Quantifying Water and Energy Savings Associated With Water Efficiency Retrofits

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Water Efficiency at Redhill School

1. Research Questions
2. Methods
3. Results
4. Next Steps

Research Questions

RQ1: What was the impact of the Water Efficiency Retrofit (WER) on the annual water demand at the school?

RQ2: What is the payback period for the water efficiency retrofit?

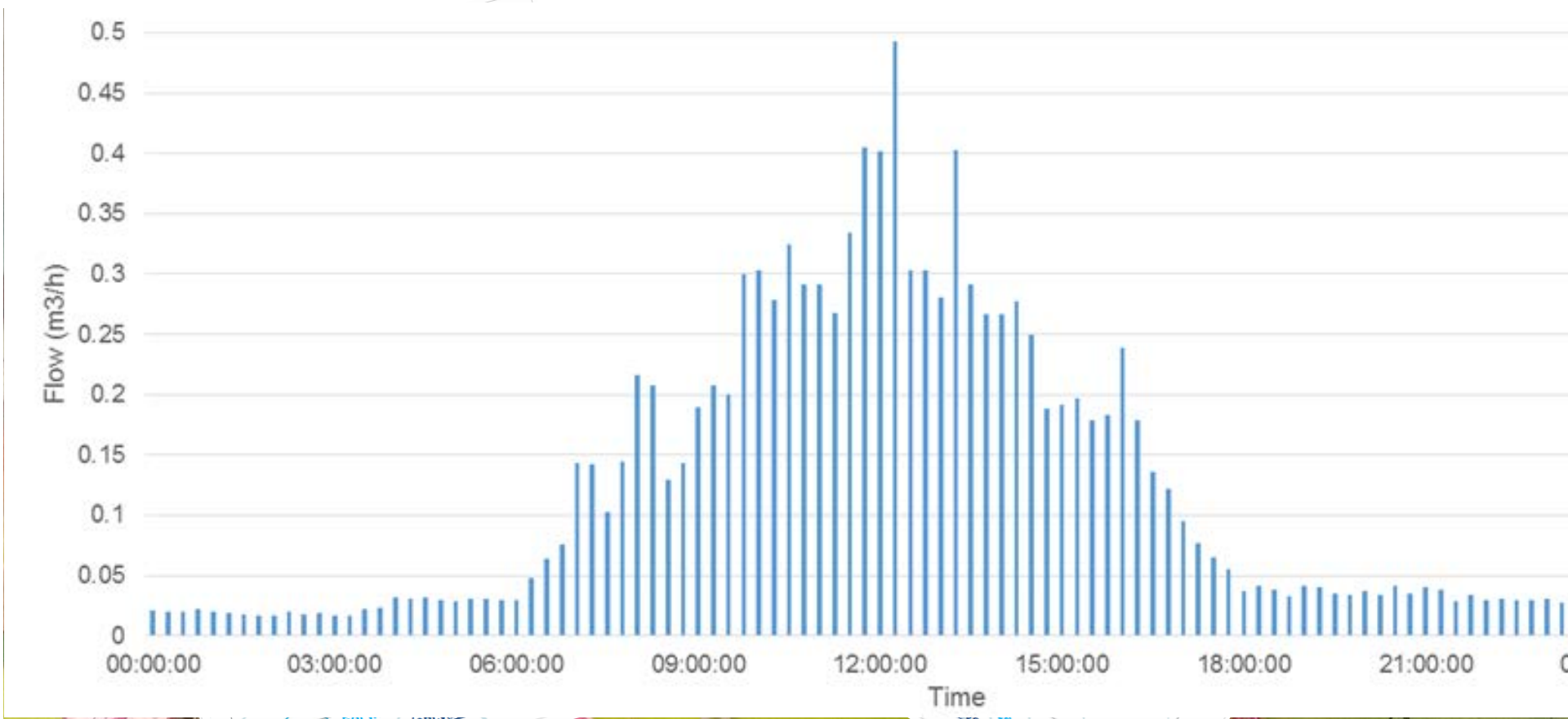
RQ3: What was the energy saving associated with reduced hot water demand?

