



**AMENDED**

**TREE PROTECTION PLAN  
AND ARBORICULTURAL  
METHOD STATEMENT  
FOR EDHILL AVENUE,  
NORTH SHIELDS**



June 2016  
R04

ST/1141/15/LAA

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## **A SUMMARY**

E3 Ecology Ltd was commissioned by CEAD Ltd. to create a Tree Protection Plan (TPP) with relevant arboricultural method statements (AMS), for trees within and surrounding a site along Edhill Avenue, South Shields.

A pre-development Tree Constraints Assessment (TCA) was conducted by E3 Ecology Ltd on the 21<sup>st</sup> September 2015, the results of which inform this TPP. An updating survey was conducted on the 6<sup>th</sup> June 2016.

Current site proposals include the construction of a two storey apartment block and two bungalows with associated hard and soft landscaping.

Of the nine trees surveyed, one early-mature wild cherry tree (T1) within the site boundary will be removed and replaced to facilitate construction of the new buildings and areas of hardstanding (Appendix 1). The roots and crowns of the remaining surveyed trees will be protected in accordance with the prescriptions within section D and the arboricultural method statement (AMS) in appendix 4.

At the time of survey, there were no further ecological constraints on tree T1 which will be removed. There were no features present within tree T1 with a risk of supporting roosting bats. If tree T1 contains nesting birds at the time of felling, it will have to be retained for the duration of the nesting period, which would add an additional timing constraint to the development.

Consultation with South Tyneside Council in October 2015, highlighted that the trees are not within a Conservation Area, but that currently all of the trees within the property to the north of the site boundary which may be affected by the proposed development are protected by area Tree Preservation Order (TPO) number 155 (Appendix 6). All trees served with TPO's are protected under the Town and Country Planning Act 1990 (as amended) and the Town and Country (Tree Preservation) (England) Regulations 2012 (Appendix 7), which should be considered when preparing the final development layout.

The roots and crowns of trees adjacent to the boundary will be protected in accordance with the prescriptions of this TPP and future site management. According to the Arboricultural Implications Assessment AIA (Appendix 3), the trees adjacent to the site boundary are of a moderate to high ecological, landscape and arboricultural value to the site, with safe use life expectancies (SULE) of between 20 and 40 years.

The two bungalows to the rear of the plot will have a piled-raft foundation to limit damage to established tree roots and will allow for sufficient regrowth following completion of the development

Although there is limited space within the site for extensive tree planting and landscaping, a number of native medium-sized species flowering/fruit trees will be planted within the landholding. This will enhance the site for invertebrate and bird biodiversity and provide seasonal colour and shade for the new residents.

Specific tree details are in the annexed TCA (E3 Ecology report 4358 R03 Edhill Avenue TCA).

*E<sup>3</sup> Ecology Ltd accepts no responsibility for injury that may occur as a result of incorrectly interpreting this report. Trees are living organisms whose health and condition can change rapidly as a result of environmental changes. All trees, even healthy ones, are at risk from unpredictable climatic and man-made events. The assessment of risk for these trees is based upon factors evident at the time of the inspection, the potential an individual tree has for survival, and the interpretation of those factors by the inspector. The health, condition and safety of these trees should be checked on a basis commensurate with the level of risk as specified in this report.*

*If works are not likely to start within 12 months of this report, it is recommended that an updating survey is undertaken to ascertain any changes which may have occurred to trees surveyed, where failure to carry out the prescribed works within the specified time frames has occurred.*

*If you are assessing this report for a local planning authority and have any difficulties interpreting plans and figures from a scanned version of the report, E<sup>3</sup> Ecology Ltd would be happy to email a PDF copy to you. Please contact us on 01434 230982.*

## **B INTRODUCTION**

### **B.1 Background**

E3 Ecology Ltd was commissioned by CEAD Ltd. to create a TPP with relevant arboricultural method statements (AMSs), for trees within and surrounding a site along Edhill Avenue, South Shields.

A TCA is the subject of a separate report (E3 Ecology report 4358 R03 Edhill Avenue TCA). The current plans for the site are provided in figure 1 (B.4) below.

### **B.2 Objectives of the TPP**

The tree protection plan shows the location of the trees, their categorisation, the location of the new development, the trees to be lost and the tree protection measures;

The objectives of the Tree Protection Plan (TPP) are as follows:

- To confirm the trees that are to be retained on site (categories A ●, B ● & C ●).
- To confirm which trees will be lost (category U ●).
- To confirm the extent of the root protection areas (RPAs) required for the trees to be retained.
- Propose an acceptable location for the installation of fencing to create a construction exclusion zone or root protection zone.
- To specify the nature, design and extent of the protective fencing required.
- Propose proactive tree care methods which will be of benefit to the trees, to prolong their safe use life expectancy and their future contribution to the site.
- To provide an appropriate method statement for the implementation of the tree protection plan, acknowledging the need to co-ordinate and synchronise the timings with the development activities.

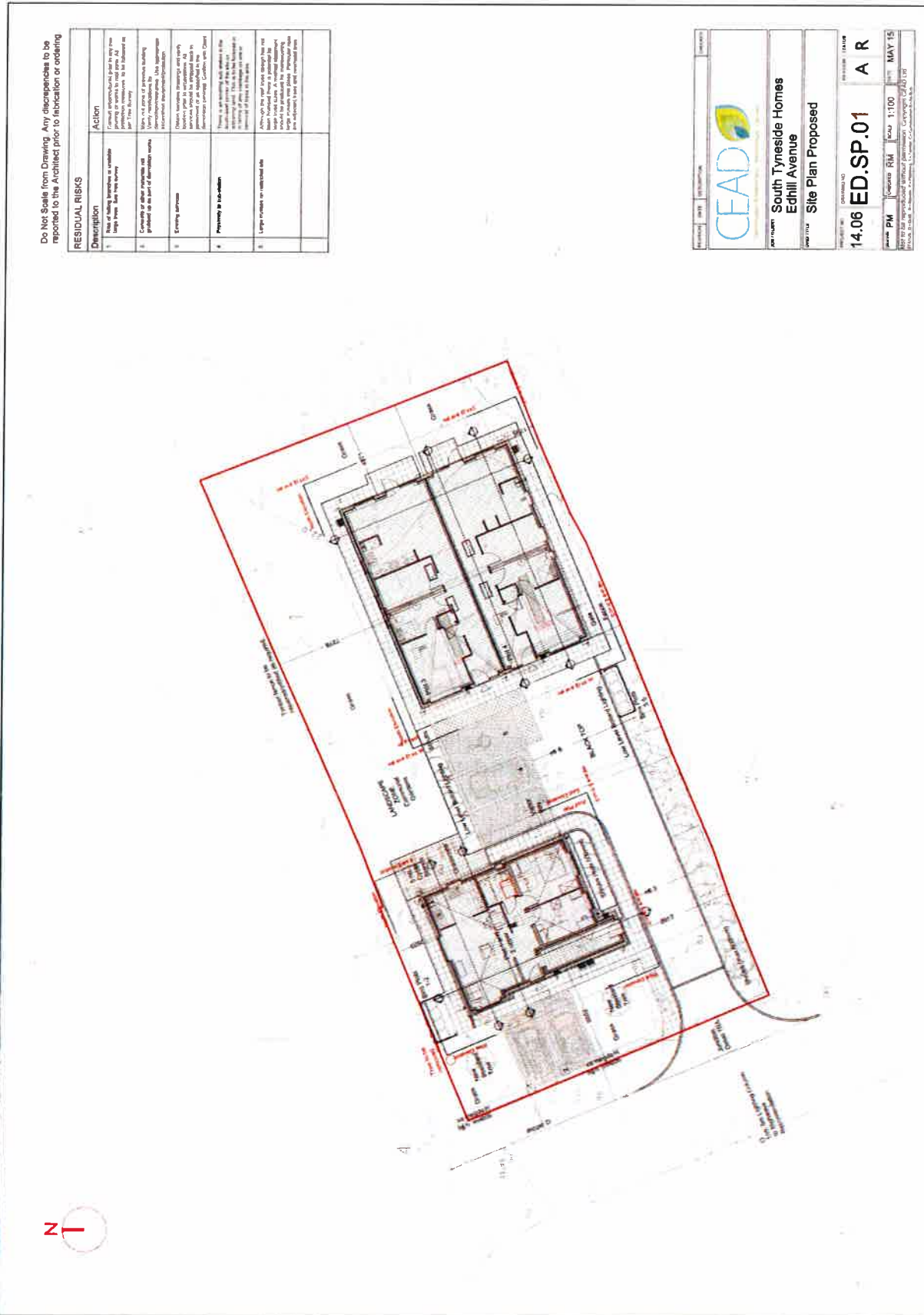
### **B.3 Land survey**

The site is currently surrounded by a close boarded fence. There is a single category 'B' early mature wild cherry to the front of the site within the boundary. The remainder of the site is dominated by poor semi-improved grassland, with areas of tall ruderal and weed species. There are two category 'A' early mature ash trees outside the northern site boundary which form part of two belts of trees growing around the site. These trees are most likely survivors of a former landuse and form part of a small block of mixed woodland to the rear of private gardens to the north of the site.

### **B.4 Proposed site/ development plan**

Current site proposals include the construction of a two storey apartment block and two bungalows with associated hard and soft landscaping.

Figure 1. Proposed development/landscape plan: CEAD: 14.06/EA.SP.01/A/ May 2015.



Do Not Scale from Drawing Any discrepancies to be reported to the Architect prior to fabrication or ordering

RESIDUAL RISKS	
Description	Action
1. Risk of being breached or variable slope from the top survey	Contractor to be instructed to provide a means to cut into the AD slope to ensure the site is safe for the survey
2. Contaminated or other materials not identified as part of site investigation	More of a check of previous building materials and any other materials identified in the site investigation
3. Existing structures	Check existing structures and any other materials identified in the site investigation
4. Proximity to infrastructure	There is an existing wall within the site boundary which is the boundary between the site and the existing structure. The wall is made of brick and is in good condition. It is proposed to be demolished and replaced with a new wall made of brick and is in good condition.
5. Large trees or structural risks	There are no large trees or structural risks identified in the site investigation.

**CEAD**

South Tyneside Homes  
Edhill Avenue  
Site Plan Proposed

14.06 ED.SP.01

Scale: 1:100



DATE: MAY 15

Author: PM  
Checked: RH  
Drawn: JLD

- 7) Each tree will be planted prior to the dormant season for the particular species growing in open ground (generally Mid- October) and during ideal weather conditions (overcast, wet weather, when the soil is moist and workable).
- 8) Sufficient backfilling (with as much of the indigenous soil as possible which has been mixed with a slow release fertiliser), anchoring of the root ball, mulching and protection from browsing animals, human and mechanical damage, are all operations which will be carried out by an experienced contractor.
- 9) Each tree planted will be supported by twin round stakes and a cross-tie and surrounded by a light mesh to prevent basal damage by browsing animals and to dissuade petty vandalism. These materials will be removed once the trees are fully established and the risk of animal/ human damage is assessed as being negligible).
- 10) **A management agreement for the aftercare of the trees will be required as a commitment**, following plantation. This will include compensating for soil settlement, weed removal, supplementary nutrition if necessary, maintenance pruning, watering and removal of stakes/ protection measures once the trees have established.



#### D.4 Remedial pruning works for overhanging branches

<p><b>Tree T5 (outside site boundary)</b> End prune the crown to shape and raise as the tree matures. Only prune up to maximum twig diameter of 15mm to a distal bud. (See BS3998:2010 Appendix 5).</p>	
<p><b>Tree T7 Protected by tree preservation area (outside site boundary)</b> Prune two large epicormic limbs back to the main stem to raise the crown to 6m from ground level. These limbs are secondary regrowth following removal of a large lower limb approximately 10 years ago. This will lift the crown to allow more evening light to reach the property. The limbs will be pruned to the branch collar to reduce the likelihood of epicormic regrowth.</p>	

**Tree T7**




There is a cavity developing at the included bark union of the lower limb and the main stem from which there is an exudate which could be bacterial wetwood. This combined with staining could indicate the early stages of internal decay.



**Tree T7**

Prune the first eastern significant limb back 5m to the nearest distal growth point to shape and raise the crown.

