CABINET	AGENDA ITEM No. 6
24 SEPTEMBER 2018	PUBLIC REPORT

Report of:	Simon Machen - Corporate Director of Growth and Regeneration	
Cabinet Member(s) responsible:	Councillor Peter Hiller - Cabinet Member for Growth, Planning and Economic Development	
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PETERBOROUGH CITY COUNCIL'S TREE AND WOODLAND STRATEGY

RECOMMENDATIONS	
FROM: Corporate Director of Growth and Regeneration	**Deadline date:** N/A
It is recommended that Cabinet recommends the Tree and Woodland Strategy to Full Council for approval.	

1. ORIGIN OF REPORT

1.1 This report is submitted to Cabinet following consideration by the Growth, Environment and Resources Scrutiny Committee on 10 January 2018 and Cabinet 15 January 2018, prior to four weeks public consultation from 2 March 2018 to 29 March 2018.

2. PURPOSE AND REASON FOR REPORT

2.1 The purpose of this report is to present the City Council's updated Tree and Woodland Strategy for the Cabinet to consider and if appropriate to refer it to Full Council for consideration as part of the major policy framework.

2.2 This report is for Cabinet to consider under its Terms of Reference No. 3.2.1, 'To take collective responsibility for the delivery of all strategic Executive functions within the Council's Major Policy and Budget Framework and lead the Council's overall improvement programmes to deliver excellent services'.

3. TIMESCALES

Is this a Major Policy Item/Statutory Plan?	**YES**	If yes, date for Cabinet meeting	**24 September 2018**
Date for relevant Council meeting	**17 October 2018**	Date for submission to Government Dept.	**N/A**

4. BACKGROUND AND KEY ISSUES

4.1 The Council adopted its current Tree and Woodland Strategy in 2012. That Strategy has been

extremely effective in putting in place clear process and guidelines as to how the city council will not only discharge its statutory functions in relation to Trees and Woodland, but also its guidelines, or 'service standards', in respect of this important resource, a matter which is very 'public facing' service the council delivers.

It is, however, time to refresh that strategy, building on the success of the current strategy, but also providing further clarification on what service the council will offer (and importantly what it will not).

The draft strategy has been drafted taking account of the following key principles:

- fulfilling our statutory duties (including health and safety)
- being as clear as possible where the council will and will not provide service.
- recognition of the vital importance of trees and woodland to our communities, quality of life and ecosystems services.
- our financial constraints.

Statutory duties

The City Council's Trees and Woodland Strategy takes account of the legislative requirement introduced by the Natural Environment and Rural Communities Act S40 and The Natural Choice: securing the value of nature –Environment White Paper.

In addition it will help the Council facilitate compliance with:

- Occupiers Liability Act 1957 [revised 1984] which requires it "to take reasonable care" to maintain its trees and woods in a reasonably safe condition.
- The Health and Safety at Work Act 1974 which requires the council to have a duty of care to employees and members of the public in respect to safety of the trees in its ownership.

The systems of health and safety checks on trees that have been developed are proposed to be maintained. The aim will be to continue to keep risks presented by trees as low as it is reasonably practical to do so. In 2012 the Council's contractors produced a Tree Risk Management Plan, now included within the revised strategy, which includes measures recommended in current guidance.

Service standards

As organisms of longevity and complexity, in order to manage trees sustainably, a strategic operational approach is essential. The understanding of the way pruning affects trees has evolved, but the basic premise has not changed: all tree surgery is not for the benefit of the tree, other than to enable it to continue to co-exist in an artificial human environment.

The analysis of enquiries received over the last five years of has enabled the Council to monitor customer concerns, prioritise work and establish best practice in the way that it is undertaken. Improved levels of consultation and communication have been developed. Equally, firmer policies have been developed, and proposed to be included in the new strategy, that inform residents of the Council's actions in respect to common concerns. These policies are integral to a more pro-active level of service delivered within financial constraints.

Importance of trees

Trees are the largest and oldest living organisms in our environment. Trees and woodlands are dominant features of the landscape and environment of Peterborough. Collectively they form one of its finest and most important features. However, they are not simply embellishments, but provide a range of important ecosystem services and contribute towards the sustainable future of the City. Previously when referred to Cabinet the report illustrate the importance of some of the ecosystem services provided by trees and how they can help to deliver its Environment Action Plan (EAP) targets. As part of consultation feedback this evidence was further expanded by the commissioning of a i-Tree Eco v6 evaluation, used to describe the tree stock and quantify and value air pollution removal, carbon storage, carbon sequestration and reductions in surface water

runoff delivered by the trees (see consultation feedback below).

Financial constraints

In these challenging financial times the strategy has been written within the constraints of the current budgetary provision. No new financial demands are envisaged from the revised strategy however it does highlight the potential threats of major pest and disease that may in future impact financially on the council. It also highlights the need to retain existing resourcing chains to avoid existing problems getting worse to the point where the tree stock could be considered a negative asset.

Measures are also proposed to introduce mechanisation, such as a tractor mounted tree shears, where it is practicable to reduce the cost of selective woodland management. In addition to expanding tree and woodland cover through sustainable external funding sources.

5. CONSULTATION

5.1 Public consultation on the strategy commenced for four weeks post Cabinet approval. A range of local organisations will be invited to comment during this consultation period. These included:

- The Local Conservation Bodies
- Peterborough Environment City Trust
- Nene Park Trust
- The Woodland Trust

5.2 A total of 4 consultation responses were received. These comments and observations have been incorporated, where appropriate, within the revised Strategy presented. A summary of the consultation comments is included within Appendix A.

5.3 The recommended revisions are, on the whole, very limited and focused in very few areas of the Strategy. One comment raised by Scrutiny was its lack of evidence to support the positive benefits of the Council's tree resource. In order to address this a report was commissioned to present an evaluation of some of the benefits provided by Peterborough's council owned tree stock. This work, using i-Tree Eco v6, describes the tree stock and attempts to quantify and value air pollution removal, carbon storage, carbon sequestration and reductions in surface water runoff delivered by the trees. Amenity value of the tree stock was calculated using the Capital Asset Value for Amenity Trees (CAVAT) quick method. This useful report has been added within Appendix 8 of the Trees & Woodland Strategy. In summary the report highlights that the council owned trees are providing significant benefits to society in the form of public services. Amenity value far outweighs the other benefits, with a total value of £2.9 billion, compared to a present value of £38.20 million over 80 years for all other benefits combined, plus total carbon storage value of £11.07 million. Interestingly the tree stock can be credited with offsetting 79.3% of the Council's emissions (data taken from the annual Carbon Reduction Commitment (CRC) figures 17-18).

It was noted by Cabinet, as well as a consultation comment, that ward boundary references were outdated and that canopy cover data did not relate to the most recent ward boundary changes. Subsequently, following consultation, the most upto date canopy cover data was prepared and spatially analysed against current ward boundaries. The resultant independent analysis showed some differences between those figures in the draft Strategy and the revised data. In summary the updated work has resulted in a new, higher quality, canopy cover data set, more accurately demonstrating the significant variance in ward areas, and is to be inserted into the Strategy.

6. ANTICIPATED OUTCOMES OR IMPACT

6.1 The proposed Strategy, if approved will be used in making decisions on the management of the Council's Trees and Woodland asset. The Strategy aims also to expand our knowledge of the competing pressures experienced in managing a sizeable maturing urban tree population.

7. REASON FOR THE RECOMMENDATION

7.1 The strategy will help deliver the city's Environment Capital priority by providing clear strategic direction for the management of the council's tree resource and set targets with which the progress of the strategy will be measured.

8. ALTERNATIVE OPTIONS CONSIDERED

8.1 The alternative option of not producing an updated strategy would mean that there would be no clear vision and targets associated with the management of the Council's Trees and Woodland, making progress difficult to monitor and the effective allocation of resources challenging. Therefore the alternative option of not updating the strategy was rejected.

9. IMPLICATIONS

Financial Implications

9.1 There are no new financial implications on the Council, as a result of the policies proposed in the draft strategy. Where applicable, all targets contained within the plans are currently planned to be achieved within existing resources.

Legal Implications

9.2 As detailed in 4.2 above the strategy also ensures the council continues to fulfil its duties under the Health and Safety at Work Act and the Occupiers Liability Act.

Equalities Implications

9.3 There are no anticipated equalities implications of this recommendation.

10. BACKGROUND DOCUMENTS

Used to prepare this report, in accordance with the Local Government (Access to Information) Act 1985

10.1 Peterborough Tree and Woodland Strategy 2012
Environment Action Plan: Peterborough City Council 2017

11. APPENDICES

11.1 Appendix A - Trees and Woodland Strategy - Consultation Comments
Appendix B - Draft Trees and Woodland Strategy

Strategy reference	Comment	PCC Position	Outcome
6.6	Peakirk Parish Council supports the overall content of the document, especially the aim to increase canopy cover across areas where the cover is low. Our canopy cover is one of the lowest in the authority area at 2.32% (at that time we were part of Newborough Ward).	Noted. Canopy cover data remodelled with new Ward boundaries	Canopy cover data amended.
9.2.15	We are also keen to encourage the promotion and conservation of wet woodland at the Old Wildfowl Trust site.(paragraph 9.2.15 then stated)	Noted. The site remains in private ownership and the desires expressed will be considered, along with others, within any future Statutory Duties PCC are required to deliver in respect to this land.	No text amended
TP40, TP41	We also welcome the policies TP40 and TP41 that confirm the importance of tree cover in planning applications.	Noted	No text amended
TP36.3, TP37, TP37.1,TP37.2, & TP37.3	We support Priorities: TP36.3, TP37, TP37.1,TP37.2, & TP37.3	Noted	No text amended

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Peterborough

Tree and Woodland Strategy



PETERBOROUGH CITY COUNCIL

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1. Introduction

1.1 This new strategy will aim to build on the achievements and progress made during the life of the 2012 document. However, many of the old policies will remain unchanged. The City's trees and woodlands have the capacity to both improve the quality of life for Peterborough residents and make a significant contribution towards the Council's environmental targets and aspirations.

1.2 The new strategy will seek to consolidate the Council owned tree stocks and woodland and manage them in a sustainable way. This particularly applies to the extensive legacy woodlands planted by the Peterborough Development Corporation (PDC) in the 1970's. The strategy seeks to make the woodlands more resilient in the face of threats from introduced pests and diseases and the impact of climate change.

1.3 A key aim will be to increase tree canopy cover in the City by both planting new trees and ensuring proper development of newly established trees to maximise the benefits they can provide. Also to support and contribute to the Forest of Peterborough Project target to plant 183,000 trees in and around the city and surrounding countryside by 2030. The extension of canopy cover will focus on the urban areas and try to redress the balance between Wards with low numbers of trees and those with extensive tree and woodland cover. However, tree and woodland planting will be encouraged throughout the whole of the unitary area.

1.4 The strategy seeks to strike a balance between maximising benefits provided by trees and recognising that trees can cause significant problems for home owners when in close proximity to dwellings and gardens. Where possible, long term solutions will be applied to reduce the level of conflict between trees and residents.

1.5 The preservation and improvement of wildlife habitats and the conservation value of the City's trees and woodlands is at the heart of the strategy. The strategy will mesh with both National policies and the Council's Ecological and Green Space Plans.

2. Background

2.1 The Unitary Peterborough extends to 34,000 ha. The current (2016) population is approximately 200,000 which is expected to increase by a further 41,500 between 2016 and 2036.

2.2 The City is set in eastern England, where the Fens meet the lowlands of the Midlands. This junction of landscapes provides a rich and diverse range of contrasting and distinctive landscapes including fenlands, clay lands, river valleys, gravels and limestone.

2.3 The eastern half of the unitary area is reclaimed high quality agricultural land on the flat fens. Originally the margins would have consisted of wet woods and carrs of alder, birch, ash and oak, edging onto vast tracts of brackish marsh, river plains and reeds.

2.4 To the west of the City the land becomes more undulating and forms the eastern extent of the Rockingham Forest character area. There are numerous ancient woodlands in this area, many of which are of high nature-conservation interest and are attractive landscape features in their

own right. Fields and roads are bounded by trees and hedgerows which link a patchwork of woods. These woods, the remnants of the Rockingham Forest, survive in western Peterborough.

2.5 Early settlements such as those found at Flag Fen and Barnack led to the clearance of the forest. Later as sea levels dropped, and man drained the Fens, so his impact on the tree cover of the area became even greater.

2.6 There has been continuous settlement at Peterborough since 45 AD. Early settlement was based around the great abbey of St Peter. The City grew beyond its medieval boundaries during the nineteenth century and the City's industrial heritage evolved with the great rail workshops. At the same time the brick industry, so closely linked to the City until the 1980's, was developing. The older parts of the City, which accommodated the industrial growth of Peterborough from Victorian times to the 1950s, have a structured layout with tree lined roads, formal promenading parks and open spaces.

2.7 In 1967 Peterborough was designated as a New Town and during the 1970s and 1980s the population increased significantly with three new townships constructed around the core of the old city. The PDC ceased to exist in 1988. However, the process of housing growth and township creation continues with the latest development; the privately funded Hamptons, built on former brickfields to the south of the City.

2.8 The PDC undertook extensive tree planting throughout the new townships using a naturalistic planting scheme including woodland belts tree groups and individual tree planting in close association with residential and commercial development. This planting style was partially influenced by the garden city concept. The main road network, created as part of the new town construction, was edged by tree belts, the main design influence here was the American parkway movement. Many of the roadside tree belts are also in close proximity to residential properties. The PDC tree and woodland planting is now coming to maturity providing a valuable legacy for today's residents of the City but is in need of ongoing management and renewal.

3. Aims of the Strategy

3.1 Sustainability is at the heart of the Council's long term aims and is encapsulated in the Environment Action Plan. This tree and woodland strategy seeks to provide:

"A sustainable tree and woodland resource for a growing city"

3.2 The strategy sets out how the benefits provided by trees and woodland will be maintained and enhanced. This will include positive steps to consolidate tree stocks and address some of the recurring problems associated with the Council's trees.

3.3 The primary aims are summarised as follows:

- **To maintain and enhance the tree population of the City.**
- **To increase the tree canopy cover across the City with particular reference to areas with low canopy cover.**
- **To protect, consolidate and, where necessary, restructure the legacy of trees and woodland established by the PDC.**
- **To maintain and maximise the ecosystem services provided by the Council's trees.**
- **To ensure, as far possible, that the Council's tree stocks are resilient in the light of threats from introduced tree pests and diseases and climate change.**
- **To promote biodiversity and conserve tree and woodland eco-systems.**
- **To conserve and protect ancient woodland and ancient trees with significant ecological, historical and amenity value.**
- **To work with partners to expand the woodland cover through sustainable external funding.**
- **To fulfil the Council's duty of care in respect of its tree stocks. The systems of health and safety checks on trees that have been developed will be maintained. The aim will be to keep risks presented by trees as low as it is reasonably practical to do so.**

3.4 This document highlights the importance of the tree resource under the stewardship of the Council and sets a standard for its management, which ensures its long term conservation and development for the benefit of the people of Peterborough and future generations.

3.5 Many of the issues affecting tree and woodlands have strong links with other Council initiatives in urban design and land use. Tree and Woodland protection and care is concerned with managing the risks and benefits to ensure the best and most sustainable outcome.

3.6 The Council will act to conserve and enhance the quality, value, role and diversity of the trees and woodlands in the City. The focus will be on consolidation and, where necessary, rationalisation.

3.7 The Council will respond to the concerns and actions of residents. However, the removal of trees shall be resisted and, when it is necessary to do so, replacement planting will be required.

3.8 The Council are a lead partner in the Forest for Peterborough project led by Peterborough Environment City Trust (PECT), The projects target is to plant 183, 000 trees by the year 2030. Since the project started in 2010 a total of 93,600 native trees have been planted. Over the remaining 13 years of this project the Council will continue to review its land management practices and, where possible, provide areas for new trees and woodlands to be planted.

4. Achievements since the Last Strategy was Produced in 2012

4.1 There has been considerable progress since the last tree and woodland strategy was produced.

4.2 Management of the Council's tree stocks was contracted out in 2013, as part of a 23 year infrastructure support service contract currently managed by Amey plc.

4.3 The focus of the work during the period has been the completion of extensive tree surveys to, as far as is reasonably practicable, reduce the risk of tree failures. A Tree Risk Management Plan was produced in 2012 setting out the procedures to be followed to fulfil the Council's duty of care. As a result of the adoption of the Tree Risk Management Plan proprietary tree management software was installed. Approximately 50,000 street trees have now been surveyed and logged into the tree database. This will greatly facilitate the day to day and future management of the Council's tree stocks and has led to management of tree stocks becoming pro-active rather than reactive.

4.4 A canopy cover survey was commissioned in 2014 which gives the percentage canopy cover over the City by Ward. Canopy cover is defined as the area occupied by the crowns of the trees as a percentage of the land area. The figure is used to assess the tree cover of the City and also allows comparison with other urban areas in the UK and across the world.

4.5 The legacy woodlands planted by PDC are extensive and extend to 280 ha. These have all had basic level health and safety surveys around the woodland edges and footpaths which included noting details of the woodland composition. Any trees presenting a risk of failure or highway obstructions have been dealt with by either remedial tree work or removal.

4.6 The Bretton Woodlands, including Grimshaw Wood, Pocock's Wood and Highlees Spinney are the only Ancient woodlands in the Council ownership. In 2013 after consultation with stakeholders a Management Plan for the woods was produced to ensure their long term sustainability. The plan took full account of the importance of the sites for heritage, wildlife, recreation and impact on the local landscape. Aided by a Heritage Lottery Fund grant and EWGS grant from the Forestry Commission the Peterborough Environmental City Trust restored coppice working to some of the areas of the woods providing opportunities for community involvement in traditional woodland crafts. New access paths and pedestrian bridges were constructed in Grimshaw and Pocock's wood and some non-native invasive species removed.

4.7 Some management work has been completed in the woodland belts including thinning, and removal of edge trees causing a nuisance. This was completed on a trial basis to gauge the response of residents. The trial in Werrington was completed with a largely positive reaction from local residents.

4.8 All this represents a considerable improvement to the position at the beginning of the last plan. However, now the systems are in place, a similar effort and focus is now needed to secure the Council's tree stock for the future.

5. Other Council Policies which Impact on the Tree and Woodland Strategy

The Environmental Action Plan

5.1.1 In 2017 PCC adopted an updated an Environment Action Plan (EAP) the key elements of which are shown in Table 1. The EAP sets out the Council's overarching strategy to make the city fully sustainable by 2050. The aim is to achieve 'One Planet Living' (at present we use the resources of three planets. One planet living would reduce this to utilising our planets resources in a fully sustainable way).

5.1.2 Trees and woodland feature directly in selected aims of the EAP, however, the urban forest has the potential to provide a significant contribution to the broad range of Council's targets.

5.1.3 Trees are the largest and oldest living organisms in our environment. Trees and woodlands are dominant features of the landscape and environment of Peterborough. Collectively they form one of its finest and most important features. However, they are not simply embellishments, but provide a range of important ecosystem services and contribute towards the sustainable future of the City. The following examples, in the table below, illustrate the importance of some of the ecosystem services provided and how trees can help to deliver its EAP targets. These values are further expanded within a report (detailed within Appendix 8) commissioned to present an evaluation of some of the benefits provided by Peterborough's council owned tree stock. i-Tree Eco v6 was used to describe the tree stock and quantify and value air pollution removal, carbon storage, carbon sequestration and reductions in surface water runoff delivered by the trees. Amenity value of the tree stock was calculated using the Capital Asset Value for Amenity Trees (CAVAT) quick method.

Table 1 – The Contribution of the City's Urban Forest to EAP Targets

EAP Aims	The Ways in which Trees and Woodland Contribute to a Sustainable Future for Peterborough through the broad range of ecosystem services provided
Zero Carbon CO_2	• Carbon is stored and locked in timber. • A % of the carbon emissions of the City are sequestered by trees each year. • Fuel wood produced from sustainable woodland management is a source of carbon neutral fuel. • Help alleviate the effects of climate change
Sustainable Water	• Trees reduce surface water runoff and help prevent flooding. All parts of the City are susceptible to flooding due to surface water runoff (Environment Agency, 2016). Additional tree planting particularly in conjunction with Sustainable Urban Drainage Schemes (SUDS) has the potential to intercept and slow down runoff reducing damage caused. • Trees in catchment areas delay and reduce run off into water courses. • Trees are important components of sustainable drainage schemes. • Trees help to improve the quality of polluted sites. • Help to reduce the impact of climate change.
Land Use and Wildlife	• Providing a range of wildlife habitats. • Ancient trees and ancient woodlands provide habitat for many rare species. • Woods provide wildlife corridors throughout the City. • Provide landscape benefits

Sustainable Materials	• Timber produced in the city's urban forest is sustainably managed. • All timber products used in tree and woodland management will be from Forestry Stewardship Council (FSC) registered sources.
Local and Sustainable Food	• Fruit trees and orchards throughout the city produce locally sourced food. • Old orchards provide important wildlife habitats.
Zero Waste	• Waste from tree works is recycled for fuel wood or composted for mulch. • Re-cycled green waste can be used for mulching of trees and shrubs and surfacing informal footpaths within the woods.
Sustainable Transport	• Paths through woodland and greenspace provide for safe walking and cycling routes across the city. • Road edge tree belts screen traffic, lower noise levels. • Trees trap atmospheric pollutants and particulates created by traffic.
Culture and Heritage	• Trees and woods provide an educational resource. • Provide a link with past lives and landscapes • Woods preserve archeological remains and features.
Equity and Local Economy	• Provides local jobs. • A recreational resource open to all. • Provides opportunities for community involvement. • The proximity of trees and woodland can increase property values.
Health and Wellbeing	• Provides Recreational opportunities. the UK it has been estimated only one third of the ıpulation does the recommended level of exercise. The estimated cost Ill health due to obesity is £1 billion per year. The City's woodlands encourages outdoor recreation and a healthy life style • Air pollution from vehicles and industrial processes produces minute particles known as particulate matter as well as gasses such as ozone, nitrogen dioxide and sulphur dioxide. These present a risk to health, it has been estimated around 30,000 deaths in the UK are attributable to air pollution. Trees trap particulates on the leaves and take in gasses through the pores lowering the risk to health. • Gives a feeling of wellbeing and relieves stress. • Reduce air temperatures and provide shading. • Produces improvements in both physical and mental health.

Peterborough Local Plan 2016 to 2036

5.1.4 This plan is being revised to reflect latent housing, job and infrastructure needs, as well as latest National Policy. It is also strongly aligned with the EAP aims. It includes; polices designed to extend open space and green infrastructure (LP22), maintain green wedges between areas of development (LP26) and protect ancient woodland and ancient trees from development. (LP28). The plan refers to the tree and woodland strategy on questions of tree management hence the need to revise this document to give clear and up to date guidance.

5.1.5 When considering planning applications, the Council will ensure that suitable trees are retained on development sites and that they are properly protected during the construction phase. Any tree losses will need to be replaced with new planting.

5.1.6 This revised strategy has been prepared with due consideration to current international, regional and corporate policies, and to provide a structure for compliance with the Council's legal responsibilities. The strategy will contribute to the delivery of the broad range of Council aims, objectives and priorities on the environment, communities, health, and land use planning.

5.1.7 The structure of this strategy is to ensure that key Council and National policies are considered and are at the core of the policies and priorities herein. This document will contribute to delivering the broad range of Council aims in conjunction with priorities on community and land use planning issues. In addition, the strategy also takes account of the latest Government Forestry and Woodlands Policy Statement issued by DEFRA in January 2013 and the UK Forestry Standard.

5.1.8 In recognition of the change that population growth will mean to communities and infrastructure, we need to ensure that stability and social cohesion continue and that growth will lead to a cleaner and greener city. The urban forest has an important role in this process.

The Biodiversity, Green Infrastructure and Open Space Strategies

5.1.9 These documents provide a strategic plan to deliver a network of high quality green spaces. They set out to ensure green space will be designed and managed as a multi-functional resource, delivering a wide range of environmental and quality of life benefits. Trees and woodlands are a very important part of this and play a vital role in defining Peterborough as an Environment City.

5.1.10 Woodlands, especially old trees and ancient woodlands, are amongst our richest habitats. The highest levels of biodiversity are often found in woodlands that are actively and sensitively managed. Their diversity is even greater when they form part of a mixed landscape in close proximity to other features such as ponds, grasslands and even residential gardens. Hedgerows linking woodlands act as wildlife corridors and so greatly promote the extent and range of wildlife. In order to protect this ecological asset an evaluation will be given to the sensitivity of the species and habitats identified to ensure public access remains appropriate, without harming the biodiversity interest.

5.1.11 The challenge in the future will be to maintain and enhance diversity. Planning and management needs to be aimed at providing a natural environment which is resilient to climate change. Climate change will impact on the range of native wild plants and animals and hence the character of our woods.

5.1.12 The presence of some invasive non-native species such as Japanese knotweed (*Fallopia japonica*) will need to be addressed.

5.1.13 Woodlands protect ground water from pollution and lessen the likelihood of flooding by intercepting rain before it reaches watercourses. Strategically planted shelterbelts intercept air pollutants. To realise integrated and multifunctional landscape management the Council will work closely with external partners and a variety of landowners.

5.1.14 The Trees and Woodland Strategy is mutually compatible with these overlapping strategic documents and thus provides a clear direction for the management of the City's Green space and natural environment assets.

6. The Resource (an Analysis of the Council's Tree stocks)

6.1 As a result of the progress made in surveying and entering the Council's tree stocks on to a database, the survey work carried out in the PDC legacy woodlands and the canopy cover survey carried out in 2014, it is possible to get a good overview of the state of the Council's trees.

6.2 To draw conclusions from the data taken from the database it is necessary to separate the 280 ha of woodland planted by PDC from other tree stocks in streets and public open space which are defined as 'Specimen trees" .

Specimen Tree Stock-Age

6.3 In certain circumstances some species of tree can live to 200 to 300 years and beyond. However in dynamic urban conditions with poor soils and growing conditions life expectancy can be considerably shorter, in some cases as low as 20 to 30 years. Figure 1 shows the age structure of trees on the data base (excluding the PDC woods).

