NOTE Attention is drawn to the Hedgerows Regulations 1997 [2].

4.4.2.9 On shrinkable soils (known or suspected), if it is evident that trees or substantial stems have been removed from a hedgerow, this should be recorded, along with any apparent signs of past management, such as laying or significant height reduction. Such information can be of particular relevance to foundation design, where the current species composition and dimensions might not reflect the previous influence of a hedgerow on ground moisture levels.

4.5 Tree categorization method

4.5.1 As part of the tree survey (see **4.4**), trees should be categorized using the criteria shown in Table 1.

NOTE The means of identifying each category on the tree survey plan is shown in Table 2.

4.5.2 The purpose of the tree categorization method, which should be applied by an arboriculturist, is to identify the quality and value (in a non-fiscal sense) of the existing tree stock, allowing informed decisions to be made concerning which trees should be removed or retained in the event of development occurring.

4.5.3 For a tree to qualify under any given category, it should fall within the scope of that category's definition (U, A, B, C) and, for trees in categories A to C, it should qualify under one or more of the three subcategories (1, 2, 3). Subcategories 1, 2 and 3 are intended to reflect arboricultural and landscape qualities, and cultural values, respectively.

4.5.4 The tree survey schedule should list which subcategory applies. It is intended that each subcategory has equal weight such that, for example, an A1 tree has the same retention priority as an A2 tree. Some trees could qualify under more than one criterion.

4.5.5 When determining the appropriate category for any given tree, group or woodland (see **4.4**), the arboriculturist should start by considering whether the tree falls within the scope of category U. Assuming that it does not, the arboriculturist should then proceed on the presumption that all trees are considered according to the criteria for inclusion in category A. Trees that do not meet these criteria should then be considered in light of the criteria for inclusion in category B. This process should be repeated, as required, until the appropriate quality or value assessment is reached.

4.5.6 Trees of generally high quality and/or value which have a defect or defects that do not reduce their retention span below the suggested 40 year threshold, should be placed in category A, i.e. they should not be downgraded as a result of minor imperfections.

4.5.7 Where trees would otherwise be categorized as U, but have identifiable conservation, heritage or landscape value, even though only for the short term, they may be upgraded, although they might be suitable for retention only where issues concerning their safety can be appropriately managed.

4.5.8 When categorizing a tree, the presence of any serious disease or tree-related hazards should be taken into account. If disease is likely to be fatal or irremediable, or likely to require sanitation for the protection of other trees, it might be appropriate for the trees concerned to be categorized as U, even if they otherwise have considerable value. If structural defects present an unacceptable risk to people or property, the extent to which the defects are remediable, including the effect that this might have on the tree's remaining value, will influence whether the tree be assigned to the category that it would otherwise merit.

Table 1 **Cascade chart for tree quality assessment**

Category and definition	Criteria (including subcategories where appropriate)			Identification on plan
Trees unsuitable for retention (see Note)				
Category U Those in such a condition that they cannot realistically be retained as living trees in the context of the current land use for longer than 10 years	• Trees that have a serious, irremediable, structural defect, such that their early loss is expected due to collapse, including those that will become unviable after removal of other category U trees (e.g. where, for whatever reason, the loss of companion shelter cannot be mitigated by pruning) • Trees that are dead or are showing signs of significant, immediate, and irreversible overall decline • Trees infected with pathogens of significance to the health and/or safety of other trees nearby, or very low quality trees suppressing adjacent trees of better quality *NOTE Category U trees can have existing or potential conservation value which it might be desirable to preserve; see 4.5.7.*			See Table 2
	1 Mainly arboricultural qualities	**2 Mainly landscape qualities**	**3 Mainly cultural values, including conservation**	
Trees to be considered for retention				
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)	See Table 2
Category B **Trees of moderate quality** with an estimated remaining life expectancy of at least 20 years	Trees that might be included in category A, but are downgraded because of impaired condition (e.g. presence of significant though remediable defects, including unsympathetic past management and storm damage), such that they are unlikely to be suitable for retention for beyond 40 years; or trees lacking the special quality necessary to merit the category A designation	Trees present in numbers, usually growing as groups or woodlands, such that they attract a higher collective rating than they might as individuals; or trees occurring as collectives but situated so as to make little visual contribution to the wider locality	Trees with material conservation or other cultural value	See Table 2
Category C **Trees of low quality** with an estimated remaining life expectancy of at least 10 years, or young trees with a stem diameter below 150 mm	Unremarkable trees of very limited merit or such impaired condition that they do not qualify in higher categories	Trees present in groups or woodlands, but without this conferring on them significantly greater collective landscape value; and/or trees offering low or only temporary/transient landscape benefits	Trees with no material conservation or other cultural value	See Table 2

