Smart Water Fund

Melbourne Residential Water Use Studies

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City West Water | South East Water | Yarra Valley Water

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Melbourne Residential Water Use Studies

This document is a summary of the results of two major studies in residential water use undertaken by City West Water, South East Water and Yarra Valley Water within metropolitan Melbourne. The first is a sampling survey of water using appliance stock and usage pattern in 2012. The second consists of the measurement of the flow rates of individual end uses to a high resolution for a sample of customers in the winter of 2010 and the summer of 2012.

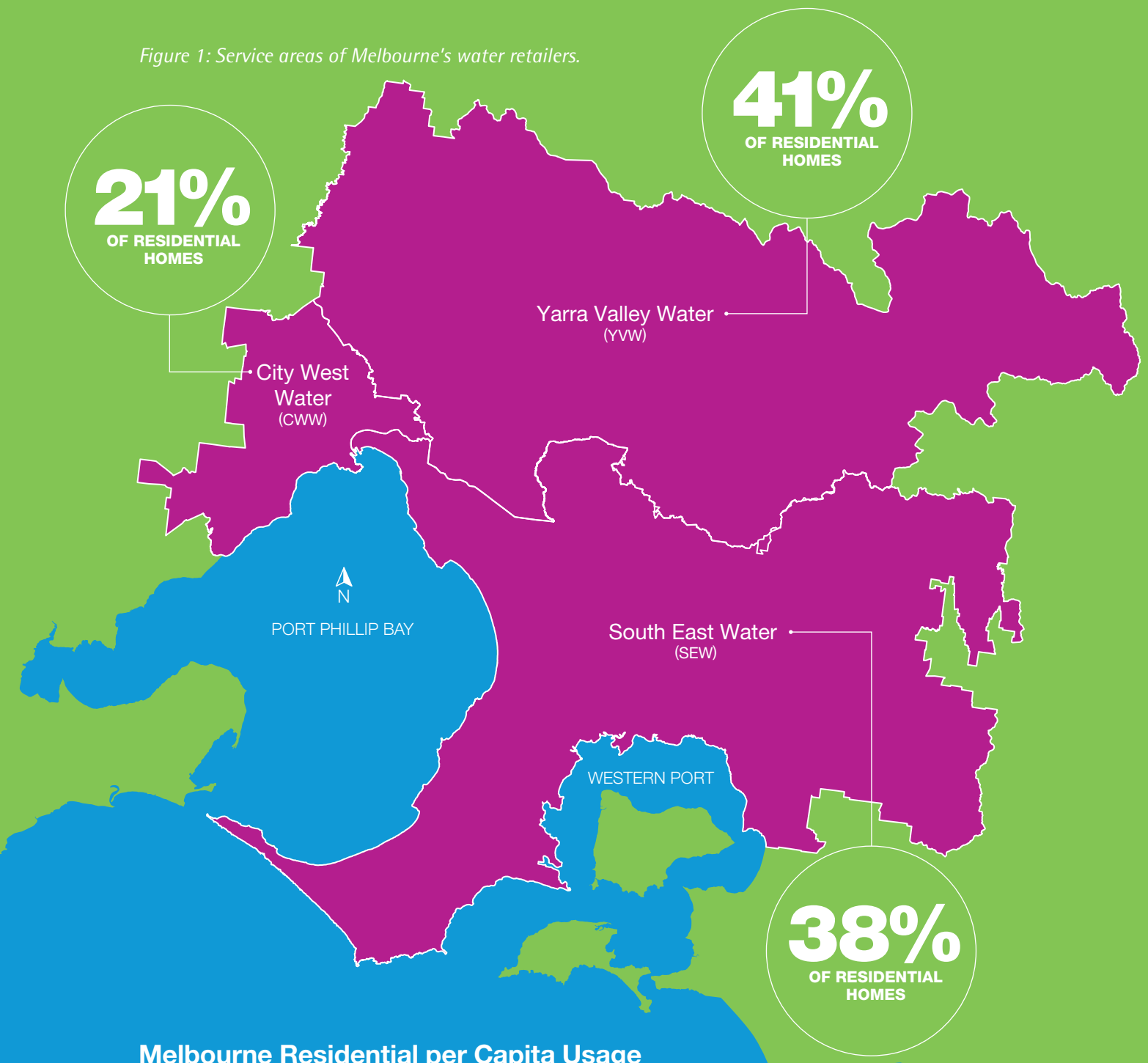
While essentially collecting the same types of data, the two studies are methodologically quite different. The appliance survey relied primarily on self-reports for usage behaviours from large, statistically valid samples. The end use measurement study monitored actual flow rates, timings and frequencies of appliance usage amongst a small sample of customers.

Both studies were undertaken by Melbourne's water retailers for their specific customers and individual reports were published. Following this, the data was pooled and re-analysed and the results consolidated into two metropolitan wide reports. This report is a summary of the key findings of the two metropolitan reports. All these reports are listed in the References section of this document.

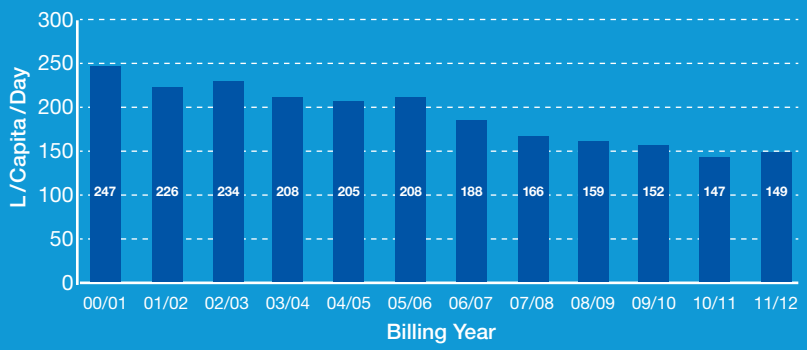
Melbourne's Water Retailers

Melbourne's three water retailers — City West Water (CWW), South East Water (SEW) and Yarra Valley Water (YVW) — purchase bulk water from Melbourne Water for direct sale to customers within their designated licence areas. In 2012, they provide water and sewerage services to around 4.2 million persons in 1.6 million homes and 153,000 businesses. YVW services about 41% of residential homes within metropolitan Melbourne while SEW and CWW services 38% and 21% respectively. Figure 1 shows the licence area for each water retailer.

Figure 1: Service areas of Melbourne's water retailers.

