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UWTSD Water Management Plan

Assessment and Upgrade

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1 Issues Faced by The University

1.1 Current Information:

The UWTSD Water Management Plan outlines the collective water usage for all UWTSD campuses and student accommodation (plus catering outlets and grounds / landscaping) (Merebark, 2025). This provides a broad overview of water usage across the institution, although lacks specified information on the constituent areas (Merebark, 2025). Given the variation in requirements and usage of the different places, this gap creates inefficiency in the management process which could be avoided if each area had its own policy.

Age is a key feature of the UWTSD water policy document; being over 3 years old, scope and accuracy has to be taken into consideration (Merebark, 2025). Whilst the University recognises its duty to ensure sustainable water usage (in line with its sustainability plan, the Environment Wales Act of 2016 and the UN sustainable goals), there is a prevailing lack of analytical data across the document (Merebark, 2025). Of the seven objectives listed, only one contains a specific, quantifiable variable:

“To reduce overall water consumption per FTE student and staff member to below 4.5m² by 2026 and 3.5m³ 2030.” (Merebark, 2025).

Current monitoring involves measurement at mains bill meters which are monitored by the sustainability team, and annually reviewed for anomalous consumption (Merebark, 2025). This method leaves potential for improvement, particularly in the time frame involved. The overall water consumption baseline identified by the University (2012-2013) is stated to be

49611m³, with staff and students occupying 5.46m³ of this (Merebark). This figure is likely to be outdated given that it's been over a decade (requires updating).

Additional objectives in the document include:

- Further data collection on water consumption
- Identification and elimination of leaks
- Further development of grey water collection infrastructure on-site

(table 1) (Merebark, 2025).

Appendix A: Water Management Action Plan

Issue	Action	By Department	By When	Estimated Target
Lack of data to identify high usage and leaks	Implement sub metering at strategic supply points.	Sustainability & Technical Services and Compliance	December 2024	
Taps left to run for extended periods	Upgrade existing taps with percussion/IR taps.	Technical Services and Compliance		
Water Consumption Savings	Audit existing infrastructure, build priority matrix to target improvements.	Sustainability & Technical Services and Compliance	Audit to be completed by end of November 2023. Matrix to be completed for works to commence December 2024.	3% annual reduction in usage up to a maximum saving of 21%
Accommodation showers	Audit existing stock Installation of eco shower heads.	Sustainability Technical Services and Compliance	Summer 2022 Ongoing with refurbishment	Reduction based on audit findings
Legionella flushing consumption	Develop consumption baseline. Develop flushing sequence in line with plumbing layout to reduce tap run times	Sustainability Compliance	May 2023 Sequence flushing: July 2023 Flushing schematics September 2023 Ongoing	40% reduction of determined baseline.
Treated drinking grade water for maintaining grounds	Water butts and rainwater diverters for grounds water storage and trickle watering.	Sustainability Grounds	April 2024	70% of watering grounds comes from rainwater
Education in water conservation	Education campaign to highlight the importance of personal actions regarding water consumption. Water Saving Week	Sustainability	October 2023 May 2024	Ongoing
Ground water recharge and overland flow	Development of 2 natural ponds in Carmarthen to aid	Projects	April 2023 delayed until June 2024	In progress

reduction	ground water recharge and act as over land flow buffer during high rainfall events.			
Lack of accommodation consumption rate data	Develop accommodation FTE baseline. Utilize submetering to produce water score cards	Sustainability	August 2023 September 2024	
Manual washing of dishes in accommodation leading to high consumption.	Fit dishwashers within accommodation	Technical compliance	September 2023	50% reduction in current student kitchen consumption.
Current waste water is estimate based on incoming supply.	Look at drainage system and develop waste water metering station for baseline development.	Sustainability Technical Compliance	August 2023	Accurate measured waste water figures.

Table 1: UWTS Water Management Action Plan (Merebark, 2025)

1.2 NHS Water Management Strategy Comparison:

The NHS water management strategy begins by outlining the financial and environmental issues associated with water consumption, particularly with the understanding that many areas of England and Wales are coming under increasing water stress (NHS, 2013).

The NHS water management strategy differs in both its scope, due to the magnitude of the organisation, and its priorities,

given that it cannot compromise on its duty of care (NHS, 2013). Additionally, healthcare institutions require specialised wastewater processes which are not applicable to universities (Water UK, 2025). Despite this, many of the practises displayed are relevant to UWTSD.

