

Urban Water Security Research Alliance



SEQ End Use Study: Closing the Loop on Urban Water Planning and Management

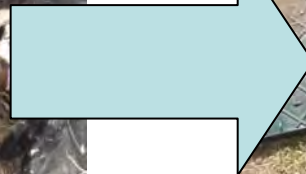
Dr. Rodney Stewart
SEQ Residential End Use Study

17 August 2009



Water End Use Analysis Overview

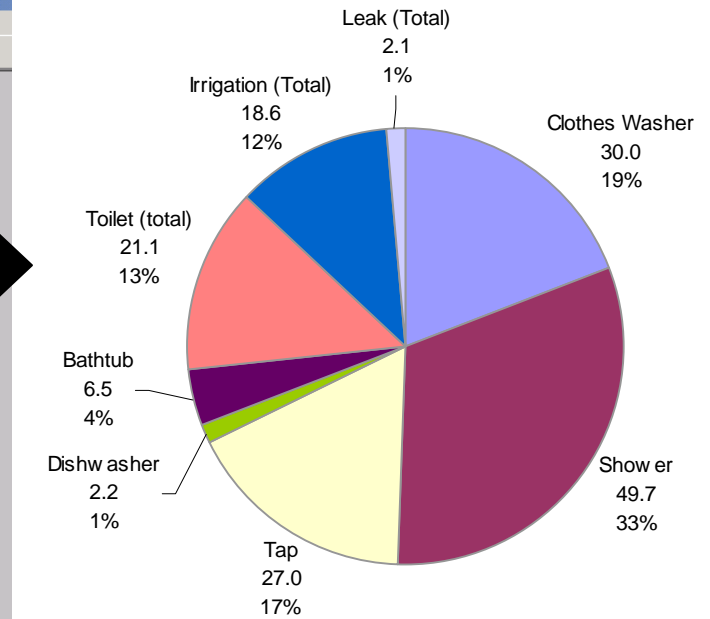
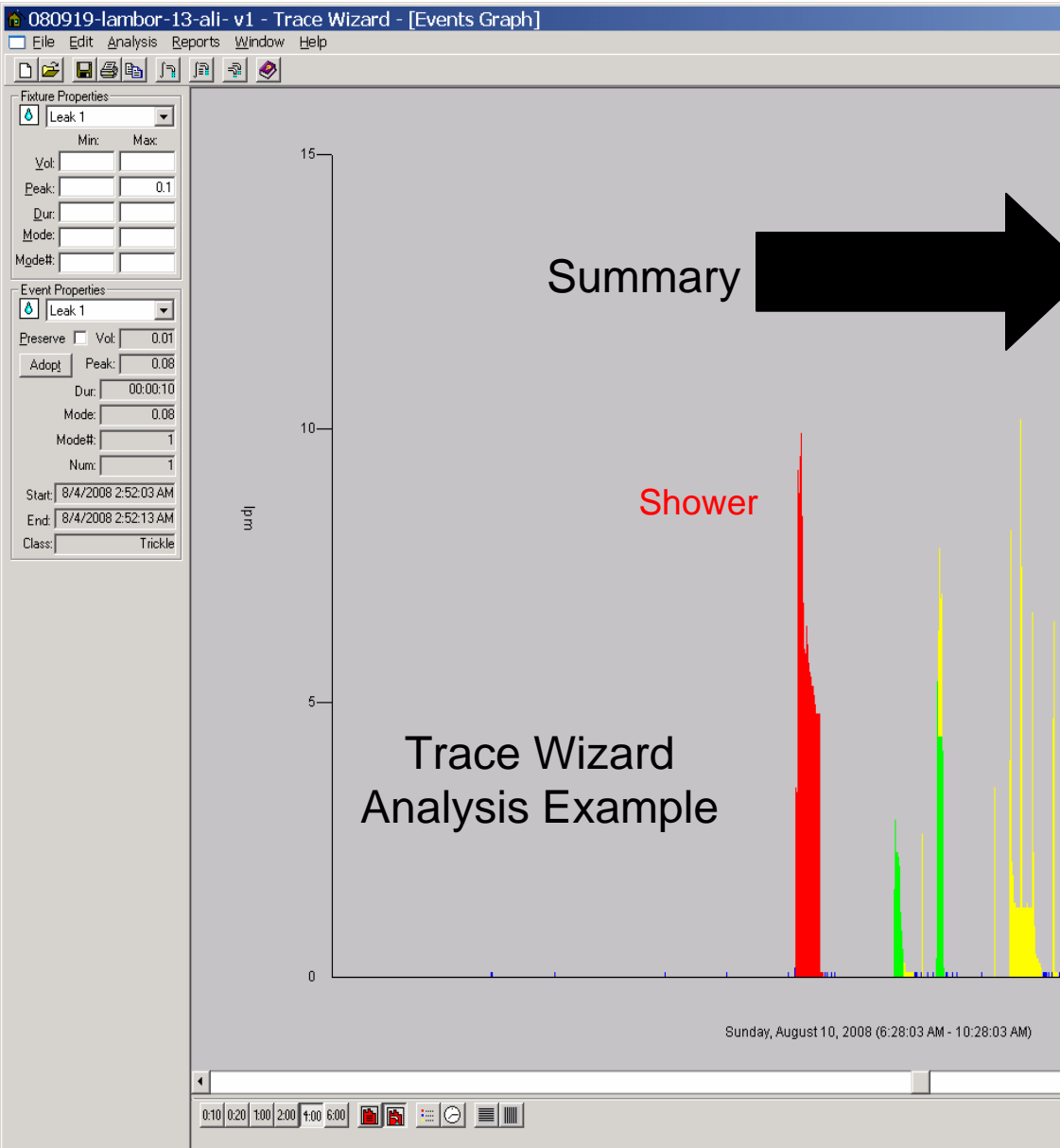
- What is water end use analysis?