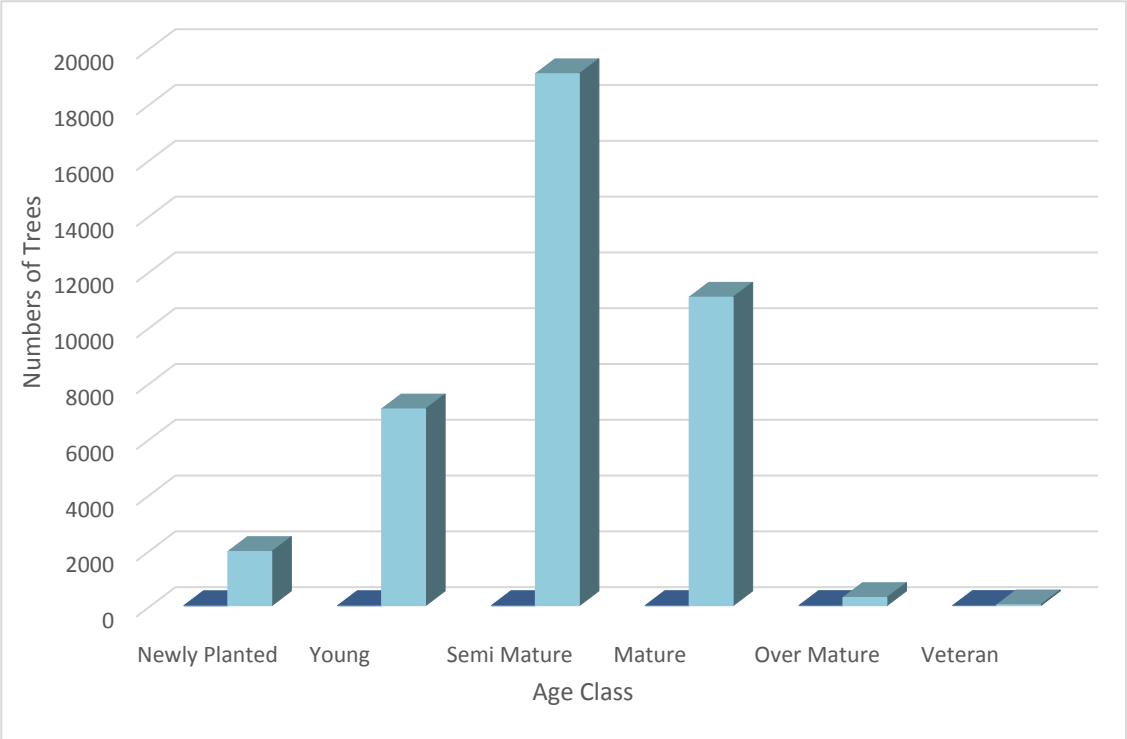

Fig 1: Bar chart showing the age distribution of the trees on City's tree data base

6.1 It can be seen from Figure 1 that the vast majority of the Council's urban trees are in the semi mature category. The semi-mature trees are defined as trees in the first third of their, expected safe, useful life and have reached the point where they will need increasing amounts of management. As the trees grow into maturity there will be increased encroachment of roots and crowns into adjoining properties and a higher incidence of tree failures and fungal infection.

6.2 It should be noted that are a very small number of over mature and veteran/ancient trees present in the City. The industrialisation of the nineteenth and twentieth centuries coupled with the sweeping landscape changes wrought by the new town development generally left few old trees. The veteran and ancient trees and woodlands that do exist are therefore of particular historic and conservation value.

Woodland Tree-Age

6.3 The demographics of the City's tree stocks are heavily influenced by the planting carried out by the PDC between 1970 and 1986. For example, 63% of these woods were planted in a four year period between 1975 and 1979 and are now between 40 and 50 years old. The Pie chart Figure 2 shows the age structure in the PDC woods. It can be seen that 93% of these woodlands are between 30 and 50 years old.

6.4 In the first third of their lifecycle trees in the PDC Legacy woodlands have been relatively trouble free and the trees have required minimal maintenance. However, they are growing inexorably towards neighbouring buildings and carriageways, obscuring road signs and blocking visibility splays.

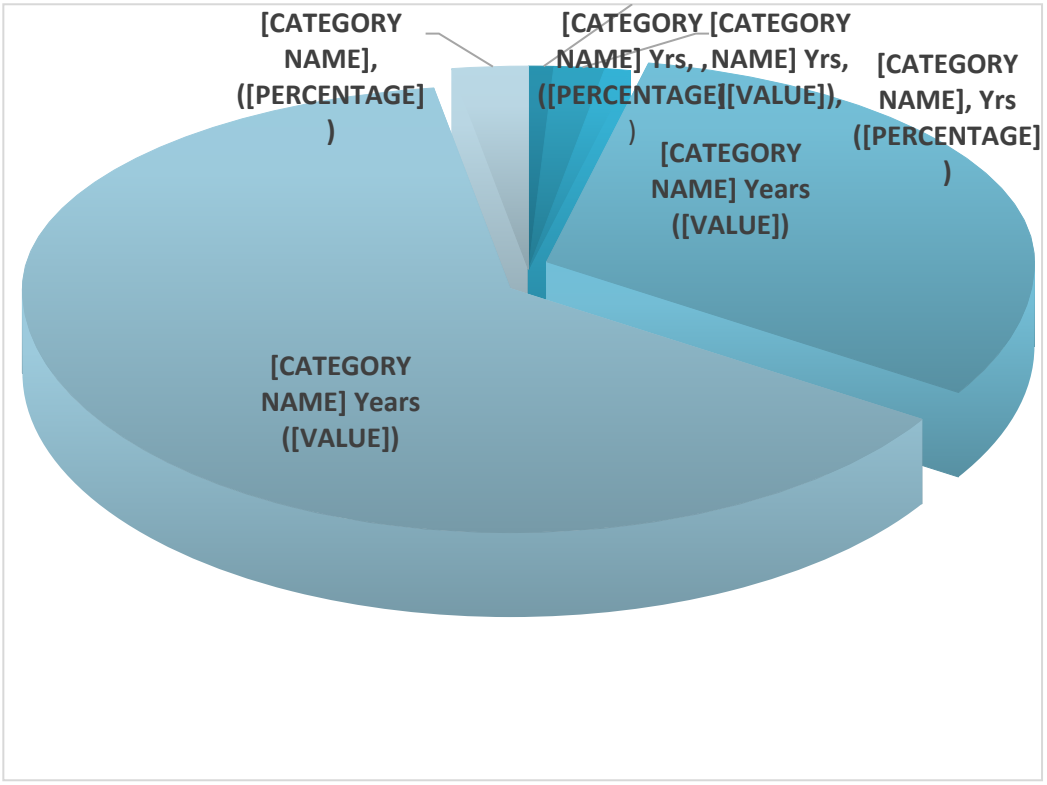

Fig 2: Pie Chart showing the age structure of the PDC Legacy woodlands

Canopy Cover

6.5 Peterborough's trees are not evenly distributed. The density of canopy cover in the City varies greatly, with densest tree cover in the new townships created by PDC. In 2017 a canopy cover survey was commissioned which involved analysing aerial photography and measuring the area occupied by tree crowns. This found that the average canopy cover in the City is 9.2%. However, there was a wide discrepancy between canopy cover in different Wards. For example, Bretton, in the west, has 22.5% canopy cover compared with only 7.2% in Stanground South. The table showing the canopy cover survey by Ward forms Appendix 2.

Fig 3: Stanground Canopy Cover 7.2%

Fig 4: Bretton Canopy cover 22.5%

6.6 Although the combined canopy cover, for both privately owned and council owned land is important, it was considered necessary to analyse this data for canopy cover on council owned land alone. This data, shown below show that overall the council has 20.4% canopy cover on land

within its direct control (i.e. not leased out). The council's canopy cover forms 20.7% of the unitary areas total canopy cover. It can be clearly seen that many wards offer little land for further tree planting, without compromising other land uses.

Table 2 PCC Canopy Cover (Excluding Leased Land)

Ward	Council land per ward / ha	Council land not leased out per ward / ha	Canopy cover on Council land not leased out / Ha	% canopy cover on Council land not leased out
Bretton Ward	153.3	141.8	57.0	40.2
Orton Waterville Ward	303.1	160.0	52.4	32.7
West Ward	174.1	92.0	29.2	31.8
Orton Longueville Ward	304.5	143.4	40.9	28.6
Werrington Ward	145.0	142.8	40.3	28.2
Wittering Ward	51.9	51.2	13.6	26.7
Hampton Vale Ward	55.2	45.3	11.8	26.0
Paston & Walton Ward	94.4	86.2	18.1	21.0
Hargate & Hempsted Ward	94.1	93.8	19.6	20.9
Glinton & Castor Ward	385.4	150.6	30.9	20.5
Barnack Ward	77.4	76.2	13.9	18.3
Ravensthorpe Ward	136.9	117.0	21.1	18.1
Fletton & Woodston Ward	149.5	78.0	13.9	17.8
Dogsthorpe Ward	108.3	88.9	15.5	17.4
Gunthorpe Ward	104.7	102.2	17.4	17.0
North Ward	78.1	69.7	11.3	16.2
East Ward	206.2	163.1	26.3	16.1
Park Ward	62.0	48.1	6.5	13.5
Stanground South Ward	85.8	83.3	10.2	12.3
Central Ward	101.4	88.3	9.9	11.2
Fletton & Stanground Ward	74.5	69.8	7.1	10.1
Eye, Thorney & Newborough Ward	1393.3	341.2	28.3	8.3
Peterborough total	**4338.9**	**2432.7**	**495.2**	**20.4**

Specimen Tree Stock- Species Mix

6.7 As protection against pests and diseases and the possible impact of climate change it is important to have a wide range of tree species and plant families making up the urban forest. Again there is a marked difference in the distribution of species between the street and park trees included on the database and in the PDC legacy woodlands. The database lists 269 different species and cultivars drawn from 76 genera. No single species exceeds 8% of the total. This is a healthy mixture that should provide a useful degree of resilience. However, where there are concentrations of a single species within an area there is, obviously, a greater vulnerability. Appendix 3 gives the full species list and percentages. The top ten species from the database are shown in Table 3.

Table 3 – Top Ten Species from the Database.

Species	Number of trees	% of Total	Origin
Norway maple	*3243*	8.0%	Introduced
Ash	*3133*	7.7%	Native
Common lime	*2566*	6.3%	Introduced clone
Wild cherry	*1946*	4.8%	Native
Hawthorn	*1788*	4.4%	Native
London plane	*1734*	4.3%	Hybrid Origin
Sycamore	*1714*	4.2%	Introduced
Silver birch	*1680*	4.2%	Native
Field maple	*1509*	3.7%	Native
Horse chestnut	*1157*	2.9%	Introduced
All other species		49.5	Mixed Origin

6.8 It can be seen that at the top of the list is Norway maple (*Acer platanoides*). This tree thrives in the City and regenerates freely often at the expense of native species. A close second is ash (*Fraxinus excelsior*) currently under threat from ash dieback (see Section 9 below).

Woodland- species mix

6.9 The species mix in the PDC legacy woodlands is less varied. Figure 5 shows a pie chart with the estimated species mix derived from the 2013 survey of the belts. 309 sections of belt were inspected and the percentage of each tree species visually estimated. From these figures it was possible to obtain an estimate of the average species mix shown in Figure 3.

6.10 It can be seen in Figure 5 that 21% of the woodland trees are from the genus *Acer* (the maples) and 18.5% from the genus *Fraxinus* (ash). As almost 40% of the woodland tree stock comes from just two genera it is therefore considered vulnerable to pests and diseases.

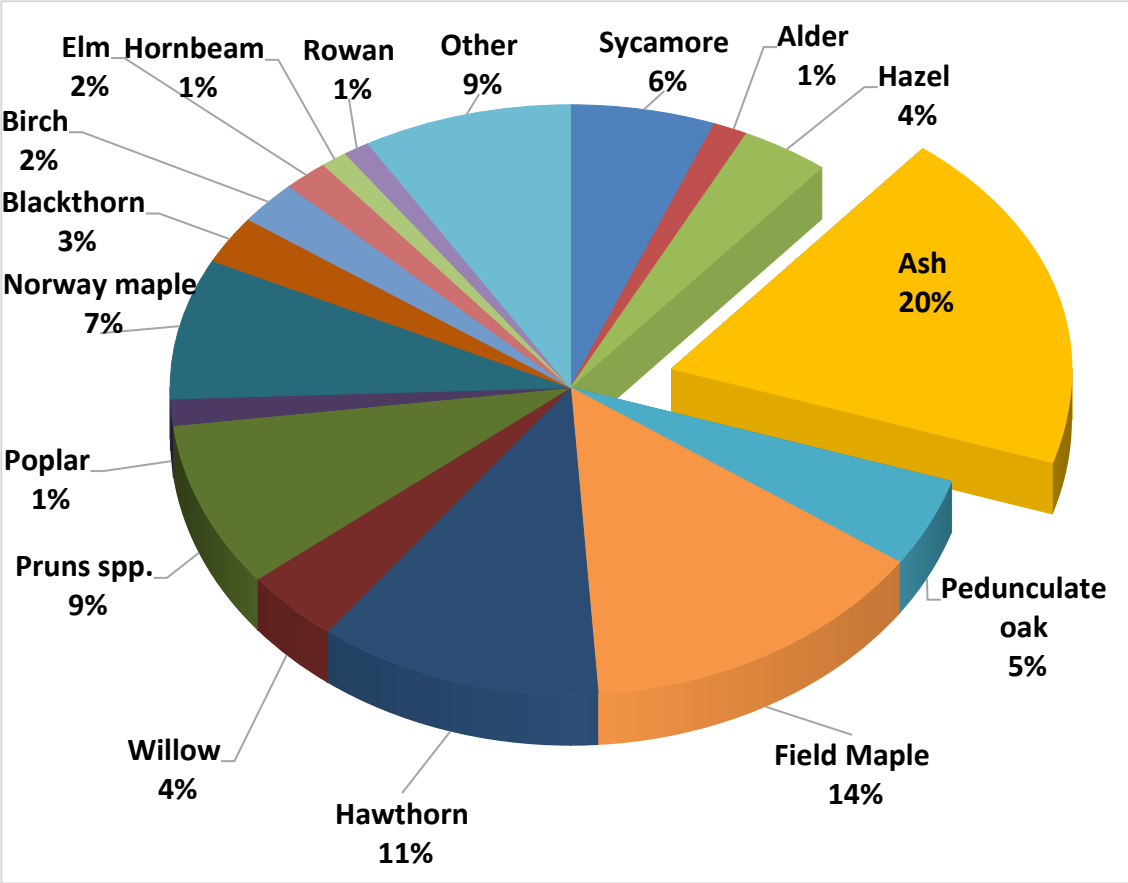

Fig 5: Estimated species mix in PDC Tree Belts - "Other" includes all species that form less than 1% of the total

6.11 With regard to ash 18.5% is the average proportion and some of the blocks sampled did not have any ash present. Of the belts that do have an ash component, it forms an average 25% of the trees present.

7. Problems Caused by the Council's Trees

Analysis of tree based enquires 2016

7.1 It must be recognised that trees can be responsible for ecosystem disservices. For example they cause problems for residents where they are growing close to private property and gardens. In 2015 Amey staff dealt with 1288 enquires on behalf of the Council this increased slightly in 2016 to 1332. Figure 3 shows a bar graph of the number of enquires in 2016 by ward. It can be seen that by far the largest number of enquiries (48%) emanate from the former PDC townships.

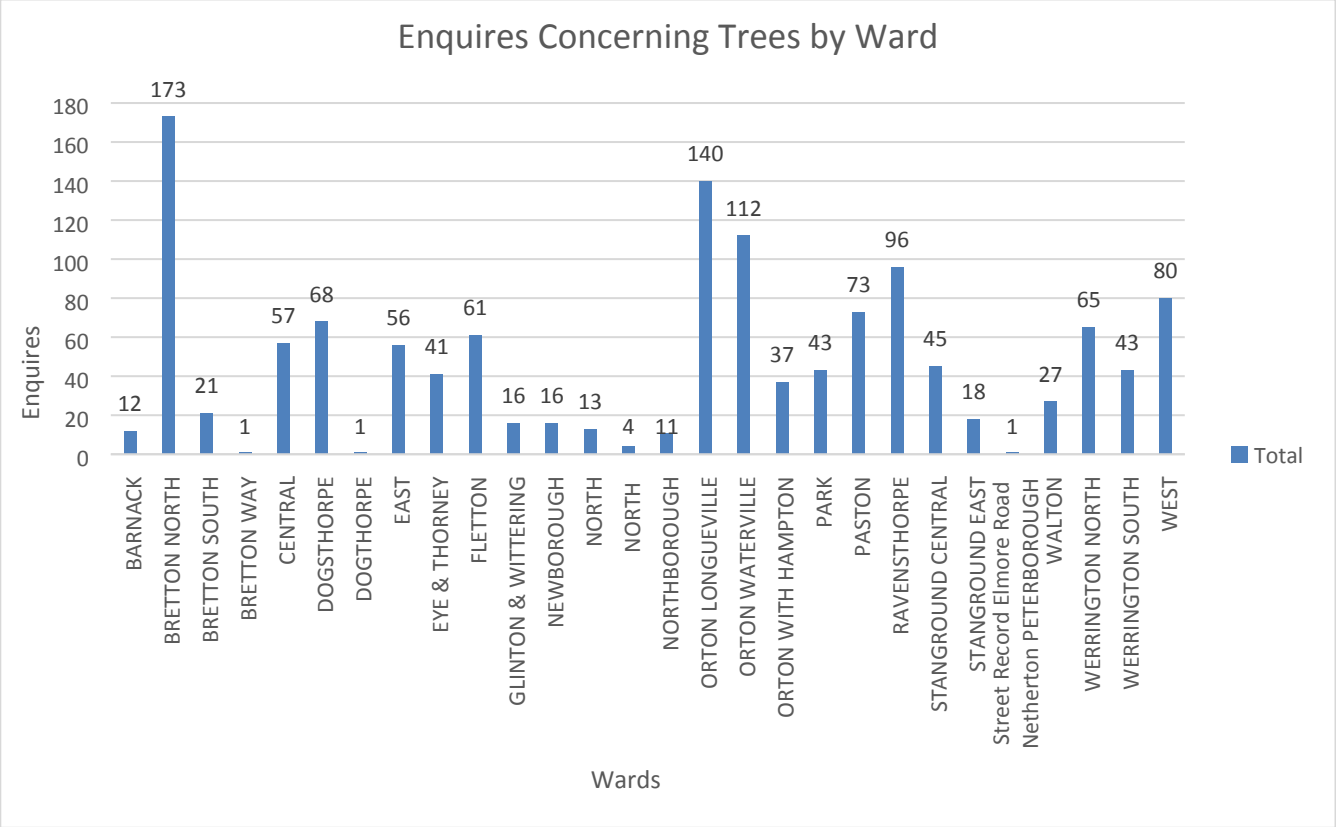

Fig 6: Tree enquiries concerning trees in 2016 by ward

7.2 The nature of the enquiries are varied; the top ten problems are listed in Table 4 below. It can be seen that by far the highest percentage of enquiries are related to overhanging and encroaching branches.

Nature of Enquiry	**Total per problem**	**% of Total**
Overhanging Trees and Branches	495	39%
Branch Failure	74	6%
Trees blocking light	70	5%
Root encroachment	66	5%
Tree proximity	54	4%
Fallen tree needing emergency clearance	41	3%
Trees causing damage to property	74	6%
Dying Trees	40	3%
Leaning Trees	19	1%
All other enquiries	151	11%

Table 4 – Showing the Most Frequent Types of Enquiries Regarding Trees.

Damage to Property Caused by Tree Roots

7.3 In Peterborough the potential for property damage due to volume change in clay soils is a significant limiting factor to maintenance of the existing tree cover and restricting the extent of new planting.

7.4 Clay soils predominate in the Peterborough area. Most of these are classed as shrinkable and are subject to volume change. When moisture is drawn out of shrinkable clay soils by vegetation, particularly trees, the clay shrinks which can lead, in some circumstances, to property damage. Most volume change is seasonal and as soils rehydrate in the winter months and levels are restored. Modern buildings are designed to cope with some seasonal movement. Since 1976 the National House Building Council (NHBC) Chapter 4.2 recommendations for foundation depth when building near trees has reduced the incidence of damage.

7.5 When soils no longer rehydrate a permanent water deficit is formed. If large trees are removed, where they have created a permanent water deficit, water uptake stops and the soils can rehydrate lifting any building that has been built on the dehydrated ground. This type of property damage known as heave is rare and mainly found on very plastic clay soils such as London clay. Local soil types are not normally associated with heave and the damage it can cause.

7.6 In the NHBC guidance tree species are classed depending on their water demand. It is often high water demand species such as poplar and willow that are linked with subsidence damage to properties. However, in some circumstances, tree species listed in the NHBC guidance as moderate or low water demand can be implicated in structural damage to buildings.

7.7 Any cases of property damage resulting from encroachment of the roots of Council owned trees on to private land will be investigated by the Council on a case by case basis. It is not reasonable to remove all trees that could conceivably damage property when no damage has occurred, this would involve a huge loss of amenity and ecosystem services. However, the potential of Council owned trees for root encroachment will be considered in the management of the existing woodland belts and street trees and when new trees are being planted. Where, in the past, trees and woodlands have been planted with unsuitable species in unsuitable positions in relation to buildings there will be a policy of restructuring and management to enable trees and buildings to co-exist.

7.8 Trees in close proximity to light structures such as free standing walls, patios and paved areas can cause damage by direct pressure of the stems and roots as they grow and expand. Stem and root expansion can cause cracks in free standing walls. Surface roots can lift pavements and other hard surfaces. The Council will seek to minimise the impact of roots of council owned trees particularly where these present a risk to the public safety. BS 5837:2012 gives guidance on the clearance needed to avoid direct damage and trees need to be very close, normally under 1 m from a structure, for this class of damage to occur.

7.9 Tree roots can proliferate in drains, which offer ideal rooting conditions, sometimes blocking them. However, tree roots have little capacity to enter well maintained and intact drainage systems. In the case of drainage problems linked to tree roots a drainage expert is the best source of advice.

8. Service Delivery, Policies and Priorities

Standards of service delivery

8.1 Trees are complex organisms with a long natural lifecycle, in order to manage them sustainably, a strategic operational approach is essential. As understanding of the way pruning affects trees has evolved, the basic premise has not changed: all tree surgery is not for the benefit of the tree, other than to enable it to continue to co-exist in an artificial human environment.

8.2 The management and maintenance of trees is therefore a complex and skilled task, often requiring different services and organisations to work closely together in order that trees are appropriately managed to minimise the risk they may pose and may be posed to them.

8.3 An important part of delivering an effective risk management system is ensuring that the tree managers have the pre-requisite skills, with suitable qualifications and experience to meet the challenges.

8.4 The complexity of tree stock within Peterborough requires well trained Arboriculturists as an integral part of a defensible tree and woodland management service. This has been substantiated by industry best practice, peer review and confirmed in common law precedence.

8.5 The breadth of arboricultural knowledge and skill is not only needed by those who undertake the works, pruning, planting and removing trees, but in this highly regulated industry, also those inspecting the trees, responding to service requests and specifying works must be appropriately qualified.

8.6 The analysis of enquiries received over the last five years of the contract has enabled the Council to monitor customer concerns, prioritise work and the way that it is undertaken. Improved levels of consultation and communication have been developed, which are detailed below. Equally, firmer policies have been developed that inform residents of the Council's actions in respect to common concerns. These policies are integral to a more pro-active level of service delivered within financial constraints (See Appendix 8 for the Consultation Protocol).

Legal Considerations (meeting the Council's Duty of care)

8.7 The risk presented by trees is low. For example the Health and Safety Executive estimate the risk of death caused by a failing tree or branch is 1 in 10,000,000 which is much lower than the risks accepted by people on a day to day basis such as using the roads where the risk of death is 1 in 16,800. These low risks must also be balanced with the benefits trees provide.

8.8 The Council has a duty of care to employees and members of the public in respect of safety of the trees in its ownership. This does not mean that the Council must maintain all its trees in a safe condition. Trees are dynamic organisms, subject to the forces of nature, which can fail without showing warning symptoms and can never be classed as entirely safe. However, the Council must try to keep risks presented by trees as low as is reasonably practicable.

8.9 The most recent guidance in the Tree Health and Safety Group's "Common Sense Guide to the Management of Tree Safety" published by the Forestry Commission in 2011 sets how out a Local

Authority should approach tree safety. This involves zoning areas based on the usage of the ground around the trees, working out a level of tree inspection needed, employing trained and competent staff to complete various levels of survey and recording and storing all findings on a database.

8.10 In 2012 Council produced a Tree Risk Management Plan (Appendix 4) which includes all the measures recommended in current guidance. The strategy has been fully implemented with all streets trees checked and their details entered on the data base. Basic level inspections have been completed for the PDC legacy woodlands.

8.11 The instigation of the database and a system of inspections has led to a pro-active system of management complimented by structured systems to respond to service requests. These have delivered greater efficiency and economy savings over the position before the system was in place.

Stakeholder Involvement

8.12 It is very important that stakeholders and residents within the City understand the principles set out in this strategy particularly that cyclical renewal and management of trees is necessary to ensure their long term sustainably. The strategy will be widely distributed and available on line on the Peterborough City Council web site. It is hoped residents will be assured that the City's trees are being sensitively and professionally managed to achieve long term sustainability. The Council would like residents to feel a sense of involvement and communal ownership and take pride in the City's extensive tree cover, woods and greenspaces.

8.13 Before adopting this strategy the Council consulted with a range of local organisations who were invited to comment. These included;

- The Local Conservation Bodies
- Peterborough Environmental City Trust
- Town and Parish Councils
- The Nene Park Trust
- The Woodland Trust

8.14 The Council will seek to support community based projects regarding trees, in particular to encourage schools and youth groups to become involved in the City's trees and woodland.

8.15 Trees and woodlands offer a variety of outdoor opportunities for recreation and learning. The priority will be to provide high quality access near to where people live and work. To ensure woodlands remain valued as a lifelong resource, appropriate information needs to be freely available. This should include recognition of their historic, archaeological and cultural significance.

8.16 Partnership working promotes community involvement and so links to existing partners should be strengthened and new ones established by providing advice and support to communities with plans to create and maintain their own woodland or become involved in managing existing blocks of woodland in their neighbourhood. Partnerships can help support funding applications and could qualify for funding from organisations such as The Woodland Trust under the 'Morewoods'

scheme. The proposed tree planting campaign to create the Forest Of Peterborough is another example of a productive partnership helping deliver the objectives of this Trees and Woodland Strategy.

8.17 All queries on tree matters will be promptly responded to and residents views given due consideration. When making management decisions, it may not always be possible to comply with resident's wishes in respect of neighbouring trees.

8.18 The Council are committed to ensuring that, when undertaking tree work, local residents are kept informed. Notice of major tree works will be published on the Council Website as detailed within the consultation protocol detailed that forms Appendix 7.

General policies

TP 1: The Council will maintain its trees and woodlands in accordance with its obligations to observe duty of care and the safety of both people and property.

Priorities:

TP 1.1: The regime of periodic tree inspections and data recording as set out in the Tree Risk Management Plan will be continued.

TP 1.2: Staff employed to deliver the contract will maintain a high level of training and continued professional development to ensure that tree management decisions are well founded and in line with current industry practice.

TP 1.3: To undertake tree works in line with the risk based prioritisation.

TP 2: The Council will encourage a better understanding of tree and woodland management and in so doing promote community involvement.

Priorities:

TP 2.1: The Council will seek to disseminate information on its tree and woodland activities as widely as possible.

TP 2.2: The aim will be to support and maximise community involvement in the City's trees and woodlands.

