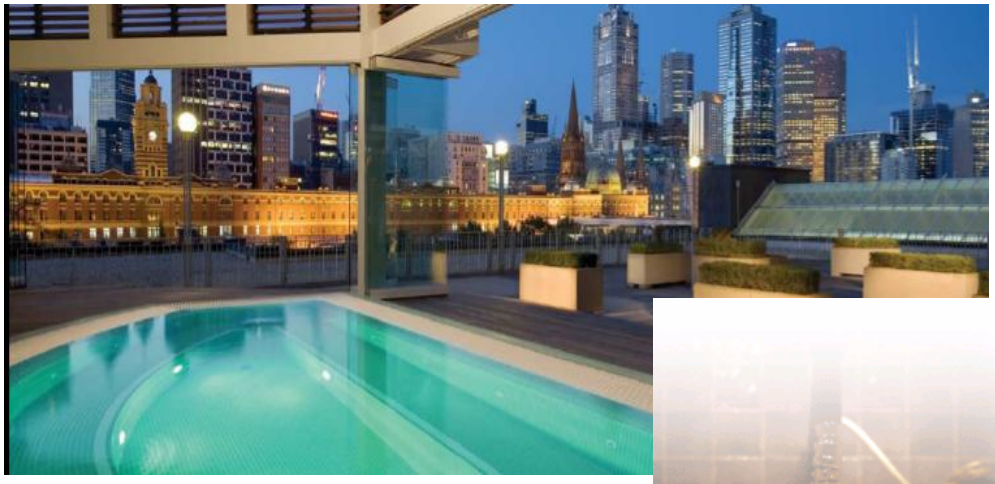
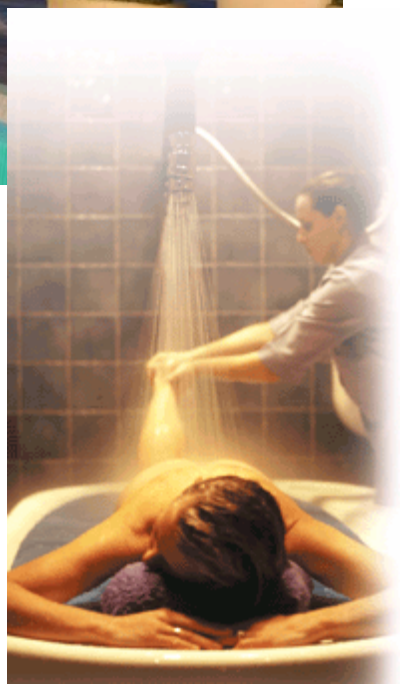
Australasian Spa Association

Water Wise Project – Smart Water

Victorian Spa Water Audit





CONFIDENTIAL

Prepared by
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On behalf of ASpa

ASPA
Embracing Spa Health and Wellness
Australasian Spa Association

Funding Provided By:

Smart Water Fund
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Smart Water Fund

The Smart Water Fund, established in 2002, is a joint initiative between the Victorian water industry and the Victorian Government established to encourage and support the development of innovative water recycling, water conservation and sustainable biosolids management initiatives, to help secure Victoria's future water needs.

Please visit www.smartwater.com.au for more information

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1. Introduction

Australia is experiencing increasing pressure on its finite water resources following an extended period of drought affecting much of the country. With water restrictions imposed on large portions of the population, increased community interest in water conservation has led households, business and community to reconsider their water use.

Water is an integral component within the corporate and industry branding of the spa industry and as such may be scrutinised by regulatory authorities and the community alike for ensuring best practice is adopted in water efficiencies. The Australasian Spa Association felt that a proactive approach to an industry-wide water initiative would benefit all stakeholders, community, businesses, government and the environment.