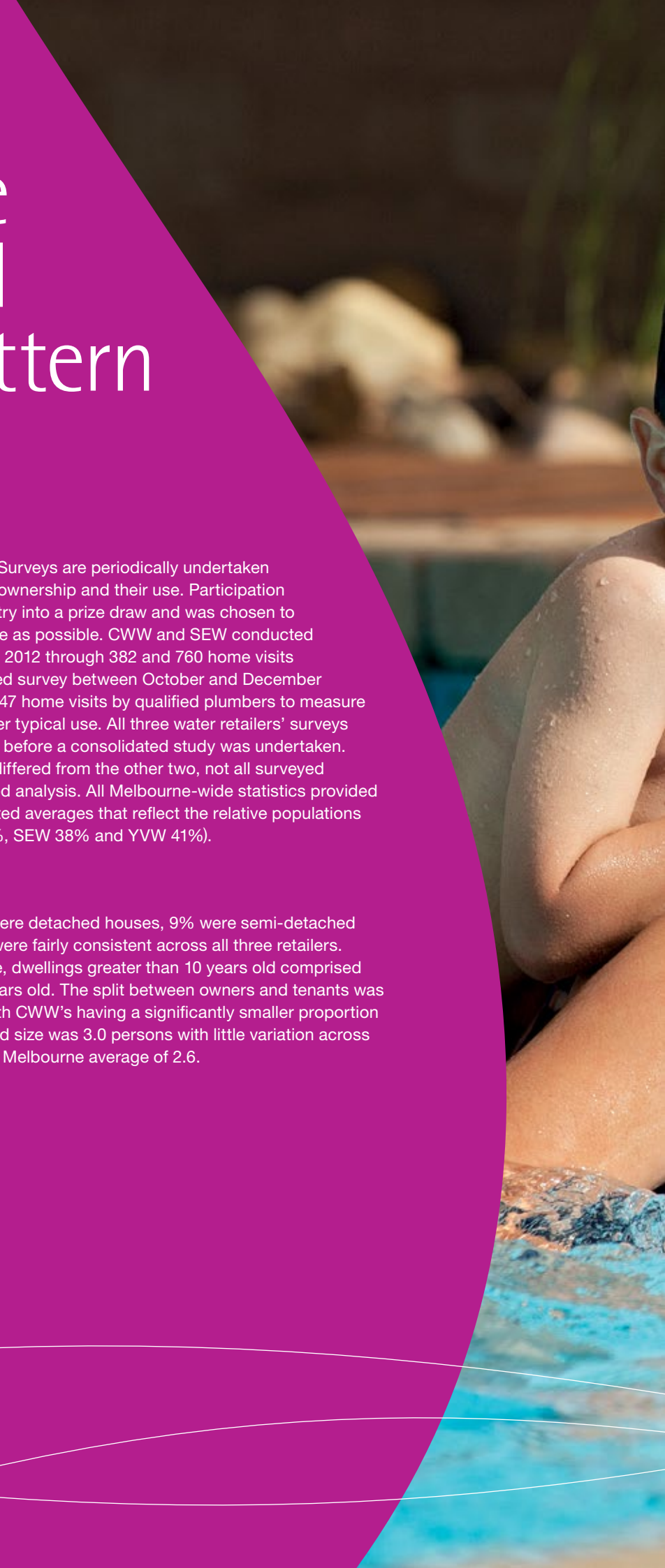


Melbourne Residential per Capita Usage



Melbourne's residential per capita water use has shown a declining trend since 2000/01 against which the seasonal usage in the sample may be compared.

Appliance Stock and Usage Pattern Survey



Introduction

The Appliance Stock and Usage Pattern Surveys are periodically undertaken to gain a picture of household appliance ownership and their use. Participation was incentivised through gift cards or entry into a prize draw and was chosen to be as representative of the customer base as possible. CWW and SEW conducted their surveys between February and April 2012 through 382 and 760 home visits respectively. YVW undertook a web-based survey between October and December 2011 with 1241 participants followed by 247 home visits by qualified plumbers to measure appliance flow rates at capacity and under typical use. All three water retailers' surveys were analysed and published individually before a consolidated study was undertaken. However, because YVW's methodology differed from the other two, not all surveyed characteristics were amenable to a pooled analysis. All Melbourne-wide statistics provided in this document for this study are weighted averages that reflect the relative populations serviced by the three retailers (CWW 21%, SEW 38% and YVW 41%).

Sample Characteristics

Of the pooled Melbourne sample, 77% were detached houses, 9% were semi-detached and 14% were units. These proportions were fairly consistent across all three retailers. For CWW's and SEW's combined sample, dwellings greater than 10 years old comprised 81% while only 9% were less than five years old. The split between owners and tenants was 80% to 20% in the Melbourne sample with CWW's having a significantly smaller proportion of owners. The sample average household size was 3.0 persons with little variation across the three retailers compared to a Greater Melbourne average of 2.6.

AVERAGE
PER CAPITA
CONSUMPTION
2000/01
247
LITRES PER DAY
2011/12
149
LITRES PER DAY

SHOWERS ARE THE SINGLE LARGEST USE OF WATER IN THE WHOLE HOUSE

Overall Water Use

Average daily water use for each household was computed from a quarterly billing period in the summer of 2011/12. The results show a strong linear correlation with the size of the household (Figure 2). The relationship may be accurately represented by the simple linear model:

*Daily Consumption (L) = 93.60 * householdsize + 145.18*

This equation effectively suggests that each new member introduced into the household increases daily water use by 94 litres on average.

Average Household Consumption

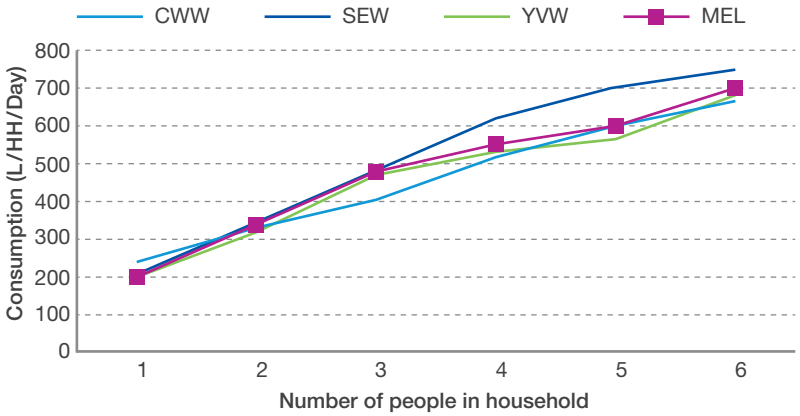


Figure 2: Household average daily water use vs. household size.

On a per capita basis, consumption declines as household size increases (Figure 3) due to more effective sharing of water uses such as clothes washing, dish washing and garden irrigation.

