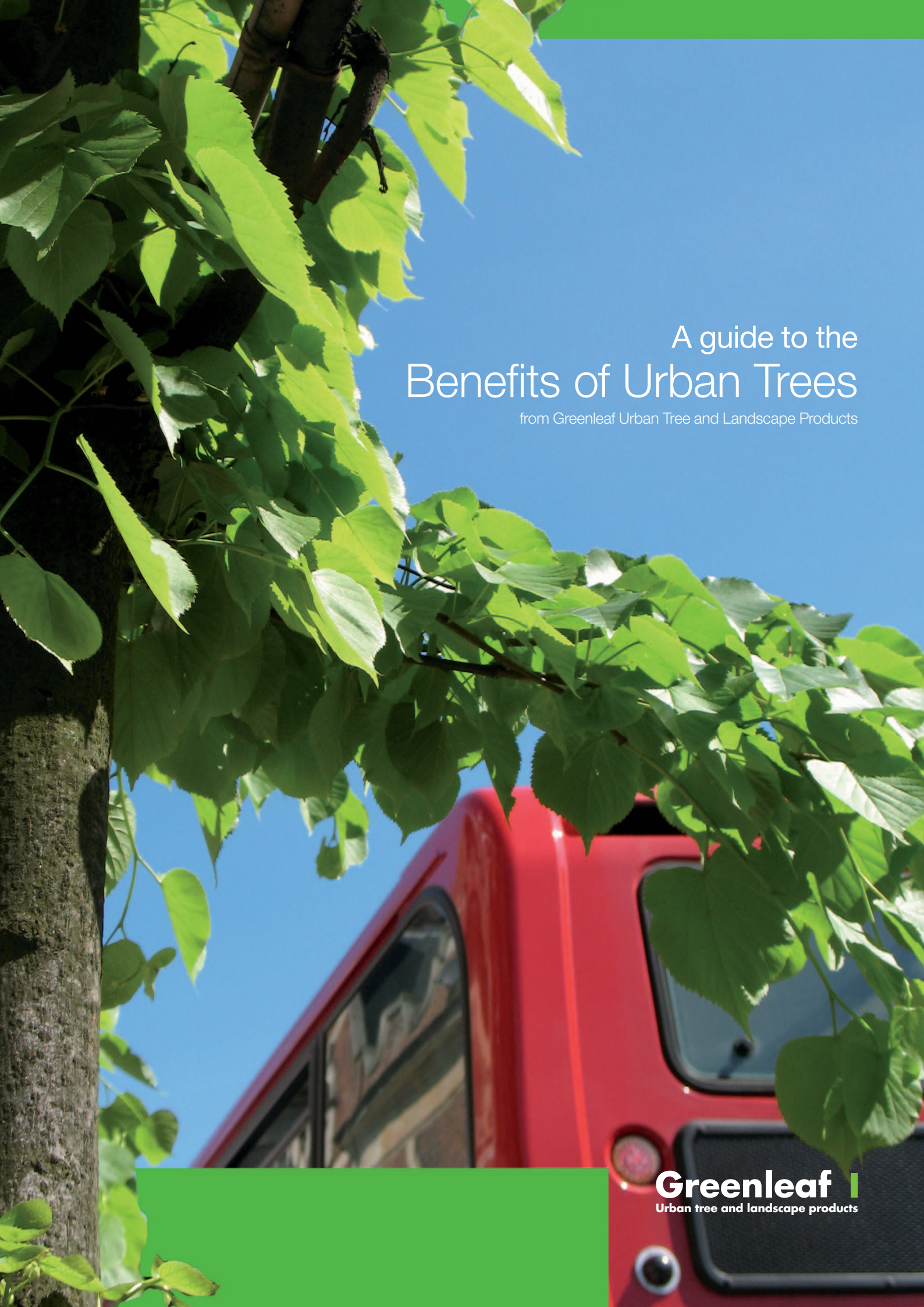

A guide to the

Benefits of Urban Trees

from Greenleaf Urban Tree and Landscape Products

Greenleaf

Urban tree and landscape products

Introduction

Over the last decade, the activities of numerous charities and public sector organisations (e.g. Trees for Cities, The Forestry Commission and Natural England) have helped to put the creation of sustainable urban forests firmly on the agenda for politicians, policy makers, planners and landscape design professionals.

