



ARBORICULTURAL CONSULTANTS

ARBORICULTURAL IMPACT ASSESSMENT

AT

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UB3 5AY.

By

ARBORICULTURAL SOLUTIONS LLP

ORIGINAL – NOVEMBER 2016

REVISION 1 – DECEMBER 2016

REVISION 2 – APRIL 2017

REVISION 3 – APRIL 2017

REVISION 4 – JUNE 2017

REVISION 5 – OCTOBER 2017

REVISION 6 – JULY 2018

SUMMARY

The purpose of this report is to provide an assessment of the arboricultural implications of the proposed development. Trees considered to be within the influencing distance of the development have been assessed in accordance with BS5837:2012 "Trees in relation to design, demolition and construction – Recommendations"

The development proposal the development proposal is to build a new five storey hotel with an underground car park on the car park of Axis House; as a result, twenty-nine trees were inspected. The implications of the proposal are:

1. Seven trees are required to be removed for the development as they fall within or are very close to the proposed building footprint. Of those, one tree has been categorised as U and has been recommended for removal due to its condition.
2. The alignment of the new buildings does not encroach significantly into the Root Protection Areas (RPAs) of any of the retained trees. No specialist foundation designs or construction methods will be required. Specialist designs may still be required for other reasons, including the potential influencing distance of tree roots and future removals/losses or existing sub-soil conditions subject to expert advice from a structural engineer.
3. An extensive tree planting scheme has been included within the proposed landscaping scheme to mitigate the loss of the trees.

Given the above, there are no arboricultural constraints that can be considered reasonable to preclude the proposed construction.

1. Introduction

1.1. Instructions

1.1.1. We are instructed by Rhomco, the Project Managers on behalf of their clients; Acre Hotels Ltd, to inspect and report on trees in the vicinity of the car park adjacent to Axis House. We are to report on the tree stock, their current condition, amenity value, and suitability for retention.

1.2. Drawings and Documents

1.2.1. We can confirm sight of the following documents and drawings:

- Proposed basement plan. Drawing number 1056/PL001 at scale 1:200@A1 dated June 2018.
- Proposed ground floor plan. Drawing number 1056/PL002 at scale 1:200@A1 dated March 2018.
- Proposed ground floor plan. Drawing number 1056/PL003 at scale 1:100@A1 dated April 2018.
- Proposed first to third floor plans. Drawing number 1056/PL004 at scale 1:100@A1 dated April 2018.
- Proposed fourth floor plan. Drawing number 1056/PL007 at scale 1:100@A1 dated April 2018.
- Proposed fifth floor plan. Drawing number 1056/PL008 at scale 1:100@A1 dated April 2018.
- Proposed & approved east elevations plan. Drawing number 1056/PL100 at scale 1:100@A1 dated April 2018.
- Proposed & approved north elevations plan. Drawing number 1056/PL101 at scale 1:100@A1 dated April 2018.
- Proposed & approved west elevations plan. Drawing number 1056/PL102 at scale 1:100@A1 dated April 2018.
- Proposed & approved south elevations plan. Drawing number 1056/PL103 at scale 1:100@A1 dated April 2018.

2. Report on site visit

2.1. General

2.1.1. The site was inspected on 14th November 2016 by F. Critchley of Arboricultural Solutions LLP. The site was revisited on 4th April 2017 to survey the trees in Egerton Way. All

arboricultural data contained in this report was recorded at these times. Weather conditions were overcast with intermittent light rain and light winds.

3. Tree inspection and methodology

3.1. Inspection

3.1.1. Trees likely to be affected by any developments were identified and inspected from ground level only and were not climbed. No invasive examination technique (such as increment boring, or internal decay detection) was carried out. As the inspection was visual only, no guarantee, either expressed or implied, of the internal condition of the wood of these trees can be given.

3.2. Marking

3.2.1. Trees surveyed were referenced with a number corresponding to the particular tree on the site plan. Where appropriate, close growing trees were entered as a group and given a generic entry within the tree schedule.

3.2.2. Each reference number refers to a survey sheet entry completed on site to show the following data:

- Sequential tree reference number (recorded on tree survey plan)
- Species - Common name followed by the Latin name for the first entry of each different species
- Height in metres
- Trunk diameter in millimetres, measured in accordance with Annex C of BS 5837:2012
- Crown radius measured at the four cardinal points – where only one measurement is given, the crown is symmetrical
- First significant branch height and direction of growth
- Crown clearance above ground level
- Life stage (young, semi-mature, early mature, mature, over-mature, veteran)
- General observations, particularly of structural and/or physiological condition, and/or preliminary management recommendations
- Estimated remaining contribution in years (less than 10, 10+, 20+, more than 40)
- Category U or A to C grading, to be recorded on the tree survey plan

3.2.3. Survey sheet entries are shown at Appendix A of this report.

3.3. Tree categorisation

3.3.1. Trees vary in, size, age, and landscape importance. All trees were categorised in accordance with the British Standard Trees in Relation to Design, Demolition and Construction

- Recommendations BS 5837: 2012. BS Categories have been entered in the tree schedule and are as follows:

U – Trees unsuitable for retention. Trees in such a condition that they cannot realistically be retained as living trees in the context of the current land use for longer than 10 years.

A - High Category. Trees of high quality with an estimated remaining life expectancy of at least 40 years.

B - Moderate Category. Trees of moderate quality with an estimated remaining life expectancy of at least 20 years.

C - Low Category. Trees of low quality with an estimated remaining life expectancy of at least 10 years, or young trees with a stem diameter below 150mm.

3.3.2. The proposed ground floor plan was edited to show the above and below ground constraints relative to the existing site and potential conflicts with the proposed new buildings (refer to drawing TRP_242BATHRD_2 Rev D). The root protection areas (RPAs) have been calculated using Trees in Relation to Design, Demolition and Construction - recommendations BS 5837: 2012 (refer to Appendix A). The RPAs of trees implicated in the design proposal have not been adjusted in shape to take into account the existing or past site conditions such as the presence of roads, structures and underground services. The trees are growing within hard surfacing, close to roads, boundary walls or existing buildings making the prediction of their root spread problematic. Instead, the full RPA has been retained to show the areas where special precautions are required to prevent potential damage to the roots. Whilst roots are likely to be present beneath the hard surfacing, experience suggests they would be of low number/density. The trunk diameter circle and crown outline shows the BS Category in the following colours:

Category U	Dark red
High Quality (A)	Light green
Moderate Quality (B)	Mid-blue
Low Quality (C)	Grey

3.3.3. Trees in Relation to Design, Demolition and Construction - Recommendations BS 5837: 2012 do not include arguments for or against development, or for the removal or retention of trees. Where development is likely to occur the standard provides guidance on how to decide which trees are appropriate for retention.

4. Brief Site Description

4.1. General

4.1.1. The development site is located within an area known as the northern perimeter of Heathrow Airport, in an area of commercial development along the Bath Road. This includes several hotels and offices running parallel with the northern runway. The existing use of the site is a surface car park. To the east and west are six storey buildings; Axis House (now residential use) and Strata House a commercial office building. These properties date from the late 20th Century and are of eclectic architectural design, one being 'post-modern commercial'

(neo vernacular style), the other being modernist hybrid with curtain wall elevations. Both have truncated fake pitched roof forms with flat roof central areas. To the north are residential properties in Doghurst Avenue; and to the south is Heathrow Airport.

4.1.2. The application site itself is a flat tarmac surface formerly used as a car park to the adjacent office building Axis House which has since been converted to residential use. There is an existing belt of shrubs and trees between Egerton Way and the residential properties in Doghurst Avenue (to the north of the site) and a line of trees within the footway the southern (Bath Road) frontage. Within the car park itself are lines of shrubs managed at approximately 1.5 metres height between the parking bays and a few smaller growing trees planted as groups.

4.2. Tree Preservation Orders

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

4.2.2. A Conservation Area is an area designated by the Local Planning Authority as one of "special architectural or historic interest, the character or appearance of which it is desirable to preserve or enhance". Special controls exist with regard to demolition and alteration of buildings; Listed Building Consent must also be obtained for any demolition, even if the building is not itself listed. Similarly, trees are given some protection with the requirement for the local authority to be given six weeks written notice before carrying out any work on trees; this gives the authority time to decide if a TPO is necessary.

4.2.3. The protection status of the trees has been checked using London Borough of Hillingdon Planning Services interactive map. The site is not within a designated Conservation Area and there are no TPOs in effect on the trees surveyed. This must be reconfirmed prior to undertaking any tree works on the site.

