

LTOA Guidance Document | July 2013

Sustainable Water Management

Trees are part of the solution..



Authors: Rupert Bentley Walls (LB Hackney), Cameron Brown (LB Camden), David Lofthouse (LB Merton), John Parker (Transport for London), Katie Roberts (Trees for Cities) and Grayham Tindal (LB Islington).

“Here I discovered water.. a very different element from the green crawling scum that stank in the garden tub. You could pump it in pure blue gulps out of the ground, you could swing on the pump handle and it came out sparkling like liquid sky... Substance of magic – which you could tear or wear, confine or scatter, or send down holes, but never burn or break or destroy.”

Laurie Lee, *Cider With Rosie*.

1 Introduction

1.1 In Spring 2012 London and the south east of England were officially declared to be in drought conditions. Just as our trees were coming into leaf, water suppliers imposed heavy restrictions which affected how and when newly-planted specimens could be watered. The London Tree Officers Association (LTOA) feels that the current attitude toward trees in time of drought urgently needs to be challenged and revised. Rather than contributing to the problems associated with water management, trees are part of the solution.

1.2 Those who manage trees are well aware of the immediate and long-term environmental benefits that they bring. Trees are an integral part of urban water cycles, slowing the percolation rate of water by interrupting rainfall and releasing it more gradually to ground level, and in many cases channelling water down the stem and into tree pits instead of the surrounding hard landscape (Xiao *et al* 2000). The risk of flooding is further alleviated by the increased permeability of soil caused by roots penetrating previously compacted areas (Denman *et al* 2012). Soil moisture is steadily replenished and the constant process of transpiration helps to prevent waterlogging. In the absence of trees, rainfall hits our paved surfaces and is directed straight into the drainage systems (where capacity allows) to be lost without benefit.

1.3 The high (and increasing) ratio of hard, reflective surfaces in cities such as London – combined with high levels of heat and fuel emissions – make them particularly susceptible to the Urban Heat Island effect, exacerbating local drought conditions and elevating temperatures above acceptable levels for the resident population. It is now well recognised that urban environments can be several degrees warmer than surrounding rural areas (Ennos 2012); policy makers are therefore having to respond to future climate impacts in order to mitigate risks to service delivery, the public, infrastructure, businesses and the environment.

1.4 Climate change forecasters predict more weather extremes in the future, featuring both heavy rainfall and long periods of drought with associated temperature increases. Trees – and the canopy cover they provide – play a crucial role in alleviating the effects of these conditions (Ray *et al* 2010) by regulating temperatures through the provision of shade, reducing wind speeds, through the discernible effects of transpiration and by reducing the risk of flooding in the ways already described. Successful tree planting to

sustain tree stocks and guarantee the condition of the urban forest of the future is a crucial part of this process, but without an investment of water in the first few years of establishment new trees will not survive to contribute to dealing with the wider issues.

1.5 The LTOA is keen to emphasise the importance of ensuring that every young tree in London has access to the water that it needs to survive and establish. Every litre moving slowly through the canopy and seeping into the soil is a litre which will not end up flowing into the Thames, flooding the High Street on its way. The more healthy and vigorous a tree is, the more effectively it will be able to intercept and conserve water. This document aims to provide practical recommendations to tree managers with regard to water sourcing, usage and conservation which will help the arboricultural industry to deal with future drought conditions.



Above: Another victim of inadequate watering

1.6 During the 2012 drought there was considerable confusion over what could or could not be irrigated. Watering 'gardens' – defined as including parks, lawns and grass verges – was prohibited, but no specific mention was made of tree pits. At the same time, washing cars for commercial purposes using drinking water was exempted from the ban (Thames Water 2012). To address the concerns arising from the 2012 Temporary Usage Ban, in addition to releasing this document the LTOA have also written to the major water suppliers to ask for clarification regarding trees, and to insist that tree watering is given dispensation from future restrictions. This letter is reproduced in Appendix I.

1.7 This document was produced by the LTOA Sustainable Water Management

Working Party, comprised of Rupert Bentley Walls (LB Hackney), Cameron Brown (LB Camden), David Lofthouse (LB Merton), John Parker (Transport for London), Katie Roberts (Trees for Cities) and Grayham Tindal (LB Islington).

