

# Tree Strategy



## Good Practice Guide 1 Tree Work

March 2016

# **Staffordshire Moorlands District Council**

## **Good Practice Guide 1**

### **Tree Work**

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## **1. Purpose of the Guide**

The aim of this guide is to provide general information and advice on tree work, particularly pruning, by describing different pruning techniques and how they might be used and for what reasons. It supplements the Good Practice Guide 2 - Tree Management which also forms part of the Council's Tree Strategy. Good Practice Guide 1 is primarily aimed at providing additional information to private tree owners and managers, particularly those with protected trees.

The British Standard 3998:2010 Tree Work – Recommendations is referred to in this document. It is a more comprehensive guide to tree management techniques and will also be used to provide guidance and specification in relation to tree work.

The work of the Council's arboricultural contractors is also guided by this Good Practice Guide and BS 3998:2010, and strengthened by the more detailed contract specifications which cover areas such as health and safety.

## **2. Introduction**

Pruning is the most common tree maintenance procedure. Pruning is often desirable or necessary to improve tree structure, limit nuisance or maintain safety. Excessive, poorly carried out or unnecessary pruning can do more harm than good since each cut has the potential to change the growth of a tree, cause damage or allow the entry of wood decaying organisms. Therefore no branch should be removed without a good reason, and then only in accordance with best practice guidance. Older trees do not tolerate pruning as well as younger trees and substantial pruning can be very damaging. The effect of pruning also varies between species and some are not naturally tolerant of significant cutting, notably beech and birch.

Generally, no more than a quarter of a tree's leaf area by volume should be removed in a single year; greater removal than this should have overriding reasons of justification. It is important to consider pruning over the entire life-span of the tree or trees involved, and not as a one-off single operation. Many trees generate adventitious sprouts in response to over-pruning, as they attempt to replace the stored energy. However live-branch pruning is an essential part of forming good crown structure, and is a necessary procedure in the management of specimen trees within residential parks and gardens.

This Good Practice Guide outlines the acceptable standards of tree work at the present time. It is based on various guidance, primarily on the BS 3998:2010 and the Arboricultural Advisory and Information Service's Arboriculture Research Note 48, 'A Definition of the Best Pruning Position'. Any reputable contractor will

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be aware of and familiar with these publications and will be able to carry out work to the required standard. This guidance deals with the most common procedures undertaken in tree work, however more specialised pruning may occasionally be specified.

### **3. Protected Trees**

Some trees are protected by Tree Preservation Orders. Therefore it is important to check with the council before proceeding with any tree works. If a tree is protected it will normally be necessary to make an application to the Council and get written consent before proceeding.

All trees of stem diameter greater than 7.5cm which are situated in Conservation Areas are also protected and you will normally need to notify the Council in writing of your intention to undertake works to these trees.

To find out whether or not a tree is protected you can check the Council's interactive planning map, or contact the Council's arboricultural officer, the details are given at section 9 of this document.

### **4. Wildlife**

The habitat of all nesting birds and bat roosts are protected by the Wildlife and Countryside Act, 1981 (amended 1984), strengthened by the Countryside and Rights of Way Act, 2000. With regards to birds this means that the felling or pruning of trees must be carefully carried out to avoid any risk of disturbing nesting birds, particularly between the months of March to August inclusive.

Even a dead or dying tree may provide a habitat for plants and wildlife protected under the Wildlife and Countryside Act, 1981. Most notably trees with hollows and crevices may well provide important natural roost sites for many bat species. All native bats are European Protected Species and it is an offence to kill or destroy such a species or to damage or destroy their breeding site or resting places. When proposing to fell or carry out other work to such a tree care must be taken to ensure that there are no bats or roost sites present before commencing the work. Best practice should be followed as advocated in the Bat Conservation Trust's *Bat Surveys for Professional Ecologists: Good Practice Guidelines (3<sup>rd</sup> Edition)* and British Standard 8596:2015 *Surveying for Bats in Trees and Woodland – Guide*. If in any doubt that a bat roost may be present contact Natural England or the Bat Conservation Trust; their details are at section 9 of this document. If a bat is discovered by a contractor whilst undertaking work all work must cease immediately and the site made safe, then Natural England or the Bat Conservation Trust should be contacted immediately.

Pruning trees can affect wildlife in more subtle ways. Very manicured trees provide fewer opportunities for wildlife and where possible it is good to leave some deadwood in trees, and allow dense crowns and low branches to develop to provide cover. Where trees are pruned or felled it is also important to leave some of this dead wood around as a habitat for small mammals and insects.

