UKDN WATERFLOW (LG) Ltd

White Paper - Drain maintenance: getting to the root of the issue

By Richard Leigh | 15th June 2018

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Contents

Introduction - Tree roots, drains and climate change

Trees are a much-loved part of our landscape both in the countryside and in towns and cities. Campaigns to plant trees to support wildlife and absorb carbon that contributes to global warming and climate change have added to their perceived value.

However, especially in the urban environment, there has been concern and controversy about the impact of trees on assets such as pavements, roads, buildings, and underground structures, including drains and sewers.

In recent months, the debate about the impact of trees on the built environment, and the lives of local communities, has been headline news.

There are ongoing major protests in Sheffield, South Yorkshire, about the local authority's tree management strategy, which requires the felling of thousands of mature trees, largely due to concerns about public safety.

Certainly, tree roots and the root systems of substantial shrubs do cause problems in drain and sewer systems. Drainage engineers from UKDN Waterflow (LG) are continuously responding to blockages caused by root ingress into underground pipes.

Local authorities and other agencies give detailed advice about how to plant and manage trees in urban environments to support sustainable drainage systems (SuDS). This includes advice on minimising risks to sewers from root ingress.

There is also growing awareness that climate change could affect the way trees impact on underground assets, not least because we could start planting different species.

So, what is the truth about the way trees may or may not affect drains and sewers? What do businesses and householders need to know about trees and underground assets? And what does the future hold?

How tree roots grow

Even though trees are part of our everyday lives, there is still widespread ignorance about how root systems develop. The standard view is that the tree above ground is mirrored below ground, with large roots growing deep into the soil.

This is not true at all. Tree roots invariably travel outwards from the tree in all directions and are concentrated largely in the top 600mm of the soil, with the main structural roots located in the top 300mm. So much so, that many trees send roots out as far as the tree is tall. In some cases, especially in compacted and infertile soil, they travel up to three times the trees' height.
Where they meet a barrier, such as a drainage pipe, the roots are deflected but once clear of the obstruction, often find a way around them to continue on their path.
The shallow nature of tree roots also counters a myth that they reach down to the water table. In almost all cases, the water table is far below tree root systems. Instead, trees rely on seepage into the soil of water from rainfall for their water supply.

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Root ingress into pipes

There is a perception that tree roots can have a powerful effect on assets such as buildings, walls and pipes. There is talk of roots breaking into and damaging pipes.
However, a study by the Arboricultural Advisory and Information Service (AAIS), until 2013 a government-funded research agency, concluded that tree roots rarely cause direct damage to built structures.
It points out that the pressure that can be exerted by tree roots is relatively small. What most commonly happens, says the AAIS, is that roots take advantage of damage to the pipe or its displacement.
Challenging this view, to a degree, research carried out in Sweden and the UK, concludes that tree roots can exert a pressure of up to 20 bar per sq cm, while rubber seals commonly used to join polyethylene pipes can resist a pressure of just 6 bar per sq cm.
The research found that, while it might take up to 20 years for root ingress to happen, roots can eventually break into a pipe by displacing a seal.

If a water pipe is leaking into the ground, tree roots can grow around it to absorb the moisture. This can cause drying, especially in clay soils, that may cause the pipe to move, making cracks and gaps in joints worse.
All this time, fine roots are growing through the gaps into the pipe, where the additional nutrients and water encourage rapid growth to the point where the roots can fill the pipe.
The AAIS study concluded the poor installation of pipes, and their design (for example, clay pipes with loose joints) are the main factors in allowing roots to get into drains.
Disruption to pipes caused during the subsequent laying of other services, such as digital cables, is also likely to give roots a chance to find a way in.
The large amount of hard surfacing in modern urban environments may also contribute to pipe root infestation. With a large proportion of rainfall being channelled into storm drains, soil can dry out, increasing the risk of tree roots growing around seepage points in pipes.

Tree roots – impact on drainage systems

Once tree roots have gained entry into pipes they can have a significant impact on its water carrying efficiency, and the wider drainage network.