Throughout this period, ongoing scientific research has continued to provide overwhelming evidence of the numerous benefits and advantages that trees can bring to the urban environment, in terms of both their social and environmental impact.

That trees can improve the quality of life for city residents and make a positive contribution to large-scale planning and infrastructure requirements is now beyond question. In fact, the establishment of healthy urban trees is fast becoming a central component in strategies to deliver a diverse range of outcomes such as the management of urban micro-climates, the creation of Sustainable Urban Drainage Systems (SUDS) and the improvement of air quality in towns and cities. The growth of urban forests also has an important part to play in the development of carbon reduction strategies.

The first section of this document reviews the range of benefits that urban trees can deliver in our towns and cities, providing a compelling case for the expansion and maintenance of our urban tree populations.

Planting trees remains one of the cheapest, most cost effective means of drawing excess CO_2 from the atmosphere.

Key points

- A single mature tree absorbs carbon at a rate of 21.6kg per year
- Tree planting remains one of the most cost-effective methods of controlling CO_2
- Tree planting helps to create new habitat for our native fauna
- Trees improve air quality – particulate levels on tree-lined streets can be up to 60% lower than those without trees
- Trees buffer storm water and prevent erosion – 100 mature trees can capture as much as 1,137,500 litres of rainwater each year
- One mature tree has the same cooling effect as 10 room-sized air conditioners – this can reduce local energy consumption by as much as 10%
- The structural value of trees is huge – a study in Torbay has estimated the value of the area's trees at £280,000,000
- Trees have a positive impact on health – a 10% increase in urban green space can postpone the onset of health problems by up to 5 years – conditions affected include asthma, skin cancer and stress-related conditions
- Trees can aid concentration and enhance learning skills/ social functioning in children
- Mature trees and green spaces help to reduce crime levels in urban areas
- Road side planting encourages careful driving and reduces incidences of speeding
- Trees and green spaces improve property prices by as much as 15%
- Every £1 spent on tree planting could save £7 of expenditure in other areas

Trees are capable of removing and storing harmful pollutants including:

- Sulphur Dioxide
- Nitrogen Oxides and Particulates
- Carbon Monoxide
- Cadmium
- Nickel
- Lead

The Benefits of Urban Trees

Carbon Reduction

One area of both national and international concern in which trees are already playing a vital role is the creation of carbon offsets and the regulation of greenhouse gas emissions. Trees are proven to absorb carbon and their ability to do so is one of their most valuable properties in light of global efforts to tackle climate change. Our tree populations currently absorb approximately 2% of total UK emissions, but could potentially absorb a lot more.

A single mature tree can absorb carbon dioxide at a rate of over twenty kilograms per year and releases enough oxygen back into the atmosphere to support two human beings. Planting trees remains one of the cheapest, most cost effective means of drawing excess CO_2 from the atmosphere, with research showing that trees deliver an abatement cost of approximately £25 per tonne of CO_2.

Mature trees can even have a positive impact on the levels of petty crime and anti-social behavior in inner-city areas.

Whilst only the largest third world forestry projects are currently producing Kyoto-compliant carbon offsets (as certified by the United Nations Framework Convention on Climate Change) the development of a voluntary carbon market and a variety of quality assurance standards for voluntary carbon offsets has ensured that tree planting will be a key feature of the ongoing battle against climate change.

For example, the Forestry Commission's Woodland Carbon Project is currently in its pilot phase and will be rolled out during 2011. This Voluntary Carbon Standard (VCS) aims to bring clarity and methodological rigour to the assessment and verification of carbon offsets derived from UK tree planting schemes. Although it is expected that the majority of offsets derived from the scheme will come from rural and agricultural land, the Forestry Commission recognises the benefit of urban brownfield sites as suitable locations for woodland carbon projects.