RQ4: Was leakage identified on site?

RQ5: Would retrofitting rainwater harvesting provide further savings?

RQ6: How can monitoring and data collection be improved?

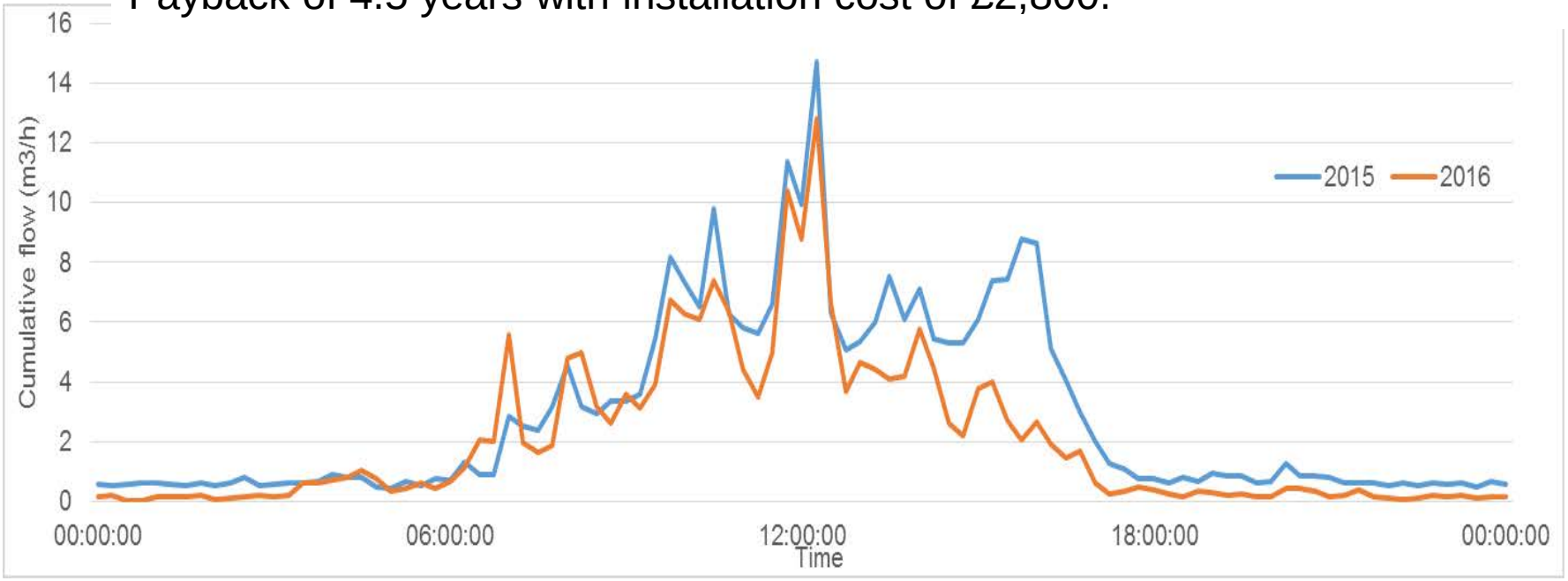
Methods: Survey, Install & Monitor



Low cost, low regret interventions

Results – RQ1&2 Water Demand

The water usage reduced by 29% from 70.2m^3 to 49.8m^3 = £623/annum
Payback of 4.5 years with installation cost of £2,800.



Water demand, daily profile, 2015 versus 2016 for month of April

RQ3 Energy saving (on site)

- Only 3 of the 30 WC's needed upgrades.
- However all three urinal systems were upgraded.
- Significant upgrades completed to taps (42 hot and 53 cold).
- Conservatively assumed that 50% of savings associated with taps.
- Necessary to assume that hot taps used as frequently as cold.
- An annual energy saving has been estimated valued at £86 assuming gas costs 4.16p/kWh.
- 381kg/annum CO_2e.