Average Per Capita Consumption

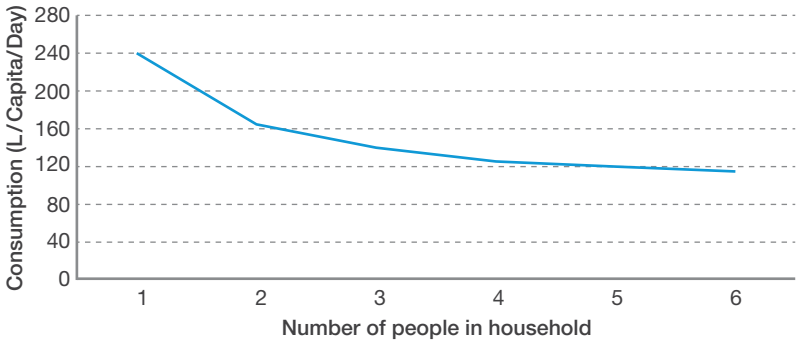


Figure 3: Per capita average daily water use vs. household size.

Showers

The average time spent in the shower for all Melbourne residents was 6.1 minutes with an average frequency of 6.3 times a week. The SEW sample showed a shorter shower duration while the YVW sample reported a lower frequency of showering (Table 1). The capacity flow rates of showerheads were measured on site as well as the "typical" flow rates that residents claimed to use. Overall, 37% of showerheads were found to be efficient i.e. with a capacity flow rate of not more than 8 L/min with CWW having by far the largest proportion compared to the others. Around 80% of those in CWW's and YVW's sample showered in the efficient flow range but only 59% of SEW's sample did so. This result should be treated with caution as the data is dependent on one household member's estimation of all residents' typical flow rates.

Showers	CWW	SEW	YVW	MEL
Mean shower duration (mins)	6.3	5.9	6.3	6.1
Mean weekly use of shower per person	6.4	6.5	6.0	6.3
Capacity flow rates ≤8 L/min (%)	68	36	21	37
Typical flow rates ≤8 L/min (%)	80	59	79	72

Table 1: Shower survey characteristics.

Toilets

There were an average of 1.9 toilets per household, differing slightly across the three water retailers with the great majority (89%) being dual flush (Table 2). Of the dual flush toilets, 60% were either 6/3 or 4.5/3, these being the two most efficient models on the market. CWW's customers appeared to have the highest proportion of efficient toilets and they flushed least often although the large variation in frequency of use across retailers suggests that caution must be exercised with self-reports.

Toilets	CWW	SEW	YVW	MEL
Average number of toilets per home	2.1	1.8	2.0	1.9
Dual flush toilets (%)	93	93	84	89
6/3 or 4.5/3 Dual flush toilets(%)	71	61	53	60
Average flushes per person per day	2.2	3.0	4.2	3.3

Table 2: Toilet survey characteristics.

89% OF ALL TOILETS ARE NOW LIKELY TO BE DUAL FLUSH

Laundry

Nearly all (99%) of Melbourne's households had washing machines, with slightly more top (55%) than front loaders except for SEW with its higher proportion (58%) of top loaders (Table 3). On average, Melbournians did 4.6 loads of washing per week and this was consistent across the whole region. The relationship between the number of washes and household size can be accurately modelled using the following linear equation:

*Number Weekly Loads = 1.13 * household size + 1.21*

Around half of customers used the auto setting for their machines with cold washes preferred for two-thirds to three-quarters of customers. SEW had the least efficient washing machines with only 28% being 4-star or above compared to YVW's 41% but the water star rating could not be found for around half the machines. All three water retailers had quite different average capacity flow rates from their customers' laundry trough tap, varying from 10.7 L/min at CWW to 19.6 L/min for YVW. Around two-thirds of homes did no hand washing of laundry.

ABOUT HALF OF ALL HOUSEHOLDS HAVE A FRONT LOADING WASHING MACHINE

Laundry	CWW	SEW	YVW	MEL
Top loaders (%)	55	58	51	55
Average loads per week	4.6	4.6	4.6	4.6
Uses Auto setting (%)	53	51	46	49
Wash in cold water (%)	66	67	73	69
4-Star or better machines (%)	39	28	41	36
Average capacity flow rate of laundry tap (L/min)	10.7	16.4	19.6	16.5
Do not hand wash (%)	61	67	63	64

Table 3: Laundry survey characteristics.

Bath

Eighty-nine percent of homes in the Melbourne sample indicated that they had bathtubs installed with CWW having the highest proportion (Table 4). On average (including those homes that don't have baths), residents in CWW's and SEW's area have 1.5 baths per week). Of homes that have baths, their residents average 3.4 baths each week. The average fill of the bath for the majority of these children (59%) was one quarter full.

Baths	CWW	SEW	YVW	MEL
Homes with bath (%)	97	91	82	89
Proportion of children's bath ¼ full	58	59	NA	59

Table 4: Bath survey characteristics.

Kitchen

Hand washing of dishes was a popular choice, taking place around seven times a week on average (Table 5). YVW customers were less likely to plug the sink when doing so. The average tap flow rate at capacity was significantly higher in SEW homes than in CWW's. Only around half of CWW's customers owned a dishwasher compared to nearly three-quarters for YVW's. Around 80% of Melbourne's dishwashers had a WELS rating of less than 4-star. These machines tended to be used around four times per week across Melbourne but the average increased with the number of persons in the household in accordance with the following equation:

$$Dishwasher\ Uses\ per\ Week = 2.05 * household\ size^{0.58}$$

Dishwashing	CWW	SEW	YVW	MEL
Average number of times per week hand wash	7.3	7.2	6.6	7.0
Use plug in sink (%)	74	77	60	69
Average capacity tap flow (L/min)	9.5	13.7	NA	12.3
Dishwasher ownership (%)	53	69	73	67
Dishwashers 4 water stars or above (%)	17	14	24	19
Average number of times dishwashers used per week	3.7	4.0	3.9	3.9

Table 5: Dishwashing survey characteristics.

HANDWASHING OF DISHES WAS A POPULAR CHOICE

Hand Basin

Ninety-one percent of Melbourne homes had either one or two hand basins, the remainder had more than two, although YVW's customers exhibited a different distribution (Table 6). The average flow rate when using a hand basin was 6.4 L/min across Melbourne with some variation across retailers.

Basin Use	CWW	SEW	YVW	MEL
Have one hand basin (%)	53	54	78	64
Have two hand basins (%)	30	32	20	27
Average typical flow rate (L/min)	6.4	7.4	5.4	6.4

Table 6: Hand basin survey characteristics.