As an initial step, an application for funding was submitted in October 2006 to the Victorian Smart Water Fund to assist in the process of an industry first, a physical water audit of the spa sector. Funding was approved and the project commenced in January 2007 with the formation of a steering committee and contracting of a specialist water consultancy company, Arris Ltd. Committee members are:

- Ian Drayton (Director, ASpa – Chair)
- Brian Gay (Director, Hydroco)
- Dr Daryl Stevens (Principle Scientist, Arris Ltd)
- Craig Beeching (Owner, Blaze Rock Spa)
- Susanne Nelson (Business Development Manager, Li'tya)
- Angela Drayton (General Manager, ASpa)

This report:

- Outlines the methods for physical water audits completed on 20 treatment spas across Victoria.
- Analyses the data from the physical water audits
- Highlights the major finding and recommendations from the physical water audit.

1.1. Acknowledgements

This water audit has the potential to place the Australian spa industry at the leading edge of water awareness and efficiencies in the world. It has been made possible by funding from the Victorian Government through the Smart Water Fund. ASpa would like to formally acknowledge the contribution of the steering committee members for guiding the direction of the audit process, Arris staff for their expertise and dedication to the task and all spa owners, managers and staff who participated in both the initial phone surveys and physical water audits without whose contribution this important project would not have been possible.

1.2. Confidentiality

Much of the data shared by spas during the water audit process was confidential in nature. As such, participant spas have not been named in this document.

1.3. Regions

Spas were split into 5 major regions so that general comparison between regions were possible as well as specific comparisons (treatment type) between country Victoria (Eastern, Northern, Southern and Western) and Metropolitan (Greater Melbourne) (Figure 1).

Figure 1 Definition of areas defined in Victorian Spa Audit (red circle defines metropolitan Melbourne, north top of page)

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1.4. Number of spas audited

An equal distribution of different spa sizes (or client numbers) was determined from the initial spa survey and physical audits were completed on a range of spas sizes in each region:

Small Spas	0-370 clients	(6 spas)
Medium Spas	371-890 clients	(7 Spas)
Large Spas	891+	(7 Spas)

The number of spas in each size category and region are represented in Table below. Spas were selected so, where possible, there was a small, medium and large spa in each region. A small spa for Northern Victoria that was willing to participate in the audit was not identified during the pre-audit survey.

Table 1 Number of spas in each defined size and regions where the physical audit was completed

	Spa size		
Region	**Small 0-370**	**Medium (371 to 890)**	**Large (>890)**
Eastern Victoria	2	1	1
Metropolitan	1	1	2
Northern Victoria	0	2	2
Southern Victoria	2	1	1
Western Victoria	1	1	2

1.5. Source of water

Western Victoria and Central Victoria regions had several water sources that could be used to select spas. However, Metropolitan Melbourne, Yarra Valley and the Mornington Peninsula regions only had mains/domestic water supply. Therefore comparisons between different water sources in each region were not possible. However, general comparisons for Victoria could be made if all regions and water types were included.

1.6. Equipment types

There are 16 water based treatments with specific equipment used across all regions (Table 2).

Table 2 Summary of equipment at individual spas

Equipment	Individual spas with equipment
Water based treatments	
Hydrostorm	1
Spas	11
Tubs	10
Capsules	1
Vichy	14
Hydrostorm	1
Pools	4
Plunge pool	1
Foot soak bowls	2
Salon hair basins	4
Manicure bowls/basins	13
Pedicure bowls/basins	17
Stone heaters	9
Facial bowls	15
Spray booth	4
Treatment showers	17
Accessory equipment using water	
Client showers	15
Laundry Facilities	7
Water features	5

Note: does not include within spa numbers of individual equipment units

1.7. Differences in water use between spa types

During the pre-audit survey respondents indicated they were either day spas and day/destination spas or boutique spas. There seemed to be some confusion about the type of Spa. For the physical audit spas were defined as per ASpa (Table 4). The numbers of each spa types audited are summarised in Table 3.

