention of large, mature, over-mature or veteran trees which become enclosed within the new development. Where such trees are retained, adequate space should be allowed for their long-term physical retention and future maintenance. However, such retentions are seen as beneficial, helping to contribute to climate change resilience, amongst other benefits of habit and biodiversity. Achieving successful integration of large species trees requires careful consideration at the conceptual and design stages and specialist arboricultural input.

Design Considerations. To enable a realistic assessment of the probable impacts of any proposed development on the trees, and vice versa which should take into account the characteristics and condition of the trees. To maximize the probability of successful tree retention, the following factors are taken into account.

- **Shading of Buildings**. This can be a problem, particularly where there are rooms, which require natural light.
- **Shading of Open Spaces & Gardens**. Sitting normally requires direct sunlight for at least for part of the day. However, s*hading can be desirable to reduce glare or excessive solar heating, or to provide for comfort during hot weather.*
- **Privacy and screening**. The retention of trees helps to reduce overlooking by neighbours or to mitigate undesirable views, such as busy roads, railway lines or industrial premises.
- **Direct damage**. Below ground, damage to structures can occur because of incremental root and stem growth. In addition, above ground damage can occur to trees and structures by the continuous whipping of branches against the fabric of a building. Therefore, this needs to be considered to avoid the need for frequent remedial pruning or other maintenance.
- **Future pressure for removal**. The relationship of buildings to large trees can cause apprehension to occupiers or users of nearby buildings or spaces, resulting in pressure for the removal of the trees. Buildings and other structures should be sited to allow adequate space for a tree's natural development, with due consideration given to its predicted height and canopy spread.
- **Seasonal nuisance**. Trees are naturally growing and shedding organisms. Leaves of some species can cause problems, particularly in the autumn, by blocking gullies and gutters. Fruit can cause slippery patches or accumulations of honeydew, which can be damaging to surfaces, these aspects, should also considered.

In general, developments close to trees needs to maintain the site and particularly the soils close to the current prevailing conditions and avoid significant changes. However, a development is achievable providing the 8 key points listed below can be incorporated into the proposal's design:-

1. **Available Space,** The proposal should consider the available space both now and in the future and avoid the need to remove large diameter branches and stems whilst providing sufficient space for future growth.

2. **Foundations,** the proposal will need to offer support to the structures with the need for minimal excavation to avoid tree root severance, typically a pile and beam or partial cantilever solution could be considered following the advice of a structural engineer.

3. **The Building,** particularly the underside of the proposal will need to be above the current soil level to avoid compaction, excavation and ensure continued soil hydration and aeration. Typically, either a timber frame or block and beam can be adopted to achieve this relatively simply.

4. **Ground Protection,** needs to be a principal theme running throughout the proposal with the current ground being protected from, Excavation, Cultivation or Compaction and should remain wherever possible close to its current condition. This can be significantly simplified through the adoption of timber frame construction avoiding the need for potentially damaging heavy weights and potential noxious material such as concrete blocks, bricks and chemicals such as cements to be used near trees.

5. **Services** for the proposal should be located outside the Root Protection Area to avoid the need for excavation. Where new services are required within the Root Protection Area, these should adopt low impact methods of installation such as moling. Ideally, existing site utilities should be either isolated and retained in situ where they extend into the RPA or recycled or upgraded where this can be done without excavation.

6. **Hard surfacing** will typically be required unless it can be substituted for decking or above ground walkways. Hard surfacing will need to be installed without the need for excavation and should be porous to allow continued soil hydration and aeration. Typically, either a porous paving system or gravel supported by a NO-dig foundations such as Cell-Web can be adopted to achieve this.

7. **Building use,** within the proposal, available light should help inform the building design, layout and its use. Ideally, windows and views should be directed away from trees and toward open areas. In addition, the use of secondary or passive light through light reflecting tubes should be considered to help reduce the negative aspects of large trees.

8. **Building maintenance** will be required, particularly where canopies of trees extend close to or above the roofline, this can cause maintenance difficulties due to leaf and organic matter build up in the gutters and down pipes. This problem needs to be designed out as far as possible by the addition of filters in the gutters to restrict the access to leaves and small twigs.