2 Sourcing

2.1 The LTOA recognise that in a time of drought, water should be conserved wherever possible and used responsibly. This document does not seek to offer loopholes or quick

fixes to allow tree managers to circumvent the regulations in order to protect the tree resource of London. The intention is quite the opposite; to work within the existing framework whilst exerting pressure to change the terms of temporary usage bans to include tree watering in the exemptions. In this section we examine some potential sources of water, and the considerations which should be taken into account when obtaining it. The Environment Agency (EA) is responsible for managing water resources in England and Wales, and it is therefore considered best practice to contact them if in any doubt as to sourcing. As well as ensuring that the regulations and legislation are respected, this will also ensure that a healthy working relationship is maintained between our organisations.

2.2 During periods of extended drought it must be recognised that the extraction from any available source will inevitably affect the availability of water in the longer term. Where possible, usage of potable water (water fit for human consumption) should be minimised; grey water (recycled water not fit for human consumption) can be used to irrigate trees just as effectively. It is increasingly important that the concept of recycling water and using it more than once – where appropriate – is promoted (Levine, 2004). In some Boroughs it may be appropriate to engage with the local community and request that residents irrigate the trees on their street using the water that they have washed the dishes in, for example. If members of the public are to be involved in this way then it is worth giving them some basic guidance as to what is and isn't appropriate. Sample guidance is contained within Appendices II and III.

2.3 Trees can also be irrigated using grey water sourced from public swimming pools; this water should be left in storage for a minimum of 48hrs (preferably up to a week) in order to ensure that chemical levels have reduced down to 1ppm and that the pH is between 7-8. It can then be used to irrigate trees and shrubs, ideally being concentrated on those species with a known tolerance to salt (Percival 2012). A solution such as this is not likely to be something that can be easily arranged at short notice; an emergency procedure should therefore be in place for the storage and subsequent use of this potential resource so that it can be accessed in times of need. Mapping and calculating the capacity of these reserves will allow managers and operators to swiftly implement programmes of work during extended periods of drought. It should be remembered that using water from swimming pools is still only a local solution, and should be regarded as just one part of a wider strategy promoting water recycling using resources such as attenuation tanks.

2.4 Rainwater butts are an effective way of collecting water to be re-used at a later date; it has been estimated that 80,000 litres of rainfall lands on a typical UK roof every year, and that a standard garden water butt can collect 1380 litres of water in a year (Thames Water 2012). If tree contractors have the space and the capacity to collect and store rainwater in their depots over the wetter months then it would go some way to providing a sustainable source of water, as well as clearly demonstrating the

commitment of the arboricultural industry to minimise mains usage as far as reasonably practicable. The same principle can be applied to municipal buildings, where practical.

2.5 Some tree managers may have access to water sources such as rivers, lakes and boreholes. Such resources must be used responsibly, and water should only be extracted using appropriate methods and in acceptable quantities. Guidance to extraction from rivers, lakes and boreholes should be sought from both the local water supplier and the authority responsible for maintaining the asset in question, and all water obtained in this way must be gathered and transported in a way which minimises wastage. In situations where one Local Authority is in possession of this resource it is recommended that they liaise with neighbouring boroughs and work together to maximise the benefits for the whole area rather than being exclusively constrained by political and borough boundaries.

3 Delivery

3.1 Newly planted trees are highly susceptible to damage during periods of drought (Chiatante *et al* 1999); more so than established specimens. Tree Managers are advised to implement the watering programmes that they would ordinarily have undertaken were there not drought conditions, as far as is reasonably practicable. For example, if in an ordinary watering season a Local Authority typically waters those trees which have been planted over the last three years then they should strive to do the same in times of drought, whilst carefully considering sourcing as detailed in Section 2 of this document. Going forward it must be hoped that species selection in future tree planting programmes will take drought tolerance into account alongside all of the other usual considerations (Armour *et al* 2012). Detailed investigations into the dendro-ecology of some of these species is ongoing (Sjöman *et al* 2010, 2012).



Above: A slow-release watering system

3.2 In addition to the traditional method of watering individual trees with a bowser there are other solutions available which may be more effective in delivering water to the tree over a given period, such as slow-release bags or drip-feed irrigation systems. This document is not able to make specific reviews of these products, other than to say that

certain solutions may be more appropriate than others in certain situations. It is the role of the tree manager to determine what may or may not be suitable, and it is highly recommended that the efficiency (or otherwise) of these various products is researched and discussed between fellow professionals before investment is made. Tools such as the LTOA website Forum (www.ltoa.org.uk) are invaluable in driving these discussions forward and ensuring that information and experience is shared and that best practice is developed.