Table 2 **Identification of tree categories**

Category (from Table 1)	Colour [A)]	RGB code [A)]
U	Dark red	127-000-000
A	Light green	000-255-000
B	Mid blue	000-000-255
C	Grey	091-091-091

[A)] Colours verified against http://safecolours.rigdenage.com/palettefiles.html#files [viewed 2012-03-26].

4.5.9 During the course of a tree survey, it might be found that certain trees require immediate attention. For example, they might present an imminent and serious hazard to life or property, or they might be affected by a pest or pathogen which would cause widespread and serious damage unless controlled or eradicated. These issues should be recorded and promptly brought to the attention of the relevant person or organization (including statutory authorities where applicable).

4.5.10 Particular care is needed when evaluating young trees, especially where they occur as individual specimens. Where these are less than 150 mm stem diameter at 1.5 m above adjacent ground level, it might be acceptable and relatively straightforward to mitigate their loss, if necessary, with similar new tree planting. Alternatively, it might be practicable to relocate such trees within the site (e.g. using a tree spade). Whilst the presence of young trees of good form and vitality is generally desirable (i.e. those trees which have the potential to develop into quality mature specimens), they need not necessarily be a significant constraint on the site's potential.

NOTE It is sometimes possible to relocate mature trees. However, as this is a costly and complex operation with a variable chance of success, it is a viable option only in exceptional cases.

4.5.11 The tree survey might identify the presence of veteran trees on the site. The implications of their presence on the use of the surrounding land should be assessed at the earliest possible stage of the design process. Where such trees are to be retained, particular care should be taken in the design to accommodate them in a setting that aids their long-term retention.

NOTE Whilst veteran trees typically provide a range of niche habitats, they are especially valuable if ancient, due to their scarcity and high habitat values for associated species of fungi, lichens and saproxylic invertebrates, including some which are rare or endangered and occur only where such trees have been continuously present for centuries. These trees will therefore almost always be included in the A3 category.

4.6 Root protection area (RPA)

4.6.1 For single stem trees, the RPA (see **3.7**) should be calculated as an area equivalent to a circle with a radius 12 times the stem diameter. For trees with more than one stem, one of the two calculation methods below should be used. In all cases, the stem diameter(s) should be measured in accordance with Annex C, and the RPA should be determined from Annex D. The calculated RPA for each tree should be capped to 707 m^2.

a) For trees with two to five stems, the combined stem diameter should be calculated as follows:

$$\sqrt{(\text{stem diameter 1})^2 + (\text{stem diameter 2})^2 \ldots + (\text{stem diameter 5})^2}$$

5.3 Proximity of structures to trees

5.3.1 The default position should be that structures (see **3.10**) are located outside the RPAs of trees to be retained. However, where there is an overriding justification for construction within the RPA, technical solutions might be available that prevent damage to the tree(s) (see Clause **7**). If operations within the RPA are proposed, the project arboriculturist should:

a) demonstrate that the tree(s) can remain viable and that the area lost to encroachment can be compensated for elsewhere, contiguous with its RPA;

b) propose a series of mitigation measures to improve the soil environment that is used by the tree for growth.

5.3.2 The cumulative effects of incursions into the RPA, e.g. from excavation for utility apparatus, are damaging and should be avoided. Where there is evidence that a tree has been previously subjected to damage by construction activity, this should be taken into account when considering the acceptability of further activity within the RPA.

5.3.3 On shrinkable soils, the foundation design should take account of the risks of indirect damage, i.e. subsidence and/or heave brought about by changes in moisture content of the soil due to remaining and removed vegetation, as well as the future influence of new planting (see Annex A).