TP3: The removal of trees and woodlands shall be resisted, unless there are sound Health and Safety or arboricultural reasons supported within this strategy.

Priorities:

TP 3.1: The removal of healthy trees in response to complaints shall be resisted unless the complaint has an overriding justification and no alternative management practice can be implemented.

TP4: The Council will maintain its trees and woodlands in a way that demonstrates best practice, providing worthy examples of management for others to follow.

Priorities:

TP 4.1: To provide plans for long term management and development of trees and woodlands as essential components within the landscape.

TP 4.2: To ensure the best use of resources is made during the planning of operations.

TP 4.3: To supplement the Council's spending by seeking additional funding from external sources where ever possible.

TP 4.4: To realise any economic potential of trees, and woodlands, or materials generated from them, where this does not conflict with the other policies and priorities of the Strategy.

Operational Policies

Bird Droppings

TP5: Policy: Council trees will not be prune or removed to stop or reduce bird droppings from trees, nor will the council remove bird droppings from private land.

Bird droppings may be a nuisance, but the problem is not considered a sufficient reason to prune or remove a tree. Nesting birds are protected under the Wildlife and Countryside Act (and other related wildlife law).

Priority:

TP5.1Residents will be advised of their powers to exercise your Common Law right to remove the nuisance associated with encroaching trees or alternatively that warm soapy water is usually sufficient in removing bird droppings.

Blossom

TP6: Policy: Council trees will not be removed to stop or reduce blossom from trees and fallen blossom will not be removed from private land.

Blossom is a natural occurrence, which cannot be avoided by pruning.

Priorities:

TP 6.1 Roads, streets, foot or cycle paths swept of excessive blossom as part of normal cleaning cycles.

TP 6.2 Residents will be informed of their entitlement to exercise their Common Law right to remove (abate) the nuisance associated with encroaching trees.

Low Tree Branches; Road, Cycle or Footpath

TP 7: Policy: The council will carry out work to a council owned tree with the aim to maintain a minimum of:

- Road – 5.5 metre height clearance
- Cycle path next to a road or highway – 3 metres height clearance
- Footpath next to a road or highway – 2.5 metres height clearance

Priority:

TP 7.1 These works will be identified and actioned in routine pro-active surveying and as a result of reported breaches of these standards.

Trees Overhanging Property

TP 8: Policy: Council owned trees will not be pruned or removed to stop the nuisance of overhanging branches.

Priority:

TP8.1 All trees (excluding woodland areas) will be inspected every three to five years, depending on how much the area surrounding them is used. Maintenance will be carried out, if the tree is considered likely to touch property structures prior to re-inspection.

TP8.2 Residents will be informed of their entitlement to exercise their Common Law right to remove (abate) the nuisance associated with encroaching trees.

Drains

TP9: Policy: The roots of Council owned trees will not be pruned, removed or cut to prevent roots entering a drain that is already broken or damaged.

Priorities;

TP 9.1Residents will be advised that tree roots typically invade drains that are already broken or damaged.

TP 9.2 Trees themselves very rarely break or damage a drain. Tree roots found in drains are usually due to an underlying problem with a broken pipe.

TP 9.2 If residents are concerned about the condition of their drains they are advised to contact their water and Sewerage Company or a drainage expert.

Fruit, Berries, Nuts and Seeds

TP10: Policy: Council owned trees will not be pruned or removed to stop or reduce the nuisance of fruit, berries, nuts or seeds, nor will the council remove fallen fruit, seeds or seedlings from private land including gutters.

Priorities:

TP 10.1 Should fallen fruit lead to a significant anti-social problem residents will be advised to contact the police.

TP 10.2 Residents will be advised that the maintenance of gutters is the responsibility of the landowner and that the council is not obliged to remove fruit/berries/nuts/seeds or seedlings that may have fallen from council owned trees.

TP 10.3 Residents or the council's tree team will report a road, street or highway that needs to be cleaned, under the cleansing contract.

Poisonous Berries

TP11:Policy: There is no general policy to remove trees bearing poisonous fruit / foliage (such as yew trees). However, where it is claimed or known that unsupervised young children or livestock are likely to be exposed to poisonous berries or foliage, such cases will be investigated and appropriate action considered.

Priority:

TP11.1 All reported concerns over a tree with poisonous berries that unsupervised young children are exposed to will be investigated promptly.

Leaves

TP12: Policy: Council owned trees will not be pruned or removed to stop or reduce leaf fall nor will the council remove fallen leaves from private property.

Priorities:

TP12.1 Residents will be advised that the loss of leaves from trees in the autumn is part of the natural cycle and cannot be avoided by pruning.

TP 12.2 Residents will be advised that the maintenance of gutters is the responsibility of the landowner and the council is not obliged to remove leaves that may have fallen from council owned trees.

TP 12.3 Where leaves have been reported to have accumulated on council owned roads, footpaths these will be reported to the street cleansing team.

Light

TP13: Policy: A Council owned tree will not be pruned or removed to improve natural light in or to a property. This includes properties with (or planned to be installed) solar panels.

Priority:

TP13.1 Residents will be advised that in law there is no general right to light.

Suckers from Tree Roots

TP14: Policy: Council owned trees will not be pruned or removed to stop or reduce the nuisance of sucker growth on private land.

Priority:

TP 14.1 Residents will be advised of their rights to remove suckers on their land.

Personal Medical Condition – Complaint

TP15: There is no policy regarding personal medical conditions that may be specifically affected by nearby Council owned trees. Such cases will be investigated, and appropriate action considered.

Priority:

TP 15.1 Residents will be informed of their entitlement to exercise their Common Law right to remove (abate) the nuisance associated with encroaching trees.

Pollen

TP16:Policy: Council owned trees will not be pruned or removed to stop or reduce the release of pollen

TP16.1Residents will be advised that pollen is a natural and seasonal problem.

Trees Affecting Street Lights, Signs and Traffic View

TP17: Work on a council owned trees will be undertaken to maintain clear sight lines (where feasible) at junctions, access points (associated with a street, road or highway), traffic signals and street signs.

Priority:

TP 17.1 These works will be identified and actioned in routine pro-active surveying and as a result of reported, breach of these standards.

Sap and Honeydew

TP18: Policy: Council owned trees will not be pruned or removed to reduce honeydew or other sticky residue from trees.

Priority:

TP18.1 Residents will be advised that honeydew is a natural and seasonal problem. When new trees are planted we try to choose trees less likely to cause this problem.

Subsidence Damage to Property (Tree-related)

TP19: The council has in place active tree management systems to minimise risk of damage being caused to buildings and other structures because of the action of council owned trees.

Priorities:

TP19.1 Residents will be advised that if they have concerns about tree related subsidence damage to property, that they should contact their insurance provider for advice.

TP19.2 If a residents wishes to make a formal claim for damage they will be advised to contact the Council Insurance Team Direct. Alternatively the case will be investigated by the Council's Tree Team, once reported.

Trip Hazard

TP20: The council will make safe an unacceptable trip hazard caused by the growth of council owned trees.

Priority:

TP 20.1 All reported cases will be investigated and actioned accordingly.

Tree Touching Building

TP21: Policy: If a council owned tree is touching a property (house, boundary wall, garage etc.) action will be taken to remove the problem.

Priority:

TP21.1 All reported cases will be investigated and actioned accordingly.

Tree Too Big / Too Tall

TP22: Policy: Council owned trees will not be pruned or removed because they are considered to be too big or tall.

Priorities:

TP22.1 Residents will be advised that a tree may seem too big for where it is, but this doesn't make it dangerous.

TP22.2 All trees (excluding woodland areas) will be inspected for safety. We inspect them every three to five years, depending on how much the area surround them is used. Maintenance will be carried out, if necessary.

Tree and TV / Satellite Reception

TP23: Policy: Council owned trees will not be pruned or removed to prevent interference with TV / satellite installation / reception.

Priority:

TP23.1 Residents will be advised that their satellite or TV provider may be able to suggest an alternative solution to the problem.

View

TP24: Policy: Council owned trees will not be pruned or removed to improve the view from a private property.

Priority:

TP 24.1The Council will promote the amenity value offered by trees in their own right.

Wild Animal / Insect Pest

TP25: Policy: Council owned trees will not be pruned or removed to stop or reduce incidents of perceived pests such as bees, wasps, or wild animals, unless it is in the national or public safety interest to do so due to a harmful invasive species.

Priorities:

TP25.1 Residents will be advised that Bees are protected species and advice should be taken before considering their removal.

TP25.2 On private land residents will be advised that external companies provide a chargeable service for removing certain pest species.

9. Policies and Priorities for the Management of Council Owned Trees

9.1 The Council's tree stocks can be divided into seven main categories as follows:

- Street Trees and Trees in Residential Areas: Street trees are planted in pavements or road verges. These help to filter traffic pollution, provide shade for car parking and improve the overall appearance of the street scene. Trees in residential areas are trees growing within and around housing estates and planted by the original Parks Department or the Peterborough Development Corporation to enhance the local environment.
- Avenues and other arboricultural features were little utilised by PDC that favoured more naturalistic design layouts. The avenues that exist in the City are in the older parks or lining some of the streets (mostly planted since 1988).
- Parks and Open Spaces: These are frequently the trees of greatest local significance and provide maximum visual amenity for both residents and visitors.
- Woodlands: These are some of the remaining pockets of the original Rockingham Forest that once covered the area. Grimshaw Wood, an ancient woodland site and Local Nature Reserve in Bretton, is one such woodland which is an unusually valuable wildlife and amenity resource within the urban fringe.
- PDC Legacy Woods: Formerly classed as shelterbelts, they were mostly planted alongside the parkways and in areas that separated the new townships. They provide visual amenity and habitat for wildlife.

- Village and Rural Trees: The villages have a unique character, much of which is achieved by their content of historic trees, as well as those growing within the surrounding countryside.
- New and Replacement Planting: polices and priorities in respect of new and replacement planting are a key element of the strategy and decisions made now will have a bearing on the future resilience and sustainability of the City's tree cover.

9.2 Each category of tree cover is assessed below and the specific policies and priorities that relate to them are detailed.

Street Trees and trees in Residential Areas

9.2.1 The City has approximately 50,000 street trees and trees in residential areas which have to survive in difficult environments. Utilities demand space, as do road signs and streetlights. The limited space is made all the more challenging because of polluting car emissions, road salt, oil and other contaminants. Against the odds, trees can and do survive but often with a limited life expectancy.

9.2.2 The character of Peterborough's street trees varies considerably, from the older Victorian planting in roads like Broadway, the inter-war developments such as Dogsthorpe, to the newer developments built by the PDC. The Victorian areas contain large old trees, many of which are managed as pollards. Today there is access to a wider range of smaller ornamental trees that are suitable for restricted sites.

9.2.3 Many of Peterborough's streets have tree populations that are over-mature. Such trees are vulnerable to climatic change, disease and damage. As time progresses this over-mature population of street trees will be removed as individual trees deteriorate. In these areas new trees will be introduced between the mature specimens to ensure that there will be continuous future tree cover.

9.2.4 A large proportion of public sector housing in the City was built by the PDC. The PDC tree and shrub planting areas include individual trees and tree groups interspersed with shrub planting. These enhance the environment and are very important to the quality of life for the residents. However, as the trees mature, design faults such as planting trees too close to buildings and each other and selecting inappropriate species for a given situation become evident. Problems of encroachment of branches and in some cases property damage are therefore becoming more common and make up a high proportion of enquires to the Council.

Policy TP26: To endeavour to protect street trees from threats such as loss of verges and damage to same.

Priorities:

TP26.1: Work with and monitor the activities of utility companies in order to minimise accidental operational damage to trees.

Policy TP27: To place a priority on the replacement of ageing street trees; particularly where these adjoin major traffic routes. Planting will ensure the selection of the most appropriate species for the location.

Priorities:

TP27.1: To plant new and replacement street trees in appropriate sites, giving priority to streets where trees are currently standing or have been in the past.

TP27.2: To consider alternative planting positions and methods of establishment where maintenance of street trees in the same positions of the trees to be replaced will be either unduly difficult or expensive to maintain.

Policy TP28: To renew and restructure tree stocks planted by the Peterborough Development Corporation within residential areas;

Priorities:

TP28.1 To introduce a phased removal of trees growing too close to buildings and replace with new planting more appropriate to the situation or relocate planting areas to more suitable sites in the neighbourhood. Replanting will be, as far as is practicable, carried out using a combination of standard trees, whips and bare root transplants.

TP28.2: To thin dense groups of trees to allow full crown development where there is sufficient space.

TP28.3: To ensure that replacement planting is sufficient to retain the existing level of canopy cover in the area.

Avenues and other Arboricultural Features

9.2.5 Avenues are found in some parks and in some cases street trees have been planted to form avenues such the example shown in Figure 7.

9.2.6 As avenue trees decline due to old age or due to the impact of pests and diseases, decisions on management and renewal are needed to perpetuate the formal landscape effect.

9.2.7 In some cases appropriate avenue species have been planted but in inappropriate situations. Figure 7 shows an avenue of fast growing London plane. These require careful management to maintain the landscape impact while avoiding issues caused by the proximity to buildings. Figure 8 shows the position of avenue tree in relation to a dwelling.

Fig 7: An avenue of semi mature London plane at Werrington.

Fig 8: The same avenue as shown in figure 7 showing the proximity to nearby buildings.

Policy TP29: To maintain formal arboricultural features in the urban landscape by careful management and timely renewal as required.

Priorities:

TP29.1 To consider the long term development and safe life expectancy of mature avenues and instigate a policy of gradual renewal and replacement in advance of them becoming untenable. Measures could include pruning, total removal and replacement, partial removal and replacement

Policy TP30: To take action to restructure avenue trees planted with inappropriate species too close to neighbouring properties.

Priorities:

TP30.1: In areas where avenue trees pose a potential threat to adjoining buildings, the council will manage or restructure the avenues to minimise the impact on the properties. Options will include but not be limited to:

- Removing avenue trees and replacing with low water demand species.
- Removing avenue trees adjoining buildings and filling the gaps with smaller low water demand species. As far as possible maintaining regular spacing and the avenue effect.
- For suitable species such as lime and London plane reduce the crown or pollard to reduce water uptake. This will only reduce water demand if the trees are pruned on short and regular cycle of no more than three years.

Legacy Woodlands Established by PDC

9.2.8 280 ha of new woodland was planted by the PDC as part of the landscape masterplan. The woods extend for 117 kilometres. The woodland was planted with a limited number of core species predominantly ash, sycamore and Norway maple. However, a wide range of other native and ornamental species occur sporadically. The woods were designed to have good structure with larger trees at the centres grading to smaller trees and ground cover shrubs at the edges.

Unfortunately the designs were not always adhered to and trees planted in random mixture sometimes putting large trees on the woodland boundaries.

Fig 9: An example of a well-structured belt with woody shrubs on the edge grading to ground cover shrubs on the roadside

Fig 10: A roadside of a belt with little structure and dense shallow crowned trees reducing the value of screening for residential properties to the rear.

9.2.9 Despite those localised issues, these woods provide considerable benefits in terms of ecosystem services, biodiversity and landscape amenity and represent an example of a far-seeing and impressive investment in the future by the PDC that is only now coming to fruition. However, the design of these woods has a flaw which is that many trees, including some unsuitable fast growing species, were planted too close to residential properties as illustrated in figures 11 and 12. It has been identified that the issue of proximity, particularly encroaching branches, accounts for around 40% of enquires received by the Council.

Fig 11: Trees encroaching towards a residential property.

Fig 12: The close proximity of trees to the rear of properties cause a range of problems for residents which will become worse as the trees grow to maturity.

Policy TP31: The Council will seek to reduce impact of woodland trees on adjoining properties.

Priorities:

TP31.1: Starting on a trial basis, and only where necessary, the woodland belts will be restructured cutting trees back from the edge of property boundaries by up to 7m. Following the tree removal new native small trees and woody shrubs will be planted to form a woodland fringe. The replanting will both replace the lost biomass and provide improved wildlife habitat. In addition to the edge clearance some light selective thinning will be carried out in the belts to ensure some of the best trees have room for proper crown development. The aim of the thinning is to slowly reduce the number of trees in some of the belts to achieve the effect of groves of full crowned trees rather than dense woodland conditions. However this process will be done in stages, to maintain stability and to spread the significant financial impact.

TP31.2: High water demand trees within influencing distance of adjoining properties will be progressively removed in thinning.

TP31.3: As part of the Tree health and safety strategy basic level checks will be periodically carried out on boundary trees, looking for obvious defects that present a risk of failure.

Policy TP32: The woods will be managed in a fully sustainable manner which will include periodic thinning to allow proper crown development and light to reach the woodland floor.

Priorities:

TP32.1: In suitable woods selective thinning will be carried out removing no more than 10% of the trees by number. Where appropriate these thinnings will be sold.

TP32.2: Mechanisation such as a tractor mounted tree shear shown in Figure 14 will be used where it is practicable to reduce the cost of management. Economical mechanised working will help address the problems of proximity to buildings and high water demand trees in a cost efficient way. However, not all areas are suitable for this approach. The tree belt survey completed in 2013 found that 40% of the tree belts were suitable for mechanised working and in a further 15% some mechanised working was considered possible.

TP32.3: Those woodland belts that are unsuitable for either thinning or re-structuring with a dense low cover of species such as hawthorn and blackthorn will be managed as non-intervention areas.

Fig 13: Sustainably produced woodland produce; a source of carbon neutral fuel wood

Fig 14: A tree shear mounted on an excavator or tractor can delicately extract trees from dense broadleaved woodlands

Policy TP33: The woods will not be clear felled and management will be on a continuous cover basis.

Priorities:

TP33.1: Natural re-generation within the woodland belts will be managed and encouraged.

TP33.2: Management will endeavour to increase the range of age classes within the woods.

Policy TP34:The Council will encourage community involvement and advise residents when work is proposed.

Priorities:

TP33.1: The council will try to address the problems of anti-social behaviour in woodlands.

TP33.2: The Council will encourage community involvement in the woods and support projects such as Nene Coppicing and Craft.

Parks and Open Spaces

9.2.10 Trees are fundamental to the structure of parks and very important contributors to the environment of the area. The nature of different parks and green spaces is very variable. For example, Central Park has a declining tree population displaying over maturity in comparison to Bretton Park with younger but neglected stock all planted by the PDC which is now in great need of management by selective thinning. The latter is now urgently required to prevent very high losses over the next ten years. For this reason management has to be planned on a site by site basis.

9.2.11 Certain newer areas of Peterborough contain large open spaces of short grass and minimal structural planting. These areas are ideal for enhancement. Research within The Woodland Trust's "Trees or Turf" report aims to demonstrate that management of woodlands could be markedly cheaper than maintaining some types of grassland. By creating small woodlands on such amenity

grassland opportunities for wildlife can be promoted in addition to landscape enhancement and providing a contribution to the forest for Peterborough targets.

Policy TP35: To maintain tree cover within all the City's parks by renewing the tree stocks and increasing the range of age classes present

Priorities:

TP35.1: To commence a replacement programme that incorporates a diverse range of tree species and, where appropriate, to re-establish historic landscapes.

TP35.2: To ensure that management work takes into consideration the sensitivities of the residents who use and care about the parks. In particular, to ensure that the reasons for particular operations are explained to the public before commencement.

TP35.3: To carry out tree removal and replanting in a phased way rather than causing large amounts of disturbance and change to the landscape of the park in one operation.

TP35.4: To carry out replacement tree planting in anticipation of the need to replace older tree stocks in the future. Planting of low maintenance bare rooted whips with appropriate guards will be favoured over larger planting stock.

Woodland

9.2.12 Cambridgeshire and Peterborough are amongst the least wooded areas in the UK. The total area of woodland, of 0.1 ha and over, is 12,325 ha. This represents 3.6% of the county land area. A considerable proportion of this is ancient semi-natural woodland which represents a valuable wildlife and landscape resource.

9.2.13 The City Council own six ancient woodlands. It manages The Bretton Woodlands (including Grimshaw Wood and Pocock's Wood) and leases the others to Nene Park Trust and the Woodland Trust. These areas amount to approximately 27 hectares and have attracted the designation of Local Nature Reserves. The Bretton Woodlands include Highlees Spinney which is not an Ancient Woodland but is a former coppice and standards wood with the same species mix and general condition. Bretton woodlands contain a high proportion of ash and were formerly managed as oak and ash standards with mainly ash and some hazel coppice.

9.2.14 In 2013 a 20 year management plan was produced for the Bretton Woodlands which has now been implemented with the aid of Forestry Commission and Heritage Lottery fund grants. Improved access and signage has facilitated better access to the woods with some coppicing having been completed. However, coppicing of the ash stools in the wood has been suspended due to the risk of ash dieback.

9.2.15 Peterborough contains 78 hectares of wet woodland habitat across 73 sites. Of these, the majority are less than 1 hectare in size. Wet woodland is nationally and locally rare. It is a priority habitat within the Cambridgeshire and Peterborough Biodiversity Action Plan owing to a rich diversity of habitat. Opportunities to create new wet woodlands will be sought in accordance with the wet

woodland audit completed in 2004 by a partnership of organisations including the Forestry Commission and the City Council.

Policy TP36: The Council will aim to achieve sustainable management of its ancient woodlands and to protect and preserve wet woodland habitats.

Priorities:

TP36.1: The Council will, as far as possible in the light of the threat from ash dieback, fully implement the Bretton Woodland Management Plan (Ash is a major component of the Bretton Woodlands).

TP36.2: The Council will monitor the impact of impact of ash dieback on its ancient woodlands and take all necessary measures to maintain the integrity and conservation value of the areas.

TP36.3: The Council will seek to protect and extend the areas of wet woodland.

Village and Rural Trees

9.2.16 Many of the trees in the villages and rural areas are privately owned. In spite of this the Council still has responsibility for a significant proportion which total approximately 5000. These trees include trees up to 200 years old and are amongst the oldest managed by the Authority.

9.2.17 Locally, elm was once one of the most important trees. When Dutch EIm Disease (DED) struck this dominant hedgerow tree was lost. Considerable areas of relatively denuded landscape have not been replaced, particularly within areas of more intensive farming. While most of the common elm has gone, there remains elm regeneration that exists within a continual state of growth followed by disease related decline. Some mature DED resistant elms are found to the west of the City particularly Huntingdon elm (*Ulmus x hollandica* 'Vegeta') and wych elm (*Ulmus glabra*). While these species are resistant they are not totally immune from the disease.

9.2.18 Distinctive village scenes can be maintained and enhanced by planting tree species that originally generated such landscapes. The use of native species will be prioritised within locations where appropriate i.e. rural verges. In certain village locations the use of non-native stock may be considered where site restrictions or the surrounding landscape dictates. For the foreseeable future planting of ash will not be supported.

9.2.19 Many trees have been planted on verges by village communities. Where possible, the Council has helped facilitate these requests by offering suitable planting locations and the commitment to manage those trees planted on Council owned land.

9.2.20 The Council will fulfil its duty of care in respect of Council owned trees in villages which will be surveyed in line with the Tree Risk Management Plan.

Policy TP37: The Council will preserve and enhance the distinctiveness of village and rural trees in its ownership.

Priorities:

TP37.1: To ensure that all Council owned trees in Villages are logged on to the Tree data base and receive periodic inspection in line with the Tree Risk Management Plan.

TP37.2: To replace all trees which are removed in these areas and attempt to expand tree cover if appropriate.

TP37.3: To re-plant using suitable native trees except where this would result in loss of familiar vernacular.

New and Replacement Planting Plan

9.2.21 A key aim of this strategy is to increase the numbers of trees within the City by both new and replacement planting. Opportunities to improve wildlife habitats and connectivity between woods and tree groups will be a major consideration in setting out new planting areas.

9.2.22 Trees as living organisms have a finite life expectancy. Whilst relatively long-lived, the stress and strain of the urban environment significantly shortens their life span. Tree surveys and inspections in the City have revealed a large number which are not suitable for their location in the medium to long term.

9.2.23 The expansion of tree cover will be on a planned basis. To build in resilience to pests and diseases, planting stock will be selected from a wide range of genera and species. The guiding principle for new planting will be using no more than 10% of the same species, no more than 20% of the same genus and no more than 30% from the same plant family. However, this principle must be balanced with other factors such as site conditions and design criteria. There is a limited range of native tree species (approximately 35 species excluding micro species drawn from 21 genera and 11 plant families) therefore where ecological considerations dictate that native species are used it will be more difficult to achieve the desired variation.

9.2.24 While the aim is to produce a more even spread of canopy cover over Council Owned land it is important that we set targets to achieve this through a combination of Council tree planting budgets and the allocation of land for the “Forest for Peterborough” scheme. As detailed earlier within the strategy, the council has very high levels of canopy cover on land within its ownership. The aim will be to retain and expand this cover in the following ways:

- Council owned street trees that are removed will be replaced on a one for one basis, using established nursery grown standard trees.

- Trees felled owing to them being inappropriate for their location will replanted on a one for one basis, typically elsewhere within the ward. The size of nursery stock used within these location will vary to the planting location.

- Trees felled within groups, avenues or woodlands will not be replaced, where it is considered appropriate arboricultural or woodland management, to reduce competition between species.

- Previously the City council have not set targets for tree canopy cover increase, in excess of the natural gains as trees grow and mature. A 10% overall increase in canopy cover within the Council’s direct control is viewed deliverable and challenging target within the next 10 years A

10% increase in green cover (canopy cover) can potentially eliminate the effects of climate change on increasing surface temperatures (CABE Space. (no date). The benefits of urban trees). Canopy cover on council owned land within the Council's direct control (not leased out) currently stands at 495.2 ha. A 10% increase would result in a further 49.5ha of additional canopy cover being required. In order to achieve this objective the council aims to target those wards where currently canopy cover is lowest. Simplistic modelling based on an average tree canopy of 0.012 ha (the average canopy spread from the canopy cover data) would indicate that a further **4126** trees would need to be planted on council owned land. However the delivery of the desired canopy cover is dependent on the growth rate of the trees as they mature. The size and nature of planting will be specified accordingly on the planting locations available. Delivery of these targets will be dependent on constraints within the land ownership. A more ward-by-ward individual target setting was considered impractical to both set and deliver. Instead, the more overarching 10% increase, with a targeting of wards with low current cover, is the most practical and flexible approach.

9.2.25 Many of the problems encountered during the daily management of trees can be directly attributed to the inappropriate choice of species at the time of planting. Greatest long term economic savings in tree management can be achieved by ensuring the philosophy of "Right Tree in the Right Place" is followed every time a new or replacement tree is selected and planted.

9.2.26 Deciding which tree species to plant will take account of a range of factors beyond purely ornamental or conservation values. Trees must be selected in the light of the need for resilience to changes caused by climate change in particular drought resistance. Some diseases such as Ash Dieback will be a major limiting factor for the use of certain species or genera.

9.2.27 Planting is only the first stage in the process of planted trees achieving independence in the landscape. Well drafted planting specifications will ensure healthy trees are established, failures minimised, and defects, which could affect the mature condition of the tree, removed at the time which is most cost effective.