## 5. Timing of Pruning

Although most minor pruning can be carried out at anytime of the year, where possible it is desirable to avoid pruning operations when deciduous trees are coming into leaf and in the autumn when they are losing their foliage as the trees ability to close wounds is depleted and the tree can lose valuable energy reserves. This is particularly important if it is necessary to carry out heavy pruning or work on older trees.

The pruning of Maples (including Sycamore), Lime and Birch should be avoided in the early spring when the sap is starting to rise as they will bleed sap from the pruning wound. This bleeding is harmless, but wastes the trees resources and is unsightly. The following fruiting and ornamental flowering trees are best pruned after flowering between June and August: Plums, especially the cultivar 'Victoria', Cherry, Peach, Apricot, Pear, Apple, Laburnum, Portugal Laurel and Rhododendron.

Pruning should be avoided when the tree is under stress from environmental factors for example during or soon after a period of drought or water-logging.

Further information is give in BS 3998:2010 at section 7.2.3

## 6. Pruning and Felling Specifications

Generally most trees that need to be pruned will require one, or a combination of, the following pruning techniques. Usually between 15-20% of the crown volume is removed at any one time. Although in some cases the maximum of 25% may be recommended where justified.

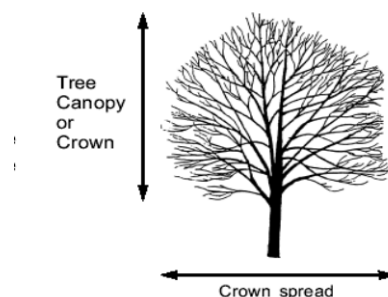


Figure 1: Crown or canopy of tree

## 6.1 Branch Removal and Appropriate Pruning Points

When pruning branches back to the main stem or fork, the branch should be reduced in small sections using the step cut method leaving a small stub before carrying out the final cut. The final pruning cut should be made back to, but not into the branch collar (See Figures 2 and 3 for illustration). When the branch collar cannot be discerned the angle of the final pruning cut should be a mirror image of the angle formed by the branch bark ridge.

Where a limb, branch or leader is to be shortened it should be cut back cleanly to a vigorous side branch finishing with a sloping cut, leaving the branch bark ridge and branch collar intact. The remaining side branch should be at least 1/3 the diameter of the branch removed. (Figure 3). This is to reduce the likelihood of decay or die-back as the lateral branch should be able to produce enough energy to keep the parent branch alive and there should be enough growth regulators present to suppress excessive shoots.

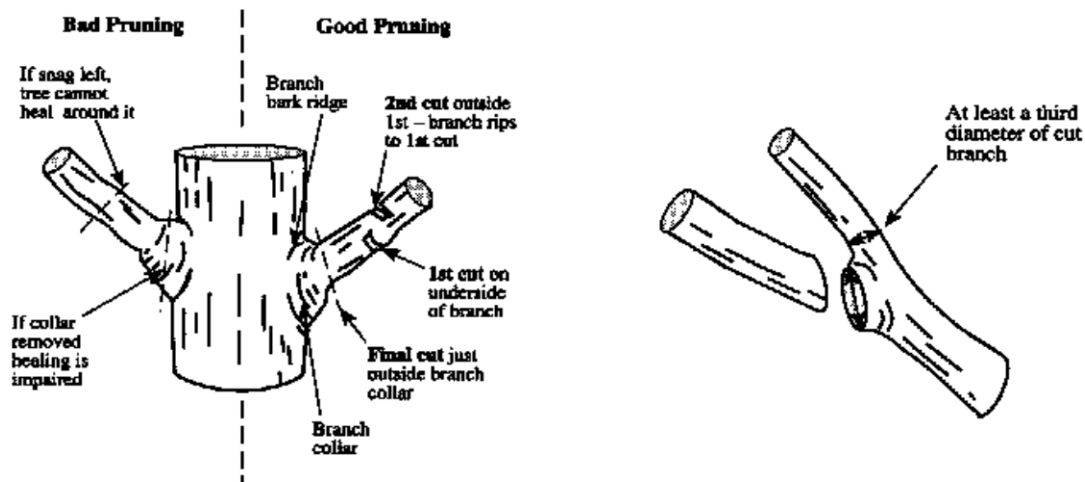


Figure 2: Branch pruning to stem

Figure 3: Pruning a branch back to a fork

Further information is give in BS 3998:2010 at section 7.2.4 -5

## 6.2 Crown Thinning

Description: Crown thinning Is the removal of a proportion of secondary and small live branch growth, throughout the crown, to produce as far as possible an even density of foliage around a well spaced and balanced branch structure (see Figure 4). It includes the removal of dead, dying, diseased, crossing, crowded



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and weakly attached branches of low vigour. Merely removing secondary growth along the limbs and leaving dense branch ends is not an acceptable practice.