With surface water pipes, in particular, they can build up significant density in long lengths of pipe, with the problem only revealed during periods of heavy rain when water backs up and causes localised flooding.

Tree roots will expand in size and grow faster where there are plentiful supplies of nutrients, which is certainly often the case in foul drains and sewers.

Yet even smaller tree root systems in pipes can trigger wider blockage problems by combining with other materials that should not be in sewer pipes. These include fats, oils, and grease, sanitary products, and wet wipes, along with silt and vegetation washed into the drain system.

Tree roots can act as a mesh that snags this material, and slows water flows, accelerating the development of serious blockages, either around the roots, or further along the pipe.

Pipe material and design

In this way, tree root blockages often contribute to sewage flooding in homes, commercial buildings, gardens and along highways.
As has been discussed, studies identify clay pipes as being particularly prone to root ingress, due to gaps in the joints between each section of pipe.
However, modern plastic pipe systems are also affected. They are only as good as the seals that join them together, and plastic pipes can be more susceptible to damage caused by ground movement.
Pitch fibre pipes, installed extensively between the 1940s and 1970s, have also proved to be at higher risk of root ingress. They were made from wood pulp and coal tar and favoured for their cheapness and lightness. But they were found to deform and crack easily, so proved an easy target for probing root systems.
The inherent flaws in pitch fibre pipes have a bearing on whether a property owner can make insurance claims for damage caused by tree roots, a topic discussed later in this article.

Trees associated with drain blockage problems

All common species of trees in the UK can affect drainage pipes in this way. Some species are noted for the vigour of the growth of their root systems and may be a particular problem.
Tree species most commonly cited by arborists as posing a particular risk to drains are willow, maple, polar, elm, sycamore, oak, and plane.

Given this concern, it may be sensible for property owners to consider avoiding planting these trees, and certainly not close to underground pipes or other utilities. Insurers may be particularly interested to know if these species are present on a property before agreeing to provide buildings insurance.

Overcoming tree-related drainage problems

The best way to guard against tree root ingress is to put in place a rigorous planned and preventative drainage maintenance system. This will identify pipes that are most at risk and catch tree root ingress at an early stage when the problem can be nipped quickly in the bud, at least cost.
Only trees less than three metres from a pipe will be a risk in terms of direct mechanical damage caused by root development.
Because tree root systems extend so far, it is much harder to predict how and where a drainage system will be affected by root ingress.
Carrying out a CCTV drainage survey will reveal if tree root ingress has already taken place. It will also establish the condition of the pipe, and whether it is at risk of root infiltration through cracks of displaced joints.
CCTV drainage surveys, combined with topographical and GPS surveys also accurately map drainage systems, so their locations are known with near-millimetre accuracy. This will support effective SuDS planning, including the future location of trees to minimise the risk of sewer damage.
If roots are found in pipes, there are various ways they can be cleared. In the past, it may have been necessary to excavate the pipe and replace the affected section.

There are now no-dig blockage clearance and pipe rehabilitation solutions that are quicker, less invasive, and less costly.

Removing tree roots from pipes – no-dig solutions

There are now no-dig blockage clearance and pipe rehabilitation solutions that are quicker, less invasive, and less costly.
It may be possible to clear the roots, and associated debris, with water jetting or high-pressure water jetting. Drainage companies can use specialist spinning jet heads designed to slice through roots more easily.
In some cases, for example in smaller diameter pipes, it may be more appropriate to use remote mechanical cutting equipment, which uses a rotating cutting head to clear roots.

For the most persistent root systems, robotic cutting machines, such as the KA-TE cutter, which uses a grinding tool controlled by an operative up to 150 metres away, can be deployed.
As mentioned, finding tree roots in pipes indicate that the pipe is defective. If roots are merely cut out, they are very likely to return. Therefore, a long-term solution is to rehabilitate the pipe by lining it. Cured in place pipe lining (CIPP) involves a glass fibre liner being installed inside the defective pipe, creating a new pipe-within-a-pipe.
As it formed a new continuous inner wall, it prevents roots from getting in. A whole pipe can be lined, or a point liner – or patch liner – usually less than 2m in length, can be inserted to repair a cracked, displaced or partially collapsed pipe, all conditions associated with root ingress.