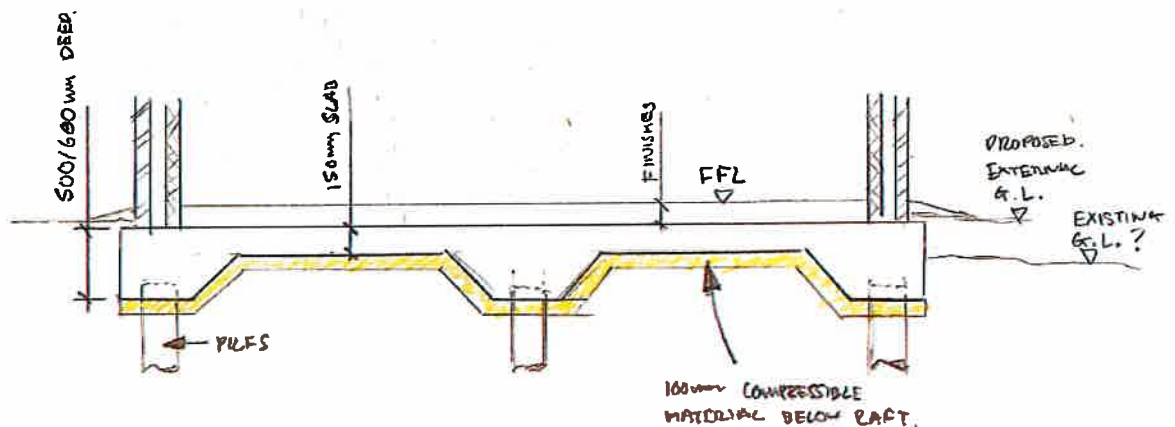


<p><b>Tree T8 protected by TPO (outside site boundary)</b>  Crown lift the south facing lower branches to the main union cluster. The first major south facing limb is to be removed to the main stem to raise the crown.</p>	
<p><b>Tree T9 protected by TPO (outside site boundary)</b>  This tree has five stems growing from the base.</p>	
<p><b>Tree T9</b>  Crown lift the tree up to 4m on the main stems.</p>	

**D.5 Prescriptions for trees adjacent to the boundary to be retained and protected**

- 1) All works will follow the AMS provided in Appendix 4.
- 2) Measures to protect the roots of trees and tree groups immediately adjacent to the site boundary will be installed prior to the development, around the calculated root protection areas illustrated in figure 3 (Appendix 4 H.1 BS5837:2012 – Recommendations; The construction exclusion zone (CEZ): barriers and ground protection).

- 3) The CEZ will be enclosed at the ends, to prevent both incursion into the RPAs of the retained trees and root compaction, in addition to any other long term structural damage.
- 4) These barriers will be maintained for the duration of the development period, with the CEZ strictly enforced by the site manager. These will be checked by the project consultant Arboriculturalist.
- 5) Consideration should be given for the encroachment of tree roots into foundations in the future, through the installation of a root blocker membrane such as ReRoot 2000 (Appendix 8) around the edge of the foundations of walls, adjacent to the tree during construction. Roots from the early mature trees adjacent to the site are likely to extend beyond the mandatory 12 x stem diameter at 1.5m, as specified in BS5837:2012, as they mature.
- 6) The current locations and proposed routes of subterranean service lines will not impinge on the roots of trees to be retained. They will be buried at a sufficient depth and suitably encapsulated so as not to be directly impacted upon by newly planted trees as they grow to maturity.
- 7) The two bungalows to the rear of the plot will have a piled-raft foundation to limit damage to established tree roots and will allow for sufficient regrowth following completion of the development (see below).



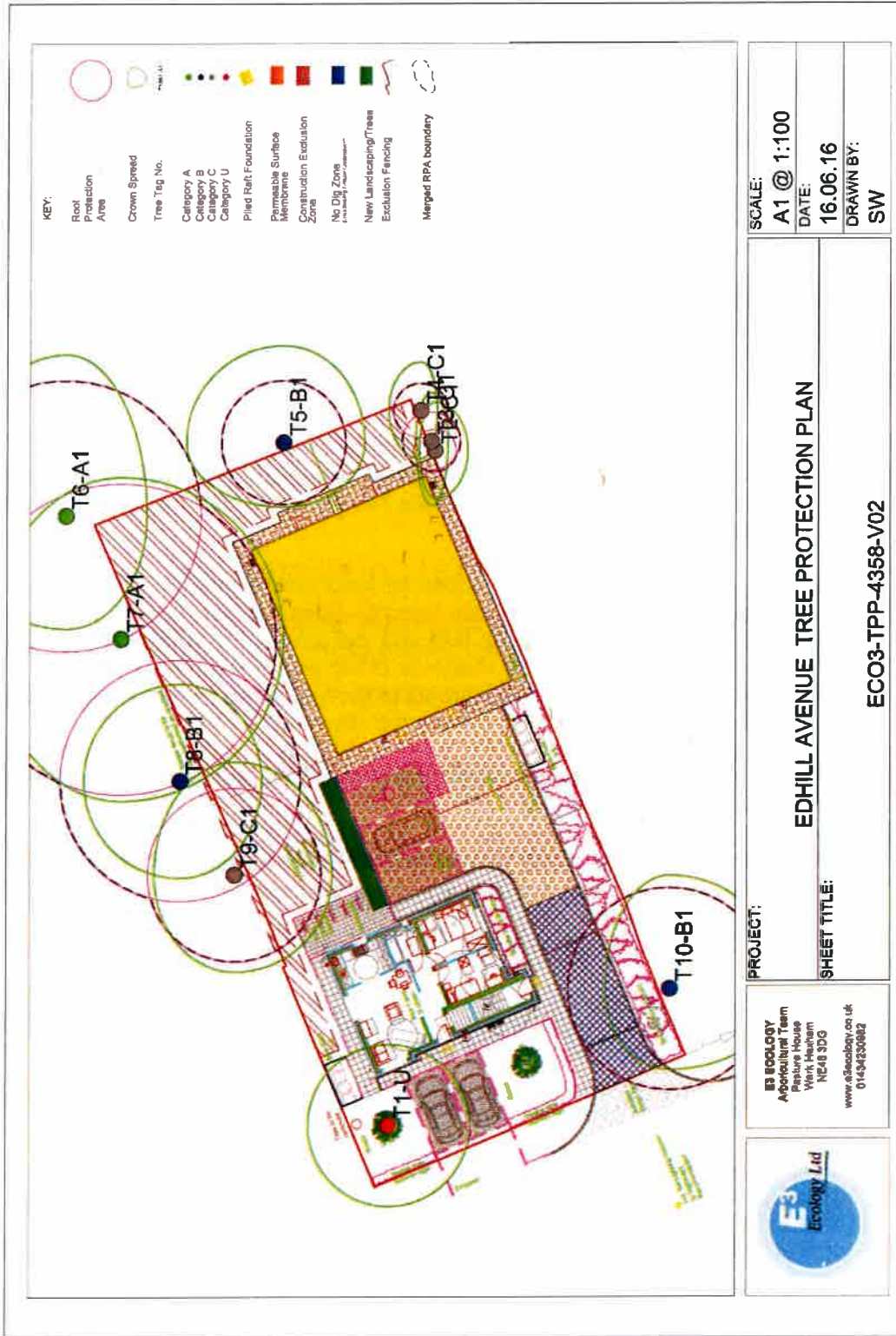
TYPICAL SECTION THRO' PILED RAFT

- 8) A permeable asphalt such as Ultidrive® porous made by Tarmac will be used for the parking and turnaround areas around the bungalows to maximise rainwater percolation into the soil of the site.
- 9) Terram Geocell (Appendix 9) or an equivalent will be used in the construction of pedestrian paths around the bungalows. This is a no-dig solution which will minimise impacts on the established tree roots and ensure that tree roots within this section continue to receive nutrients and oxygen. This material will be integrated with the raft and pile foundation design to establish finished levels.
- 10) A section of the access drive will impinge significantly on the root plate area of tree T9. A load bearing cellular confinement system which can be used in 'no dig' zones, such as Terram Geocell, Stratacell® or an equivalent as specified in the TPP, will be used to prevent root compaction and asphyxiation. Use of these techniques will considerably increase the safe use life expectancy (SULE) of tree T9 following completion of the development.

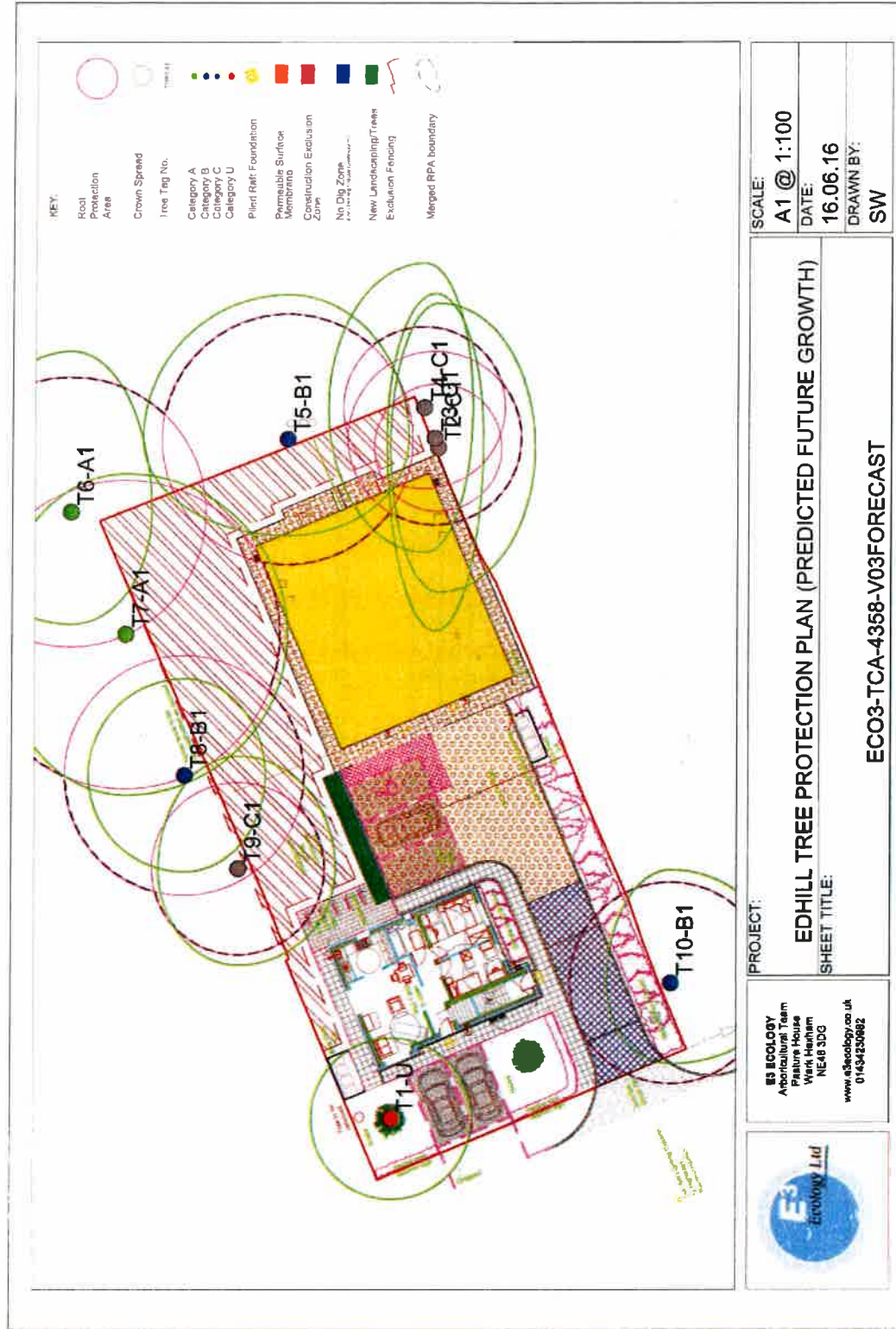
#### **D.6 Predicted future growth of surrounding trees (figure 3)**