Reason: Crown thinning reduces the density of the crown without altering the shape or overall size of the tree. Thinning allows more light to pass through the crown therefore reducing shading and a more open crown reduces wind resistance. It can also reduce weight on heavy limbs.

Specification: The estimated percentage of crown to be removed is normally between 10% and 25% dependent on the circumstances. Most branches removed during a thinning operation are less than 4cm in diameter.

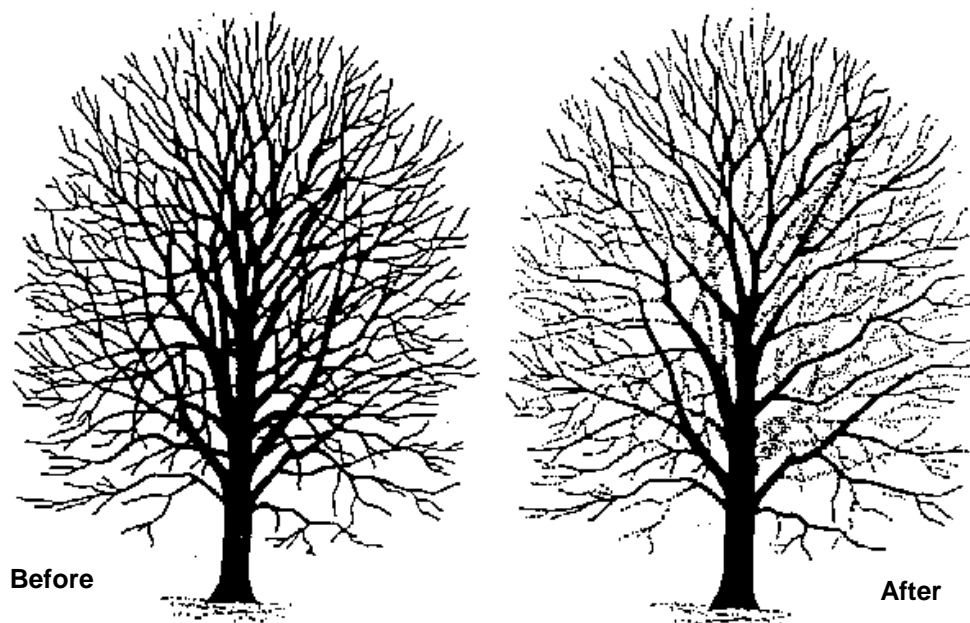


Figure 4: Crown Thinning

### 6.3 Crown Lifting

Description: Crown lifting is the selective reduction and removal of the lower branches. The excessive removal of low branches can lead to the development of poor trunk/crown balance, where a tree may become top heavy. Also large wounds around the main trunk of a tree could potentially allow the development of decay which may reduce the long term integrity of the tree's main supporting structure.

Reason: To allow space under the tree for light, people, vehicles or buildings.

Specification: Where ever possible the number and size of wounds should be limited and well spaced, so there is less chance of decay pockets combining to form larger cavities. To avoid lack of balance after crown lifting the remaining

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crown should be at least  $\frac{2}{3}$  of the total height of the tree. Some of the problematic issues described above can be addressed by the reduction of branches to lateral/secondary growth leaving a flowing branchline rather than their complete removal.

Crown lifting is specified as the height from the ground to the desired height of lowest secondary branch. Trees situated along public highways must be maintained at the following minimum clearance height:

- a) Over footpaths/paved areas - 2.4 metres over kerb height.
- b) Over carriageways - 5.2 metres over kerb height.