Trees and urban drainage systems

Trees have always been part of the urban environment, for example in tree-lined avenues and parks. Public demand for even more trees in cities is growing, as people increasingly value the amenity of green landscapes.

Many planners, architects, and environmentalists point to the social advantages of trees in improving mental and physical health, and environmental benefits, moderating climate change and improving water and air quality.

However, concerns about urban trees include damage to pavements and highways, increasing accident risks, the cost of tree management, and the potential damage to underground utilities, including sewers and drains.

These are all issues being played out in Sheffield, where more than 5,000 mature trees have been felled at the request of the city council, amid growing public protests, with 12,000 more at risk.

Latest guidance on trees in hard landscape

Planning authorities work with other agencies to manage and control tree planting to establish sustainable drainage systems (SuDS).

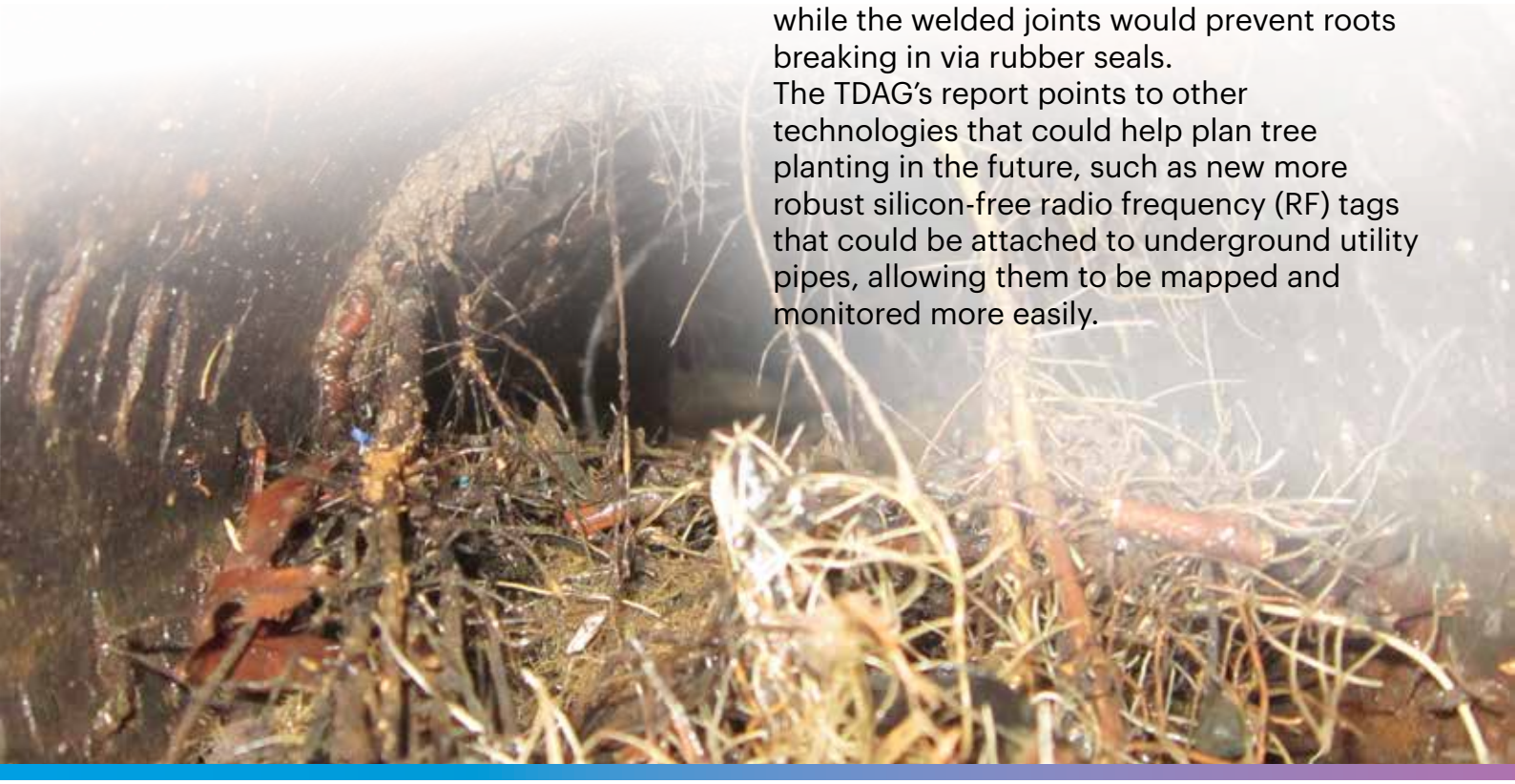
Latest thinking on this work is contained in a report, Trees In Hard Landscape – A Guide For Delivery, from the Trees And Design Action Group (TDAG), a group of private and public sector experts promoting trees in urban landscapes in the UK.