The design should take account of the effects of any tree loss required to implement the design, and any potentially damaging activities proposed near retained trees. This might include the removal of existing structures and hard surfacing, the installation of new hard surfacing, the installation of services.

APPENDIX D - RISKS TO TREES DURING CONSTRUCTION

The following operations are all very damaging to trees, I have included a poster that demonstrates these points, and this might be useful for full circulation:

Compaction of the soil - Compaction will destroy the soil structure by removing the spaces between soil particles preventing the uptake of oxygen and nutrients. Compaction is caused by storage of materials, including bricks, soil, gravel and cement, and even a single vehicle movement will cause damage. Compacted ground will also damage soil drainage, which may then become waterlogged.

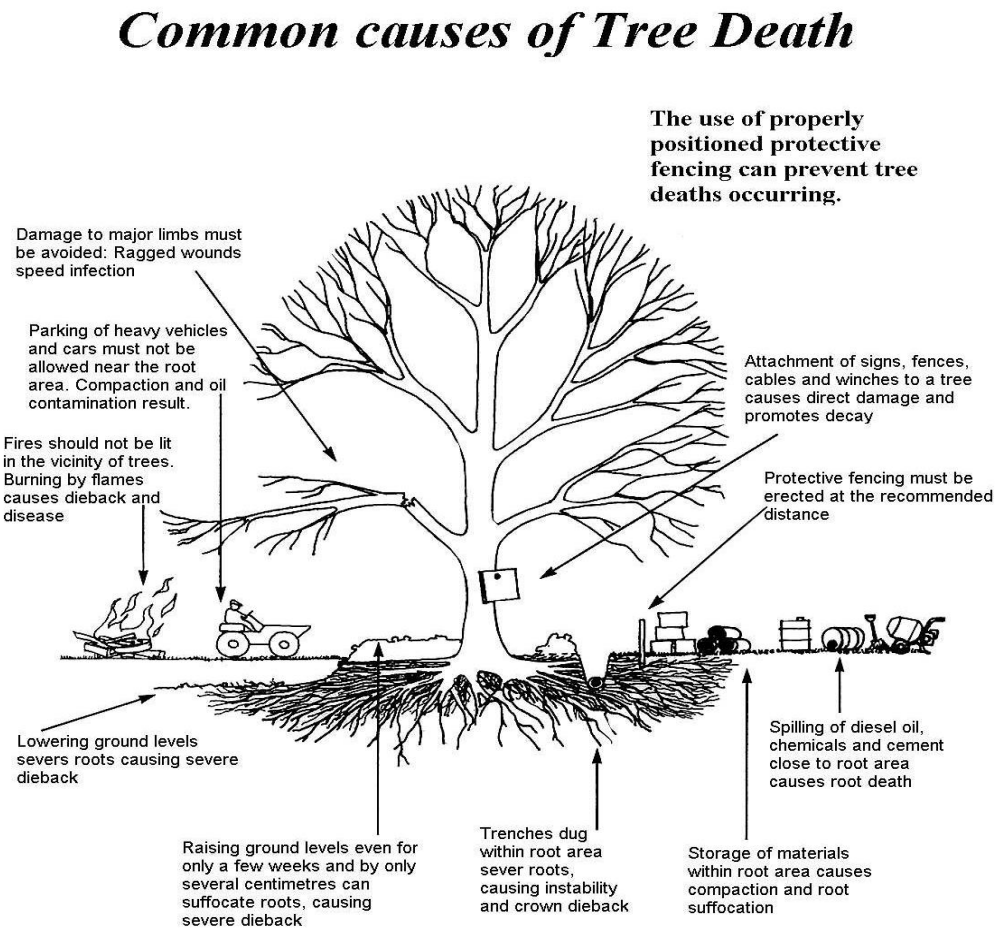
Excavations - any excavations close to the tree are likely to cause root severance. The closer excavations occur to the tree the more severe the damage. Root severance will lead to loss of vigour of the tree, reduce uptake of water and nutrients, allow access for decay organisms and increase likelihood of wind throw.

Ground level changes - both reduction and raising of soil levels will be detrimental even if this is only by a few centimetres. Reducing ground levels will sever roots, and can increase the drainage of a site thereby reducing water availability. Raising ground levels will cause compaction, suffocate roots and damage fibrous roots.