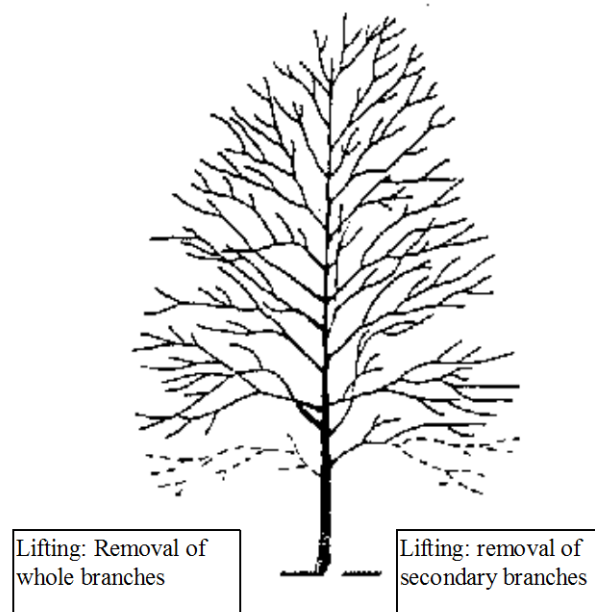


Figure 5: Crown Lifting

### 6.4 Crown Reduction

**Description:** Crown reduction or shaping, involves the systematic reduction of peripheral branches to decrease the height and/or spread of a tree's crown area to leave a flowing line.

**Reason:** This is normally specified to reduce the contact between buildings and other infrastructure or to rebalance a tree after storm damage.

**Specification:** When a branch is pruned the diameter of the remaining branch should be at least  $\frac{1}{3}$  of the diameter of the branch that is removed. The natural shape and form of the species should be maintained and the tree should be balanced and uniform on completion (Figure 6).



Crown reduction work can be specified to cover every branch within a tree's crown or it can be limited to just one. Crown reduction is specified as the in length of the effected branches or overall crown spread d or height. The reduction in most cases should be exceed 25% of the crown volume. An example of the calculation of the crown volume is given at appendix 1.

The desired reduction should be accomplished by pruning back to an appropriate pruning point (see section 5.1). This allows more effective healing of the pruning cuts and maintains a good tree architecture. Inappropriate pruning can significantly increase maintenance requirements.

**Pruning to a side branch:**

The side branch reduced to (A) should be at least 1/3 of the diameter of the proposed cut (B).

**Note:** Branch pruned back to a suitable outward pointing bud or small branch.

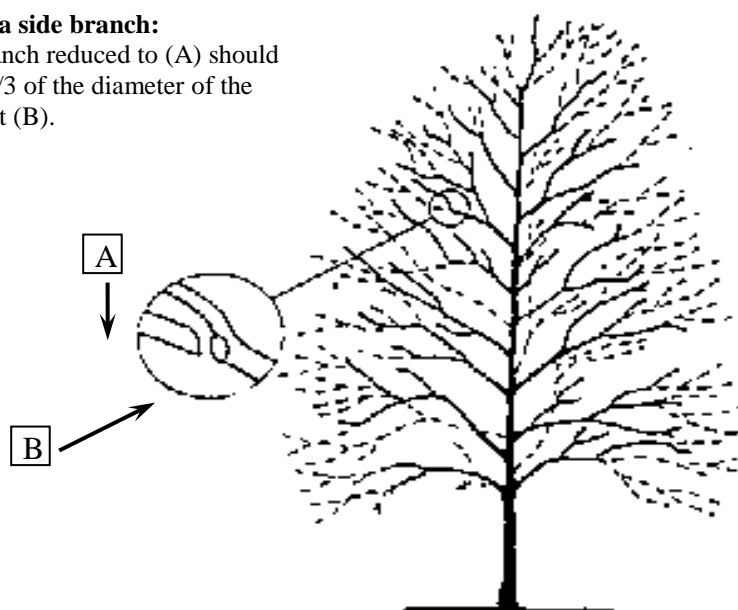


Figure 6: Crown Reduction

### 6.5 Formative Pruning

Description: Pruning to improve the shape and form of young trees.

Reason: This type of pruning is usually completed when the tree is still relatively young. The main objective of this type of pruning is to encourage the formation of good stem and branch structure, by improving the orientation and spacing of branches and removing any potential weak structures that may fail later in life. Well planned, formative pruning during the establishment of a young tree can reduce the need for pruning later on. Formative or structural pruning can be completed on semi-mature trees, but should be avoided on mature specimens.

Specification: Remove or reduce any competing leading shoots to leave one strong, dominant leader. Rubbing, diseased, dead, congested or weak branches should be removed along with epicormic and basal growth on the main stem. Low branches pointed in undesirable directions must also be removed. All work should be carried out should take into account the species concerned, and the natural form of the tree.

