# Australian Water Association R&D Excellence Award 2024

# Project details

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| Title | Demonstrating the cooling benefits of irrigating green space and misting at Aquarevo House and Burnley |
| Lead organisation | South East Water |
| Lead organisation’s AWA Membership no. | 48745 |
| Collaborators | The University of Melbourne  Water Sensitive Cities Australia |
| Contact person | David Bergmann, Research & Development Manager, South East Water, 101 Wells Street, Frankston, Victoria, 3199. 0425 741 909, David.bergmann@sew.com.au |

# Overview

The R&D Excellence Award recognises projects that challenge current practice and address the need for a sustainable future. These projects add to the conservation or better use of water resources, knowledge of water technology, environment, sociology, economics or culture aspects. This award is open to research and development of all types, including early-stage.

Entry for the R&D Excellence Award is at a state or territory level with winners eligible for national awards.

# Eligibility

Open to all corporate members of the Australian Water Association for projects taking place in the last two years.

# Submission Criteria

Project executive summary (150 words)

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| Irrigating urban green spaces has been proposed as an effective cooling strategy, but there is little direct scientific evidence to understand how much to irrigate, when to irrigate and how much cooling benefit can be expected. This project aimed to use experiments to demonstrate cooling impacts and best irrigation amount and scheduling.  We conducted irrigation experiments at the Aquarevo House of South East Water and Burnley Campus of University of Melbourne to measure and optimise the cooling benefits.. We measured that irrigating turfgrass at 4 mm/day reduced the mean air temperature in the afternoon by 0.9°C, which was comparable to the air temperature cooling effect of tree shade in Melbourne. We also found that irrigating in small amounts, e.g., 1 mm, but at multiple times during the day was the best strategy. We also demonstrated how IoT devices and sensors with feedback control can be used to autonomously create the conditions for optimized cooling outcomes. |

Outline the most significant contribution of the R&D project to achieving a prosperous and sustainable water future (250 words)

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| In this project, we advocate that more fit-for-purpose water needs to be recycled, harvested and stored to increase our ability to irrigate and cool the urban environment. This approach is different to traditional water and landscape management strategies, which aim to use water as efficiently as possible, and to reduce water consumption during irrigation. Irrigation for cooling requires a shift in thinking to accept an approach that irrigates to saturation, and to irrigate at times when more water will be evaporated from soil and vegetations surfaces  The most significant contribution of this project is that we have demonstrated the feasibility of collecting enough fit-for-purpose water to support irrigation, the cooling benefits of irrigating urban vegetation, and the IoT systems to autonomous control and deliver these outcomes.  *Feasibility*  Using the Aquarevo House as the testing ground, we demonstrated that the stormwater collection and wastewater recycling systems at Aquarevo can provide enough fit-for-purpose water to irrigate all the vegetation at Aquarevo House through summer. We developed and used an algorithm and IoT technology to optimise irrigation amount to avoid under- or over-irrigation according to past weather conditions,weather forecast, and the soil condition.  *Cooling benefits*  At Burnley campus, we used replicated experiments and research-grade instruments to quantify the cooling benefits of irrigating turfgrass. We demonstrated that irrigating turfgrass can significantly reduce air temperature and turf surface temperature by 0.9 and 4.9°C in the afternoon. Such cooling benefits confirmed that irrigating urban vegetation is an effective strategy to mitigate the warming effects of climate change. At the Aquarevo house we demonstrated we could replicate the irrigation and moisture conditions using IoT-based sensor and control systems. |

Provide evidence of research excellence e.g. competitive funding awarded, industry acceptance (uptake), honours and prizes (250 words)

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| This project has received two prizes for its research excellence.  Dr Paul Cheung from the University of Melbourne received the [2022 Young Scientist Research Prize from the Royal Society of Victoria](https://rsv.org.au/ysrp-2022/) for presenting the findings of this project. It was a highly competitive prize with over 60 applicants. He also received the student presentation award in the [11th International Conference on Urban Climate](https://icuc11.com/). |

Demonstrate the social, economic, environmental and/or cultural impacts of the project, how the impact has been achieved and by whom (250 words)