Other Environmental Benefits

Healthy urban trees can help to maintain biodiversity by providing natural habitats for birds, squirrels and other fauna. Habitat creation of this type is increasingly necessary, as many of our native species

are coming under pressure because of habitat degradation caused by greenfield development. With considered planning, strips of planted land can be created to provide links between urban parks and gardens and areas of countryside, allowing wildlife to move freely in and out of urban areas and creating additional habitat space.

In addition to delivering environmental benefits for wildlife, urban trees also provide a range of environmental benefits for the human populations of towns and cities. One of the most important of these is their overall impact on air quality. Trees are capable of removing and storing a surprising number of harmful pollutants that have become associated with poor urban air and soil quality. These include:

- Sulphur Dioxide
- Nitrogen Oxides and Particulates
- Carbon Monoxide
- Cadmium
- Nickel
- Lead

The removal of these harmful chemicals from local ecosystems naturally has a knock-on effect for the health of urban populations, which is discussed in more detail later.

Trees can also help to regulate a number of climatic effects that can disrupt the residents and infrastructures of urban areas and strategists and planners now recognise their capabilities in this field. For example, trees have the potential to form a key element of urban climate change mitigation adaptation strategies because of their ability to create shade and reduce ambient temperatures by the transpiration of water.

One mature tree can produce the same cooling effect as ten room-sized air conditioners. This cooling effect becomes an effective tool in reducing urban heat islands and hot spots in cities. Trees can save up to 10% of local energy consumption through their moderation of local climate, reducing the need for fans and air conditioning during the warmer months.

Trees can also have a big impact on the water cycle of urban areas. The crown of a large tree is a free standing anti-flood reservoir and one hundred mature trees can capture over one million litres of rainwater each year. For every 5% of tree cover in a community, storm water run-off is reduced by 2%, which also reduces topsoil erosion and prevents the

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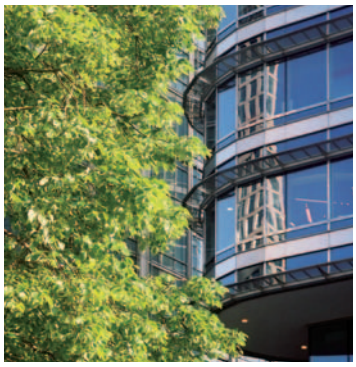

leaching of urban pollutants into watercourses. Because of their water carrying capacity, trees are becoming a key component of Sustainable Urban Drainage Systems (SUDS).

Finally, by creating barriers and baffles, urban trees can help to reduce noise pollution and urban wind tunnel effects. Research suggests that the effect of trees on wind speeds can extend up to to ten times their own height.

Improving the Quality of Urban Living

Few things can compare with the visual impact and seasonal interest that trees bring to an urban environment. Trees and green spaces foster community cohesion by creating a sense of place, a local identity and a system of landmarks. Tree areas can provide space for leisure and community activities, helping residents to take pride in the attractiveness of their location. They can also have surprising effects on the physical and psychological well being of the local population.

Trees have been shown to help reduce incidences of skin cancer, asthma, hypertension and stress-related illnesses.

A Dutch study suggests that every 10% increase in green space can postpone health complaints in communities by five years. Trees have been shown to help reduce incidences of skin cancer, asthma, hypertension and stress-related illnesses. They do this by filtering polluted air, reducing smog formation, providing shade from solar radiation and creating an attractive, calming setting.

Recent research also suggests that trees can have a therapeutic effect for individuals suffering from Attention Deficit and Hyperactivity Disorder (ADHD), improving both their attention levels and social functioning. The same study also suggested that students with regular access to green spaces performed better in tests.

Mature trees can even have a positive impact on the levels of petty crime and anti-social behavior in inner-city areas. Research conducted in Chicago by scientists from the University of Illinois concluded that even after socio-economic factors were accounted for, the presence of trees in a location could reduce crime levels by as much as 7%. At the level of individual buildings and developments, the impact of mature trees was even more pronounced; apartment blocks surrounded by mature trees experienced an incredible 52% fewer reported crimes than those without any greenery.

Finally, trees have also been shown to have a positive effect on road safety. Research conducted in Norfolk villages showed that the strategic positioning of roadside trees can effect drivers' perceptions of the speed at which they are travelling and cause them to slow down. Road side planting can also be used to improve pedestrian safety by creating a barrier between roads and pavements and it is thought that travelling through tree lined streets may have a calming effect on motorists that results in fewer incidences of 'road rage'.