## 6.6 Pollarding

Description: Is a method of management where the main leading stem of a young tree is removed to encourage regrowth. The regrowth that then occurs can be regularly removed (re-pollarding) back to the same point (the pollard head). Traditionally this has been a practice in some rural areas but true pollarded trees are rare in the Staffordshire Moorlands area.

Reason: Pollarding is a management system used to control the growth of a tree throughout its life, develop a specific/controlled shape, or (historically) to produce new young growth of foliage and shoots above animal browsing height. True pollarding is initiated at a young age. Poorly cut trees can be regarded as an eyesore and when older mature trees are treated in this way as a crude form of size control this can be described as topping, and can seriously damage or even kill the tree (section 6.7). It is unlikely that pollarding will be considered an appropriate management option.

Specification: As a general rule the stem should account for approximately 60% of the overall height and the crown 40%. Re pollarding involves pruning back the tree crown to previous pruning points located on its main stem without damaging the pollard heads. Final cuts should be angled to assist the run-off of rainwater.

## 6.7 Topping

Description: Is the hard pruning, of a mature or semi mature tree, involving the removal of nearly all of the tree's branches and foliage. This is nearly always considered unacceptable practice and should not be confused with pollarding. This type of pruning destroys the trees shape and introduces decay and encourages the development of a weak branch structure and can kill some species, such as Beech.

Reason: This type of work will only rarely be acceptable for example where a tree has become hazardous and cannot be made safe by normal pruning practice but the retention of the stem or tree in a much reduced form is desirable for biodiversity. Where a tree has previously been topped it may be acceptable to prune back to the previous pruning points as with pollarding.

Specification: Topping will rarely be specified and where it is it will be individually specified.

## **6.8 Restoration Pruning**

Description: The principles behind this type of pruning are similar to those used in structural or formative pruning on establishing trees, but more care is required due to the maturity of the specimens involved. Restoration pruning may involve the training of young epicormic shoots to form new branches and allow the re-establishment of new area of crown. It is therefore important to provide a more detailed pruning specification, which may involved the identification of a specific area of the tree's crown or even a particular branch.

Reason: Restoration pruning is necessary where a tree has been damaged, poorly pruned or where a once regular management regime has lapsed, resulting in the formation of poor structural features. This is often a more appropriate pruning option than re-topping previously topped trees.

Specification: This type of pruning has to be planned over a much longer time frame and only a limited percentage (perhaps only 10%) of a trees leaf area should be removed at any one time.

## **6.9 Crown Cleaning and Dead Wood Removal**

Description: The removal of dead, dying or diseased branches, stumps, snags, broken branches, rubbing branches, unwanted epicormic shoots and climbing plants etc.

Reason: This type of pruning is more commonly used where a tree is being maintained as a specimen within the context of a formal park or garden. Here the removal of dead, dying, diseased, detached or broken branches is specified to improve crown appearance and the overall tree aesthetics. The removal of such branches may also be considered desirable where they represent a risk to persons or property. However, the formation of dead wood within the crown of a tree is part of the natural system of tree life and should not be considered to be a negative thing that has to be removed to maintain healthy tree growth, it is also important to remember that dead wood is an essential habitat for a large number of organisms in the ecosystem in which the tree lives. So it is important to consider that any removal of dead wood from the crown could potentially be detrimental to the continued viability of the ecosystem in which the tree lives. Subject to safety and aesthetic considerations, it may be that crown cleaning is therefore not a necessary or priority management practice in any given case.

Specification: This is achieved by systematically climbing throughout the crown of the tree. Cuts into live wood must be avoided when removing dead branches and stubs. No damage must occur to the branch collar, or callus tissue when carrying out this operation.

### **6.10 Removal of Epicormic Shoots**

Description: Epicormic growth is twiggy shoot growth which appears to grow from the bark surface and which grows on some species of trees, notably Lime and Sycamore. It often grows from the base of the tree, or on the stem or in the crown as a reaction to heavy pruning. Epicormic shoots grow from dormant or adventitious buds located on stem and/or branches.

Reason: This growth, particularly around the base of the tree can cause an obstruction where it is close to footpaths, driveways or the road. Also it may be removed for aesthetic reasons. This type of maintenance will often have to be done annually as the shoots soon regrow.

Specification: Epicormic growth less than 20mm in diameter should be pruned cleanly back to its point of origin, avoiding damaging the bark of the tree. Growth greater than 20mm should be cut back to avoid damage to the branch bark ridge and collar. This must be carried out using a sharp handsaw or secateurs. On no account should a chainsaw be used in this operation. All shoots must be removed back to but not into the branch collar leaving no projections or exaggerating the size of the wound.