It points to the development of new soil support systems – usually in the form of plastic meshed containers installed to hold tree root systems – that can contain and deflect root growth, reducing the risk of roots reaching nearby sewers.

The report also warns against the planting of trees with fast-growing root systems often associated with root infiltration, including willows and poplars.

It also suggests welded polyethylene water pipes could be installed near trees. Plastic pipes could better withstand soil shrinkage caused by the uptake of water by trees, while the welded joints would prevent roots breaking in via rubber seals.

The TDAG's report points to other technologies that could help plan tree planting in the future, such as new more robust silicon-free radio frequency (RF) tags that could be attached to underground utility pipes, allowing them to be mapped and monitored more easily.



Trees on private land – making an insurance claim

For private householders, and companies that have trees on their land, there is often additional concern about the potential additional cost of drainage maintenance. Companies should, but may not, mitigate the risk by having a planned and preventative maintenance programme that monitors the potential impact of trees on drainage systems.

Private home owners can be less well prepared when they experience an unexpected drain blockage problem. A private home owner is responsible for the maintenance of a drain up to the boundary of their property, if the drain is only serving their property.

They may be jointly responsible for maintenance of a drain if it serves two or more homes before passing under the property boundary.

So, there will be a risk that trees planted in gardens can get into a drain, causing a blockage, or exacerbating problems with the pipe, such as cracking or displaced joints. Where this happens, the householder is liable for the cost of removing the blockage and any other repairs, though it is worth checking with the local water company's policy on carrying out such work.

It is also worth seeking advice from a reputable drainage specialist that has significant experience in no-dig remote blockage removal. Some contactors may recommend excavating and replacing the blocked pipe, when such a costly solution is not necessary.

The Financial Ombudsman Service has published specific guidance on buildings insurance relating to pitch fibre pipes.

Insurance cover for tree root damage to pipes

It may be possible to claim in a buildings insurance policy to cover the cost or part of the cost of removing tree roots from a drain pipe. But this may not be a straightforward process.

Insurance companies will often ask customers if they have trees within their property or are planning to plant them. Then, conditions may be attached to providing insurance cover. For example, the insurer may exclude pipe damage or blockages caused by tree roots. Or it may require certain trees to be removed.