9.2.28 A tree requires space in which to grow, if it is to thrive and provide its many positive benefits. To achieve this any proposed site should provide adequate space for both the tree and, most importantly, its root system to develop in the long-term. Species selection must be with consideration to the tree's likely ultimate size.

9.2.29 The constraints of the urban environment can make the enlargement of woodland and other habitats impractical. With fore-planning and management of open spaces and gardens that border these sites, effective buffers and extensions can be created.

9.2.30 Peterborough's most limiting resource is space. This needs to be used appropriately, and to greatest sustainable benefit. The application of "Right Tree in the Right Place" framework will ensure new planting and natural regeneration are appropriately located and designed, and that woodland expansion is not to the detriment of protecting and restoring existing woodlands. The framework for tree and location selection is set out briefly in Appendix 5.

9.2.31 In some parts of the City the constraint of sufficient public space means a low number of trees. Often in these areas there are prominent privately owned sites.

Policy TP38: The Council will encourage an increase in tree cover by new and replacement planting, placing great emphasis on use of appropriate tree species.

Priorities:

TP38.1: To implement the planting plan that sustains the tree population, with emphasis on the long term replacement of mature and over mature trees.

TP38.2: Allocate a percentage of the total tree budget to fund the replacement and new tree planting targets set. As and when the prospect arises, to work with other organisations to secure additional funding streams for the establishment and management of tree stocks.

TP38.3: To pay careful attention to the site conditions in particular providing sufficient space for root development.

TP38.4: To ensure that all planting stock used, of whatever type, is healthy and has a well formed root structure. Imported plants must have spent at least one growing season in the UK and be free from pests and diseases.

TP38.5: To ensure all newly planted trees achieve independence in the landscape by virtue of a sustained programme of maintenance.

TP38.6: As far as is practicable, reduce the tree maintenance commitment by the use of smaller planting stock that will establish quickly and require less attention.

10. Threats and Challenges

Tree Pests and Diseases

10.1.1 In the last 20 years there has been a steady rise in the number of introduced tree pests and diseases some of which have the potential to cause significant loss of tree cover and the benefits they provide. The reasons for this include increasing levels of world trade particularly in plant material, world travel and changes in the climate making it suitable for pests from warmer environments to establish in the UK.

10.1.2 To illustrate the destructive potential of tree diseases the virulent strain of Dutch elm disease, which was imported into the country in the late 1960's on elm logs, killed around 23 million trees changing landscapes and reducing tree cover over large areas the UK countryside.

10.1.3 Among the recent introduction or occurrences of pests and diseases the following two examples pose a particular threat to Peterborough's trees and landscape:

Ash Dieback (*Hymenoscyphus fraxineus*)

10.1.4 This fungal disease has caused extensive tree losses in continental Europe, for example killing over 90% of the ash population in Sweden. It was first found in the UK in 2012 and has rapidly spread from east to west across the country.

10.1.5 Ash forms 7.7% of the street and park trees in the City and, an estimated, 18.5% of the woodland tree population. The level of infection is currently low but expected to rise significantly in the next few years. The symptoms are initially browning and dead leaves and diamond shaped stem lesions as illustrated in Figure 15. This is followed by a fairly rapid dieback in the crown on larger trees. Typically, an infected tree will have tufts of re-growth that eventually succumb to the disease and illustrated in Figure 16. The progress of the disease can be quite rapid with large trees killed in a single growing season in East Anglia where the disease has become well established.

Fig 15: Dead leaves and diamond shape stem lesions are symptomatic of the disease

Forestry Commission Picture Library

Fig 16: Typical crown dieback with tufts of regrowth

Forestry Commission Picture Library

10.1.6 There is, currently, no proven cure or treatment that can be applied. However, there has been extensive research to try to isolate resistant individuals and indeed, in areas of high infection, some trees appear to remain free from infection.

10.1.7 It is not clear how the disease will progress in the area so, at this stage, ash should not be pre-emptively removed.

10.1.8 Ash should be excluded from new tree planting schemes and alternative species planted. However, in woodland conditions, natural re-generation of ash should, as far as possible, be retained as it may contain resistant individuals.

Oak Processionary Moth (*Thaumetopoea processionea*)

10.1.9 The caterpillars of this moth feed on oak trees and defoliate the tree by eating the foliage. However, perhaps a more serious problem is the effect of the caterpillars urticating hairs, which detach from caterpillars bodies, causing serious allergic reactions and respiratory difficulties in humans and their animals.

10.1.10 This pest was introduced on imported trees into the London area in 2005. It was hoped to contain or eradicate the species by volume spraying foliage with insecticide and destroying the communal silken nests which have an accumulation of toxic hairs. Unfortunately, this policy has not been

successful and the pest is spreading outside the London area. The current most northerly sighting is at Watford some 80 miles south of Peterborough.

10.1.11 The hairy caterpillars are shown on Figure 17. Perhaps their most distinguishing feature is that they cluster near food and follow each other in a nose to tail line when moving to and from feeding areas. They make silken nests on the stems and branches of oak trees as shown in Figure 18.

Fig 17: A cluster of caterpillars on an oak leaf clearly showing their urticating hairs

Forestry Commission Picture Library

Fig 18: A communal nest on an oak tree full of toxic hairs

Forestry Commission Picture Library

10.1.12 High populations of this insect will lead to repeated defoliation of oak trees which could seriously weaken them. However, trees are generally resistant to browsing insect damage and their lost leaves will generally grow back even after complete defoliation. This pest is more of a public health problem than a tree issue.

10.1.13 Oak trees form only 2% of the tree stock listed on the data base and around 4% of the PDC woodland belts but they are widely distributed around the City.

10.1.14 Given the public health risk the Council will take prompt action to try to eradicate populations of this insect as they are discovered on their land and offer help to private landowners to deal with the problem. The Council will also periodically review its policy on controlling this insect.

10.1.15 Both the Oak Processionary Moth and Ash Dieback present a serious threat and, if they become established, are likely to require a large amount of staff time and expenditure to deal with. Therefore they will both be added to the Council's risk register.

Brown-tail Moth (*Euproctis chrysorrhoea)*

10.1.16 Another defoliating moth species is the Brown-tail Moth (*Euproctis chrysorrhoea).* This insect has already been found the City in 2013, 2015 and 2016. The infestations were limited in scale and contained by prompt action of Amey staff. The caterpillars also have hairs that cause an allergic reaction and they make silken winter nests normally strung between branches. They are

often found in association with hedgerow trees. These insects should be avoided and will be subject to the same control policy as Oak Processionary Moth.

Other Pests and Diseases

10.1.17 Other recently introduced diseases that have the potential to impact on the tree cover in the City are detailed in Table 5.

Table 5 – Two other serious tree pests and diseases.

Species	Images of Infected trees	Details
Ramorum Disease (*Phytophthora ramorum*)	 Crown dieback in larch caused by Ramorum Disease. **Forestry Commission Picture**	Initially known as "sudden oak death" this disease is currently mainly affecting larch but could affects a wide species range. It can kill larch trees within 12 months. The only control for Ramorum disease is to remove both the infected trees and a buffer of heathy trees to prevent the spread. There are few larch at risk in the urban area where they make up 1% of the population. However, they are likely to form a more significant component of farm and estate woods in the west of the unitary area.
Sweet Chestnut Blight (*Cryphonectria parasitica)*	 Stem lesions caused by the disease and a sweet chestnut stem **Forestry Commission Picture**	Recently found in the UK, this disease of sweet chestnut wiped out the entire population of American sweet chestnut on the eastern seaboard of the USA; killing an estimated 3.5 billion trees. Symptoms appear as cankers on the stem fungal mycelium under the bark. Sweet chestnut makes up around 1% of the tree stock in the urban area but are likely to be a more significant component of woods and parkland to the west.

Pests and diseases not yet established in the UK

10.1.18 There are a number of very serious pests and diseases that have either not yet been found in the UK or have been found, and eradicated. Three examples are shown in Table 6. If they become established in the country, all have the potential to seriously denude the City's tree population:

Table 6 – Potentially Damaging Pests yet to become established in the UK

Species	Images of Pests and Damage	Details
The Asian Longhorn Beetle, (*Anoplophora glabripennis*)	 An adult beetle with distinctive white markings and long antenna **Forestry Commission Picture Library**	Introduced into the USA from Asia the larva of this wood boring insect has killed large areas of urban trees. It is transported around the world in packing timber and by the international plant trade. A small population found in Kent has been eradicated by plant health officials. Any sighting of the large (25 to 30 mm) distinctive beetle must be reported to DEFRA and the Council without delay. It has a large host range encompassing many of the broadleaved species found in the City including maples that make up a high proportion of the tree stock.
Emerald Ash Borer (*Agrilus planipennis)*	 The adult beetle **Forestry Commission Picture Library**	This wood boring insect was introduced into the USA where it has devastated ash populations killing millions of trees. It is now present in Europe with a rapidly expanding population centred on Moscow. The larva of the insect bore into the stems of trees weakening and killing them. Wood boring insects are particularly attracted to trees in a weakened condition and, if it reaches the UK, trees infected with ash dieback would facilitate its rapid spread.
Plane Wilt (*Ceratocystis platani)*	 Extensive dieback on one side of the crown of London plane **Forestry Commission Picture Library**	This fungal wilt disease is related to Elm disease and works in the same way blocking water carrying vessels in the tree causing rapid decline. It is currently killing large numbers of London plane trees in France and throughout Europe. London plane are important street and amenity trees in the City only forming 4% of the tree stock but occupying prominent positions in the street scene.

Policy TP39: To maintain a high level of training and awareness of tree pests diseases and take prompt action, in accordance with best practice guidance, to, as far as is practicable, alleviate the impact when they are discovered.

Priorities:

TP39.1 The condition of Council owned trees will be monitored as part of the normal health and safety inspections policy and promptly dealt with if they present a significant risk to the public. This does not mean that all infected or dead trees will be removed. The Council's policy on tree pests will be reviewed on an annual basis.

TP39.2 Where appropriate and advised, simple biosecurity measures such as cleaning boots, shoes and tyres after visiting woodlands will be implemented.

TP39.3 With regard to protected trees, the Council will not grant permission to fell infected ash trees unless the disease has caused the tree to become dangerous or to present a significant health and safety risk.

Climate Change

10.2 The likely effects of climate change, caused by anthropogenic carbon emissions which are enhancing the greenhouse effect of the upper atmosphere include summer drought and more frequent storm events. Measures to both mitigate and adapt to these predicted effects of climate change will be incorporated into the strategy wherever possible, taking full account of the "Climate Change Strategy for Peterborough".

11. Privately Owned Trees and Woodland Policies and Priorities

Trees and Development

11.1 The significance of the London–Stansted–Cambridge-Peterborough (M11) Growth Corridor means there will be major investment in housing, community facilities and infrastructure. This brings with it opportunities for innovative and strategically planned tree and woodland enhancement. It is essential that trees and woodlands are recognised as an essential part of the design and fabric of growth.

11.2 Accommodating the predicted growth in Peterborough's population and economy provides significant opportunities for a strategic approach to tree and woodland planting. There are a number of initiatives to enhance the natural environment. They all offer opportunities to increase the tree and woodland cover of Peterborough as part of the mosaic of green space and habitats. However, as each has its own agenda and priorities, efforts should be made to ensure that they are coordinated and complimentary.

11.3 The scale of development which will need to take place in coming decades will facilitate significant funding for the creation of attractive and green residential and business environments. Developers have a valuable role as the key player in the majority of land use changes. They need to respect the existing trees and where appropriate incorporate tree planting within new developments. There is extensive research showing that retained trees and newly planted trees

increase the sale value of new properties providing firm financial reasons for developers to consider trees as integral part of their projects.

Policy TP40: The Council will respond to tree issues within planning applications, in accordance with Local Plan Policies, in such a way that ensures the retention of good quality trees and woodland coverage or ensures its creation. Development will not be supported that would directly or indirectly damage existing ancient woodland or ancient trees.

Priorities:

TP40.1: To be guided by best practice and local policies for a consistent approach to assessing planning applications.

TP40.2: Trees and woodlands are to be given significant consideration within planning applications, requiring submission of Arboricultural Impact Assessment (AIA) surveys in accordance with British Standard 5837:2012 "*Trees in relation to demolition, design and construction – Recommendations*". Where trees are on or within influencing distance of a potential development (within 15m of the development area), an AIA must be prepared and submitted as part of the planning application.

TP40.3: The British Standard sets out a process to protect trees at every stage of a development. The Council will, normally, condition the tree protection measures set out in the AIA. This will include proper provision for arboricultural supervision by a qualified arboriculturist and a timetable for inspection visits and the method of reporting findings to all parties including Council Tree Officers.

TP40.4: Producing an AIA is only the first stage in protecting trees during construction. The tree protection measures set out in the AIA are often either disregarded or are poorly implemented once planning permission has been granted. The Council will seek to enforce conditions relating to tree protection and to consider prosecution when planning conditions are breached or there are breaches of Tree Preservation Orders (TPO) or the requirements of Conservation Area regulations.

TP40.5: It is extremely important that plans for remedial tree planting and green infrastructure submitted as part of planning applications come to fruition. When granting planning permissions the Council will set conditions for the protection, planting and proper maintenance of trees and periodically check on compliance.

TP40.6: Where appropriate, the Council will allocate funds produced from the Community Infrastructure levy for community tree planting projects.

TP40.7: The Council will utilise planning powers to retain and protect good quality existing trees threatened by new development including changes to existing properties and enforce the tree protection measures put in place.

Policy TP41: The Council will require that new and replacement tree and woodland planting to be included in new development proposals wherever it is practicable to do so.

Priorities:

TP41.1: To require developers to submit details of tree species, size of planting stock to be used and numbers to be planted as part of their proposals. Planting should aim to replace any loss of biomass and, where practicable, retain or increase the canopy cover on the site. Where it is difficult to achieve the Council will consider offering alternative planting sites on its own land.

TP41.2: To ensure that provision made for tree planning takes account of industry best practice, in particular, BS 8545:2014 "Trees from nursery to independence in the landscape-Recommendations". Further guidance is available from the publications of the Trees and Design Action Group (TDAG).

TP41.3: The Council will encourage planting of healthy plant material. In the light of the threat from imported pests and diseases all planting stock used in the City should be healthy and sourced from reliable sources with appropriate documentation such as plant passports where required. While British grown stock is preferable, if imported stock is used it should have spent at least one year in a UK nursery under observation.

Tree Protection

11.4 Statutory protection is afforded to trees under the Forestry Act 1967 (as amended) and permission from the Forestry Commission (FC) to fell growing trees is often required. There are certain exemptions which include trees in gardens, orchards, Churchyards and designated public open spaces. This permission is granted by the FC via a Felling Licence. Typically an application would be required where trees above 8 cm stem diameter at 1.3 m diameter above ground level need to be felled. If the felling is for thinning a plantation the minimum diameter rises to 10 cm and in the case of coppicing the minimum is 15 cm. A licence is not needed to fell up to 5 m^3 of timber within a given calendar quarter. However, this drops to 2 m^3 if the timber is sold. Any felling approved as part of a planning permission will not need a felling licence. Felling trees within the scope of the regulations without a felling licence is illegal and subject to prosecution and fines.

11.5 In conjunction with its duty, as set out in the Town and Country Planning Act, the Council will incorporate policies relating to Trees and Woodlands within its Local Development Framework. Policies protecting trees exist within the Core Strategy and Planning Policies Development Plan documents.

11.6 There are over 350 TPOs and 29 Local Authority Conservation Areas in the City. The pressure for development sometimes necessitates the pro-active use of TPOs. TPO's are also used reactively when a threat to the condition or retention of a tree is known. The Council will, as far as funding will allow, review many of its older Tree Preservation Orders.

11.7 The work on trees protected by a TPO places a duty on the tree owner to be granted permission from the Council prior to undertaking the work. The Council has a duty to respond to these requests within 8 weeks. In the event that the Council refuse permission for work on, or removal of a protected tree, the owner can appeal to the Planning Inspectorate.

11.8 Before carrying out any tree work or felling of trees within a Local Authority Conservation Area the Local Planning Authority must be given six weeks advance notice. During the six week period the Council may decide to protect the trees in question. However, if no response is received from the Council work may proceed.

11.9 To carry out work, damage or remove trees which are the subject of Tree Preservation Order or within a Conservation order without permission is a criminal offence that, on conviction, carry fines of up to £20,000 per tree. However, if trees are illegally removed to facilitate development then the fine per tree is unlimited and may reflect the increase in land value that has resulted from the loss of the tree.

11.10 Protection Through Advice

11.11 Where necessary and appropriate the Council will provide advice on trees in relation to planning TPOs and work in Conservation areas with the aim of making the process more efficient and therefore provide a cost effective service.

11.12 There are, unfortunately, many people willing to offer tree advice which is inaccurate, and may have serious consequences for the tree and its owner. Arboriculture is an established technical discipline where qualifications at various levels are available. Research is carried out to further our knowledge of trees and their care, good advice is available and should be sought from reliable sources. Tree owners should be aware that research has resulted in updated and substantially changed tree management in the last 20 years. Consequently, any person offering advice should keep their knowledge up to date, through membership of an appropriate professional body.

11.13 Also of concern is the number of people who carry out tree surgery work whose technical abilities are poor. This can lead to low standards of work, which are not in the interests of the tree or its owner. Only reputable companies, capable of working to recognised standards of work such as “British Standard 3998: 2010, “Tree work. Recommendations", should be engaged to carry out tree work. Companies or individuals undertaking tree work should hold Public Liability Insurance cover and proof of cover should be provided before commencement.

11.14 As the Local Planning Authority, the Council has a statutory duty to protect trees of greatest amenity value. This section sets out the City Council's approach to the protection of privately owned trees.

Policy TP42: The Council will seek to ensure that all trees and woodlands making a positive contribution to the environment* are protected. **Priorities:**

Priorities:

TP42.1: To utilise and enforce planning powers to retain and protect trees through Tree Preservation Orders and Conservation Area status.

TP42.2: To comment and advise on strategy and other initiatives which affect trees and woodlands.

**based on the quality and value categorized using the criteria within BS5837:2012 Trees in relation to design, demolition and construction- Recommendations*

Policy TP43: The outright removal of good quality trees and woodlands shall be resisted unless there are sound arboricultural and technical reasons such as irrefutable evidence of damage caused to a property by soil volume change associated with trees.

Priorities:

TP43.1: To protect trees of amenity value

Policy TP44: The Council will promote public awareness and a better understanding of tree and woodland management through community consultation and involvement.

Priorities:

TP44.1 The Council will promote good standards of tree and woodland care.

TP44.2: To, as far as possible, encourage owners of notable trees that are worthy of protection to adopt better practices of tree care.

TP44.3: To support community tree initiatives.

TP44.4: To support the work of national bodies such as the Tree Council and the Trees and Design Action Group.

11.15 A summary of all policies for the management of all trees is provided in Appendix 6.

12. Summary of the Key Elements of the Strategy

12.1 This revised strategy highlights the immense value of Peterborough's urban forest to the wellbeing of its residents and the substantial contribution it makes to the City's sustainable future.

12.2 Since 2012 considerable progress has been made to put systems in place to manage the City's trees and woodlands, particularly the steps that have been taken to fulfil the Council's duty of care in respect of health and safety. This new strategy builds on these achievements.

12.3 The focus of this new strategy is consolidation of the Council's trees stocks; the legacy trees planted by PDC are even aged and all growing towards maturity at the same time. Up to this point they have required relatively low maintenance. However, increasing growth rates are causing conflicts with private properties on the boundaries of the woods and close to trees growing within residential areas. Dealing with these problems is taking up a high proportion of the allocated funds and unless positive management steps are put in place the level of service requests will increase exponentially. It is important that the need for this programme is recognised and adequate resources allocated.

12.4 Faults of both design and implementation by PDC such as planting trees too close to each other and buildings, and allowing deviation from carefully planned species layouts and mixtures need rectifying by restructuring the legacy woodlands and trees and tree groups in residential areas. Where it is necessary to remove trees these will be replaced with more suitable species while retaining or improving the level of canopy cover.

12.5 Shallow, narrow crowned and un-thinned trees provide only a fraction of the ecosystem services of healthy full crowned trees. Dense woods prevent light reaching the ground leading to lack ground flora and poor natural re-generation of tree species. It is therefore necessary to instigate a programme of periodic thinning in many of the woods and tree groups.

12.6 The tree stock must be carefully managed to provide a degree of resilience to both imported pests and diseases and the climate change.

12.7 The expansion of the urban forest will be a priority to ensure that the ecosystem services can be maintained to meet the needs of a growing population. However this will be carefully planned and targeted to as far as possible avoid the mistakes of the past. The Forest for Peterborough project will be strongly supported.

12.8 Development in the City presents both challenges and opportunities for its tree cover. The Council will seek to ensure suitable trees are retained on development sites and commensurate and appropriate provision is made for new tree planting and green space.

12.9 Unless adequate resourcing chains are provided there is a danger that the problems will get progressively worse to the point where the tree stocks become a negative asset.

12.10 It is hoped that both stakeholders and residents of Peterborough will appreciate that the urban forest requires careful management to thrive and provide the considerable benefits of which it is capable. The Council's policies and priorities contained in this strategy represent a commitment to sustainable management of the City's trees for both the existing and future generations.

13. References

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Peterborough City Council 2006, “Climate Change Strategy”

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Peterborough City Council 2007, “A Place for People to Grow”

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Town and Country Planning Act 1990

UKCP09 Climate Predictions

Wildlife and Countryside Act 1981

Woodland Trust "Space for People"

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CABE Space. (No date). The benefits of urban trees.

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14. Glossary of Terms

Ancient Trees – Trees significantly older, and often larger in girth, than the general tree population providing a rich variety of habitats for wildlife.

Ancient Woodlands – Woodland thought to have been in existence since at least 1600 and designated on the Natural England register of ancient woodlands.

Biomass – Renewable vegetation that can be used as a carbon neutral fuel source. This includes not only the timber but small branches and foliage.

Carbon neutral fuel - The term carbon neutral fuel is used for wood used for fuel that comes from sustainably managed woodlands where the carbon loss will rapidly be mediated by replacement trees

Canopy Cover – The area of ground occupied (covered) by the overall branch spread of trees normally expressed as a percentage of the total land area; hence Peterborough has a land area of 34,343 ha, a canopy cover of 3239 ha and therefore a canopy cover of 9.4%.

Coppice and Standards – A traditional woodland management practice of retaining a proportion of single stemmed trees within an area of coppice to grow on for timber production.

Coppicing – A method of repeatedly cutting back trees and woody shrubs to the base of the stem on a short cycle to produce small poles or rods. A traditional management technique associated with ancient woodlands which provides an important sequence of habitats for woodland flora and fauna.

Ecosystem disservices – Trees can cause problems in urban conditions particularity when growing in close association with roads, railways and buildings.

Trees can also have negative effects on the urban atmosphere for example roadside trees trapping polluting gasses under the canopy. However, most researchers see the net effect of trees on the atmosphere as positive.

Ecosystem Services – Services provided by trees and vegetation that contribute to the quality of the environment such as their capacity to sequester carbon from the atmosphere and reduce surface water runoff.

Heat Island Effect – Urbans areas are warmer than the surrounding countryside by virtue of the concentrated activities their population particularly energy use**.** Hard surfaces store thermal energy and release it slowly keeping up night time temperatures. In heat waves urban conditions can lead to even higher temperatures.

High Water Demand Trees – Trees that take up large amounts of water from the soil in comparison to other species with a lesser capacity to extract water.

Legacy Woodlands – Tree belts planted by PDC in the new townships and taken over by PCC on the winding up of the PDC in 1988.

Mature trees – Trees in the second third of their life cycle and still growing strongly.

Natural Regeneration – Young self-sown trees derived from naturally distributed seed produced by nearby trees.

Newly planted trees – Trees that require regular maintenance and have yet to become established in the landscape.

Over mature trees – Trees in the final third of their life expectancy and beginning to decline with very slow growth rates of growth or signs of natural retrenchment (bare dead branches in the upper crown with a healthy but reduced crown at a lower level)

Pollarding – A traditional management technique often used in deer parks and wood pasture which involves cutting off the tree at a height of around 3 to 4 m on a cyclical basis to provide firewood and small poles; the regrowth is then safe from browsing livestock and deer. In an urban situation pollarding is often used to control the crown spread of trees and reduce the water demand. Cyclically reducing trees to a low framework of branches is a form of pollarding. Some species are particularly tolerant of this treatment such and lime, London plane and willow.

Semi Mature Trees – Trees in the first third of their life cycle and growing strongly.

SUDS – Acronym for Sustainable Urban Drainage Schemes which allow for natural drainage of water runoff from roofs and hard surfaces into the ground, rather than directing runoff into the sewerage and main drainage systems.

Specimen Trees - Largely free standing, Council owned trees in streets or public open spaces.

Structured Soils – Specially formed soils that can be compacted but still allow root growth and water percolation. Normal structural soils have a high percentage of sand and gravels.

Tree Stocks – The total of Council owned trees.

Tree Belt – Narrow belt of trees typically 15 to 20 m often planted for screening and shelter. Tree belts were widely planted by PDC surrounding residential areas and edging roads.

Urban Forest – All trees and woody vegetation which grow within a city collectively form the urban forest regardless of ownership.