### **6.11 Felling**

Description: The complete removal of the tree.

Reason: Felling will only be considered where pruning does not offer a reasonable solution. Where risk is an issue a risk assessment of the tree will be undertaken. Tree work may be required for the benefit of a group of trees; for example it may be necessary to remove diseased trees or to thin out a group of closely planted trees to benefit the strongest individuals. More detailed guidance on making decisions in relation to felling is given in Good Practice Guide 2 - Tree Management.

Specification: To cut the tree as close to ground level as possible, unless otherwise specified. Sometimes it is desirable to level a taller stump to avoid creating a trip or slip hazard, prior to complete stump removal – see section 6.12. On occasion, it may be specified to leave a taller standing stump or stem for wildlife habitat reasons.

## 6.12 Stump Removal

Description: Removing the stump of the tree and the main roots near the stump.

Reason: The stump may be removed for aesthetic reasons, to accommodate replacement planting in the same position, so the ground can be reinstated, or to remove a tripping hazard.

Specification: Stumps can be removed either by digging out or by using a suitable stump grinding machine. The stump and exposed buttress roots are normally chipped to a depth of 300mm below the surrounding surface. Consideration should be given to the potential presence of underground services such as electricity cables and in many cases it will be necessary to contact public utility companies in order to identify any services, which may be present.

Stumps should be removed where they would form a slipping or tripping hazard to the public or to site management personnel. It will not be appropriate to retain stumps in paved areas, amenity grassland, formal shrub beds and herbaceous borders. Retention of stumps in more informal shrub beds and at the edges of meadows may be acceptable, and in woodland areas, nature reserves and countryside sites it will often be appropriate. In such circumstances stumps should be of sufficient height to be clearly visible and avoid a tripping hazard.

## 6.13 Stump Treatment

Description: Treating stumps of felled trees with herbicide to prevent regrowth.

Reason: Where stumps are to be left in situ it is sometimes desirable to treat the stumps to prevent them regrowing. This regrowth is more likely in some species than others, for example Poplar, Willow, Lime and Sycamore will often shoot again from the stump where as this rarely occurs in conifer species.

Stump treatment should not be undertaken where there is a group of trees of the same species growing together as the herbicide may be translocated from the stump to the roots of a live tree via a root graft. This could potentially kill a neighbouring tree.

Specification: This should be undertaken as soon as possible after the tree has been felled to be effective. Approved stump killing herbicide must be applied in accordance with the manufacturer's specifications by suitably trained and qualified personnel in possession of a current certificate of competence under the Control of Pesticides Regulations 1986. It should be applied by drilling holes in the outer cambium layer of the stump, which should then be bunged or covered to keep water out in order to prevent the chemical being diluted.

## **6.14 Retaining or Removing Tree Work Arisings**

The default specification in the Council's arboricultural contract is that all tree work arisings (felled trees, and any timber, dead wood, brash and foliage cut from retained trees) will be removed from site unless otherwise specified. However, in some circumstances it is appropriate to leave arisings on site and contractors will be instructed accordingly by the arboricultural officer, in consultation with other officers involved in managing the site where appropriate. The character of the site, its function and the type and intensity of its use will be taken into account.

Where trees are to be felled or, if acceptably justified, topped, standing stems as wildlife habitat features may be left in-situ at suitable locations. These will normally be informal sites such as woodlands, nature reserves and countryside sites, or similar informal areas of otherwise more formal sites. However, such retention of standing stems will not normally be appropriate in amenity grassland or formally laid out/maintained areas/sites.

Felled or uprooted stems, and cut or fallen large limb/branch sections, may be left lying on site for biodiversity enhancement or as informal natural play structures where this would not conflict with safety issues, constrain or obstruct site management operations or be considered damaging to a site's visual qualities aesthetics. Such retention will not normally be appropriate in amenity grassland or formally laid out/maintained areas/sites. Consideration may be given to re-locating large sections of wood to more suitable positions elsewhere on the same site if retention in-situ is not appropriate.

Smaller sections of timber or dead wood may be left lying as fallen, or stacked into habitat piles, and brash also left in informal piles, for biodiversity enhancement where this is in keeping with the site characteristics. Again this will not be appropriate on formal sites or formally maintained parts of sites including amenity grassland, shrub beds and herbaceous borders, and will generally only be acceptable in woodlands and on sites managed specifically for wildlife conservation and enhancement.