In its executive summary, it states not only the water consumption (40.3 million cubic metres), but also waste water production (34.4 million cubic metres) (NHS, 2013). It also estimates a potential £9.5 million could be saved per year (2001 prices) given water efficiency measures, with little to no investment cost (NHS, 2013). It begins to tackle the issue with an outline of the biggest users in the institution (table 2), along with potential water-saving actions to be taken, as part of the water strategy process (figure 1) (NHS, 2013).

Item	Typical percentage of total healthcare consumption	Typical consumption rate	Potential actions
WCs	24	6–9 L flush	• Install a cistern displacement device – saving approximately 1 L per flush • Retrofit to a dual flush or lower flush system – giving the option for a half flush. (Note: Where dual-flush toilets are specified, they should have guidance or symbols instructing the user on the appropriate operation of the flushing device) • Replace old WCs with those that give a flush volume of up to 6 L (maximum)
Urinals	5	500–900 L per day	• Controlled flushing through foot triggers or motion sensors can reduce consumption by 120–200 L per day • Waterless urinals
Taps	13	400 L per day	• Flow restrictors, non-concussive self-closing taps and sensor^a taps can reduce consumption by up to 50% (Note: the choice of tap should be appropriate for the intended use)
Leak detection	15–30	Small leak: 6 L per hour Large leak: 400–800 L per hour	Inspect all fixtures and fittings, graph monthly bills, or conduct internal monitoring through submetering to identify possible leaks
Boiler	Variable	Intense energy consumption means costs are much higher than water alone	• Adjust boiler blowdown amount and frequency to reduce waste and to control total dissolved solids (TDS) • Collect and reuse steam condensate • Control steam losses

Table 2: NHS water consumption table (NHS, 2013)

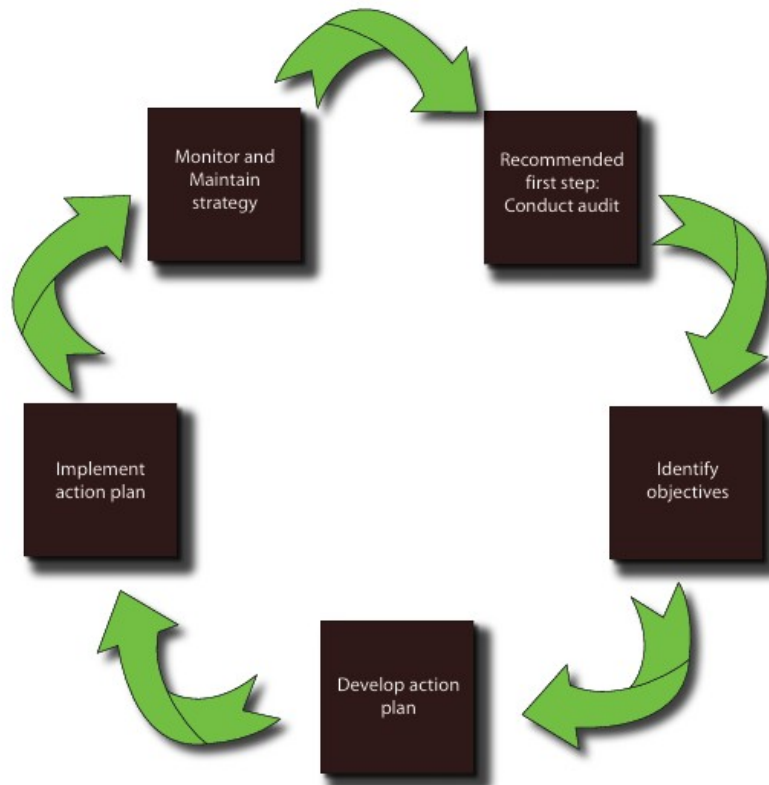


Figure 1: NHS water strategy process (NHS, 2013)

Included in its water-saving technologies is wastewater recycling, with particular reference to reverse osmosis plants (figure 2) (NHS, 2013). Using these techniques, in 2005, the East Kent and Canterbury Trust saved 33% of the annual mains consumption (£7000), which meant project costs were recovered in under 3 years (NHS, 2013).

