Hillside Trees Ltd.
Arboricultural Consultancy

Arboricultural Impact Assessment

Arboricultural Method Statement

Tree Protection Plan

THE STABLES, TANHOUSE LANE, YATE, BRISTOL, BS37 7LP

On behalf of

Matthew Rushent

Prepared by

Alister Rankine BSc (Forestry); Tech Cert (Arbor A), ProfArborA
Arboricultural Consultant

December 2023

Version No	Checked by	Date
1.1	SR	14/12/2023

Arboricultural ASSOCIATION
Professional Member

EXECUTIVE SUMMARY

Proposed Development:
Construction of 3No. new detached dwellings with associated access and parking

Number of existing trees on site to be retained and protected:
3

Number of off-site trees to be retained and protected:
9

Tree Protection:

- Tree protection barriers and site notices
- Existing hard surfacing
- Temporary ground protection

Construction of access drive and parking spaces:

- Cellular confinement system

Installation of Drainage:

- NJUG4
- Monitoring by Project Arboriculturalist

1.0 Introduction

1.1 Brief

This report is prepared by Hillside Trees Ltd on behalf of Matthew Rushent.

1.2 Purpose of the Report

1.2.0 This report is intended to accompany a planning application relating to proposed development at The Stables, Tanhouse Lane, Yate. This document has been produced to demonstrate that the implications of the proposed development in relation to the arboricultural and landscape value of the trees on the site have been fully considered during the detailed design process.

1.2.1 This report and the accompanying information is supplied in order to:

- Identify trees to be retained and requiring protection during the site preparation and construction phase of the project.
- Present information regarding the location of protective barriers (Construction Exclusion Zones) and temporary ground protection on a Tree Protection Plan.
- Identify special engineering measures
- Provide a Detailed Arboricultural Method Statement for the recommended works related to trees to be retained during and after the development.

1.3 Documents Provided to Hillside Trees Ltd.

- Topographical Survey
- First Fox Architecture Drawing No.200 - Proposed Site Plan October 2023
- TJ Infrastrusture Drawing Nos. D-001 P02 – Drainage Layout
- TJ Infrastrusture Drawing Nos. D-002 P02 – Drainage Model
-

1.4 Tree Survey Methodology

1.4.1 A tree survey was undertaken on 5th October 2023 by an Arboricultural Consultant of Hillside Trees Ltd.

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1.4.2 The survey took place from ground level aided by the Visual Tree Assessment method (Mattheck and Breloer, 1994).

1.4.3 This survey is not a tree risk assessment but takes into account any observed structural defects of the trees in order to inform conclusions with regard to their retentive worth.

1.5 Data Collection

1.5.1 Data collected includes designated tree number, tree species, height, number of stems, stem diameter, crown clearance (height of periphery of crown spread above ground level), branch spread (to N, S, E and W), age class, physiological condition, useful life expectancy, tree structural condition, site notes (where this has a bearing on the present or future health or structural condition of the tree), and tree category.

1.6 Presentation of the Data Collected

1.6.1 Data collected regarding individual trees are presented in the Tree Schedule table in Appendix A in accordance with BS5837:2012 'Trees in relation to design, demolition and construction – Recommendations'. The tree schedule also gives scientific names for all trees mentioned in the report.

1.6.2 The data significant to the proposed site layout is also presented on the Tree Protection Plan Drawing Number 231120-TS-TPP-Rev B-SD contained within the Detailed Arboricultural Method Statement (Appendix B).

1.6.3 All other relevant data are presented within the main body of this report.

1.6.4 Trees have been allocated an individual tree number. This tree number is used to identify individual trees throughout this report, within the Tree Schedule and on all plans presented in the appendices of this report.

2.0 Arboricultural Constraints

An assessment of the trees surveyed presented in the Tree Schedule table in Appendix A, is also considered in the main body of the report below.

An Arboricultural Impact Assessment Plan has been produced showing the root protection areas (RPAs) for the individual trees identified in the Tree Schedule (Appendix A). This represents the minimum area in m^2 which ideally should be left undisturbed around each tree were it to be retained. The RPA has been calculated in accordance with Section 4.6 of BS5837:2012 'Trees in relation to design, demolition and construction – Recommendations'.

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The Arboricultural Impact Assessment Plan also shows a representation of the crown spread of each tree measured in four cardinal directions.

The preparation of the Arboricultural Impact Assessment Plan described above has assisted in the design of the site layout through presenting the above and below ground constraints posed to the development of the site by the trees present.

2.1 Trees Identified for Retention and Removal

The proposed development involves the construction of 3No. new detached dwellings with associated access and parking

The following on site trees will be retained

Tree no	Common name	Total
T1	Norway spruce	1
T2, T3	Oak	2
	Total number retained	**3**

No trees will be removed:

2.2 Trees Outside Site Boundary

The following trees outside the site boundary are affected within the current proposals:

Tree no	Common name	Total
T4, T5, T6, T8, T11	Ash	5
T7	Oak	1
T9, T10	Copper beech	2
T12	Elm	1
	Total number	**9**

3.0 Tree Protection

The trees to be retained on and adjacent to the site during and after development as listed in Sections 2.1 and 2.1 will require protection.

Protection measures based on the RPA's presented in the Arboricultural Impact Assessment Plan, will involve the erection of tree protection barriers as discussed in the Detailed Arboricultural Method Statement (Appendix B). Where the proposed site layout requires the breaching of these

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ideal areas, measures are recommended in order to minimise the damage to the roots and the root environment of the tree in question. Such measures acknowledge the fact that the extent, distribution and actual position of roots of a tree within the RPA are not known.

The tree protection barriers are illustrated in the Tree Protection Plan contained within the Detailed Arboricultural Method Statement.

REFERENCES

Mattheck, C. and Breloer, H. (1995). The Body Language of Trees: A handbook for failure analysis. Research for Amenity Trees 4. HMSO, London, 240pp.

STANDARDS PUBLICATIONS

Trees in relation to design, demolition and construction – Recommendations (BS5837), British Standards Institution, London (2012)

Tree Work Recommendations (BS3998), British Standards Institution, London (2010)

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Appendix A

Tree Schedule

Table 1 Cascade Chart taken from BS5837:2012 Trees in relation to design, demolition and construction – Recommendations.

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Appendix A - Tree Schedule The Stables, Tanhouse Lane, Yate

Client: Matthew Rushent

Surveyor: Alister Rankine

Date of Survey: 5th October 2023

Hillside Trees Ltd.
Arboricultural Consultancy

Tree Number	Single or Group	Common Name	Scientific Name	Height (m)	Calculated Stem Diameter (mm)	Number of Stems	Root Protection Area (Radius, m)	Crown Clearance (m)	N - Radius (m)	S - Radius (m)	E - Radius (m)	W - Radius (m)	Age Class	Physiological Condition	ULE (Years)	Tree Structural Condition and Site Notes.	BS Category
T1	S	Norway spruce	*Picea abies*	12	260	1	3.12	2	2	2	2	2	M	F	10-20	Fair	C1
T2	S	Oak	*Quercus robur*	14	540	1	6.48	5	4	7	5	7	M	G	40+	Good	B1/2
T3	S	Oak	*Quercus robur*	17	850	1	10.20	3	6	7	7	6	M	G	40+	Good	B1/2
T4	S	Ash	*Fraxinus excelsior*	5	198	2	2.38	3	1	1	1	1	M	P	<10	Poor. Off site	U
T5	S	Ash	*Fraxinus excelsior*	9	350	1	4.20	4	1	2	2	1	M	F	<10	Fair. Off site	U
T6	S	Ash	*Fraxinus excelsior*	11	394	2	4.72	7	1	1	2	2	M	F	<10	Fair. Off site	U
T7	S	Oak	*Fraxinus excelsior*	10	350	1	4.20	6	4	3	4	3	M	F	40+	Fair. Off site	C1/2
T8	S	Ash	*Fraxinus excelsior*	14	400	1	4.80	6	3	3	3	3	M	F	<10	Fair. Off site	U
T9	S	Copper beech	*Fagus sylvatica 'Purpurea'*	13	500	1	6.00	4	3	3	3	3	M	F	20-40	Fair. Off site	C1/2
T10	S	Copper beech	*Fagus sylvatica 'Purpurea'*	13	440	1	5.28	4	3	3	3	3	M	F	20-40	Fair. Off site	C1/2
T11	S	Ash	*Fraxinus excelsior*	14	338	3	4.05	5	1	2	2	2	M	F	<10	Fair. Off site	U
T12	S	Elm	*Ulmus procera*	14	450	1	5.40	4	3	3	5	3	M	F	<10	Fair. Off site	U

Table 1 – Cascade chart for tree quality assessment

TREES FOR REMOVAL

Category and definition	Criteria	Identification on plan
Category U Those in such 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, irremedial, 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 show signs of significant, immediate, and irreversible overall decline • Trees infected by pathogens of significance to the health and/or safety of other trees nearby, or very low quality trees suppressing other trees of better quality *NOTE Category U trees can have existing potential conservation value which might be desirable to preserve; see **4.5.7***	**DARK RED** **RGB code** **127-000-000** **AutoCAD 246**

TREES TO BE CONSIDERED FOR RETENTION

Category and definition	Criteria - Subcategories			Identification on plan
	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	**LIGHT GREEN** **RGB code:** **000-255-000** **AutoCAD 90**
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 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	**MID BLUE** **RGB code:** **000-000-255** **AutoCAD 170**
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 150mm	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	**GREY** **RGB code:** **091-091-091** **AutoCAD 252**

Appendix B

Detailed Arboricultural Method Statement

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Tree Protection Plan

THE STABLES, TANHOUSE LANE, YATE, BRISTOL, BS37 7LP

On behalf of

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December 2023

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Arboricultural Method Statement

INTRODUCTION

*The purpose of this document is to give a step by step guide to protecting trees on and adjacent to this site. It is vital that all members of the team are familiar with it so that they not only understand **why** trees need protecting but also **how** they are to be protected and their own role in protecting them.*

THE IMPORTANCE OF TREES

- Trees play a crucial role in the fight against climate change. One mature tree can absorb in the region of 1 tonne of carbon during its lifetime – the world needs all the trees it can get
- Trees are an important wildlife habitat, for example many insects and birds rely on them for food and shelter
- Trees are an integral part of human habitat. People like trees for their landscape value and for their shading and sheltering properties

WHAT WILL CAUSE DAMAGE TO A TREE?

- Wounds to the trunk or limbs of a tree can let in pathogens which could go on to infect and eventually even kill a tree
- Removal of branches decreases the number of leaves a tree has. Leaves are vital to the tree for manufacture of the energy they need through photosynthesis
- Compaction of the soil around a tree will damage its roots making it unable to absorb water or oxygen which can result in the tree's death. The extent of the roots are shown on the Tree Protection Plan in the document below as Root Protection Areas or RPA's

HOW YOU AND YOUR TEAM CAN PREVENT DAMAGE TO TREES

- Ensure all members of the team read this document before work starts
- Follow the instructions given, don't cut corners
- Take pride in protecting trees – treated well they will outlive you and continue to give benefit for years to come

Planning permission for this project depends on this method statement being followed. Dealing with breaches of condition is far harder, more time consuming and costly than following the instructions. Failure to comply could even result in prosecution.

THE PROJECT ARBORICULTURALIST IS ON HAND TO HELP. IF IN DOUBT, PLEASE RING FOR ADVICE. 01761 233244

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This Method Statement Comprises:

1. **Method Statement Document**
2. **Appendices:**
   - **I. Tree Protection Site Notice**
   - **II. Temporary Ground Protection**
   - **III. APN 12 'Through the Trees to Development', CellWeb Confinement Systems**
   - **IV. NJUG4**
3. **Tree Protection Plan (231120-TS-TPP-Rev B-SD)**

THESE DOCUMENTS ARE TO BE KEPT TOGETHER

Full Site Address:

The Stables
Tanhouse Lane
Yate
Bristol, BS37 7LP

Proposed Development:

Construction of 3No. new detached dwellings with associated access and parking

Contacts:

Client:
Matthew Rushent

Project Manager (for the client):
Marcus Fox MCIAT
FirstFox Architecture Ltd

E: m.fox@firstfox.co.uk
T: 0117 9602261
M: 07880 783602

Contractor / Builder:
To be confirmed

Site Manager:

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To be confirmed

Arboricultural Officer:
Kate Tate
Assistant Arboricultural Officer
Department of Environment & Community Services
South Gloucestershire Council

Tel: 01454 86953
Email: Kate.Tate@southglos.gov.uk

Project Arboriculturalist:
Alister Rankine
Hillside Trees Ltd.

Telephone: 01761 233244
Email: alister@hillsidetrees.co.uk

Works Requiring Tree Protection:

Development Operations	Tree Number	Type of Protection / Works	Reference
Site Traffic	T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12	Existing hard surfacing (T1, T3, T9, T10, T11, T12 only) Existing close board fence (T3, T9, T10, T11, T12 only) Tree Protection Barriers (T1, T2, TT5, T6, T7, T8 only) Tree Protection Site Notices (T1, T2, T5, T6, T7, T8 only) Temporary Ground Protection (T3 only)	 Section 2 Appendix I Appendix II
General Construction	T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12	Existing hard surfacing (T1, T3, T9, T10, T11, T12 only) Existing close board fence (T3, T9, T10, T11, T12 only)	

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		Tree Protection Barriers (T1, T2, TT5, T6, T7, T8 only) Tree Protection Site Notices (T1, T2, TT5, T6, T7, T8 only) Temporary Ground Protection (T3 only)	Section 2 Appendix I Appendix II
Construction of access drive to Plots 2 & 3 & parking for Plot 2	T3	Cellular Confinement System	Appendix III
Drainage installation	T3, T9, T10	NJUG 4 Monitoring by Project Arboriculturalist	Appendix IV

Sequencing of Operations:

The tree protection measures appropriate for the site operations below, if required by the Local Planning Authority will be monitored by the Project Arboriculturalist. It will be the responsibility of the Project Manager and / or the Site Manager to inform the Project Arboriculturalist if site visits and reports are required and to arrange them accordingly

Please note: If the Project Manager and / or the Site Manager fails to inform the Project Arboriculturalist when site monitoring is required and the schedule of monitoring visits is not followed, it will not be possible to issue a Certificate of Compliance at the end of the project.