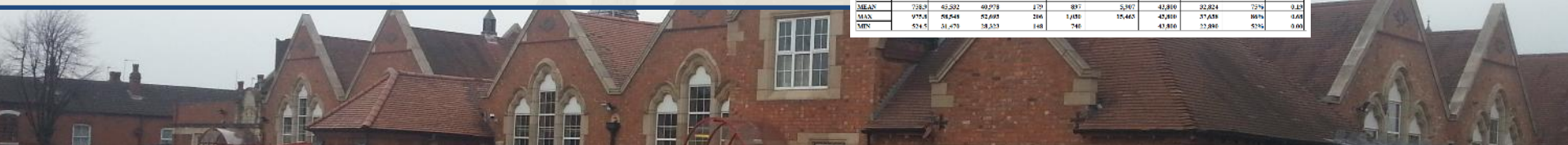
RQ4 Night-Time Water Demand

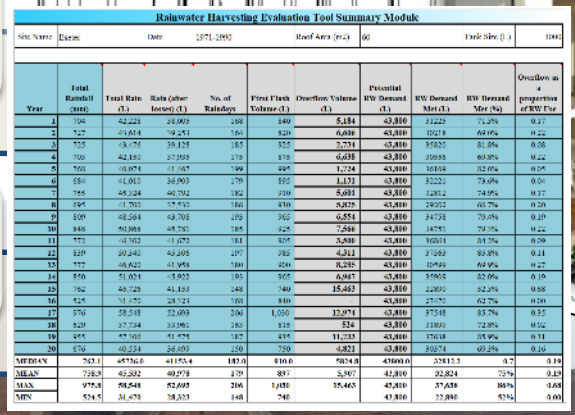
- Pre-intervention night-time flows (11pm-6am) in April. 2015 totalled 16.0m^3.
- 76 l/hour.
- Attributable to: 1) urinal flushing and 2) leakage.
- April 2016 totalled 6.8m^3.
- Now 30 l/hour.

RQ5 Retrofit Raiwater Harvesting

RainWET: RainWater harvesting Evaluation Tool

- Time Series Rainfall Data
- Rainwater Demand Model
- RWH/SuDS Configuration
- Simulation Module