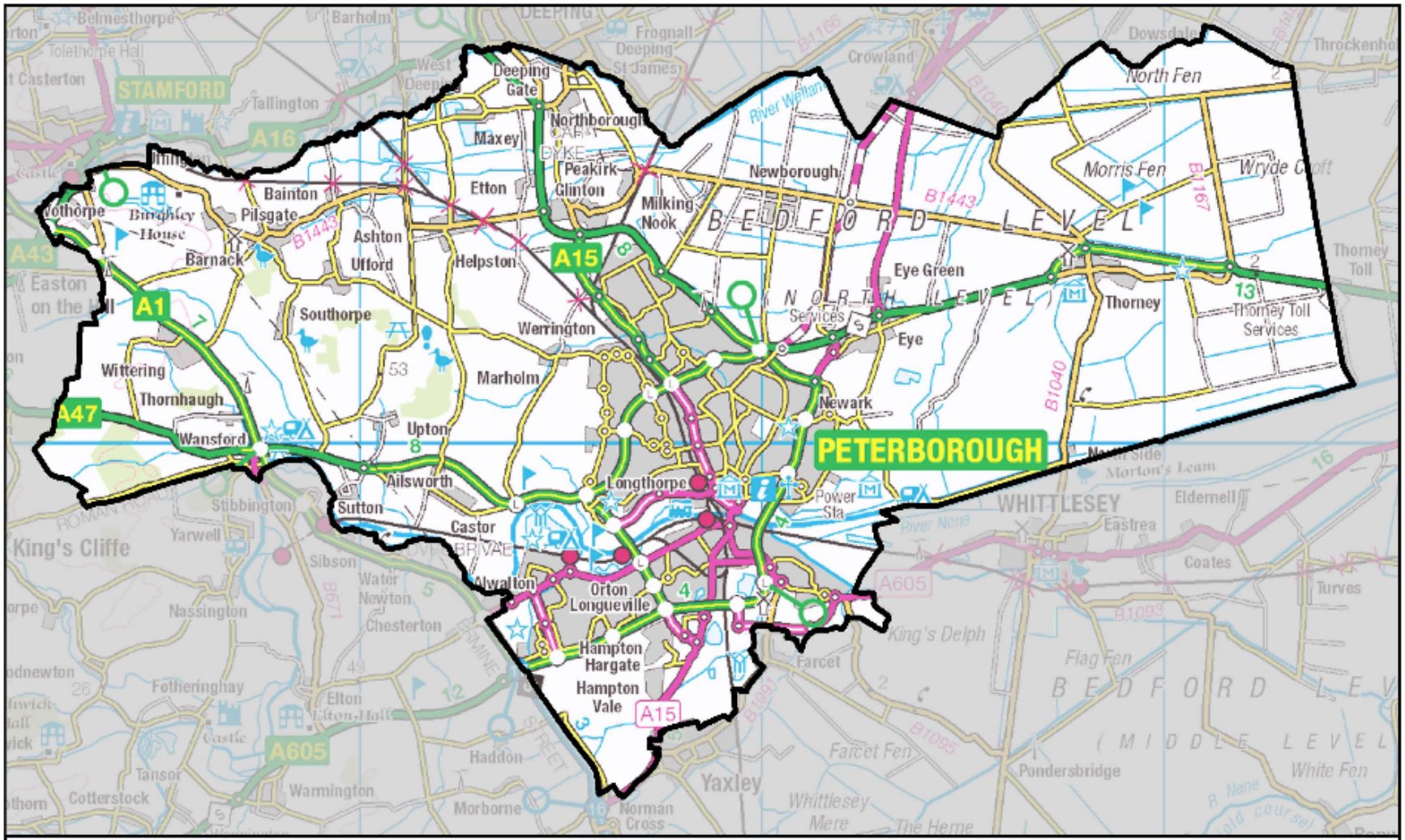
Veteran Trees – Traditionally, trees with the same characteristics as given for ancient trees. However, more recently, the term has been expanded to include trees of any age that have features that support wildlife such as splits, cracks, holes and dead wood.

Wet Woodlands – Woodland growing on soils subject to seasonal waterlogging often in river valleys and adjacent to watercourses. Common species in wet woodlands include alder, willow, aspen and birch.

Whips – Transplanted and bare rooted nursery stock 60 cm to 1.2 m.

Young Trees – Recently established trees that have achieved independence in the landscape.

APPENDIX B1



PETERBOROUGH CITY COUNCIL UNITARY AUTHORITY AREA

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Appendix B2

Canopy cover by ward

Ward	Canopy cover (Ha)	% canopy cover
Barnack Ward	670.8	14.9
Bretton Ward	70.3	22.5
Central Ward	27.0	9.0
Dogsthorpe Ward	26.2	12.0
East Ward	62.7	6.5
Eye, Thorney & Newborough Ward	320.3	2.4
Fletton & Stanground Ward	26.6	5.2
Fletton & Woodston Ward	61.2	19.1
Glinton & Castor Ward	614.3	11.5
Gunthorpe Ward	36.7	10.1
Hampton Vale Ward	80.0	9.6
Hargate & Hempsted Ward	88.5	11.5
North Ward	19.0	8.7
Orton Longueville Ward	103.2	23.3
Orton Waterville Ward	121.1	17.6
Park Ward	22.1	10.8
Paston & Walton Ward	30.0	12.3
Ravensthorpe Ward	38.1	11.3
Stanground South Ward	32.7	7.2
Werrington Ward	58.5	17.0
West Ward	93.2	25.9
Wittering Ward	549.2	17.1
Peterborough total	**3151.7**	**9.2**

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Appendix 3 - Complete List of Tree Species on Peterborough City Council's Database

APPENDIX 3B

Common Name	Scientific Name	Totals	%
Maple	*Acer species*	38	0.1%
Field Maple	*Acer campestre*	1509	**3.7%**
Box Elder	*Acer negundo*	49	0.1%
Norway Maple	*Acer platanoides*	3243	**8.0%**
Norway Maple	*Acer platanoides 'Crimson King'*	107	0.3%
Norway Maple	*Acer platanoides Purple Variety*	53	0.1%
Sycamore	*Acer pseudoplatanus*	1714	**4.2%**
Silver Maple	*Acer saccarinum*	274	**0.7%**
Sugar Maple	*Acer saccharum*	25	0.1%
Horrse Chestnut	*Aesculus hippocastanum*	1157	**2.9%**
Red |Horse Chestnut	*Aesculus x carnea*	96	0.2%
Tree of Heaven	*Ailanthus altissima*	59	0.1%
Italian Alder	*Alnus cordata*	443	**1.1%**
Alder	*Alnus glutinosa*	327	**0.8%**
Grey Alder	*Alnus incana*	36	0.1%
Snowy mespil	*Amelanchier lamarckii*	63	0.2%
Jacquemont's Birch	*Betula jacquemontii*	88	0.2%
Paper Bark Birch	*Betula papyrifera*	38	0.1%
Silver Birch	*Betula pendula*	1680	**4.2%**
Silver Birch	*Betula species*	38	0.1%
Himalayan Birch	*Betula utilis*	57	0.1%
Hornbeam	*Carpinus betulus*	645	**1.6%**
Fastigiate Hornbeam	*Carpinus betulus 'Fastigiata'*	142	0.4%
Sweet Chestnut	*Castanea sativa*	29	0.1%
Blue Atlas Cedar	*Cedrus atlantica glauca*	28	0.1%
Lawson Cypress	*Chamaecyparis (unknown)*	40	0.1%
Lawson Cypress	*Chamaecyparis lawsoniana*	137	0.3%
Hazel	*Corylus avellana*	57	0.1%
Turkish	*Corylus colurna*	73	0.2%
Cotoneaster	*Cotoneaster 'Cornubia'*	48	0.1%
Cotoneaster	*Cotoneaster species*	40	0.1%
Cockspur thorn	*Crataegus crus-gallii*	98	0.2%
Hawthorn	*Crataegus monogyna*	1788	**4.4%**
Broad Leaved Cockspur Thorn	*Crataegus X persimilis 'prunifolia'*	38	0.1%
Hawtorn Species	*Crataegus species*	138	0.3%
Cypress	*Cuppressus unknown species*	104	0.3%
Leyland Cypress	*Cupressocyparis leylandii*	285	0.7%
Dead	*Dead*	278	0.7%
Beech	*Fagus sylvatica*	274	0.7%
Copper Beech	*Fagus sylvatica purpurea*	80	0.2%
Ash	*Fraxinus excelsior*	3133	**7.7%**
Mana Ash	*Fraxinus ornus*	70	0.2%
Narrow leafed Ash	*Fraxinus oxycarpa*	53	0.1%
Raywood Ash	*Fraxinus oxycarpa Raywood*	51	0.1%
Ash	*Fraxinus species*	53	0.1%
Ginkgo	*Ginkgo biloba*	34	0.1%
Hony locust	*Gleditsia triacanthos*	40	0.1%
Holy	*Ilex aquifolium*	126	0.3%
Holy	*Ilex species*	72	0.2%

Appendix 3 - Complete List of Tree Species on Peterborough City Council's Database

APPENDIX 3B

Common Name	Scientific Name	Totals	%
Walnut	*Juglans regia*	30	0.1%
Laburnum	*Laburnum anagyroides*	47	0.1%
European Larch	*Larix decidua*	28	0.1%
Liquid Ambar	*Liquidambar styraciflua*	32	0.1%
Flowering Crab Apple	*Malus baccata*	21	0.1%
Flowering Crab Apple	*Malus species*	931	2.3%
Pillar Apple	*Malus tschonoskii*	43	0.1%
Dawn Redwood	*Metasequoia glyptostroboides*	26	0.1%
Austrian Pine	*Pinus nigra*	73	0.2%
Pine	*Pinus species*	29	0.1%
Scots Pine	*Pinus sylvestris*	187	0.5%
London plane	*Platanus x hispanica*	1734	4.3%
White Poplear	*Populus alba*	187	0.5%
Black Poplar	*Populus nigra*	165	0.4%
Native Black poplar	*Populus nigra 'Betulifolia'*	31	0.1%
Lombardy Poplar	*Populus nigra 'Italica'*	109	0.3%
Poplar Species	*Populus species*	97	0.2%
Aspen	*Populus tremula*	36	0.1%
Lombady Poplar Cherry	*Prunus 'Amanogawa'*	67	0.2%
Wild Cherry	*Prunus avium*	1946	4.8%
	Prunus avium 'Plena'	27	0.1%
Myobalan	*Prunus cerasifera*	125	0.3%
Purple Leafed Plum	*Prunus cerasifera 'Pissardii'*	413	1.0%
Plum	*Prunus domestica*	196	0.5%
Japanese Flowering Cherry	*Prunus 'Kanzan'*	34	0.1%
Laurel	*Prunus laurocerasus*	29	0.1%
Bird Cherry	*Prunus padus*	101	0.2%
	Prunus serrulata	40	0.1%
	Prunus species	1415	3.5%
Blackthorn	*Prunus spinosa*	46	0.1%
Calery Pear	*Pyrus calleryana 'Chanticleer'*	204	0.5%
	Pyrus species	35	0.1%
Pedunculate Oak	*Quercus robur*	814	2.0%
Red Oak	*Quercus rubra*	48	0.1%
Accaia	*Robinia pseudoacacia*	218	0.5%
	Robinia species	27	0.1%
White Willow	*Salix alba*	497	1.2%
Weeping Woillow	*Salix babyloncia*	26	0.1%
Goat Willow	*Salix caprea*	66	0.2%
Crack Willow	*Salix fragilis*	259	0.6%
Willow Species	*Salix species*	162	0.4%
Golden Weeping Willow	*Salix x chrysocoma*	143	0.4%
Elder	*Sambucus nigra*	192	0.5%
Whitebeam	*Sorbus aria*	1124	2.8%
Whitebeam	*Sorbus aria 'Lutescens'*	22	0.1%
Rowan	*Sorbus aucuparia*	1337	3.3%
Swedish White Beam	*Sorbus intermedia*	949	2.3%
Sorbus Species	*Sorbus species*	225	0.6%
Bastard Servic Tree	*Sorbus x thuringiaca*	66	0.2%

Appendix 3 - Complete List of Tree Species on Peterborough City Council's Database

Common Name	Scientific Name	Totals	%
	'Species not in list'	27	0.1%
	'Species not known'	77	0.2%
Lilac	*Syringa vulgaris*	21	0.1%
Yew	*Taxus baccata*	366	0.9%
Small Leafed Lime	*Tilia cordata*	1365	3.4%
Large Leafed Lime	*Tilia platyphyllos*	68	0.2%
Lime	*Tilia species*	89	0.2%
Causcasian Lime	*Tilia x euchlora*	61	0.2%
Common Lime	*Tilia x europaea*	2566	**6.3%**
	Tilia x europaea 'Pallida'	39	0.1%
Common Elm	*Ulmus procera*	64	0.2%
Elm	*Ulmus species*	121	0.3%
	Unknown Species - Broadleaf	52	0.1%
		39638	
	'Suitable locations for new trees	809	2.0%
Species	**Number of trees**	**%**	**Origin**
Norway Maple	*3243*	8.0%	Introduced
Ash	*3133*	7.7%	Native
Common Lime	*2566*	6.3%	Introduced
Wild Cherry	*1946*	4.8%	Native
Hawthorn	*1788*	4.4%	Native
London plane	*1734*	4.3%	Hybrid Origin
Sycamore	*1714*	4.2%	Introduced
Silver Birch	*1680*	4.2%	Native
Acer campestre	*1509*	3.7%	Native
Horse Chestnut	*1157*	2.9%	Introduced

Species	Number of trees	%	Origin
Norway Maple	*3243*	8.0%	Introduced
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Common Lime	*2566*	6.3%	Introduced
Wild Cherry	*1946*	4.8%	Native
Hawthorn	*1788*	4.4%	Native
London plane	*1734*	4.3%	Hybrid Origin
Sycamore	*1714*	4.2%	Introduced
Silver Birch	*1680*	4.2%	Native
Acer campestre	*1509*	3.7%	Native
Horse Chestnut	*1157*	2.9%	Introduced

Tree Risk Management Plan

Enterprise Peterborough
Nursery Lane
Fengate
Peterborough
PE1 5BG

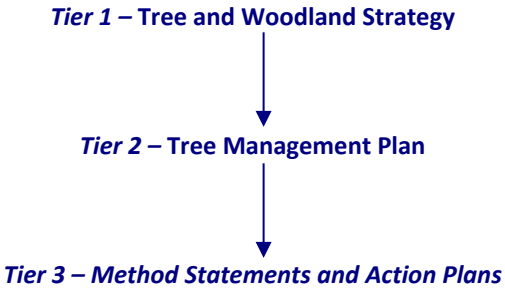
Enterprise Peterborough
Caring for your environment

Table of Contents

Document control		
RAmeyort version	**File reference**	**Quality check completed**
α draft		
β draft	2012 11 29 1500 TMP	
γ draft		
Final release		

1. Introduction

1. This ***Tree Risk Management Plan*** (the Plan) supports Peterborough City Council's (PCC) adopted ***Tree and Woodland Strategy*** (TWS) and is integral to the sustainable management of the wide range of trees and woods managed by Amey in Peterborough (AP). In hierarchical terms the relationship between the documents is as follows:



2. This document has been revised to include updated strategies and method statements.

2. There was no credible historic data available for the vast majority of the tree stock that is managed by AMEY. That knowledge gap means that:

- there is no understanding of the risks to citizens or visitors posed by the tree stock
- there is no understanding of the risks to property posed by the tree stock
- it is not possible to limit the Council's tree-related liabilities
- it is not possible to accurately budget for the provision of tree services
- there is no programme of tree works
- there are limited records of works that may have been carried out

3. The Plan has been developed to address the knowledge gap in a considered and systematic way and to allow for realistic and rational plans to be made for the provision of a sustainable tree service, and for accurate records to be made that relate to the existing tree stock, and any works that may be carried out to those trees and the reasons for those works.

1. The abridged legal background

1. The TWS refers to the comprehensive and dynamic legislative framework under which tree management in the pubic realm must be delivered.

2. This Plan is AMEY's statement of their duty of care under the broad range of legislation and case law affecting trees, people and property, and in particular a response to the publication in 2007 of the **Health and Safety Executive's** (HSE) Sector Information Minute ***Management of the risk from falling trees*** (***SIM 01/2007/05***).

3. When an occupier fails to meet the requirements of their duty of care, which subsequently results in reasonably foreseeable harm or damage to persons, animals, or property, it is likely to be construed that the occupier has been negligent. This may be either by their action (for example using a person without sufficient skill to survey trees, by undertaking incompetent pruning, or by destabilising a tree by root severance) or by their omission (for example by a failure to inspect trees on a reasonable cycle or the failure to carry out prescribed remedial actions).

> *The person responsible for a tree is expected to take reasonable care to avoid acts or omissions, which could reasonably be foreseen to be likely to cause harm. This person is deemed to be*

whomever has sufficient control over the land to appreciate the extent of any dangers and to take any actions.

(Mynors, 2002:25)

4. As part of their carrying out of undertakings, or control of premises, including public spaces, employers have a duty of care under the ***Health and Safety at Work etc. Act 1974*** (HSW Act). In particular there is a duty to do what is reasonably practicable to ensure that they and other people are not exposed to risk. Section 3 of the Act confirms that an employer cannot pass on their legal duty by way of a contract to third parties.

5. The ***Management of Health and Safety at Work Regulations 1999*** (MHSWR) require a risk assessment to be carried out to identify the nature and level of the risks associated with the works and associated operations. Regulation 3.1 states:

1. Every employer shall make a suitable and sufficient assessment of:

a. the risks to the health and safety of his employees to which they are exposed whilst they are at work; and

b. the risks to the health and safety of persons not in his employment arising out or in connection with the conduct by him of his undertakings.

(Cited in Health and Safety Executive 2000:4)

6. The MHSWR affect all parts of the tree management process, though in the context of this Plan they apply most particularly to the undertaking of tree inspection on a reasonable cycle and the completion of the necessary remediation work.

7. Under ***The Occupiers Liability Act 1957*** AMEY, as the occupier, owes a duty of care to all visitors to ensure that their visit is reasonably safe. Trespassers are protected under ***The Occupiers Liability Act 1984*** from the risks that the occupier is aware of. Consideration, therefore, is needed to be given to any known tree-related risks and the actions necessary to reduce or remove them.

8. Other legislation requiring positive action in response to health and safety concerns includes the ***Highways Act 1980***. The Government has, for at least three decades, published advice on the inspection and care of trees:

*The Secretaries of State wish to draw . . . attention **once again** to the need for regular inspection of roadside trees in order that any considered to be a danger to road users can be made safe or felled.*

(DOE, 1973:2)

9. Collectively, street trees and trees within falling distance of the highway (including those outside the ownership and direct control of the highway authority and so potentially some AMEY-managed trees) are classed as highway trees. The highway authority is responsible for ensuring that highway trees do not endanger the highway and its users. Recommendations in ***Well-maintained Highways, Code of Practice for Highway Maintenance Management*** include R9.3:

Highway safety inspections should include highway trees . . . . Inspectors should take note of any encroachment or visible obstruction and any obvious damage, . . . a sAmeyarate programme of tree inspections should be undertaken by arboricultural advisors

(Roads Liaison Group, 2005:119)

10. Statute law has been reinforced, clarified and extended through legal precedent in common law. Precedents from neighbour conflicts dating back to the 1790's are still relevant, however it is some more recent cases which are particularly germane to the management of trees in the public realm. In **Chapman – v – Barking and Dagenham LBC** (1997) there was a clear failure to inspect. Judge Viscount Colville of Culross QC stated:

> *I am satisfied that, despite all encouragement and advice both from external sources and to some extent from their own officers, the defendant Council did not at any relevant time appreciate the distinction between making lists of trees and routine maintenance, as opposed to systematic expert inspection as often as would be reasonably required. I find that no such inspections were ever made, that it was a clear duty on the defendants to make them, and that they have failed in that duty.*
>
> *(cited in Mynors, 2002:150)*

11. The need to use a suitably trained, experienced and/or qualified tree inspector was at the core of **Poll – v – Bartholomew and Bartholomew** (2006) when the claimant successfully sued the landowners for negligence. The judgement also recognised that there are varying levels of skill in inspectors and it is the employers' duty to ensure that they employ a competent person at the appropriate skill level, re-asserted in **Atkin – v – Scott** (2008).

12. **Edwards – v – National Coal Board** (1949) provided a general precedence of what is reasonably practicable. Lord Justice Asquith in his summing up narrowed the interpretation of this to:

> *'Reasonably practicable' is a narrower term than 'physically possible' . . . a computation must be made by the owner in which the quantum of risk is placed on one scale and the sacrifice involved in the measures necessary for averting the risk (whether in money, time or trouble) is placed in the other, and that, if it be shown that there is a gross disproportion between them – the risk being insignificant in relation to the sacrifice – the defendants discharge the onus on them.*
>
> *(LJ Asquith, cited on hse.gov.uk)*

13. In 1999, a tree failed in Birmingham, killing three people; the City Council was successfully prosecuted for their failure to comply with the HSW Act, Section 3, Sub Section 1 (**Crown – v – Birmingham City Council**, 2002). An Improvement Notice was served as part of the proceedings, requiring the council to;

    1. improve its systems to provide suitable and sufficient routine inspection, including identifying all trees and woodland, and

    2. procure competent advisors as necessary, and

    3. carry out and record necessary remedial actions.

    Other incidents have resulted in similar Improvement Notices and requirements.

14. In December 2011 the **National Tree Safety Group** published ***Common sense risk management of trees*** which in Chapter 3 ***What the law says*** provides a summary of covers the law in respect of an owner's liabilities for injury to others caused by the fall of a tree or branch.

15. On 30 June 2011 a branch failed in a recreation ground in Yaxley killing a teenager sitting on a bench: in November 2012 the family reached an out-of-court settlement with Yaxley Parish Council which was responsible for the tree.

2. Tree Risk Management Plan structure

1. The Plan is presented in three sections, dealing with:

    - data capture
    - the tree service
    - the range of actions that will be followed

2. Data capture

1. The scope of the survey

1. As has been stated in **1.2** above there was no credible historical data available for the vast majority of the tree stock that is managed by AMEY.

2. In order to meet their duty of care under the tree-related legislation and case law, and especially the guidance on the standard of risk management of trees as rehearsed in SIM 01/2007/05, AMEY will carry out a systematic and thorough inventory survey of all the trees under their control.

3. During that survey and in the course of their normal activity, AMEY will record any obvious defects of those trees that are within falling distance of the highway.

4. The survey will be cyclical: the first cycle will create a complete inventory of all trees over 75 mm diameter at 1.5m above ground level and all planted trees:

    1. free-standing individuals will be plotted as individual data points,

    2. the extent of groups will be plotted by reference to the group's drip-line,

    3. in groups, there may be individual trees that stand out for whatever reason (e.g. age, species, condition etc.) and they may be plotted within the outline of the group as an individual data point.

5. The first cycle of the survey will be carried out according to geography: the surveyors will move systematically from ward to ward this program of wards has been selected based on historical records of public and Councillor enquiries

6. The timing of the second survey will be evidence lead and will depend upon the particular information about each individual tree that the surveyors capture during the first cycle of the survey.

7. The timing of subsequent surveys will continue to be evidence lead and will depend upon the particular information about each individual tree that the surveyors capture during their assessments.

8. The surveyors will develop a number of survey cycles depending upon, for example, tree health and condition, or the proximity of targets. Those cycles will be determined by the parameter that the surveyor has identified as requiring to be re-surveyed and might take seasonality into account (when looking at the quality of the crown or the tree's architecture or the presence of fungal fruiting bodies for example) or might simply be an annual re-survey to record any changes to the tree or its surroundings.

9. The period between surveys of individual trees will be determined by the surveyors: the maximum period between re-surveys will not exceed 60 months.

2. The extent of the survey

1. The inventory will include following, as defined in the TWS:

    - street trees
    - trees in parks and open spaces
    - trees in some, but not all, schools
    - trees in woodlands
    - trees in the urban woods
    - village and rural trees
    - trees on other sites
    - Landmark Trees

2. Trees on housing land previously owned by PCC are typically the responsibility of Cross Keys Homes and so are outside the scope of The Plan.

3. The survey software

1. There are a number of computerised tree management database tools available from UK software houses: all are equally worthy and all are capable of providing an organised means of capturing tree-related data and geo-spatial references, plotting the point data upon a map and allowing that data to be sorted, organised and manipulated in a variety of ways.

2. E***zytreev*** from RA Information Systems (www.ezytreev.com) was selected to manage the tree data which will be stored, updated within 5 working days and available for Peterborough City Council client access via a web portal.

4. The data to be captured

1. Two sorts of data will be captured and recorded for subsequent manipulation:

    1. **quantitative** data such as species, stem diameter, crown spread, height, date of inspection, date of re-inspection, the frequency of use of the target influenced by the tree, and

    2. **qualitative** data including an assessment of the tree's health, it's condition, the hazard it may pose, the target exposed to that hazard.

2. The data to be recorded may include numerical, textual, spatial or pictorial information: the data may be recorded in full or in abbreviated form as an agreed code.

3. One key piece of data that will be recorded for each and every tree will be the date of the next inspection: completion of this field will provide AMEY with the management information required to develop the programme for the second and subsequent surveys, see **2.2** above.

5. Tree risk assessment

1. There are a number of generally accepted protocols for assessing the risk that a tree may pose to adjacent targets, including but not limited to:

    - ***Evaluation of Hazard Trees in Urban Areas***, Matheny and Clark 1994
    - ***Hazards from Trees – A General Guide***, Forestry Commission, 2000
    - ***Quantified Tree Risk Assessment***, Ellison, 1998
    - ***Professional Tree Inspection***, Lantra, 2006
    - ***Tree Hazard: Risk Evaluation and Treatment System***, Forbes-Laird, 2010

- ***Visual Tree Assessment***, Mattheck and Breloer, 1994

2. Of the protocols listed above some are in the public domain as published papers or works of reference, others can only be accessed and used following attendance at a recognised training event.

3. The protocol that has been adopted for the Plan is the ***Tree Hazard: Risk Evaluation and Treatment System*** (THREATS) developed by an Arboricultural Association Registered Consultant, Julian Forbes-Laird, www.flac.uk.com

4. The THREATS ***Guidance Note*** is available at no direct cost as a download from the Forbes-Laird Arboricultural Consultancy web site, http://tinyurl.com/7pfwurm: AMEY will use the abridged version of THREATS that is embedded within ezytreev in what is described in the Guidance Note as "*a compressed form to evaluate risk as part of larger scale tree surveys*".

5. The first cycle of the survey regime will vary from the protocol established in THREATS in one significant detail: because there is no antecedent data from which to determine survey priorities the survey will proceed on a geographic basis, not on the perceived level of hazard (which will remain unknown until the survey has been undertaken).

6. During the first cycle of the survey regime each individual tree and certain individual trees in the woodlands and urban woodlands will be assessed according to THREATS and the ***Risk Evaluation Sum*** will be calculated and recorded.

7. The Risk Evaluation Sum will be used to determine the priority for second and subsequent survey regimes.

6. Tree value assessment

1. The **Forest Research** publication from April 2011 ***Research Note 008 Street tree valuation systems*** http://tinyurl.com/7j9hftu refers to three generally recognised methods for assessing the value that may be afforded to a tree:

   - ***Capital Asset Value for Amenity Trees*** (2007 Christopher Neilan, United Kingdom, http://tinyurl.com/82bamct)
   - ***Visual Amenity Valuation of Trees and Woodlands (The Helliwell System 2008)*** (2008 Rodney Helliwell, United Kingdom, http://tinyurl.com/84yexfz)
   - ***iTree*** (2006 USDA Forest Service, United States of America, www.itreetools.org)

2. In addition, over the last 50 years, the **Council of Tree and Landscape Appraisers** (CTLA) has developed an approach to tree valuation that is based on internationally recognised valuation principles.

3. ***Capital Asset Value for Amenity Trees*** (CAVAT) has been adopted as the preferred tree value assessment tool for The Plan; AMEY will use the abridged version of CAVAT that is embedded within ezytreev.

4. CAVAT is available as a download at no direct cost from the **London Tree Officers' Association** web site, http://tinyurl.com/82bamct

5. During the first cycle of the survey regime CAVAT *will not* be routinely applied: the imperative will be to generate the Risk Evaluation Sum under THREATS in order to determine the priority for tree works and future survey regimes.

6. During the first cycle of the survey regime CAVAT may be applied in certain situations, particularly where a tree that is intuitively considered to be of high value or benefit has been surveyed and found to be in need of removal or remedial works which might affect the tree's appearance or perceived value or benefit.