1. **Pre-commencement site meeting**
    a. The Appointed Contractor will co-ordinate with the Project Arboriculturalist to discuss and agree the site operations programme and tree protection.

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2. **Install tree protection barriers**
    a. Tree protection barriers will be installed in the locations shown on the Tree Protection Plan
    b. The areas between the tree protection barriers and the trees will be construction exclusion zones (CEZ's)
    c. Tree protection barriers will be constructed using 'Heras' weldmesh panels secured in robust bases and tightly clamped.
    d. Site Notices will be securely fixed to the tree protection barrier panels (Appendix I)
    e. There will be no movement of tree protection barriers unless it is overseen by the Project Arboriculturalist
    f. No activity is planned to take place within the CEZ's; however, any work that does take place within the CEZ's will require approval of the Local Planning Authority and will be overseen and approved by the Project Arboriculturalist.

3. **Installation of temporary ground protection**
    a. Temporary ground protection will be installed in the location indicated on the Tree Protection Plan
    b. Ground protection will consist of scaffold boards or heavy duty chip board placed on top of a compression-resistant layer (e.g. 100mm depth woodchip) laid on to a geo-textile membrane. (Appendix II)

4. **Construction of new buildings**
    a. Construction of the new buildings will not require access to the CEZ's.

5. **Installation of services**
    a. Installation of services will not require access to the CEZ

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6. Construction of new access drive and parking

a. Where the access drive to Plots 2 and 3 and the parking spaces for Plot 2 breach the root protection areas of T3, as indicated on the Tree Protection Plan, construction will be in accordance with Arboricultural Practice Note (APN) 12 'Through the trees to Development' using a 'No-Dig' Cellular Confinement system such as 'CellWeb' (Appendix III).

b. The temporary ground protection will be carefully removed.

c. The position of the new driveway layout will be marked out incorporating the existing driveway. This area will then be cleared of vegetation and a general level created using hand tools and clean sand where necessary. A geo textile membrane will then be laid across the surface.

d. The 'Cellular Confinement System' (CCS) will then be laid across the area. This will provide a load-bearing and permeable structure. The cellular design and perforated cell walls reduces the vertical load pressure on sub soils to tree roots and prevents damage.

e. Once the CCS is in place it will be backfilled with clean angular stone which will enable air and moisture to reach the roots and encourage healthy growth. A porous wearing course will then be applied, to a depth of 30-40mm as the finished surface. The edges of the driveway will be retained using tannalised wooden retaining boards staked into the ground tapering down to the existing ground level with top soil.

7. Installation of Drainage

a. Where the proposed drainage model impacts on the RPA's of trees T3, T9 and T10 installation will be carried out in accordance with NJUG 4 (Appendix IV)

b. Excavation works within the RPA's will be monitored by the Project Arboriculturalist. Any tree roots encountered less than 25mm in diameter will carefully severed flush with the trench walls using sharp, clean secateurs or loppers.

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Any roots greater than 25mm in diameter, depending on size and frequency, will either be cut cleanly flush with the trench walls using sharp, clean loppers or pruning saw or carefully excavated around by hand and wrapped in damp hessian to prevent desiccation and a flexible drainage pipe carefully manoeuvred around the roots..

8. Removal of tree protection barriers

a. Tree protection barriers will only be removed once all works associated with the development have been completed. These include:

- Construction and fitting out of the new dwellings
- Installation of services
- Construction of access drive and parking spaces

General Precautions

1. Site office, welfare facilities and site storage compound will be positioned outside the CEZ's. The location will be agreed between the Site Manager and the Project Arboriculturalist prior to commencement of the project.

2. Any crane or plant for the manoeuvring of materials will be sited on locations to be agreed between the Site Manager and the Project Arboriculturalist prior to commencement of the project. All crane operations should be conducted under the supervision of a banksman to ensure adequate clearance from the retained trees is maintained at all times.

3. No materials that are likely to have an adverse effect on tree health will be stored or discharged within 10 metres of the trunk of a tree that is to be retained. Consideration will be given to the implications of storing materials upslope of this exclusion zone in order to avoid the risk of potential spillages leaching down-slope and contaminating the Root Protection Area of a tree. Such materials include:

- Oil
- Bitumen

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- Cement

4. No fires will be lit unless the site of the fire is agreed with the Project Arboriculturalist.

5. Concrete will not be mixed or transported over unprotected ground, within 10 metres of the trunk of any tree.

6. In the event of unforeseen incidents occurring that may adversely affect or threaten the welfare or security of the trees, the Site Manager shall inform the Project Arboriculturalist at the earliest opportunity and not more than one working day following the incident.

7. The Project Arboriculturalist will visit the site to inspect and assess the circumstances and make any appropriate recommendations. The Local Planning Authority Arboricultural Officer will be informed by the Project Arboriculturalist of such incidents and recommendations will be submitted for approval by the Local Planning Authority, initially verbally, and then in writing.

8. A record of any emergency incidents and works shall be maintained by the Project Arboriculturalist.

9. Incidents which may merit such contingency plans include:

    - Accidental / unauthorised damage to the limbs, roots or trunk of trees
    - The spillage of chemicals within or adjacent to a Root Protection Area
    - The discharge of toxins / waste within or adjacent to a Root Protection Area
    - The un-scheduled breaching of a tree protective barrier or Construction Exclusion Zone.

This Method Statement has Been Informed by the Following Information

- Arboricultural Site Survey carried out by Hillside Trees Ltd on 5th October 2023
- First Fox Architecture Drawing No.200 - Proposed Site Plan October 2023
- BS5837: 2012 'Trees in relation to design, demolition and construction – Recommendations'

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Appendix I

Schedule of Tree Works

Tree Number	Work Specification
TX	XXX

All tree surgery works will be carried out by a suitably qualified and experienced tree surgeon

All works will be carried out to industry best practice and will be in accordance with BS3998:2010 'Works to Trees'

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Appendix I

Tree Protection Site Notice

Hillside Trees Ltd.
2 Hillside, Bowden Hill, Chilcompton, Radstock, BA3 4EN
Tel: 01761 233244 E: enquiries@hillsidetrees.co.uk

Directors: A Rankine BSc (Forestry), Tech Cert (Arbor A), *ProfArborA*, S J Rankine BSc (Hons), Dip Arb L4, *TechArborA*

Registered in England No. 07175569
Registered Office: Broadway House, Third Avenue, Westfield Industrial Estate, Radstock. BA3 4XD

PROTECTIVE FENCING. THIS FENCING MUST BE MAINTAINED IN ACCORDANCE WITH THE APPROVED PLANS AND DRAWINGS FOR THIS DEVELOPMENT.

TREE PROTECTION AREA
KEEP OUT !

(TOWN & COUNTRY PLANNING ACT 1990)
TREES ENCLOSED BY THIS FENCE ARE PROTECTED BY PLANNING CONDITIONS AND/OR ARE THE SUBJECTS OF A TREE PRESERVATION ORDER.
CONTRAVENTION OF A TREE PRESERVATION ORDER MAY LEAD TO CRIMINAL PROSECUTION

ANY INCURSION INTO THE PROTECTED AREA MUST BE WITH THE WRITTEN PERMISSION OF THE LOCAL PLANNING AUTHORITY

Appendix II

Temporary Ground Protection

Hillside Trees Ltd.
2 Hillside, Bowden Hill, Chilcompton, Radstock, BA3 4EN
Tel: 01761 233244 E: enquiries@hillsidetrees.co.uk

Directors: A Rankine BSc (Forestry), Tech Cert (Arbor A), *ProfArborA*, S J Rankine BSc (Hons), Dip Arb L4, *TechArborA*

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Temporary Ground Protection Method and Specification

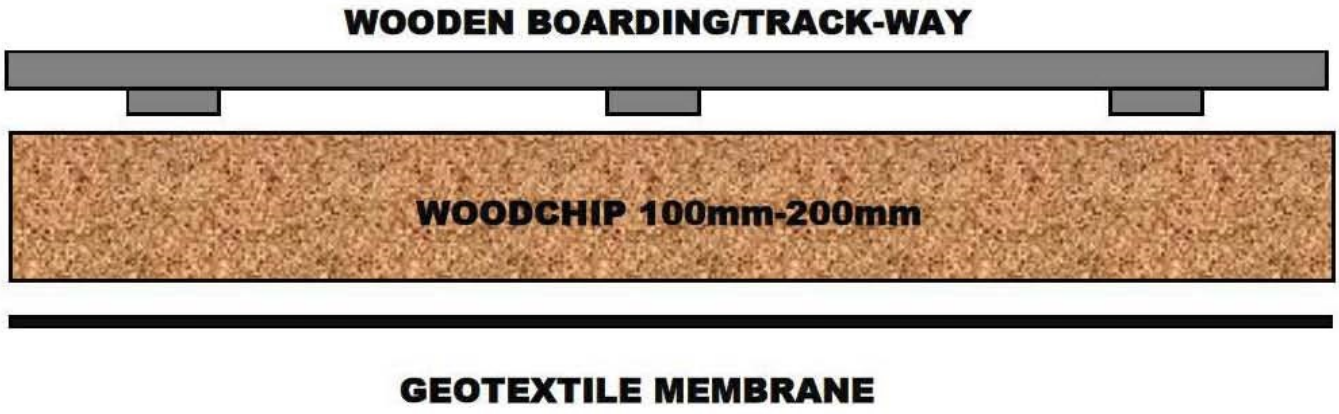
BS5837 recognizes that incursions in to the construction inclusion zones will be required at times during some developments.

The objective is to minimize soil compaction

Example 1 - *for pedestrian movements only, a single thickness of scaffold boards places either on top of a driven scaffold frame, so as to form a suspended walkway, or on top of a compression-resistant layer (e.g.) 100mm depth of woodchip), laid on to a geotextile membrane.*

Example 2 - *For pedestrian-operated plant up to a gross weight of 2 t, proprietary inter-linked ground protection boards placed on top of a compression-resistant layer (e.g. 150mm depth of woodchip), laid onto a geotextile membrane;*

Example 3 - *For wheeled or tracked construction traffic exceeding 2 t gross weight, an alternative system (e.g. proprietary systems or pre-cast reinforced concrete slabs) to an engineering specification designed conjunction with arboricultural advice, to accommodate the likely loading to which it will be subjected.*



Appendix III

APN 12 ‘Through the Trees to Development’

‘CellWeb’ Confinement Systems

Hillside Trees Ltd.
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Tel: 01761 233244 E: enquiries@hillsidetrees.co.uk

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APN 12

Arboricultural Practice Notes

Trees in focus

Through the Trees to Development

Derek Patch and Ben Holding

Arboricultural Advisory and Information Service

Summary

The majority of tree roots grow in the upper metre of soil and they may spread outwards in any direction a distance equal to the tree's height. Any disturbance of the ground within the root spread of a tree can damage its roots and may severely injure the tree. Damage to roots will interrupt the supply of water necessary to keep the tree alive and may cause decline in vigour, dieback or even death of the tree.The tree may also be made unstable and so pose an unacceptable threat to the safety of people and property. Development of a site, including construction of access routes, driveways and parking areas can result in substantial root severance of trees. Techniques for the construction of access drives, which may avoid or lessen the damage caused to trees, are described.

This note embraces the principles first published by The Tree Advice Trust as "Driveways Close to Trees" (Aboricutural Practice Note No. 1[1]) and reviews where the principles may be applied in practice.

Trees: A Cause of Conflict

Development of a site is sometimes hampered or prevented because of the presence of trees. Local authorities and residents may wish to see trees 'preserved' whilst developers seek permission to build close to them - often ignorant about the damage this may cause to trees. Even developments such as access drives and parking areas can threaten existing nearby trees.

Traditional driveway construction (excavation and backfilling with a compactable load-bearing sub-base material) can seriously damage tree roots. Such damage occurs because of a lack of understanding that roots mainly grow outwards from a tree's trunk, near to the soil surface, rather than downwards (Dobson 1995). Where there is a significant risk of damage to trees by root severance, or changes in soil conditions during construction, local planning authorities may sometimes refuse permission for installation of an access driveway or parking area close to trees - especially if the trees are subjects of Tree Preservation Orders.