20T/H Process flow diagram of reverse osmosis system

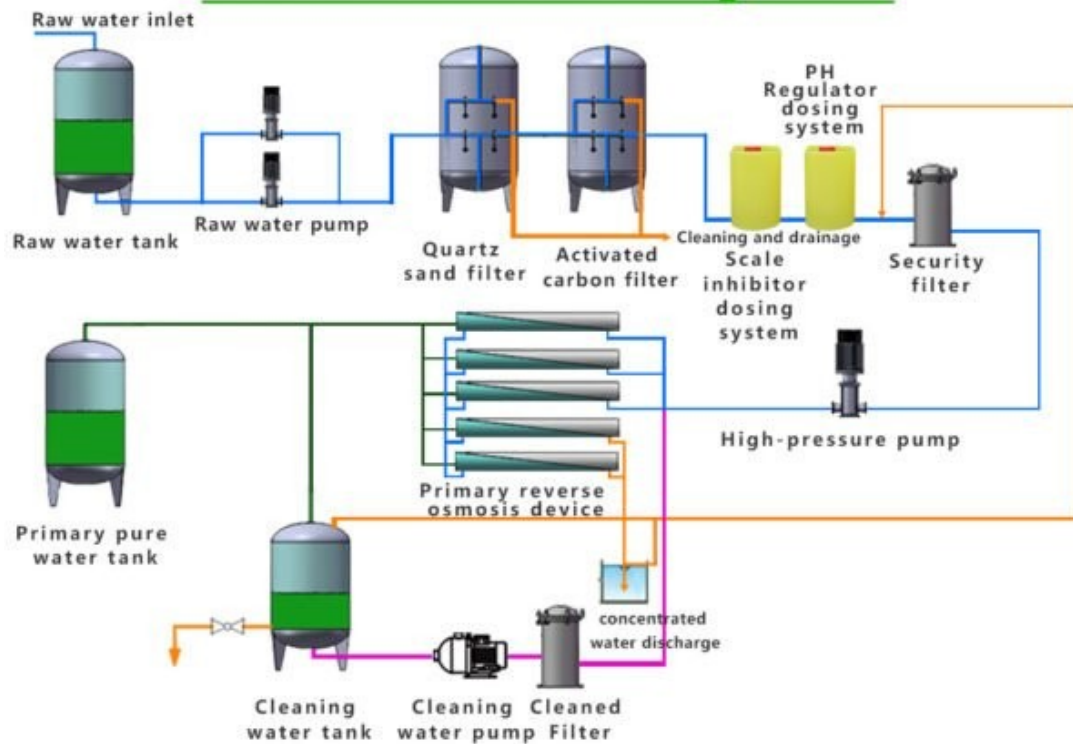


Figure 2: Reverse osmosis plant breakdown (Chunke Water Treatment, 2025)

2 Suggestions for Improvement

2.1 Audit:

To obtain an overview of water and wastewater data in the university, an initial on-site inspection should be carried out across the campus (Rice, 2024).

Statistical data analysis is central to water management (Rice, 2024). Given the purpose of the UWTSD Waterfront Campus, a water audit should look to assess the requirements of:

- Student and staff usage (particularly in student accommodation)
- Heating (where applicable)

- Server banks and labs
- The cafeteria
- Cleaning processes
- Landscaping

Areas of highest consumption should be prioritised for analysis as these areas will have the biggest cost saving potential.

2.2 Potential for SMART Sensing (IoT) and Building Management Systems (BMS):

Smart sensing is a method of gathering and sorting data which integrates into the Internet of Things (IoT) (IEEE Reality, 2025). It has the ability to gather and record data over time, allowing for pattern identification with increasing accuracy the longer it is established (IEEE Reality, 2025). Real-time monitoring of water consumption allows systems to be continuously adjusted and optimised in response to variation in demand (BMS Admin, 2023; Dada et al, 2024). When combined with BMS, water management throughout an institution can be largely automated, reducing maintenance costs (BMS Admin, 2023; Dada et al, 2024). Progression in sensing technology and BMS can be summarised in figure 3; the key capability of the Smart Water Stage is dynamic optimisation (Dai et al, 2025).