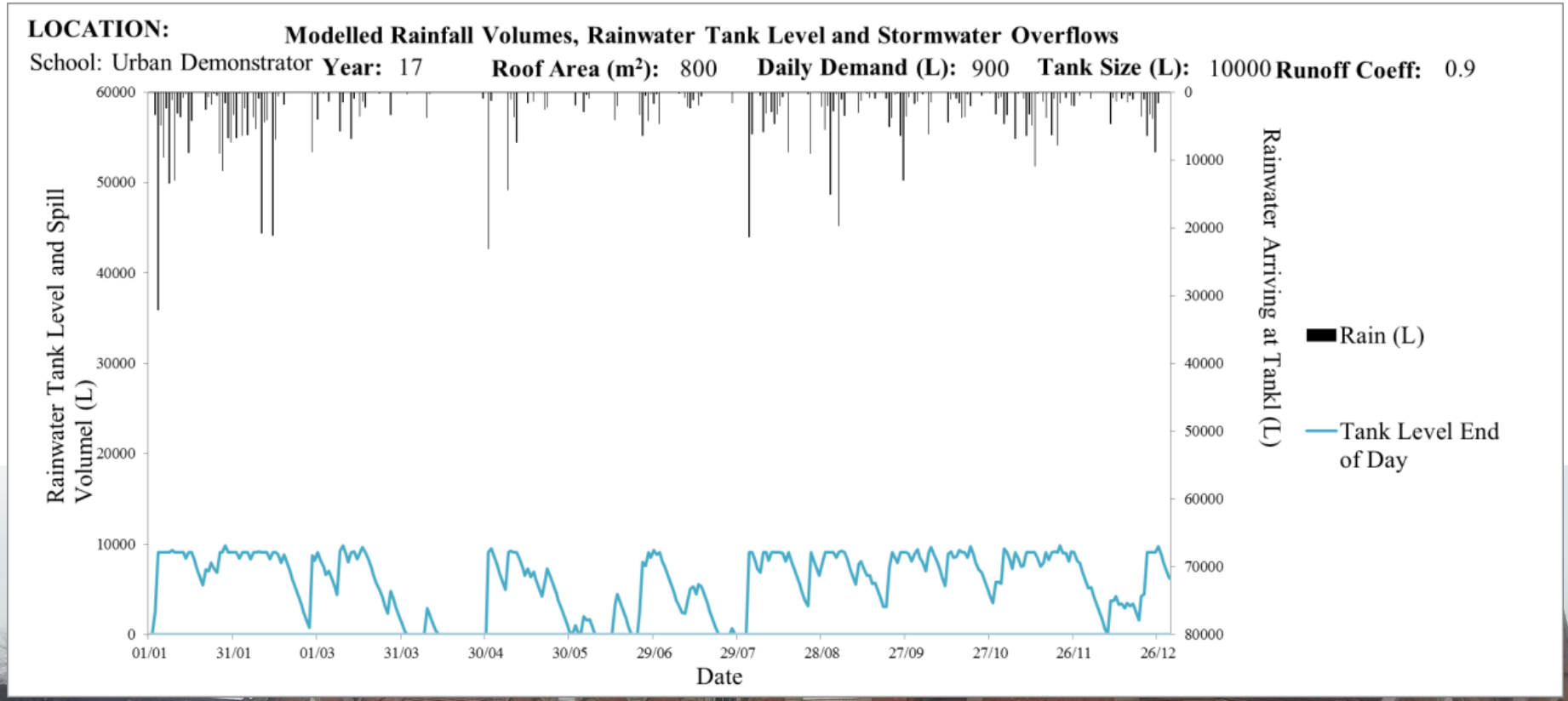


Rainwater Harvesting Evaluation Tool Summary Module

Year	Total Rainfall (mm)	Total Rain (L)	Rain Collected (L)	No. of Raindays	First Flush Volume (L)	Overflow Volume (L)	Potential RW Demand (L)	RW Demand Met (L)	RW Demand Met (%)	Overflow as a proportion of RW Use
1	704	42,225	28,003	188	840	5,184	43,800	31,225	71.3%	0.17
2	727	41,614	29,251	164	820	6,600	43,800	30,219	69.0%	0.22
3	735	43,076	30,128	185	905	5,724	43,800	35,822	81.8%	0.08
4	708	42,150	27,359	178	875	6,638	43,800	30,888	70.5%	0.22
5	760	46,074	31,667	199	895	1,724	43,800	36,104	82.4%	0.05
6	686	41,013	30,903	179	895	1,131	43,800	32,221	73.6%	0.04
7	755	45,324	30,792	182	839	5,601	43,800	32,812	74.9%	0.17
8	695	41,700	27,570	166	810	5,825	43,800	29,902	68.3%	0.20
9	800	48,564	43,708	193	965	6,554	43,800	34,758	79.4%	0.19
10	848	50,868	45,781	185	925	7,598	43,800	36,751	79.3%	0.22
11	773	46,362	41,672	181	905	5,580	43,800	36,661	84.7%	0.09
12	827	50,340	46,305	197	985	4,311	43,800	37,963	86.8%	0.11
13	777	46,620	41,958	186	930	5,255	43,800	36,958	84.9%	0.13
14	850	51,001	45,900	195	905	6,947	43,800	37,903	82.9%	0.16
15	782	48,725	41,186	148	740	15,463	43,800	22,891	52.2%	0.68
16	525	31,470	28,323	168	840		43,800	27,570	62.7%	0.00
17	876	58,548	52,693	206	1,030	12,974	43,800	37,548	85.7%	0.35
18	829	57,734	53,961	163	815	524	43,800	31,889	72.8%	0.02
19	844	57,108	51,575	187	935	11,733	43,800	37,618	85.9%	0.31
20	576	40,234	36,693	159	795	4,823	43,800	30,874	70.5%	0.16
MEDIAN	763.1	45,756.0	41,154.4	183.0	910.0	5874.0	43800.0	33813.2	0.7	0.19
MEAN	758.9	47,502	40,978	179	897	5,967	43,800	32,824	75%	0.19
MAX	975.8	58,548	52,693	206	1,030	15,463	43,800	37,638	86%	0.68
MIN	524.5	31,470	28,323	148	740		43,800	22,891	52%	0.00