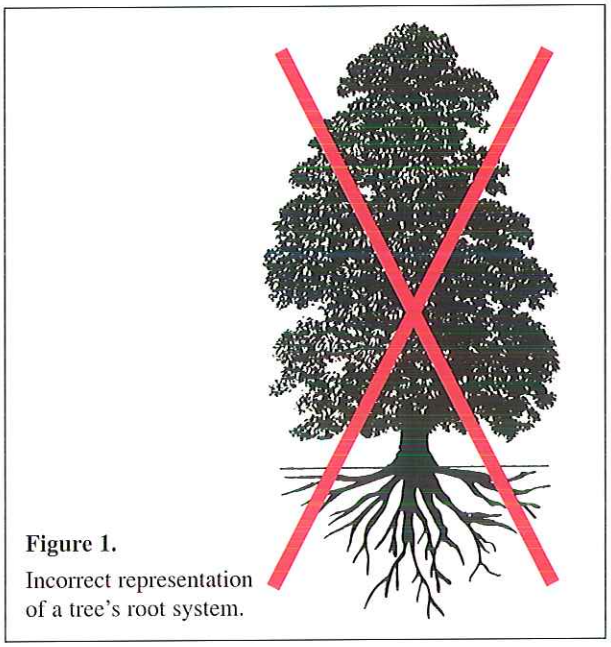


Figure 1.
Incorrect representation of a tree's root system.

However, if the potential for damage to the tree's root system (e.g. by severance or soil compaction) can be avoided during construction, development may be more easily accepted. A technique is described below which should reduce the risk of significant damage to tree roots while enabling access and parking for light vehicles to be constructed close to trees.

Where Do Tree Roots Grow?

Survival of a tree depends on its roots being able to absorb enough water from the soil to sustain the foliage (an estimated 1,000 litres per day in summer for a fully grown forest tree in a rural area) and on developing a strong root system capable of keeping the tree upright through autumn and winter gales. To achieve this the tree's roots must exploit a very large volume of soil. However, the assumption that these requirements are met by a system of roots growing predominantly downwards (Figure 1), and that anchoring roots are very thick and descend into the soil for many metres (like the base of a lamp post) is incorrect. In reality tree roots:

[1] Driveways Close to Trees, Arboricultural Practice Note No. 1 is withdrawn and superceded by this wider text.

- grow in any direction more or less parallel with the soil surface rather than vertically (Figure 2). This is also true for trees growing on sloping land.
- are usually relatively shallow - most of a tree's roots are in the upper metre of soil.
- usually radiate outwards from a tree for a distance equivalent to at least the tree's height (which for a mature tree may be 20 m or more).
- can be 30 cm or more in diameter at the base of the trunk.
- sub-divide and taper rapidly as they extend out from the trunk.
- are only 2-3 cm in diameter, and often much less at 3-4 m distance from the trunk.

The small woody roots (those less than 3 cm diameter) taper very little but they may spread out for long distances. Smaller, non-woody roots (sometimes described as white, feeder, fibrous, fragile or absorbing roots) grow outwards and usually upwards from the woody roots and subdivide to exploit the better aerated surface soil. Although generally short lived they (and the fungi associated with them - called mycorrizas) are the principal absorbers of moisture and nutrients.

Most roots (both thick and fine) are situated close to the soil surface, forming a thin layer less than 1m deep, but some small roots (usually only a few mm in diameter) may reach 2 m or more deep.

Roots and the Soil

Roots are living and, like all plants and animals, must have oxygen if they are to survive. Without oxygen roots are unable to function properly or grow, and when they are starved of oxygen for prolonged periods, they die.

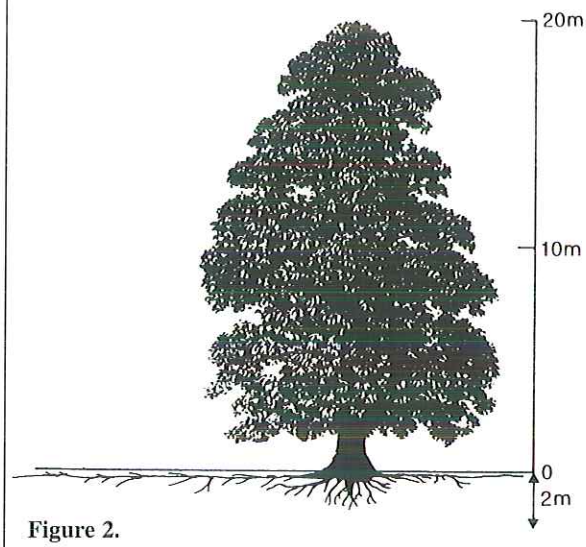


Figure 2.
Trees have a relatively shallow but wide spreading root system.

Both oxygen and water are held in the pores between the soil particles. Where the pores are large (e.g. in coarse or sandy soils) the soil will generally be freely draining and well-aerated, but where the pores are small (e.g. in heavy clays or soils which have been compacted) they may be full of water and have a poor supply of oxygen.

Most trees that have been growing undisturbed on a site for many years will have developed an extensive root system with the roots growing where the soil conditions are most favourable. There will be a balance between the development of the crown (which demands water) and the roots (which supply it). Any sudden alteration of the soil conditions within the tree's rooting area (a circle of radius equal to the tree's height) will therefore upset this balance. For example, the single passage of a machine will 'squeeze' the soil closing up the pores (causing compaction - especially in the upper levels) and so reduce the amount of oxygen available to roots which prevents them from growing through the soil. With each additional machinery movement the compaction increases and so do the problems for the tree and its roots.

Placing soil or other materials over the root system of a tree will impede air movement into and out of the soil around the roots and consequently reduce the availability of oxygen to the roots. The effect on the tree is usually progressive shoot and branch dieback until a new balance has been reached between the reduced capacity of the damaged root system to absorb water and the demands of the leaves. If damage is progressive or so severe that such a balance cannot be achieved, the tree will ultimately die.

Excavations - **even stripping the topsoil** - within the rooting area will sever roots. The closer the excavation is to the trunk of the tree the larger will be the roots lost and the greater the significance for the health and stability of the tree. Once the excavation is a metre deep virtually all of the roots growing into the excavated area will have been severed. The tree may then either be unable to absorb sufficient water to sustain the foliage and dieback will occur, or anchorage will be so reduced that the tree is unsafe and has to be severely pruned or even felled for safety.

Soil compaction, excavations and soil level increases will all damage roots and the closer to the trunk they occur the greater the damage inflicted on the tree. Nevertheless, healthy trees are generally able to withstand the loss of some roots (a maximum of about 20% of the rooting area, Helliwell and Fordham (1992)) without noticeable adverse effects.

Development Near Trees

British Standard BS 5837:2005 *Trees in Relation to Construction – Recommendations* recommends that on construction sites an area around a tree should be left undisturbed (the Root Protection Area) so that unacceptable damage to the root system is avoided. In the British Standard the Root Protection Area is calculated as

the equivalent of a circle about 12x the diameter of the tree's trunk (measured at 1.5m above ground level). The distance from the trunk extending to the branch spread, or half the tree's height, whichever is the greater (Figure 3) is a useful indicator of the typical Root Protection Area for a given tree.

The Root Protection Area is an area of protected ground around a tree within which any activity that could damage roots should be prohibited without the prior agreement of an aboriculturist.

However, if the principles and guidelines set out below are followed, installation of access driveways and parking for light vehicles within the Root Protection Area may, in many situations, be possible without causing significant, permanent damage to trees. Nevertheless, expert arboricultural advice should be sought to determine whether the tree and the site conditions lend themselves to the principles described in this Note. Any assessment of a site should include consideration of the health and overall condition of the tree(s). That is because old and declining trees may be vulnerable to sudden changes in the site conditions and so they may warrant a larger area than the minimum recommended in the British Standard.

Engineering Needs

Driveways, footpaths and car parking areas must be built on a firm, stable base. Engineers usually achieve this by excavating the soil to a depth of about 0.5 m, compacting the base if necessary, and backfilling with an inert material that can be compacted to form a stable platform. This usually involves progressive placement of layers of inert material with each being compacted by repeated passes of a powered roller or whacker plate. Each pass of a machine creates increasing compaction at depth in the soil. The edges of the excavation act as the supporting formation and kerbs or other edgings may be used to retain the surface material.

Any such excavations or soil stripping will sever roots and should be avoided within the Root Protection Area.

Compacting the base of an excavation can change the bulk density of the subsoil creating conditions unsuitable for the survival of any roots, particularly the water absorbing fine roots, contained in that volume. Placement and particularly compaction of load bearing construction materials will contribute to this creation of conditions unsuitable for root survival

On many sites it is possible to construct an adequately supported access driveway suitable for limited usage by light vehicles while retaining healthy, stable trees, by adoption of three principals particularly when construction is within the Root Protection Area as determined in consultation with an arboriculturist.

Where the finished structure will be adopted by the Highway Authority a more robust specification may be required. Provided the same principles are embraced construction across the root systems of trees should still be feasible.

Protection *and* Construction

For tree roots to be retained undamaged there must be *no excavation, no soil stripping* and *no grading of the site within the Root Protection Area* - in other words, **NO DIGGING**. This means that construction will have to be above the existing ground level.

Passage of vehicles across an unprotected soil surface must also be avoided, particularly where the soil is wet, as this will cause breakage of surface roots, soil compaction and consequently reduced soil aeration. These problems are heightened on clay soils. Most vulnerable to soil compaction are the fine white roots (those roots that are generally difficult to find when soil is examined) essential for water absorption. Surviving roots may not be able to grow through the compacted soil.

To reiterate there must be **NO COMPACTION** of the soil.

Where trees are to be retained on a site it is essential, therefore, that all but the immediate area of the development is protected from access and construction operations by fencing as recommended in BS 5837.

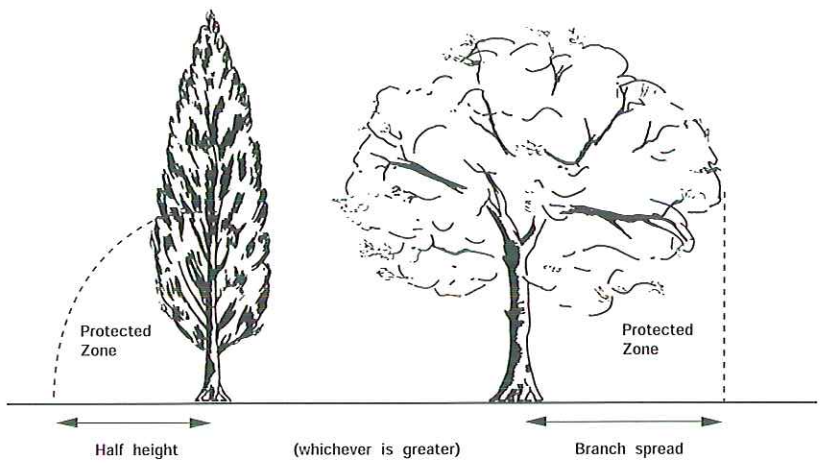


Figure 3.
Distance from a tree which constitutes the zone in which roots should be protected - i.e. no digging.

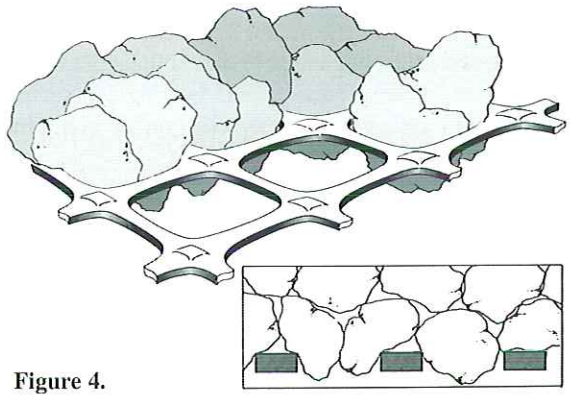


Figure 4.
The mechanism of interlock between aggregate and geogrid.

No-Dig Construction

Successful retention of trees, even when adopting a no-dig method, depends upon the condition (health and vigour) of the tree(s), which should be assessed by a qualified arboriculturist, and on adherence to three simple rules within the Root Protection Area:

- roots must not be severed, cut or broken – **no digging**
- ground levels must not be changed - **no digging, no soil level raising**
- **soil must not be compacted – no tracking of vehicles**
- oxygen must be able to diffuse into the soil beneath the engineered surface – **no tracking of vehicles**

Meeting the Engineering Needs

Damage to trees can be avoided only if the construction embraces the above simple principles and, within the fenced Root Protection Area, is no more than 5m wide.

Construction should incorporate two main components:

- a synthetic load spreading material
- a no-fines aggregate sub-base

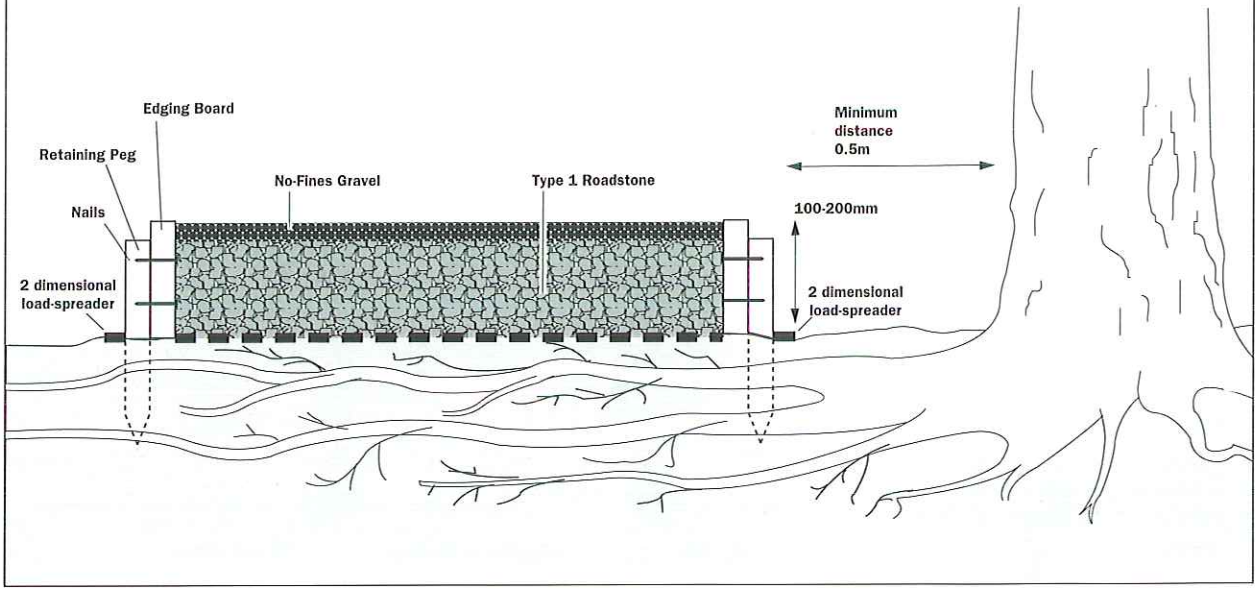
Note: a geotextile, which is usually used to prevent layers of different mineral materials mixing while allowing water to pass through, is not designed to be load bearing.