5.3.4 A realistic assessment of the probable impact of any proposed development on the trees and vice versa should take into account the characteristics and condition of the trees, with due allowance and space for their future growth and maintenance requirements. To maximize the probability of successful tree retention, the following factors should be taken into account during the design process.

a) **Shading**. Shading by trees affects buildings and open spaces.

   1) **Shading of buildings**. Shading of buildings by trees can be a problem, particularly where there are rooms which require natural light. Proposed buildings should be designed to take account of existing trees, their ultimate size and density of foliage, and the effect that these will have on the availability of light.

   2) **Shading of open spaces**. Open spaces such as gardens and sitting areas should be designed to meet the normal requirement for direct sunlight for at least a part of the day.

   NOTE 1 Shading can be desirable to reduce glare or excessive solar heating, or to provide for comfort during hot weather. The combination of shading, wind speed/turbulence reduction and evapo-transpiration effects of trees can be utilized in conjunction with the design of buildings and spaces to provide local microclimatic benefits.

b) **Privacy and screening**. It might be highly desirable for trees to provide screening to a building, e.g. for internal privacy, to reduce overlooking by neighbours or to mitigate undesirable views, such as busy roads, railway lines or industrial premises. In order to achieve the desired outcome, account should be taken of the proposed orientation and aspect of the building, the type of building, its use and location relative to the tree, and the species attributes of the tree.

c) **Direct damage**. Below-ground damage to structures can occur as a result of incremental root and stem growth. Above-ground damage can occur to trees and structures by the continuous whipping of branches against the fabric of a building. Branch ends might have to be cut back periodically, possibly affecting the shape of the tree. Structures should therefore be

designed and/or located with due consideration for a tree's ultimate growth, so as to reduce the need for frequent remedial pruning or other maintenance.

NOTE 2 Exceptions might arise where this is a known and acceptable management outcome (e.g. cyclical maintenance of previously pollarded trees or where retention of desirable trees would otherwise not be feasible).

d) **Future pressure for removal**. The relationship of buildings to large trees can cause apprehension to occupiers or users of nearby buildings or spaces, resulting in pressure for the removal of the trees. Buildings and other structures should be sited allowing adequate space for a tree's natural development, with due consideration given to its predicted height and canopy spread. However, this does not mean that trees should not be retained within any particular distance of a structure (see Table A.1 for new planting).

e) **Seasonal nuisance**. Trees are naturally growing and shedding organisms. Leaves of some species can cause problems, particularly in the autumn, by blocking gullies and gutters. Fruit can cause slippery patches, and accumulation of honeydew can be damaging to surfaces and vehicles. Buildings, footpaths and hard-standing areas should be designed with due consideration to the proximity of retained trees, especially in terms of their foliage, flowering and fruiting habits. Where conflicts might arise, detailed design should address these issues, e.g. use of non-slip paving; provision of leaf guards or grilles on gutters and gullies; provision of access and means of maintenance.

5.4 Arboricultural impact assessment

5.4.1 The project arboriculturist should use the information detailed in **5.2** and **5.3** to prepare an arboricultural impact assessment that evaluates the direct and indirect effects of the proposed design and where necessary recommends mitigation.

5.4.2 The assessment should take account of the effects of any tree loss required to implement the design, and any potentially damaging activities proposed in the vicinity of retained trees. Such activities might include the removal of existing structures and hard surfacing, the installation of new hard surfacing, the installation of services, and the location and dimensions of all proposed excavations or changes in ground level, including any that might arise from the implementation of the recommended mitigation measures. In addition to the impact of the permanent works, account should be taken of the buildability of the scheme in terms of access, adequate working space and provision for the storage of materials, including topsoil.

NOTE Scaled cross-sections and other drawings might be required to demonstrate the feasibility of the proposals (see Annex B).

5.4.3 As well as an evaluation of the extent of the impact on existing trees, the arboricultural impact assessment should include:

a) the tree survey (see **4.4**);

b) trees selected for retention, clearly identified (e.g. by number) and marked on a plan with a continuous outline;

c) trees to be removed, also clearly identified (e.g. by number) and marked on a plan with a dashed outline or similar;

d) trees to be pruned, including any access facilitation pruning, also clearly identified and labelled or listed as appropriate;

Annex A (informative) General advice for other interested parties

NOTE This annex contains general advice that is expected to be of use to land managers, contractors, planners, statutory undertakers, surveyors, and all others interested in harmony between trees and construction.