Meter Replacement to specially modified water meters:
Actaris CTS-5 Modified Water Meters (72 pulses/litre)
and Aegis Data Cell D/R/RTx-CZ21020 Loggers

Data download to computer or mobile GPRS
Gold Coast Wired (D) – **SEQ - Wireless (RTx)**

Water End Use Analysis Overview



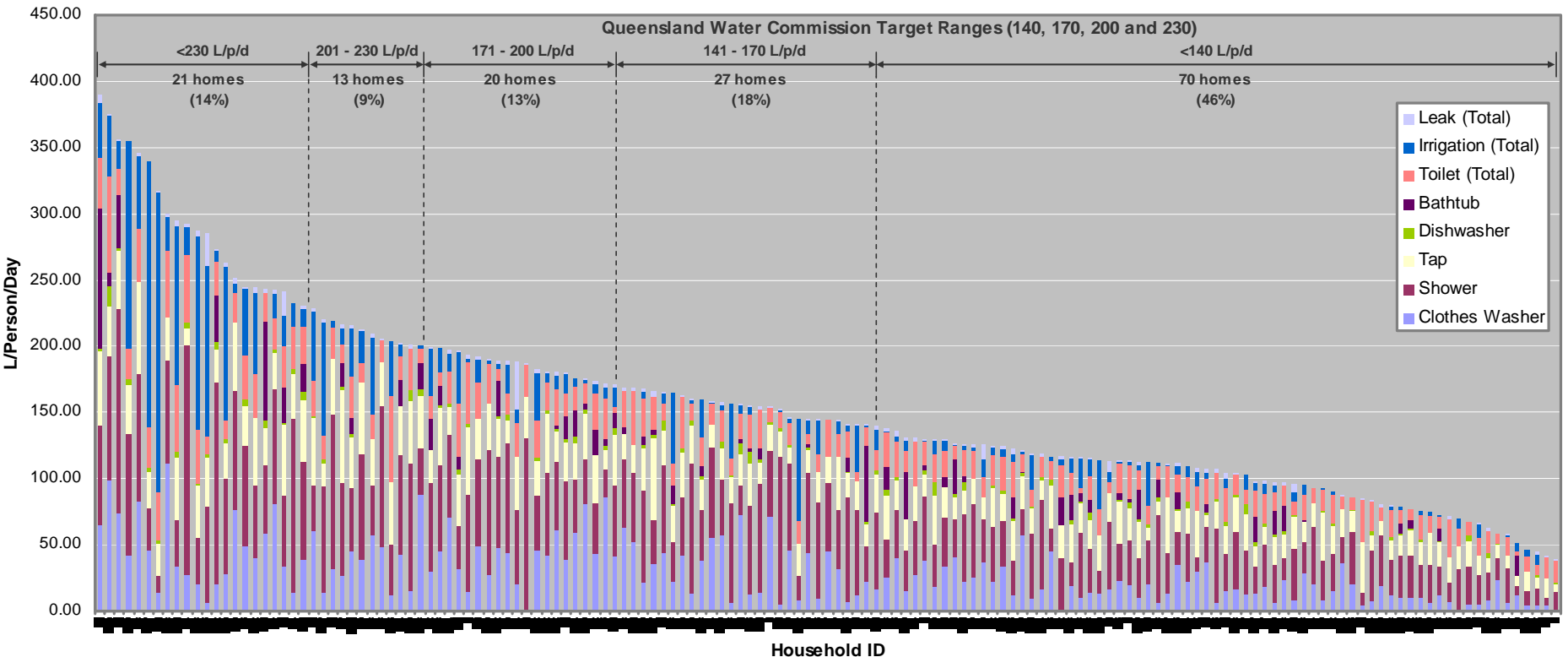
Total = 157.2L/p/d

- Pool
- Cooler
- Humidifier
- Hottub
- Other
- Undetermined

Background

Gold Coast End Use Study GCEUS Sample Results (Winter 2008)

Household Daily Per Capita Consumption: Activity Break Down



Background

Gold Coast End Use Study GCEUS Sample Results (Winter 2008)