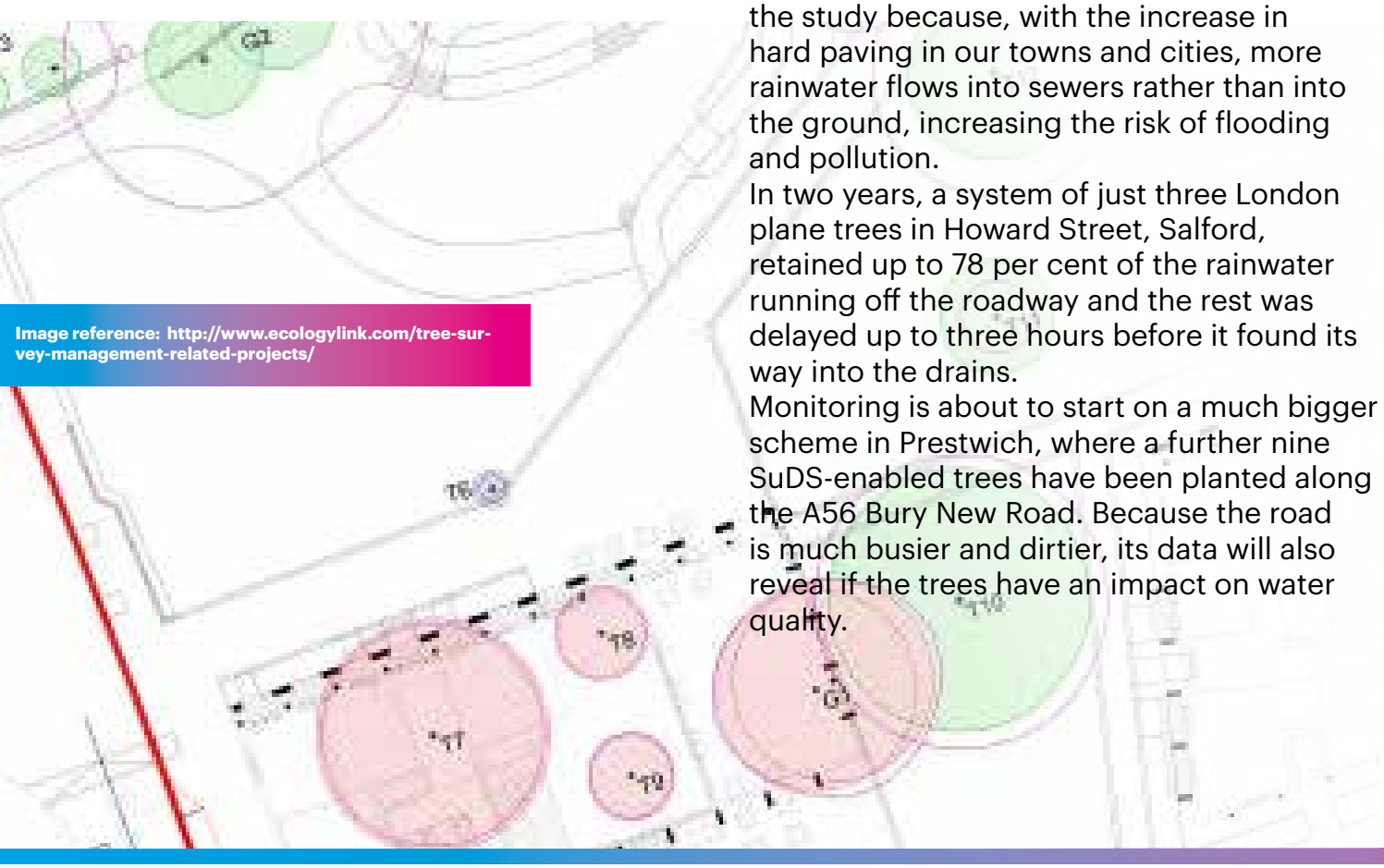
Some insurers will only cover 'sudden' accident impact on structures, such as pipes, and consider tree root damage to be a 'gradual' effect which could have been foreseen or as 'wear and tear', so will refuse to fund the cost of the repair or clearing the blockage. Others will count it as accidental so will pay out against the cost of repairs.

The Financial Ombudsman Service has published specific guidance on buildings insurance relating to pitch fibre pipes. This is because the problems associated with this type of pipe have triggered significant numbers of insurance claims for tree root infestation and damage over recent years.