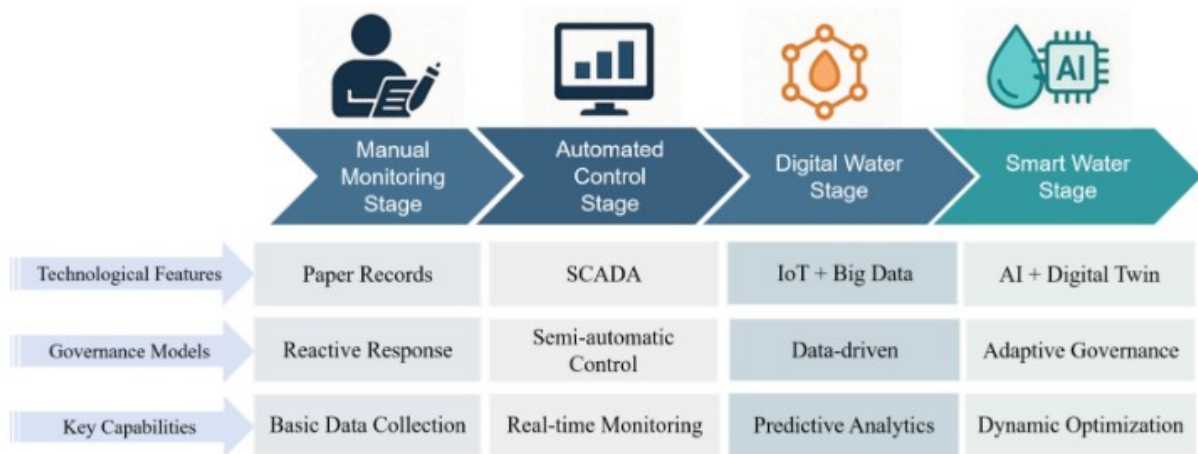


Figure 3: Features of water management progression over time (Dai et al, 2025)

Depending on sensing coverage, BMS can provide support in additional management roles of water services, such as identification of leaks, excessive consumption, and demand forecasting (BMS Admin, 2023; Dai et al, 2025). As a result, implementing BMS in water management can lead to more effective and efficient operation across an institution, whilst allowing facility managers to operate remotely (BMS Admin, 2023). This has seen deployment on a mass scale in Singapore's Smart Water Grid, a project which aims to save 10 million gallons of water daily (figure 4) (Dai et al, 2025).

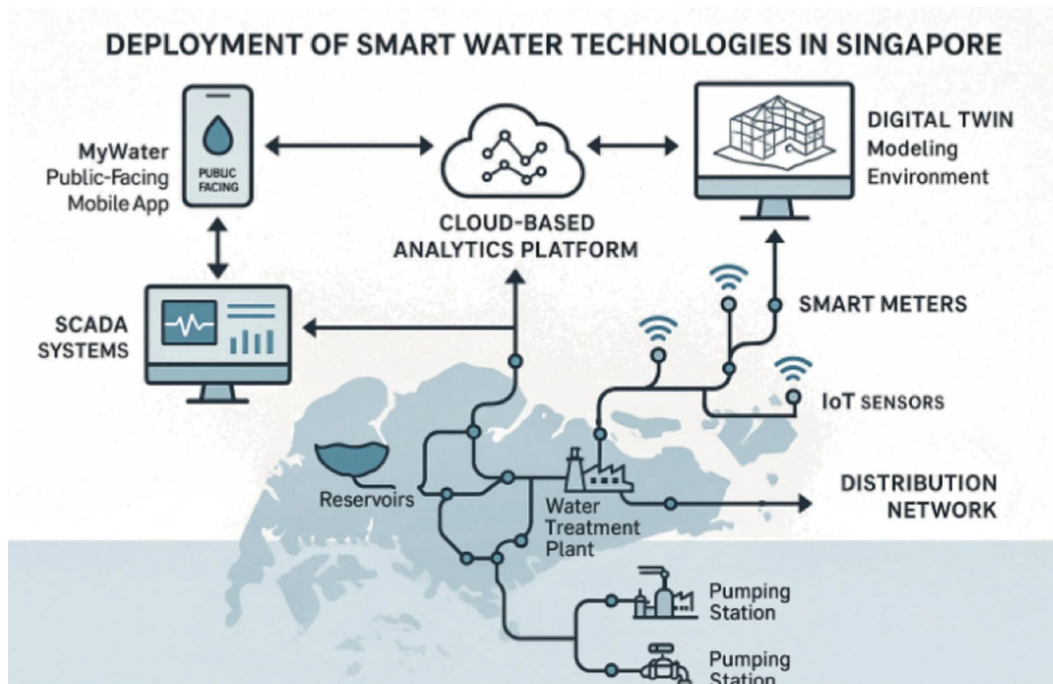


Figure 4: Water technologies in Singapore's Smart Water Grid (Dai et al, 2025)