- 1) Figure 3 illustrates the predicted future root and canopy growth of trees T2 – T5 based on a simple calculation of the gain in mean annual increment of Fraxinus and Acer in Britain and an estimation of growth of the trees towards maturity. This is calculated from the existing dimensions of the trees.
  - 2) Growth of the trees will be influenced by local environmental and ground conditions. However as the trees grow towards maturity within the next 40 – 80 years there will be a significant increase in shading, twig and leaf drop in the south eastern corner, which will have a negative impact on residents of the proposed development. To mitigate for this, there will need to be a commitment to the future maintenance of the trees perhaps as a management agreement between the site owners and residents.
  - 3) Future maintenance would include crown reduction and facilitation pruning of limbs away from the site boundary.
- **Mitigation measures, such as root protection barriers and cellular confinement systems are to be checked by the project Arborist prior to commencement of demolition or construction works.**

**E APPENDIX 1, FIGURE 2: TREE PROTECTION PLAN.**



**F APPENDIX 2. Figure 3. Predicted future growth of trees.**



**G APPENDIX 3. TREES TO BE REMOVED/WORKS TO TREES.**

**KEY:**

<b>Arboricultural implications assessment (AIA)</b>	
<b>Key</b>	<b>Age class</b>
<b>St dia:</b>	Y- Young
<b>Cr Rad:</b>	SM- semi-mature (1st 1/3 of life expectancy)
<b>Cr clearance:</b>	EM - early mature
<b>Est cont:</b>	M - Mature (final 1/3 of life expectancy)
<b>Rad RPA:</b>	OM -Over Mature(beyond life-expectancy/declining naturally)
<b>RP</b>	V - Veteran (of great age and potential conservation value)
<b>Condition:</b>	P - Physiological (Poor= significant weakness, Fair= symptoms of ill health that can be remediated, Good= No significant health problems)
	S - Structural (Poor= significant weakness, Fair= symptoms of weakness that can be remediated, Good= 'normal' structure)
<b>BS cat:</b>	British Standard (5837:2012) tree quality category of retention: U- removal A(1-3)- high quality value B(1-3)-moderate quality value C(1-3)- low quality value
<b>Phenological stage (tree ref):</b>	D = dormant, I = in bud, L= in leaf, F= flowering, Fr = Fruiting, LD = Leaf drop, Nwr - No Work Required

For multi-stemmed trees, the RPA is calculated from the square root of the (combined stem diameters) <sup>2</sup>.



Table 1. Trees to be removed

Tree ref. No.	Tag Number	English Name	Scientific Name	Phenological Stage	Height (m)	St dia. at 1.5m (mm)	Cr Rad.(m) N	Cr Rad.(m) E	Cr Rad.(m) S	Cr Rad.(m) W	Cr. Clearance (m)	Age class	Est cont	Physiological condition (+ve/-ve features)	Structural condition (+ve/-ve features)	Management recommendations	Time frame (months)	RP	Rad RPA (m <sup>2</sup> )	RPA Radius (m)/offset	BS cat
T1	1864	Wild cherry	<i>Prunus avium</i>	Leaf	9.1	465	5	5	5	5	2	EM	20+	Good	Fair. Crown lifted on the northern elevation. Tree outside site boundary fence.	Remove tree to facilitate the proposed development. Replace with two ornamental Japanese cherry trees within the landscaping zone.	6	0	97.83	5.6/ 1.1	U

Table 2. Trees to be retained.

Tree ref. No.	Tag Number	English Name	Scientific Name	Phenological Stage	Height (m)	St dia. at 1.5m (mm)	Cr Rad.(m) N	Cr Rad.(m) E	Cr Rad.(m) S	Cr Rad.(m) W	Cr. Clearance (m)	Age class	Est cont	Physiological condition (+/-) -ve features)	Structural condition (+/-) -ve features)	Management recommendations	Time frame (months)	RP	Rad RPA (m2)	RPA Radius (m)/offset	BS cat
T2	0	Common Ash	<i>Fraxinus excelsior</i>	Fruit	7.8	110	1	3	2	3	3	SM	20+	Good	Good. Group of three trees forming a contiguous group. Outside site boundary.	Nwr	0	36	5.47	1.3/ 0.3	C1
T3	0	Common Ash	<i>Fraxinus excelsior</i>	Fruit	8.1	150	1	3	1	4	2	SM	20+	Good	Good. Self-seeded. See above.	Nwr	0	36	10.18	1.8/ 0.4	C1
T4	0	Common Ash	<i>Fraxinus excelsior</i>	Fruit	8	140	2	3	1	3	2	SM	20+	Good	Good. Self-seeded. See above.	Nwr	0	36	8.87	1.7/ 0.3	C1
T5	0	Sycamore	<i>Acer pseudoplatanus</i>	Leaf	11	320	6	6	5	4	3	EM	20+	Good	Good	Tree outside site boundary. Quadruple leaders, asymmetric growth to the north. End prune the crown to the shape and	8	0	46.33 / 1.4	3.8/ 0.8	B1





## **H APPENDIX 4: ARBORICULTURAL METHOD STATEMENT: EDHILL AVENUE 2016**

This Arboricultural Method Statement (AMS) explains how and when protection measures for retained trees should be maintained and how they should be maintained for the duration of the development period.

A hard copy of this report must be permanently available on the site during the development period to:

- Illustrate to site staff the active advisory and supervisory role of the consultant arboriculturalist within the development process.
- Correctly identify protection measures for specific trees as numbered on site and as detailed within this plan.
- Ensure that any works prescribed within this plan are carried out correctly, systematically and within the timeframe specified.
- Allow the site team to use the document as a practical guide on how to effectively protect and minimise impacts on trees and site soft landscaping.

### **H.1 Tree protection and phased tree management programme**

The following systematic process will ensure that trees are adequately protected for the full duration of the development period and continue to contribute to the site long after the development has been completed.

1. Pre-commencement consultation and if necessary site meeting with the planning team.
2. Tree works (felling/pruning) as prescribed within this plan are carried out to specified trees.
3. Installation of construction exclusion zones and root protection barriers.
4. Inspection of the positioning of barriers by project arboriculturalist.
5. If required, installation of cellular confinement systems or root protection measures in high impact zones.
6. Installation of new services/ upgrading of existing services within the existing root structure using conventional soil displacement, Ground Penetrating Radar (GPR) or directional thrust-boring.
7. Mid-term inspection by the project arboriculturalist to ensure that protective measures are still in place.
8. On completion of the development removal of temporary protective measures.
9. Tree planting and landscaping mitigation.
10. Post development monitoring if required.

## H.2 Phased tree management and impact mitigation programme.

This is a dynamic document which should be signed off on completion of each phase, as evidence that the work was completed to the correct standard, to minimise residual impacts on trees.

Phase	Action	Input of Arboricultural consultant	Date completed
1 Pre-commencement of any works that would impact on trees	<ul style="list-style-type: none"> <li>• Pre-commencement meeting between site planning team and project arboriculturalist.</li> <li>• There may be a requirement for a further meeting with the LPA tree officer to discuss site mitigation and tree loss due to the presence of protected trees within the site.</li> </ul>	<ul style="list-style-type: none"> <li>• Liaise with LPA tree officer. Discuss whether a site meeting is necessary.</li> <li>• Discuss the design and locations of site tree protection measures.</li> <li>• Discuss details of and the extent of tree management (pruning, crown lifting, bracing etc.).</li> <li>• Ensure correct tree protection measures will be put in place and agree a time frame.</li> <li>• Identify construction exclusion zones, and specific treatments which may be required for tree impact zones (cellular confinement, no-dig areas, thrust-bored services, GPR etc.).</li> </ul>	
2 During works to trees; prior to construction site setup.	<ul style="list-style-type: none"> <li>• Remedial tree management works by an experienced contractor.</li> <li>• Erection of CEZ fencing</li> <li>• Installation of root protection measures in high impact zones</li> <li>• Establish access routes for plant machinery and equipment/ plant holding areas.</li> </ul>	<ul style="list-style-type: none"> <li>• Liaise with site manager prior to commencement of works.</li> <li>• Liaise if necessary on site with arboricultural contractor to review tree works.</li> <li>• Check and photograph CEZ fencing and root impact zones</li> </ul>	
3 During hard and soft landscaping phase	<ul style="list-style-type: none"> <li>• Installation of root protection measures/ cellular confinement/ Cellweb if required.</li> <li>• Installation of new services</li> </ul>	<ul style="list-style-type: none"> <li>• Pre-works meeting with relevant contactors</li> <li>• Supervise soil displacement measures if necessary for new subterranean construction.</li> </ul>	

		<ul style="list-style-type: none"> <li>• Photograph various stages.</li> </ul>	
<p><b>4</b></p> <p>Following completion of development</p>	<ul style="list-style-type: none"> <li>• Removal of CEZ protective fencing</li> <li>• Tree planting</li> </ul>	<ul style="list-style-type: none"> <li>• Ensure fences are removed only once site operations have completely ceased</li> <li>• Check condition and tree species being planted</li> <li>• Liaise with contractor regarding planting methodology, protection measures and post planting monitoring/ management.</li> </ul>	
<p><b>5</b></p> <p>Post development monitoring</p>	<ul style="list-style-type: none"> <li>• Protected trees adjacent to the site boundary to be monitored up to 3 years post development for long term effects of the groundworks on the roots.</li> </ul>	<ul style="list-style-type: none"> <li>• Conduct detailed inspection</li> <li>• Detailed before/ after photography.</li> </ul>	

The precise order and timing of some of these operations may change due to site operating requirements, but all operations that can affect trees will remain under arboricultural supervision.

## H.3 Construction Exclusion Zones

### H.3.1 General

- All trees which are being retained on site should be protected by barriers and or ground protection as specified within this report (Figure 3). Correct dimensions for the positioning of root protection fencing are included within the AIA (Appendix 2) and stated in metres as the RPA radius (as approximately 12 times the diameter of the tree measured at 1.5m from ground level).
- Vertical barriers should be erected and ground protection installed before any materials or machinery are brought onto the site and before any demolition, development or stripping of soil commences.
- Areas of new or retained structure planting should be similarly protected, based on the extent of the soft landscaping as shown on the approved drawings. Once erected, barriers and ground protection should be regarded as sacrosanct, and should not be removed or altered without prior recommendation by an arboriculturalist and approval of the local planning authority.
- In the case of particularly vulnerable trees or trees sited close to the construction access, the owner or developer should make arrangements for an arboriculturalist to supervise necessary works and the erection of protection before the handover of land to the contractor. Pre-development tree work may be undertaken before the installation of tree protection, where required, with the agreement of the local planning authority.