Taking legal action over tree root problems

Property owners may also find their drains are affected by roots from trees in neighbouring properties. In this case, it may be possible to make a civil claim against the neighbour to cover the cost of putting right the damage, and any other losses caused by their effect.

However, as with all such claim, there are complexities and a risk that the claim may not be upheld. For example, in one case, a property owner was seeking damages from a council for alleged damage to a drain caused by a maple tree just outside their property. The court refused the claim, saying the tree roots had not caused cracks in the pipe, but had exploited gaps in pipe joints, which should have been closed by the property owner. The judge also said, given how many trees there were on council land, it was not reasonable to make it financially responsible for all problems caused be tree roots.



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Measuring the value of trees

The impact of trees on sewer systems is being factored in to new digital apps designed to give a clearer measure of the value of trees. The New Scientist has reported how it used the MyTree app to establish the value of one tree outside its office in Boston, USA.

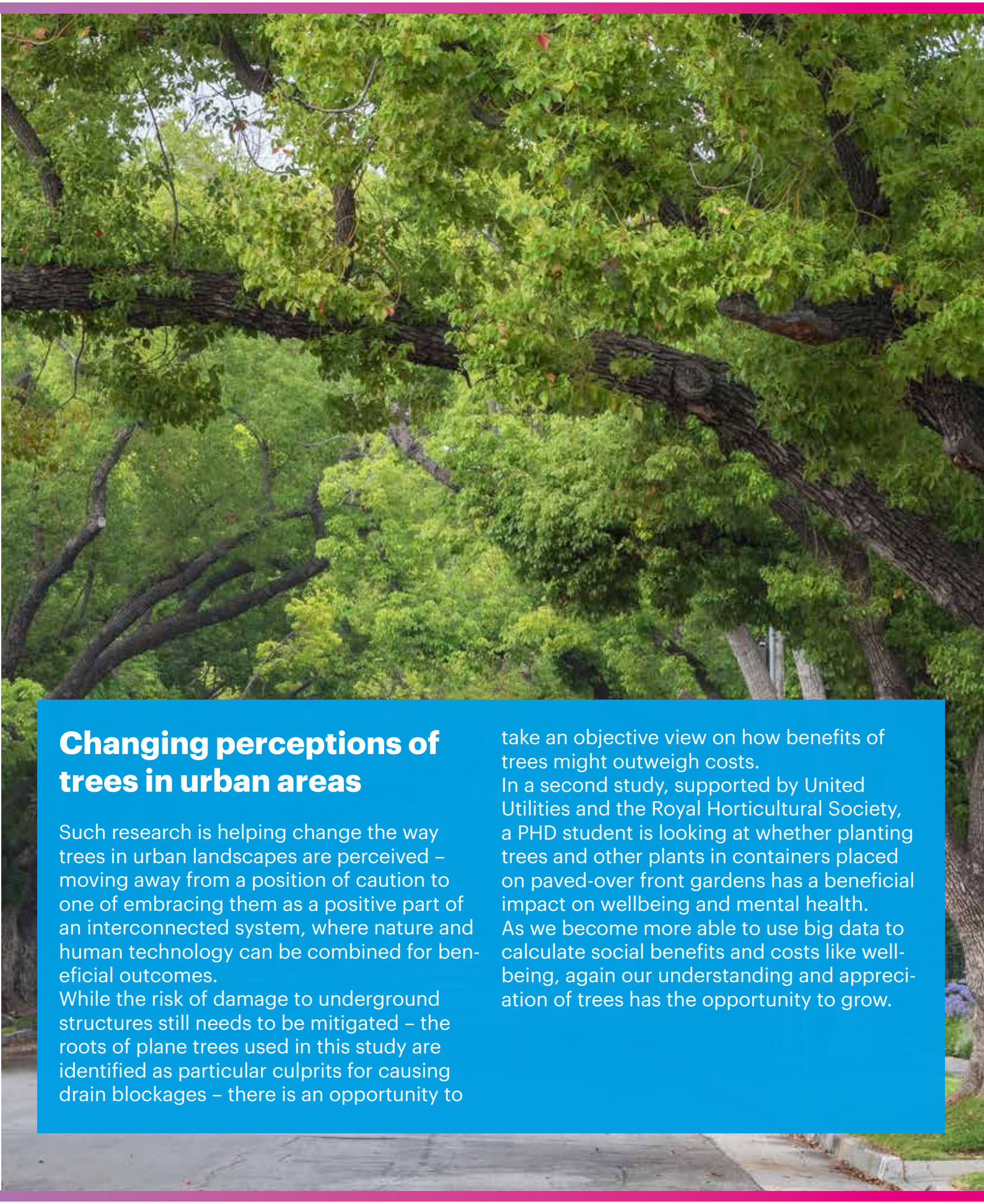
The app calculated that the maple tree absorbed 23,000 litres of rainwater a year, saving £30 a year in sewer capacity costs, plus £30 in air conditioning costs by helping cool the nearby office building. And it removed 1.4 kg of pollutants every year. The total value came to £65 of benefits.