2.3 Role of AI and Infrastructure Improvements:

For UWTSD, one of the major hurdles in infrastructure development is grey water storage capacity, which could be greatly expanded. Looking at decentralised treatment (specifically for grey water), could be a sustainable method of on-site water reclamation / recycling, substantially reducing reliance on external infrastructure (water supply and treatment) (Khajvand et al, 2022). In combination with on-site grey water treatment, increased rainwater capture capacity, could further alleviate reliance on mains water supply across the campus (Filali et al, 2022). Examples of this have been shown in cases such as the Schwalbe Hybrid Building, which uses rooftop collection and underground storage to deliver a large proportion of its water demand (Sara, 2024). Retrofitting technologies such as closed loop systems and low flow fixtures can also significantly reduce water usage; collaboration with stakeholders may help to proactively consider where water can be saved in this example (Ahmed, Alazameh and Asif, 2022).

Advanced filtration methods such as reverse osmosis plants, as shown in the NHS Water Strategy, can provide on-site treatment of water for reuse in grey water systems (NHS, 2013). Whilst it involves large upfront investment, costs can be recuperated over time, making it more applicable to larger institutions (Chunke Water Treatment, 2025; NHS, 2013).

Leakage is one of the biggest causes of inefficiency within water distribution networks (Abdelmageed et al, 2022). Use of AI in has a potentially powerful role in both detection and prediction of leaks, through integration with sensing systems without significant investment cost (figure 5) (Abdelmageed et al, 2022).

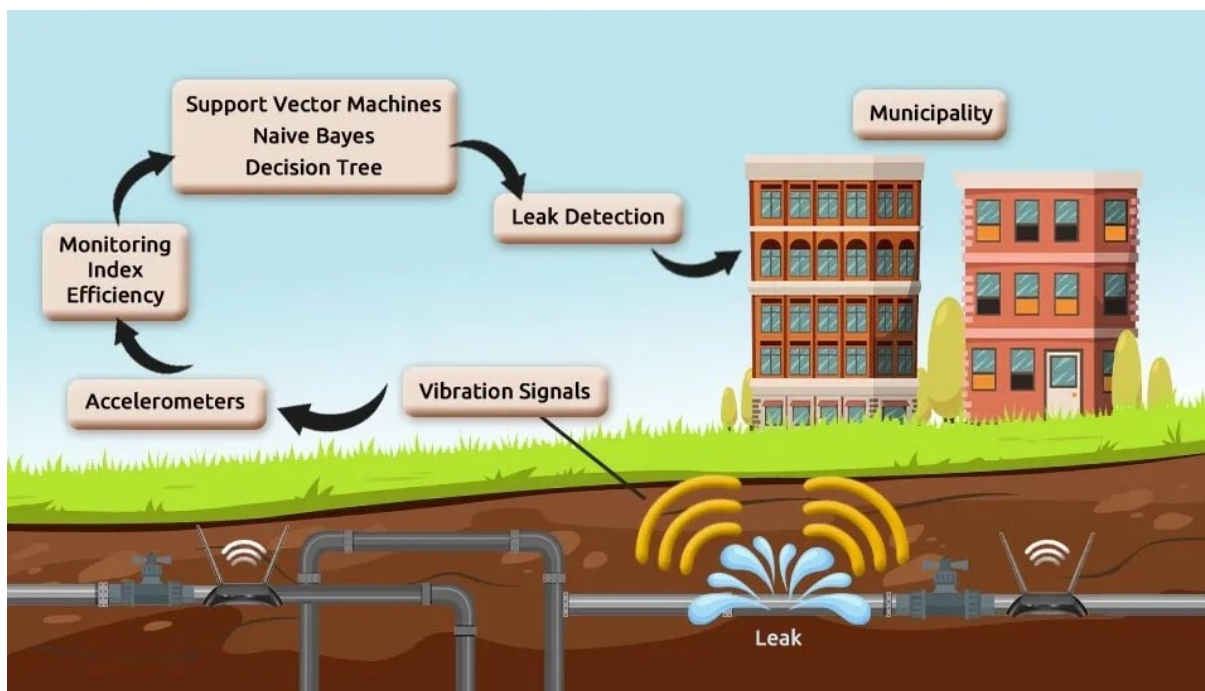


Figure 5: Model AI leak detection system (Moradi, 2025)