4.3. Development Proposal

4.3.1 The development proposal is to build a new five storey hotel with an underground car park on the car park of Axis House providing 157 bedrooms. The hotel itself will be accessed from Egerton Way which will include a set down coach bay and short term parking. There is also a provision of ramp vehicle access to underground car parking forming a basement storey which will include plant room and stores.

4.3.2. This report has been produced to reflect the current design layout and the potential impacts on the tree population. Where significant conflicts exist, the removal of trees of generally good condition and landscape value may be acceptable following negotiation with the council planning department providing the submitted landscape plan has provision for high quality replacements of long-term potential.

5. Tree Population

5.1. Tree schedule

5.1.1. Refer to appendix A for detailed records of individual trees and drawing Tree Constraints Plan (drawing number TCP_242BATHRD_1 Rev B) for the locations of trees and groups. Trees that have been surveyed and included as groups have not been included in the following tree population analysis.

5.2. Species diversity

Species	Number
Italian Alder	4
Downy Birch	6
Himalayan Birch	2
Red maple	2
Silver Maple	2
American Elm	1
Norway Maple	6
Elder	1
Wild Cherry	3
Portugal Laurel	2
Total:	29

5.2.1. The tree population is generally typical of an urban area and is considered appropriate to the location. The trees surveyed comprise 10 different species and 6 different genera. The tree population is considered diverse for a small area although there are only one or two representatives present of some species.

5.3. Age distribution

Age class	Number
Semi-mature	7
Early-mature	17
Mature	5
Young	0
Over-mature	0
Total:	29

5.3.1. The tree population consists of a balance of age categories and would be expected to provide long-term tree cover around the site.

5.4. Grade classification

Tree grade	BS5837:2012 Definition	Number
A	High	0
B	Moderate	11
C	Low	17
U	Remove	1
Total:		29

5.4.1. The above table represents individual trees surveyed. The tree categories include both low and moderate landscape value reflecting the size, landscape amenity value, prominence and screen value of the trees surveyed.

5.4.2. One tree has been categorised as U on the basis of its condition and is considered to be in such a condition that it cannot realistically be retained as living tree in the context of the current land use for longer than 10 years.

6. Arboricultural Impact Assessment

6.1. Tree Population Summary

6.1.1. Trees 1, 2 and 3 are Downy Birch trees planted as a group at the eastern end of the existing car park. The trees are mutually suppressed with unbalanced crown shapes and of restricted landscape value as they are obscured from view by the existing buildings. Trees 10 (Elder), 11 and 12 (Wild Cherry) are in a raised planter on the west side of the car park. These trees as a group are suppressed by the adjacent shrubs and larger growing trees. They are publicly visible but are not likely to attain such a size as to be considered as being of significant landscape value.

6.1.2. Trees 4 to 9 inclusive form a line of trees along the southern boundary of the car park. Trees 4 and 5 are within the curtilage of Axis House and the existing car park, trees 6 to 9 are located within the public footway adjacent to Bath Road. This line is of mixed age classes including semi-mature trees (trees 6 and 8), early mature trees (tree 7) and mature trees (tree 4, 5 and 9) and makes a significant contribution in an area of few large specimen trees.

6.1.3. Trees 13 to 29 inclusive and groups 1 and 2 form a linear feature between Egerton Way and the residential properties in Doghurst Avenue to the north of the development area. This is essentially a line of trees with an understorey of mature shrubs planted in a narrow embankment between the kerb line in Egerton Way and the rear gardens fences of the houses. This feature contributes to the low-level screen between the houses and Bath Road, with the individual trees visible in the locality. The trees are rooted approximately 0.4 metres above the Highway level in Egerton Way.

6.1.4. The current design proposal will require the removal of trees 1 to 3 inclusive (Downy Birch), tree 4 (Silver Maple), tree 10 (Elder) and trees 11 and 12 (Wild Cherry) for the construction of the hotel building. In addition, due to the differences in ground levels

between the road and the trees, trees 14, 15, 18 – 21 inclusive, 24, 27, 28 and groups 1 and 2 may require removal for the construction of the car parking spaces along Egerton Way.

6.2. Impact on Retained Trees

6.2.1. Existing trees are an important factor on construction sites, whether on or near the working areas. BS5837:2012 – “Trees in relation to design, demolition and construction – Recommendations” is intended to assist decision-making with regard to existing and proposed trees in the context of design, demolition and construction. Root systems, stems and canopies, with allowance for future movement and growth, need to be taken into account.

6.2.2. BS5837:2012 - Trees in relation to design, demolition and construction – recommendations have been used to calculate the RPAs. It should be noted that this method is primarily used to calculate the volume of soil required to maintain healthy growth based on the trunk diameter of the tree. In practice, roots may extend beyond this area, and in some cases the spread may be less.

6.2.3. The proposed development will require the removal of trees 1 to 3 inclusive, tree 4 and trees 10 to 12 inclusive. Refer to tree removal plan (TRP_242BATHRD_2 Rev D).

6.2.4. With reference to drawing TRP_242BATHRD_2 Rev D showing the proposed layout, the alignment of the new building does not significantly encroach within the Root Protection Areas (RPAs) of any of the retained trees and so there are no conflicts with the RPAs of the trees from the construction/demolition work. No specialist foundation designs or construction methods will be required. Specialist designs may still be required for other reasons, including the potential influencing distance of tree roots and future removals/losses or existing sub-soil conditions subject to expert advice from a structural engineer.

6.2.5. The proposed hotel development includes basement level parking. This will involve excavations close to trees 5 to 9 and will encroach slightly into the northern edge of the RPA of tree 9. There are also several street level parking bays along Egerton Way. These have been designed to allow for the retention of the most significant trees and positioned to be located outside the RPAs of the retained trees. There are minor encroachments for parking bay 7 into the RPA of tree 29 and parking bay 3 into the RPA of tree 23; this may be reduced by the repositioning of the parking bays.

6.2.6. The proposed new development includes extensive new tree plantings on both the Egerton Way and Bath Road frontages. Tree planting is also included as part of the construction of the car parking spaces in Egerton Way. The replacement tree species will be high quality, semi-mature nursery stock of long-term potential and selected to enhance the development. In areas where the space is restricted appropriate small growing species would include: Juneberry (*Amelanchier lamarkii*), Photinia x fraseri Red Robin, Holly (*Ilex x Nelli Stevens*), Cape Myrtle (*Lagerstroemia indica Rosea*) and Variegated Wedding Cake Tree (*Cornus contraversa Variegata*). It is proposed to plant trees between the car parking spaces along Egerton Way. Appropriate narrow crown species would include: Cypress Oak trees (*Quercus robur 'Fastigiata Koster'*), Field Maple (*Acer campestre William Caldwell*), and Callery Pear (*Pyrus calleryana Chanticleer*).

6.3. Summary of impact

Impact	Reason	Low value (Cat C & U) trees	Moderate value (Cat B) trees	High value (Cat A) trees	Potential design & mitigation techniques
Trees to be removed	Building construction and/or surfacing	Trees 1 to 3 inclusive, 10 to 12 inclusive	Trees 4 & 27 inclusive		New landscaping is proposed including an internal garden area and extensive tree planting on Egerton Way & Bath Road frontages.
	Arboricultural reasons	Tree 1			Refer to Appendix A (1) for tree survey details and condition comments.
Retained trees to be managed	Enabling works/space for development				Tree 5 has been recently re-pollarded. No further pruning works are required for construction purposes.
Retained trees that may be damaged	Removal of existing structures				No demolition is required as part of this application. All tree protection measures (fencing and ground protection) are to be in place before any works on site.
	Removal of existing surfacing				No works are planned with the RPAs of retained trees. If required, all works with RPAs of retained trees to be undertaken using hand tools only.
	Material storage/washing areas/welfare areas	Potentially all retained trees	Potentially all retained trees	Potentially all retained trees	There is adequate space on site to ensure all material storage/washing areas/welfare areas are located away from the RPAs.
	Temporary access to construction areas				All construction access will be via Egerton Way.
	Installation of new structures	Tree 5	Trees 6 to 9 inclusive		All construction is outside the RPAs of retained trees. All tree protection measures (fencing and ground protection) are to be in place before any works on site.
	Installation of new surfacing	Tree 5	Trees 6 to 9 inclusive		All construction is outside the RPAs of retained trees. All tree protection measures (fencing and ground protection) are to be in place before any works on site.
	Excavations or ground level changes	Tree 5	Trees 6 to 9 inclusive		No ground level changes are required within the RPAs of retained trees. The excavation of the basement level encroaches slightly into the RPA of tree 9. Within 1 metres of the RPA soil must be hand dug to below root level & any roots cleanly cut back behind back edge of excavations.
	Installation of services*				No proposed works within the RPAs of retained trees.
	Landscaping works	Potentially all retained trees	Potentially all retained trees	Potentially all retained trees	All landscaping works within RPAs (if applicable) of retained trees to be undertaken using hand tools only.