'Load spreading' materials, are synthetic grids/webs designed to support roads on soft ground by distributing the load of a wheel over a larger area than would normally occur. They may be 2- or 3-dimensional.

When placed on a 2-dimensional grid, appropriate, no-fines granular sub-base material penetrates the mesh, but is unable to pass through it, forming a positive interlock (Figure 4). This interlock between aggregate and grid provides a reinforced platform and efficient load spread into the underlying ground over a wider area than the footprint of the wheel on the surface. A suitable geogrid/aggregate combination constructed with the grid under tension should prevent rutting of the ground beneath the construction (Figure 5).

The 3-dimensional load spreading products (Cellular Confinement System) create cells into which the sub-base material is placed (Figure 6). Such a construction does not support the sub-base material, it confines the material in discrete cells. Manufacturers recommended, therefore, that a geotextile (see note above) is placed between the ground

Figure 5. Diagram of a 'no-dig' method for constructing access drives and parking near to trees in order to minimise damage to tree roots. *(Not to scale)*



and the load spreader to prevent the cell-contained mineral material being pressed down into the underlying soil.

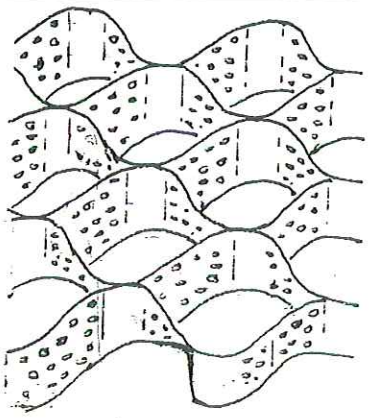


Figure 6.
3-dimensional load-spreader

A no-dig construction, that is a construction above ground level, will need to be contained to prevent outward creep under the weight of vehicles. This may be achieved with an edging support provided its construction does not involve excavation. A suitable material may be long-life timbers pinned through the load-spreader into the underlying soil. This could add strength to the structure because the pressure of vehicles forcing the sub-base downwards and outwards will tend to increase the tension on the grid and any tendency to rutting.

Note: some manufacturers specify that their product should be placed in a 100mm or greater depth of formation (i.e. excavation). It is important that before such a construction is adopted the agreement of an arboriculturist who has considered the circumstances of the tree's health and evaluated the site conditions, should be obtained. Failure to do so could result in breach of a Tree Preservation Order and Conservation Area legislation because roots will inevitably be damaged by an excavation of as little as 100mm.

The granular sub-base material should have a no 'fines' content which means that even when it is compacted it should be freely draining and will allow oxygen to diffuse into, and damaging gases (e.g. carbon dioxide and methane) out of the soil.

For site-specific prescriptions and materials specifications advice should be sought from a qualified geotechnical or civil engineer who should work in consultation with an arboriculturist.

Putting the Principles into Practice

Is the site suitable for a no-dig construction? (see next section)

Construction should ideally be undertaken in dry weather between May and October when the ground is likely to be driest and least prone to damaging compaction.

There must be a method of working that does not require movement of machinery or heavy plant within the branch spread of the tree before the ground is protected by a load spreader and the sub-base. Then the movements must be only along the construction.

For example when making a new access into a site construction should commence at the entrance to the site and 'roll out' the driveway in front of the machinery which always remains over the sub-base.

Ground vegetation should be killed using a translocated herbicide such as glyphosate[2]. (This may be most appropriately done in consultation with an experienced arboriculturist to ensure that the chemical and application method do not result in damage to retained trees.) After allowing time for the chemical to be absorbed and kill the plants, including their roots, gather up the dead organic material - this will prevent the build up of anaerobic conditions beneath the construction which might otherwise occur as dead vegetation decomposes.

Carefully remove major protrusions such as rocks.

Remove tree or shrub stumps (stumps should be ground out rather than excavated to minimise soil disturbance).

Fill major hollows with clean sharp sand – **DO NOT GRADE-OFF HIGH SPOTS**.

If necessary, for example when using a three dimensional cellular confinement product as a load spreader, a geotextile should be spread over the area of the driveway or car park.

With a two dimensional load spreading product into which the no-fines sub-base stone forms a lock a geotextile may be used but it is not essential.

Lay the synthetic load spreader directly onto the levelled ground or the geotextile as appropriate.

Secure the synthetic load spreader under tension using long pins driven into the ground through the grid.

Note: Before driving pins into the ground check for underground services that could be damaged.

Construct an edging which is secured through the load spreader so that pressure on the running surface will force the edging outwards and so increase the tension on the load spreader.

Cover the load spreader with a minimum of 100 mm of no-fines aggregate. This should not be tipped straight onto the synthetic material, but should be placed at one end and then pushed onto the load spreader between the retaining edges so that machinery is supported by the spread sub-base material rather than directly on the load-spreader and not on the ground either side of it.

Compact the sub-base to ensure binding with the load spreader and to minimise future rutting.

[2] When selecting a herbicide care must be taken to select a product which does not damage the roots of desirable vegetation that may extend into the treated area. Always read the product label before use.

A further geotextile may be placed over the sub-base to prevent dry bedding materials or surfacings merging with the sub-base.

Place the final surface. In the main it is likely that this will consist of gravel or tarmacadam, although paving slabs and brick paviours may be acceptable provided they are dry bedded on the sub-base and the joints are not sealed with grout, to allow for infiltration of water and gaseous diffusion[3].

Where a mass concrete, or impervious surface material is required the specification for an adoptable road (see below) should be used.

Sites are not all the Same!

The principles detailed above, if applied sensibly, should permit access to be constructed across the root system of a healthy tree. That is where the construction passes through the Root Protected Area retained around a tree as recommended by British Standard BS 5837:2005 *Trees in relation to construction - Recommendations.*

Why the 'sensibly'? No two sites are the same, in fact some are totally unsuitable for a no-dig construction and it may be necessary to admit that access to the site cannot be achieved if certain trees are so important/valuable that their retention is essential. For example, where trees grow on an old hedge bank excavation to cut through the bank may be unavoidable and so an unacceptable proportion of the root system would be severed. In contrast ditches that can be filled/piped/bridged (Figure 7) should be less problematic.

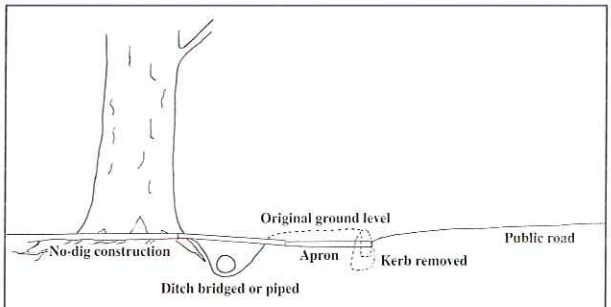


Figure 7. No-dig construction and a ditch.

When planning a driveway it is important to consider the ground levels on site and to relate them to the fixed level on the public thoroughfare into which the drive must connect and be tied. Where a roadside verge within the root protection area around a tree cannot be crossed without excavations then a different access point may be needed if the tree is deemed to be of very significant value to the amenities of the area.

Highway Authorities generally seek an 'apron' (upto 4m long), with a shallow or no gradient and a sealed surface at the entrance to a site where the drive joins the highway. This is to reduce the risk of loose material migrating onto the footpath and road where it could become a hazard. Such an apron may involve excavation thus reducing the scope for a drive constructed using the no-dig principles.

The simplest site on which a no-dig construction can be used is where the ground falls into the site from the edge of the road. Level sites should not pose significant problems provided there is an adequately wide verge/pavement to accommodate the 'apron' without severing roots.

It is also important to remember that the no-dig construction needs to tie onto the road and also the levels of the garage or damp proof course of a building.

The roots of a tree will generally grow parallel with the ground surface – they do not grow preferentially up, down or across the slope! As such trees growing on a slope do not present any problems different from those of trees growing on a flat site – it is the engineering requirements that differ! Where the drive crosses the contours at a gentle angle, there is no reason why the depth of a no-dig construction should be constant across its width of a drive. The engineering problem may be how to retain the structure. The scope for increasing the lift on one side of a drive is not unlimited – probably 1:3 should be a maximum (Figure 8).

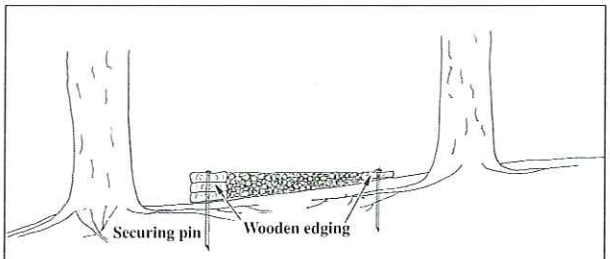


Figure 8. No-dig construction across a slope.

Permanently wet areas of ground should normally be drained, or they may be filled with no-fines stone, or if the water is flowing, they may be partially piped. In contrast, seasonally wet areas may benefit from drainage and building up the ground with coarse stone with a low fines component over which the drive is constructed.

The depth of each layer in the construction of a no-dig drive will be influenced by the bearing capacity of the ground over which the drive will pass. Also there must be consideration of the weight of traffic that will use the drive. The final design should, therefore, be achieved in discussion between a civil engineer and an arboriculturist.

A Potential Benefit

Inclusion of a load spreader in a construction should offer resistance to direct damage often caused to drives and car parks by diameter growth of roots under the structure.

[3] For drives less than 5m wide the finished surface may be constructed of a less permeable material such as asphalt/or reinforced mass concrete.

Adoptable Highways

The above construction is generally unacceptable where the finished structure is to be adopted by a Highway Authority - a more robust specification will be required for example pre-rutting, that is compaction of the ground under the driveway before construction commences, will be required. Such an engineering requirement will usually involve a vibrating roller or repeated tracking of heavy machinery, which is totally unacceptable for the welfare of the tree. The repeated tracking needed to deliver and consolidate layers of aggregate is likely to severely compact the underlying soil at increasing depth. A single pass of a vehicle can cause significant changes in the pore structure in the soil. Repeated passes will further compact the soil which will favour the needs of the engineer, but will eventually create conditions in the soil that are totally unsuitable for root activity and root death will result.

In such circumstances consideration must be given to designing and constructing a running surface which does not require either excavation, or direct compaction of the material under the construction and which does not place a dynamic force on the soil around tree roots. Further, an adopted road is likely to have a width greater than the 5m driveway considered above. The wider the construction the greater the impedance to gaseous exchange between the atmosphere and the soil around roots.

Where a load spreader is acceptable to the Highway Authority there will be need for a greater thickness of no-fines sub-base to support the loads carried by the finished structure[4]. It is then practical to include a system of perforated pipes laid in the sub-base material with venting either at the road surface or in the verges at the edge of the road. The finished surface over the sub-base may then be impermeable to gases (e.g. hot rolled asphalt, or concrete). Inclusion of a 'clay board', or similar over the sub-base may be appropriate to aid casting of the surface.

In the more extreme circumstances a construction to bridge the root system of a very high value tree could be based on an elevated 'board walk' or causeway. That is a series of pads sunk into the ground (causing only localised damage to the root system) supporting beams across which reinforced concrete beams are placed (c.f. a suspended floor in a building). Such a construction would not apply pressure to the ground and so there would not be any threat to underlying tree roots. This removes the need for a load spreader and specialized anchors and edgings.

Final Remarks

Adoption of the no-dig principles for creating access and parking for light vehicles near to trees, which avoids root severance, should help to overcome concerns about possible adverse effects on trees. Nevertheless, successful retention of a tree will depend upon the site in relation to the adjacent highway and strict adherence to the above principles, and upon the tree's condition - indicative of its ability to withstand changes in its rooting environment. This should be assessed by a qualified arboriculturist.

On completion a no-dig construction will be at least 300m above the original ground level.

Acknowledgement

The authors acknowledge the valuable comments and suggestions made by colleagues and members of the Arboricultural Association.

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[4] Type 1, as specified by the Highways Agency (2004) is not a recommended aggregate for use around tree roots because it contains a significant proportion of 'fines'.