THREE QUARTERS OF HOUSEHOLDS HAVE AN AIR CONDITIONER

Air Conditioners

The majority of the Melbourne sample (76%) reported owning an air conditioner (Table 7). The type of air conditioner was investigated by only CWW and SEW. About one-third were of the evaporative type with most of the rest being reverse cycle. Only a small percentage of air conditioners were run for more than eight hours a day with CWW customers tending to run them the least amount of time.

Air Conditioner	CWW	SEW	YVW	MEL
Have air conditioner (%)	66	76	80	76
Evaporative air (%)	32	29	NA	30
Reverse cycle (%)	49	59	NA	56
Refrigerative (%)	19	12	NA	14
Runs <4 hours per day (%)	45	38	39	40
Runs 4 to 8 hours per day (%)	38	38	46	41

Table 7: Air conditioners survey characteristics.

Outdoor Water Use

A high proportion (82%) of homes in CWW and SEW had gardens (Table 8). The traditional garden was most common overall (35%) although the interpretation of this term may vary as it was not defined in the questions. Only around 15% reported having a native or water conserving garden. In both these water retailer areas, 95% of the sample reported having a vegetable patch. Significantly more homes in SEW's area had lawns compared to CWW's.

Because of the different structuring of questions, data on garden watering were analysed separately for CWW/SEW and YVW. In CWW and SEW areas, customers watered on average once a week during Stage 3a restrictions which prevailed at the time the surveys were conducted. When asked how often they would water if restrictions were to be lifted, CWW customers increased their expectation to 1.4 times per week in contrast to SEW's minimal increase to 1.2.

Garden Use	CWW	SEW	YVW	MEL
Have a garden (%)	74	86	NA	82
Have vegetable patch (%)	95	95	NA	95
Have lawn (%)	55	75	NA	68
Average number of watering per week in 3a restrictions	1.0	1.1	NA	1.0
Average number of watering per week with no restrictions (intention)	1.4	1.2	NA	1.3

Table 8: Outdoor water use survey characteristics.

YVW's customers were asked how often they would water in an unrestricted summer. The most common response was 3 times per week (31%) followed by twice per week (24%). The average lies at 3.4 times a week.

The hose was the most popular watering device for gardens for all three water retailers' customers with 60% in CWW and 56% in SEW reporting that they used it all or part of the time. Of YVW's sample, 59% reported using a hose. The bucket was the next most popular watering device, favoured by 23% in YVW's area. In CWW's and SEW's area, 17% and 31% respectively reported bucketing all or part of the time.

Overall, across CWW and SEW, most respondents watered their garden for 15 minutes or less (78%) with only 22% of these households watering for 30 minutes or more. YVW's customers followed similar patterns with 40% watering for 10 minutes or less and 27% falling into the 11–20 minutes category. Only 15% of residents in YVW watered for more than 30 minutes each session.

Rainwater Tanks

Rainwater tanks were well spread around Melbourne with 28% of households having one on their property with the drier CWW service area being somewhat less at 22% (Table 9). There was a fairly even distribution in tank sizes up to 5000 litres with only 6% being 20,000 litres or bigger.

Rainwater Tanks	CWW	SEW	YVW	MEL
Tank installed (%)	22	30	30	28
≤1000 L (%)	32	19	19	22
>1000 to ≤2000 L (%)	25	22	16	20
>2000 to ≤3000 L (%)	22	22	19	21
>3000 to ≤5000 L (%)	12	25	24	22
>5000 L (%)	9	13	23	16

Table 9: Rainwater tanks survey characteristics.

NEARLY ONE THIRD OF ALL HOUSEHOLDS HAVE A RAINWATER TANK

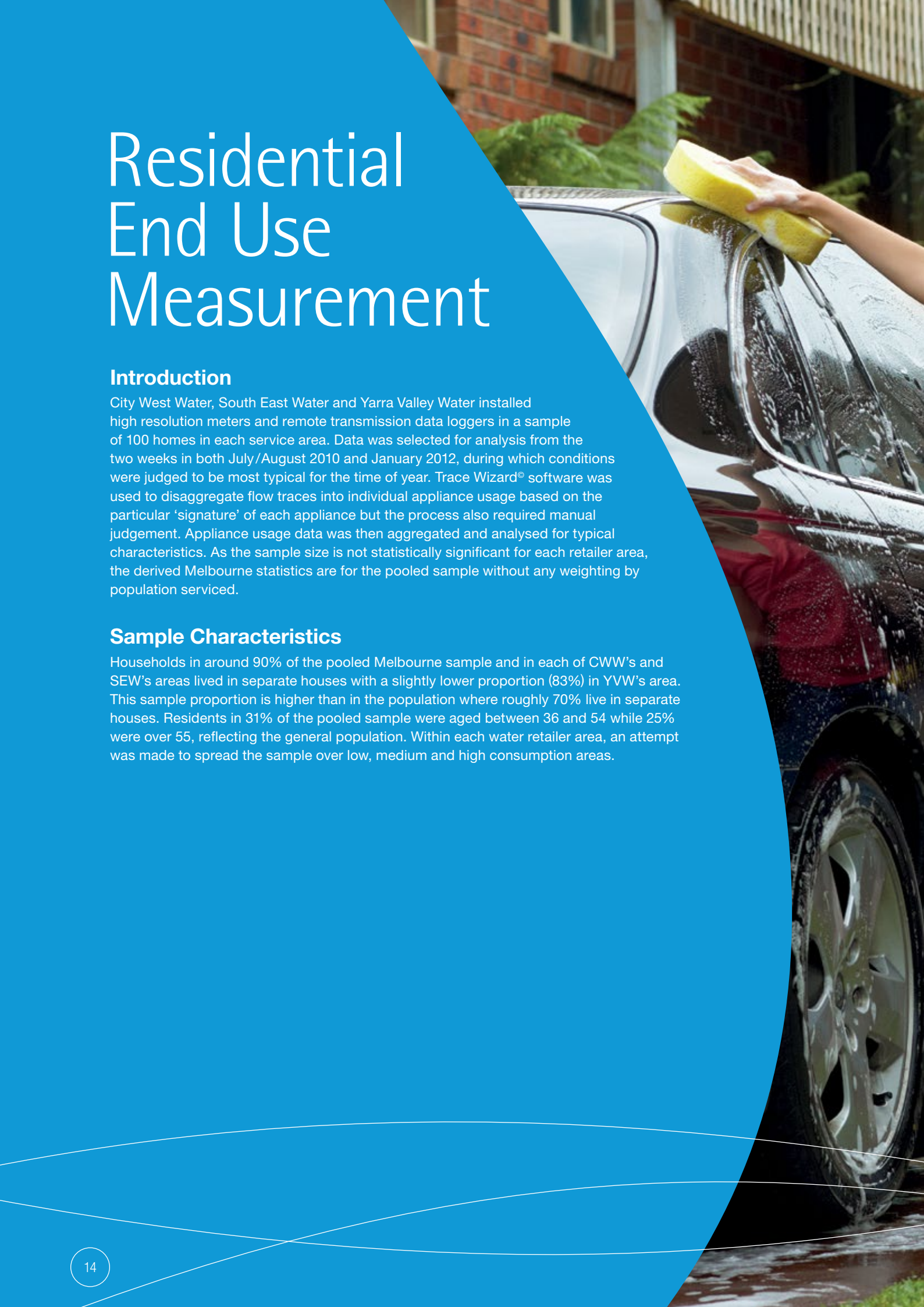
Swimming Pools

Only 8% of Melbourne homes were equipped with pools with a slightly smaller proportion in CWW's area and slightly larger in SEW's. YVW's customers appeared to be most likely to top up their pools using rainwater and CWW's the least.