Green infrastructure options, such as green roofs, carry many benefits (summarised in figure 6). Caparrós-Martínez et al (2020), suggests that:

"The development and conservation of a region's GI is considered a sound strategy for nature, the economy and employment"

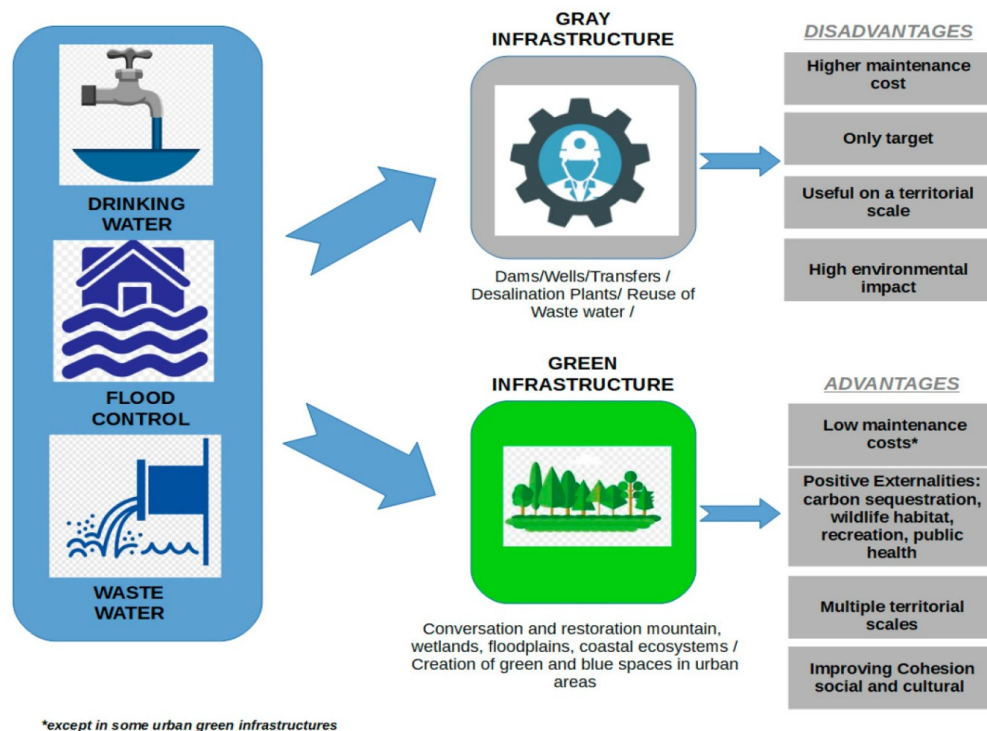


Figure 6: Grey vs green water infrastructure (Caparrós-Martínez et al, 2020)

Depending on the source of grey water (e.g. showers, washing machines etc.), heat recovery could be a viable option to assist water heating (Piotrowska, 2022). Figure 7 depicts two variants of grey water heat recovery infrastructure (Piotrowska, 2022).