Geosynthetics Limited Tel: 01455 617 139 Fax: 01455 617 140 Email: sales@geosyn.co.uk

Cellweb® TRP Installation Guide

Step 1: Prepare Surface

Step 2: Lay out Treetex™

Step 3: Lay out Cellweb ® TRP

- Cellweb® TRP is a NO DIG tree root protection measure and it is recommended that no excavation be performed without prior approval and guidance from the Local Authority Arboricultural Officer.
- Soil compaction from vehicles, machinery and materials is to be strictly prohibited during construction within Root Protection Areas (RPAs).
- Approval must be obtained from the Local Authority that the design and the method of construction is acceptable.
- Further information is available from the following two documents;
  - British Standard BS5837: 'Trees in Relation to Design, Demolition and Construction' (2012).
  - Arboricultural Advisory and Information Service: Practice note 12 – 'Through the Trees to Development' (APN12).

Installation Method

1. Prepare the Surface

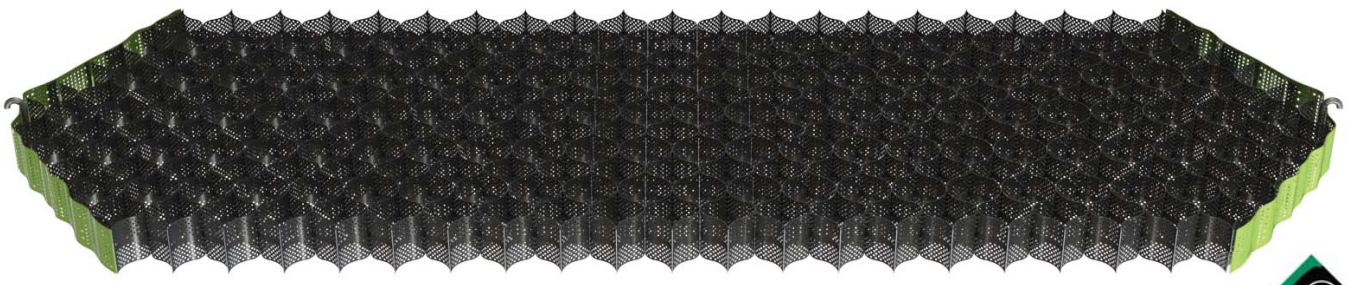
- Remove the surface vegetation using appropriate hand held tools or herbicide (see Note 1).
- Remove any surface rocks, debris and organic material.
- Create a level surface by filling any hollows with clean angular stone or sharp sand.
- Do not level off high spots or compact the soil through rolling.

2. Lay out the Treetex™ Non-Woven Geotextile

- Lay out the Treetex™ over the prepared area, overlaying the edges of the required area by 300mm.
- Overlap any joins by 300mm minimum or more, depending on soil structure (see Note 2).

3. Lay out the Cellweb® TRP Cellular Confinement System

- Lay out the collapsed Cellweb® TRP on-top of the Treetex™.
- Place one of the supplied J pins into the centre cell at the end of the panel and secure into the ground.

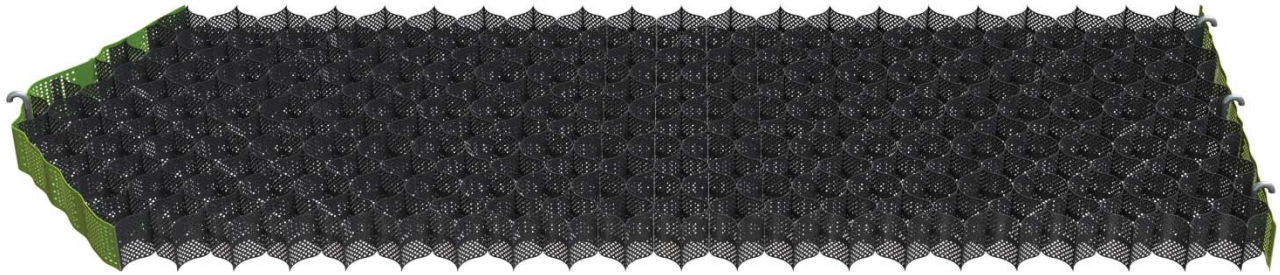


Cellweb® TRP - Installation Guide

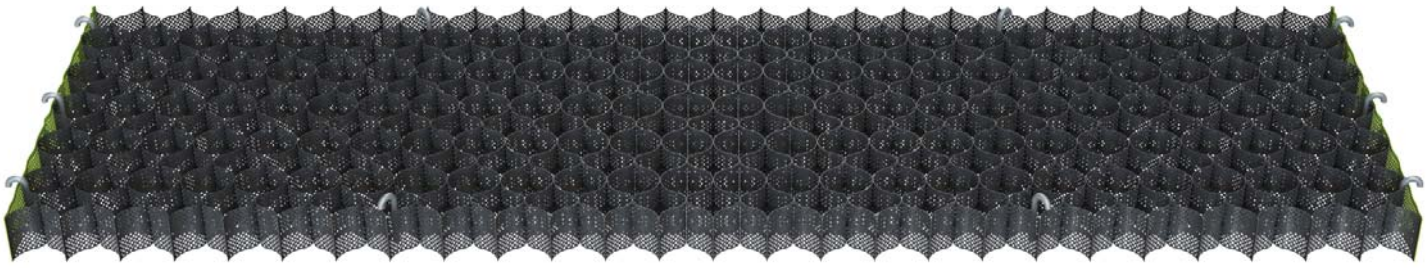
Step 3: Pinning Cellweb ® TRP

Step 3: Stapling Cellweb ® TRP

- Pull out the Cellweb® TRP to its full 8.1m length and secure its length with another J pin.



- Now measure its width to 2.56m and secure in each of the corners with the J pins.
- Use 10 pins per panel to create a panel measuring 8.1m x 2.56m.



- This will produce a cell size of 259mm x 224mm which is the required cell diameter. Each cell must be fully extended and under tension.
- Staple adjacent panels together at each cell (see Note 3).
- If a curved path or shape is required, this should be cut when the Cellweb® TRP panel is pinned out to 8.1 x 2.56m, ensuring complete cells remain. Do not try to curve or bend the Cellweb® TRP panels into place.
- All cells must be fully opened to the required diameter.

Cellweb® TRP - Installation Guide

Step 4: Clean Angular Stone

Step 5: Edge Restaints

Step 6: Surface Options

4. Infill the Clean Angular Stone

- The infill material must be a clean angular stone, Type 4/20mm or Type 20/40mm (see Note 4).
- Do not use M.O.T type 1 or crushed stone with fines for tree root protection.
- Infill the Cellweb® TRP cells with the clean angular stone, working towards the tree and using the infilled panels as a platform.
- Minimum 25mm overfill of clean angular stone.
- No compaction is required of the infill. Do not use a whacker plate or other means of compaction**.**

5. Edge restraints

- Excavations for kerbs and edgings should be avoided within the RPAs.
- Where edging is required for footpath and light structures, a peg and treated timber board edging is acceptable
- Other options include wooden sleepers, kerb edging constructed on-top of the Cellweb® TRP system, plastic and metal edging etc.

6. Surface options

- Surfaces can include block paving, asphalt, loose gravel, grass and gravel retention systems (eg Golpla™), resin bound gravel, concrete etc.
- For Root Protection Areas this surface must be porous.

NOTES

1. **Herbicide:** According to BS5837:2012 "The use of herbicides in the vicinity of existing trees should be appropriate for the type of vegetation to be killed, and all instructions, warnings and other relevant information from the manufacturers should be strictly observed and followed. Care should be taken to avoid any damaging effects upon existing plants and trees to be retained, species to be introduced, and existing sensitive habitats, particularly those associated with aquatic or drainage features."
2. **Geotextile:** We recommend the installation of a Treetex™ under the Cellweb® TRP, or under the sub-base, if installed. The overlapping between adjacent rolls of Geotextile should be: CBR > 3%: 300mm minimum, CBR between 1% and 3%: 500mm minimum. CBR ≤ 1%: 750mm minimum.
3. **Staples:** Number of staples per join: 200mm: 5 staples. 150mm: 4 staples. 100mm: 3 staples. 75mm: 3 staples.
4. **Granular Fill:** Open graded sub-base, clean angular stone Type 4/20 or Type 20/40. Please refer to BS7533-13:2009 and to the Design Manual for Roads and Bridges (DMRB), Volume 4 Geotechnics and Drainage, Section 1 Earthworks, HA44/91, Volume 7 – IAN 73/06 Design Guidance for road pavement foundations and Manual of Contract Documents for Highway Works (MCHW), Volume 1 Specification for Highway Works for the construction and maintenance of the fill material.

Appendix IV

NJUG 4

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The National Joint Utilities Group

NJUG Guidelines for the Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees

Volume 4

NJUG GUIDELINES FOR THE PLANNING, INSTALLATION AND MAINTENANCE OF UTILITY APPARATUS IN PROXIMITY TO TREES

PLEASE ENSURE THAT YOU READ THE LEGAL NOTICE AND DISCLAIMER WHICH APPEARS IN APPENDIX B OF THIS PUBLICATION

Issue 1: 8th October 2007

NJUG has a vision for street works, this vision is simply:

- Safety is the number one priority
- Damage to underground assets is avoided
- Utilities work together and in partnership with local authorities to minimise disruption
- Utilities deliver consistent high quality
- Utilities maximise the use of sustainable methods and materials
- Street Works in the U.K. are regarded as world class

This document forms part of that vision.

Mark Ostheimer
Director, Safety and Policy

NJUG Guidelines for the Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees

The following volumes constitute the NJUG Publications. They are living documents and may be amended from time to time. There is no attempt to describe any specific industry process as each utility has its own specifications and procedures. Not all the publications will necessarily be available at one time as individual volumes will be published when available.

NJUG PUBLICATIONS	
Current	*Previous*
VOLUME 1	
NJUG Guidelines on the Positioning and Colour Coding of Underground Utilities' Apparatus	NJUG 4 & 7
VOLUME 2	
NJUG Guidelines on the Positioning of Underground Utilities Apparatus for New Development Sites	NJUG 2, 5 & 6
VOLUME 3	
NJUG Guidelines on the Management of Third Party Cable Ducting	New
VOLUME 4	
NJUG Guidelines for the Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees	NJUG 10
VOLUME 5	
NJUG Guidelines on Environmental Good Practice	New
VOLUME 6	
Legislation & Bibliography	NJUG 1

The following NJUG publications have not been reviewed and have been completely withdrawn:

NJUG 3 – Cable Locating Devices
NJUG 8 – Performance Guide for the Assessment of Metallic Pipe and Cable Locators
NJUG 9 – Recommendations for the Exchange of Records of Apparatus between Utilities
NJUG 11 – Proposed Data Exchange Format for Utility Map Data
NJUG 12 – NJUG Specification for the Digitisation of Large Scale OS Maps
NJUG 13 – Quality Control Procedure for Large Scale OS Maps Digitised to OS 1988
NJUG 15 – NJUG/Ordnance Survey Service Level Agreement (Technical) for Digital Map Products and Services

CONTENTS

In this document the word 'apparatus' is used to describe both the distribution mains and also the lateral apparatus to properties. The words 'plant' or 'services' are also used to collectively describe this and other equipment.

This volume supersedes NJUG 10 'Guidelines for the Planning, Installation and Maintenance of Utility Services in Proximity to Trees' and has been drafted by NJUG members and arboriculturists.

Background

The statutory right of undertakers (utilities) to carry out works within the public highway in order to provide and maintain their apparatus dates from the mid - 19th century. There are no statutory obligations governing the position or depth at which apparatus should be laid within the highway. The following guidelines should therefore be adhered to wherever practicable.

The New Roads and Street Works Act 1991, as amended by the Transport Act 2000, the Traffic Management Act 2004, the Transport (Scotland) Act 2005 together with the Street Works (Northern Ireland) Order 1995, sets down the legislative requirements to be adopted during the installation, repair and maintenance of apparatus in roads and streets (**see Volume 6 – 'Legislation and Bibliography'**).

Scope

(i) Trees (including shrubs and hedges) play an essential role in the environment and visual amenity of both rural and urban landscapes. They may take decades to grow, but can be destroyed in minutes. Wherever they are growing, whether in public footpaths, private gardens, rural verges or elsewhere, they require space for the adequate development of their root systems and to allow the branches to develop an attractive and natural shape.

(ii) Modern society expects a multiplicity of apparatus (electricity, gas, water, sewage, telecommunications and cable television) each of which requires an extensive distribution network, both above and below ground. These networks also need space, and they are frequently under tight constraints regarding their alignment.

(iii) The space available for both trees and apparatus is often very restricted, and they are frequently forced to share the available space, both above and below ground. Where they are in close proximity, there is the potential for either the tree or the apparatus to be subject to damage. To successfully co-exist precautions should be taken to minimise the risk of damage to both trees and apparatus based upon technical guidance obtained from this document and where appropriate further advice from local authority arboriculturists.

(iv) Legislative mechanisms for ensuring that existing trees (including shrubs and hedges) are safeguarded already exist (see sub-section 7 – 'Legislation'). References to legislation relate to the whole of the United Kingdom (UK) but variations between countries may occur. They seek to provide constructive advice on how to minimise damage to trees by undertakers (utilities) and to utility apparatus by trees and will be helpful to utility companies, contractors, arboriculturists, highway engineers, developers and planners. The guidelines have been prepared in collaboration between representatives of the utilities, the arboricultural and urban forestry professions and the Department for Communities and Local Government. As with all guidelines, their interpretation and application should be complimented at all times by common sense. However, expert guidance on specific instances should be sought from the appropriate utility, local authority or arboriculturist. The emphasis throughout this document is on the need for local liaison and communication.