Swimming Pools	CWW	SEW	YVW	MEL
Pool ownership (%)	5	10	8	8
Top up with potable water (%)	65	53	19	41
Top up with rainwater (%)	12	37	47	36
Top up with both (%)	24	10	34	23

Table 10: Swimming pool survey characteristics.

Residential End Use Measurement



Introduction

City West Water, South East Water and Yarra Valley Water installed high resolution meters and remote transmission data loggers in a sample of 100 homes in each service area. Data was selected for analysis from the two weeks in both July/August 2010 and January 2012, during which conditions were judged to be most typical for the time of year. Trace Wizard© software was used to disaggregate flow traces into individual appliance usage based on the particular 'signature' of each appliance but the process also required manual judgement. Appliance usage data was then aggregated and analysed for typical characteristics. As the sample size is not statistically significant for each retailer area, the derived Melbourne statistics are for the pooled sample without any weighting by population serviced.

Sample Characteristics

Households in around 90% of the pooled Melbourne sample and in each of CWW's and SEW's areas lived in separate houses with a slightly lower proportion (83%) in YVW's area. This sample proportion is higher than in the population where roughly 70% live in separate houses. Residents in 31% of the pooled sample were aged between 36 and 54 while 25% were over 55, reflecting the general population. Within each water retailer area, an attempt was made to spread the sample over low, medium and high consumption areas.

AVERAGE HOUSEHOLD CONSUMPTION
WINTER
352
LITRES PER DAY
SUMMER
442
LITRES PER DAY

Overall Water Use

The analysis generated a volumetric breakdown of household water use averaged across the sample. These are shown in Figure 4 and Figure 5 for summer and winter respectively. In both seasons, the largest proportion of water use was for showers. The small differences between retailers are not statistically significant. For the Melbourne sample, average household consumption was 442 litres per day in summer and 352 in winter. This works out to 145 litres per person per day in summer and 114 in winter. Figure 6 shows the volumes of daily per capita end uses for combined summer and winter analysis periods. On average, 36 litres per person per day was used for showers while roughly similar volumes (19 to 21 litres per person per day) were used for taps, toilets, clothes washers and irrigation.

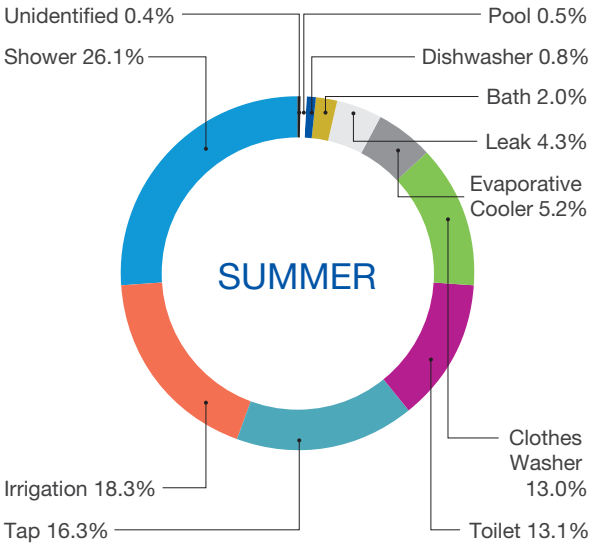


Figure 4: End use percentage shares by volume in summer.

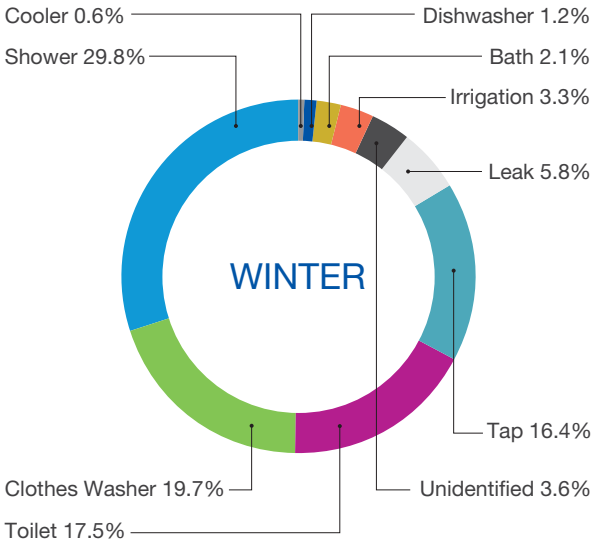


Figure 5: End use percentage shares by volume in winter.