End use data comparison based on different study locations

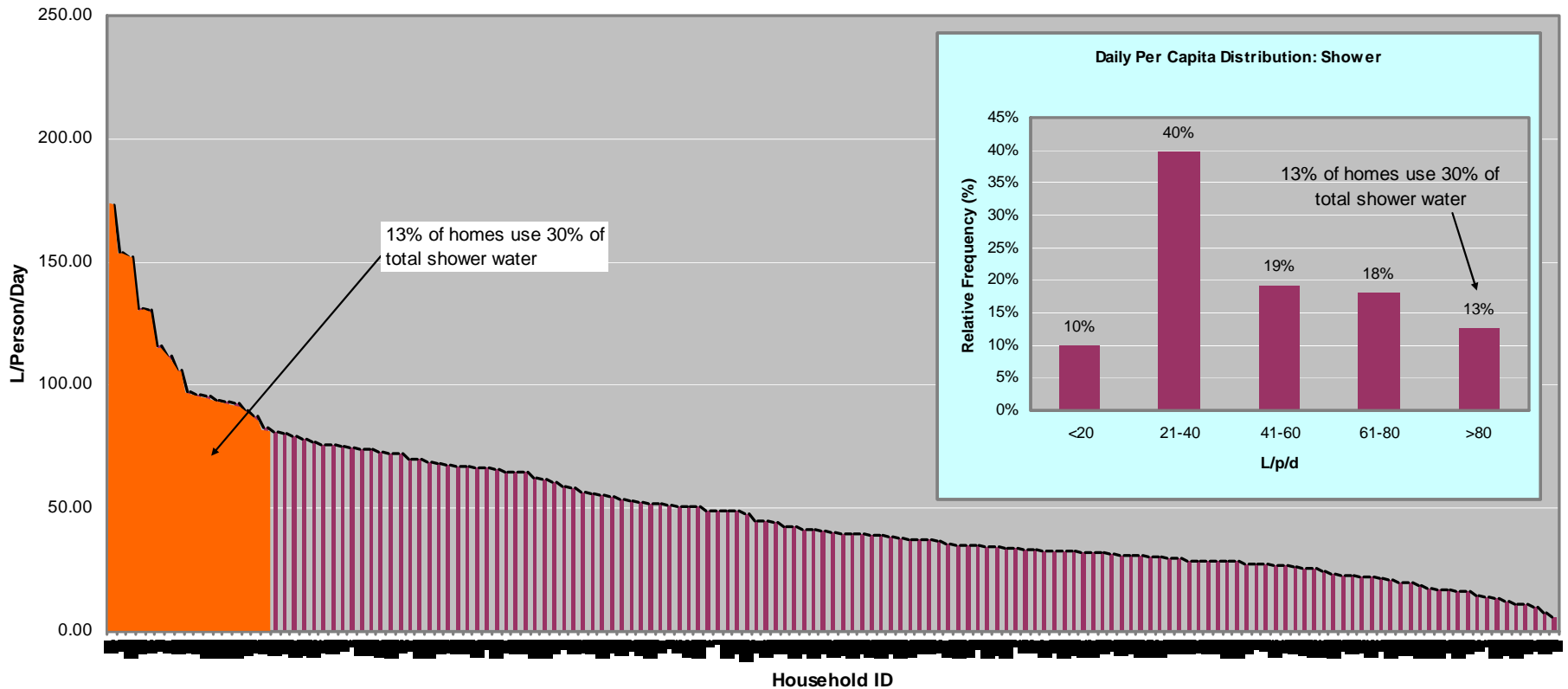
End use	Perth (2003)		Melbourne (2005)		Auckland (2007)		Gold Coast (2008)	
	L/p/d	Percent	L/p/d	Percent	L/p/d	Percent	L/p/d	Percent
Clothes washer	42.0	13%	40.4	19%	39.9	24%	30.0	19%
Shower	51.0	15%	49.1	22%	44.9	27%	49.7	33%
Tap	24.0	7%	27.0	12%	22.7	14%	27.0	17%
Dishwasher	NA	NA	2.7	1%	2.1	1%	2.2	1%
Bathtub	NA	NA	3.2	2%	5.5	3%	6.5	4%
Toilet (total)	33.0	10%	30.4	13%	31.3	19%	21.1	13%
Irrigation (total)	180	54%	57.4	25%	13.9	8%	18.6	12%
Leak (total)	5.0	1%	15.9	6%	7.8	4%	2.1	1%
Total	335.0	100%	226.2	100%	168.1	100%	157.2	100%

New 300 household end use study commencing in Melbourne

Background

GCEUS: Sample Results (Winter 2008)