### H.3.2 Barriers

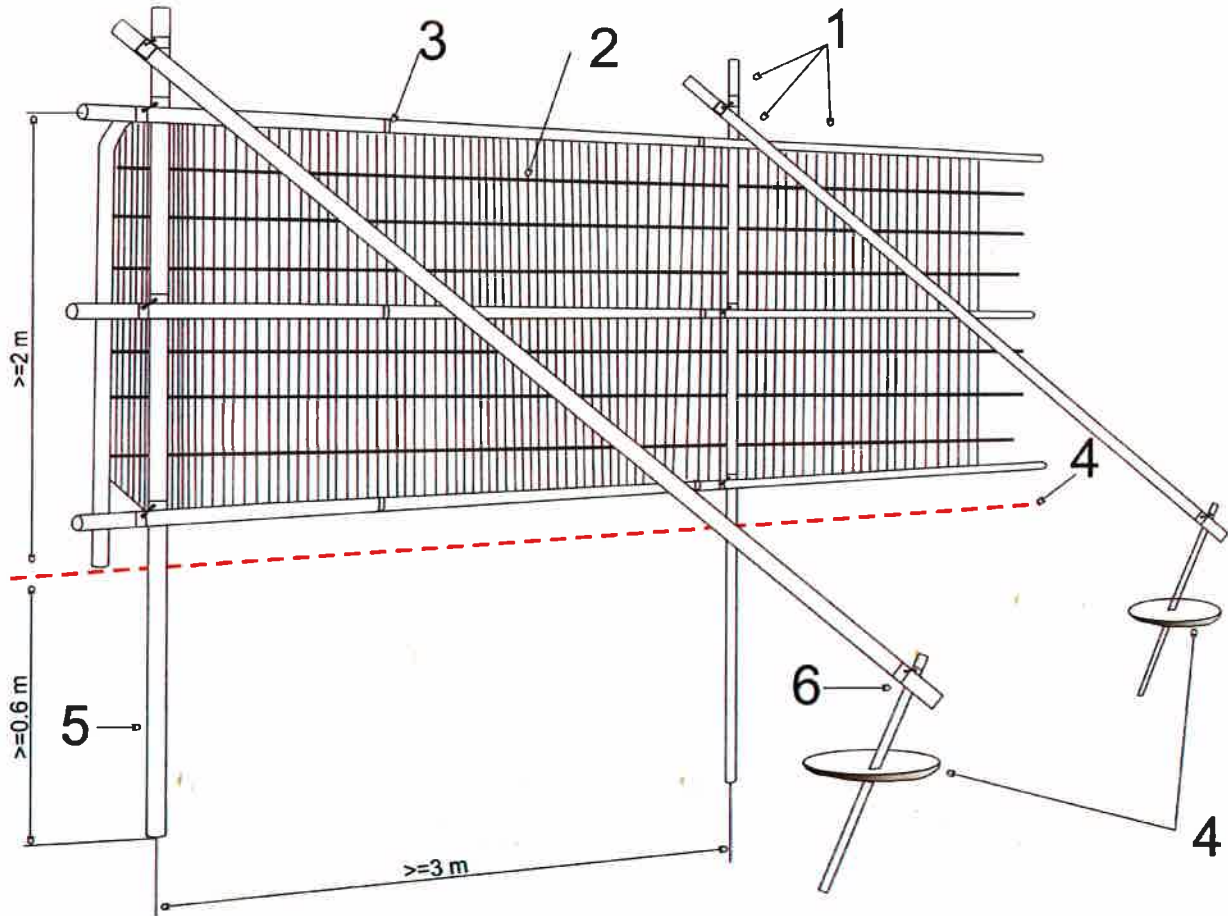
- Barriers should be fit for the purpose of excluding construction activity and appropriate to the degree and proximity of work taking place around the retained tree(s). On all sites, special attention should be paid to ensuring that barriers remain rigid and complete.
- In most cases, barriers should consist of a scaffold framework in accordance with Figure 3 and 4 (below) comprising a vertical and horizontal framework, well braced to resist impacts, with vertical tubes spaced at a maximum interval of 3m. Onto this, Weldmesh panels should be securely fixed with wire or scaffold clamps. Weldmesh panels on rubber or concrete feet are not resistant to impact and should not be used.
- NOTE: The above is preferred because it is readily available, resistant to impact, can be re-used and enables inspection of the protected area.

### H.3.3 Ground protection

- The position of the barrier may be shown within the RPA at the edge of the agreed working zone but the soil structure beyond the barrier to the edge of the RPA should be protected with ground protection. For pedestrian movements within the RPA the installation of ground protection in the form of a single thickness of scaffold boards on top of a compressible layer laid onto a geotextile, or supported by scaffold, may be acceptable (Figure 7).



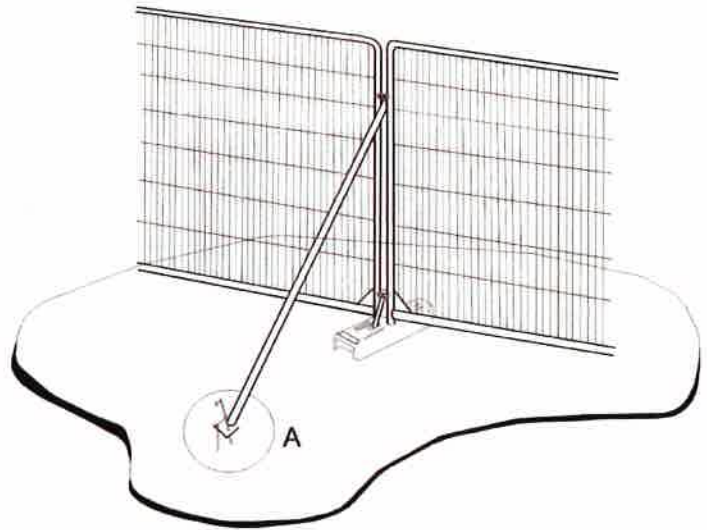
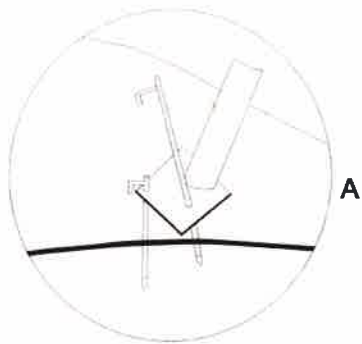
Figure 3 - Default specification for protective barrier. 'Heras' fencing bolted/ wired to a supporting structure as illustrated is the most effective and robust method.



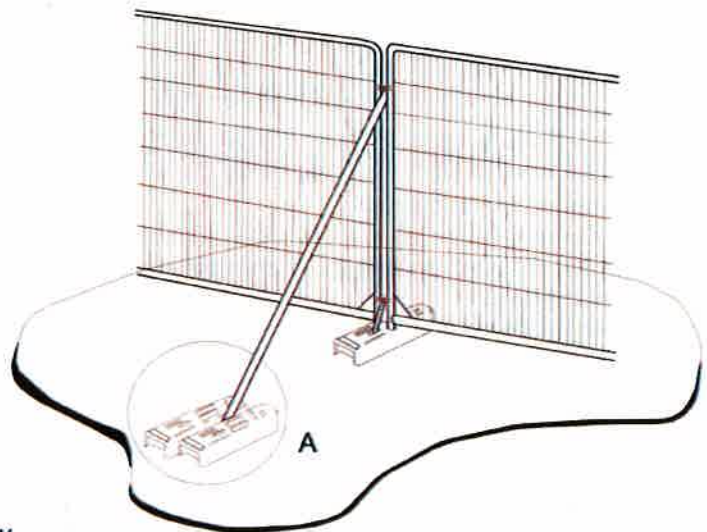
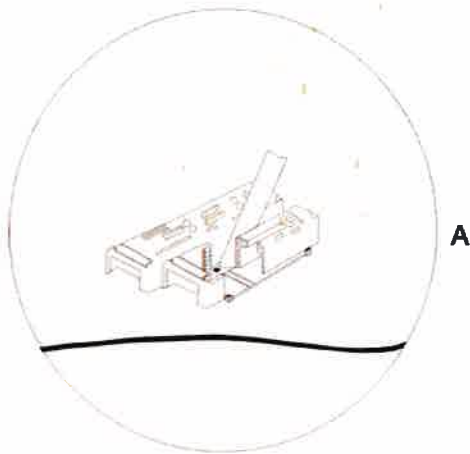
**Key**

- 1 Standard scaffold poles
- 2 Heavy gauge 2m tall galvanized tube and welded mesh infill panels
- 3 Panels secured to uprights and cross-members with wire ties
- 4 Ground level
- 5 Uprights driven into the ground until secure (minimum depth 0.6 metres)
- 6 Standard scaffold clamps

Figure 4 - Examples of above ground stabilising systems.



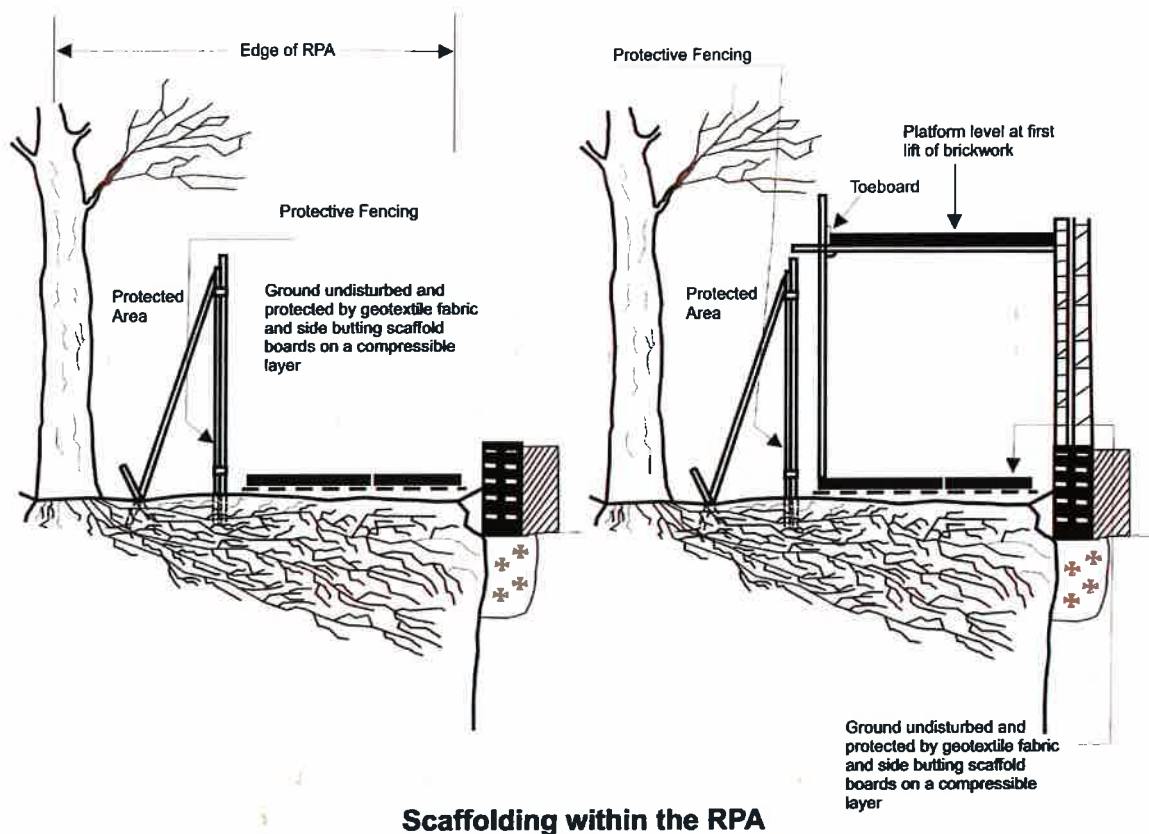
a) Stabilizer strut with base plate secured with ground pins



b) Stabilizer strut mounted on block tray

Figures 5 & 6: Examples of tree protection signage to be permanently attached to the root protection fence.





**Scaffolding within the RPA**

**Figure 7- Use of scaffolding within the RPA**

**Additional precautions outside the exclusion zone**

- Once the exclusion zone has been protected by barriers and/or ground protection, construction work can commence. All-weather notices should be erected on the barrier with words such as (see figures+ 5 & 6):

**“Construction exclusion zone — Keep out”.**

In addition the following should be addressed or avoided:

- Care should be taken when planning site operations to ensure that wide or tall loads, or plant with booms, jibs and counterweights can operate without coming into contact with retained trees. Such contact can result in serious damage to them and might make their safe retention impossible.
- Consequently, any transit or traverse of plant in close proximity to trees should be conducted under the supervision of a banksman to ensure that adequate clearance from trees is maintained at all times. In some circumstances it may be impossible to maintain adequate clearance thus necessitating access facilitation pruning.
- Material which will contaminate the soil, e.g. concrete mixings, diesel oil and vehicle washings, should not be discharged within 10m of the tree stem.
- 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.

- It is essential that allowance should be made for the slope of the ground so that damaging materials such as concrete washings, mortar or diesel oil cannot run towards trees.

#### H.4 Avoiding the damage of structures by trees

##### General

- Buildings should be constructed to allow for future growth of planted or self-sown trees.
- In some situations, trees and vegetation can adversely affect structures either by direct action, or by indirect action causing shrinkage or swelling of a clay subsoil.
- Even if no trees exist at the time of construction, they may be planted in the future or self-seeded. Consideration should be given to this possibility by having foundations in accordance with Table 3, which will allow for reasonable future vegetation, or to an engineered design.

##### Direct damage by trees to structures

Trees can cause direct damage to structures by:

- a. The disruption of underground services and pipelines;
- b. Displacement, lifting or distorting;
- c. The impact of branches with the superstructure;
- d. Structural failure of the tree.