Economic Factors

Given that urban trees can deliver all these benefits, it is perhaps not surprising that properties in districts with healthy tree populations are deemed more attractive and thus more valuable. Independent studies conducted in both the UK and the USA show that properties in tree-lined streets are consistently valued between 5 and 15% higher than identical properties on roads without trees. Even having a view of a planted area or park can be sufficient to increase the value of a home.

Tree planting represents an investment that benefits not only individual property owners, but society at large.

With its positive impact on infrastructure and energy use, tree planting represents an investment that benefits not only individual property owners, but society at large. One study by Natural England calculated that every £1 spent on tree planting would yield £7 savings, which if taken nationally would amount to annual potential savings of £2.1 billion! In 2010 the Environment Secretary, Caroline Spelman suggested that in some inner-city areas each tree was worth as much as £78,000 and a recent study undertaken for Torbay Council calculated the structural value of the trees in that local authority area was equivalent to a remarkable £280,000,000.

Conclusion

With their capacity to deliver such wide-ranging benefits, it is no surprise that people at all levels of society are becoming increasingly aware of the important role that trees have to play in creating a sustainable future for our towns and cities. This growing awareness is reflected in the number of tree planting commitments

being made by leading politicians, both in the UK and abroad. For example, in the USA the city of New York plans to plant one million trees over the next decade, increasing the size of its urban forest by 20%. Here in Britain, London authorities aim to plant ten thousand extra trees across the capital prior to the commencement of the 2012 Olympics and in December 2010 the UK government launched its Big Tree Plant campaign, which aims to plant one million trees throughout the UK using £4.2M in funds derived from DEFRA and the Forestry Commission.

That policy makers are prepared to prioritise investment in our urban forests in spite of an uncertain economic climate is excellent news for environmentalists and town/city dwellers alike, but in order for the benefits of these initiatives to be fully realised it is vital that the trees which are planted have the best possible chance of survival. This means that care must be taken to ensure that they are planted in conditions that allow them to establish and thrive, rather than being starved of nutrients and growing space, particularly rooting volume, because of hostile urban environments. The next section of this document considers the factors that must be accounted for and controlled to provide urban trees with the best possible chance for successful growth and development, to ensure and maximise their benefits.

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The Principles of Successful Urban Tree Pit Design

The benefits that populations of healthy urban trees can create are significant, yet the environmental conditions found in urban spaces can often be a barrier to their successful establishment and long term survival. In order to provide urban trees with the best opportunity to survive and thrive it is essential to consider the conditions of soil, climate and water availability that trees face when they are planted in towns and cities. The correct design and installation of tree pits will mitigate the negative effects of the urban environment. Some of the key factors for consideration are as follows:

It is essential to consider the conditions of soil, climate and water availability that trees face in towns and cities.

Root Volume Availability

It is generally accepted that a minimum of 3m^3 of potential rooting volume is required to give most tree species any viable chance of establishing successfully. In nature, a mature tree root spread will occupy more than ten times this volume, but a 3m^3 tree pit will give most tree species an excellent start and chance in life.

The correct design and installation of tree pits will mitigate the negative effects of the urban environment.

Where this amount of space is not available, tree establishment is still a possibility provided great care is taken with regard to species selection and root management. In all cases the deployment of soil structure modules will help to prevent soil compaction and ensure that the available rooting volume is fully utilised. This is particularly important if the tree is to be located next to a road or another engineered structure, as the soil structure requirements for hard surfaces capable of sustaining large weights are diametrically opposed to those of a healthy tree root network.

Root Management

In addition to being provided with a sufficient volume for growth, tree roots must also be appropriately directed to ensure that they do not damage surrounding surfaces or underground structures. Paved surfaces and utilities are particularly vulnerable to tree root damage and various types of root management products can be specified depending upon the item that requires protection. For example, if a tree pit is to be located amidst a continually paved surface then the tree roots will need to be managed downwards by at least 300mm to remove the possibility of paving heave.

