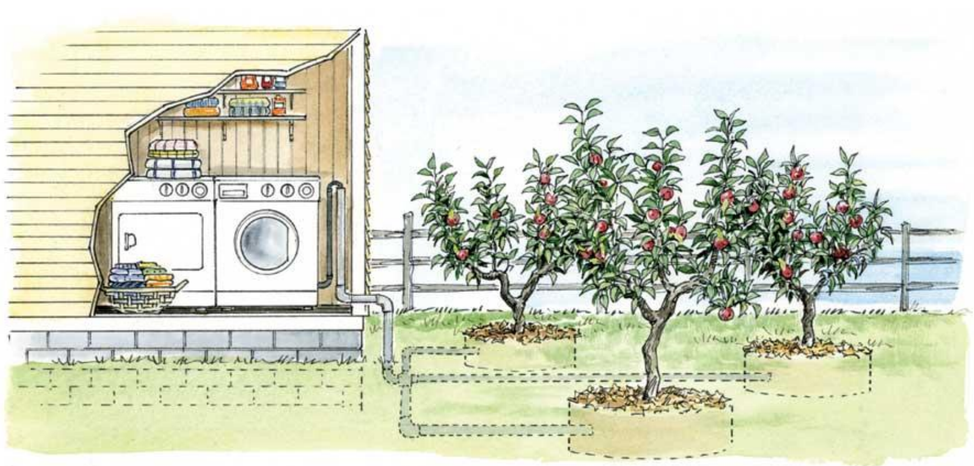
Advantages in Grey Water Applications

As much as 30% of potential grey water is sent for treatment in urban settings; water which could otherwise be utilized in a variety of applications ranging from agriculture, heating and cooling systems and toilet flushing. The percentage of unused grey water in normal households' is even higher up to 50-80% (Li, F., et al 2009). Reuse leads to advantages including significant reductions in sewage treatment and extraction of fresh water by public utilities; especially in drought stricken regions like California.

In arid areas of Jordan where potable water is highly valued, soil samples collected over the course of two years revealed that grey water was suitable for fodder and tree crops irrigation despite increasing salinity levels (Al-Hamaiedeh & Bino 2010). In the 30 acre Encore District of Tampa, a 33,000 cubic foot stormwater vault stores run-off in order to provide readily available water for secondary uses like car washing or irrigation. Vanderweil Engineers in Boston rerouted stormwater, and grey water from kitchens and dishwashers through labeled pipes to cooling towers in a 12 story office building, saving 6,500 gallons of potable water daily with an annual utility savings of $44,000 (Barista, 2003).

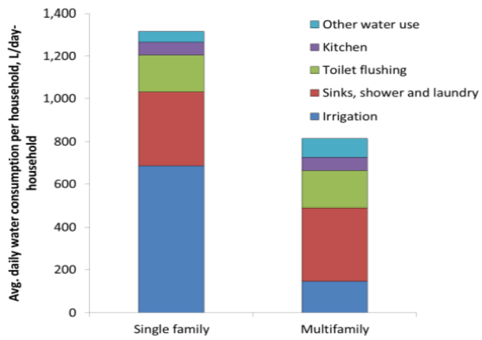
Grey water has clear advantages for secondary use including: saving considerable dollars, reducing the need for additional potable water and lessening the burden to treatment plants. However, an educational gap current exists, hindering the adoption of best practices. In addition, plumbing codes have posted infrastructure barriers in certain states, with regulating bodies restricting the quantities allowed for storage and reuse. Variability in permitting and grey water treatment options (e.g. disinfection units) also concerns citizens in its utilization. However, the advantages and environmental benefits warrant embracing grey water reuse.

Due to the nature of grey water deriving from household wastewater of which it has not been contaminated by sewage, it can be obtained from common sources ranging from dishwashers, washing machines, bathtubs, showers and faucets. Residential zones therefore may capitalize on low-cost solutions to reduce their water footprint by redirecting water with filtration and disinfection before going into secondary application. In areas whose local ordinance and codes forbid the storage of grey water like Queensland, Australia, residents may to use direct systems such as Caroma's Profile Smart series toilet which has a sink mounted on the tank allowing water to pass into the reservoir (Allen et al, 2010). This type of system makes affordability a factor in middle class urban environments where the fixture may cost as little as 100 dollars. Moreover, laundry to landscape systems are another low-cost application that harvests 10-25 gallons of water per load that can be pumped out to vegetation outsides the home despite ongoing research on long term effects to plants given alkalinity and ph levels.