The potential for direct damage should be taken into consideration throughout the design and construction process, as detailed below:

- The growth of the base of the stem or of roots near the surface exerts relatively small forces. Whilst paving slabs or low boundary walls can be lifted or pushed aside easily, heavier or stronger structures are more likely to withstand these forces without damage, as the root distorts around the obstruction before damage occurs. The greatest risk of direct damage occurs close to the tree from the incremental growth of the main stem and secondary thickening of the roots, and diminishes rapidly with distance.
- New tree planting should be kept at distances from structures of at least those in Table 3.
- In the case of established trees where construction work is to take place near to the main stem and roots, the following precautions should be taken to allow for future tree growth in order to protect the structure:
  - a. Foundations should be reinforced to resist lateral thrust; or
  - b. Walls or structural slabs should bridge over roots allowing sufficient clearance for secondary thickening or be designed to distort without cracking; or
  - c. Pavings and other surfaces should be laid on a flexible base to allow movement and to facilitate relaying if distortion becomes excessive.
- Water leaking from damaged drains, sewers or water mains encourages localized root growth. Roots are then likely to enter a drain or sewer through the defect and proliferate, causing blockage and an enlarging of the initial defect. Provided they are further from trees than distances stipulated in Table 3, intact drains are not likely to suffer direct damage and will not attract roots. Damage to drains and sewers can be avoided by the following:
  - a. Re-routing services to conform to Table 3;
  - b. Ensuring watertight joints;

- c. In clay soils, use of flexible materials and/or joints to accommodate movement;
  - d. Not using perforated land drains near trees.
- Allowance should be made for the swaying of stems and branches during storm conditions. Branches which are liable to strike the structure should be pruned back to a suitable branching point. Trees in a condition that renders them liable to collapse should not be retained near structures.

Type of structure	Diameter of stem at 1.5m above ground level at maturity		
	<30cm	(30 – 60) cm	>60cm
Buildings and heavily loaded structures		0.5	1.2
Lightly loaded structures such as garages, porches etc.		0.7	1.5
Drains and underground services < 1m deep	0.5	1.5	3.0
> 1m deep		1.0	2.0
Masonry boundary walls*		0.5 (1.0)	1.0 (2.0)
In situ concrete paths and drives*	- (0.5)	0.5 (1.0)	1.5 (2.5)
Paths and drives with flexible surfaces or paving slabs*	- (0.7)	0.5 (1.5)	1.0 (3.0)
*These distances assume that some movement and minor damage might occur. Guidance on distances which will generally avoid all damage is given in brackets.			

Table 3. Minimum distance (m) between young trees or new planting and structure to avoid direct damage to a structure from future tree growth.

#### H.5 Principles for avoiding tree root damage during construction

- Prior to the installation of a new ground surface, existing ground cover vegetation (e.g. grass sward) should be killed using an appropriate herbicide. Herbicides that can leach through the soil, e.g. products containing sodium chlorate, should not be used. Specialist advice should be sought in order to determine the most suitable herbicide treatment.
- The soil surface should not be skimmed to establish new paving or other surfaces at the former ground level. Loose organic matter and/or turf should be removed carefully using hand tools. The new surface should then be established above the former ground level, using a granular fill, where required.
- If ground levels are to be raised within the RPA this should be achieved by use of a granular material which does not inhibit vertical gaseous diffusion. Examples of suitable granular materials include, no-fines gravel, washed aggregate, or cobbles. Depending on the California Bearing Ratio (CBR) of the soil, it may be necessary to install a load suspension layer such as a cellular confinement system.
- In concentration carbon dioxide is detrimental to tree root function. Because this gas principally diffuses vertically through the soil, new impermeable surfacing within the RPA should be restricted to a maximum width of 3m and situated tangentially to one side of a tree only, or confined to an area no greater than 20% of the root protection area, whichever is the smaller.
- Any excavations which have to be undertaken within the root protection area should be carried out carefully by hand, avoiding damage to the protective bark covering larger

roots. Roots, whilst exposed, should be wrapped in dry, clean hessian sacking to prevent desiccation and to protect from rapid temperature changes. Roots smaller than 25mm diameter may be pruned back, preferably to a side branch, using a proprietary cutting tool such as bypass secateurs or handsaws. Roots larger than 25mm should only be severed following consultation with an arboriculturist, as they may be essential to the tree's health and stability. Prior to backfilling, any hessian wrapping should be removed and retained roots should be surrounded with sharp sand (builders' sand should not be used because of its high salt content which is toxic to tree roots), or other loose granular fill, before soil or other material is replaced. This material should be free of contaminants and other foreign objects potentially injurious to tree roots.

#### **H.6 Provision for water and oxygen**

- 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. New impermeable surfacing should not cover more than 20 % of the root protection area.
- No-fines granular materials should be used wherever fill or a sub-base is required to help to ensure adequate gaseous diffusion. Due to the need to avoid excavation, and thereby root severance, within the RPA such sub-bases should be formed using a cellular confinement system such as a load suspension layer laid at ground level.
- 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. If contamination is likely to be a problem, an impermeable surface may be used to prevent entry of toxic material.
- If excess water is likely to be a problem, consideration should be given to the provision of suitable land drainage. Such drains should not be located within root protection areas.

#### **H.7 Allowance for future growth**

- Future growth can lift paths or distort light structures such as walls. Where such structures, including surfaces, are unavoidable near to trees, design and construction specification should take account of future growth.
- If it is necessary to build a wall or similar structure over a root greater than 50mm diameter, provision should be made for future diameter growth by surrounding the root with un-compacted sharp sand, void-formers, or other flexible fill materials, and by laying an adequately reinforced lintel or raft over the surface.

#### **H.8 Foundations within the RPA**

The insertion of structures within root protection areas may be justified if this allows the retention of a good quality tree (category A or B). However, it is essential that careful consideration is given to foundation design. In such cases, the use of traditional strip footings, in particular those constructed tangentially across the root zone, can result in severe damage to tree roots and should be avoided.

Root damage can be minimised by using a combination of the following:

- Piles or radial strip footings both of which should be located to avoid major tree roots;
- Beams, slabs, suspended floors, where all should be laid at or above ground level, and cantilevered as necessary to avoid tree roots.

In order to arrive at a suitable solution, site specific and specialist advice regarding foundation design should be sought from an arboriculturist and an engineer.

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. The latter is particularly important where piling within the branch spread is proposed, as mini-rigs reduce the need for access facilitation pruning. Sheathed piles protect the soil and adjacent roots from the potential toxic effects of concrete.

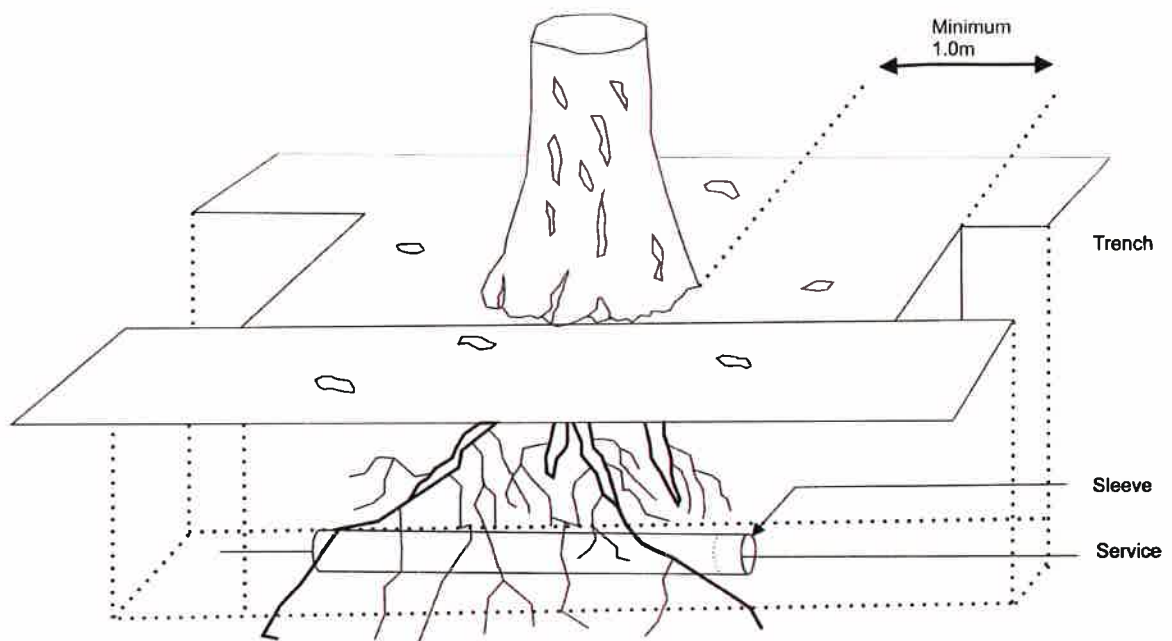
#### **H.9 Underground and above ground services**

Trenching for the installation of underground services severs any roots present and may change the local soil hydrology in a way that adversely affects the health of the tree. For this reason particular care should be taken in the routing and methods of installation of all underground services. Wherever possible, they should be kept together and trenchless techniques used. At all times where services are to pass within the RPA, detailed plans showing the proposed routing should be drawn up in conjunction with an arboriculturist. Such plans should also show the levels and access space needed for installing the services and be accompanied by arboricultural method statements (AMS).

As an alternative to trenchless techniques, a possible solution is to hand excavate a narrow trench passing directly towards a tree along a radius to not closer than 1m from the trunk, tunnel straight beneath the tree, preferably not less than 750mm deep, and exit on the opposite side along another radius (see Figure 6). Provided the trench is kept as narrow as possible, the amount of root severance will be minimal, and will be far less than if a trench passes close beside the tree. It may be necessary to make provision to facilitate future servicing and repair without further damage to the tree roots.

Consideration should be given to the routing of above ground services in order to avoid the need for detrimental and repetitive pruning. In this regard the current and future crown size of the tree should be assessed. Tree branches can be pruned back with care to provide space.





Trenching along radii to minimise damage

Figure 6 Trenching in proximity to roots.

#### H.10 Low-invasive vehicular access in proximity to trees

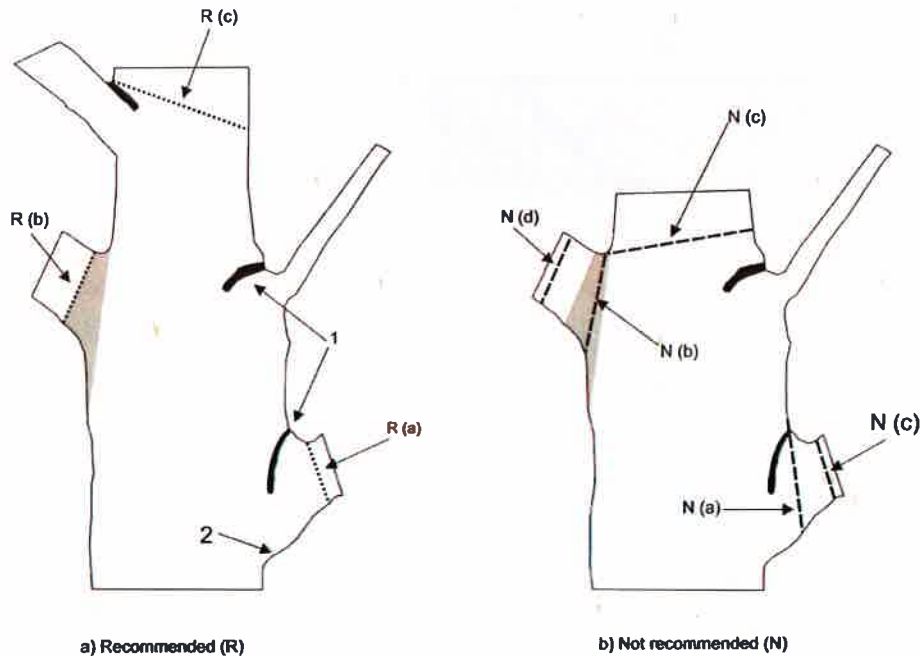
Where the construction of hard surface access cannot be avoided within the root protection area, a no-dig design should be used to avoid root loss due to excavation. In addition the structure of the hard surface should be designed to avoid localized compaction, by evenly distributing the carried weight over the track width and wheelbase of any vehicles that will use the access. Such designs might include the use of a three dimensional cellular confinement system as an integral component of the sub-base, to act as a load suspension layer. Driveways and roadways constructed according to this principle can be designed to be suitable for most types of traffic. Where this type of access is proposed, site-specific and specialist advice should be sought from an engineer and an arboriculturalist in order to ensure that it is fit for purpose.

## I APPENDIX 5: RECOMMENDATIONS FOR TREE WORK

(The following extracts are taken from the BS3998:2010: Tree work recommendations).