7. Development

7.1. Threats to trees during development

7.1.1. These may be listed, in general terms as:

- Compaction of ground
- Covering rooting areas with impervious surfaces
- Excavations for foundations
- Excavation for service runs
- Alterations in ground level
- Access and movement of machinery
- Need for temporary site storage
- Crown damage by passage of high-sided vehicles

7.1.2. British Standard 5837 (1991) 'Trees in relation to construction' provided useful guidance for the assessment and formulation of measures for the mitigation of such threats. Using the experience gained from this Standard, it was revised and upgraded to 'Recommendation' status as British Standard 5837 'Trees in Relation to Construction' (2005). This British Standard was withdrawn on 30th April 2012 and replaced with Trees in Relation to Design, Demolition and Construction - Recommendations BS 5837: 2012. To assist in the prediction of the likely impact of development on retained trees, a model is used. This model is based on the age, vitality and size of individual specimens.

7.1.3. The British Standard relies heavily on the creation of a protected zone (RPA) around each tree. This area should be protected from disturbance "in order to avoid unacceptable damage to the tree as a result of severance or asphyxiation of the root system." The recommended minimum area (m²) for each tree to avoid potentially harmful disturbance have been calculated for all the trees on site and entered into the tree schedule (appendix A).

7.1.4. BS 5837: (2012) acknowledges that the shape of the tree root system may be affected by several factors and that the shape of the RPA should reflect this. Any deviation in the RPA from the original circular plot should take account of the following factors whilst still providing adequate protection for the root system:

- a) the morphology and disposition of the roots, when influenced by past or present existing site conditions (e.g. the presence of roads, structures and underground apparatus);
- b) topography and drainage;
- c) likely tolerance of the tree to root disturbance or damage based on factors such as species, age, condition and past management.

7.2. Root Damage

7.2.1. Trees that are growing satisfactorily have achieved equilibrium with their surroundings. Any construction work that affects this equilibrium could be detrimental to health, future growth and the safety of the tree.

7.2.2. The part of the tree most susceptible to damage is the root system, which, because it is not immediately visible, is frequently ignored. Damage or death of the root system will affect the health, growth, life expectancy and safety of the rest of the tree. The effects of such damage may only become evident several years later.

7.2.3. The majority of a tree's root system is generally considered to be in the top 600mm of the soil, extending radially in any direction for distances frequently in excess of the tree's height. However, roots are adventitious and if conditions suitable for root development exist to a greater depth, the roots may extend to depths of three metres or more. Works within the root spread may damage the root system.

7.2.4. Close to the trunk are the main structural roots that develop in response to the tree's need for structural stability. Beyond these major roots, the root system rapidly subdivides into smaller diameter roots; off this main system a mass of fine roots develops.

7.2.5. Tree root systems can be damaged in a number of ways during construction works.

- **Root severance.** Severing of a root will destroy all parts of the root beyond that point. Even roots less than 10mm diameter may be serving a mass of fine roots over a large area. The larger the root severed, the greater the impact on the tree.
- **Damage to root bark.** The bark protects the root and is essential for further root growth; it is loosely attached and easily damaged. If damage extends around the whole circumference, the root beyond that point will be killed.
- **Compaction of the soil.** Compaction of the ground reduces the space between soil particles, particularly in clay soils. A single passage of heavy equipment or the storage of materials can cause significant damage. Compaction can restrict or even prevent gaseous diffusion through the soil and thereby asphyxiate the roots. The roots must have oxygen for survival, growth and effective functioning.
- **Alterations in ground levels.** Lowering the level will strip out the mass of roots near to the surface. Raising the ground levels will have the same effect as compaction.
- **Covering the rooting area with impervious surfaces.** This prevents natural diffusion of gases between the soil and the atmosphere and can lead to oxygen depletion in the soil.
- **Direct toxicity of some materials.** For instance, petrol or diesel spillage or lime in cement can kill underlying roots.
- **Wounding.** Minor wounds to root bark can allow pathogens into the tree root system that can lead to a further impairment of water absorption. The general debilitation of

trees due to root severance can make them more susceptible to invasion by some decay fungi such as *Armillaria* spp.

- Damage to the fine roots by severance of a main root, or by compaction, or by alteration of levels, will prevent the fine roots absorbing the water and nutrients essential for tree growth. The effects of damage from different causes will be cumulative.

7.2.6. The effects of tree root damage may not be immediately apparent. If the root system is capable of rapid regeneration, the tree may recover without noticeable ill effects, though usually symptoms take several years to develop. The range of symptoms varies from minor branch dieback, to deterioration and ultimate tree death depending on the severity of the damage and the ability of the roots to regenerate.

7.2.7. The default position should be that structures are located outside the RPAs of trees that are to be retained. The cumulative effects of incursions into the RPA e.g. from excavations for utility apparatus are damaging and should be avoided. Where there is evidence that a tree has been previously subjected to damage by construction activity this should be taken into account when considering the acceptability of further activity within the RPA.

8. Arboricultural Method Statement

8.1. Tree protection with barriers and ground protection.

8.1.1. Protective fencing will be placed at the distance indicated in Appendix A. This must be constructed as defined in Trees in relation to design, demolition and construction - recommendations BS 5837: 2012 and is included in Appendix B of this report. In this case, all the retained trees are outside the proposed development area and perimeter hoardings will therefore double up as the tree protection fencing.

8.1.2. Where it is necessary to move fencing for access and construction, the existing hard surface should remain as ground protection and fencing as specified in Appendix C section 1.2 and figs 1 & 2 must be used. If it becomes necessary to remove existing hard surfacing within the RPAs, temporary ground protection **must** be installed. Refer to Appendix B section 1.2.7 for examples of ground protection

8.1.3. All materials storage and mixing will be confined to areas outside the RPAs of the trees. Where mixing of materials is undertaken close to the RPAs, this should be on an impervious surface with no run-off to prevent chemical contamination of the RPA from spillage.

8.1.4. All tree protection measures **must** be erected before any works commence or materials or machinery is brought onto site. It is recommended that the existing concrete slab is retained as ground protection throughout the construction phase of the development. Once erected, barriers and ground protection are sacrosanct, and **must** not be moved or altered without prior consultation with the arboriculturalist or Local Authority Tree Officer. Fencing will remain in place throughout the following processes:

- Contractor occupancy
- Plant and materials delivery
- Demolition/construction works
- Installation of utilities
- Completion of development

8.2. Installation and/or upgrading of existing services

8.2.1. New services will be required for the development these can be located outside the RPAs and will not impact on the retained trees.

8.3. Excavations in RPAs

8.3.1. Any work in RPAs **must** be carried out with care as set out in Appendix C section 1.6. On this site special precautions **must** be taken near retained trees, particularly tree 9 (refer to Appendix C section 1.12 and drawing TCP_242BATHRD_1 Rev B for locations of no-dig construction/surfacing).

8.3.2. Excavation works will be undertaken from within the existing car park working towards the trees on Bath Road. As the basement is close to the RPA of tree 9, the excavation should be carried out by hand within 1 metre of the RPA of the tree until it can be confirmed that no roots are present within the proposed excavation footprint, to prevent diggers 'pulling' roots out of the ground beyond the maximum extent of the excavation. Soil removal must be undertaken with care to prevent disturbance of the roots beyond the immediate area of the excavation.

8.3.3. Clumps of roots less than 25mm diameter (including fibrous roots) will be retained in situ without damage. Where a mass of flexible roots is encountered, it may be possible either to displace the roots to another location temporarily or permanently to avoid areas of excavation. All exposed roots to be removed should be cut cleanly with a sharp saw or secateurs approximately 20cm back from the face of the final excavation.

8.3.4. On the southern elevations the outer face of the concrete foundation will be sheathed to protect the soil and adjacent roots from the potential toxic effects of concrete.