3.3 New trees should be planted in pits which will maximise the effectiveness of future irrigation. This is not generally a solution which can be implemented retrospectively for existing trees, but is something which should be considered for the future. The pressures of planting in urban situations often mean that the ideal pit is not possible to achieve, but in general it should be ensured that watering pipes are installed in such a way as to allow a thorough wetting of the root ball as opposed to merely channelling water into the ground below (Mayhew 2005). The openings of watering pipes should be checked regularly and kept clear of obstructions, and using organic mulch as a pit surface material will slow the process of evaporation and suppress weed growth. The overall design of the pit should be intended to maximise root development and water storage whilst allowing adequate drainage. It should be noted that tree pit compaction due to pedestrian traffic may mean that careful maintenance is required to increase permeability and aeration.

3.4 Competing vegetation in tree pits has a detrimental effect on the growth and development newly planted trees (Willoughby *et al* 2009). Managing this competition is therefore an important part of the establishment period, particularly under drought conditions. Residents and other third parties are increasingly becoming involved in local landscape management (McKay 2011), working to improve conditions in their estates, parks and streets by planting flowers and shrubs, often within tree pits and in competition to the tree. This shallow-rooting vegetation will typically survive at the expense of the tree, and should therefore be removed from pits. If competing vegetation is to be removed then chemical spraying should be avoided; there are concerns as to the effect of weedkillers on the young tree itself, and on the water and fungi in the soil (Busse *et al* 2001). The loss of existing - and developing - mycorrhizal associations would have a detrimental effect on the health of the tree.

3.5 Operators who undertake watering – and their managers – must be aware of how important it is to reduce spillage and waste. This can be achieved through appropriate training and by ensuring that all equipment is fit for purpose. All pipes, valves and fittings should be secure and free of leaks, and operators must be in attendance at all times when filling bowsers. All transportation of water must be undertaken using sealed containers in order to prevent spillage. It is of paramount significance that the general public - and water suppliers - recognise the value of the work being carried out and appreciate the importance that our industry attributes to water conservation and the promotion of responsible usage.

4 Quantities

4.1 The volume of water that a tree should receive – and the frequency at which it receives it – is dependent on many factors. Species, size, soil type, soil conditions and competing vegetation are just some of the considerations which must be taken into account. This document is not able to give precise recommendations with regard to species-specific watering requirements, but general figures can be given. As an approximation, saturating the root area with 50 litres of water, per 5cm stem diameter (measured at 1m from ground level), per application, is recommended (See Note One). Accurate requirements can be calculated on a tree-by-tree basis but this will require additional site data and monitoring to ensure that adequate water levels are supplied at a level appropriate to the needs of the tree.

4.2 In the letter from the LTOA to the water suppliers, an estimate was given which suggests that the young tree resource of all 33 London boroughs could be kept alive for one year using less water than is contained in six Olympic-sized swimming pools. For reference purposes, this figure was reached in the following way. A 14-16cm tree will have a DBH of approximately 4-4.5cm and will therefore require around 50 litres of water, per visit. If the tree is visited twice a week for four months, then it will require



Above: A poorly-developed root system

1600 litres per year. If each of the 33 boroughs were watering 250 trees then this would equate to 13,200,000 litres a year. An Olympic-sized swimming pool contains approximately 2,500,000 litres of water, therefore six pools would contain 15,000,000 litres. It is hugely important to emphasise that this is only a general calculation, based on estimates and averages, and should not be taken as a definitive figure.

4.3 Tree managers must specify to operatives exactly how much water they expect to be delivered per tree, per visit, so that wastage can be avoided and the maximum number of trees can be safeguarded from failure. As stated in 3.1, standard watering programmes should be continued during times of drought as far as is practicable; reducing the amount

of water given to each tree would have little impact in the context of the total usage of water across London, but could have a significant effect on individual trees. A water management programme should be developed to maximise the efficiency of irrigation (Harris *et al* 2004); this programme can incorporate all aspects of watering from sourcing and extraction through to quantities and frequency of delivery.

British Standard 8545 - Young trees; from the nursery to independence in the landscape

The new BS8545 is currently in development, and is due for publication later in 2013. It will:

- State the need for irrigation plans;
- Observe that the timing and frequency of watering should take into account prevailing weather conditions, soil moisture release characteristics and the response of the tree species to water deficit;
- Advise that the frequency of irrigation is more important than the quantity delivered at one time;
- Observe that local rainfall levels are seldom a useful guide to irrigation requirements in situations where young trees with poorly-developed root systems are growing in areas dominated by impervious surfaces.