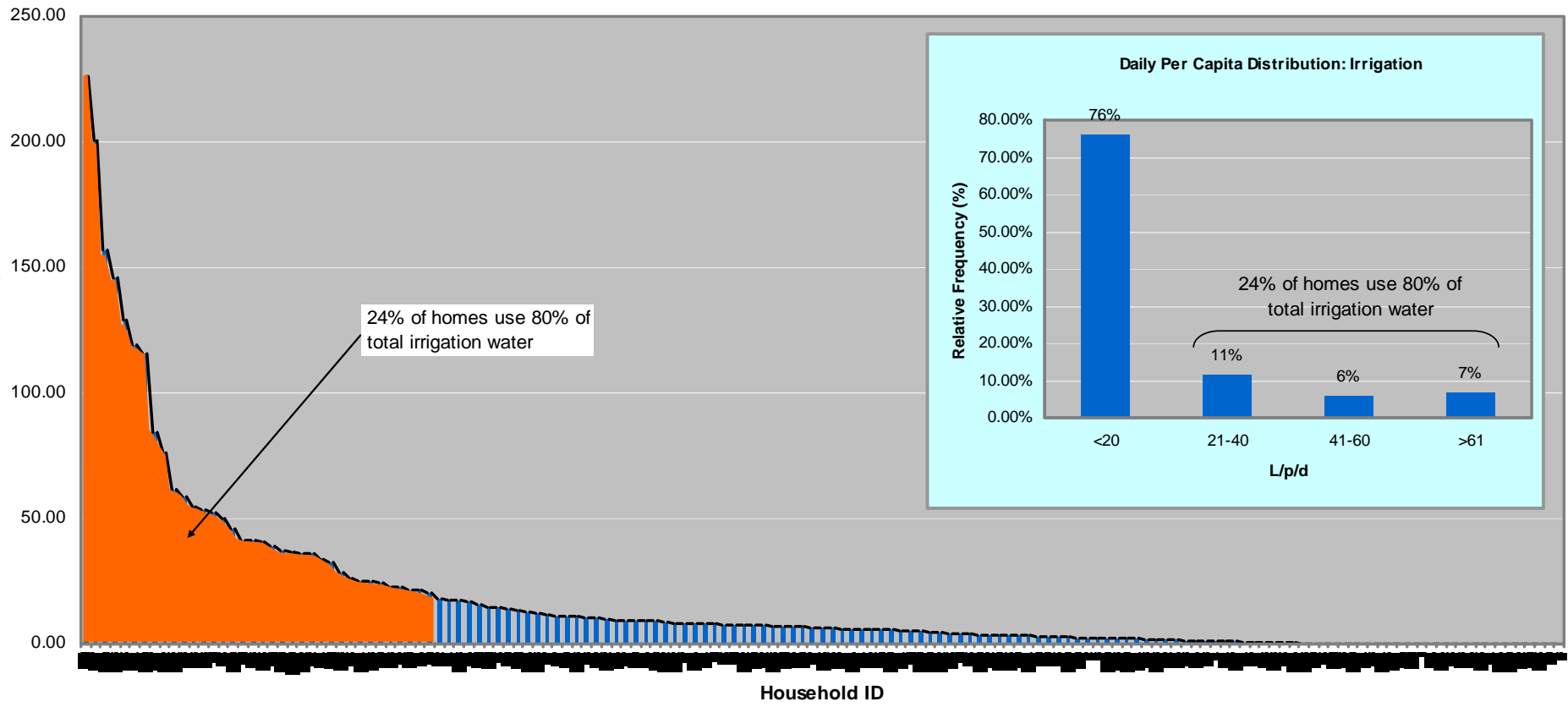
Household Daily Per Capita Consumption: Shower Only



Background

GCEUS: Sample Results (Winter 2008)

Household Daily Per Capita Consumption: Irrigation Only



Background

GCEUS: Sample Results (Winter 2008)