## **7. Employing a Tree Work Contractor**

Tree work requires a high degree of skill and should only be undertaken by well trained and competent arborists (also sometimes know as tree surgeons or arboricultural contractors) who will be able to undertake tree work to specifications in this document. Qualified arborists can provide a variety of services to assist in performing the job safely and reducing the risk of personal injury and damage to property. They can also assist you in determining what type of pruning is necessary to maintain or improve the health, appearance and safety of your trees. If tree work is not undertaken properly it could not only lead to injury to people and damage to property, but cause permanent damage to trees.

## Good Practice Guide 1 – tree work

Any one can advertise themselves as a tree work contractor or arborist so you should assure yourself that they are competent to undertake tree works. Ask to see copies of their qualifications, particularly compulsory NPTC certifications for chainsaw use appropriate to the type of work and specific operations being undertaken. Always check that they have an up to date insurance certificate with at least £5 Million employers' & public liability cover. It is advisable to get at least two written quotes and be aware that the lowest quote may not be the best one. Also ask for the phone number of some one who would be happy to show you an example of their work. Contractors may say they are members of a trade association, check the validity of any such claim. The Arboricultural Association produces a list of approved contractors; see section 9 for their details.

Remember, bona-fide tree work contractors do not knock on doors to get business.

### 8. Summary

- Consider whether the work is really necessary and that the type of pruning specified will achieve the desired aim.
- Check whether consent is required from the Council before commencing with tree works.
- The presence of nesting birds and bats and other wildlife should be considered, and surveys should be carried out according to best practice, before undertaking work.
- A maximum of 25% of the trees crown should be removed in a single operation, although less is often desirable.
- Tree work should be undertaken by a qualified, competent and insured contractor.
- Poor pruning often leads to increased maintenance and cost in the future.



## 9. Further Information

Arboricultural Officer  
 Staffordshire Moorlands District Council  
 Moorlands House  
 Stockwell Street  
 Leek  
 ST13 6HQ

Tel: 01538 395788

Email: [steve.massey@staffsmoorlands.gov.uk](mailto:steve.massey@staffsmoorlands.gov.uk)