8.3.5. Backfilling of trenches should be carried out using the excavated soil, which should be worked in around roots and lightly "tamped" not compacted and preserving the original soil profile.

8.3.6. With reference to TPP_242BATHRD_1 Rev B all excavations associated with the installation of the street level parking bays on Egerton Road will be undertaken by hand within 1 metres of the RPAs of the retained trees. Where possible tree roots must be retained as described in section 8.3.3. above.

8.4. Changes of Surface

8.4.1. Removal of existing surfacing (any hard surface used as a vehicular road, parking or pedestrian path including tarmac, solid stone, crushed stone, compacted aggregate,

concrete and timber decking; this does not apply to compacted soil with no hard covering) is a high risk to any adjacent tree roots and guidance in Appendix B section 1.7 **must** be followed. In this case the existing surface should be broken up by pneumatic hammer, the paving surface can be carefully lifted away working away from the tree 1 and using the hard surfacing as ground protection. If required, the sub-base should be removed by hand digging to ensure no tree roots are present beneath the hard surface.

8.5. Installation of new Surfaces

8.5.1. Changes of surfacing within RPAs is potentially very damaging as it usually involves changes in gradient/levels that may lead to root damage. The guidance in Appendix B section 1.8 **must** be followed to minimise any impacts on retained trees. As cement is toxic to roots, any excavations close to the RPAs must be lined with an impermeable membrane to prevent concrete leachates being exposed to roots. Whenever practicable, the old hard surface should be removed by working away from the tree so that any plant/equipment operates from the existing hard surface to prevent compaction damage.

8.6. Lightly founded structures

8.6.1. Where new fencing, gates or boundary walls are planned within the RPAs of retained trees, the excavations for supporting posts/foundations should be excavated by hand to ensure no roots are present. If significant roots >than 25mm diameter are found it may be possible to cut them under advice from a suitably qualified arboricultural professional. If the roots have to remain, the design should be suitably flexible to allow repositioning of any foundation structure. Any design involving concrete must utilise an impermeable membrane in the excavation to prevent concrete leachates contacting roots. Boundary walls can be constructed on surface beams set on micro-piles to avoid large roots and reduce excavations within the RPAs.

8.7. Use of cranes

8.7.1. The use of cranes or other lifting equipment could damage a tree if the cranes jib or load encounters tree branches. Caution is needed during working operations to ensure the crane's jib or other plant and equipment does not damage any retained tree. The use of a Bank's Man with the ability to observe and communicate directly with the crane or plant operator may be a solution to avoid damage and may be considered in any Risk Assessment undertaken by the Crane Operator.

8.8. Other tree-related site works

8.8.1. **Pre-commencement site visit:** A site meeting should be held by the interested parties prior to any works. All details of the tree protection measures should be discussed to ensure adherence by all parties during the works. Any modifications to the tree protection measures must be recorded and agreed in writing.

8.8.2. **Site supervision:** Site visits by the project arboriculturist may be required by the local planning authority, particularly if works are proposed within the RPAs of retained trees. Once

the site is active, the project arboriculturist will ensure compliance with arboricultural conditions and advise on tree problems or any modifications that may arise. The developer must ensure that all conditions of the arboricultural method statement and any amendments are known and fully understood by all site personnel. All personnel engaged in works near trees must have access to written copies of the method statement and understand the content before working near trees.

8.9. Sequence of events Table

Proposed Works
1. Pre-commencement site meeting including the contractor, LPA Landscape/Tree Officer and the supervising Arboriculturist or suitable delegate.
2. Implementation of protective barriers and ground protection as per the TPP.
3. Tree pruning and construction operations, including further supervisory visits by the Arboriculturist or suitable delegate.
4. Removal of protective barriers.
5. Post-completion site meeting with all relevant stakeholders

9. General

9.1.1. Limitations of report: This report is based on a supplied indicative layout for the development of the site and is intended to highlight to developers the constraints imposed on the site by the existing tree population and potential conflicts whilst providing guidance on the techniques required to ensure the long-term health of retained trees. The content may require revision if the design layout is altered or as the scheme evolves.

9.1.2. Arboricultural Standards: Any tree works should be done in accordance with the British Standard Recommendations for Tree work, BS 3998 as modified by later research. Works should be undertaken by properly qualified and experienced tree contracting company as recommended by a local authority or one approved by the Arboricultural Association. A Register of Contractors is available from:

The Arboricultural Association
 The Malthouse
 Stroud Green
 Standish
 Stonehouse
 Gloucestershire GL10 3DL
 UKTel +44 (0) 1242 522152
 Fax +44 (0) 1242 577766
 Email: admin@trees.org.uk.

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

Fiona Critchley B. Sc. (Sp. Hons), Ad Dip. F. Arbor. A, Tech Cert. (AA), R.F.S Cert Arb

APPENDIX A TREE SCHEDULE

Tree No.	Species	Height (m)	Stem No.	DBH (mm)	Crown radius (m)				Lower crown height (m)	Life stage	General observations	Est. Rem'ing contrib'n	BS Cat	RPA (m²)	RPA as circle of radius (x)m
					N	E	S	W							
1	Downy Birch	7	2	140	1.5	2	1	1	2	EM	Declining condition. Low vitality. Leaning North. Tree located within raised bed. Bacterial flux present. Stem divides at ground level. Light deadwood in crown. Crown becoming sparse. Dieback in crown. Low bud/leaf density.	<10	U	17.8	2.38
2	Downy Birch	5.5	3	90	1.5	1	1	1.5	1.8	SM	Average condition. Normal vigour. Tree located within raised bed. Multiple stems at ground level. Unbalanced crown shape. Crown distorted due to group pressure.	10+	C1	3.7	1.08
3	Downy Birch	8	2	120	1.5	0.5	1	1	1.6	EM	Average condition. Normal vigour. Tree located within raised bed. Stem divides at ground level. Rubbing branches causing damage. Unbalanced crown shape. Crown distorted due to group pressure. Branches restricting highway light.	10+	C1	6.5	1.44

Tree No.	Species	Height (m)	Stem No.	DBH (mm)	Crown radius (m)				Lower crown height (m)	Life stage	General observations	Est. Rem'ing contrib'n	BS Cat	RPA (m²)	RPA as circle of radius (x)m
					N	E	S	W							
4	Silver Maple	12	2	440	9	6	6.5	7	1.7	M	Average condition. Normal vigour. Basal growth. Tree located within hard surface area. Tree located within raised bed. Ivy on stem. Epicormics on stem. Stem divides at ground level. Stem divides above 1.5m. Included bark present in main fork. Previously crown reduced. Rubbing branches causing damage. Low branches over road/footpath. Screen value. Appropriate to location. Contributes to general amenity of area.	20+	B2	87.6	5.28
5	Silver Maple	5	5	200	2.5	2.5	2.5	2.5	1.7	M	Average condition. Normal vigour. Pollard. Tree located within hard surface area. Tree located within raised bed. Decay present on stem. Multiple stems at ground level. Included bark present in main fork. Low branches over road/footpath. Screen value. Appropriate to location. Contributes to general amenity of area. Recently repollarded.	20+	C1	18.1	2.4
6	American Elm	5	1	100	2.5	2	1.5	2	1.5	SM	Plotted by eye on plan. In neighbouring property. Good condition. Normal vigour. Tree located within hard surface area. Low branches over road/footpath. Screen value. Appropriate to location. Contributes to general amenity of area.	20+	B2	4.5	1.2

Tree No.	Species	Height (m)	Stem No.	DBH (mm)	Crown radius (m)				Lower crown height (m)	Life stage	General observations	Est. Rem'ing contrib'n	BS Cat	RPA (m²)	RPA as circle of radius (x)m
					N	E	S	W							
7	Norway Maple	5.5	1	240	3.5	3.5	3.5	3.5	2	EM	Plotted by eye on plan. In neighbouring property. Average condition. Normal vigour. Tree located within hard surface area. Stem divides above 1.5m. Rubbing branches causing damage. Screen value. Appropriate to location. Contributes to general amenity of area.	40+	B2	26.1	2.88
8	Norway Maple	5.5	1	160	1.5	2.5	2	1	2	SM	Plotted by eye on plan. In neighbouring property. Average condition. Normal vigour. Poor shape & form. Tree located within hard surface area. Stem divides above 1.5m. Included bark present in main fork. Rubbing branches causing damage. Crown distorted due to group pressure. Screen value. Appropriate to location. Contributes to general amenity of area.	40+	B2	11.6	1.92
9	Norway Maple	11	1	660	7.5	8	7	7	4	M	Plotted by eye on plan. Diameter estimated. Average condition. Normal vigour. Roots lifting surfacing. Tree located within hard surface area. Occluded wounds on trunk. Stem divides above 1.5m. Included bark present in main fork. Decay pockets in pruning wounds. Rubbing branches causing damage. Light deadwood in crown. Screen value. Appropriate to location. Contributes to general amenity of area.	40+	B2	197.1	7.92