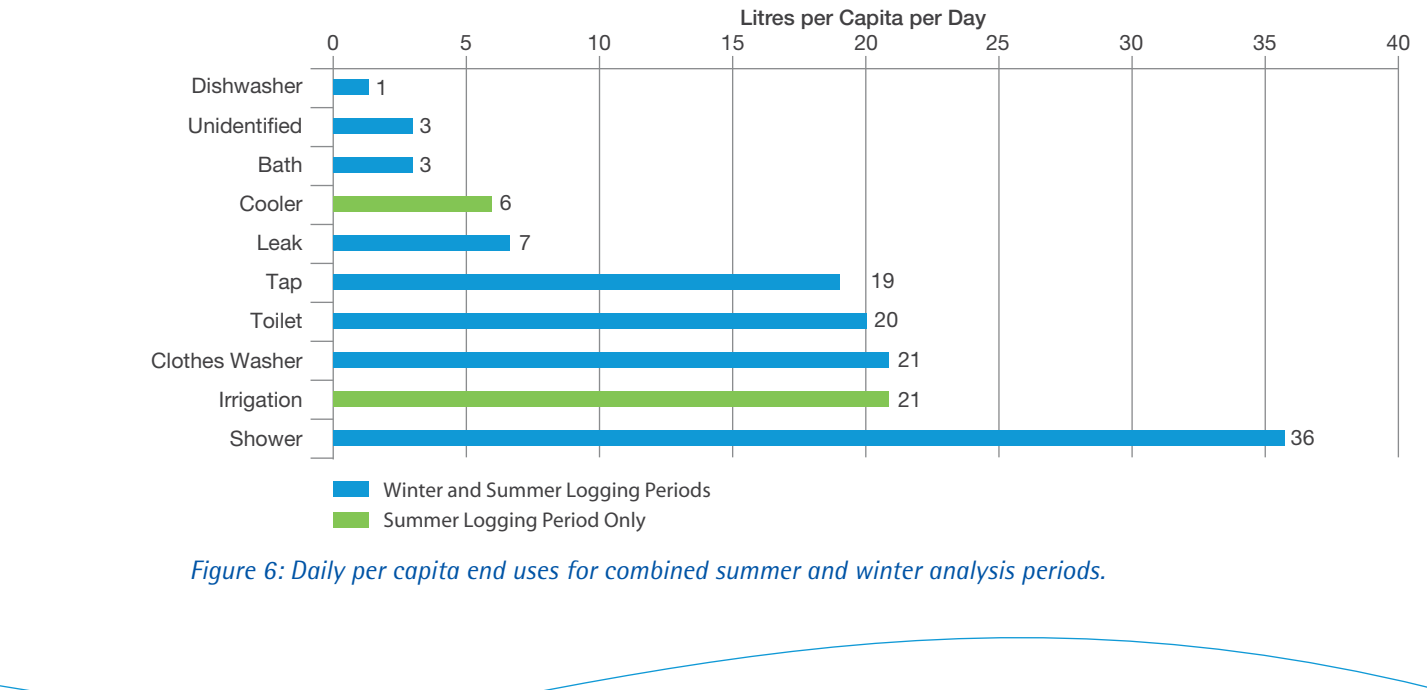


Figure 6: Daily per capita end uses for combined summer and winter analysis periods.

Showers

Showers formed the most significant indoor water use. Over Melbourne, the average shower duration was 6.4 minutes in summer and 6.8 minutes in winter with a distribution skewed towards the low end in both seasons, when 95% of showers lasted 14 minutes or less (Table 11). The average showering frequency was 0.9 times per person per day in summer, decreasing to 0.7 in winter. Hence, there was a tendency towards longer but less frequent showers in winter but of persons taking two or more showers per day was relatively small in either season. The mean flow rate was slightly greater than 7 L/min with 90% showering at 12 L/min or less. This compares with an average capacity flow rate of 10.6 L/min for all showerheads, so showers were typically run at around two thirds of their capacity flow rate.

Showers	CWW	SEW	YVW	MEL
Average duration – summer (mins)	6.0	6.8	6.5	6.4
Average duration – winter (mins)	6.7	6.6	7.1	6.8
Average frequency – summer (per person per day)	1.0	1.0	0.7	0.9
Average frequency – winter (per person per day)	0.7	0.7	0.7	0.7
Average flow rate – summer (L/min)	7.1	7.2	7.3	7.2
Average flow rate – winter (L/min)	7.3	6.8	7.2	7.1

Table 11: Shower measurement characteristics.

MOST PEOPLE SHOWER FOR 6.5 MINUTES

Toilets

Toilet use consistently ranked in the top three indoor end uses by volume across both seasons. For the metropolitan region, the average flush volume was recorded at 5.8 litres per flush in summer and 6.0 litres per flush in winter (Table 12). The slightly higher result in winter was due to an unusually high 6.4 L average flush volume logged by CWW, apart from which there was little seasonal variation.

The average full and half flush volumes for both seasons were 7.3 and 4.7 litres respectively for the metropolitan region. Frequency of toilet use were fairly constant in both seasons, with Melbourne wide figures of just less than four uses per person per day. Half flushes were found to be more common in the summer period, with an almost equal split in the winter.

Toilets	CWW	SEW	YVW	MEL
Average flush volume – summer (L)	5.7	5.9	5.6	5.8
Average flush volume – winter (L)	6.4	5.8	5.7	6.0
Average frequency – summer (per person per day)	3.5	4.3	3.8	3.9
Average frequency – winter (per person per day)	3.4	4.1	3.9	3.8
Proportion half : full flush – summer	0.60 : 0.40			
Proportion half : full flush – winter	0.52 : 0.48			

Table 12: Toilet measurement characteristics

Clothes Washers

The clothes washer accounted for the second largest end use. In summer, the average volume used per load was 85 litres, somewhat less than the winter figure of 96 litres with some variation across retailers (Table 13). These figures may be dissociated into front and top loading machine cycles with winter averages of 54 and 130 litres respectively. For the summer, the equivalent values are 51 and 117 litres, with a significantly higher number of low volume cycles. In both seasons, the number of loads per week was 4.9 at the metropolitan level, however, more variation was observed in the winter data set with a range from 4.2 to 5.3 loads per week. Approximately 66% of homes did five or fewer loads per week in either season.

Clothes Washers	CWW	SEW	YVW	MEL
Average volume per cycle – summer (L)	78	85	93	85
Average volume per cycle – winter (L)	94	88	108	96
Average frequency – summer (loads per week)	4.8	5.0	4.8	4.9
Average frequency – winter (loads per week)	5.0	5.3	4.2	4.9
Loading Types	**Front**		**Top**	
Average volume per cycle – summer (L)	51		117	
Average volume per cycle – winter (L)	54		130	

Table 13: Clothes washer measurement characteristics

DISHWASHERS ONLY ACCOUNT FOR JUST OVER 1% OF TOTAL WATER USE

Bath

The bath accounted for only about 2% of total water use on average. Baths during the summer were generally larger in volume and slightly more frequent, with the average volume being 21% higher than in winter due to some extremely large volume events over 500 litres (Table 14). There was considerable variation in volumes across retailers and seasons which could be due to the discretion in identifying bath events using Trace Wizard©. Roughly 70% of baths were less than 120 litres in volume. Baths were seen to occur most frequently in the SEW sample and least frequently in the CWW sample. In households with children under 10 years of age, there was a slight increase in the frequency of baths.

Baths	CWW	SEW	YVW	MEL
Average volume – summer (L)	252.0	184.6	70.5	142.6
Average volume – winter (L)	82.3	140.3	126.1	117.6
Average frequency – summer (times per week)	1.4	3.9	2.4	2.8
Average frequency – winter (times per week)	1.9	2.3	2.1	2.1

Table 14: Bath measurement characteristics

Dishwashers

Dishwashing comprised the smallest indoor water use, representing no more than 1.2% of total water use. There was a slightly lower average volume per load recorded in summer, possibly due to the selection of more intensive cycles that would be required to wash off greasier food residues associated with winter cooking. Over the summer logging period, 60% of loads were less than 15 litres, while less than 50% were below this volume in winter. Homes in the YVW region used the dishwasher consistently in both seasons, whilst CWW and SEW tended to do slightly more loads in summer. In either season, just over 50% of households with dishwashers used them 3 times a week or less.