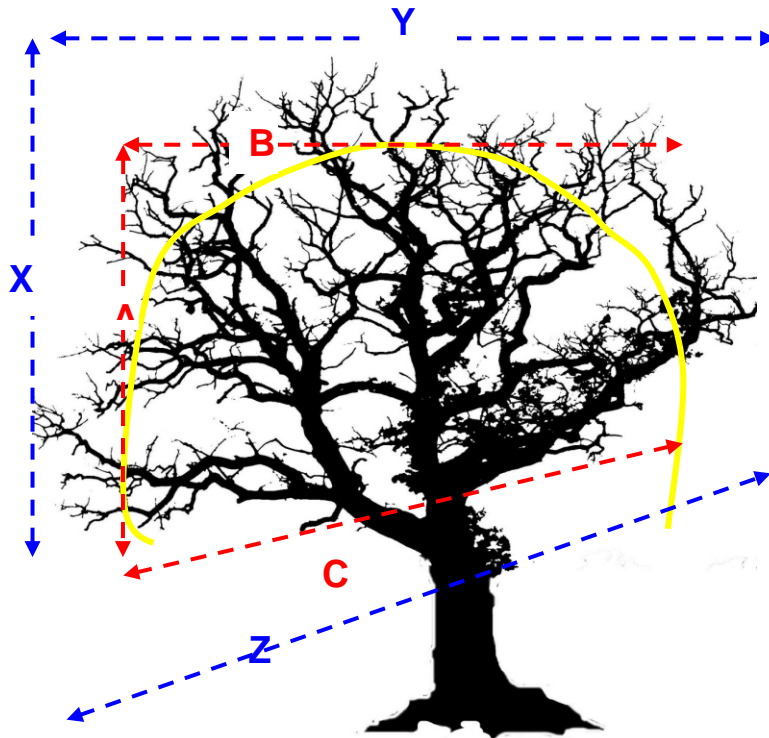
### Other Useful Contacts

Arboricultural Association	Tel: 01242 522152 Website: <a href="http://www.trees.org.uk">www.trees.org.uk</a> E-mail: <a href="mailto:admin@trees.org.uk">admin@trees.org.uk</a>
Bat Conservation Trust	Tel: 0345 1300 228 (bat helpline) Website: <a href="http://www.bats.org.uk">www.bats.org.uk</a> E-mail: <a href="mailto:enquiries@bats.org.uk">enquiries@bats.org.uk</a>
British Standards	Tel: 0208 123 5933 Website: <a href="http://www.standardsuk.com">www.standardsuk.com</a>
Chartered Institute of Ecology and Environmental Management	Tel: 01962 868626 Website: <a href="http://www.cieem.net">www.cieem.net</a> E-mail: <a href="mailto:enquiries@cieem.net">enquiries@cieem.net</a>
Natural England	Tel: 0300 060 3900 Website: <a href="http://www.gov.uk/government/organisations/natural-england">www.gov.uk/government/organisations/natural-england</a> E-mail: <a href="mailto:enquiries@naturalengland.org.uk">enquiries@naturalengland.org.uk</a>
Staffordshire Wildlife Trust	Tel: 01889 880100 Website: <a href="http://www.staffs-wildlife.org.uk">www.staffs-wildlife.org.uk</a> E-mail: <a href="mailto:info@staffs-wildlife.org.uk">info@staffs-wildlife.org.uk</a>
The Tree Council	Tel: 0207 407 9992 Website: <a href="http://www.treecouncil.org.uk">www.treecouncil.org.uk</a> E-mail: <a href="mailto:info@treecouncil.org.uk">info@treecouncil.org.uk</a>
Woodland Trust	Tel: 01476 581111 Website: <a href="http://www.woodlandtrust.org.uk">www.woodlandtrust.org.uk</a> E-mail: <a href="mailto:England@woodlandtrust.org.uk">England@woodlandtrust.org.uk</a>

### Useful Documents

British Standard BS 3998:2010 Tree Work - Recommendations
British Standard BS 5837:2012 Trees in Relation to Design, Demolition and Construction – Recommendations
British Standard BS 8596:2015 Surveying for Bats in Trees and Woodland – Guide
Bat Surveys for Professional Ecologists: Good Practice Guidelines (3 <sup>rd</sup> Edition) available from: <a href="http://www.bats.org.uk/pages/batsurveyguide.html">http://www.bats.org.uk/pages/batsurveyguide.html</a>
Town and Country Planning Act 1990.
Town and Country Planning (Trees) (England) Regulations 2012
Guidance on Tree Preservation Orders and trees in Conservation Areas is available from DCLG: <a href="http://planningguidance.communities.gov.uk/blog/guidance/tree-preservation-orders/">http://planningguidance.communities.gov.uk/blog/guidance/tree-preservation-orders/</a>

Appendix 1 – illustration of calculation of crown reduction volume



**FIG 1:** Illustration of volume reduction of crown of tree. The solid yellow line is indicative of the tree's shape following pruning.

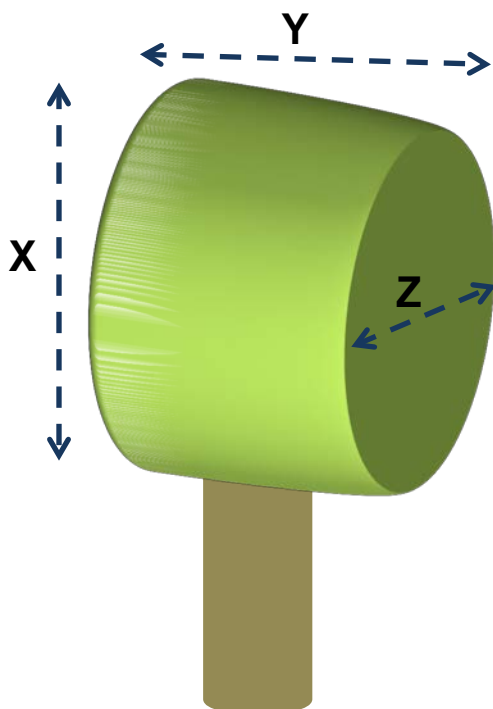
X = height of the crown of the tree – not the overall height

Y= diameter of the crown of the tree north – south

Z = diameter of the crown of the tree east - west

Initial Crown volume  $Xm \times Ym \times Zm$  eg  $10m \times 10m \times 10m = 1000m^3$

A reduction of 1m in each direction is approximately a 27% reduction in crown volume  $9m \times 9m \times 9m = 729m^3$



**FIG 2:** Illustration of the calculation of the volume of the crown of tree using a 3D model

X = height of the crown of the tree – not the overall height of the tree

Y= diameter of the crown of the tree north – south

Z = diameter of the crown of the tree east - west