(v) Certain trees are subject to Tree Preservation Orders (TPOs). Trees protected by a TPO must not be willfully damaged or destroyed and cannot be cut down, uprooted, topped or lopped without the local planning authority consent.

(vi) These guidelines are applicable to all apparatus (underground and overhead) and to trees in any location (public or private, rural or urban). They should be considered when new apparatus is planned to be constructed adjacent to existing trees, when new trees are to be planted adjacent to existing apparatus and where apparatus is to be maintained or repaired and trees are to be managed (e.g. pruning, removal or replacement).

(vii) Site surveys should be undertaken appropriate to the scale of the planned works. These surveys will identify the presence of trees which could impact on works. Advice should then be sought from a local authority tree officer. However, on major projects, a consultant arboriculturist may be employed to liase with the local authority tree officer. Site surveys should be carried out according to the recommendations within BS 5837 (see sub-section 8 – 'Other Useful Publications').

(viii) The principles set out in these guidelines also have relevance in respect of work carried out to highways near trees (e.g. kerbing, footway reinstatement).

1. HOW TREES ARE DAMAGED

Trees are complex living organisms, which are susceptible to damage from a wide range of physical agents or activities. Trees do not heal, damage caused to a tree will remain for the rest of its life. Even minor damage may set up circumstances leading to serious long term decay.

Contrary to popular belief, the root system of a tree is not a mirror image of the branches, nor is there usually a 'tap root'. The majority of the root system of any tree is in the surface 600mm of soil, extending radially in any direction for distances frequently in excess of the tree's height. Excavation or other works within this area are liable to damage the roots.

1.1 The Root System

The base of a trunk typically flares out in buttresses extending into the main lateral structural roots. These rapidly subdivide into the mass of smaller roots which serve to anchor the tree into the soil and transport water and nutrients. Even at a short distance (3m) from a large mature tree, most roots will be less than 10mm in diameter, but these may extend to well beyond the branch spread of the tree. A mass of fine roots, less than 1 mm in diameter, develop off all parts of this root system. These fine roots also absorb the water and nutrients, which are essential for the growth of the tree.

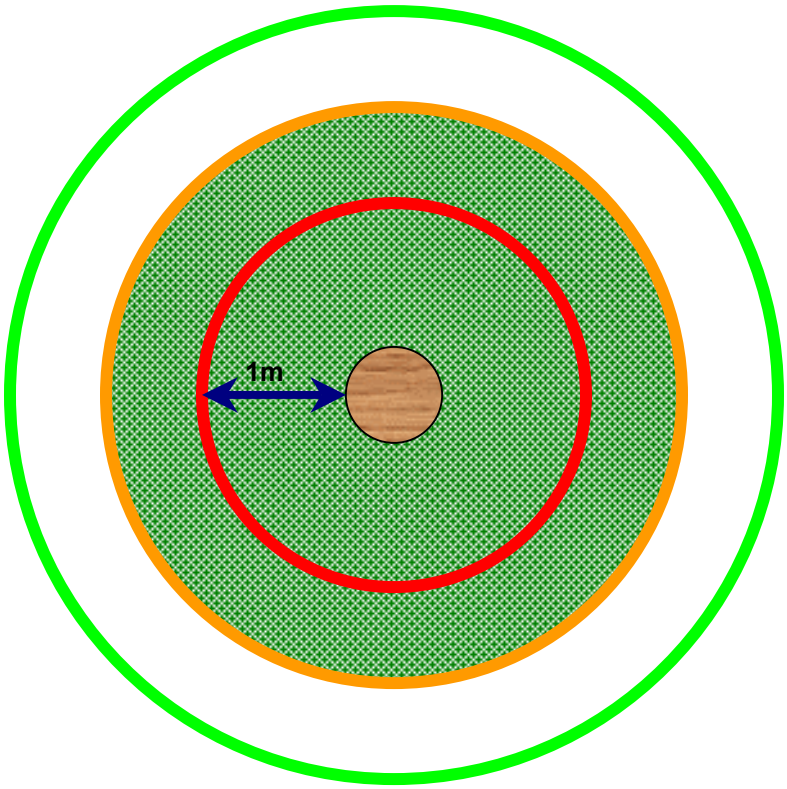
The main structural roots (close to the trunk) develop as the tree grows in response to the need for physical stability. Beyond these major roots growth is influenced by the availability of water, air and nutrients in the soil. Disturbance of soil provides ideal conditions for root growth. Apparatus is often cooler than the surrounding soil encouraging moisture within the soil to condense on its surface stimulating root growth close to the apparatus. For all these reasons root growth is often most prolific within the backfilled trench and in the soil around the apparatus.

There are certain areas around trees, illustrated in Figure 1 – 'Tree Protection Zone', where excavation either must not be undertaken or only undertaken under strict conditions in order to avoid or minimise any damage to a tree's root system.

For the purposes of this guideline document they are called zones;

- the Prohibited Zone (1m from the trunk)
- the Precautionary Zone (beneath the canopy or branch spread)
- the Permitted Zone (outside of the Precautionary Zone)

FIGURE 1 – Tree Protection Zone



Key

Trunk of tree

Canopy or branch spread

PROHIBITED ZONE – 1m from trunk. Excavations of any kind must not be undertaken within this zone unless full consultation with the local authority Tree Officer is undertaken. Materials, plant and spoil must not be stored within this zone.

PRECAUTIONARY ZONE - beneath canopy or branch spread. Where excavations must be undertaken within this zone the use of mechanical excavation plant should be prohibited. Precautions should be undertaken to protect any exposed roots. Materials, plant and spoil should not be stored within this zone. Consult with the local authority Tree Officer if in any doubt.

PERMITTED ZONE – outside of the precautionary zone. Excavation works may be undertaken within this zone, however caution must be applied and the use of mechanical plant limited. Any exposed roots should be protected.

1.2 Below Ground

1.2.1 **Root systems can be damaged by;**

- the severance of a root, for example by trenching will destroy all parts of the root beyond that point. Even roots less than 10mm in diameter may be serving the fine roots over a wide area. The larger the root severed, the greater the impact on the tree.

Typical root damage caused by excavation works

- damage to the bark on the root. The bark protects the root from decay and is also essential for further root growth. It is loosely attached and easily damaged. If damage to the bark extends around the whole circumference the root beyond that point will be killed.

- damage to surface roots. Care must be taken when using mechanical plant. Materials and vehicles must never be stored within the Prohibited Zone and ideally should not be stored within the Precautionary Zone.

- compaction of the soil. Incidental compaction may occur from storage of materials and / or the passing of heavy equipment over the roots. This 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.

Poor site management within the Precautionary Zone

- alterations in soil level. Lowering the level will strip out the mass of roots near the surface. Raising levels will have the same effect as soil compaction.

- the application of herbicide - frequently used to clear weed growth on operational land (e.g. substations). The wide-ranging root system of a tree may extend into the operational land and absorb herbicides, which have been applied to the ground. Herbicide absorbed in one part of the root system can kill the whole tree.

NOTE: The selection and application of herbicides must be undertaken by a competent person in accordance with Control of Substances Hazardous to Health (COSHH) regulations.

- spillage of oils or other materials (e.g. diesel oil, cement, resins). Spillage can permeate into the soil and damage root systems (see sub-section 4.3 – 'Chemical Damage to Trees').

1.2.2 **If roots are damaged;**

- close to the trunk. The anchorage and stability of the tree may be adversely affected rendering the tree immediately hazardous.

- anywhere along their length. The distal portion including the fine roots they serve, will be destroyed. Damage to fine roots by severance of a main root, or by compaction or alteration of ground levels, will prevent fine roots from absorbing the water and nutrients which are essential for the well-being, growth and anchorage of the tree.

- by successive excavations. Multi-utility excavations close to a tree can cumulatively damage a root system.

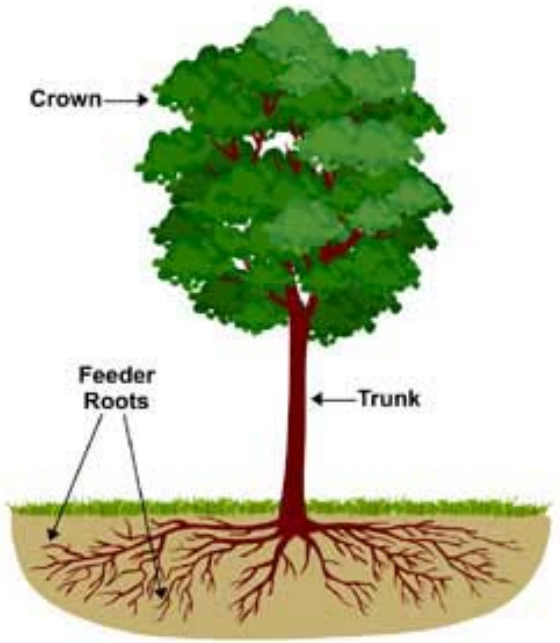


Figure 2 - Typical Tree Structure

1.2.3 **Symptoms**

Trees with damage may not show any immediate symptoms. Such symptoms may range from minor branch dieback to deterioration and ultimate death and collapse of the tree dependent on the severity of damage and the ability of the roots to regenerate.

If a root of 25mm diameter or over is severed, as a precautionary measure, a local authority tree officer / arboricultural officer should be contacted immediately.

1.3 Above Ground

Trees have a single or multi-stemmed trunk supporting a framework of branches and twigs. These structures are protected by a layer of bark, the purpose of which is to protect the functional tissues immediately beneath.

Trees can be damaged by:

- Direct impact by plant or machinery
- Fire and scorching.
- Poor pruning
- Abrasion by overhead apparatus
- Chemicals and fuel oils
- Storage of materials within the Prohibited and Precautionary Zones

1.3.1 **Abrasion**

The tree may be damaged by abrasion with overhead apparatus. Initially this only removes the outer bark. If the abrasion continues it can expose the underlying wood which may increase the risk of fire or eventual collapse of the branch or the tree.

If trees are growing in proximity to overhead apparatus it should be possible to prevent the development of problems by timely pruning and tree management. This requires knowledge of the growth pattern of the many different species of tree, consideration of the effects of the pruning on the appearance of the tree and application of the correct pruning techniques. All pruning should be in accordance with BS 3998 (see sub-section 8 – ‘Other Useful Publications’). All operatives should be authorised and competent.

For all works other than emergency or urgent works, notification and consultation with all interested parties is necessary before work commences (see section 5 – ‘How to Avoid Damage to Apparatus by Trees’).

1.3.2 **Permissions / Notifications**
Any work to trees adjacent to an area of operations that extends beyond what is absolutely necessary for operational requirements may require either written permission from the local planning authority (in respect to tree preservation orders) or six weeks' notification to the local planning authority (in respect to trees in conservation areas)(see also section 6 – 'Sites with Designated Status').

2. HOW APPARATUS IS DAMAGED

The positioning and type of underground apparatus are detailed in NJUG publication **Volume 1 – 'NJUG Guidelines on the Positioning and Colour Coding of Underground Utilities' Apparatus'.**

Construction methods and utility service materials are subject to change and any cluster of utility services is likely to consist of a variety of historic and modern materials constructed to various specifications. In general utility apparatus includes the following:

Pipes
Cables
Ducts
Chambers
Poles/Towers/Masts/Satellite dishes
Above ground installations

2.1 Below Ground

Underground apparatus (especially those less than 600mm deep) may be affected by tree roots. The risk will depend on the ability of the apparatus, in particular any joints, to resist or tolerate distortion.

2.1.1 **Direct damage**
Direct damage is caused by the annual increase in root thickness resulting in eventual contact with apparatus. However, it is usually either the root or the adjacent soil that will distort rather than the apparatus itself. The potential for damage depends on how much the root thickens and is greatest in the main structural roots within 3 metres of the tree. Roots may grow around an apparatus to form a sheath but this will rarely exert sufficient pressure to cause any damage. Surface wrappings inadequately attached to an apparatus, if non-toxic, may be colonised by roots and eventually lifted off.

2.1.2 **Indirect damage**

Indirect damage is restricted to shrinkable soils, mainly clays but also peat and some silts. Such soils shrink as they dry with the potential to distort any apparatus supported by the soil. Vegetation growing within the same area of soil may increase the drying effect.

The degree of the shrinkability of the soil will affect the amount of movement caused by drying and thus the potential for damage to occur. In situations where apparatus passes from a shrinkable soil into a rigid structure there is the possibility of extreme distortion taking place. Regular seasonal movement can also cause damage even in the absence of roots, particularly with short segmented pipes (see sub-section 3.1.4 – 'Shrinkable Soils').

2.1.3 **Root incursion**

Intact apparatus will not generally be penetrated by roots. However roots can exploit existing defects such as;

- defective pipe joints
- cracks in foul or surface water drains
- inadequate or degraded pointing of inspection chambers.

Where internal conditions are moist and aerated and therefore most conducive to root growth, root proliferation may occur and ultimately block the apparatus. If root thickening occurs where it passes into apparatus, root related enlargement of a defect may occur. This is unlikely at distances 3 metres or more from the trunk.

2.1.4 **Trees and Wind Movement**.

The potential for damage to apparatus close to a tree may increase due to movement of the lower trunk and a structural root as the tree sways in strong winds. Such movement may result in direct pressure being applied to the apparatus. Furthermore, if a tree is uprooted, any apparatus passing across or through the disturbed root plate may also be displaced. Such events are unlikely and are restricted to situations where apparatus is in close proximity to the trunk of the tree, but the potential may be increased if other structural roots are severed. Encasing apparatus in lean mix or course concrete can exacerbate this problem as fine roots may penetrate the material providing a greater 'hold' on the apparatus unless an appropriate root barrier material is used to separate the apparatus from the root system.

