



How Trees and Sustainable Urban Drainage Systems Reduce Heat Stress and Surface Water Flooding in Margate, Kent

**Summary:**

- Between 2018 -2020, Kent County Council completed a pilot project to address street-level heat stress on two residential streets, Maynard Avenue and Garrard Avenue, in Margate, Kent, as part of the Cool Towns Interreg 2 Seas project.
- The site was selected in accordance with its vulnerability to heat stress and surface water flooding. The demographic make-up of the area, findings from heat stress vulnerability mapping, and a study assessing surface water flood risk by KCC’s Flood and Water Management team were all considered during the pilot design process.
- 31 trees and 11 Sustainable Urban Drainage System tree pits were planted and installed in total, with the pilot contributing towards increasing the area’s resilience to extreme temperatures and surface water flood risk, as well as creating new spaces for nature and adding amenity value for residents.

<p>Maynard Avenue before intervention</p> 	<p>One of 30 trees being planted</p> 
<p>Installation of tree pits</p> 	<p>After planting a tree in the tree pit system</p> 

### Location

Margate is a coastal town situated in the district of Thanet, North Kent, with a population of approximately 61,223 people<sup>(1)</sup>. 4,780 of those live in the 649 houses found in Garlinge Ward<sup>(2)</sup>, which is where the pilot site is located. 22% of the population of the area are over the age of 65<sup>(2)</sup>, with noteworthy local services including a nurse and primary school, a disabled children's hospital, and an elderly care facility.

### Site Description

Maynard Avenue and Garrard Avenue are two residential roads in Margate which are lined with two-storey houses, either as single residencies or split into separate flats, on both sides of the central road. The houses are separated from the road by paved pedestrian walkways and narrow grass verges, some of which had trees planted on them at sporadic intervals.

Kent County Council (KCC) owns and maintains the road itself, the pedestrian walkways, the verges, and the trees. This provided scope to assess whether tree planting and installing Sustainable Urban Drainage System (SuDS) tree pits could lead to reduced street-level temperatures during summer months, whilst also improving surface water drainage during heavy-rainfall events.

### Pilot Design

discussions with KCC's Flood and Water Management team confirmed that installing SuDS tree pits on the verges of Maynard and Garrard Avenues would help to reduce flood risk in the Margate catchment. This provided the opportunity to combine heat stress reduction, which would be achieved through increasing canopy coverage, with improved underground water drainage, through the installation of the SuDS tree pits. After establishing the desired outcomes KCC collaborated with project partner [Green Blue Urban](#), a company specialising in green and blue infrastructure interventions, and consultants [WSP](#) to develop a proposal that took into account underground utilities, road safety, geology, and the suitability of the verges for retrofitting SuDS tree pits. KCC's Soft Landscape Team were consulted when selecting tree species, considering overhead cables, and local conditions. Resident feedback was integrated into the final design, with some of the comments received included below.

#### **Comments received during resident engagement:**

- *'We don't want to lose parking places on the street'*
- *'Proposed tree locations block out the sunlight to my house and garden'*
- *'There is no tree proposed for outside my house, please can you plant a new tree outside my house'*

### Implementation

The table above lists the works completed during the implementation phase of the project and the capital costs associated with each piece of work. As indicated, 30 trees were successfully implemented which will increase the canopy cover on the streets, which will help to mitigate against heat stress, as well as creating extra space for nature in a sub-urban area. Additionally, 11 SuDS tree pits were installed at various points across the pilot site, which will improve drainage and reduce surface water flooding.

**Indicative costs:** please note that costs have been rounded and, while accurate at the time of implementation, can only be used as an indication of cost.

Capital Cost	€	£ - 1.15 €
30 trees	8,612	7,500
Topographical Road Survey	574	500
Ground Penetrating Radar Survey of roads	13,780	12,000
Site Specific Design including tendering support, landscaping support and SuDS Optioneering	24,116	21,000
Trial test tree pit exploration	8,038	7,000
Civil installation of SuDS tree pits	144,820	100,000
Green Blue Urban Arborflow Tree pit system product total cost for 11 tree pit systems within scheme	37,890	33,000
<b>Total</b>	<b>207,714</b>	<b>181,000</b>

The table above does not include the anticipated costs of maintaining the trees, as a failure to maintain the trees will most likely cause them to die, thus eliminating the potential gains from the increased canopy coverage. Based on an expected 30-year lifespan, the estimated maintenance total cost for the 30 trees can be seen below:

Estimated Tree Maintenance Total Cost	€	£ - 1.15 €
£300 (Tree Maintenance) x 30 (units)	9,000	9,000
<b>Total</b>	<b>9,000</b>	<b>9,000</b>

Whilst the contractors were able to complete the required works, there were issues along the way. Firstly, site operators were required to close parts of the pedestrian walkway and implement an alternative route. Additionally, the narrow verges meant that there was limited space to carry out the required excavations, and undiscovered underground utility lines added to the complexity of operation. Lastly, reinstating the walkway was not factored into the original budget, which led to additional costs.