7. The tree surveyors

1. The tree survey will be undertaken by suitably trained, qualified and experienced AMEY staff. Typical minimum arboricultural qualifications awarded under the **National Qualifications Framework** would include the NVQ/SVQ Level 3 in Treework, the AA/ABC Awards Technician's Certificate in Arboriculture, the EAC European Tree Technician, or a National Award or Diploma (depending upon the syllabus), or their successors under the **Qualifications and Credit Framework**.

2. In addition, the AMEY tree surveyors would have completed the Lantra Awards Professional Tree Inspection course.

3. The requirement will be that a surveyor is are able to demonstrate their competence in the recognition of tree species, diseases, defects and signs of debility, and the consequences of those symptoms. On-going training will be made available as required in order to maintain the currency of the surveyors' arboricultural knowledge.

4. In addition, a surveyor will be able to demonstrate:

    1. understanding of and competence in the use of ezytreev in the field.

    2. understanding of and competence in the implementation of THREATS to a consistent standard in the field, and

    3. understanding of and consistent implementation of CAVAT in the field, and

5. It will be the surveyor's responsibility to acknowledge their own limitations in both knowledge and understanding to ensure that they do not attempt to sign off a survey for which they are not suitably and sufficiently qualified. The surveyor will be encouraged to refer those trees for a second opinion, including a recommendation for a more detailed inspection, including the use of decay detection devices such as the resistograph or sonic tomograph, should the surveyor determine that to be necessary.

8. The delivery of the survey

1. The survey delivery will conform to the ***Arboricultural Inspection Method Statement*** which is annexed to The Plan.

1. The cyclical survey regime

1. Currently there is no credible data available for the vast majority of the tree stock that is managed by AMEY. The first cycle of the survey regime will provide:

    1. a complete inventory of all the individual trees over 75 mm diameter at 1.5m above ground level and all planted trees, and

    2. an inventory of the woodlands and shelterbelts, in general by group or area rather than by individual tree, and

    3. an assessment of tree health and condition against the parameters of the abridged version of THREATS that is embedded within ezytreev, and

    4. an evidence-lead programme of re-surveys and more detailed tree inspections derived from the parameters recorded to generate the Risk Evaluation Sum using THREATS as embedded within ezytreev, and

    5. an evidence-lead programme of tree works by priority derived from the parameters recorded to generate that Risk Evaluation Sum.

2. The obligations and responsibilities of AMEY and PCC for the inspection of highway trees, as defined in **1.1.9** above, are set out in paragraph 22.12 of the **Notification of Change**.

3. The first cycle of the survey regime will be complete by no later than 31 July 2015.

4. Those outputs will generate the management information required by AMEY to:

    1. determine the appropriate resource profile for the tree service, and

    2. determine the appropriate budget for the tree service, and

    3. deliver sustainable tree management in an even and consistent way that can withstand scrutiny and audit, and

    4. create suitable reporting templates, and

    5. finesse the parameters of the data that is being captured.

5. It has been decided to base the first cycle of the survey regime upon geography, to start with Central Park and Itter Park and then adopt the following route across the electoral wards:

    1. Bretton North
    2. Orton Longueville
    3. Orton Waterville
    4. Central
    5. Ravensthorpe
    6. Dogsthorpe
    7. Werrington North
    8. West
    9. Werrington South
    10. East
    11. Bretton South
    12. Park
    13. Fletton and Woodston
    14. Stanground Central
    15. Paston
    16. Glinton and Wittering
    17. Walton
    18. Eye and Thorney
    19. Stanground East
    20. Barnack
    21. Newborough
    22. Orton with Hampton
    23. North
    24. Northborough

6. The proposed route does not follow a clear and ordered geographic route but is a response to the number of tree-related enquiries that have been received by AMEY.

7. This survey route has been amended based on further enquiries from residents, Councillors and from finding of those enquiries by Amey staff from the tree services team.

7. The progress of the survey will be publicised on both the PCC and AMEY web sites.

2. *Ad hoc* inspections outside the survey regime

1. In addition to the programmed first cycle of the survey regime there will be occasions when *ad hoc* inspections of specific trees or tree groups are required in response to an enquiry. During these inspections the surveyors will apply, in their abridged forms as embedded ion the ezytreev software,

    1. THREATS, and

    2. CAVAT

2. The outputs from the *ad hoc* surveys will therefore provide the opportunity to balance the need for work, as derived from the application of the embedded THREATS protocol, with an indication of the value of the tree, as derived from the application of the embedded CAVAT.

9. Monitoring the survey

1. For the monitoring of the implementation of the survey to be adequate then AMEY will need to put procedures in place to demonstrate that each of the following have been met and any agreed benchmarks and or milestones have been achieved, and if they have not then what control measures will be put in place:

    1. the scope of the survey has been met: either the following are true or they are not:

        - all free-standing individuals have been plotted as individual data points,
        - all groups will have been plotted by reference to their drip-line,
        - the noteworthy individuals in groups have been plotted within the outline of the group as an individual data point.

    2. the extent of the survey has been met: either the complete set of data has been captured for each tree under AMEY's control, of these areas or it has not:

        - street trees (and highway trees, see **2.1.9**)
        - trees in parks and open spaces
        - trees in some, but not all, schools
        - trees in woodlands
        - trees in the urban woods
        - village and rural trees
        - trees on other sites
        - Landmark Trees

    3. all the required data fields have been completed:

        - quantitative data is likely to be recorded from a sequence of drop down menus and so should be consistently presented,
        - qualitative data may be recorded as free text that may require editing before it can be used, editing may give the opportunity to a suitably qualified and experienced arboriculturist to verify the data

    4. the embedded version of THREATS has been consistently applied, across time, geography and the team:

        - the use of a suitably qualified and experienced arboriculturist to lead the analysis and comparison of the data captured by the team will help the team move toward a common vocabulary of risk and a shared understanding of the interpretation of the THREATS protocol

    5. the embedded version of CAVAT has been consistently applied, across time, geography and the team:

- as for risk assessment, the leadership of a suitably qualified and experienced arboriculturist will help the team move toward a common vocabulary of value and a shared understanding of the interpretation of the CAVAT protocol

10. Discharging the duty of care

1. The SIM 01/2007/05 states, at paragraph 3:

> *Employers, persons carrying out undertakings or in control of premises all have duties under the HSW Act. In particular, there is the duty to do all that is reasonably practicable to ensure that people are not exposed to risk to their health and safety. Doing all that is reasonably practicable does **not** mean that all trees have to be individually examined on a regular basis. A decision has to be taken on what is reasonable in the circumstances and this will include consideration of the risks to which people may be exposed.*

2. The SIM 01/2007/05 continues, at paragraph 5:

> *In addition to duties under the HSW Act there are a number of reasons why . . . duty holders . . . may want to manage their tree stocks, for example responsibilities under other legislation and the risk of civil liabilities to:*
>
> - *reduce the risk of property damage from subsidence;*
> - *maintain stocks to preserve their amenity, conservation, and environmental value;*
> - *prevent personal injury through trips and falls on footways disturbed by tree roots; and*
> - *prevent vehicle damage and personal injury from obscured sightlines on the highway.*
>
> ***For these and other reasons, some duty holders may undertake inspection of trees in a manner well beyond the reasonably practicable requirements of the HSW Act.***

3. The SIM 01/2007/05 continues, at paragraph 7:

> *Individual tree inspection should only be necessary in specific circumstances, for example where a particular tree is in a place frequently visited by the public, has been identified as having structural faults that are likely to make it unstable, but a decision has been made to retain it with these faults.*

4. It is clear therefore that the knowledge gap dictates that the first cycle of the survey regime shall generate a complete inventory of tree-related data, something that SIM 01/2007/05 would describe as

> ***inspection of trees in a manner well beyond the reasonably practicable requirements of the HSW Act.***

5. It is also clear therefore that by adopting and fully implementing the stAmeys described in **2. Data capture** above AMEY will be able to discharge their duty of care under the broad range of legislation and case law affecting trees, people and property.

3. The tree service

1. The profile of the tree service

1. AMEY will determine the appropriate structure for of the tree service required to deliver the Plan, and the authority, competence and responsibilities of the individuals in that structure. The appropriate level of resource will be kept under constant review by AMEY.

2. Analysis of the survey data will lead to the development of a tree work programme; the most appropriate means to deliver the programme will be agreed between AMEY and PCC.

2. The budget

1. AMEY will deliver the tree service through existing budgets allocated to them via PCC. In addition to the resources allocated at the commencement of the contract extra budget was allocated in the ***Medium Term Financial Strategy*** for years 2012 to 2017.

2. The indicative costs of the common range of tree service tasks or services will be used to plot how to draw down the available budget.

3. For operational reasons it is likely that some of the works that are identified by the survey will be brought forward and completed in advance of the recommended date because of the need to use the overall budget wisely and to consolidate service delivery within particular areas at given times.

3. Sustainable tree management

1. The Plan seeks to help to deliver PCC's commitment to protect, plant and maintain the trees and woodland within its authority. Sustainable systems of management will be promoted that will aim to:

    - maintain or enhance the tree population
    - facilitate the removal of dangerous or potentially hazardous trees
    - promote biodiversity and conserve the tree/woodland eco-system
    - conserve veteran trees with significant ecological, historical and amenity value
    - establish a tree population with a balanced diversity of age class
    - optimize the use of timber and other products of tree management

2. Records of tree management decisions that were based on high quality management information will help to deliver tree care in an even and consistent way that can withstand public scrutiny and audit.

4. Management information

1. The summary of the recommendations in SIM 01/2007/05 is that the tree manager in the public realm, as the duty holder, should have the following management information:

    1. an overall assessment of risks from trees to enable the risks associated with tree stocks to be prioritised, and to help identify any checks or inspections that may be needed,

    2. a system for periodic checks, to involve a quick visual check for obvious signs that a tree is likely to be unstable to be carried out by a person with a working knowledge of trees and their defects, but who need not be an arboriculturist,

    3. a record of when an individual tree has been checked or inspected with details of any defects found and action taken,

4. a procedure to obtain specialist assistance when a check reveals defects beyond the experience and knowledge of the person carrying out the check,

5. a system to enable people to report damage to trees and to trigger checks following potentially damaging activities, such as work by the utilities in the vicinity of trees or severe gales,

6. specific assessments for those trees that the duty holder wishes to retain, despite the presence of serious structural faults,

7. an action plan to manage the risk that has been identified by a check, without unnecessarily felling or pruning trees,

8. a register of individual trees that require more detailed inspection because, for example, they have structural faults that are likely to make them unstable and a decision has been made to retain the tree with these faults in close proximity to targets,

9. a monitoring regime to ensure that the arrangements are fully implemented.

2. As one of the leading tree management database systems the developers of ezytreev have ensured that the available fields and the software architecture have been designed to meet the recommendations of SIM 01/2007/05.

5. Reports

1. Data capture is predicated upon the available fields and the software architecture of ezytreev.

2. Once the data has been recorded ezytreev allows it to be interrogated in a variety of ways and for high quality management information to be generated in a number of formats that will be suitable for a wide variety of purposes.

3. Typical reports that will be generated will include:

    1. the progress of the survey, both within each electoral ward and also across Peterborough,

    2. an analysis of the enquiries that have been received, for example how many over what period, what type (emergency, 20 day etc), Location

    3. the prescriptions for work as generated by the survey,

    4. the delivery of the tree work programme generated by the survey,

    5. and so on.

4. The progress of the tree work programme will be publicised on both the PCC and AMEY web sites, updates may be shared using social media.

6. Finessing the survey

1. It is to be expected that as the survey proceeds the surveyors and the tree service will want to make changes to the data that is recorded, or the way in which it is recorded.

4. Tree management

1. AMEY will follow two broad principles when considering what tree management action is appropriate in each circumstance, be that as part of planned works or an emergency response:

    1. appropriate action will be taken to minimise a clear and foreseeable threat to the personal safety of residents or visitors, or of harm to property, which is directly related to the condition of, or presence of, an AMEY-managed tree, and

    2. early intervention will be preferred to prevent everyday arboricultural situations from developing into a hazard that is difficult or unreasonably expensive to control.

2. AMEY will not take action against normal, routine, seasonal household maintenance tasks which property owners are expected to carry out, for example

    1. the clearing of leaves from gutters and pathways, or

    2. the weeding of self-set seedlings from the property

3. The general presumption will be that tree pruning will provide the preferred option of a sustainable solution; however in some circumstances tree removal may be the only option.

4. The appropriate response in each circumstance will be determined by the particular facts, however an analysis of the previous decisions that have been taken, each one based on high quality management information, will help to deliver tree care in an even and consistent way that can withstand public scrutiny and audit.

1. The two broad principles

1. An obvious defect

1. For example, where there is a concern that at some time in the future large limb failure may occur

    1. pruning will be the preferred option to provide a sustainable solution to address an asymmetric or disfigured profile, a limb might be reduced or removed for example, or the complete crown managed, or the target moved away from the hazard; or,

    2. the premature removal of the tree may be the only realistic option in order to mitigate the risk.

2. A second example might be when there is a concern that root growth will cause a trip hazard to be created then:

    1. root pruning will the preferred option to reduce that risk; however,

    2 where there is a real risk that a trip hazard might develop because of tree roots underneath a footpath or car park surface then the intention will be to intervene early and take decisive action, for example to remove the tree that is giving rise to the concern.

3. Threats that arise that are an indirect consequence of the presence of the tree (including for example slippery leaves on the pavement in autumn, or seasonal fruit fall) will only be dealt with in extraordinary circumstances and when AMEY considers that no other option is available.

2. Early intervention

1. As a consequence of cyclical maintenance as part of planned works Amey will seek to ensure that:

1. adequate overhead clearance is maintained for an adopted highway: 2.4 m is generally considered adequate for pedestrians, 5.2 m may be required for double-decker buses for example,

2. forward visibility of the full face of road signs is maintained,

3. street furniture remains unobstructed by Amey-managed trees,

4. trees under their management do not prevent street lamps from illuminating the highway (the purpose of street lamps is to illuminate the public highway; where there is adequate illumination of the highway Amey **will not** normally take action to improve the levels of illumination for an adjacent property).

2. In general a pruning regime will be the preferred option to manage obstruction; however premature tree removal may be the only realistic option available to AMEY.

3. A range of circumstances

7. Wildlife

1. Trees have co-evolved and co-exist in the wild with a wide range of wildlife, including insects and birds: in general AMEY will take no action to try to resolve the possible conflicts that may arise because of wildlife as it is most likely that tree pruning or removal will simply displace the problem, it will not provide a sustainable solution. For example:

    1. trees provide a source of food, or shelter for birds to nest or roost; in consequence bird-droppings may become a local problem. However, pruning will be unlikely to provide a solution as the birds will continue to sit on the remaining branches of the tree,

    2. all trees change with the passing seasons and they will bear pollen, petals, fruit, seed, leaves or needles which will simply drop, uncontrolled, to the ground or be carried freely on the wind. AMEY will not consider action to alleviate the problems that may arise as the clearance of these arisings is considered to be part of the routine, seasonal property maintenance that householders are expected to carry out,

    3. honeydew is an excretion from aphids and other plant sucking insects, it is a sticky dAmeyosit, an almost pure sugar solution, similar to the plant sap from which it is derived. Honeydew can not readily controllable by pruning and the cleaning of affected surfaces should be considered to be routine maintenance

2. In contract, grey squirrels are considered to be destructive and opportunistic and are very well adapted to exploit both urban and suburban habitats. They strip the bark of thin barked trees, and bury fruits, nuts and seeds often destroying the seed's growth-point before it is buried. They can easily access buildings and they may take up residence: they may gnaw through electrical wiring, lead or plastic pipe, roof timbers or felt.

3. AMEY will be prAmeyared to consider pruning trees to provide a clearance of 2 to 3m from buildings to deter squirrels, but will not consider felling trees to displace squirrels as this will not provide a sustainable solution.

4. Trees and buildings

1. As a consequence of cyclical maintenance AMEY will seek to ensure that adequate clearance is maintained between an AMEY-managed tree and adjacent buildings, in order to prevent abrasion damage to either.

2. In certain areas of Peterborough there may be

    1. residents' requests for mitigation where tree-related damage to low-rise structures has been alleged, or

    2. insurance claims where subsidence has allegedly occurred as a consequence of an AMEY-managed tree.

The appropriate response in each circumstance will be determined by the particular facts,

Streets and public highways

Threats that arise that are an indirect consequence of the presence of the tree (including for example slippery leaves on the pavement in autumn, or seasonal fruit fall) will only be dealt with in extraordinary circumstances and when AMEY considers that no other option is available.

Review

This document will be reviewed every 2 years by the partner Amey and Peterborough City Council.

5. Abbreviations and references

1. Abbreviations

CAVAT	=	Capital Asset Value for Amenity Trees
AMEY	=	Enterprise Peterborough
HSE	=	Health and Safety Executive
HSW Act	=	Health and Safety at Work etc. Act 1974
MHSWR	=	Management of Health and Safety at Work Regulations 1999
PCC	=	Peterborough City Council
SIM 01/2007/05	=	Sector Information Minute Management of the risk from falling trees
The Plan	=	Tree Risk Management Plan
The TWS	=	Tree and Woodland Strategy
THREATS	=	Tree Hazard: Risk Evaluation and Treatment System

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Appendix B5 - The Right Tree In the Right Place Framework

Landscape Impact	▪ Consider the existing use of the space and question whether the presence of trees would be a positive addition. ▪ Identify the landscape type and what constraints this will place on the selection of species. ▪ Examine existing habitats so as to assess their compatibility with additional trees and woodlands and therefore the latter's ability to add value. ▪ Establish the history of tree cover to determine whether new additions would be appropriate.
Site Constraint	▪ Maintain local distinctiveness. ▪ Assess the impact of planting on vistas. ▪ Consider the presence of underground and overhead services. ▪ Meet the statutory safety requirements of access for pedestrians and vehicles. ▪ Assess impact on the nearest buildings to be sure that future potential problems can be minimised, particularly subsidence. ▪ Prioritise sites in relation to where greatest public benefit can be realised.
Species Consideration	▪ Select species known to thrive on the soil type, its compaction, nutrients and available water. ▪ Consider space available relative to size of tree at maturity unless the tree is destined for controlled management such as coppicing or pollarding. ▪ Select the largest growing species the site will reasonably accommodate. ▪ Consider use of natural regeneration where appropriate. ▪ Where possible use native species. ▪ Maintain diversity within the tree population planting no more that 10%f any species, 20% of any genus and 30% of any plant family. ▪ Consider the species' tolerance to disease and wind damage. ▪ Consider the use of fruit tree planting as a productive and attractive feature. ▪ Consider potential nuisance of fruit fall in the autumn, slippery paths and associated requests for service to deal with problems.

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Appendix B6 – Summary of Tree Policies (TP)

TP 1: The Council will maintain its trees and woodlands in accordance with its obligations to observe duty of care and the safety of both people and property.

TP 2: The Council will encourage a better understanding of tree and woodland management and in so doing promote community involvement.

TP3: The removal of trees and woodlands shall be resisted, unless there are sound Health and Safety or arboricultural reasons supported within this strategy.

TP4: The Council will maintain its trees and woodlands in a way that demonstrates best practice, providing worthy examples of management for others to follow.

TP5: Council trees will not be pruned or removed to stop or reduce bird droppings from trees, or remove bird droppings from private land.

TP6: Council trees will not be removed to stop or reduce blossom from trees and fallen blossom will not be removed from private land.

TP 7: The Council will carry out work on council owned trees to maintain a minimum of:

- Road – 5.5 metre height clearance
- Cycle path next to a road or highway – 3 metres height clearance
- Footpath next to a road or highway – 2.5 metres height clearance

TP 8: Council owned trees will not be pruned or removed to stop the nuisance of overhanging branches

TP9: The roots of Council owned trees will not be pruned removed or cut to prevent roots entering a drain that is already broken or damaged.

TP10: Council owned trees will not be pruned or removed to stop or reduce the nuisance of fruit, berries, nuts or seeds, or remove fallen fruit, seeds or seedlings from private land including gutters.

TP11: There is no general policy to remove trees bearing poisonous fruit / foliage (such as yew trees). However, where it is claimed or known that unsupervised young children or livestock are likely to be exposed to poisonous berries or foliage, such cases will be investigated, and appropriate action considered.

TP12: Council owned trees will not be pruned or removed to stop or reduce leaf fall or remove fallen leaves from private property.

TP13: A Council owned tree will not be pruned or removed to improve natural light in or to a property including solar panels.

TP14: Council owned trees will not be pruned or removed to stop or reduce the nuisance of sucker growth on private land.

Appendix B6 – Summary of Tree Policies (TP)

TP15: There is no policy regarding personal medical conditions that may be specifically affected by nearby Council owned trees such cases will be investigated, and appropriate action considered.

TP16: Council owned trees will not be pruned or removed to stop or reduce the release of pollen

TP17: Work on a council owned trees will be undertaken to maintain clear sight lines (where feasible) at junctions, access points (associated with a street, road or highway), traffic signals and street signs.

TP18: Council owned trees will not be pruned or removed to reduce honeydew or other sticky residue from trees.

TP19: The council has in place active tree management systems to avoid damage being caused to buildings and other structures because of the action of council owned trees.

TP20: The council will make safe an unacceptable trip hazard caused by the growth of council owned trees.

TP21: If a council owned tree is touching a property (house, boundary wall, garage etc.) action will be taken to remove the problem.

TP22: Council owned trees will not be pruned or removed because they are considered to be too big or tall.

TP23: Council owned trees will not be pruned or removed to prevent interference with TV / satellite installation / reception.

TP24: *C*ouncil owned *trees* will not be pruned or removed to improve the view from a private property.

TP25: Council owned trees will not be pruned or removed to stop or reduce incidents of perceived pests such as bees, wasps, or wild animals.

TP26: To endeavour to protect street trees from threats such as loss of verges and damage to same.

TP27: To place a priority on the replacement of ageing street trees; particularly where these adjoin major traffic routes. Planting will ensure the selection of the most appropriate species for the location.

TP28: To renew and restructure tree stocks planted by the Peterborough Development Corporation within residential areas;

TP29: To maintain formal arboricultural features in the urban landscape by careful management and timely renewal as required.

TP30: To take action to restructure belts planted with inappropriate species too close to neighbouring properties.

TP31: The Council will seek to reduce impact of woodland trees on adjoining properties

TP32: The woods will be managed in a fully sustainable manner which will include periodic thinning to allow proper crown development and light to reach the woodland floor.

Appendix B6 – Summary of Tree Policies (TP)

TP33: The woods will not be clear felled and management will be on a continuous cover basis.

TP34 The Council will encourage community involvement and advise residents when work is proposed.

TP35: To maintain tree cover within all the City's parks by renewing the tree stocks and increasing the range of age classes present

TP36: The Council will aim to achieve sustainable management of its ancient woodlands and to protect and preserve wet woodland habitats.

TP37: The Council will preserve and enhance the distinctiveness of village and rural trees in its ownership.

TP38: The Council will encourage an increase in tree cover by new and replacement planting, placing great emphasis on use of appropriate tree species.

TP39: To maintain a high level of training and awareness of tree pests diseases and take prompt action, in accordance with best practice guidance, to, as far as is practicable, alleviate the impact when they are discovered.

TP40: The Council will respond to tree issues within planning applications, in accordance with Local Plan Policies, in such a way that ensures the retention of good quality trees and woodland coverage or ensures its creation. Development will not be supported that would directly or indirectly damage existing ancient woodland or ancient trees.

TP41: The Council will require that new and replacement tree and woodland planting to be included in new development proposals wherever it is practicable to do so.

TP42: The Council will seek to ensure that all trees and woodlands making a positive contribution to the environment are protected.

TP43: The outright removal of good quality trees and woodlands shall be resisted unless there are sound arboricultural and technical reasons such as irrefutable evidence of damage caused to a property by soil volume change associated with trees.

TP44: The Council will promote public awareness and a better understanding of tree and woodland management through community consultation and involvement.

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Consultation Protocol

TREE WORK OPERATIONS Tree Work Operations are described as follows:

Major Tree Work Operations

These operations are classified as any work that alters the appearance of a tree significantly. These works may include:

• felling of any live tree over 20cm diameter at 1.5m from ground level.

• transplanting a tree that, prior to transplantation, does not require the support of a stake or underground guying system.

• major crown reduction - in excess of 30% of the canopy.

• pollarding, if the tree has not been pollarded before, or has not been pollarded within the last 10 years.

• coppicing, if the tree has not been coppiced before, or has not been coppiced within the last 20 years.

• schedule of minor works that would have a significant cumulative impact on a landscape character or habitat.

Minor Tree Work Operations

These procedures are good management practice and are carried out in accordance with BS 3998:2010 ‘Tree work-Recommendations’. Some of the operations are undertaken on a regular, cyclical basis. The work should have no adverse impact upon the health of the tree, or significantly change its appearance, such that the amenity of the tree, or the townscape, is diminished. This work includes the following operations:

• Felling of dead trees.

• Felling of dying or diseased trees, where 40% of the canopy has died and no recovery is possible.

• Felling of newly planted trees that had been damaged, vandalised, diseased, dead or dying. • Pollarding, when the tree is under a regular management regime.

• Coppicing, when the tree is under a regular management regime.

• Formative pruning of young trees to promote a well developed canopy.

• Cleaning out the canopy. This operation includes the removal of dead wood, diseased or dying branches and snags, which may harbour pests and diseases. It also includes the removal of crossing branches, unwanted climbing plants and objects.

• Crown lifting is a procedure which removes the lower branches from the main stem, or branch system, up to a specified height above ground. It is usually carried out to provide sufficient headroom for pedestrians, cyclists and vehicles to pass under the canopy, or to allow light to reach surrounding plants and buildings.

• Crown thinning is an operation carried out to reduce the density of foliage. This may help to make the tree safer by reducing wind resistance, giving a more balanced weight distribution and removing unsafe branches. It stimulates good growth by admitting more light and air to the crown and encourages good branch development in young trees. Thinning may also be carried out to allow light into buildings.

• The following pruning operations: • The removal, or shortening, of branches which are interfering with overhead public utility wires and lamp heads. • The removal, or shortening, of branches which would, in time, become excessively long and heavy. • Shortening branches so as to manage excessive end weight. • Removing, or shortening, branches which are weakly attached, dead, detached but hanging, cracked, seriously decayed or a hazard. • Balancing the crowns of storm-damaged trees. • Crown reduction and crown thinning to reduce the lever arm or the sail area of hazardous trees. • Root pruning to abate minor structural damage, or a trip hazard.

TREE MANAGEMENT PROCEDURES Tree Management Procedures fall within four categories which are described as follows:

Proactive Works: These are the subject of planned management surveys. These surveys are usually undertaken on a cyclical basis. In some circumstances, the client service may request a survey to be undertaken of a tree(s) on land for which it is responsible. Works set out in the schedules may include tree work operations of a major and minor nature.

Reactive Works This is reactive work. It is usually scheduled in response to enquiries or notifications to the Council, but may also include work identified as part of an unscheduled inspection. Works may include operations of a major and minor nature.