Dishwashers	CWW	SEW	YVW	MEL
Average volume per cycle – summer (L)	13.9	15.0	14.4	14.4
Average volume per cycle – winter (L)	15.2	14.8	17.0	15.7
Average frequency – summer (times per week)	3.2	3.3	3.4	3.3
Average frequency – winter (times per week)	2.9	3.0	3.4	3.1

Table 15: Dishwasher measurement characteristics

Tap Use

The design of the study did not allow discrimination regarding particular areas of the house where taps were used. Tap flow was characterised by high frequency and low volume and was the fourth highest indoor use. Usage was slightly more frequent in summer and at 25% greater volume per event compared to winter (Table 16). Taps were left running 44% longer in summer, with an average duration of 26 seconds. Approximately half of the summer events had a flow rate of 2 L/min or less against 40% in winter. A flow rate of around 3 L/min was fairly constant across retailers and seasons except for the unusually low YVW summer rate of 2.2 L/min. This depressed the average metropolitan summer flow rate to 2.6 litres per minute.

Taps	CWW	SEW	YVW	MEL
Average duration – summer (sec)	30.2	27.8	22.3	26.2
Average duration – winter (sec)	17.0	19.2	18.4	18.2
Average flow rate – summer (L/min)	3.1	2.8	2.2	2.6
Average flow rate – winter (L/min)	2.9	2.9	3.2	3.0
Average volume per use – summer (L)	1.5			
Average volume per use – winter (L)	1.2			
Average frequency – summer (per person per day)	20.5			
Average frequency – winter (per person per day)	18.9			

Table 16: Tap measurement characteristics

WE USE AN AVERAGE OF 1.3 LITRES EVERY TIME WE USE A TAP

Leaks and Drips

Accounting for up to 6% of total use, leaks generally occurred both randomly and over short intervals, with the majority of the volume from relatively few households. In the sample, 39 homes were responsible for 80% of leaks by volume (Figure 4). Ninety percent of all leak events result in water loss of no more than 11% of total household water use. The largest volume of water was lost by leaks lasting less than 5 seconds, with volumes diminishing over larger durations. There was a slight correlation found between average daily volume of leaks and the number of persons living in the household.

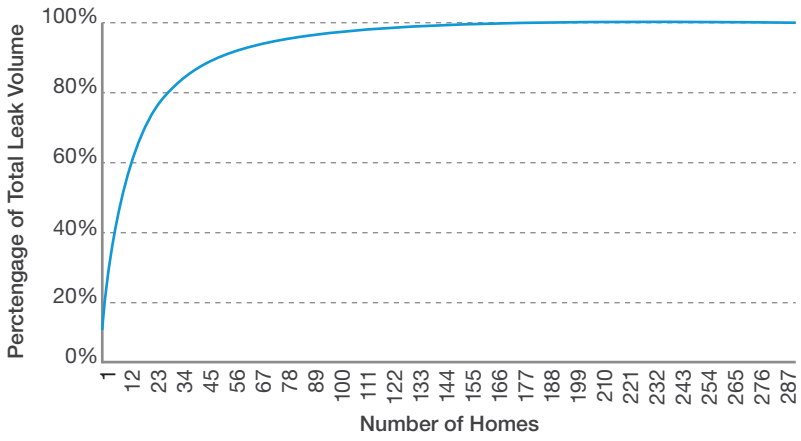


Figure 7: Cumulative distribution of leak volume as a percentage of total leak volume

A SMALL NUMBER OF HOMES ACCOUNT FOR MOST LEAKS, AND A SURPRISING AMOUNT OF WATER

Evaporative Cooler

Evaporative cooler use was logged by 28% of the metropolitan sample over the summer period analysed, which was warmer than average. Of homes that used their evaporative coolers, usage was recorded on average around four days per week with CWW below and SEW above this figure (Table 17). Around 18% of homes used their coolers seven days a week. For the pooled Melbourne sample, the average duration of use was 3.8 hours per day but this varied greatly across retailers with CWW homes recording only 1.1 hours per day. SEW customers appeared to have the most efficient coolers, using only 13.4 litres per operational hour compared to the 25.3 litres used by CWW customers. As expected, there was a clear correlation between evaporative cooler use and the maximum day temperature.

Evaporative Coolers	CWW	SEW	YVW	MEL
Average frequency of use (days per week)	3.4	4.4	4.2	4.1
Average duration (hours per day)	1.1	3.4	5.1	3.8
Average volume (L per operational hour)	25.3	13.4	18.1	17.1

Table 17: Evaporative coolers measurement characteristics

ON AVERAGE WE WATER OUR GARDENS TWICE A WEEK IN SUMMER

Irrigation

Over the summer period analysed, stage 1 water restrictions were in place. The average daily maximum temperature was 28.7°C and there was no rain, compared to a long term January average of 25.9°C. A total of 204 out of 243 (84%) households irrigated at least once during the two-week summer period. It must be appreciated that almost half of homes monitored had rainwater tanks installed. Of those households that irrigated 44% used up to 10% of their total water use on the garden.

Daily irrigation volumes varied over a very wide range across retailers to give a Melbourne average of 334 litres per day, with standard deviations roughly twice the mean value in most cases. The overall average flow rate was 6.3 L/min but was considerably higher for the YVW sample (9.9 L/min). Time spent irrigating was highly variable with YVW customers spending on average only 20 minutes compared to SEW's 101 minutes. This could be a reflection of the predominately clay soils in YVW's area and sandy soils in SEW's area. The distribution, is however, highly skewed towards shorter events. Fifty-five percent of events were 20 minutes or less. On average, irrigation occurred twice a week over Melbourne with only a quarter of homes irrigating more than two days a week.

Irrigation	CWW	SEW	YVW	MEL
Average volume (L per day)	439	379	208	334
Average flow rate (L per min)	6.0	5.1	9.9	6.3
Average duration (mins per day)	68	101	20	61
Frequency (days per week)	1.9	1.8	2.3	2.0

Table 18: Irrigation measurement characteristics

Comparison Between Survey and Measurement

Many similarities can be found when comparing the results from both studies. There was a tendency to slightly underestimate the frequency and duration of use at the appliance level in the surveys (Table 19) but the margin was mostly not large.