All tree managers (and anyone in the Arboriculture industry) are advised to read and familiarise themselves with this important new British Standard once it released.

5 Recommendations

5.1 The recommendations contained in this document can be summarised as follows:

- The water suppliers must act to include tree watering on the list of exemptions for future Temporary Usage Bans;
- Water should be conserved wherever possible, and always used responsibly;
- Grey water and rainwater should be used in preference to potable water;
- A register of alternative sources of water such as swimming pools and boreholes should be kept, and a plan developed to utilise these resources when necessary;
- Contractors, local authorities and other landowners should be encouraged to collect and store rainwater during wet months;
- The general public should be engaged where appropriate to help with watering;
- All operatives involved in tree watering should be properly trained to ensure that water is contained and transported in an efficient and waste-free manner;
- Experience of different watering methods should be shared between tree managers;

- Tree pits should be designed and constructed in such a way that will maximise the effectiveness of irrigation;
- Tree pits should be kept clear of all competing vegetation during establishment;
- A water management programme should be developed to determine appropriate frequency of visits and quantities of water;
- Tree Managers should always work within the restrictions imposed by Temporary Usage Bans.

6 Conclusion

6.1 In light of the drought conditions which forced the Temporary Usage Ban in 2012, water has risen up the political agenda. Sustainable Urban Drainage Systems (SUDS) are becoming standardised across Europe and the USA and are increasingly embedded in regulatory frameworks; in the UK they have been actively promoted by the Mayor of London (London Plan 2011), DEFRA (DEFRA 2011) and Thames Water (Thames Water 2011) amongst others. Furthermore, legislation is now in place which requires new developments (and redevelopments) in England and Wales to implement sustainable drainage/surface runoff plans into their design (The Flood and Water Management Act 2010). Unfortunately - despite the fact that one of the principal aims of SUDS is to minimise the risk of flooding by slowing the rate at which rainwater enters the drainage system - tree planting (and the watering required to establish previously planted trees) is seemingly not promoted as being part of the solution.

6.2 In order for the UK to meet the challenges posed by a changing climate and to mitigate the risk of flooding and drought in the future, it is essential that the importance and benefits of trees is fully appreciated outside of the Arboricultural Industry. The problems will not be overcome without a healthy tree population, but a healthy tree population will not be maintained without an initial investment of water in the all-important establishment period. In the National Planning Policy Framework of 2012 the Government stated that local planning



Above: Sunflowers thriving at the expense of the tree
authorities should “set out a strategic approach in their Local Plans, planning positively for the creation, protection, enhancement and management of networks of biodiversity and



green infrastructure” (Communities and Local Government 2012). It must be made clear that this creation, protection, enhancement and management is dependent on sufficient watering of new trees; more important during drought conditions than at any other time.

Notes

1. The figure of 50 litres per tree, per visit, is derived from recommendations provided by several nurseries and tree suppliers, backed up by extensive experience in the field by the LTOA Executive Committee and the Sustainable Water Management LTOA Working Party. This figure is an estimate for guidance only, and it must be stressed that a number of factors must be taken into consideration when determining exact watering requirements.

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All photographs supplied by the authors with the exception of the image of the poorly-developed root ball in Section 4, which was used with kind permission of Clive Mayhew.



Appendices

Appendix I. Text of 2013 LTOA letter to water suppliers.

Appendix II. Sample guidance for resident watering.

Appendix III. Sample 'Please water me' notice for young trees.



Appendix I: Text of 2013 LTOA letter to water suppliers.

The drought of 2012 and subsequent water usage restrictions were of huge concern to the London Tree Officers Association (LTOA) and the arboricultural industry as a whole. The omission of young tree watering from the list of permitted activities in the Temporary Use Ban posed a significant risk to the future of London's urban forest and indicated that in some quarters it may not be recognised that rather than contributing to the problems of water shortages, trees are part of the solution.

London is quite rightly acknowledged as being one of the greenest cities in the world; in no small part this is due to the trees in our streets and public parks. New and replacement tree planting is a vital part of this process, and is essential if we are to ensure that the multitude of benefits derived from trees can be enjoyed by generations to come. However, in order to establish successfully and fulfil their potential these young trees need to be watered in dry conditions.