Emergency Works. These works are required to make a tree safe without delay. Under the Framework Agreement the contractor appointed to deal with such work shall be available 24 hours a day, 365 days a year, and is required to respond to a call out immediately. Occasionally, an event may occur whereby a tree does not present a hazard, but the situation, or circumstance, requires an immediate solution which can only be resolved by pruning or felling. These works may include operations of a major and minor nature.

Urgent Works. These works are required to rectify a hazard and, in accordance with the Framework Agreement, must be undertaken within 7 or less working days. These works may include operations of a major and minor nature.

CONSULTATION PROCESS FOR TREE WORK OPERATIONS

Major Tree Work Operations Consultation will take place in advance of any works being undertaken. The consultation will comprise the following:

1. Relevant Parish and Ward Councillors shall be advised of Major tree work operations that are programmed 14 day in advance of the works.
2. The works will be advertised on the Council's website.
3. Notices shall be posted on trees stating the nature of the proposals, a brief explanation for the reasons for undertaking the work.

Minor Tree Work Operations Consultation –no formal consultation will take place in advance of the works other than relevant Ward and Parish Council's being notified of the pro-active works commencing in their area.

Emergency Works Consultation - No consultation will be undertaken

Urgent Works Consultation - No consultation will be undertaken.

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The value of Peterborough City Council's trees

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Report prepared for:
Peterborough City Council

July 2018

Executive summary

Urban trees provide numerous environmental, ecological and social benefits. Until recently, these benefits were rarely recognised or valued, whereas the costs of damage and management are widely reported, meaning that trees can be viewed as a liability rather than an asset. Understanding of the importance of urban trees for delivering multiple benefits is, however, being increasingly understood and tools now exist for quantifying these benefits and their associated monetary value. Valuing urban trees is helping to change perceptions of public trees and allows for better and more informed management decisions to be made.

This report presents an evaluation of some of the benefits provided by Peterborough's council owned tree stock and was commissioned by Peterborough City Council. i-Tree Eco v6 was used to describe the tree stock and quantify and value air pollution removal, carbon storage, carbon sequestration and reductions in surface water runoff delivered by the trees. Amenity value of the tree stock was calculated using the Capital Asset Value for Amenity Trees (CAVAT) quick method. The results were based on a council inventory of single trees surveyed in the field, and informed estimates of tree groups (areas of shelterbelt and ancient woodlands). The key findings are presented in the table below for the whole of Peterborough and were also calculated for each ward.

Peterborough's council owned trees are providing significant benefits to society in the form of public services. Amenity value far outweighs the other benefits, with a total value of £2.9 billion, compared to a present value of £38.20 million over 80 years for all other benefits combined, plus total carbon storage value of £11.07 million.

Key findings

	Single trees	Tree groups	Total	Present value[a]
Number/area of trees	37,950	350ha		
Most common species	Sycamore, Norway maple, European ash	European ash, elm, hazel		
Total Annual benefits	£196,215	£1,067,711	£1,263,926	£38,199,003
Pollution removal (annual)	£91,566	£513,536	£605,102	£18,287,709
Carbon storage	£3,004,699	£8,068,010	£11,072,709	n/a
Carbon sequestration (annual)	£78,594	£419,677	£498,271	£15,059,008
Avoided surface water runoff (annual)	£26,054	£134,498	£160,552	£4,852,286
Amenity value (CAVAT)	£564M	£2,293.14M	£2,856.70M	n/a

[a]*Present value is calculated over 80 years*

Contents

1. Background

Urban trees provide a wide range of benefits to society, ranging from carbon storage to improving air quality, as well as providing visual attractiveness, character and local distinctiveness. These benefits are rarely recognised or valued, whereas the costs of damage and management are widely reported, meaning that trees can be viewed as a liability rather than an asset. The importance of urban trees for delivering multiple benefits is, however, being increasingly documented and methods established for quantifying these services. Understanding the range and value of benefits provided by urban trees and how these vary with location is a key step in achieving more sustainable management of these assets.

1.1 Aims

Natural Capital Solutions were commissioned by Peterborough City Council to undertake a monetary valuation of the benefits provided by the council tree stock. The assessment summarises the council-owned tree stock, the flow of a selection of benefits delivered by the trees, and their value to society. Note that the council-owned tree stock is a subset of the total tree stock across Peterborough.

1.2 The natural capital approach

The natural environment underpins our well-being and economic prosperity, providing multiple benefits to society, yet is consistently undervalued in decision-making. Natural capital is defined as "*..elements of nature that directly or indirectly produce value or benefits to people, including ecosystems, species, freshwater, land, minerals, the air and oceans, as well as natural processes and functions"* (Natural Capital Committee 2014). These benefits (often referred to as ecosystem services) include food production, regulation of flooding and climate, pollination of crops, and cultural benefits such as aesthetic value and recreational opportunities (Figure 1).

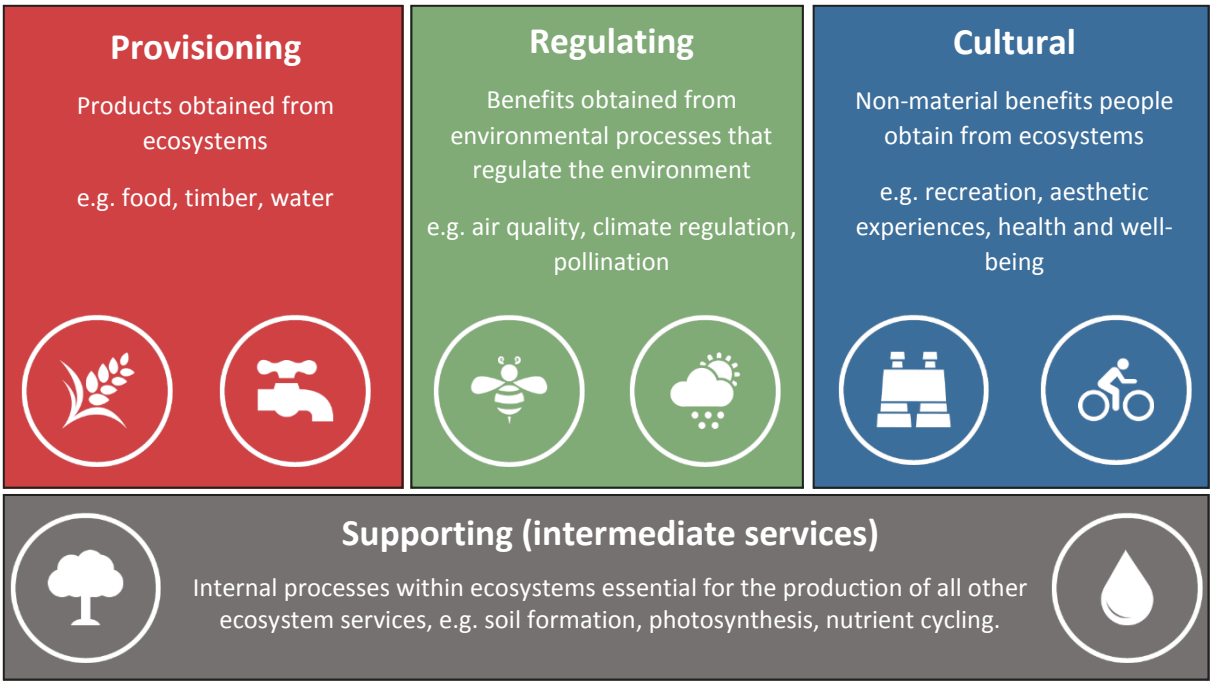

Figure 1. Key types of ecosystem services (based on MA 2005)

The concept of natural capital and its associated approaches can be used to understand the natural capital assets of an area or organisation. Through a natural capital assessment, it is possible to understand the extent and condition of those assets, so the number and the flow of ecosystem service benefits from those assets can be established. These benefits can then be valued. Information on condition, benefits and their value allows informed and transparent management decisions to be made. Furthermore, adopting the natural capital and ecosystem services approach is a key policy objective of the UK Government and is central to Defra's new 25-year Environment plan.

The approach taken in this report is based on the natural capital approach, with Peterborough's trees being the natural capital assets described, and the benefits and services derived from them quantified and valued. By taking this approach, Peterborough Council will be able to more accurately demonstrate the value of their tree stock, allowing natural capital to be taken in to account more fully in decision making. The analysis presented here also acts as a baseline, allowing the council to monitor losses and gains over time.

1.3 The benefits provided by trees and their valuation

The vast range of services provided by urban trees is summarised in Table 1. Very few of these services can be valued using existing markets, with the exception of the provisioning services such as timber, woodfuel and other bioenergy uses. A range of methods have therefore been developed to value some of the other benefits provided by trees, for which there is not currently a market, many of which have been packaged into tools for use by practitioners. One of the most complete tools available to measure multiple urban tree benefits is a software package, i-Tree Eco, which has been developed over many years by the United States Department of Agriculture Forest Service. i-Tree Eco has been successfully applied in more than 100 countries and several UK cities and provides valuations of benefits such as air pollution absorption, carbon storage and sequestration and surface water runoff reduction, all of which are described in more detail below.

Table 1: The ecosystem service benefits provided by urban trees and some of the ecological and economic implications of these services.

Ecosystem services	
Regulating services	
Reducing rate and volume of storm water runoff	Providing shade
Reducing flood risk	Reducing summer air temperatures and the urban heat island effect
Enhancing infiltration and recharging ground water	
Reducing soil erosion	Providing shelter from wind
Trapping sediment	Reducing energy use
Enhancing water quality	Reducing glare
Absorbing air pollution – particulate matter (PM), NO_x, SO_3, ozone, carbon monoxide, ammonia	Attenuating noise
	Screening unattractive or noisy places
Removing dust and odour	Supporting pollinators
Producing oxygen	Enhancing pest and disease control
Sequestering and storing carbon – directly and in soil	
Cultural services	
Providing and enhancing landscape character	Enhancing community cohesion
Contributing to sense of place and identity	Reducing aggression, violence and crime rates
Part of cultural heritage	Increasing security
Enhancing aesthetics	Enhancing driver and pedestrian safety
Benefiting physical health – reducing blood pressure, stress, asthma	Reducing road traffic speeds
	Enhancing privacy
Speeding recovery from surgery and illness	Bringing people closer to nature
Enhancing attention and cognitive function	Providing setting for outdoor learning
Improving mental health and well-being	Improving educational outcomes through improvements in concentration and performance and reduced time off for illness
Improving pregnancy and birth outcomes	
Reducing mortality rates – especially related to cardiovascular and respiratory diseases	Enhancing quality of life
	Providing spiritual value and meaning
Encouraging physical activity	Supporting biodiversity and wildlife viewing
Enhancing connectivity	
Provisioning services	
Source of timber, fuel, fodder, fruits, nuts and berries	Source of biofuels
Enhancing water supply	
Ecological benefits	
Habitat provision, improvement & connectivity	
Economic benefits	
Increasing land and property prices	Reducing heating and cooling costs
Reducing 'time on market' for selling property	Increasing property taxes
Attracting business and customers	Enhancing rental income
Reducing health care costs	Increasing tourism and visitor revenues
Reducing expenditure on air pollution removal	Reducing screening costs especially next to main roads
Reducing expenditure on storm water infrastructure	Providing potential for carbon offsetting trade
Reducing expenditure on flood defences	Generating income from sales of food, fibre, biofuels
Saving investment in new power supplies	Creating jobs and employment in environmental sector

Air quality amelioration

According to the World Health Organisation, air pollution is the greatest environmental health risk in Western Europe and globally. Exposure to air pollution in the UK causes around 40,000 deaths each year and plays a major role in cancer, asthma, stroke, heart disease, diabetes, obesity, and changes linked to dementia (RCP 2016). The cost has been estimated at more than £20 billion per year (RCP 2016) and the government is under increasing pressure to tackle the problem more effectively (e.g. House of Commons 2018). Although policies to implement clean air zones and encourage the uptake of electric vehicles, will have much the greatest impact on air pollution, the natural environment can also play a role.

Urban trees can be effective at mitigating the effects of air pollution primarily by intercepting airborne particulate matter (PM), but also by absorbing ozone, sulphur dioxide (SO_2) and nitrogen oxides (NO_X) (Elmqvist et al. 2015). The effectiveness of trees in reducing air pollution varies greatly depending on multiple factors including species, environmental conditions and concentration of pollutants (Sæbø et al. 2012, Broadmeadow and Freer-Smith 1996).

Although the average percent air quality improvement due to vegetation is relatively low, the improvement is for multiple pollutants and the actual magnitude of pollution removal can be significant, the associated monetary value of which can be very high (Rouquette and Holt 2017).

Trees can also contribute to air pollution as they emit volatile organic compounds that can lead to the formation of pollutants such as ozone and carbon monoxide. Whether trees are a net source or sink of pollution varies depending on multiple factors including species and street characteristics, though studies have concluded that an increase in tree cover usually leads to reduced ozone formation (Nowak Dwyer 2000).

Carbon storage and sequestration

Carbon storage and sequestration is seen as increasingly important as we move towards a low-carbon future. The importance of managing land and vegetation as a carbon store has been recognised by the UK government and has a major role to play in national carbon accounting. Carbon is increasingly being given a monetary value and forms the basis of Payments for Ecosystem Services (PES) schemes such as the UK Woodland Carbon Code. Trees, especially large ones, are able to store and sequester significant amounts of carbon and also facilitate a gradual accumulation of carbon in the soil (Forest Research 2010).

Avoided surface water runoff

The intensity of rainfall and storm events has increased in recent years throughout the UK, increasing the number of flood events and causing billions of pounds worth of damage. Urban drainage systems are thus increasingly under pressure, but these are costly and often outdated. There are a number of mechanisms by which trees can help alleviate the amount of urban surface water and hence reduce flood risk (Nisbet et al. 2011, Mullaney et al. 2015) including direct interception of rainwater, promoting higher infiltration rates into the soil

and through greater water use. Trees can therefore significantly reduce pressure on drainage systems in urban areas, although the extent varies depending on factors such as tree size, species and intensity and duration of rainfall.

Amenity value

Urban trees also deliver cultural, non-material benefits such as aesthetic inspiration and cultural identity that are not captured in i-Tree Eco. There is, however, another tool often used in conjunction with i-Tree Eco (which values a subset of benefits) that can better capture these more social aspects of urban tree benefits, providing an indication of the amenity value of individual trees. The Capital Asset Value for Amenity Trees (CAVAT) method is an expert-based amenity tree valuation tool developed by the London Tree Officers Association (Neilan 2010). CAVAT was designed as an asset management tool for trees that are publicly owned, or of public importance, helping to change perceptions of public trees into that of assets and not liabilities (as well as a means of gaining appropriate compensation where public trees are damaged or removed).

We use a combination of both i-Tree Eco and CAVAT valuation to describe the structure of Peterborough's tree population and quantify some of the benefits delivered by this tree stock.

2. Methodology

2.1 Tree data and benefit analysis

A detailed inventory of Peterborough's public tree stock was provided by the council from surveys undertaken between July 2012 and April 2018. This dataset was used to conduct a Full Inventory assessment in i-Tree Eco v6. This provides a summary of the basic structure of the tree population and quantifies the amount and value of pollution removal, carbon storage, carbon sequestration and avoided surface water runoff services delivered by the tree stock (see Annex 1 for full details of model calculations).

The minimum data required to run i-Tree Eco is tree species and trunk diameter at breast height (DBH), however the more information included for each tree, the more accurate the results. We therefore also included tree height in the i-Tree models, but no other tree data could be incorporated. All trees within the inventory that were missing information regarding tree species, DBH and height were removed prior to analysis (3,976 entries). Dead trees and those listed as felled were also removed.

The dataset was also used to calculate the amenity value of trees using the Quick CAVAT Method (See Annex 2 for full details, Nielan 2017). In order to calculate the CAVAT value, the life expectancy and functional value of the tree (how well a tree is performing biologically) is required in addition to DBH. All entries within the inventory missing this information were removed (552 entries). The amenity value of a tree is also dependent on the human population density of the nearby area, as trees that are seen by more people will

have higher value. Each tree was therefore assigned to the ward in which it was situated, and the Community Tree Index (CTI) Factor within the CAVAT calculation was adjusted according to the population density of each ward. Ward population densities were taken from the 2011 census.

The final dataset consisted of 37,950 single trees across Peterborough. In addition to these single trees, there are also a number of tree groups and woodlands within Peterborough. These broadly fall into one of two categories; shelterbelts planted along Peterborough's main roads, and ancient woodland. Exact data on individual trees within these trees groups was not available. Estimates of characteristics required to run i-Tree Eco and the CAVAT method in order to value these tree groups were therefore derived using a combination of information provided by the council and average values from the database of single trees. These estimates thus need to be considered with caution, but are able to give us a broad understanding of the contribution tree groups make to benefit delivery in Peterborough and their associated value.

The majority (63%) of the shelterbelt trees in Peterborough were planted in a four year period in the late 1970s and 93% are 30-50 years old. The species mix and density of different tree sizes (by DBH) are known from council surveys and were used as the basis for determining the average composition of a typical hectare of shelterbelt tree group (see Annex 3).

The same process was taken for the two areas of ancient woodland within Peterborough, with tree characteristics and species composition again estimated from sample surveys provided by Peterborough Council. These woods typically contain large mature standards, interspersed with a much larger number of smaller trees, typically about 30 years old, that have developed from coppice stools. Estimates of DBH were provided for the ancient woodland standards. For the younger trees developed from coppice stools, the range of DBHs of the shelterbelt trees was applied, as these were of a similar age (see Annex 3 for the full details of the ancient tree group composition estimate and how this was derived).

i-Tree and CAVAT values were derived for these typical hectares of shelterbelt and ancient woodland and then multiplied by the area of both tree group types within each ward to give an estimated value of the tree stock per ward. To calculate the area of tree groups per ward, entries representing discrete tree groups within the main Peterborough tree inventory were identified, extracted and displayed in GIS (a total of 1362 polygons). There were a number of council owned tree groups missing from this layer. Therefore, a separate "shelterbelts" layer supplied by Peterborough Council was examined, and an additional 101 polygons that did not appear on the first layer were selected and combined with the first layer. A layer showing ancient woodland sites across the study area was consulted to identify which polygons should be classified as ancient woodland. Following discussion with Peterborough Council, all other polygons were classified as shelterbelt. Finally, each of the final polygons was assigned to the ward in which it was centred and the area of shelterbelt and ancient woodland within each ward was calculated. These ward estimates were then summed to give the total estimated value of the Peterborough tree groups stock. Caution must be taken in interpreting the CAVAT value for tree groups as the CAVAT method was designed for

individual trees and does not enable any account to be made of the number of trees in a group.

All analyses were therefore grouped in to two. One set of analyses were conducted on the single trees contained in the council inventory, totalling 37,950 trees. This dataset is henceforth referred to as "single trees" and is based on data collected in the field. The second set of analyses were conducted on the tree groups and woodlands, henceforth referred to as "tree groups", where some tree characteristics were based on informed estimates, totalling an estimated 349 ha of trees. All analyses were conducted both for Peterborough as a whole and by ward (removal of pollutants could not be incorporated into ward estimates as i-Tree does not break down pollution removal figures by ward). The mean value per tree, for air pollution removal, carbon storage and sequestration, and avoided runoff was also calculated for the single trees only, given the higher accuracy of this dataset.

The Present Value (PV) was determined for each of the benefits (excluding carbon storage and CAVAT values), which is a standard approach based on the Government's Green Book (HM Treasury 2018). This approach calculates the value of the flow of benefits over a given time period and is based on the concept that people generally prefer to receive goods and services now rather than later. A benefit delivered 80 years in the future is thus likely to be of less value than that same benefit delivered today. Discount rates are applied to the annual value of benefits at particular time junctures into the future to calculate the value of that benefit over a given number of years in present value terms. We applied discount rates from the HM Treasury (2018), and the ONS (2014) to calculate the value of flows of benefits of Peterborough's trees over an 80 year period. A period of 80 years was chosen as CAVAT values are calculated over this same time period as it is considered to represent average human life expectancy in the UK. This allows for total CAVAT values and PVs of the other tree benefits to be compared. Note that there will be considerable turnover over the 80 years, with many trees dying and being replaced, with surviving trees likely to increase in value over that time. The asset value therefore represents the average value of the tree stock over an 80 year period, assuming the overall number of trees remains constant.

Carbon in vegetation and soil is a stock (i.e. a quantity of resource measurable at a fixed point of time) and not a benefit that is accrued over a period of time, hence PV cannot be calculated for carbon storage benefits.

3. Results

3.1 The Peterborough tree stock

Single trees

Complete measurements were available from approximately 38,000 single trees across Peterborough. The most common species of single trees are Sycamore (*Acer pseudoplatanus*, 9.5%), Norway maple (*Acer platanoides*, 9%) and European ash (*Fraxinus excelsior*, 8%). The full breakdown of species composition is given in Figure 2. The wards

with the greatest density of single public trees are Bretton (15.9/ha), followed by Dogsthorpe (9.7/ha) and Ravensthorpe (8.8/ha).

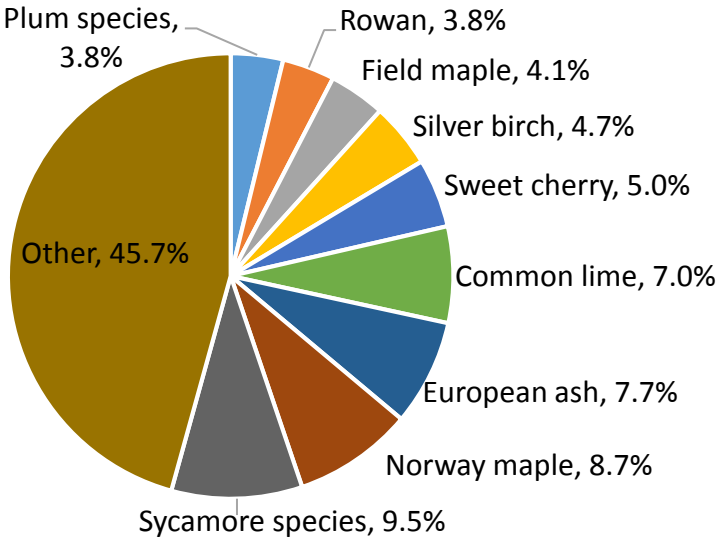

Figure 2: Species composition of council owned single trees in Peterborough.

It is estimated that 52% of the single public trees in Peterborough have a DBH of less than 30cm, while 40% have a DBH of 30-60cm and the remaining 8% have a DBH of greater than 60cm.

Tree groups

Tree groups cover approximately 350 hectares of Peterborough (330ha of shelterbelt and 20ha of ancient woodland). The most common species of trees within the shelterbelt groups are ash (Fraxinus species, 18.5%), field maple (Acer campestre, 14.3%) and hawthorn (Crataegus species, 11.5%). A full species composition breakdown is given in Figure 3. The wards with the greatest area of shelterbelt are Hargate and Hempsted (51.2ha), Orton Waterville (40.6ha) and Orton Longueville (30.9ha).

Previous surveys conducted by the council estimated that the proportion of trees in a typical hectare of shelterbelt with a DBH of 0-20cm was 67.4%, while trees with a DBH of 21-40cm make up 31.9% of shelterbelts, with a final 0.8% of shelterbelt trees having a DBH of 41-60cm. Shelterbelt trees are therefore typically smaller on average than the single measured trees described above.

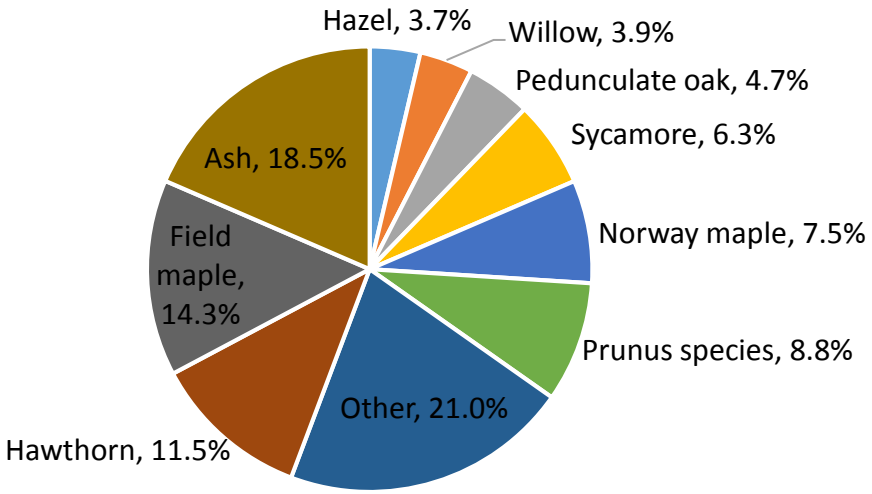

Figure 3: Estimated species composition of council owned shelterbelt trees in Peterborough.

There are two areas of ancient woodland in Peterborough, Grimeshaw Wood and Pockocks Wood. The larger of the two (Grimeshaw Wood) is in the ward of Bretton and is approximately 18ha in size. The smaller area of ancient woodland is in the ward of Glinton and Castor and covers roughly 2ha. These woods both contain approximately 286 medium and large mature standards per hectare, interspersed with a much larger number of smaller tress (roughly 1340), typically about 30 years old that have developed from coppice stools. The standards are dominated by ash (roughly 57%) and oak trees (roughly 16%) with a full breakdown given in Figure 4a. The most common species of trees within the understorey of these woodlands are elm (Ulmus species, 34%), hazel (Corylus species, 31%) and ash (Fraxinus species, 10%). A full species composition breakdown is given in Figure 4b.

The medium and large ash and oak trees typically have DBHs of 21-60cm and 61-120cm respectively and make up approximately 13.7% of the ancient woodlands. The remaining standards in a typical hectare are a variety of species and different sizes and make up 5.0% of the ancient woodlands. No information was available for the DBHs of the coppice trees but as these were a similar age to the shelterbelt trees, they were allocated the same proportion split of DBHs as these stands (see above).

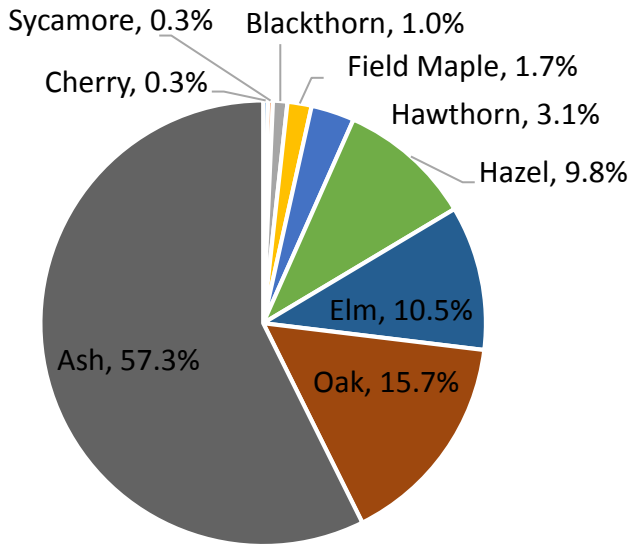

Figure 4a. Estimated species composition of the canopy / standard trees within council owned ancient woodlands in Peterborough.