Table 3 Type of spas surveyed and their general location in Victoria

	Spa type count		
Region	**Day spa**	**Destination spa**	**Natural bathing spa**
Eastern Victoria	4	0	0
Metropolitan	2	1	1
Northern Victoria	1	0	3
Southern Victoria	3	0	1
Western Victoria	4	0	0

1.8. Spa Definitions

Day spa	Destination spa	Natural bathing spa
Day Spa A business that provides professionally administered spa services that are offered to clients on a daily basis within appropriate day spa facilities	*Hotel Spa* Spa business operating within a hotel location offering full day spa therapies and services including water therapy and relaxation areas. May or may not offer wellness programmes and spa cuisine/health food option	*Mineral Spring Spa* Spa business operating within a retreat location, offering extensive use of communal bathing in naturally occurring spring water pools or baths with a full range of spa services, may or may not provide on site guest accommodation
Wellness Spa Combines spa services with wellness programs within appropriate day spa facilities		*Hot Spring Spa* Spa business operating within a retreat location, offering extensive use of communal bathing in naturally occurring hot spring water pools or baths with a full range of spa services, may or may not provide on site guest accommodation
Medi Spa Medical and wellness care in an environment that combines spa services as well as orthodox medical and/or cosmetic medical with complementary therapies and treatments		

Table 4 Spa categories used during the Victorian spa physical water audit

Source: http://aspaassociation.com.au/displaycommon.cfm?an=3

1.9. Spas selected process for the physical audit

Spas were selected for the physical audit from information gathered through a pre-audit survey which determined:

- The approximation number of clients per month (size)
- Willingness to participate in a physical audit of the spa facility (availability)
- Location
- A cross selection of equipment used in the spa industry.
- As a whole considered to represent the types of spas that you would find operating in Victoria.

Twenty Spas were measured in the physical audit representing ~20% of spas in Victoria,

2. Spas measured in the Physical Audit

Table 5 Summary of selected spas where physical audits were completed

Name	No. of clients p/m	Region	Size	Water Supply
1	606	Metropolitan	Medium	Recycle onto gardens Mains water
2	887		Large	Sea water Mains water
3	72		small	Only small one in metro Mains water
4	1360		Large	Have capsule Mains water
5	1043	Northern Vic	Large	Mains water
6	1214		Large	Very cooperative, mains water & spring water
7	582		Medium	Recycle onto gardens, & mineral water
8	708		Medium	Mains water
9	550	Western Vic	Medium	Recycle & use rainwater
10	1302		Large	Wellness unit Mains water
11	210		Small	Mains supply
12	962		Large	Mains supply
13	890	Eastern Vic including Yarra Valley	Large	Recycling to toilets Mains water
14	194		Small	Enviro septic system Mains water
15	91		Small	Mains water
16	373		Small	Recycle on vines , mains water
17	600	Southern Vic including Mornington Peninsula	Medium	Mains water
18	115		Small	Mains water
19	7000		Large	Mineral & mains water
20	312		Small	Recycling to gardens, rainwater

Where possible all water used in individual spas was measured by running apparatus and measuring flow rates and average times of treatments. For pools water use was determined as top up volumes and water use in water spas was estimated by calculating volumes required (minimising water wastage). Methods for measuring/calculating water use for all water treatments are detail in Section 3.

Figure 2 Measurement of water use by Vichy treatments (above) and other water uses

3. Results

3.1. Water use per client (Litres/client)

There was no significant difference between the region in Victoria and size of spa compared with water use per client (base on total water use per a client or water use per a water based treatment) (Appendix 6.3). There was no obvious trend in water usage related to location or size. Any of these differences were most likely shadowed by the type of water based treatment and the number of treatments per client (See below Section 3.2).

Water treatments were only a portion of the treatments offered at most spas (Figure 3). Generally approximately 50% of clients have water based spa treatments. However, one spa (13) administered more water treatments than clients, highlighting that in some cases clients can have a number of treatments and these could be water treatments. In the case of spa 13 all clients were given a complimentary foot spa.