Tree No.	Species	Height (m)	Stem No.	DBH (mm)	Crown radius (m)				Lower crown height (m)	Life stage	General observations	Est. Rem'ing contrib'n	BS Cat	RPA (m²)	RPA as circle of radius (x)m
					N	E	S	W							
10	Elder	3.5	6	70	2	1	1	1	1	M	Plotted by eye on plan. Self-set tree. Average condition. Normal vigour. Suppressed growth. Tree located within raised bed. Multiple stems at ground level. Rubbing branches causing damage. Light deadwood in crown. Crown distorted due to group pressure. Contributes to low level screen.	10+	C1	2.2	0.84
11	Wild Cherry	4	1	160	2	1	3	1.5	1.5	SM	Average condition. Normal vigour. Suppressed growth. Leaning South. Tree located within raised bed. Stem divides above 1.5m. Rubbing branches causing damage. Unbalanced crown shape. Crown distorted due to group pressure. Low branches over road/footpath. Contributes to low level screen.	10+	C1	11.6	1.92
12	Wild Cherry	3	1	140	2.5	1.5	1	1	1.5	EM	Average condition. Normal vigour. Suppressed growth. Tree located within raised bed. Stem divides below 1.5m. Rubbing branches causing damage. Unbalanced crown shape. Crown distorted due to group pressure. Low branches over road/footpath. Contributes to low level screen.	10+	C1	8.9	1.68

Tree No.	Species	Height (m)	Stem No.	DBH (mm)	Crown radius (m)				Lower crown height (m)	Life stage	General observations	Est. Rem'ing contrib'n	BS Cat	RPA (m²)	RPA as circle of radius (x)m
					N	E	S	W							
13	Italian Alder	14	1	340	2	4	2.5	3	4	EM	Average condition. Normal vigour. Part of linear group. Root spread restricted. Basal growth. Stem divides above 1.5m. Crown distorted due to group pressure. Screen value. Appropriate to location. Contributes to general amenity of area.	20+	B2	52.3	4.08
14	Red Maple	9	6	150	1.5	2	4	3	3.5	EM	Average condition. Normal vigour. Part of linear group. Root spread restricted. Multiple stems at ground level. Included bark present in main fork. Rubbing branches causing damage. Broken branches in crown. Crown distorted due to group pressure. Crown damaged by vehicle strikes. Low branches over road. Screen value. Contributes to general amenity of area.	20+	C1	10.2	1.8

Tree No.	Species	Height (m)	Stem No.	DBH (mm)	Crown radius (m)				Lower crown height (m)	Life stage	General observations	Est. Rem'ing contrib'n	BS Cat	RPA (m²)	RPA as circle of radius (x)m
					N	E	S	W							
15	Red Maple	9.5	6	150	1.5	7	4	5	4	EM	Average condition. Normal vigour. Part of linear group. Root spread restricted. Bark wounding on trunk. Occluded wounds on trunk. Multiple stems at ground level. Included bark present in main fork. Rubbing branches causing damage. Broken branches in crown. Crown distorted due to group pressure. Partially occluding wound 1 to 1.6m south side. Stems leaning apart. Stems rubbing & grafting together. Numerous embedded bark junctions. Numerous broken & damaged branches due to vehicle strikes. Low branches over road. Screen value. Contributes to general amenity of area.	20+	C1	10.2	1.8
16	Italian Alder	12	1	420	2	3	3	3	3.5	EM	Average condition. Normal vigour. Part of linear group. Root spread restricted. Basal growth. Unable to inspect stem due to Ivy. Stem divides above 1.5m. Low branches over road. Branches encroaching upon building. Screen value. Contributes to general amenity of area.	20+	B2	79.8	5.04

Tree No.	Species	Height (m)	Stem No.	DBH (mm)	Crown radius (m)				Lower crown height (m)	Life stage	General observations	Est. Rem'ing contrib'n	BS Cat	RPA (m²)	RPA as circle of radius (x)m
					N	E	S	W							
17	Italian Alder	13	1	460	2	2	2	2	3.5	EM	Average condition. Normal vigour. Part of linear group. Root spread restricted. Basal growth. Unable to inspect stem due to Ivy. Light deadwood in crown. Low branches over road. Branches encroaching upon building. Screen value. Contributes to general amenity of area.	20+	B2	95.7	5.52
18	Downy Birch	5	1	180	2	1	2	1.5	3	EM	Average condition. Normal vigour. Part of linear group. Root spread restricted. Stem divides above 1.5m. Decay pockets in pruning wounds. Rubbing branches causing damage. Light deadwood in crown. Crown distorted due to group pressure. Branches encroaching upon building. Screen value. Contributes to general amenity of area.	10+	C1	14.7	2.16
19	Downy Birch	5	2	180	2.5	1.5	2	1.5	2.5	EM	Average condition. Normal vigour. Part of linear group. Stem divides at ground level. Rubbing branches causing damage. Light deadwood in crown. Broken branches in crown. Crown distorted due to group pressure. Screen value. Contributes to general amenity of area.	10+	C1	14.7	2.16

Tree No.	Species	Height (m)	Stem No.	DBH (mm)	Crown radius (m)				Lower crown height (m)	Life stage	General observations	Est. Rem'ing contrib'n	BS Cat	RPA (m²)	RPA as circle of radius (x)m
					N	E	S	W							
20	Downy Birch	4.5	1	110	0.5	1	1	1	2.5	EM	Average condition. Normal vigour. Part of linear group. Stem divides at ground level. Rubbing branches causing damage. Light deadwood in crown. Crown distorted due to group pressure. Screen value. Contributes to general amenity of area.	10+	C1	5.5	1.32
21	Norway Maple	4	1	110	0	1	1	0.5	3	SM	Self-set tree. Average condition. Normal vigour. Suppressed growth. Part of linear group. Stem divides above 1.5m. Rubbing branches causing damage. Crown distorted due to group pressure. Screen value. Contributes to general amenity of area.	10+	C1	5.5	1.32
22	Norway Maple	3	1	90	0	1	0.5	0.5		SM	Self-set tree. Average condition. Normal vigour. Suppressed growth. Part of linear group. Crown distorted due to group pressure. Screen value. Contributes to general amenity of area.	10+	C1	3.7	1.08
23	Italian Alder	14	1	350	2.5	5	3.5	2	3	EM	Average condition. Normal vigour. Part of linear group. Leaning east. Stem divides above 1.5m. Broken branches in crown. Unbalanced crown shape. Crown cut back from gardens by residents. Crown distorted due to group pressure. Low branches over road. Screen value. Contributes to general amenity of area.	20+	C1	55.4	4.2

Tree No.	Species	Height (m)	Stem No.	DBH (mm)	Crown radius (m)				Lower crown height (m)	Life stage	General observations	Est. Rem'ing contrib'n	BS Cat	RPA (m²)	RPA as circle of radius (x)m
					N	E	S	W							
24	Norway Maple	4	1	100	1	0.5	1	0.5		SM	Inappropriate location. Tree located at rear of kerb line & struck by vehicles. Self-set tree. Average condition. Normal vigour. Poor shape & form. Suppressed growth. Part of linear group. Root spread restricted. Stem divides above 1.5m. Included bark present in main fork. Previously crown reduced. Crown distorted due to group pressure. Low branches over road. Screen value.	10+	C1	4.5	1.2
25	Himalayan birch	4	1	140	2	1	1	2		EM	Average condition. Normal vigour. Stem divides above 1.5m. Included bark present in main fork. Rubbing branches causing damage. Light deadwood in crown. Broken branches in crown. Crown distorted due to group pressure. Screen value. Appropriate to location.	20+	C1	8.9	1.68
26	Portugal Laurel	5	2	220	2	2	1	2	1	M	Average condition. Normal vigour. Part of linear group. Multiple stems at ground level. Rubbing branches causing damage. Light deadwood in crown. Broken branches in crown. Low branches over road. Screen value. Appropriate to location. Contributes to general amenity of area.	20+	B2	21.9	2.64