2.1.5 Mechanical Removal of Trees and Stumps

The mechanical removal of tree stumps by grinding or grubbing may disturb or damage apparatus passing across or through the root plate of the tree. Using a mechanical digger to uproot a tree scheduled for removal is very likely to damage apparatus within and also close to the Prohibited or Precautionary Zones as the roots will apply pressure to the apparatus as they are uprooted.

2.2 Above Ground

If overhead apparatus come into contact with trees they may be damaged as a result of:

- Abrasion when the tree and / or apparatus move in the wind bringing them into contact. The resultant abrasion can damage wires affecting their efficiency, strength and causing interference or loss of supply.

- The collapse of a branch or a whole tree which could bring down overhead lines.

3. PLANNING OF WORKS

The inherently variable nature of trees, and also the generally low incidence of damage to underground apparatus, makes it neither practical nor justifiable to impose absolute limits on the proximity of trees to apparatus. Therefore site specific liaison and agreement between the asset owner and other interested parties is essential.

With respect to overhead apparatus there are minimum established clearances which must be maintained. Details of these clearances can be obtained from the utility network operator.

Before new trees are planted the advice of a local authority tree officer or arboriculturist should be obtained.

3.1 Special Considerations when Planning the Installation of Underground Apparatus

3.1.1 New / Renewal of Apparatus - New Trees

In considering the location of new or renewed apparatus in conjunction with a new tree planting scheme early consultation is essential between the relevant

professional organizations e.g. local authorities, utility companies, developers and landowners

3.1.2 New / Renewal of Apparatus - Existing Trees

When planning the installation or renewal of apparatus the position of existing trees should be considered as one of the primary factors which could affect the siting, depth, method of installation and future maintenance of that apparatus.
Consultation with the relevant interested parties will identify any conflict and consideration should be given to apparatus diversion or felling and re-planting. This decision should be influenced by the value of the tree and the extent of the additional diversionary works.

3.1.3 Existing Apparatus - New Trees

Early consultation with utilities should take place before any tree work, including planting, is undertaken to ascertain the position of existing apparatus. Records of underground apparatus should be obtained from utilities and used in conjunction with on site apparatus detection techniques. The guidance contained within Health and Safety Executive guidance note HSG47 – 'Avoiding Danger from Underground Services' should be followed when excavating. In addition, when planning new tree planting, there should be liaison with the utilities, local authority and landowner so that the risks trees may pose to utility apparatus in the future are minimised.

3.1.4 Shrinkable Soils

Apparatus laid in clay or peat should be constructed to tolerate movements of the subsoil caused by root activity. Special precautions for differential movement should be incorporated where apparatus joins rigid structures founded at a different depth to the apparatus (e.g. pipe connections to chambers). See sub-section 2.1.2 'Indirect Damage'.

3.2 Precautions when Repairing Existing Apparatus

Where apparatus requires repair the location of the excavation is often defined by the location of the fault. The nature of the work usually requires open excavation. Excavation within the Prohibited and Precautionary Zones should be in accordance with sub-section 4.1 'Below Ground' except for emergency or urgent works.

Where emergency or urgent works may have caused damage to roots with a diameter in excess of 25mm, interested parties should be informed immediately. They may choose to consult a local authority tree officer or arboriculturist regarding whether remedial treatment to the tree is necessary.

If roots have grown into a drain or duct and proliferated so as to cause a blockage, the removal of the root mass from within the drain or duct will only provide temporary relief. If the root, which originally penetrated the drain, is still present it will regenerate and recreate the same problem. Roots of other plants may have a similar effect. Permanent relief can only be obtained by the proper repair of the original defect e.g. by replacement or refurbishment.

Utility apparatus may be refurbished by the use of pre-fabricated, slip lined or cured-in-place lining systems or pipes. Pre-fabricated and slip lined systems and pipes are generally resistant to root growth / intrusion, but cured-in-place linings may deform and ultimately collapse from the incursion of root growth. Following pre-survey (e.g. CCTV), it is essential that any roots are removed from the bore of the apparatus as far as practicable prior to lining, by the use of proprietary root removal systems (e.g. high-pressure water, flails, or rotating blade cutters).

3.3 Special Considerations when Planning the Installation of Above Ground Apparatus

The aerial parts of a tree are constantly growing larger and are prone to bend and flex in windy conditions. As a result parts of a tree may come close to or into contact with above ground apparatus.

3.3.1 **Electricity**

The overhead apparatus belonging to the electricity supply industry is subject to minimum clearances from adjacent trees and other structures. This is to ensure the safety of the public and protect against flashover and loss of supply. Local conditions may require an increase in the clearances specified in current electricity industry standards.

Part IV of The Electricity Supply Regulations covers the construction of power lines above ground. Schedule 4(9) of the Electricity Act 1989 enables electricity companies to require the felling or lopping of trees which obstruct or interfere with the working of their lines or constitute an unacceptable source of danger.

In addition to the above reference should be made to the Energy Networks Association (ENA) document Engineering Recommendation G55/1- Safe Tree Working in Proximity to Overhead Electric Lines (see section 8).

3.3.2 **Communications**

Communication operators run their systems under the Telecommunications Act 1984 (as amended by the Communications Act 2003) in accordance with The

Telecommunications Code (Schedule 2). Paragraph 19 of the Telecommunications Code enables operators to require the lopping of trees which overhang the street and obstruct or interfere with the working of their lines.

4. HOW TO AVOID DAMAGE TO TREES

This section gives general guidance on methods of work to minimise damage to trees. The local authority (or for privately owned trees, the owner or their agent), should be consulted at an early stage prior to the commencement of any works. This will reduce the potential for future conflict between trees and apparatus.

4.1 Below Ground

Wherever trees are present, precautions should be taken to minimise damage to their root systems. As the shape of the root system is unpredictable, there should be control and supervision of any works, particularly if this involves excavating through the surface 600mm, where the majority of roots develop.

4.1.1 **Fine Roots**

Fine roots are vulnerable to desiccation once they are exposed to the air. Larger roots have a bark layer which provides some protection against desiccation and temperature change. The greatest risk to these roots occurs when there are rapid fluctuations in air temperature around them e.g. frost and extremes of heat. It is therefore important to protect exposed roots where a trench is to be left open overnight where there is a risk of frost. In winter, before leaving the site at the end of the day, the exposed roots should be wrapped with dry sacking. This sacking must be removed before the trench is backfilled.

4.1.2 **Precautions**

The precautions referred to in this section are applicable to any excavations or other works occurring within the Prohibited or Precautionary Zones as illustrated in Figure 1 – ‘Tree Protection Zone’.

4.1.3 **Realignment**

Whenever possible apparatus should always be diverted or re-aligned outside the Prohibited or Precautionary Zones. Under no circumstances can machinery be used to excavate open trenches within the Prohibited Zone.

The appropriate method of working within the Precautionary Zone should be determined in consultation with the local authority (or for privately owned trees the owner or their agent) and may depend on the following circumstances;

- the scope of the works (e.g. one-off repair or part of an extensive operation)
- degree of urgency (e.g. for restoration of supplies)
- knowledge of location of other apparatus
- soil conditions
- age, condition, quality and life expectancy of the tree

Where works are required for the laying or maintenance of any apparatus within the Prohibited or Precautionary Zones there are various techniques available to minimise damage.

Acceptable techniques in order of preference are;

a) Trenchless

Wherever possible trenchless techniques should be used. The launch and reception pits should be located outside the Prohibited or Precautionary Zones.
In order to avoid damage to roots by percussive boring techniques it is recommended that the depth of run should be below 600mm. Techniques involving external lubrication of the equipment with materials other than water (e.g. oil, bentonite, etc.) must not be used when working within the Prohibited Zone. Lubricating materials other than water may be used within the Precautionary Zone following consultation and by agreement.

b) Broken Trench - Hand-dug

This technique combines hand dug trench sections with trenchless techniques if excavation is unavoidable. Excavation should be limited to where there is clear access around and below the roots. The trench is excavated by hand with precautions taken as for continuous trenching as in (c) below. Open sections of the trench should only be long enough to allow access for linking to the next section. The length of sections will be determined by local conditions, especially soil texture and cohesiveness, as well as the practical needs for access. In all cases the open sections should be kept as short as possible and outside of the Prohibited Zone.

c) Continuous Trench - Hand-dug

The use of this method must be considered only as a last resort if works are to be undertaken by agreement within the Prohibited Zone. The objective being to retain as many undamaged roots as possible.

Hand digging within the Prohibited or Precautionary zones must be undertaken with great care requiring closer supervision than normal operations.

After careful removal of the hard surface material digging must proceed with hand tools. Clumps of roots less than 25mm in diameter (including fibrous roots) should be retained in situ without damage. Throughout the excavation works great care should be taken to protect the bark around the roots.

All roots greater than 25mm diameter should be preserved and worked around. These roots must not be severed without first consulting the owner of the tree or the local authority tree officer / arboriculturist. If after consultation severance is unavoidable, roots must be cut back using a sharp tool to leave the smallest wound.

4.1.5 **Backfilling**

- Any reinstatement of street works in the United Kingdom must comply with the relevant national legislation (see: **Volume 6 – 'Legislation and Bibliography'**). In England this relates to the requirements of the code of practice – 'Specification for the Reinstatement of Openings in Highways' approved under the New Roads and Street Works Act 1991. Without prejudice to the requirements relating to the specification of materials and the standards of workmanship, backfilling should be carefully carried out to avoid direct damage to roots and excessive compaction of the soil around them.

- The backfill should, where possible, include the placement of an inert granular material mixed with top soil or sharp sand (not builder's sand) around the roots. This should allow the soil to be compacted for resurfacing without damage to the roots securing a local aerated zone enabling the root to survive in the longer term.

- Backfilling outside the constructed highway limits should be carried out using the excavated soil. This should not be compacted but lightly "tamped" and usually left slightly proud of the surrounding surface to allow natural settlement. Other materials should not be incorporated into the backfill.

4.1.6 **Additional Precautions near Trees**

- Movement of heavy mechanical plant (excavators etc.) must not be undertaken within the Prohibited Zone and should be avoided within the Precautionary Zone, except on existing hard surfaces, in order to prevent unnecessary compaction of the soil. This is particularly important on soils with a high proportion of clay. Spoil or material must not be stored within the Prohibited Zone and should be avoided within the Precautionary Zone.

- Where it is absolutely necessary to use mechanical plant within the Precautionary Zone care should be taken to avoid impact damage to the trunk and branches. A tree must not be used as an end-stop for paving slabs or other materials nor for security chaining of mechanical plant. If the trunk or branches of a tree are damaged in any way advice should be sought from the local authority tree officer / arboriculturist.

See TABLE 1 –'Prevention of Damage to Trees Below Ground' below for summary details regarding causes and types of damage to trees and the implications of the damage and the necessary precautions to be taken to avoid damage.

TABLE 1 - Prevention of Damage to Trees Below Ground

Causes of Damage	Type of Damage	Implications to Tree	Precautions
Trenching, mechanical digging etc.	Root severance	• The tree may fall over • Death of the root beyond the point of damage • Potential risk of infection of the tree The larger the root the greater the impact on the tree.	Hand excavate only within the Precautionary Zone. Work carefully around roots. Do not cut roots over 25mm in diameter without referring to the local authority tree officer. For roots less than 25mm in diameter use a sharp tool and make a clean cut leaving as small a wound as possible.
Trenching, mechanical digging, top soil surface removal etc.	Root bark damage	• The tree may fall over • If the damage circles the root it will cause the death of the root beyond that point • Potential risk of infection of the tree The larger the root the greater the impact on the tree.	Do not use mechanical machinery to strip the top soil within the Precautionary Zone. Hand excavate only within the Precautionary Zone. Work carefully around roots. Do not cut roots over 25mm in diameter without referring to the local authority tree officer. For roots less than 25mm use a sharp tool and make a clean cut leaving as small a wound as possible.
Vehicle movement and plant use. Material storage within the precautionary area.	Soil compaction & water saturation	Restricts or prevents passage of gaseous diffusion through soil, the roots are asphyxiated and killed affecting the whole tree.	Prevent all vehicle movement, plant use or material storage within the Precautionary Zone.
Top-soil scouring, excavation or banking up.	Alterations in soil level causing compaction or exposure of roots.	Lowering levels strips out the mass of roots over a wide area. Raising soil levels asphyxiates roots and has the same effect as soil compaction.	Avoid altering or disturbing soil levels within the Precautionary Zone.
Use of herbicides.	Poisoning of the tree via root absorption	• Death of the whole tree • Death of individual branches Damage to leaves and shoots.	The selection and application of herbicides must be undertaken by a competent person in accordance with COSHH regulations.
Spillage of oils or other materials.	Contamination of soil	Toxic and asphyxiation effects of chemicals, oils, building materials (cement, plaster, additives etc.) on the root system can kill the tree.	Never store oils, chemicals or building materials within the Precautionary Zone or within the branch spread of a tree, which ever is the greater.
Placement or replacement of underground apparatus.	Various	Death of all or part of the tree.	Effective planning and liaison with local authority tree officer, taking into consideration the position of trees, and their future growth potential and management

4.2 Above Ground

4.2.1 **Damage by Pruning**

Trees (including shrubs and hedges) can be damaged by inappropriate or excessive pruning. Reference should be made to the Energy Networks Association (ENA) document "Engineering Technical Report 136 Vegetation Management near Electricity Equipment – Principles of Good Practice" (see section 8 – 'Other Useful Publications') or appropriate company specific documentation for guidance on pruning.