Household Stock Survey Verse End Use – Clothes Washer

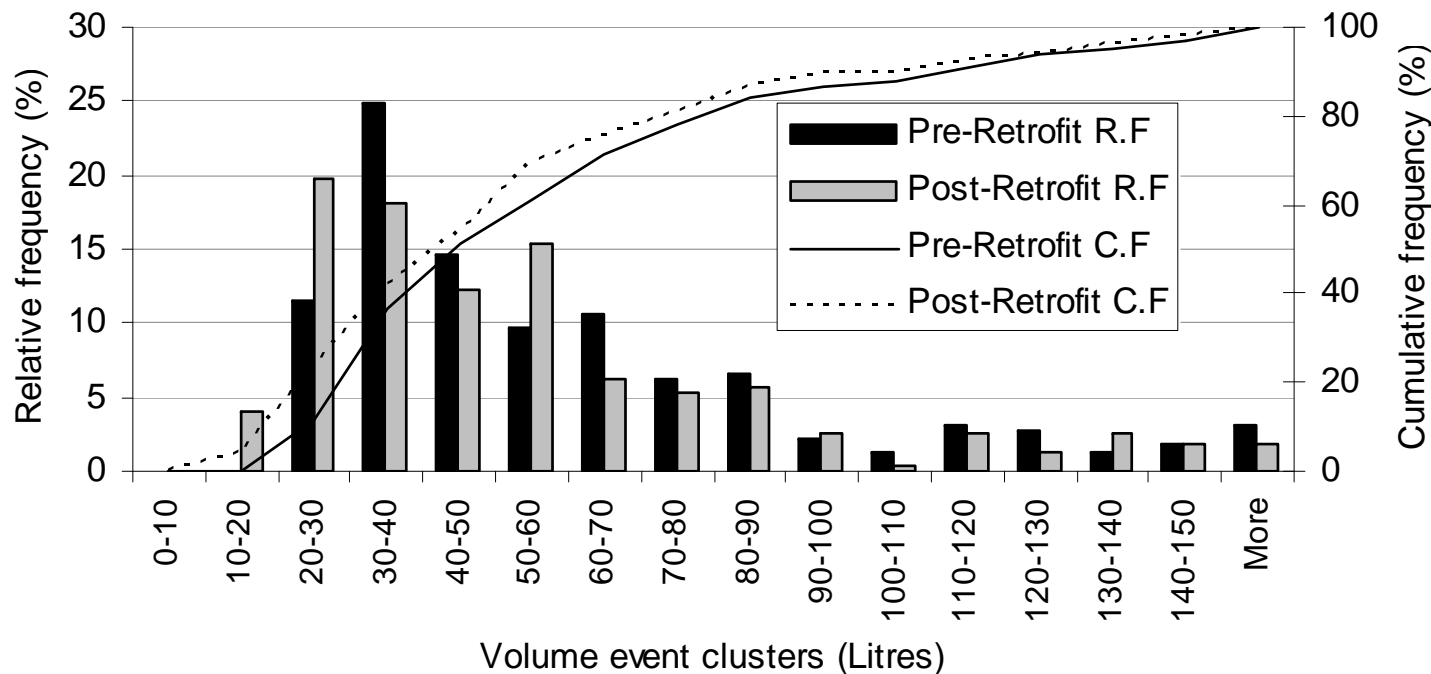
Description	Clothes washer efficiency clusters		
	Low	Medium	High
Efficiency category	1 – 2.5	3 – 3.5	4 – 6
Star rating range	1 – 2.5	3 – 3.5	4 – 6
Category (L/Wash)	120 - 170	80 - 119	40 – 79
No. of households in Cluster (N=148)	38 (26%)	40 (27%)	70 (47%)
No. of people in cluster (N=486)	148 (30%)	119 (25%)	219 (45%)
Per capita clothes washer water consumption (L/p/d)	53	36.3	14.4
Household clothes washer water consumption (L/h/d)	206.4	108	45.2
Per capita clothes washer water consumption (kL/p/year)	19.4 (3.7)	13.3 (2.5)	5.3 (1)
Household clothes washer water consumption (kL/h/year)	75.3 (4.6)	39.4 (2.4)	16.5 (1)

Background

GCEUS: Sample Results (Shower Monitor Study)

Evaluating the effect of visual display monitors on shower end use

Pre-Retrofit	Volume (L)	Post-Retrofit	Volume (L)	Reduction (L)	Reduction (%)
Median	46.38	Median	36.38	10.00	21.60
Mean	57.37	Mean	41.97	15.40	26.84