RWH system was assumed to have:

Annual Rainwater Demand Satisfied Over 20 year Time-Series (m^3)		
Max	289	88%
Mean	260	79%
Min	201	61%



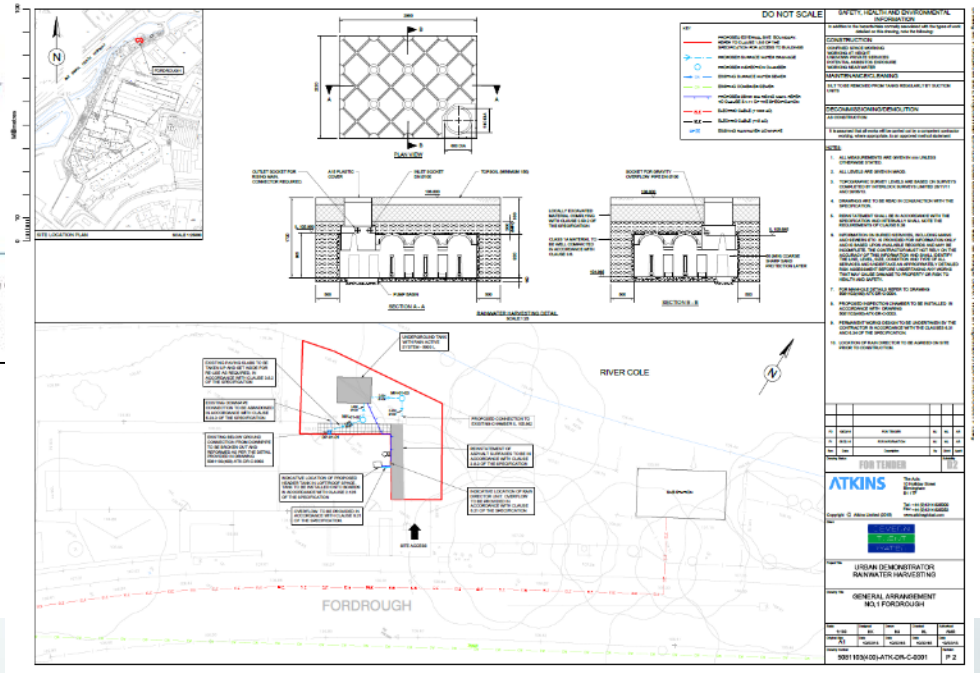
RQ6 Opportunities for Improved Monitoring?

1) Water meter (and logger) at the boiler's hot water outlet to enable total hot water usage to be identified.
2) Water meter (and logger) on urinal cistern inlets to enable urinal demand profiles to be identified.
3) Water meters (and loggers) within one or more bathrooms to enable the ratio between hot and cold taps to be identified.
4) Rain gauge (and logger) to identify the availability of rainwater to satisfy WC demand.
5) Pre vs. Post intervention component survey for each fitting.

What's Next?


RAIN GUTTER
& DRAINPIPE
RainActiv
SuDS Control Valve
Attenuation Capacity Element
Rainwater for
Non-Potable Applications
To Drainage System


BIRMINGHAM URBAN DEMONSTRATOR


DO NOT SCALE
RIVER COLE
FORDROUGH
ATKINS
URBAN DEMONSTRATOR
RAINWATER HARVESTING
GENERAL ARRANGEMENT
NO.1 FORDROUGH

Thanks to all those involved and to you for listening.
Questions?

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