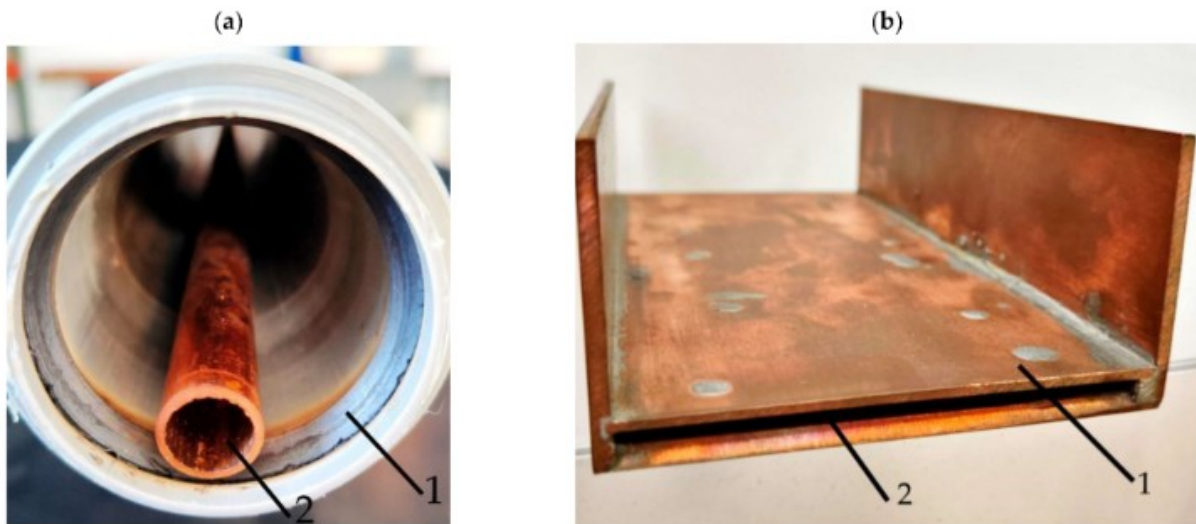


Figure 7: Grey water heat recovery technologies (Piotrowska, 2022)

2.4 Additional Efficiency Based Changes:

In terms of efficiency (cost-saving potential in particular), down-sizing of supply pipelines could be investigated to save costs and improve pressure within the system (Muya, 2024).

As stated in the NHS document, water is often conceived as an unlimited resource and as such, has a tendency to be overlooked (NHS, 2013). In addition to general promotion of water conservation, there could also be scope for optimising cleaning processes to limit water usage. This may include switching suppliers, targeted staff training or use of water-saving cleaning techniques (e.g. chemical dosing) (Cotton and Sons, 2022).

As indicated earlier, green roofs (figure 8) are useful across both social and economic aspects of water management. They provide ecosystem services through enhanced biodiversity and regulate (to some extent) grey water quality (Caparrós-Martínez et al, 2020; Intermountain Roofscapes, 2024). Additionally, they improve drainage; a feature highly relevant to the SA1 campus, particularly in periods of high precipitation when areas of the site are liable to flooding (Intermountain Roofscapes, 2024).



Figure 8: 'Living Roof' at the University of Melbourne (Pouya and Pouya, 2018)

In Istanbul Technical University, a rain garden, using deep-rooted native plant species, has been created as part of their sustainable landscaping programme (Pouya and Pouya, 2018). This space acts as a capture for stormwater runoff (aids flooding), and provides water filtration (Pouya and Pouya, 2018).

As a final point, considering water saving features at all stages of a build is important to ensure efficient and effective deployment (The Construction Daily, 2025). From a financial perspective, investing more in the early stages will pay off long-term through saved water / utility bills (The Construction Daily, 2025).

3 Conclusion

The responsibility to conserve water can be derived from the Water Act (Special Measures) 2025, and the goals of the Environmental Impact Assessment (EIA), namely, avoiding irreversible damage to the environment and safeguarding valued resources (Defra, 2024; Gov.uk, 2014). It also relates to the sustainable development goals (SDGs) in the preservation of a natural resource (Dada et al, 2024). Ultimately, this commitment to water conservation runs in line with the size and nature of the institution (Pouya and Pouya, 2018).

Whilst the UWTSD plan caters to the basics, there is vast scope for improvement, particularly on the monitoring side (Merebark, 2025). Once this has been effectively established, management practises, such as grey water treatment, can be assessed for feasibility on site.

Other institutions such as the NHS and various universities, have valuable insights into effective water management. Their successes should be analysed going forward as part of best practise. Where possible, active collaboration and sharing of knowledge with other organisations could further benefit water management at UWTSD.

An area which has seen wide scale deployment over recent years, is sustainable landscaping, and particularly green roofs (Pouya and Pouya, 2018). These innovations provide promising benefits to both social and economic aspects of water management, and neatly tie in aspects of grey water treatment, flood defence and ecosystem services (aesthetics) (Caparrós-Martínez et al, 2020). As shown in multiple case studies, these features are highly congenial to a university environment.

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