Tree No.	Species	Height (m)	Stem No.	DBH (mm)	Crown radius (m)				Lower crown height (m)	Life stage	General observations	Est. Rem'ing contrib'n	BS Cat	RPA (m²)	RPA as circle of radius (x)m
					N	E	S	W							
27	Himalayan birch	5	1	170	1	1.5	1	1.5		EM	Average condition. Normal vigour. Part of linear group. Stem divides above 1.5m. Rubbing branches causing damage. Crown distorted due to group pressure. Screen value. Contributes to general amenity of area.	20+	B2	13.1	2.04
28	Portugal Laurel	4	2	110	1	2.5	1	1	1	EM	Average condition. Normal vigour. Part of linear group. Multiple stems at ground level. Rubbing branches causing damage. Light deadwood in crown. Broken branches in crown. Low branches over road. Screen value. Appropriate to location. Contributes to general amenity of area.	20+	B2	5.5	1.32
29	Wild Cherry	6	2	150	2.5	2.5	2.5	2.5		EM	Self-set tree. Average condition. Normal vigour. Suppressed growth. Part of linear group. Stem divides at ground level. Rubbing branches causing damage. Unbalanced crown shape. Crown distorted due to group pressure. Screen value. Contributes to general amenity of area.	20+	C1	10.2	1.8

Tree No.	Species	Height (m)	Stem No.	DBH (mm)	Crown radius (m)				Lower crown height (m)	Life stage	General observations	Est. Rem'ing contrib'n	BS Cat	RPA (m²)	RPA as circle of radius (x)m
					N	E	S	W							
Group 1	Hawthorn Hazel Elder	6	1	100	2	2	2	2	4	EM	Average condition. Part of linear group. Root spread restricted. Basal growth. Bark wounding on trunk. Ivy on stem. Previously crown reduced. Rubbing branches causing damage. Light deadwood in crown. Mutually suppressed crown. Screen value. Appropriate to location.	20+	B2	4.5	1.2
Group 2	Eleagnus Photinia Pyracantha Rosa	4	MS	100	1.5	1.5	1.5	1.5	0	M	Average condition. Some sections removed or in poor condition. Normal vigour. Suppressed growth. Part of linear group. Unable to inspect stem due to Ivy. Multiple stems at ground level. Screen value.	20+	B2	4.5	1.2

TREE QUALITY ASSESSMENT CASCADE CHART

Category and definition	Criteria (including subcategories where appropriate)		
Trees unsuitable for retention Category U	Those in such a condition that they cannot realistically be retained as living trees in the context of the current land use for longer than 10 years	• Trees that have a serious, irremediable, structural defect, such that their early loss is expected due to collapse, including those that will become unviable after removal of other category U trees (e.g. where, for whatever reason, the loss of companion shelter cannot be mitigated by pruning) • Trees that are dead or are showing signs of significant, immediate, and irreversible overall decline • Trees infected with pathogens of significance to the health and/or safety of other trees nearby, or very low quality trees suppressing adjacent trees of better quality <i>NOTE Category U trees can have existing or potential conservation value which it might be desirable to preserve</i>	
Trees to be considered for retention	1 Mainly arboricultural qualities	2 Mainly landscape qualities	3 Mainly cultural values, including conservation
Category A Trees of high quality with an estimated remaining life expectancy of at least 40 years	Trees that are particularly good examples of their species, especially if rare or unusual; or those that are essential components of groups or formal or semi-formal arboricultural features (e.g. the dominant and/or principal trees within an avenue)	Trees, groups or woodlands of particular visual importance as arboricultural and/or landscape features	Trees, groups or woodlands of significant conservation, historical, commemorative or other value (e.g. veteran trees or wood-pasture)
Category B Trees of moderate quality with an estimated remaining life expectancy of at least 20 years	Trees that might be included in category A, but are downgraded because of impaired condition (e.g. presence of significant though remediable defects, including unsympathetic past management and storm damage); such that they are unlikely to be suitable for retention for beyond 40 years; or trees lacking the special quality necessary to merit the category A designation	Trees present in numbers, usually growing as groups or woodlands, such that they attract a higher collective rating than they might as individuals; or trees occurring as collectives but situated so as to make little visual contribution to the wider locality	Trees with material conservation or other cultural value
Category C Trees of low quality with an estimated remaining life expectancy of at least 10 years, or young trees with a stem diameter below 150 mm	Unremarkable trees of very limited merit or such impaired condition that they do not qualify in higher categories	Trees present in groups or woodlands, but without this conferring on them significantly greater collective landscape value; and/or trees offering low or only temporary/transient landscape benefits	Trees with no material conservation or other cultural value

APPENDIX C TREE PROTECTION

1.1. Pre-commencement site meeting.

1.1.1. A pre-commencement site meeting is advised prior to any works commencing on site, to agree all the approved processes with the relevant concerned parties.

1.2. Protective fencing and ground protection.

1.2.1. All trees to be retained on site should be protected by barriers and ground protection where applicable. Barriers should be in place before any materials or machinery is brought onto site. Once in place, barriers and ground protection should be considered sacrosanct and should not be altered or removed without prior recommendation by an arboriculturist and approval of the local planning authority. Barriers should be fit for excluding construction activity and appropriate to the degree and proximity of work taking place around the retained tree(s). Barriers should be maintained to ensure that they remain rigid and complete.

1.2.2. The protective fencing is to be erected prior to any site works or demolition works.

1.2.3. The barrier is to comprise of a vertical and horizontal framework (Figure 1 below), well braced to resist impacts, with vertical tubes spaced at a maximum interval of 3m. Weldmesh panels, such as Heras, should be securely fixed with wire or scaffold clamps to this framework. Weldmesh panels on rubber or concrete feet are not resistant to impact and should not be used. Care should be exercised when locating the vertical poles to avoid underground services and, in the case of the bracing poles, also to avoid contact with structural roots. If the presence of underground services precludes the use of driven poles, an alternative specification should be prepared in conjunction with the project arboriculturist that provides an equal level of protection. Such alternatives could include the attachment of the panels to a freestanding scaffold support framework.

1.2.4. Where retained trees are in close proximity to the existing buildings, a higher specification hoarding will be required to prevent damage from falling rubble. In place of the weldmesh, panels solid hoarding should be used, for example, scaffold boards.

1.2.5. Where the site circumstances and associated risk of damaging incursion into the RPA do not necessitate the default level of protection, an alternative specification should be prepared by the project arboriculturist and, where relevant, agreed with the local planning authority. For example, 2 m tall welded mesh panels on rubber or concrete feet might provide an adequate level of protection from cars, vans, pedestrians and manually operated plant. In such cases, the fence panels should be joined together using a minimum of two anti-tamper couplers, installed so that they can only be removed from inside the fence. The distance between the fence couplers should be at least 1 m and should be uniform throughout the fence. The panels should be supported on the inner side by stabilizer struts, which should normally be attached to a base plate secured with ground pins (Figure 2 below). Where the fencing is to be erected on retained hard

surfacing or it is otherwise unfeasible to use ground pins, e.g. due to the presence of underground services, the stabilizer struts should be mounted on a block tray

1.2.6. It is advised that a plan be pinned up on site in highly visible areas such as in the site huts, so that all ground staff involved in the demolition and construction works have a point of reference for tree protection issues. All demolition and construction workers should be briefed on the importance of tree protection prior to works commencing. Special attention must be paid to ensure that protective fencing remains rigid and complete during the course of all works.

1.2.7. Where it is agreed that vehicular or pedestrian access for construction purposes is necessary within the RPA, ground protection measure will be required to prevent damage to the soil structure within the RPA.

1.2.8. For pedestrian access within the RPA, the installation of ground protection in the form of a single thickness of scaffold boards over a compressible layer laid onto a geotextile, or supported by scaffold, is likely to be acceptable.

1.2.9. For wheeled or tracked vehicle, access within the RPA the ground protection should be designed by an engineer to accommodate the likely loading and may involve the use of proprietary systems or reinforced concrete slabs. The structure must use a no dig design (see methodology described in 1.7 below) to prevent root severance and must prevent localised soil compaction by distributing the load across the track width. Such a system may include the use of three dimensional cellular confinement systems (CCS) as a component of the sub-base, to act as a load suspension layer

1.2.10. New permanent hard surfacing should not cover in excess of 20% of the RPA or be wider than 3m within it; it should be constructed to be permeable to moisture and gas.