Irrigation, Drainage and Aeration

In order for a tree to thrive, the root network must be able to access an appropriate amount of water. If there is insufficient water then the tree will be unable to absorb nutrients from the soil and will perish as a result of the water loss that occurs during transpiration. However, if the rooting area is continuously waterlogged then the surrounding soil may become anaerobic, which is equally likely to result in the destruction of the tree. Gaseous exchanges that are vital for tree survival occur not only above ground but also in the root zone. These cannot take place if all air has been excluded from the soil pores by the presence of excess water.

In light of the above, consideration must be given to the substance and structure of the ground surrounding a tree pit to ensure that there is sufficient drainage to prevent waterlogging. However, since the majority of urban tree pits are covered by a hard, impermeable surface, tree pit designs should also incorporate the means to irrigate efficiently, particularly for the first three years.

An efficient irrigation system will account for the fact that tree roots may have been directed downwards as a result of root management measures and will deliver water directly to the rooting volume, rather than the area above it. Such an irrigation system will help with soil aeration at depth, but it is also prudent to leave sufficient open space around the trunk to allow for gaseous exchange between air and soil (and of course, tree growth). In urban areas, it is often impractical to allow for bare soil and a variety of grille systems or permeable resins may therefore be considered.

Support

Whereas young trees in their natural environment are likely to be at least partially sheltered by the presence of surrounding vegetation, many urban trees are situated in exposed locations where they are vulnerable both to the high winds that can develop as a result of urban wind tunnel effects and to disturbance from pets, pedestrians and vehicles. An appropriate form of support is therefore required to help trees through the establishment phase. Underground guying is widely favoured for urban tree pits as it is unobtrusive. Staking and tying is a cost-effective alternative although this will require maintenance.

Protection

It is an unfortunate fact that trees in many urban locations are vulnerable to gratuitous vandalism. Damage by dogs is also a growing problem that affects the health of urban trees. Where either of these is a possibility, some form of above ground protection can be critical to tree survival. When you are designing tree pits you will need to decide whether there is a need for tree grilles, vertical guards or other protective measures.

Conclusion

By creating a tree pit design that successfully accounts for the issues above you will have attended to over 90% of the reasons for urban tree failure. Greenleaf's Arborsystem products can be used in combination to address any or all of these factors as need dictates, giving you the confidence that your tree pit design will be efficient and successful, producing vigorous and healthy trees.

Greenleaf
Urban tree and landscape products

Haywood Way, Hastings,
East Sussex TN35 4PL

Sales and service: 01424 717797
Technical assistance: 01424 433233
Sales Fax line: 01424 533003
Email: enquiries@greenleaftrees.co.uk
Website: greenleaftrees.co.uk

About Greenleaf Urban Tree and Landscape Products

Founded in 1992, Greenleaf Urban Tree and Landscape Products was formed to conduct research into urban tree planting practices and provide solutions that assist trees in their battle to establish in towns and cities. With the goal of drastically improving urban planting success and increasing leaf canopy in urban areas, Greenleaf tirelessly analysed the challenges, the causes of failure, and the reasons for premature mortality in urban trees. We then examined the negative impact that poor planting can have on urban infrastructures. Having identified the key issues in both of these areas, we systematically researched the solutions for those issues and designed practical products and systems to address them.

Local authorities, landscape architects, engineers and other related professionals increasingly turn to Greenleaf for guidance and best practice advice in tree planting implementation. As the UK's market leader in specialist tree pit products, we are able to offer the results of nearly twenty years of frontline experience, exhaustive research, product development and field trials. Our support service, unrivalled in the tree planting world, can help you to achieve your vision.

Based in East Sussex, but with offices and distribution points UK wide, Greenleaf has grown every year since its inception. Our programme of continuous product development ensures that specifiers and clients can rest assured that the systems we offer for urban planting schemes represent the best available. For further details please visit our website or call/email us.

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Haywood Way, Hastings,
East Sussex TN35 4PL

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Technical assistance: 01424 433233
Sales Fax line: 01424 533003
Email: enquiries@greenleaftrees.co.uk
Website: greenleaftrees.co.uk

Greenleaf overseas:

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