End Use Studies: Data Analysis Possibilities

Psycho-social Drivers Vs End Use

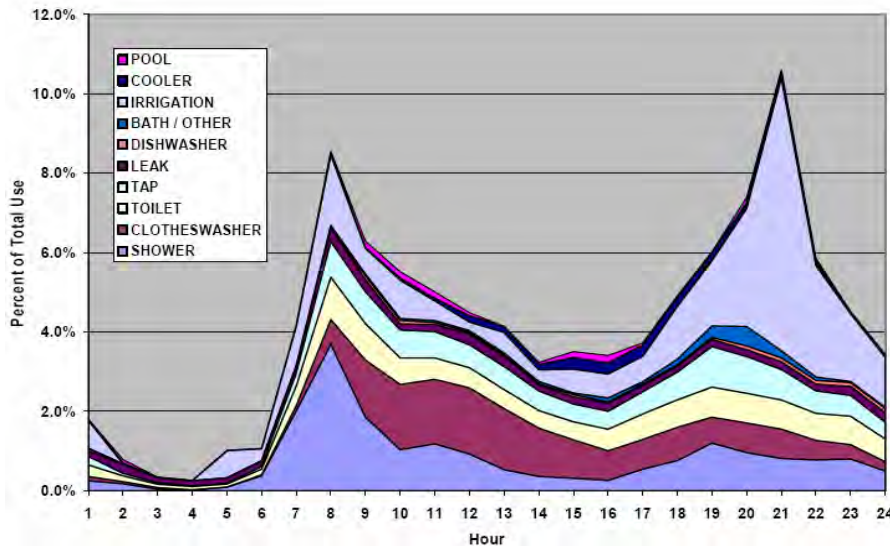
Attitudes Vs End Use

WDM Strategy Influence on End Use

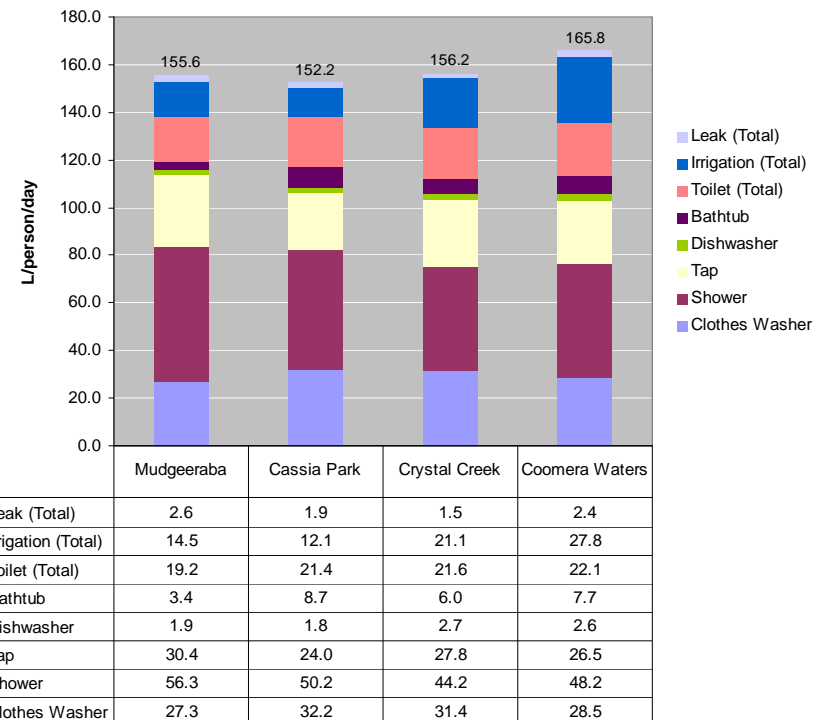
Rainfall Vs End Use

Stock Survey Influence on End Use

Restrictions Vs End Use



End Use Diurnal Patterns



Socioeconomic Vs End Use

SEQ End Use Study (SEQEUS) Overview

- 320 residential detached household sample
- Sample approx. 1/3 of SSA baseline sample
- Wireless loggers utilised for continuous data
- 2.25 year project (to June 2011) – baseline + interventions
- Approach/technology similar to GCEUS
- Baseline read (2009) + range of interventions (2010/11)
- Standalone project and SSA value adding
- Includes both ‘discovery’ and ‘applied research’ elements
 - Combining detailed descriptive, social science as well as end use data a world first – range of data analysis possibilities!
 - SEQ end use model developed (N=320) will be the most comprehensive in Australia to date
 - Pattern matching addition enhances current practice
- Pattern matching study (ANN/GA) presently being scoped for 2010 calendar year start