Picture 1 – Laundry to landscape method emphasizes outflows to benefit landscape (Allen, L., Woelfe-Erksine, C., 2011)

On the macro and city scale, a cost-benefit study was conducted on grey water systems for Los Angeles. In a state which denies on-site storage, it proved to be of considerable economic and environmental value. It was determined that the city could reduce consumption of potable water by 27% for single-family homes and 38% for multi-family homes. Furthermore, for those homes in rural areas relying on septic systems and private wells, grey water reuse poses less strain. With a population of over four million people whose water sources are split between the Colorado River and the LA Aqueduct, the city can reduce water supply and treatment related energy by 43 mega-watt hours a year with just 10% population participation (Yu, Z., et al 2014). Considering the limited rainfall southern California receives, grey water systems from rain barrels and household applications suddenly emphasize how valuable and reusable waste water is. The study from UCLA highlights both water demands among single and multifamily households to a future state where demand is shifted as a result of grey water use. Thankfully, California has a formal water reduction goal of 20% by 2020; similar to the Department of Energy's Better Buildings Challenge that guides facilities to reduce energy usage of 20% by 2020. Strategically utilizing grey water systems is a necessity to hit the states' conservation efforts, especially since the state has a deficit of 11 trillion gallons below the normal season from this past winter (NASA, 2014) as it continues to encounter drought.



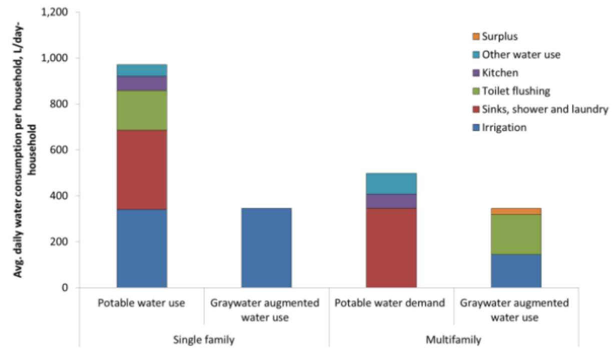


Figure 1 – Water demand from single and multifamily in LA homes (Source: Yu, Z. et al 2014)

Figure 2 – Reduction opportunities in demand

Regardless of forecasted success of such applications, the connection between regulation and treatment with grey water are an ongoing battle as the primary concern is human health. The advantage associated with grey water applications is that it typically has low organic substances but some nations have unclear regulatory requirements like the Middle East and Africa. Australia on the other hand has been a pioneer in policies that has created specifics where "untreated grey water can be used for subsurface irrigation" in addition to offering $500 rebates for the installation of such systems (Allen et al, 2010). The World Health Organization in 2006 has provided guidelines; however, internationally several governments have set their own standards.

The occurring theme in the barriers in implementing grey water systems include: variable cost-benefit, affordability in infrastructure (e.g. systems and physical treatment versus biological treatment) especially those in poverty embellished areas, long return on investment, irregular design and inconsistent regulatory requirements in respect to quality of effluent for reuse. According to a study by the Institution of Civil Engineers, there are no correlations between location and treatment options. Findings also disclose that factors such as biochemical oxygen demand (BOD), suspended solids, turbidity, and fecal coliforms are left undefined or differ in values leaving a desire for engagement in dialogue and research to establish parameters.

	Application	Parameters				
		BOD_5 ($mg.L^{-1}$)	TSS ($mg.L^{-1}$)	Turbidity (NTU)	Faecal Coliforms ($cfu.100mL^{-1}$)	Total Coliforms ($cfu.100mL^{-1}$)
Japan [42]	Toilet flushing	-	-	<2	-	ND
	Landscape	-	-	<2	-	<1000
	Recreational	-	-	<2	-	ND
Israel [29]	Wastewater reuse	10	10	-	<1	-
Spain, Canary Islands[1]	Wastewater reuse	10	3	2	-	2.2
USA, California[1]	Unrestricted water reuse	-	-	2 avg 5 max	-	2.2 avg 23 max in 30 days
USA, Florida[1]	Unrestricted water reuse	20	5	-	25% of sample ND and 25 max	-
Australia, Queensland [43]	Greywater reuse for garden watering in unsewered area	20	30	-	-	100
Canada, British Columbia [44]	Unrestricted urban reuse	10	5	2	2.2	-

Table 1 – variable parameters in grey water applications across the globe (Source: Pidou et al. 2007)

It's difficult to contest the benefits and advantages of grey water applications. The wise use of resources today to ensure generational equity means that water scarcity shouldn't be taken lightly and water conservation methods like grey water applications ought to be taken seriously. With fewer than three percent of global freshwater supplies being distributed amongst an increasing and demanding population, the outlying issue is that mankind will have to look further past grey water applications. Despite the meaningful impact these systems have on recycling and conservation, the demand from a consumption standpoint needs to be addressed. Numerous stakeholders are needed to further drive and identify advantages of grey water as opportunities in design and implementation are not fully realized. Regulators, builders, scientists, plumbers and community members like city officials need to be educated and working cross functionally to enhance these systems considering their interrelations.

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