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| *Social impacts*  Cooling our urban environment make our cities more liveable and healthier place to live. In this project, we collaborated with Lyndhurst Primary School to compare the impacts of traditional irrigation scheduling to the Internet-of-Things one. As part of this partnership we installed wicking beds at the school to provide the students with hands-on experience in watering and enhance their understanding about water. Moreover, we organised a workshop to discuss the findings of this project with the urban planning and water teams of the City of Casey.  *Economic impacts*  Cooler, greener and more liveable communities lead to healthier lifestyles, and potentially lower health costs. Furthermore the use of rainwater tanks (currently estimated at 26%) for irrigation has the significant potential to reduce water bills by lower usage and deferred system capital cost.  *Environmental impacts*  This project has significant environmental benefits because irrigating urban vegetation can reduce urban air temperature. Lower urban air temperature can reduce the energy consumption for space cooling in summer, which also reduces carbon emission.  *Cultural impacts*  This project has encouraged people to adopt a more sustainable and climate-sensitive strategy to manage stormwater and wastewater. Based on the findings of the experiments, we have developed a [practice guide](https://wscaustralia.org.au/2023/09/26/new-practice-guide-for-lot-scale-cooling/) to showcase good design for cooling outdoor spaces using water, plants and architecture. These efforts contribute to changing people’s irrigation practices, e.g. increasing their total irrigation amount and adopting Internet-of-Things technology to assist their irrigation. |

Provide evidence of the broader engagement of R&D outcomes e.g. publications (media and journals), presentations or demonstrations (250 words)

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| *Publication (media/report)*  Livesley, S. J. (2024). Using water and vegetation to mitigate extreme urban heat for humans and wildlife. [Forschung aktuell, German Public Radio](https://www.deutschlandfunk.de/forschung-aktuell-100.html).  Water Sensitive Cities Australia (2023). [Practice Guide – Cooling (Lot scale).](https://wscaustralia.org.au/2023/09/26/new-practice-guide-for-lot-scale-cooling/)  *Publication (journals)*  Cheung, P. K., et al. (2024). [Identifying the mechanisms by which irrigation can cool urban green spaces in summer](https://doi.org/10.1016/j.uclim.2024.101914). *Urban Climate.*  Cheung, P. K., et al. (2024). [Impacts of irrigation scheduling on urban green space cooling](https://doi.org/10.1016/j.landurbplan.2024.105103). *Landscape and Urban Planning.*  Cheung, P. K., et al. (2022). [Daytime irrigation leads to significantly cooler private backyards in summer](https://doi.org/10.1016/j.uclim.2022.101310). *Urban Climate.*  Cheung, P. K., et al. (2022). [Irrigating urban green space for cooling benefits: the mechanisms and management considerations](https://doi.org/10.1088/2752-5295/ac6e7c). *Environmental Research: Climate.*  Cheung, P. K., et al. (2021). [Estimating the cooling potential of irrigating green spaces in 100 global cities with arid, temperate or continental climates](https://doi.org/10.1016/j.scs.2021.102974). *Sustainable Cities and Society.*  *Presentations*  Cheung, P.K., et al. (2023). Daytime irrigation significantly reduces air and surface temperatures in backyards. In [*11th International Conference on Urban Climate*](https://icuc11.com/).  Bergmann, D., & Cheung, P.K. (2023). Smart Irrigation for Cooling and Greening Outcomes. In[*Greening communities with smarter irrigation*](https://www.gww.com.au/about/news/working-together-keep-our-green-spaces-watered-healthy). Greater Western Water, South East Water and Yarra Valley Water.  Livesley, S. J. (2024). [Using vegetation and water to cool our green spaces](https://library.portphillip.vic.gov.au/what-s-on/my-smart-garden-sustainability-videos). City of Port Phillip – My Smart Garden.  Livesley, S.J. (2024). Urban Heat: Three types of temperature. Three strategies to cool. City of Merri-Bek.  *Demonstration*  Cheung, P.K., (2022). Demonstration tour for representatives from the City of Melbourne, City of Monash and City of Frankston. |