Impact damage - this can be caused by machinery - including torn branches and damage to bark and trunks. This will lead to entry for decay organisms and reduced vigour.

Soil contamination - this can be caused by spillage of oil, fuel and chemicals and mixing cement or other materials. Allow for sloping ground – keeping toxic material downhill from trees and aim to store them 10m from the Protected Zone to allow for leaching through the soil.

Fires - both the intense heat and direct flame will damage the trees causing loss and damage to both major roots and fibrous roots. Intense heat will damage the trees vascular system under the bark even if the bark does not appear burnt.



APPENDIX E - TREE PROTECTION

Protection of retained trees. The successful retention of trees depends on the quality of the protection and the administrative procedures to ensure those protective measures remain in place while there is a risk of damage. An effective means of doing this is through an arboricultural method statement that can be specifically referred to in a planning condition. An arboricultural method statement for this site should ideally be agreed. Implementation of a method statement will allow all the retained trees to survive without any adverse impact and allow them to continue to contribute to local amenity and character.

Limiting Threats to Trees. To help reduce the potential impact of site changes BS5837:2012 recommends in Section 3.7 that a **Root Protection Area (RPA)** is included as a layout design tool. This protected area is based upon the Root Protection Area - a point equivalent to 12 times the trunk diameter. This indicates the minimum area around a tree deemed to contain sufficient roots and rooting volume to sustain the tree's viability, though ideally the offset shown as the Construction Limit should be adopted to provide additional space and enable trees to thrive.

Tree Protection: where retained trees need to be protected this is most easily achieved by establishing a **Construction Exclusion Zone (CEZ)** as part of a **Tree Protection Zone (TPZ)** to protect the roots and aerial parts as recommended in BS5837:2012 – further details upon request. Within this area, retained trees need to be protected from the effects of site changes and in particular excessive root severance, soil level changes or soil compaction.

Appropriate site organisation and management are essential following the adage of '***Prevention is better than Cure***'. Unfortunately, tree damage can easily occur and although it is costly to repair, it comes with few guarantees.

Inside the exclusion area of the fencing, the following actions need to be avoided:-

No linear mechanical excavation whatsoever.
No excavation by any other means without arboricultural site monitoring.
No hand digging without a written Method Statement having first been approved in writing by the consulting arboriculturist.
No lowering of levels for any purpose (except removal of grass sward by hand).
No construction of a sealed hard surface (except where agreed with the arborist)
No storage of plant or materials.
No storage or handling of any chemical, including cement washings.
No vehicular access.
No fire lighting.

In addition to the above, further precautions are necessary adjacent to trees:-

A 10m separation distance shall be observed between any tree and substances injurious to tree health, including fuel, oil, bitumen, cement (including cement washings), builders' sand, concrete mixing and other chemicals.
No fire shall to be lit such that flames come within 5m of tree foliage; this shall be taken to mean a fire separation distance of 20m from any tree's canopy.

Protective Fencing: Based on tree survey data, **Root Protection Area (RPA)** have been calculated for the trees identified for retention and included in the tree schedule in Appendix C. The RPA's are designed to protect at least a functional minimum of tree root mass in order to ensure that the trees survive the construction process. Tree protection will need to be installed following the initial tree works and before the onset of any demolition or ground works. The RPA should remain in position for the whole of the construction and demolition phase.

Protection fencing is highlighted on the Impact assessment Plan BA5179AIA attached to this report in Appendix F.

Sever Risk Area's - Stem Protection (TST).
To be protected from impact damage by Boarding or Plywood Boxes constructed clear of the stem. Boxes are to contain compressible material to absorb shock loading. To be located where vehicles may come into direct contact with existing trees.

Moderate Risk - Protection Fencing (TPF2)
This is to be erected as a temporary barrier to protect areas designated for later construction or landscaping the Precautionary Zone. This shall consist of Heras type panels mounted onto rubber/concrete 'boots' as shown opposite.