The frequency of showers was consistent in both reports (0.9 per person per day), implying that people honestly report their showering habits. The average duration of shower reported by participants in the surveys (6.2 minutes) was only slightly lower than that found by measurement (6.4 minutes). The average of flow rates that survey respondents claimed to shower at was appreciably below the average measured; for instance, YVW's surveyed flow rate of 5.9 L/min was 18% lower than the measured average of 7.2 L/min). However the proportion of those showering at or below the efficient benchmark of 8 L/min was almost identical from both data sets (68% for survey vs. 69% for measurement).

The frequency of clothes washer use was measured at slightly more than reported in surveys but the reverse was true for dishwasher use. The frequency of toilet use was underestimated by survey respondents by nearly one flush per person per day as was bath use to the same extent. This could be an effect of survey respondents wishing to give an impression of water efficiency during the drought.

The average tap flow rate in the measured data was found to be 2.8 L/min across all taps, which is far less than even the 6.9 L/min reported in the survey for hand basins, let alone for the laundry and kitchen taps. The discrepancy is hard to explain.

Examining homes that have gardens, respondents reported practically the same frequency of irrigation (1.3 times per week) as that measured (1.4). Self-reporting produced mean watering times very considerably less than that the measured average, but the measurement was skewed by a relatively small number of large events. The proportion irrigating for less than or equal to 45 mins was a good match between the two studies.

Appliance Use	Measurement	Survey
Shower frequency (per person per day)	0.9	0.9
Average shower duration (mins)	6.4	6.2
Average shower flow, YVW (litres per min)	7.2	5.9
Shower flow (% < 8 litres per min)	69%	68%
Average clothes washer use frequency (per week)	4.9	4.6
Average dishwasher use frequency (per week)	3.3	3.9
Average toilet use frequency (per person per day)	3.9	3.1
Average bath use frequency (total per week)	2.4	1.5
Average tap flow rate (L/min)	2.8 (all taps)	6.9 (hand basins)
Average irrigation frequency (times per week)	1.4	1.3
Average irrigation duration (mins) *	61	20.7 (CWW and SEW) 7.0 (YVW)
Irrigation duration (% < 45 mins) *	85%	82% (CWW and SEW) 85% (YVW)

Table 19: Comparison of measurement and survey results

** Survey results from City West and South East Water could not be combined with Yarra Valley Water due to the style of questions asked.*

Concluding Remarks

Surveys of appliance stock and usage behaviours can provide useful data that are statistically valid. Some basic parameters such as frequency of appliance use are reported with a fair degree of accuracy but end use measurements are required to elucidate flow rates. These are technically complex and it is often too costly to implement sample sizes that are statistically significant. However, they can still provide useful data for water planning, research and education.

Further information regarding the content of this document may be found in the full metropolitan reports for appliance stock survey and end use measurements as well as the individual water retailer reports for these studies. These are cited in the References section of this document.

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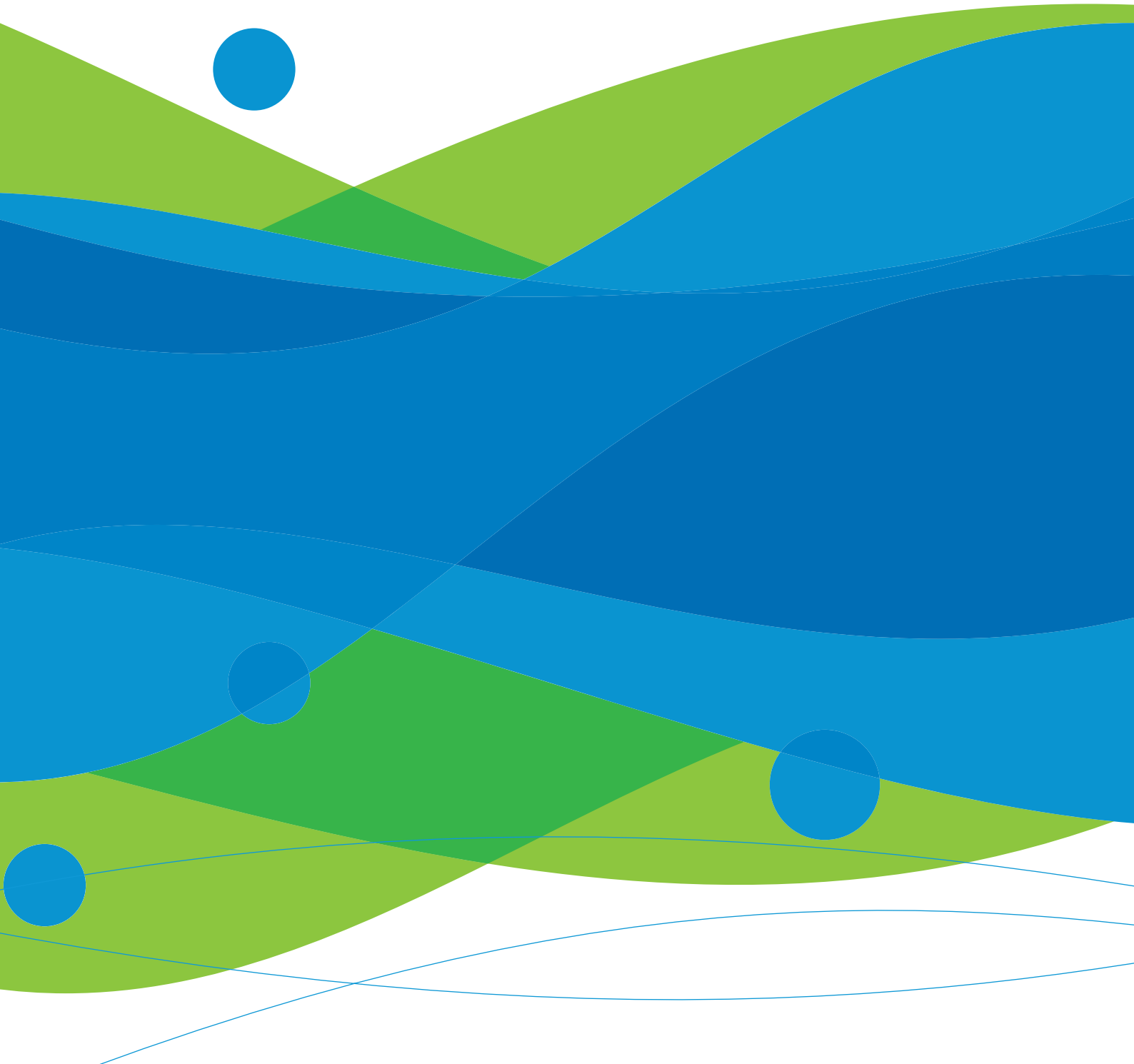
City West Water | South East Water | Yarra Valley Water