### Reflection

The pilot in Margate provided not only a much-needed intervention to reduce street-level heat stress, but it also provided KCC with several learning points that could be taken forward in future projects. KCC found that gaining support from local decision-makers, who were given regular updates of the project's progress, was a key factor in getting the pilot off the ground and then promoting the project upon its completion. Additionally, engaging residents during the pilot design phase helped to accommodate concerns that were raised before the works began, which helped to shape where some of the trees were planted and reduced the likelihood of resident dissent further along the project lifecycle. Furthermore, the pilot project was praised by the Climate Change Committee in a broadcast on BBC Radio 4 in July 2022, in which the multiple benefits achieved from the pilot (shading, improved drainage, improved air quality, carbon capture) were highlighted as an example of how to embed adaptation and mitigation.

KCC also encountered issues when procuring the pebble infill seen in the image above, where several tonnes of drainage stones that were purchased only to be found to be too small for the soil pits.

Similarly, the contractors learnt that they couldn't use the plastic mesh that is normally used to separate the pits from the rest of the earth and were instead forced to use pieces of plywood to form the barrier. This was due to the discovery of a BT utility duct, which reduced the space allowed for excavation, and ultimately led to subsidence and a minor collapse. Lastly, KCC were forced to reconsider elements of the design when holding the resident consultation, as one resident objected to having a tree in front of their property, and another highlighted how the position of the trees would conflict with KCC's street lighting policy. The policy is more stringent than the national guidelines, which was unbeknownst to the consultant who designed the pilot.

#### Technical specifications

MEASURE OF SUCCESS	EVIDENCE
Reduction of PET Value (baseline vs result values)	PET reduction in July 2021 varied between 7.2 and 12.8°C, an average of 9.5°C. This would be expected to increase as the trees grow.
Size of the area (m <sup>2</sup> ) with improved heat resilience	Maynard Avenue: 4603m <sup>2</sup> Garrard Avenue: 3188m <sup>2</sup>
The Number of Daily Users Benefitting from the Intervention	Daily users of the space benefitting from the scheme include residents, visitors and those using Garrard and Maynard Avenue as a throughfare to access nearby amenities including two bus stops, care facility and a school and nursery. Buses stop at the Caxton Road bus stop approximately every 20 minutes during the week and run from 07:20 – 18:45. Buses stop at Maynard Avenue twice a day. School and nursery drop off and collection times tend to see a higher number of users of the space when parents are collecting and dropping off their children, the combined school and nursery facility has approximately 770 pupils. The residential care facility is categorised as large and contains 60 beds.
Co-benefits Achieved	<ul style="list-style-type: none"> <li>• Additional capacity in the sewer network will reduce flood risk to 30 properties.</li> <li>• This is within an Air Quality Management Area and the trees will contribute to improving air quality</li> <li>• Trees provide habitats and food sources for animals, birds, and insects, increasing biodiversity and supporting Kent's Biodiversity Strategy and Kent's Plan Bee.</li> <li>• Trees capture and store carbon offsetting and regulating greenhouse gas emissions helping achieve net zero targets.</li> <li>• Increasing tree canopy cover can increase property value, improve visual and physical amenity, noise abatement and public health outcomes.</li> </ul>
Other Results Observed	N/A

#### Technical specifications

Green Blue Urban ArborFlow SuDS tree pit systems:

<https://greenblue.com/gb/solutions/stormwater-management/>  
<https://greenblue.com/gb/case-studies/cool-towns-margate/>

**List of tree species supplier** Palmstead wholesale nursery <https://www.palmstead.co.uk/>

- *Acer platanoides* 'Deborah' Norway Maple
- *Acer campestre* 'Elsrijk'
- *Ginkgo biloba* Maidenhair tree
- *Acer campestre* 'Louisa Red Shine'

#### References

(1) UK Consensus, 2011. ONS. [Key Statistics - 2011 Census - Census of Population - Data Sources - home - Nomis - Official Census and Labour Market Statistics \(nomisweb.co.uk\)](#)

(2) Kent Ward Profiles, 2019. KCC Strategic Commissioning Analytics. [Area profiles - Kent County Council](#)

<https://www.kent.gov.uk/environment-waste-and-planning/climate-change/kents-changing-climate/making-margate-a-cooler-greener-place>

For more information please contact [climate.change@kent.gov.uk](mailto:climate.change@kent.gov.uk)