1.3. Construction exclusion zone

1.3.1. Once the construction exclusion zone (CEZ) has been protected by barriers and/or ground protection, demolition/construction can take place. Inside the Construction Exclusion Zone (CEZ) of the protective fencing, the following prohibitions shall apply:

- No mechanical digging or scraping
- No hand digging
- No storage of plant, equipment or materials
- No vehicular or plant access
- No fire lighting
- No washing down of vehicles or machinery
- No handling, discharge or spillage of any chemical substance, including cement washings
- No action likely to cause localised waterlogging
- No change in ground levels
- No construction of a hard surface
- No earthworks

1.3.3. In order to inform site personnel of the purpose of the fencing, information notices shall be fixed to the fencing at 5m intervals. These notices shall be of all-weather construction and shall be in the form of the example provided at Figure 4 below, and replaced as and when necessary.

1.3.4. In addition to the above, further precautions are necessary adjacent to trees outside the CEZ:

- Materials that will contaminate the soil, e.g. concrete mixing, diesel soil and vehicle washings, should not be discharged within 10 metres of the tree stem
- This should take into consideration the topography of the site and slopes to avoid materials such as concrete washings running towards trees.
- Fires should not be lit in a position where their flames can extend to within 5m of foliage, branches or trunk. This will depend on the size of the fire and the wind direction.
- Notice boards, telephone cables or other services should not be attached to any part of the tree.

1.4. Avoiding damage to stems and branches

1.4.1. Site operations should be planned to ensure that wide or tall loads or plant with booms, jibs and counterweights, could operate without coming into contact with retained trees. Mechanical damage from large plant can be significant and make their safe retention impossible. Any transit or traverse of plant in close proximity to trees should be conducted under the supervision of a banksman to ensure adequate clearance from trees is maintained at all times.

1.4.2. If the use of a tower crane is necessary, its location will be predetermined and agreed in writing by the Local Planning Authority, and its operation and movements supported by a detailed Method Statement.

1.5. Reporting damage to trees and protective fencing

1.5.1. In the event of any damage to trees scheduled for retention, the damage should be reported to the site agent immediately. The site agent shall report up the chain of responsibility to the project arboriculturist or in the absence of such an appointment to an appropriately qualified arboriculturist, to enable remedial measures to be carried out immediately and if possible.

1.5.2. Should protective fencing be damaged to impair its function, all work shall cease near the damage until the fence has been returned to standard.

1.6. Excavating in RPAs

1.6.1. All excavations must be carried out using hand tools (spades, forks and trowels) and taking care not to damage bark and wood of the roots. It is acceptable to use a pneumatic hammer carefully to break up any existing hard surface for removal. Specialist tools (air spade) may be suitable in certain situations to remove soil from around the roots. All soil removal must be undertaken with care to minimise the disturbance of roots beyond the immediate area of the excavation. Where a mass of flexible roots is encountered, it may be possible either to displace the roots to another location temporarily or permanently to avoid areas of excavation. Exposed roots to be removed should be cut cleanly with a sharp saw or secateurs approximately 20cm back from the face of the final excavation. Roots that are exposed temporarily should be protected from drying out, direct sunlight and extremes of temperature by suitable covering. Roots greater than 2.5cm diameter should be retained where possible; roots up to 10cm diameter should only be cut in exceptional circumstances and roots greater than 10cm should only be cut after consultation with the appropriate supervising officer.

1.6.2. Working within RPAs requires a high level of care to ensure the long-term potential of the trees. Qualified supervision is vital to minimise the risk of misinterpretation. Site personnel must be properly briefed before work commences and ongoing work should be regularly inspected by an arboriculturist to confirm compliance by the contractor.

1.7. Removing Surfacing in RPAs

1.7.1. Roots are frequently found beneath or adjacent to existing surfacing or built structures and care is needed. Damage to the roots may be by direct physical damage or compaction of the soil from the weight of plant and machinery or repeated pedestrian movement. This is generally not a problem whilst surfacing is in place as the load is spread and additional protection is not required. However, once the existing surface is removed and the soil below exposed significant damage can occur to the soil structure and directly to the roots in a very short time. The following rules must be followed:

1. No vehicular activity or repeated pedestrian access into the RPAs unless on existing hard surfacing or custom designed ground protection, this must be designed for anticipated loads.
2. Regular vehicle and pedestrian access routes must be protected from compaction by temporary ground protection.
3. RPAs exposed by the works must be protected as set out in BS 5837:2012 until there is no risk of damage from construction activity

Appropriate tools for manually removing debris may include a pneumatic breaker/drill, crow bar, sledgehammer, pick, mattock, shovel, spade, trowel, fork and wheelbarrow. Secateurs and a bow saw must be available to deal with any exposed roots that have to be cut. Machines with a long reach may be used if they can work from outside RPAs or from areas protected by ground protection designed for the loading within the RPA. Debris to be removed from RPAs manually must be moved across existing hard surfacing or temporary

ground protection to prevent compaction damage. If possible, leaving below ground structures in place should be considered if their removal may cause excess root disturbance.

1.8. Installation of new Surfacing in RPAs

1.8.1. New surfacing is potentially damaging to trees as it may require changes to existing levels, result in localised soil structure damage and disrupt the exchange of water and gases in and out of the soil. Mature or older trees are more sensitive to this type of damage than younger trees. Potential adverse impacts on the trees can be minimised by limiting the extent of these changes. The most suitable surface will be porous to allow the relatively free movement of gas and water and load spreading to limit compaction damage. The actual specification is an engineering issue that has to be considered in the context of the load-bearing capacity of the soil; this element requires specialised input from the appropriate professional.

1.8.2. The actual location and depth of roots is unpredictable and will only become clear once excavation starts and following the guidance in section 1.7 above. Ideally, all new surfacing in the RPAs will be no dig, but this is rarely possible on undulating surfaces. New surfacing generally requires an evenly graded sub-base which can be made up to any high points with granular, permeable fills such as crushed stone or sharp sand; this sub-base must not be compacted as in a normal installation. Some limited excavation is usually necessary to achieve this and need not be damaging to the tree if carried out with care and avoiding cutting large roots. Tree roots generally do not occupy the top 5cm of soil so the removal of a turf layer need not cause root damage. It may be possible to dig to a greater depth with care and dependant on local conditions. On undulating surfaces, finished levels must be carefully planned and flexible enough to allow on-site adjustment if excavations reveal large roots. Roots of 2.5cm diameter and less can normally be cut without a significant impact on the tree and the minimal 5cm depth can be used. If roots larger than 2.5cm diameter are encountered and it is considered inappropriate to cut them by a suitably qualified professional, the surrounding levels must be adjusted to take into account the high points by infilling with a suitable material.

1.8.3. Generally, the construction of hard surface access within the root protection area is to be that of a 'no-dig' design to avoid root loss due to excavation. In addition, the structure of the hard surface should be designed to avoid localised compaction, evenly distributing the carried weight over the track width and wheelbase of any vehicles that will use the access. The design will be based on a cellular confinement system as an integral component of the sub-base, to act as a load suspension layer.

1.8.4. The finished surface will be either a granular material, permeable and gas-porous finished surface (wearing course) to allow moisture infiltration and gaseous diffusion. It is essential to maintain adequate supplies of water and oxygen for trees through the soil. Porosity is important particularly where the new hard surface covers an area of previously unmade ground, under which tree roots may have developed preferentially.

1.8.5. No-fines granular materials should be used wherever fill or a sub-base is required to help to ensure adequate gaseous diffusion. Excess water in the root protection area should be avoided, particularly on clay soils where water logging can occur. In these cases, the hard surface should slope away from the tree to avoid ponding. Provided surface water is not liable to be contaminated by salt or toxic run-off from oil or petrol, a permeable surface should be employed.

1.8.6. **Washed gravel.** Washed gravel retains its porosity unless excessively consolidated, and is particularly useful where changes of level occur, or an irregular shape is needed around the stem of a tree. Gravel is easily renewed or topped up. Although weeds may become established, they can be controlled by chemical or mechanical means. However, gravel is rarely suitable for use where there is vehicle or pedestrian traffic for example, in residential areas. Materials with high fines content, such as binding gravels or hogging, should not be used due to their almost impermeable texture when consolidated.

1.8.7. **Paving slabs and block pavers.** Paving slabs and block pavers are available with built in infiltration spaces between the slabs or blocks. These are ideal, though they should be laid dry-jointed on a sharp sand foundation to allow air and moisture to penetrate to the rooting area.