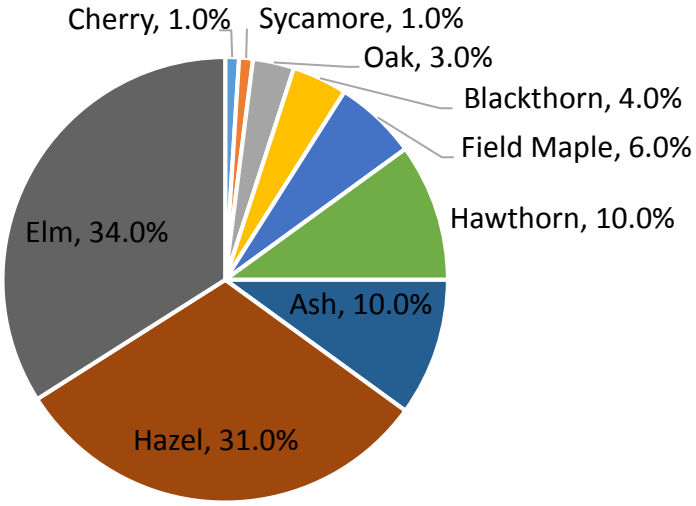

Figure 4b. Estimated species composition of the council owned ancient woodland understorey in Peterborough.

3.2 The benefits delivered by Peterborough's tree stock

The estimated annual physical amounts, annual monetary value and present value (PV) of benefits delivered by Peterborough's tree stock are outlined in Table 2. Estimates for the single trees and tree groups are shown separately as the data for the former were based on field measurements while the latter were based on informed estimates of tree group composition and structure and will be less accurate as a result. Both single tree and tree group estimates are combined to give an overview of the total benefits delivered by the

Peterborough Council owned tree stock but these values should be interpreted with caution given the assumptions made for the tree groups, and used only as a ball park figure.

The total value of air pollution removal, carbon sequestration and avoidance of surface water runoff benefits delivered by the council owned stock of trees in Peterborough is estimated to be worth £1.26 million per year (Present Value (PV) of £38.20 million over 80 years). Each tree is estimated to deliver £5.17 worth of benefits per annum (as calculated using the single trees database only). In addition, the trees also deliver an estimated total value of £11.07 million in carbon storage. A reminder that carbon in vegetation and soil is a stock and not a benefit that is accrued over time, hence this is not an annual value (which is why it is not combined with the annual values of other benefits measured), nor can PV be calculated. A breakdown of these values by the individual benefits is given below.

Table 2: Annual physical amounts, annual monetary values and present values of the benefits delivered by Peterborough's public tree stock.

Benefit	Annual physical amount			Annual monetary value (£)			Present value (£)		
	Single trees	Tree groups	Combined	Single trees	Tree groups	Combined	Single trees	Tree groups	Combined
Pollution removal (t)									
CO	0.14	0.80	0.94	137	785	922			
NO_2	2.80	15.80	18.60	62,071	350,242	412,313			
O_3	5.14	29.37	34.51	7,314	41,703	49,017			
$PM_{2.5}$	0.36	1.97	2.33	22,043	120,790	142,833			
SO_2	0.001	0.01	0.01	2	15	17			
Total	8.43	47.95	56.38	91,566	513,536	605,102	2,767,364	15,520,345	18,287,709
Carbon storage (t)[a]	12,416	33,339	45,755	3,004,699	8,068,010	11,072,709	n/a	n/a	n/a
Carbon sequestration (t)	325	1,734	2,059	78,594	419,677	498,271	2,375,318	12,683,690	15,059,008
Avoided runoff (m^3)	15,371	80,249	95,620	26,054	134,498	160,552	787,417	4,064,869	4,852,286
TOTAL (excl. carbon storage)[a]				196,215	1,067,711	1,263,926	5,930,099	32,268,904	38,199,003

[a] *Carbon storage is not an annual benefit accrued over time but a stock. The amount given here is therefore not an annual value but a total value. A present value cannot be calculated for this stock.*

Air pollution removal

Peterborough's public trees are estimated to remove a total of 58 tonnes of pollutants per year, providing annual benefits worth an estimated £605,102 (PV of £18.29M). The trees had the greatest impact on ozone (O_3), removing an estimated 35 tonnes per year (£49,017 per year), followed by approximately 19 tonnes per year of nitrous oxide (NO_2) which had the greatest associated value (£412,313 per year). The monetary value associated with particulate matter removal (PM2.5) was also high, providing benefits worth £142,833 per year (estimated removal of roughly 2 tonnes per year). Though the trees also contribute to removal of carbon monoxide (CO) and sulphur dioxide (SO_2), the concentration of these pollutants in Peterborough was low and so there is little economic impact of these benefits, especially sulphur dioxide (annual value of £922 for carbon monoxide and £17 for sulphur dioxide). i-Tree Eco accounts for emissions of pollutants from trees in its calculations, so even though some individual trees may be contributing to air pollution, the net effect of Peterborough's trees is shown to be of pollution removal. On average, each tree contributes an estimated £2.41 per year in terms of air pollution removal benefits (calculated using the single trees dataset only).

Carbon storage and sequestration

Peterborough's public trees are estimated to be responsible for the storage of 45,755 tonnes of carbon with an associated value of £11.07M. Peterborough's trees are estimated to sequester 2,059 tonnes of carbon per year (or 7,550 tonnes of CO_2), worth £498,271 annually (PV £15.06M). For comparison, 9,525 tonnes of CO_2 were emitted from properties that Peterborough City Council own and from street lighting in the year 2017-18. This means that the council owned tree stock is offsetting 79.3% of the council's own emissions. Alternatively, this is equivalent to the annual emissions of 3,881 cars (based on UK average mileage of 12,714 km per year and average emissions of 153g of CO_2 per km), which is approximately 4.6% of the total number of cars in the Peterborough local authority area.

Avoided surface water runoff

Peterborough's trees are estimated to reduce surface water runoff by 95,620 cubic metres per year, with an associated value of £160,552 (PV £4.9M). This is equivalent to the water from 38 Olympic sized swimming pools not entering the drainage system each year.

Benefit delivery by ward

The total estimated annual value of carbon sequestration and avoided surface water runoff for each ward within Peterborough is given in Table 3. Pollution removal values are not included here as it is not possible to get the breakdown by ward in i-Tree. Carbon storage is presented separately in Table 4 as this is not an annual value but a total value of the stock.

The ward contributing the most benefits in terms of monetary value per annum from its trees, despite its relatively small size (311ha), is Bretton, worth an estimated total of £124,807 per year. The value derived from the benefits delivered by single trees was highest in this ward (£15,183 per year). Bretton is also home to the largest area of ancient woodland in Peterborough which plays a significant role in the contribution of tree group benefits in

this ward (worth £109,624 per annum), second only to tree group benefits in Hargate and Hempsted. Barnack, the third largest ward (4,515 ha), had the lowest value of benefits derived from public trees, with an estimated annual value of £1,174. Unsurprisingly, carbon storage is also greatest in Bretton (estimated value of £2.24M) and lowest in Barnack (estimated value of £33,298).

Table 3: Total annual monetary values of carbon sequestration and avoidance of surface water runoff benefits delivered by public trees in the wards of Peterborough.

Ward	Ward area (ha)	Benefit value (£/year)		
		Single trees	Tree groups	Combined
Barnack	4,515	1,010	164	1,174
Bretton	311	15,183	109,624	124,807
Central	283	6,551	4,359	10,910
Dogsthorpe	228	6,501	17,872	24,373
East	842	4,248	29,390	33,638
Eye, Thorney and Newborough	13,307	6,678	25,230	31,908
Fletton and Stanground	705	2,395	7,803	10,198
Fletton and Woodston	318	4,081	13,673	17,754
Glinton and Castor	5,267	5,591	20,974	26,565
Gunthorpe	384	1,532	23,030	24,562
Hampton Vale	1,149	591	21,769	22,360
Hargate and Hempsted	280	800	72,423	73,223
North	221	3,350	5,328	8,678
Orton Longueville	464	8,429	43,720	52,149
Orton Waterville	688	6,645	57,409	64,054
Park	202	4,021	14	4,035
Paston and Walton	248	5,094	13,171	18,265
Ravensthorpe	326	8,112	10,269	18,381
Stanground South	538	2,221	11,306	13,527
Werrington	460	8,651	37,752	46,403
West	387	2,246	25,903	28,149
Wittering	3,219	720	2,994	3,714
TOTAL	**34,342**	**104,650**	**554,177**	**658,827**

**Rounding errors result in differences for breakdown by Ward compared to the overall summary.*

Table 4: Total monetary values of carbon storage benefits delivered by public trees in the wards of Peterborough.

Ward	Ward area (ha)	Carbon storage (£/year)		
		Single trees	Tree groups	Combined
Barnack	4,515	31,027	2,271	33,298
Bretton	311	372,627	1,865,182	2,237,809
Central	283	236,795	60,446	297,241
Dogsthorpe	228	181,834	247,852	429,686
East	842	122,336	407,585	529,921
Eye, Thorney and Newborough	13,307	297,028	349,902	646,930
Fletton and Stanground	705	78,309	108,217	186,526
Fletton and Woodston	318	117,167	189,618	306,785
Glinton and Castor	5,267	229,687	328,526	558,213
Gunthorpe	384	43,594	319,385	362,979
Hampton Vale	1,149	9,005	301,893	310,898
Hargate and Hempsted	280	12,669	1,004,379	1,017,048
North	221	81,186	73,885	155,071
Orton Longueville	464	204,790	606,327	811,117
Orton Waterville	688	143,141	796,171	939,312
Park	202	110,635	191	110,826
Paston and Walton	248	174,501	182,666	357,167
Ravensthorpe	326	198,266	142,410	340,676
Stanground South	538	76,162	156,793	232,955
Werrington	460	175,041	523,557	698,598
West	387	87,231	359,237	446,468
Wittering	3,219	21,666	41,517	63,183
TOTAL	**34,342**	**3,004,697**	**8,068,010**	**11,072,707**

**Rounding errors result in differences for breakdown by Ward compared to the overall summary.*

CAVAT amenity values

The CAVAT values are an estimate of tree amenity value that takes human population density into account. The total estimated CAVAT value for Peterborough's trees is £2.86 billion (Table 5). The single tree contribution to this total is £5.64 million (£14,850 per tree) while the remaining £2.29 billion is from the tree groups. The tree group value should be interpreted with caution as CAVAT was designed for use on single trees with no adjustment

possible to account for the number of trees in a group, which may influence the individual amenity value of each tree within a group.

The amenity value of trees varies considerably between Peterborough's wards ranging from £556.91 million in Bretton to £5.67 million in Barnack. The amenity value of trees in Bretton is much larger than other wards, with trees in Hargate and Hempsted, the second largest value, worth £266.14 million. This is driven primarily by the nearly 18ha of ancient woodland in the Bretton Ward.

Table 5: Amenity values of Peterborough's public tree stock calculated using the CAVAT quick method and broken down by ward.

Ward	CAVAT value (£M)		
	Single trees	Tree groups	Combined
Barnack	5.08	0.60	5.67
Bretton	68.64	488.27	556.91
Central	43.29	19.84	63.13
Dogsthorpe	39.10	97.61	136.71
East	18.38	107.01	125.39
Eye, Thorney and Newborough	48.52	91.87	140.39
Fletton and Stanground	12.07	28.41	40.48
Fletton and Woodston	21.90	62.23	84.13
Glinton and Castor	36.55	75.44	111.99
Gunthorpe	8.45	104.82	113.27
Hampton Vale	1.64	79.26	80.90
Hargate and Hempsted	2.44	263.70	266.14
North	21.39	29.10	50.48
Orton Longueville	41.70	198.99	240.69
Orton Waterville	24.26	209.04	233.29
Park	43.60	0.08	43.68
Paston and Walton	27.44	71.94	99.38
Ravensthorpe	37.44	46.74	84.18
Stanground South	10.25	41.17	51.42
Werrington	37.55	171.83	209.37
West	10.60	94.32	104.92
Wittering	3.26	10.90	14.16
TOTAL	**563.55**	**2,293.14**	**2,856.70**

4. Conclusions

Valuation of benefits provided by the council owned tree stock of Peterborough has been successfully applied using both i-Tree Eco and the CAVAT method. The results have shown that the trees in Peterborough are providing significant benefits to society in the form of public services and how these vary between wards. This approach is useful at highlighting these values which may otherwise remain hidden and provide a basis for managing trees as a public asset rather than a liability. A number of assumptions and estimates have, however, been used in the calculation of these benefits (discussed further below) and their associated values and should, therefore, be interpreted with caution.

The amenity value of Peterborough's trees was significantly larger than the value of all other benefits (total CAVAT value of £2.86 billion compared to a PV of £38.20 million for all other benefits combined. This is common in other studies that have used both i-Tree and CAVAT analysis of urban trees (Rouquette & Holt 2017) and highlights the importance of amenity value. Air pollution removal was the second most valuable benefit delivered by Peterborough's trees (PV of 18.29 million), followed by carbon sequestration (PV of 15.06 million), and reduced surface water runoff valued at £4.9 million. The per tree value of air pollution removal, carbon sequestration and surface water runoff benefits, although relatively small on a per tree basis (£5.17 per year), scale up to deliver significant benefits on a city-wide basis. Per tree values of pollution removal, carbon sequestration and avoided surface water runoff compare to the averages reported in a review of studies conducted using i-Tree (Rouquette & Holt 2017), and are, on average, a little higher (£2.41 per tree per annum compared to £1.58 for air pollution, £2.07 compared to £1.20 for carbon sequestration and £0.69 compared to £0.44 for runoff). Variations between studies are to be expected given different tree composition and structure of each city's tree stock as well as variable prices/costs used in the valuation of benefits delivered.

The CAVAT values, however, are considerably higher than the average from this same review of studies (£14,850 per tree based on the single trees database, compared to £2,000 per tree). This higher valuation of amenity value is most likely because we used a simpler method of calculation due to the lack of available data. Previous studies that have used the CAVAT method have incorporated accessibility of trees into calculations, with lower valuation attributed to trees considered to be less accessible. Trees in residential areas, for example, were downweighted to 40% accessibility. Functionality scores were also downweighted depending on various factors such as likely management intensity. We did not account for accessibility or this additional functionality measure in the present study, which could account for the comparatively higher amenity values we obtained. The amenity value of Peterborough's tree stock could therefore be an overestimate, but even when additional factors have been taken into account in other studies, amenity value is always much higher than the value of the other services measured. Furthermore, a study of Ealing Council's tree stock, which did take both accessibility and functionality into account using the CAVAT method, reported amenity values higher than those of Peterborough's trees (£25,000 per tree per year, Rogers et al. 2018). Finally, the CAVAT method does not allow

for adjustments to the valuation to be made according to whether trees are stood by themselves or in a group, which is likely to lead to an overestimation of amenity value for our tree groups.

Many assumptions had to be made for the calculation of the tree groups and the resulting estimates of the benefits they deliver. Furthermore, additional information that can help improve the estimates calculated by i-Tree Eco were not available. The results presented in this report should therefore be treated as ball park figures.

What we have presented represents a snapshot in time of Peterborough's tree resource. The trees are a dynamic asset with, for example, some trees living less than the 80 years over which time present values were calculated and others living much longer, and some trees being replaced. The valuation can act as a baseline for observing how this asset changes through time.

It is important to note that the valuation conducted here represents only some of the benefits delivered by urban trees, as only a small number of the benefits provided by trees are captured within i-Tree and through use of the CAVAT method. Many other environmental, social and ecological benefits such as reduction in noise pollution, temperature regulation and associated reductions in energy consumption, health and well-being benefits and habitat for wildlife are also provided by urban trees. Thus the total value of benefits provided by Peterborough's trees is likely to be much greater than the figures presented here. Furthermore, Peterborough's trees represent a relatively young tree stock and the benefits delivered from these trees and their associated value will generally increase as the trees mature.

The valuation will also slightly underestimate the full value of the Peterborough tree stock as not all council owned trees are currently included in the inventory of single trees or tree groups. Although the vast majority of trees in the more urban areas are included, there are some gaps in some of the rural wards. This was checked by examining a GIS layer of all tree cover against a layer that identifies all council owned land. Please note, also, that we have only assessed council owned trees. These are thought to represent less than 15% of the total tree stock across the local authority area, although in several of the wards towards the urban centre, more than 50% of the total tree stock is council owned. This means that the benefits calculated in this report represent only a relatively small proportion of the total benefits provided by trees across Peterborough.

Peterborough's individual tree stock is relatively diverse at present, with no single species taking up more than 10% of the stock. However, the tree groups are less diverse, with a large proprotion made up of ash, and overall diversity is much lower. This is a potential problem, as new pests and diseases are appearing regularly, with the potential to devastate certain species. Ash, in particular, is susceptible to ash dieback, which only appeared in this country a few years ago, and is starting to have a major impact on this species across the country. If ash dieback were to become common in Peterborough, this would lead to the potential destruction of large numbers of Peterborough's trees, which in turn would lead to a major loss of the benefits described in this report. It is important therefore, that

Peterborough Council adopts a policy of replacing all trees that are removed, and plants a wide variety of different species to reduce the impact of any one particular disease.

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Annex 1: i-Tree Eco v6 benefit model methods

i-tree Eco v6 is designed to use standardized field data along with local hourly air pollution and meteorological data to quantify urban forest structure, multiple benefits delivered by the trees and their associated value. Specifically, i-Tree Eco can provide assessments of:

- Urban forest structure (e.g., species composition, tree health, leaf area, etc.).
- Amount of pollution removed hourly by the urban forest, and its associated percent air quality improvement throughout a year.
- Total carbon stored and net carbon annually sequestered by the urban forest.
- Effects of trees on building energy use and consequent effects on carbon dioxide emissions from power sources.
- Structural value of the forest, as well as the value for air pollution removal and carbon storage and sequestration.
- Potential impact of infestations by pests, such as Asian longhorned beetle, emerald ash borer, gypsy moth, and Dutch elm disease.

Effects of trees on building energy use and the potential impact of infestations by pests were not included in our analyses of Peterborough's tree stock due to lack of data.

The most recent year both meteorological and pollution data were available within i-Tree Eco for the Peterborough area was 2013, with meteorological data collected from a weather station in Wittering (less than 10 miles from Peterborough city centre).

As information on tree crown health was not available in the provided tree inventory, i-Tree Eco used a default value of 13% dieback when tree health was required in the calculation of service benefits.

Air pollution removal

Pollution removal was calculated for ozone (O_3), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO) and particulate matter less than 2.5 microns ($PM_{2.5}$). Air pollution removal estimates were derived from calculated hourly tree-canopy resistances for O_3, and SO_2 and NO_2 based on a hybrid of big-leaf and multi-layer canopy deposition models (Baldocchi 1988; Baldocchi et al 1987). As the removal of carbon monoxide and particulate matter by vegetation is not directly related to transpiration, removal rates (deposition velocities) for these pollutants were based on average measured values from the literature (Bidwell and Fraser 1972; Lovett 1994) that were adjusted depending on leaf phenology and leaf area. Particulate removal incorporated a 50 percent resuspension rate of particles back to the atmosphere (Zinke 1967). Recent updates (2011) to air quality modelling are based on improved leaf area index simulations and weather and pollution processing and interpolation (Hirabayashi et al 2011; Hirabayashi et al 2012; Hirabayashi 2011).

Valuation for pollutant removal was derived using the UK social damage costs (central estimates) based on avoided mortality and morbidity (Defra 2015) where figures were available (NO_2, $PM_{2.5}$ and SO_2 – inflated from 2015 prices to 2018 prices). The default i-Tree values based on US externality costs were used when UK figures were not available (CO, O_3) and converted to Sterling using the July 2018 exchange rate of £0.75 to $1. Pollution removal prices used in these analyses were £984 per metric ton (tonnes) of CO, £1,423 per metric ton of O_3, £22,168 per metric ton of NO_2, £2,060 per metric ton of SO_2, and £61,230 per metric ton of $PM_{2.5}$.

Carbon storage and sequestration

Carbon storage is the amount of carbon bound up in the above-ground and below-ground parts of woody vegetation. To calculate current carbon storage, biomass for each tree was calculated using equations from the literature and measured tree data. Tree dry-weight biomass was converted to stored carbon by multiplying by 0.5.

Carbon sequestration is the removal of carbon dioxide from the air by plants. To estimate the gross amount of carbon sequestered annually, average diameter growth from the appropriate genera and diameter class and tree health was added to the existing tree diameter (year x) to estimate tree diameter and carbon storage in year x +1.

Carbon storage and carbon sequestration values were calculated by multiplying the tonnes of carbon stored by the government's non-traded central carbon price (£66 per metric tonne of CO_2, which is equivalent to £242 tonnes of carbon) in 2018 prices (BEIS 2017). The non-traded price is based on the cost of not emitting the tonne of carbon elsewhere in the UK in order to remain compliant with the Climate Change Act, in accordance with UK best practice on carbon storage and capture valuation.

Avoided surface water runoff

Annual avoided surface runoff is calculated based on rainfall interception by vegetation, specifically the difference between annual runoff with and without vegetation. Although tree leaves, branches, and bark may intercept precipitation and thus mitigate surface runoff, only the precipitation intercepted by leaves is accounted for in this analysis.

The value of avoided runoff is based on Anglian Water charges for sewerage and water drainage (£1.70 per m^3 2018 price). This approach does not separate foul water sewerage prices from surface water drainage, thus the resulting valuation may be an overestimation. This is, however, the same approach adopted in most other i-Tree studies in the UK.

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Annex 2: CAVAT method

The Capital Asset Value for Amenity Trees (CAVAT) Quick Method as described in the user guide (Neilan 2017) was used to assess the amenity value of Peterborough's trees. CAVAT works by calculating a unit value based on the diameter of the trunk, and then adjusts this value to reflect the degree of benefit that the tree provides to the local population. This takes into account the nearby human population density, tree functionality and life expectancy. The CAVAT method uses a replacement value approach and is regularly used to set levels of compensation when trees are damaged or destroyed and provides a basis for managing trees in the UK as public assets rather than liabilities.

Specifically, the CAVAT Quick Method assigns a basic value to each tree according to its diameter at breast height (DBH) broken down into one of 16 size bands. This basic value is derived using a replacement cost approach. This basic value is then adjusted according to the population density of the urban areas of the Local Authority using the Community Tree Index (CTI) factor. For Peterborough, a separate CTI factor was applied for each ward, depending on the population density of the ward. The tree value is then multiplied by the functional value of the tree (how well the tree is performing biologically compared to what would be expected of a well-grown healthy tree of the same species and DBH). Five categories of functional value are used to classify the trees. Finally, the value is then adjusted for life expectancy of the tree to give the tree's final amenity value.

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Annex 3: Tree groups

The breakdowns of how a typical hectare of shelterbelt and ancient woodland trees were calculated are given below.

Typical hectare of shelterbelt trees

The information provided by Peterborough Council on a typical hectare of shelterbelt trees included the total number of trees, the size of these trees (broken down by the number of trees in each DBH range) and the proportion of different species. There were only three DBH ranges of trees within a typical shelterbelt area, 0-20cm, 21-40cm and 41-60 cm. In order to be able to estimate benefit delivery by these trees in i-Tree Eco and with the CAVAT method, we had to estimate the number of individual trees of each species within each DBH band as well as their height, functional value and life expectancy.

Greater DBHs are more likely from larger tree species so we devised a method to account for this when estimating the proportions of trees allocated to the three different DBH bands of trees found within the shelterbelt. We classified the tree species into three categories; small, medium and large. Trees classed as small were all allocated to the 0-20cm band. This was calculated by multiplying the proportion of trees of a small species by the total number of trees in one hectare of shelterbelt. 11.49% of shelterbelt trees, for example, are hawthorns so we multiplied this by 1164 (total number of trees) to give us 134 trees, all of which were allocated a DBH of 0-20cm.

The proportion of trees left in each DBH band once all small tree species were allocated to 0-20cm DBH was then recalculated. Trees classed as medium in size were then allocated to the DBH bands of 0-20cm and 21-40cm according to the proportion of trees in each of these two categories. 14.26% of all shelterbelt trees, for example are field maple giving a total of 166 trees within a typical hectare of shelterbelt. We multiplied the proportion of remaining trees with a DBH of 0-20cm by 166 to give us the number of field maple trees of this size. The same calculation was done using the proportion of trees with a DBH of 21-40cm to give the total number of field maples of this size.

The proportion of trees left in each DBH band was recalculated once again to account for the trees already allocated to size bands of 0-20cm and 21-40cm. The trees classed as large were then allocated to each of the three size bands according to these proportions.

Each tree species of a particular DBH band was then allocated a height using the average value for that tree species and DBH from the inventory of single trees measured in the field. All trees were allocated a life expectancy or 40-80 years and functional value of 75% as these were the median and most common values for the trees in the single tree inventory.

Ranges of DBH are used in the CAVAT method, however, a single value is required in i-Tree Eco, so we used the midpoints of each DBH range.

Typical hectare of ancient woodland

Averages from previous surveys of ancient woodland areas within Peterborough together with additional information provided by the council were used to determine the composition of a typical hectare of ancient woodland. The ancient woodlands of Peterborough contain both large standards and smaller understorey coppice trees. Each hectare contains c. 286 standards, dominated by ash and oak trees. Averages from previous surveys were used to determine the proportion of both medium and large ash and oak trees per hectare. The estimated range of DBHs typical for large and medium trees within the ancient woodlands was provided by the council. We took the centre points of these size ranges to use in subsequent analyses (medium = 40cm, large = 90cm). No information on height was available so the averages of ash and oak trees from the main dataset of single trees with the medium and large DBH ranges were used to determine height. The composition of the remaining standards was not available so the proportions of the species found in the understorey were used (see below). The larger tree species (elm, sycamore) were allocated DBHs and heights using the same approach as for ash and oak. Trees from the medium sized species (field maple) were allocated a DBH of 40cm (centre point of the medium range DBHs provided by the council) while the smaller species (blackthorn, cherry, hawthorn and hazel) were allocated a DBH of 20cm (centre point for the small range of DBHs). The average height of trees for each species with the relevant range of DBHs from the main dataset of single trees was used in subsequent analyses. Information on functional value and life expectancy was not available for the standards and so the same figures as used for the shelterbelt trees were applied.

Each hectare also contains c. 1340 coppice stems. The species composition of these trees was provided but information on DBH, height, functional value and life expectancy were unavailable. We therefore used the same proportions of DBH bands as found in the areas of shelterbelt trees and followed the same methods as described in the shelterbelt section above to allocate the number of trees of each species within the differenced DBH bands. The same approach as for the shelterbelt trees was also taken to estimate tree height with the same figures as above used for functional value and life expectancy.