### I.1 Pruning

- Pruning cuts should be made to trees being retained as specified above. Removal of sections of limbs before the final target cut at the branch bark ridge will prevent harmful 'tear-offs' down the stem, especially when pruning heavy branches back to the stem.



#### Key

1 Branch bark ridges

2 Branch collar

R (a) Cut where branch collar and branch bark ridge are apparent

R (b) Cut where neither branch bark ridge nor branch collar are apparent

R (c) Position for end-cut in crown reduction—maximum size of cut in relation to size of lateral branch

N (a) Cut too close (removing the branch collar and cutting into the bark branch ridge)

N (b) Cut too close (injuring parent stem in the crotch and too steeply angled)

N (c/d) Cut too far out, leaving a stub (but see C.2, Note 2 for exceptions)

N (e) Incorrect end cut (made beyond a branch that is too small, but see 7.2.4 regarding groups of branches, rather than one branch of a required size)

----- Recommended cut

----- Not recommended cut

■ Basal flare of the branch that does not show a distinct collar or ridge

*NOTE The optimum position and angle of the end-cut cannot be exactly prescribed, as branch unions vary considerably in their formation*

Figure 7 - Branch and target pruning.

- Figure 7. Indicates the correct methodology for branch and target pruning, where the degree of wounding should be controlled according to the ability of the species to react defensively against wounding. Therefore in order to ensure that the potentially adverse effects of pruning are avoided as far as possible, the cross-sectional area of the cuts individually and in total should be minimized.
- Ideally the diameter of the final cut should generally not exceed one-third of that of the parent stem or branch. The maximum diameter of cuts should decline as the age of the tree increases to allow or a slower rate of wound occlusion.
- If a stem or branch union is to be shortened, the cut should be made distal to a union or group of unions where one or more healthy lateral branches bear enough foliage to sustain the parent stem or branch. If there is only one such union near the intended cut, the lateral branch should have as large a diameter as possible (i.e. at least one-third and preferable more than half that of the removed portion).

Size of cut (Ømm).	Maximum recommended approximate number of cuts, for each size in the left hand column (on this basis, no cuts of any other size could be created)
50	48
100	12
150	5
200	3

## **I.2 Tree felling**

Trees should only be felled if their removal or coppicing is assessed as providing the best solution in the circumstances. In making this assessment, account should be taken of:

- 1) The potential impact of exposing retained trees
- 2) The potential for indirect damage, e.g. to underground services or to built structures including archaeological features
- 3) The destabilization of slopes due to removal of support from the roots
- 4) The potential for direct damage caused by either tree felling or stump removal
- 5) The potential for tree failure

Consents might be required from the relevant authority before trees are felled; particularly for protected trees.

A tree should be felled in one piece only when there is no significant risk of damage to people, property or protected species. Where restrictions (e.g. lack of space, buildings, other features, land ownership or use, or other trees which are to be retained) cannot be overcome, trees should be dismantled in sections.

## **I.3 Stumps**

If owing to its location, a stump is considered to be a significant trip hazard or source of a pathogen that could affect retained trees, it should be either removed or destroyed. If there is a delay between felling and stump removal, the stump should meanwhile be left in a condition that leaves the site safe. Destruction of the stump by burning is not recommended.

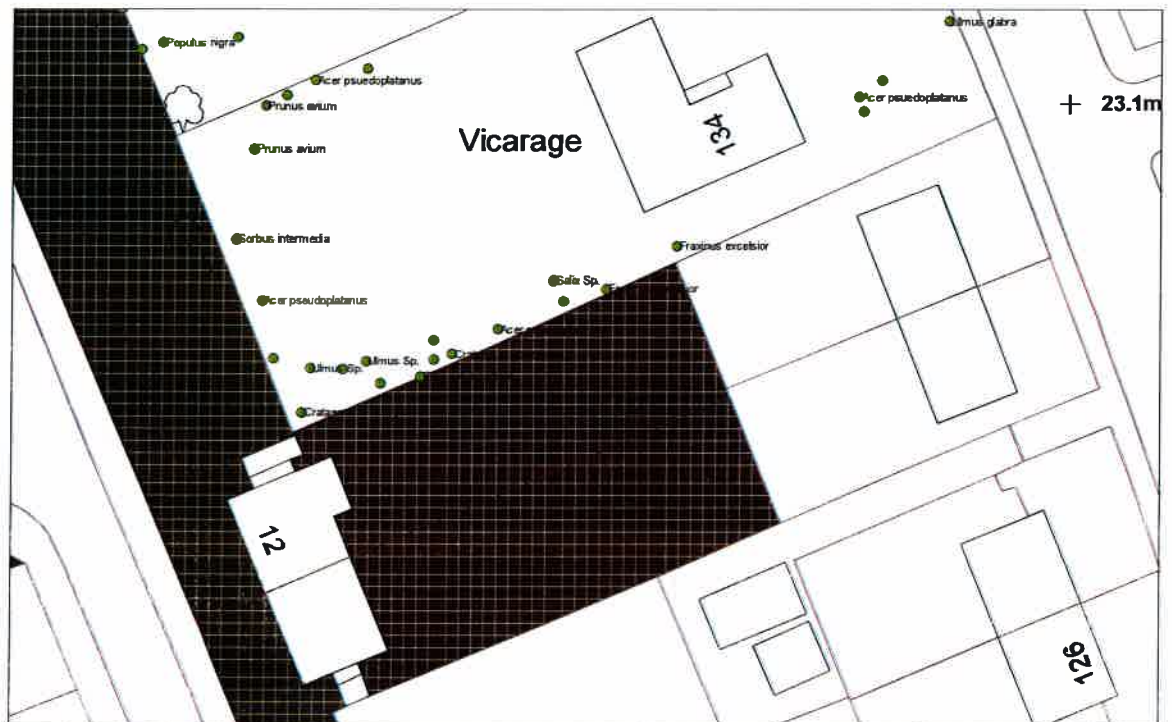
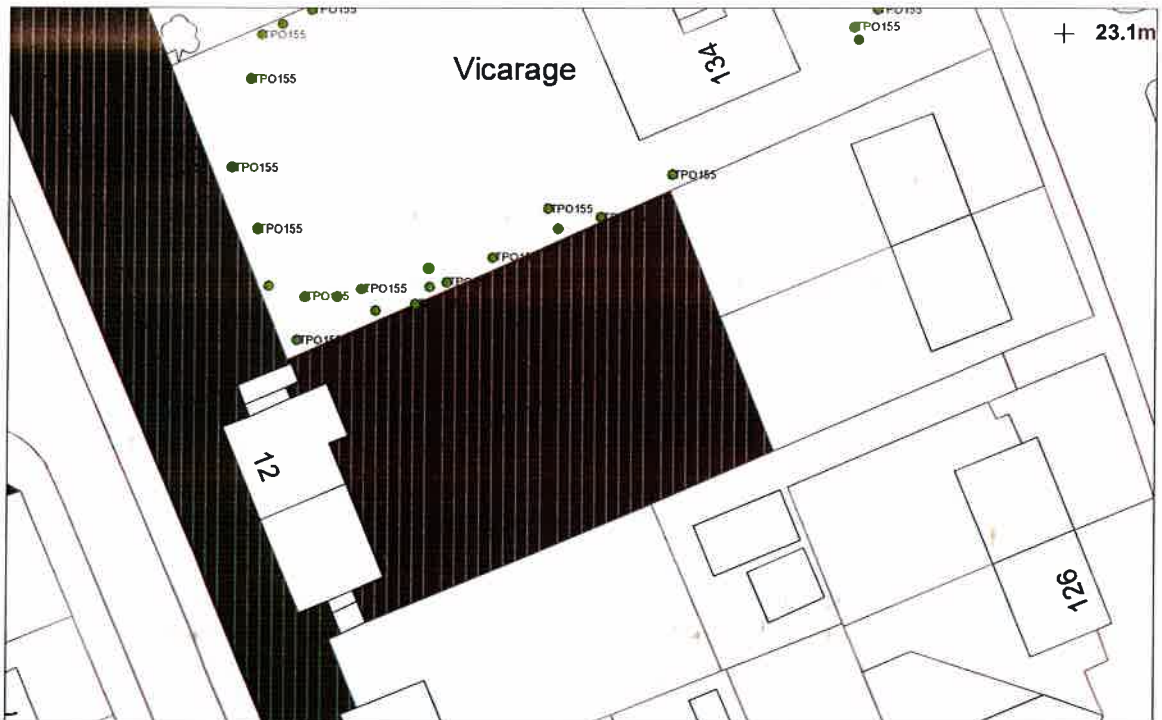
The reason for grinding the stump should be ascertained and the appropriate depth of operation agreed. Stump grinding should normally extend through the base of the stump leaving the major roots disconnected if the intention is to reduce the potential for the spread of honey fungus.

The grinding residue should be treated as arisings.

*Note: mechanical destruction of the stump is less disruptive to the site than digging out.*

J APPENDIX 6: GENERAL LEGISLATION

Area Tree Preservation Order 155



## Trees and the law

### General

Trees in any location may be protected by legislation. Where development is proposed, additional legal protection may be appropriate and can be enforced by the local authority. Attention is drawn to legal controls and liabilities under common law for consideration at the earliest stages of potential site development.

### Legal protection for trees

The Town and Country Planning Act 1990 (as amended) and the Town and Country (Tree Preservation) (England) Regulations 2012 requires that, except in certain circumstances, "no work shall be carried out which will affect trees over a certain size which are situated in **conservation areas**". Six weeks' notice of intent has to be given to the local authority before the work is carried out. This provides an opportunity for the local authority to make a tree preservation order (TPO), under this Act, to protect the trees.

Under section 211 of the Act, anyone proposing to cut down or carry out work on a tree in a Conservation Area is required to give the Local Authority, six weeks prior notice (a section 211 notice). These can be completed online at:

[www.planningportal.gov.uk/planning/applications/howtoapply/permissiontypes#Notificationofproposedworkstotreesinconservationareas](http://www.planningportal.gov.uk/planning/applications/howtoapply/permissiontypes#Notificationofproposedworkstotreesinconservationareas)

The Section 211 notice must set out clearly what work is proposed. A proposal just to 'top' or 'lop' a tree would not be acceptable because there are many different ways to 'top' or 'lop' a tree. If there are many trees on the site, it is usual to provide a scaled plan of the site including the extent of any proposed development constraints (if applicable).

Further guidance is available at:

<http://planningguidance.planningportal.gov.uk/blog/guidance/tree-preservation-orders/how-are-trees-protected-in-conservation-areas/what-is-the-decision-making-process-for-tree-protection-in-conservation-areas/what-form-should-a-section-211-notice-take/>

People are not required to submit a section 211 notice to the local planning authority for:

- The cutting down, topping, lopping of a tree whose diameter does not exceed 75mm; or
- The cutting down or uprooting of a tree, whose diameter does not exceed 100mm, for the sole purpose of improving the growth of other tree.

Tree preservation orders allow for trees to be protected either as individuals, groups, areas or woodlands. The orders have the effect of preventing the cutting down, topping, lopping, uprooting, willful damage or willful destruction of trees, except in certain circumstances, other than with consent of the local authority.

Even when no specific legal protection exists, it may be necessary to obtain a felling licence. These apply if the volume of timber exceeds specified amounts; site clearance, even of small areas, before detailed planning permission has been granted could exceed the felling licence quota. The Forestry Commission, under the Forestry Act 1967 (as amended) administers felling licenses.

### Legal protection for trees on development sites

Section 197 of the Town and Country Planning Act 1990 states "it shall be the duty of the local planning authority to ensure, whenever it is appropriate, that in granting planning permission for any development adequate provision is made, by the imposition of conditions, for the

preservation or planting of trees". It also states that "it shall be the duty of the local planning authority to make such orders under section 198 [of the Act] as appear to the authority to be necessary in connection with the grant of such permission."

It is usually appropriate for a tree preservation order to be placed on trees that are in amenity situation and structurally sound. The effect of proposed development on trees protected by tree preservation order ranks as a material consideration, which should be considered by the local authority, when determining a planning application under section 70 of the Town and Country Planning Act 1990.

Where a tree preservation order exists prior to planning permission being granted it should not normally be a block to effective use of a site. It serves to deter damage to or clearance of trees prior to planning permission being granted and provides a means of enforcing their protection during development work.