1.8.8. **Graded Soil.** Sufficient spoil shall be placed along the edge of the area to receive Geoweb, suitably graded away from the works in order that it may be pulled in later. This eliminates the need to transport soil over the finished surface. The spoil (E.g. Heicom sand) shall be graded into the finished structure at the end of the scheme.

1.8.9. **Construction.** Refer to Fig 4 for a general overview of a typical installation with porous tarmac (illustration courtesy of Geosynthetics Ltd). The depth of CellWeb will be dependent on the expected loads and should be based on the manufacturer's recommendation.

Figure 1: Tree Protective fencing

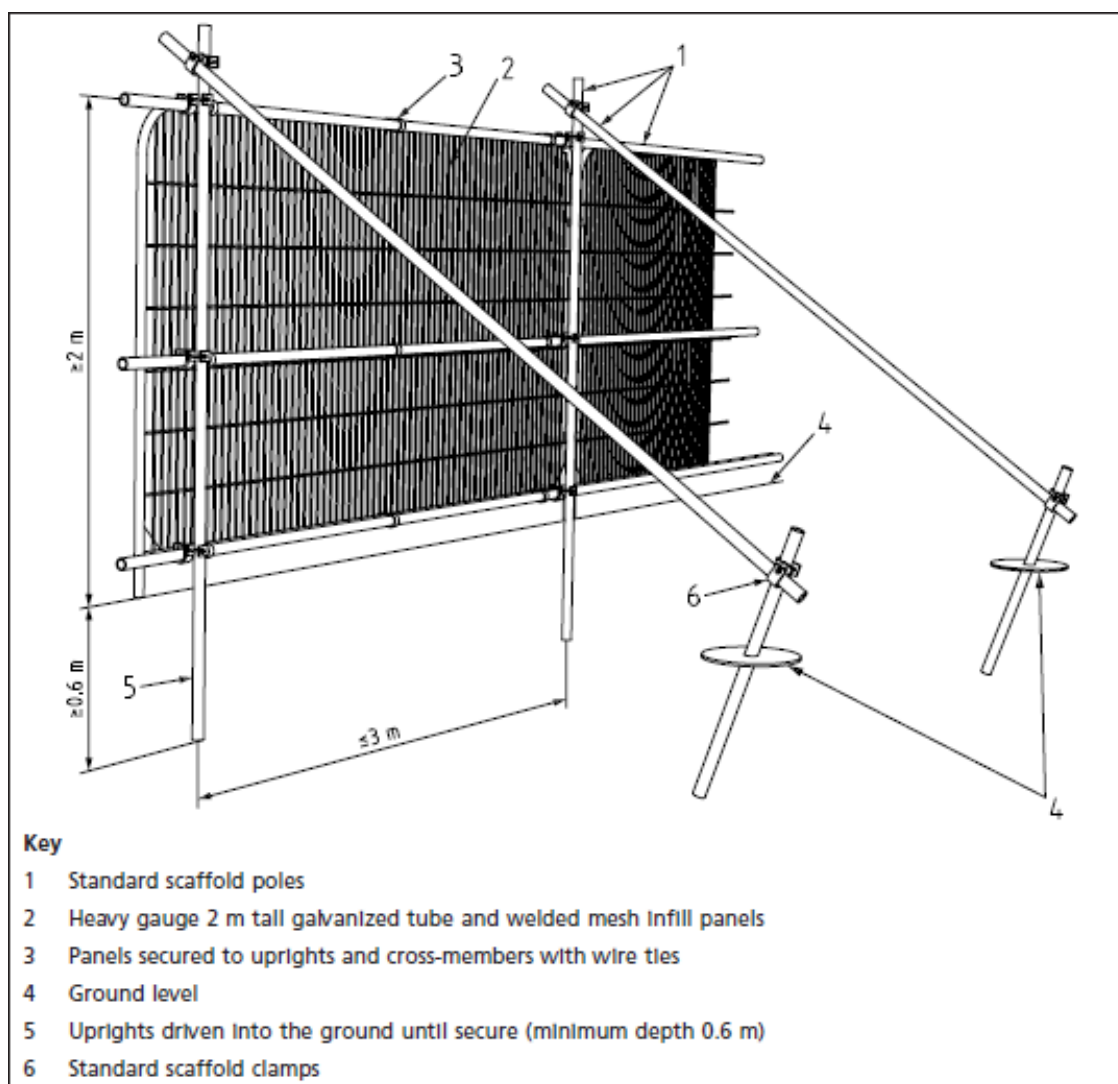


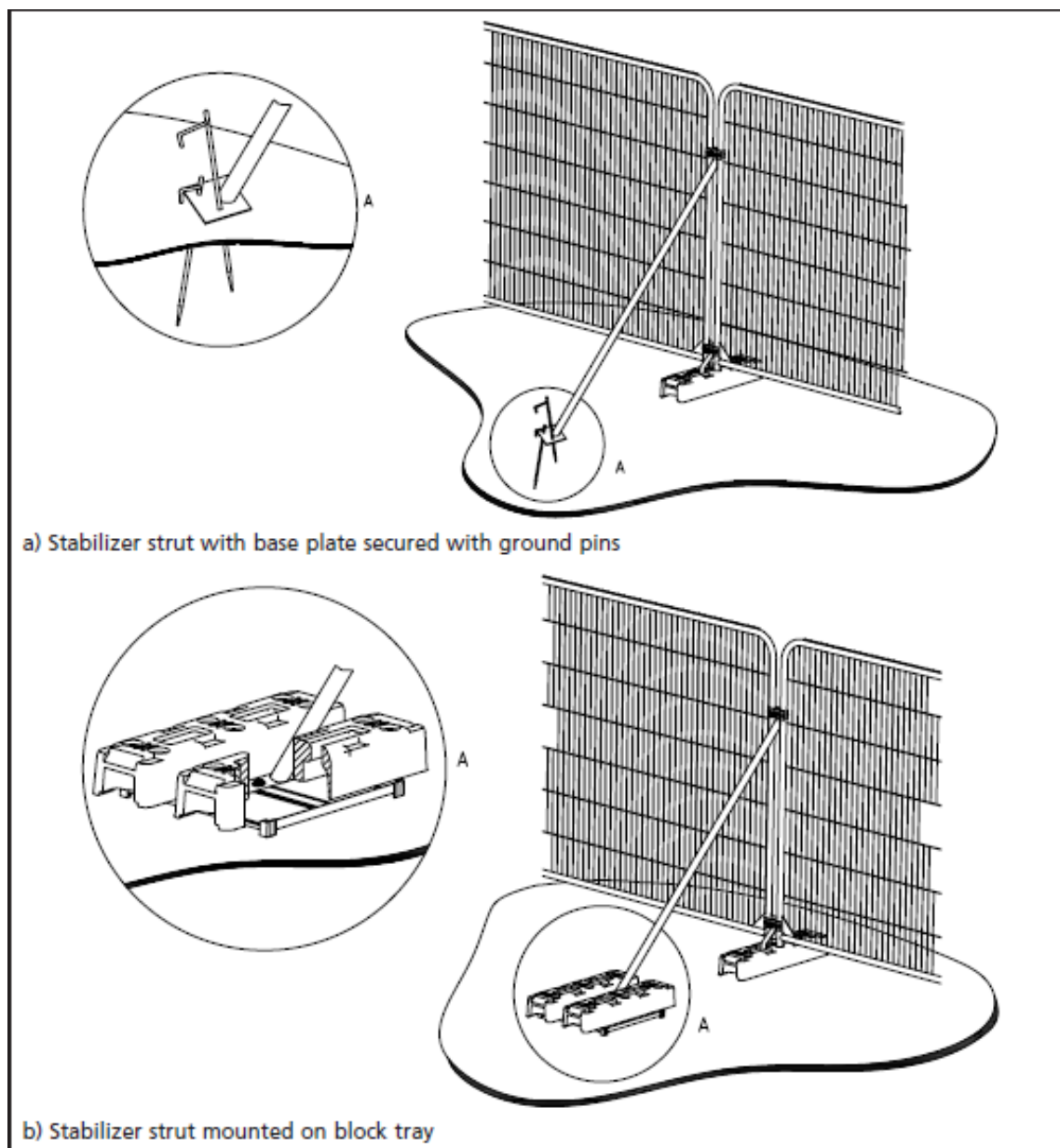
Figure 2: Tree Protective fencing (alternative)

Figure 3: Example of warning notice



Figure 4: Cellular Confinement System