High Risk - Tree Protection Fencing (TPF1)
This is to be provided by Braced Heras Fencing or solid panels. Post-holes shall be excavated by powered hand auger or low ground-pressure plant working of ground protection or outside the Precautionary Zone. Alternative more traditional post supports such as the Heras Steadfast system with an additional brace can be used where this can be pinned into position and fitted with an **Anti-Tamper Coupler.**

Low Risk - Protection Fencing (TPF3)
This is to be erected as a visual barrier to protect areas designated for no or later construction. Consisting either stock fencing, post and rail fencing, Chestnut Pale fencing or Orange Extruded Plastic Netting.

Ground Protection (Temporary): Access across the RPA, if this is required this can be achieved for the duration of the development phase in such a way, which will reduce the potential negative effects of compaction.

No Dig-Ground Protection GP1 - Option 1
For lower traffic areas, where heavy vehicles are expected, substitute compacted stone infill with a temporary above ground Trackway. This avoids the need for excavation and limits the weight of material build up and limits compaction when installed with compressible sub-surface.

No Dig-Ground Protection GP1 - Option 2
For high use areas or were heavy vehicles are expected, substitute traditional dig out and compacted stone infill with an above ground **Cellweb** or similar**,** to avoid the need for excavation and limit compaction – may be retained as a porous sub base for hard Surfacing within the scheme.

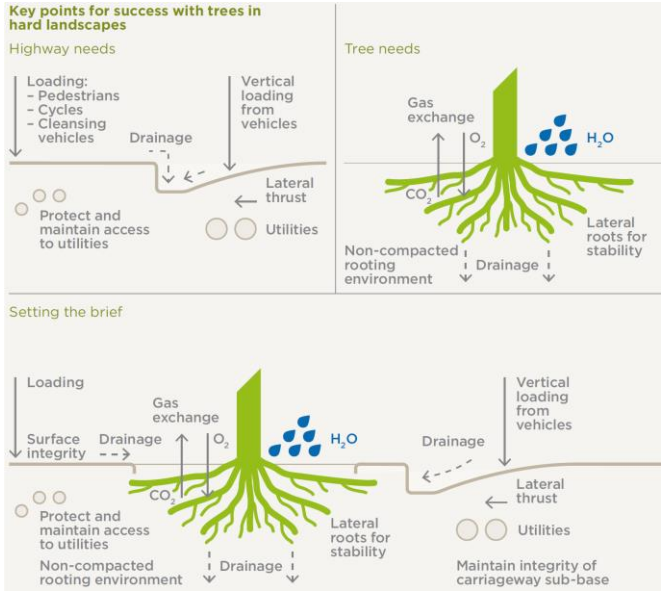
No Dig-Ground Protection GP1 - Option 3
Void forming system such as **Permavoid** or **ArborRaft** act as a protection to the tree roots and avoid the need for excavation. These systems also limit the weight of material build up and can be installed with compressible sub-surface. – may be retained as a porous sub base for hard surfacing within the scheme.

Ground Protection GP2 - Option 1
Where pedestrian-operated plant up to a gross weight of 2t are forecasted, proprietary, interlinked ground protection boards are available; such as **DuraDeck** or **Ground Guard**. These can limit compaction when installed with compressible sub-surface.

Ground Protection GP2 - Option 2
For more permanent small plant and pedestrian movements ground protection in the form of a single thickness of scaffold boarding supported by scaffold, as opposite, can be adopted to bridge areas and avoid compaction.

Ground Protection GP3
For Pedestrian movements ground protection in the form of a single thickness of scaffold boards or plywood on top of a compressible layer (Woodchip) laid onto a geotextile, or supported can be used to form the access or provide a sub base to other ground protection.

Ground Protection (Permanent): The creation of Hard Surfacing within or close to trees offers a risk to trees through compaction, excavation, soil level changes or contamination and these need to be avoided or appropriately defended as indicated opposite, so that underlying soils can continue to allow the ingress of water and exchange of gas between the soil and the atmosphere. Protective measures can be adopted successfully to help retain trees and this information should be agreed within Arboricultural Method Statement.



To counter risks, all hard surfacing shall be above the existing ground within the Root Protection Area using a porous sub-base or by bridging to support f a permanent porous surface/wearing course. This will maintain continued gaseous exchange and water ingress as outlined in the opposite brief copied from Tree in the Hard Landscape (TDAG).