When planning permission is granted, planning conditions may be imposed to provide for the erection of protective fencing and other measures for ensuring the well-being of trees during development.

**NOTE It is considered inappropriate for planning conditions to be used to provide long-term protection to trees when tree preservation orders are available as a specific provision for this purpose.**

Where circumstances require it, local authorities should apply a planning condition requiring the developer to appoint an arboriculturist to oversee the project. This person has a duty to monitor and confirm the implementation and maintenance of tree protection measures, as agreed with the local authority. Planning conditions may be imposed requiring tree planting to be undertaken as part of a project, and a tree preservation order can be made to apply to such trees once they have been planted so as to achieve their long term protection.

The consent of the local authority is not needed to carry out work on trees required to enable a person to implement a planning permission. Felling and further works cannot be said to be required when planning permission has been given on an outline application only, nor when development is exempt from planning control.

#### Enforcement of protection during development

- The effectiveness of measures to protect trees and ensure their healthy survival through development depends on co-operation between site owners, developers, contractors, arboriculturists and local authorities.
- If the local authority considers that there has been a breach of planning conditions that provide for the protection of trees, it can serve an "enforcement notice"; if necessary this can be followed by a "stop notice" (Town and Country Planning Act 1990, sections 172, 183, 184);
- *Planning policy guidance note 18*
- *Enforcing planning control [19]; DoE Circular 10/97— enforcing planning control: Legislative provisions and procedural requirements*). When considering the need for such enforcement, local authorities should consider that trees can be damaged very easily and that survival of trees is most likely to be achieved by maintenance of protection at all times.

## Common law claims and litigation concerning trees

### J.1.1 General

Problems caused by trees on development sites can result in disputes giving rise to common law claims and litigation. Such problems are particularly likely where trees grow across boundaries between properties and cause damage to the property of a third party. For instance, root activity can affect structures other than those on the development site. The crowns, stems and roots of trees may have structural weaknesses, which if they fail, could result in damage to property or injury to people. Leaves and fruit falling from trees, obstruction of light and problems of poisonous plants have all been considered by the courts. Legal advice should be sought where trees may become a problem.

Careful planning and design should minimize the possibility of litigation after completion of the development.

### Planting adjacent to boundaries

Problems with trees on or close to boundaries have resulted in litigation on many occasions, and the rights and responsibilities of tree owners and their neighbors are, in this respect, well documented in law. The government has published guidance on high hedges (*Hedge height and light loss* — ODPM, 2002) which advises on reasonable standards for evergreen hedges in domestic gardens. Careful consideration of new planting to anticipate both the likely encroachment of roots or overhang of branches of the fully grown tree relative to the site boundary can prevent potential future conflict, while the possibility of direct mechanical damage to boundary fences and walls can be avoided by allowing room for growth and movement.



## K APPENDIX 7: PROTECTED SPECIES AND TREES

### Wildlife and Habitat Considerations

Paragraph 47 of Planning Policy Guidance Note 9: Nature Conservation [18] states that "the presence of a protected species is a material consideration when a local planning authority is considering a development proposal which, if carried out, would be likely to result in harm to the species or its habitat".

Where bats are found to be present consultation needs to be carried out with the Statutory Nature Conservation Organization i.e. Natural England.

#### Bats in trees

Trees provide habitat for bats in the form of roost sites, maternity roost sites and hibernacula. As a habitat, trees provide foraging for bats, being a medium for invertebrates, and provide three dimensional feeding corridors to and from roosting sites.

The following should be considered when carrying out any works to the trees.

All bat species are specially protected under the Conservation of Habitats and Species Regulations (2010) and under Schedule 5 of the Wildlife and Countryside Act of (1981) (as amended).

As a result it is illegal to:

- Deliberately kill, injure or capture bats.
- Deliberately or recklessly disturb bats.
- Deliberately or recklessly obstruct access to a bat roost.
- Damage or destroy a bat roost.

Fines of up to £5000 *per bat* affected and confiscation of vehicles used can be imposed for deliberate or reckless disturbance of bats or damage to a roost site.

If works risk recklessly harming bats then the police can order all construction/renovation work to cease until the issue is properly addressed.

If bats are found at any time during the work E3 Ecology (01434 230982) should be contacted immediately.

#### Nesting/ Breeding Birds

Habitats on site are likely to provide a suitable nesting and foraging resource for birds.

- The early mature to mature trees on site are almost all suitable as nest sites.
- Ornamental planting in conjunction with the trees may provide foraging opportunities in the form of berries and invertebrates.

Under the provisions of the Wildlife and Countryside Act of (1981) (as amended) it is illegal to knowingly disturb any nesting bird during the breeding season.

#### Nesting/ breeding mammals

Trees provide vital nesting sites for native arboreal mammals (such as red squirrel and wood mouse), with a contiguous canopy providing an aerial highway to and from foraging sites, providing cover from predators. These factors need to be considered in any landscape design.

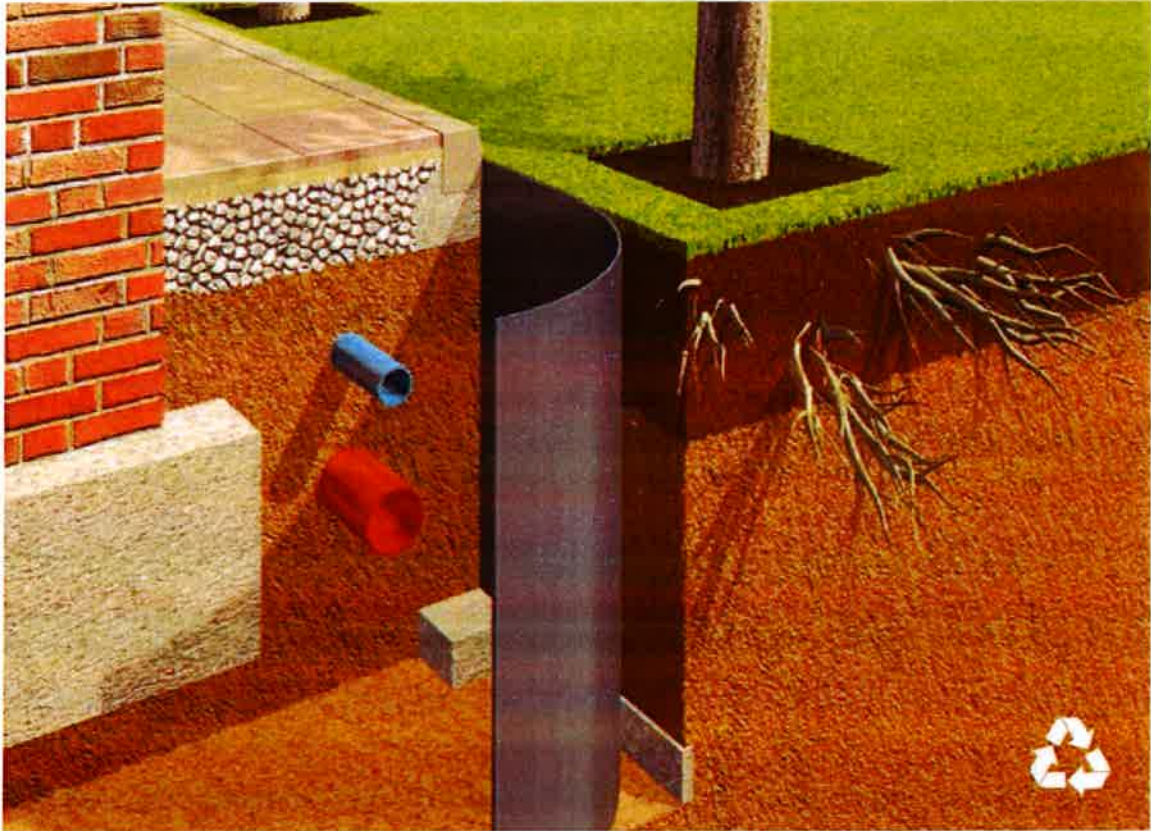
Red squirrel are protected under the provisions of the Wildlife and Countryside Act of (1981) (as amended).

## L APPENDIX 8: Root blocker membrane

Courtesy of Greenblue Urban, 2015

RER2000

PRODUCT GUIDE



## RER2000

### Linear root management

**Includes:**

- Product information sheets
- Technical data sheet



4358 TPP R04  
©E3 Ecology Ltd.

# ReRoot 2000

## DEEP APPLICATION ROOT BARRIER

**ReRoot 2000** is a high strength root barrier for deeper applications. This product has been used extensively on many projects around the UK, particularly in new service infrastructure projects, business parks and housing developments.

**ReRoot 2000** is rigid enough to hold its form when placed into a trench. This is a big advantage as it will not be dragged downward during backfilling. Market leading puncture resistance and strength, mean that this is the root barrier of choice for specifiers and utility companies requiring root free service corridors.



### BENEFITS

- Resistant to puncture by sharp objects or tearing as a result of soil movement.
- Durable, resistant to biodegradation and photodegradation.
- Easy to install, no specialist equipment needed.
- Available in standard 0.3m, 0.6m, 1.0m, 1.5m and 2.0m depth rolls up to 6 metre deep rolls to special order.
- Supplied in roll form and cut to order in 10m increments to minimise waste.
- Effective in the control of Japanese Knotweed and other invasive plants.
- Manufactured from 100% recycled material.

Important - Please read these instructions fully before starting assembly  
For further help telephone our technical helpline on 01424 433233

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# ReRoot 2000

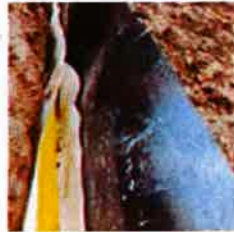
## DEEP APPLICATION ROOT BARRIER



ReRoot 2000 can be used to keep tree roots from damaging services and paved areas



ReRoot 2000 installed to protect hard surfaces at Granton, Edinburgh



ReRoot 2000 will hold its form in a trench excavation. This makes installation quick and easy. Also visible is land drain to remove groundwater pressure



ReRoot 2000 has been installed prior to topsoiling in this infrastructure project

### Typical Installation Specification

Install ReRoot 2000 (including relevant product code) linear root barrier as follows:

Excavate narrow trench between the tree and the structure to be protected. Please note, the positioning of the trench will depend on tree species and other site conditions. Please consult a qualified arboriculturist.

The barrier should be positioned in the trench against the side of the trench nearest the tree. Any sharp objects should be removed from the trench walls and the backfill material.

ReRoot 2000 roll ends can be joined by overlapping at least 500mm and securing both sides with GreenBlue Urban root barrier jointing tape. For critical applications the material can be seam welded.

Ensure that the top of the barrier finishes at least 10mm above finished soil levels tree side, to avoid subsequent root over growth. This barrier can be trimmed using a sharp knife. Backfill the trench in layers, compacting carefully.

It may be desirable, depending on site conditions, to encapsulate the top edge of the barrier in concrete haunching to protect the barrier and to finish the installation tidily.