The amount of water required for this is modest when viewed in the context of London-wide water use; It has been estimated that the entire young tree resource of all 33 local authorities in London could be irrigated for a whole year using less water than is contained in six Olympic-sized swimming pools (LTOA 2013).

Some of the water-related benefits of trees:

- Trees help reduce the effects of flash flooding and contamination of water sources by intercepting rainfall;
- Trees help prevent soil erosion and make sustainable urban drainage systems more effective;
- Trees can improve the environmental performance of buildings, reducing water usage in dry weather;
- Trees remove particulates and CO₂ from the air, combating pollution, reducing the heat island effect and slowing evaporation rates;
- Trees moderate temperatures by transpiring water, reflecting sunlight and reducing further water loss by providing shade.

The LTOA therefore urges all water suppliers to live up to their green credentials and acknowledge the importance of urban trees, committing to protect this resource for the future by agreeing to add the watering of newly-planted trees to the list of permissible activities in advance of the next Temporary Usage Ban, whenever that might be. By protecting, maintaining and expanding the urban forest it will in fact be possible to help offset the huge percentage of water lost through leaks in the system and to ensure that our city is climate-proofed for the future.

The LTOA is committed to supporting investigation into alternative sources of water in the hope of reducing dependence on potable supplies and finding a more sustainable solution. However, until such a time that this solution has been developed it is crucial that we can count on the support of the water suppliers to help us protect London's trees. We would welcome the opportunity to meet with representatives of your industry to best determine a way forward and to ensure that we do not compromise long-term benefits for short-term gain.

This open letter has been produced alongside the LTOA Guidance Note 'Sustainable Water Management: *Trees are part of the solution*' which is to be released in July 2013. This document – alongside all others produced by the LTOA - is freely available at www.ltoa.org.uk

Yours faithfully,

The London Tree Officers Association Executive Committee.

The London Tree Officers Association

Caring for the Capital's Trees



Appendix II: Sample guidance for resident watering.



Streetscene
Highways and Engineering
Email: info@hackney.gov.uk
Phone: 020 8356 2897

Dear Tree Champions and Tree Carers

What you can do to help

We hope that you are enjoying your new street trees.

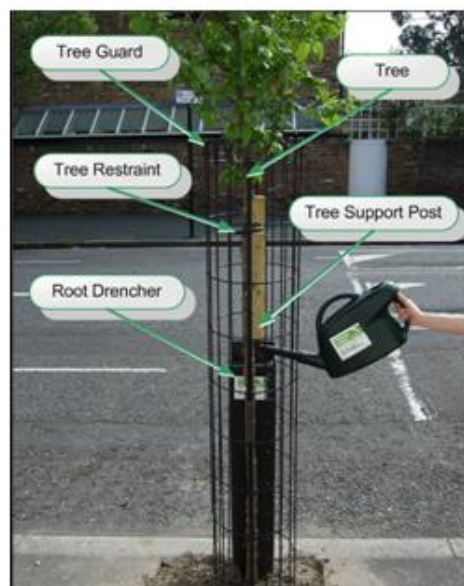
Thank you for helping us to care for these newly planted trees and this 7 litre recycled watering can has been given to you to help you to do this. The Council does have a watering and maintenance programme in place however we encourage resident participation and local care will help immensely.

Watering the trees in your street

You will see a black box located between the tree stake and the stem of the tree, this is called a root drencher which will have a sticker on it saying 'please water me'.

- The best time to water the trees is during the spring and summer months (March to September) in the early morning or evening.
- Rain or waste water including bath and washing up water with eco-friendly detergents are alright.
- 18-20 litres of water once a week or 2-3 litres a day will greatly aid a young tree.

A newly planted tree needs at least three years of after care to become properly established.



Reporting any problems to Hackney Council

This can include:

- damaged trees,
- leaning trees,
- broken branches,
- loose guards (around the tree),
- tree support post or stake,
- tree restraints (loosely holds tree to the support post)
- black water boxes (root drenchers)

Please do not attempt to maintain the tree yourself, report any problems to Streetscene on 020 8356 2897 or info@hackney.gov.uk



INVESTOR IN PEOPLE



A Host for 2012

Appendix III: Sample 'Please water me' notice for young trees.



Please water me!

Rain or waste water including bath and washing up water with eco-friendly detergents are alright.

020 8356 2897
www.hackney.gov.uk/trees

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