On the majority of sites, substituting traditional compacted stone infill with **ArborRaft** or **Cellweb** as described above will provide appropriate protection. Alternatives may include grates, a suspended pavement or road by installing pre-cast elements avoiding largescale excavation and limiting the weight of material build up. Alternatively, a cast concrete slab or above ground concrete deck supported by piles can be adopted for sites with difficult access, soils or strata as shown in the examples below.

Construction within the Root Protection Area: The creation of structures within or close to trees offers a risk to trees through compaction, excavation, soil level changes or contamination and again these need to be avoided or appropriately defended so that underlying soils can continue to allow the ingress of water and exchange of gas between the soil and the atmosphere. Protective measures can be adopted successfully to help retain trees and this information should be agreed within Arboricultural Method Statement. The work is in line with best practice guidance detailed in section 7.5.2 and 7.5.5 of **BS5837:2012 Trees in relation to design, demolition and construction – Recommendations,** that states:

Section 7.5.2 recommends Root damage can be minimized by using:

- piles, with site investigation used to determine their optimal location whilst avoiding damage to roots important for the stability of the tree, by means of hand tools or compressed air soil displacement, to a minimum depth of 600 mm;
- beams, laid at or above ground level, and cantilevered as necessary to avoid tree roots identified by site investigation.

In section 7.5.5 the standard states - Where piling is to be installed near to trees, the smallest practical pile diameter should be used, as this reduces the possibility of striking major tree roots, and reduces the size of the rig required to sink the piles. If a piling mat is required, this should conform to the parameters for temporary ground protection given in **6.2.3.** Use of the smallest practical piling rig is also important where piling within the branch spread is proposed, as this can reduce the need for access facilitation pruning. The pile type should be selected bearing in mind the need to protect the soil and adjacent roots from the potentially toxic effects of uncured concrete, e.g. Sleeved bored pile or screw pile.

Example 1 -Screw Piles. Using the hydraulic rotation motor, the screw pile can be installed from outside the outside the Root protection area. Usually, heavy buildings that need several piles to be installed use this method of installation before being joined by a beam.

Example 2 – Thrust or Bored Piles. Small plant piles can be installed within Root protection area. To enable heavy buildings to be supported several smaller piles can be connected to form a pile cap providing improved support as shown below.

APPENDIX F - PLANS

Tree Survey - BA5499TS (A0 Plan Attached)

Tree Impact Appraisal Plan - BA5499AIA (A0 Plan Attached)

Tree Surveys & Condition Reports

Tree Health & Safety Reports

Tree Risk Assessments

Tree Population Site Inventories

Estate Tree Management

Woodland Management

Tree Work Specification & Tenders

Insurance & Mortgage Reports

Decay Detection & Mapping – Picus

Windload & Stability Assessments

Development Site Tree Reports to BS5837

Arboricultural Implication Assessments (AIA)

Arboricultural Method Statements (AMS)

Construction Exclusion Zone Management

Tree Protection Plan Design

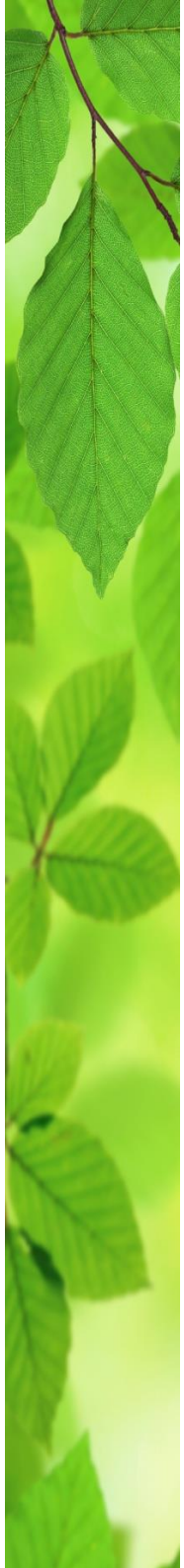
Tree Valuation & Replacement Costing

TPO Objections & Appeals

Tree planting Schemes

Landscape visual impact assessment

Landscape architecture



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