Important - Please read these instructions fully before starting assembly  
For further help telephone our technical helpline on 01424 433233

2

## ReRoot 2000 (1mm thick)

High strength root barrier

### TYPE

Flat

### CODE

RER210

### SIZE

Thickness: 1mm

Width: RER210X0.3A 300mm

RER210X0.6A 600mm

RER210X1.0A 1000mm

RER210X1.5A 1500mm

### ROLL SIZE

100LM

### MATERIAL

Recycled HDPE

### FINISH

Natural

### COLOUR

Black

### WEIGHT

1.0kg per m<sup>2</sup>

### MATERIAL CHARACTERISTICS

PROPERTIES	ISO	VALUE
<b>PHYSICAL</b>		
Density	g/cc	0.97
Shrinkage	%	2.5 – 3.0
Melt Flow (190°C/5kg)	g/10min	< 0.8
<b>MECHANICAL</b>		
Izod Impact, notched,	kJ/m <sup>2</sup>	> 13
		> 10
Stress at yield	MPa	23-26
Stress at break	MPa	28-30
Strain at break	%	> 600
Flexural Modulus	MPa	950 – 1100
Shore D hardness		60-63
<b>THERMAL</b>		
VST@10N (VST/A)	%	115-130
HDT@0.45MPa (HDT/B)	°C	73-80

Important: Please read these instructions fully before starting assembly  
For further help telephone our technical helpline on 01424 433233

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## ReRoot 2000 (2mm thick)

High strength root barrier

### TYPE

Flat

### CODE

RER220

### SIZE

Thickness: 2mm

Width: RER220X1.0A 1000mm

RER220X1.5A 1500mm

RER220X2.0A 2000mm

### ROLL SIZE

100LM

### MATERIAL

Recycled HDPE

### FINISH

Natural

### COLOUR

Black

### WEIGHT

2.0kg per m<sup>2</sup>

### MATERIAL CHARACTERISTICS

PROPERTIES	ISO	VALUE
<b>PHYSICAL</b>		
Density	g/cc	0.97
Shrinkage	%	2.5 – 3.0
Melt Flow (190°C/5kg)	g/10min	< 0.8
<b>MECHANICAL</b>		
Izod Impact, notched,	kJ/m <sup>2</sup>	> 13 > 10
Stress at yield	MPa	23-26
Stress at break	MPa	28-30
Strain at break	%	> 600
Flexular Modulus	MPa	950 – 1100
Shore D hardness		60-63
<b>THERMAL</b>		
VST@10N (VST/A)	%	115-130
HDT@0.45MPa (HDT/B)	°C	73-80

Important - Please read these instructions fully before starting assembly  
For further help telephone our technical helpline on 01424 433233

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## M APPENDIX 9: TERRAM GEOCELL



### GEOCELL FOR TREE ROOT PROTECTION

MIS 456 Issue 3, Feb 2012

## SPECIFICATION & INSTALLATION GUIDANCE



#### TERRAM GEOCELL CONFINEMENT SYSTEM FOR TREE ROOT PROTECTION

Terram Geocell is a geocellular sub-base confinement system designed for the protection of tree roots where the construction of roads, car parks and access routes are required in the vicinity of trees and where Tree Preservation Orders (TPO) may be enforced. The structure confines and stabilises the sub-base stone ensuring that vehicle loads are dissipated, rutting and soil compaction is prevented and damage to tree roots is avoided. When installed as advised, Terram Geocell will also allow the continued passage and circulation of air, water and nutrients to tree roots to sustain a healthy growing environment as recommended by the following 2 documents:

- British Standard BS5837: 'Trees in Relation to Construction' (2005).
- Arboricultural Advisory and Information Service: Practice Note 1 – 'Driveways Close to Trees' (APNI)

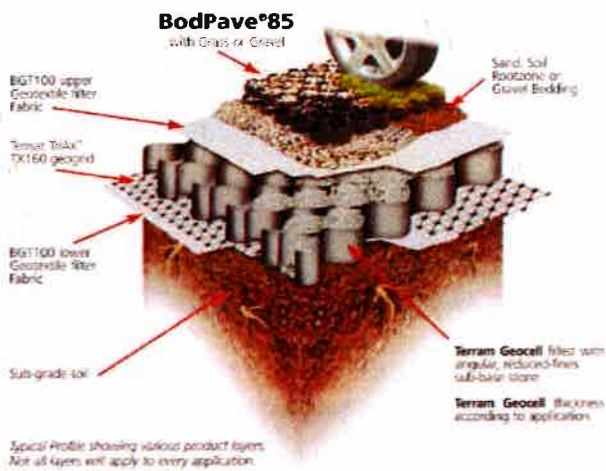
Tree Root Protection is supplied flat packed and opens to form a strong geocellular structure. It is simply pinned in place using metal fixing pins as described.

In this type of 'Reduced-Dig' or 'No-Dig' Tree Route Protection application, Terram Geocell is intended for use in conjunction with a water and gas permeable SuDS (Sustainable Drainage System) compliant pavement surface product such as BodPave®85 cellular plastic paving, Concrete Porous Block Paving or Porous Asphalt surfacing. Although Terram Geocell can be used by traffic in isolation for a very limited period when filled, it is not advised that Terram Geocell is used as the permanent surface finish for vehicle access routes. Exceptions may arise where Terram Geocell is installed as a temporary haul road for example on a site access route and may be removed and disposed of or fully re-surfaced after use. Refer to installation method details for further information.

#### GENERAL INSTALLATION ADVICE FOR ALL APPLICATIONS

Prior to commencing works it is advisable to seek the professional opinion and approval of the Local Planning Department and Arboriculture Officer. Specific design limitations may be determined by Tree Officers, Engineers or Planners and must be closely adhered to. All applications will vary according to the site conditions and specific tree species involved. The ground and tree roots within the tree root protection zone must be protected from compaction and damage at all stages of the construction works. Works may involve varying degrees of excavation or build-up where edge retention is required, which must avoid root damage and soil compaction. The use of mechanical equipment or even low ground pressure machinery in the tree root protection zone must be avoided and hand tools may be the only method of excavation close to the root system.

#### Typical Profile



#### SPECIFICATIONS

PRODUCT	PANEL SIZE	CELL DIAMETER & DEPTH	PANEL WEIGHT	MATERIAL	LOADING APPLICATION	PART No.
Geocell® 250/100	5m x 7m	250mm x 100mm	18kg	Non-woven Polypropylene	Pedestrians	051397
Geocell® 250/150	5m x 7m	250mm x 150mm	25kg	Non-woven Polypropylene	Cars/Light vehicles	051403
Geocell® 220/200	5m x 3m	220mm x 200mm	20kg	Non-woven Polypropylene	HGV's	051380

PRODUCT	MATERIAL	SIZE	UNIT	PART No.
Fixing U-Pin	Steel rod	550mm long x 8mm dia.	Each	082834

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## INSTALLATION METHOD FOR PERMANENT ACCESS ROUTES AND CAR PARKS

1. Obtain the approval of the local Planning Department and Arboriculture Officer that this method of construction is appropriate and acceptable for the application and to determine the limits of construction and proximity to the tree.
2. Prepare the site by carefully removing all debris and reducing surface levels to the allowable reduced dig as appropriate to the specification, whilst strictly avoiding soil compaction and tree root damage. Build-up directly on the existing surface levels may be necessary.
3. Ensure that the prepared surface is reasonably even and fill any localised depressions with sharp sand to achieve an even surface profile. Do not roll or consolidate the area.
4. Install tapered timber edging boards or other approved edge retention to the perimeter of the construction zone as appropriate to the total layer profile thickness. Avoid damage to tree roots when placing fixing posts and pegs. Concrete kerbs are unlikely to be appropriate or allowed.
5. Install a layer of BGT100 Geotextile Fabric across the site, overlapping adjacent rolls by a minimum of 150mm. It may be necessary to lightly pin the Geotextile in place until the overlying layers are installed.
6. An optional layer of Tensar TX150 'InAx' Geogrid may be required at this stage, possibly determined by the site soil strengths (i.e. weak CBR% strength), the proposed application and applied load such as HGV's. In some cases the TX150 layer may also aid the reduction of the required layer thickness of Terram Geocell where an extremely limited allowable excavation or build-up has been approved. Place the Geogrid layer over the Geotextile Fabric layer and fix down using steel pins to hold flat. Overlap adjacent rolls by minimum 150mm. Avoid tree root damage and soil compaction.
7. Open out and lay the specified layer thickness of Terram Geocell (100mm/150mm/200mm deep) and pin in place between the edging boards. It may be necessary to cut the Terram Geocell to size using a sharp knife or it can be left excess and folded up against the edging if preferred.
8. Pin the Terram Geocell in place using Steel Fixing Pins or similar approved. The pins are generally used to maintain the cells in an open and fully expanded position whilst the cells are being filled and also to stop the structure from being pushed up by migrating aggregate during the filling process. Pin spacing will vary according to the site conditions, but will generally be required at 1m - 2m centres on flat surfaces, mainly placed around the perimeter of the area and where adjacent sections of Terram Geocell abut each other, with less in the middle of the area. Drive the pins in so that they are just touching the top of the cells but do not compress the fabric. Avoid tree root damage during the pining process.
9. Fill the Terram Geocell, working toward the tree from the furthest point away and using the filled Terram Geocell as a platform. The cells must be filled with clean, open graded angular aggregate, normally in the particle size range of 5mm - 45mm. Not single sized or rounded aggregate. The project engineer may determine alternative fill materials such as clean 4/20 or 4/40 stone or a reduced-fines DoT Type 1X sub-base. It is not acceptable to use a standard DoT Type 1 Sub-base within the cells for tree root protection. Do not roll the surface, a light vibratory compaction plate (whacker) may be permitted to settle the stone into the cells, seek advice from the specifier or Tree Officer on this detail. Do not contaminate the filled cells with site debris, soil or mud.
10. Install the permeable pavement layer/wearing course i.e. BodPave®85, Brock Paving, Porous Asphalt, on top of the Terram Geocell according to the manufacturers recommendations. Each porous pavement layer will have a specific design layer requirement, therefore where a sand or sand/soil bedding layer is specified or a contaminant filtration layer is required, then a layer of BGT100 Geotextile Fabric shall be placed above the Terram Geocell prior to the pavement bedding layer being installed and finished according to manufacturers instructions. The Geotextile will stop the pavement bedding layer from migrating down into the aggregate voids within the Terram Geocell.

For installation recommendations for BodPave®85 cellular paving for Grass & Gravel, refer to BodPave®85 Specification and Installation Guidance Notes. For all other pavement layer products, refer to the specific manufacturers' guidance.

## INSTALLATION METHOD FOR TEMPORARY ROADS AND SACRIFICIAL PAVEMENT LAYERS IN HAUL ROADS

In some applications Terram Geocell may be installed as a temporary haul road base and completely removed after use. Alternatively it may have a sacrificial stone layer placed over it which is removed and replaced with a permanent permeable pavement solution when use of the haul road is complete.

1. Obtain the approval of the Local Planning Department and Arboriculture Officer that this method of construction is appropriate and acceptable for the application and to determine the limits of construction and proximity to the tree.
2. Apply all construction detail as for items 2 to 9 above for Permanent Access Routes.
3. Place a layer of BGT100 Geotextile or greater strength Geotextile (i.e. Tensar 2000) onto the Terram Geocell surface. The geotextile grade will be determined by the specific site design criteria and degree of haul road traffic proposed. This layer will be removed and replaced later if a porous pavement surface is being installed on the Terram Geocell.
4. Place a minimum 100mm thick layer of either clean graded stone or DoT type 1 sub-base stone onto the surface. This will be the sacrificial pavement layer to be removed later. Aggregate specification will be determined by the project manager.
5. During use of the access route, routinely check for erosion of the surface and repair with stone as required to avoid exposure of the geotextile.
6. After the haul road use is completed, remove the sacrificial layer of stone and geotextile and replace with the preferred permeable pavement layer in accordance with manufacturers recommendations. Alternatively remove the entire construction profile to return the site to its original status. It is critically important to avoid contamination of the remaining layer of open-graded stone within the Terram Geocell where partial removal is carried out and at all times to avoid damage to tree roots and soil compaction during removal and disposal of the construction layers.
7. Where complete removal of Terram Geocell is required, seek the specifiers' advice on renovation and restoration of the landscaped surfaces within the tree protection zone.

### Typical Profile Construction



### Other useful notes on Tree Root Protection

- In most applications the total porous pavement area should not exceed 20% of the tree root protection area.
- It is advisable to seek an Engineers advice on the required Terram Geocell layer thickness related to local soil strengths and proposed traffic loadings.
- Soil compaction will severely affect the trees ability to take up water and oxygen; similarly, raising soil levels around trees will deprive roots of oxygen and cause stress and dieback.
- In most cases 80% - 90% of a trees root system are in the upper 1m of soil and the small fibrous tree roots are the most important to a trees health. The fine roots enable transport of oxygen, water and nutrient to the tree via the larger roots which also anchor the tree and provide stability. Severing only a small proportion of the fine surface root structure can severely affect the tree, causing stress, dieback and loss of stability.
- CBR% Strength = California Bearing Ratio = a measure of subgrade soil strength.

### Further Reading

- British Standard BS5837 1991 / 2005 - Trees in Relation to Construction - Recommendations
- Arboricultural Advisory and Information Service Practice Note 1 - "Driveways Close to Trees" (APN1)
- "Tree Root Systems" (M. Dobson 1995) - Arboricultural Research Information Note 130IARB95.
- "Driveways Close to Trees" (M. Dobson / D. Paton 1996) - Arboricultural Practice Note 1.
- "Guidance for Trees: Conflict or Complement?" (R. Nicholson 2001) - Arboricultural Journal No. 25.

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