A.1 Avoiding damage by trees to structures

A.1.1 General

Buildings need to be designed and constructed to accommodate the current and potential future influence of existing and removed vegetation, as well as planned new planting.

In some situations, trees and vegetation can adversely affect structures either by direct action (see **A.1.2**) or by indirect action (see **A.1.4**).

A.1.2 Direct damage by trees to structures

Trees can cause direct damage to structures by:

a) the disruption of underground utility apparatus;

b) displacement, lifting or distorting;

c) the impact of branches with the superstructure;

d) structural failure of the tree.

The potential for direct damage needs to be considered throughout the design and construction process.

The growth of the base of the stem or of roots near the surface exerts relatively small forces. Whilst paving slabs or low boundary walls can be lifted or pushed aside easily, heavier or stronger structures are more likely to withstand these forces without damage, as the root distorts around the obstruction before damage occurs. The greatest risk of direct damage occurs close to the tree from the incremental growth of the main stem and the roots, and diminishes rapidly with distance.

It is advisable that new tree planting is kept at distances from structures of at least those in Table A.1.

Where construction work is to take place near to existing trees, allowance for future tree growth needs to be factored in to the construction process in order to protect the structure. For example:

1) walls or structural slabs need to bridge over roots allowing sufficient clearance for future growth;

2) paving and other surfaces need to be laid on a flexible base to allow movement and to facilitate relaying if distortion becomes excessive.

Water leaking from damaged drains and sewers encourages localized root growth; roots are then likely to enter a drain or sewer through the defect and proliferate, causing blockage and an enlarging of the initial defect. Provided they are further from trees than the distances stipulated in Table A.1, intact drains are not likely to suffer direct damage and will not attract roots. Damage to drains and sewers can be avoided by:

i) re-routeing to conform to Table A.1;

ii) ensuring watertight joints;

iii) in clay soils, use of flexible materials and/or joints to accommodate movement;

iv) not using perforated land drains near trees.

Allowance needs to be made for the swaying of stem and branches during storm conditions. Branches which are liable to strike the structure need to be removed or pruned back to a suitable branching point as appropriate (*see BS 3998:2010*).

Table A.1 **Minimum distance between young trees or new planting and structure to avoid direct damage to a structure from future tree growth**

Type of structure	Minimum distance between young trees or new planting and structure, in metres (m)		
	Stem dia. <300 mm [A)]	Stem dia. 300 mm to 600 mm [A)]	Stem dia. >600 mm [A)]
Buildings and heavily loaded structures	—	0.5	1.2
Lightly loaded structures such as garages, porches etc.	—	0.7	1.5
Services			
<1 m deep	0.5	1.5	3.0
>1 m deep	—	1.0	2.0
Masonry boundary walls	—	1.0	2.0
In-situ concrete paths and drives	0.5	1.0	2.5
Paths and drives with flexible surfaces or paving slabs	0.7	1.5	3.0

[A)] Diameter of stem at 1.5 m above ground level at maturity

A.1.3 Allowance for future growth

Where the installation of paths or light structures such as walls is unavoidable near to trees, the design and construction specification needs to take account of future growth.

If it is necessary to build a wall or similar structure over a root greater than 50 mm diameter, provision for future diameter growth needs to be made by surrounding the root with uncompacted sharp sand, void-formers, or other flexible fill materials, and by laying an adequately reinforced lintel or raft over the surface.

A.1.4 Indirect damage by trees to structures

Damage by indirect action can occur in shrinkable soils such as clay when vegetation takes moisture from the ground, causing a significant volume change resulting in ground movement. Non-cohesive soils such as sand and gravel are not shrinkable, as their volume does not alter with a change in moisture content, and so structures on these soils are unaffected by indirect damage.

Buildings and drainage need to be protected against the effects of subsidence and heave.

- Subsidence takes place when water is withdrawn from the soil causing it to shrink.
- Heave takes place when previously dehydrated soil takes up water and swells. This can happen after the felling or removal of vegetation. It can also occur beneath a building if roots are severed. These activities make heave more prevalent in new build construction than older buildings. Heave is three-dimensional, exerting both vertical and lateral pressures on structures.

Detailed guidance is given in NHBC Standards Chapter 4.2 [14].