See TABLE 2 – 'Prevention of Damage to Trees Above Ground' below for summary details regarding causes and types of damage to trees and the implications of the damage and the necessary precautions to be taken to avoid damage.

TABLE 2 - Prevention of Damage to Trees Above Ground

Causes of Damage	Type of Damage	Implications for the Tree	Precautions
Impact by vehicle or plant Physical attachment of signs or hoardings to the trunk Storage of materials at base of tree Rubbing by winch or pulling cables	Bark bruising, bark removal, damage to the wood, damage to buttress roots, abrasion to trunk	Wounding with the potential for infection ultimately resulting in death of all or part of the tree. Structural failure of the tree	Surround the trunk with protective free-standing barrier. Exclude vehicles, plant or material storage from the Precautionary Zone. Ensure sufficient clearance of cables or ropes.
Impact by vehicle or plant Rubbing by overhead cables	Bark damage to branches, breakage and splitting of branches, abrasion to branches	Structural failure of the branch. Wounding or loss of a branch with the potential for infection ultimately resulting in death of all or part of the branch or tree.	Exclude vehicles, plant or material storage from the Precautionary Zone. Ensure sufficient clearance of cables or ropes. All pruning should be carried out in accordance with BS3998 *(prune affected branches to give appropriate clearance from cables)*
Inappropriate siting of overhead apparatus, such as CCTV, lighting fixtures and communications masts and dishes.	Inappropriate pruning, unnecessary tree removal	Severely pruning tree to acquire line of sight signal for communications dish etc.	Effective planning and liaison with local authority tree officer / arboriculturist, taking into consideration the position of trees, and their future growth potential and management.
Lack of forethought in design and location of apparatus and services entries on new developments	Complete tree removal	The tree is removed unnecessarily	Agree the location and installation of services at the design stage. Consideration should be given to the creation of dedicated service routes wherever possible.
Use of herbicides	Poisoning of the tree via absorption through bark, leaves and shoots	Death of the whole tree, death of individual branches, damage to leaves and shoots	The selection and application of herbicides must be undertaken by a competent person in accordance with COSHH regulations.

4.3 Chemical Damage to Trees

Chemical damage to trees adjacent to utility premises and operational land can be avoided if;

- the risk is identified when planning any work involving herbicides or other chemicals ensuring that only appropriate chemicals are used. Particular care should be exercised when considering the use of herbicides recommended for “non crop areas” as many of these also specify “do not use where there may be roots of desirable plants”,

- herbicides are applied only at the rate and in the manner recommended by the manufacturer,

- follow-up applications are not undertaken until weeds reappear on the operational land,

- alternative methods of weed control are considered.

5. HOW TO AVOID DAMAGE TO APPARATUS BY TREES

5.1 Consultation with Utilities

The potential for future conflict between trees and above-ground apparatus can be reduced by appropriate planning. Early consultation with utilities should therefore take place before any tree work including planting is undertaken to ascertain the position of existing apparatus. Records of underground apparatus should be obtained from utilities and used in conjunction with on site apparatus detection techniques. Specific care must be taken when removing the stumps of existing trees. In addition when planning new tree planting there should be liaison with the utilities, local authority and landowner so that the risks trees may pose in the future are minimised.

5.2 Precautions during Planting

Every possible precaution should be taken to ensure that the existing apparatus is not damaged during excavation works. Health and Safety Executive guidance note HSG47 – ‘Avoiding Danger from Underground Services’ and any specific guidance issued by the apparatus owner should be followed at all stages of the work.

5.2.1 **Below Ground**

Before any excavation work begins, trial holes should be undertaken to validate the results of any detection surveys undertaken to confirm the actual position and depth of the apparatus.

5.2.2 **Above Ground**

Consideration should be given to the presence of satellite dishes and masts on commercial properties, poles and drop wires, as future tree growth may cause operational problems.

Reference should also be made to Energy Networks Association (ENA) document 'Engineering Technical Report 136 Vegetation Management near Electricity Equipment – Principles of Good Practice' (see section 8 – 'Other Useful Publications') or appropriate company specific documentation.

NOTE: In all cases where definitive clearances are required, contact must be made with the appropriate electricity or communication company who will determine the clearance to be adopted.

See also sub-section 3.3 – 'Special Considerations when Planning the Installation of Above Ground Apparatus'.

6. SITES WITH DESIGNATED STATUS

Certain sites may be specifically designated and will require consultation and / or permission from the relevant authority prior to undertaking any works. These sites include:

- Sites of Special Scientific Interest
- English Heritage Sites
- English Nature / Natural England
- National Trust Land
- Nature Reserves
- Conservation Areas
- Scottish Natural Heritage
- Areas of Outstanding Natural Beauty
- Countryside Council for Wales
- Historic Scotland
- Northern Ireland Environment and Heritage Service
- Cadw (Welsh Historic Monuments)

6.1 Tree Preservation Orders and Trees in Conservation Areas

Section198 of the Town and Country Planning Act 1990 (the Act) gives local planning authorities powers to make trees and woodlands the subject of tree preservation orders (TPOs) in the interests of amenity. Trees protected by a TPO may not be willfully damaged or destroyed and cannot be cut down, uprooted, topped or lopped without the local planning authority's consent.

Additionally, under section 211 of the Act, anyone proposing to cut down, uproot, top, lop etc. a tree in a conservation area is required to give the local planning authority six weeks' notice before doing so. This gives the authority an opportunity of making a TPO in respect of the tree.

Certain statutory obligations imposed by Acts of Parliament may allow for the limited felling, topping or lopping of trees protected by a TPO in order to supply and maintain service. This does not preclude the requirement to consult with the owner.

See also: **Volume 5 – 'NJUG Guidelines on Environmental Good Practice'**

7. LEGISLATION

Reference should also be made to **Volume 6 – 'Legislation & Bibliography'.**

7.1 Primary Legislation

National Parks and Access to the Countryside Act 1949*
Health and Safety at Work Act 1974
Highways Act 1980**
Telecommunications Act 1984
Gas Act 1986
Electricity Act 1989
Town and Country Planning Act 1990 (Section 198 Tree Preservation Orders).
Water Industry Act 1991
The New Roads and Street Works Act 1991 (NRSWA)
The Streets Works (Northern Ireland) Order 1995
Communications Act 2003
Traffic Management Act 2004
Transport (Scotland) Act 2005
The Streets Works (Northern Ireland) (Amendment) Order 2007

* Under the National Parks and Access to the Countryside Act 1949 local authorities are given a general power to plant trees.

** Under the Highways Act 1980 highway authorities may plant trees in the highway, or license others to do so. They need to ensure that trees do not overhang or cause a danger to roads or footpaths, and are given powers to prevent this from happening.

The above list is not exhaustive.

7.2 Secondary Legislation

Each Act of parliament in 7.1 will have various associated regulations that should be referred to.

8. OTHER USEFUL PUBLICATIONS

This is not an exhaustive list of available publications and is only valid at the time of issue.

BS 3998 Recommendations for Tree Work

- Provides general recommendations for tree surgery and other tree work.

BS 5837 Trees in Relation to Construction

- Gives advice on the integration of new development amongst trees.

Codes of Practice approved under the New Roads and Street Works Act 1991

- Co-ordination of Street Works and Works for Road Purposes and Related Matters
- Specification for the Reinstatement of Openings in Highways
- Safety at Street Works and Road Works
- Measures Necessary where Apparatus is Affected by Major Works (Diversionary Works)
- Inspections

Energy Networks Association publications:

- Engineering Technical Report 136 ‘Vegetation Management Near Electricity Equipment – Principles of Good Practice’
- Engineering Recommendation G55/1 – ‘Safe Tree Working in Proximity to Overhead Electric Lines’
- ENA-TS 40-80 – ENA Technical Standard for Overhead Line Clearances
- Engineering Recommendation G70 – Vegetation Control near Overhead Lines

- ETR 132 – Improving Network Performance (under abnormal weather conditions by the use of a risk based approach to vegetation management near electric overhead lines)
- MNT/004 – UK Distribution Policy for the Inspection and Maintenance of Overhead Lines

HSE Arboriculture and Forestry Advisory Group publications

- AFAG 804 Electricity at work: Forestry and arboriculture
- AFAG 404 Electrical utility arboriculture

Manual for Streets (supercedes Design Bulletin 32 and Places, Streets and Movement)

- The Department for Transport and the Department for Communities and Local Government (DCLG), with support from the Commission for Architecture and the Built Environment (CABE), commissioned WSP , TRL , Llewellyn Davies Yeang and Phil Jones Associates to develop a Manual for Streets to give guidance to a range of practitioners on effective street design.

National House Building Council (NHBC) Standards Chapter 4.2. Building near trees

- Gives information on the design of new foundations in proximity to trees on shrinkable clay soils.

9. OTHER REFERENCES

9.1 Arboricultural

Arboricultural advice may be sought from the:

- Arboricultural Advisory and Information Service
- Arboricultural Association
- Arboriculture and Forestry Advisory Group
- International Society of Arboriculture
- Local authority Arboricultural Officer
- The Tree Advice Trust

9.2. Herbicides

Information on herbicides and their application may be obtained from the:

- British Agrochemicals Association

9.3 Utilities

Utility advice may be sought from the local utility contact or NJUG.

GLOSSARY

Apparatus	Equipment such as valves, stopcocks, chambers, cabinets, transformer chambers etc and includes any structure for the lodging of apparatus.
Arboriculturist	A professional who cultivates and manages trees, hedgerows and shrubs and provides information and advice on specific tree related issues.
Carriageway	A way constituting or comprised in a highway, being a way (other than a cycle track) over which the public have a right of way for the passage of vehicles.
Cycle track	A way constituting or comprised in a highway over which the public have a right of way on pedal cycles with or without a right of way on foot.
Desiccation	The state of extreme dryness, the drying out of roots.
Distal	Situated farthest from the centre.
Drop wires	Overhead wire from telegraph pole to customer premises.
Duct / ducting	Structure (usually cylindrical) used to convey and protect apparatus.
Fibre optic	The use of very thin glass or plastic fibres through which light can be transmitted to carry information from a source to a receiver, especially for telecommunication, television and information technology systems.
Footpath	A highway over which the public have a right of way on foot only, not being a footway.
Footway	A way comprised in a highway which also comprises a carriageway, being a way over which the public have a right of way on foot only.
GRP	Glass Reinforced Plastic
Herbicide	A chemical that destroys plants.
Main	Structure (usually cylindrical) used to convey water or gas or oil generally greater than 50mm in diameter.
NJUG	National Joint Utilities Group Limited.
Pipe	Longitudinal structure (usually cylindrical) used to convey water, gas or oil.
Root plate	Formed just below the soil surface when shallow lateral growing roots predominate over the development of a deep taproot.

Service strip	A strip of designated land alongside a carriageway or footway used to convey services.
Sub-duct	Longitudinal structure (usually cylindrical) laid inside ducts used to carry smaller diameter cables such as fibre optic.
Tiles	Impact resistant cover constructed of earthenware, concrete or polyethylene for protecting underground cables
Utility	An undertaker by statute that has a legal right to provide customer services (e.g. communications, electricity, gas, water)
Verge	A strip of land which may form part of the public highway alongside a carriageway or footway, which may contain services.

APPENDIX A

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Tree Protection Plan

Drawing No: 231120-TS-TPP-Rev B-SD

Hillside Trees Ltd.
2 Hillside, Bowden Hill, Chilcompton, Radstock, BA3 4EN
Tel: 01761 233244 E: enquiries@hillsidetrees.co.uk

TANHOUSE LANE

Holmlea
House North

FELTMAKER

80-90sqm approx each bungalow

garden

close board fence 2.0mH

PRIVATE DRIVE

T1*

T2

T3

T4

T7*

T8*

T9*

T10*

T11*

T12*

garden

garden

PLOT 1

post mesh fence 2.0mH

landscaped boundaries

garden

garden

garden

PLOT 2

garden

PLOT 3

garden

landscaped boundaries

post mesh fence 2.0mH

close board fence 2.0mH

Existing
Dwelling

Existing
Dwelling
driveway
and
parking

hatched area denotes
outline of proposed
extant approved dwelling.
This dwelling is currently
being constructed

close board fence 2.0mH

Road garden
utbuildings

red line boundary
0.20 hectares

FEL

N

5m 10m

Symbol Guide

- Root Protection Area
- Canopy Spread
- Tree Position, (colour represents retention category)
- Tag Number

NOTE: Tree/group numbers marked with an * have approximate locations.

BS5837:2012 - Tree Category

- Category A Trees High Quality
- Category B Trees Moderate Quality
- Category C Trees Low Quality
- Category U Trees Poor Quality/Remove
- Existing Close Board Fencing
- Line of Protective Fencing
- Temporary Ground Protection
- 'No-Dig' Cellular Confinement System
- Existing Hard Surfacing

Hillside Trees Ltd.
Arboricultural Consultancy

Project Name:
The Stables, Tanhouse Lane

Drawing Title:
Tree Protection Plan

Drawing Number:
231120-TS-TPP-Rev B-SD

Client:
John Lines

Agent:
First Fox Architecture

Date:
November 2023

Scale:
1:200 @ A1