This approach is driving research in the UK as well. In Greater Manchester, a long-term study is investigating how street trees and landscaping might reduce flooding and improve water quality as part of a more sophisticated approach to SuDS.

Water company United Utilities is backing the study because, with the increase in hard paving in our towns and cities, more rainwater flows into sewers rather than into the ground, increasing the risk of flooding and pollution.

In two years, a system of just three London plane trees in Howard Street, Salford, retained up to 78 per cent of the rainwater running off the roadway and the rest was delayed up to three hours before it found its way into the drains.

Monitoring is about to start on a much bigger scheme in Prestwich, where a further nine SuDS-enabled trees have been planted along the A56 Bury New Road. Because the road is much busier and dirtier, its data will also reveal if the trees have an impact on water quality.



Changing perceptions of trees in urban areas

Such research is helping change the way trees in urban landscapes are perceived – moving away from a position of caution to one of embracing them as a positive part of an interconnected system, where nature and human technology can be combined for beneficial outcomes.

While the risk of damage to underground structures still needs to be mitigated – the roots of plane trees used in this study are identified as particular culprits for causing drain blockages – there is an opportunity to take an objective view on how benefits of trees might outweigh costs.

In a second study, supported by United Utilities and the Royal Horticultural Society, a PHD student is looking at whether planting trees and other plants in containers placed on paved-over front gardens has a beneficial impact on wellbeing and mental health.

As we become more able to use big data to calculate social benefits and costs like well-being, again our understanding and appreciation of trees has the opportunity to grow.

Future plans – drought and climate change

As ongoing climate change influences the UK's weather systems, the relationship between drainage systems and trees is likely to change.

We can look to other countries, where droughts and wide fluctuations in weather patterns are the norm to see how these changes may play out.

In California, USA, efforts to conserve water during long dry spells have been successful, but at a cost.

Ground movement caused by soil shrinkage has increased pipe damage, increasing the risk of root infiltration. Trees need to search harder for water too during droughts.

At the same time, with less water flowing through the pipes, there is greater risk of debris getting snagged, including on roots, and causing blockages. Maintenance programmes have had to be increased, at a time when revenue – from water sales – has fallen.

In the UK, where weather patterns may be more volatile, the risk of increased tree root infiltration may be combined with more localised flooding during heavy downpours.

Changing weather patterns are already encouraging the planting of new varieties of trees in the UK. Hunter Water, in Australia, offers its customers advice on which species pose the biggest risk to sewer systems.

So, if readers are looking to Australia for ideas for new trees to plant, consider avoiding fig trees, rubber plants, camphor laurel, and large gum trees. All are considered to pose an extreme or very high risk of sewer pipe infiltration. You have been warned.

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Author:
Richard Leigh
Business Development Director
UKDN Waterflow (LG) Ltd

Address:
300 Lansdowne Road
Monton, Eccles
M30 9PJ

Tel:
0161 788 2266

Website:
www.ukdnwaterflow.co.uk