SEQEUS Research Approach

- MOU with water distribution entity/utilities
- Sampling and participant recruitment
- Quality data collection and analysis process
- Baseline survey (SSA) and EUS measurement
- Intervention studies
- Hydraulic trace pattern matching study design
- Hydraulic trace pattern matching study conduct

Sampling and Participant Recruitment

- SSA Demand Management team deriving sample
- 320 of SSA baseline sample to be metered
- EUS scope:
 - Residential detached/semi-detached
 - Traditional water supply schemes only
 - Households reflective of SEQ water user population
 - Consent to both SSA and EUS components
 - Resource constrained (approx. \$1000 per home for equipment)
- EUS confidence levels:
 - SEQ EUS to be the highest sample completed internationally
 - EU dependant (i.e. irrigation less reliable than toilet)
 - Stratification dependent (i.e. split into socioeconomic groups)
 - Examine statistical reliability for each end use and overall

MOU with SEQ Water Businesses

- Ever changing governance landscape problematic
- Water meters the property of water businesses
- Require permission for meter replacement program
 - Gold Coast Water (80 households)
 - Brisbane Water (80 households)
 - Ipswich Water (80 households)
 - Sunshine Coast Water (80 households)
- Consent to collect end use data
- Consent to provide historical water use data to confirm sample representative of population
- Ongoing support and communication for project
- Research team provide approved results to individual water utilities to assist their planning
- Propose to build long-term partnership with distribution entity to ensure project continues beyond UWRSA

SEQEUS Data Collection Process

- GCEUS quality assurance process developed
 - Checking metering and logging equipment
 - Verification through diary with some households
 - Water audit (\$20 incentive) and descriptive information
 - Trace analysis quality assurance
 - 2 week reads for households (*Aquacraft*)
- Verified TW file EU events analysed
 - Linked to access for event registry
 - Access and MATLAB utilised for data mining
- EU summary/event and SSA database combined
- Baseline measurement and post-intervention

SEQEUS Baseline Survey and Interventions

- SSA demand management team deriving sample
- Baseline survey and EU measurement
- Intervention program
- Interventions informed by survey/EU data
- Possible interventions
 - Examine prominent psycho-social drivers of water consumption and evaluate behaviour change strategies
 - Stock interventions (i.e. Shower monitor)
 - Government policy (i.e. changes in restrictions)
 - EU Information dissemination
 - Interventions to be SSA approved as can not have multiple interventions occurring simultaneously
- Continuous data through wireless loggers enables study instigated as well as macro interventions to be evaluated

SEQEUS Deliverables/Outputs

- End use data base for 320 households and model (1-2 Yrs)
- Comparative assessment with other end use models
- Data mining and analysis on a range of end uses
- Comparative analysis on water end uses between different household demographic categories (e.g. family structure)
- Comparative analysis on water end uses of households with different fixture/appliance star ratings
- Seasonal diurnal patterns for hourly water use for sampled households
- Leakage volumes and leak typology pattern analysis
- Water end uses before and after a range of natural, macro-environment and study instigated interventions

End Use Pattern Matching Sub-Project

- Sub-project design in 2009
- Calendar 2010 conduct – 1 FTE + 2 No. supervisor
- Robust trace wizard analysis resource intensive
 - Requires manual analysis
 - Requires water audit and descriptive information
 - Requires verification and checking process to be accurate
- 72.5 pulses/L (0.014L/pulse) provides adequate signal for mathematical modelling (ANN/GA)
- Train signal with GCEUS and SEQEUS (550+) + other EUS
- Verify accuracy of developed algorithms through advanced trace analysis technique/tool and diary verification

Thank you

www.urbanwateralliance.org.au