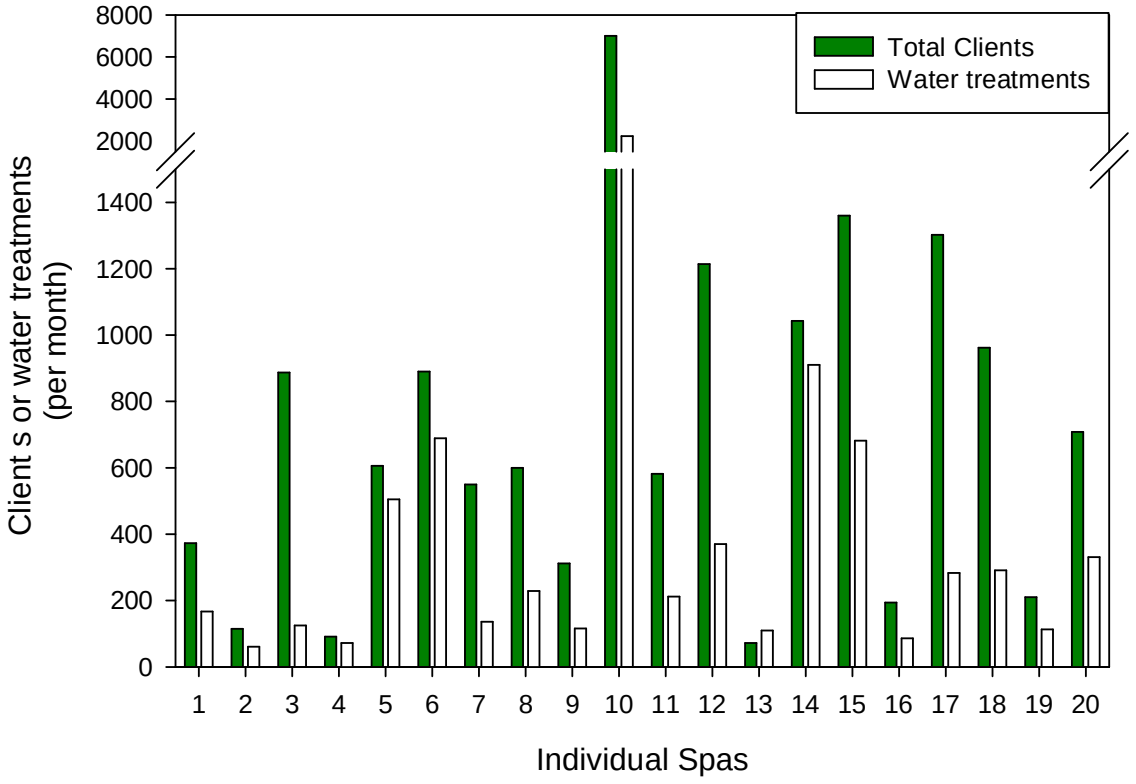

Figure 3 Comparison of clients and water treatments provided.

3.2. Water used with Spa treatments

Water use for spa treatments and accessory water varied considerably between spas (Figure 4). The higher water use treatments were Vichy, Capsules, Tubs and Spas. Water use in the Vichy treatment varied due to the number of shower heads, their flow rate, and the treatment method. For Vichy treatments the number of shower heads varied from 1 to 18 and averaged 7, flow rate varied from 4-25 l/min averaging 16 l/min (includes hand held shower head used in many Vichy treatments)

Variations in water use for water treatments with most equipment highlight that similar treatments can be given with greater water efficiencies if required. However, the quality and experience give by the treatment should not be compromised. No measure of this was taken for the audit. For accessory water used during the water treatment process, small gains could be made with more water efficient shower and toilets. Only 4 spas audited had pools and water used to top the pool per month up was relatively high (Figure 5).

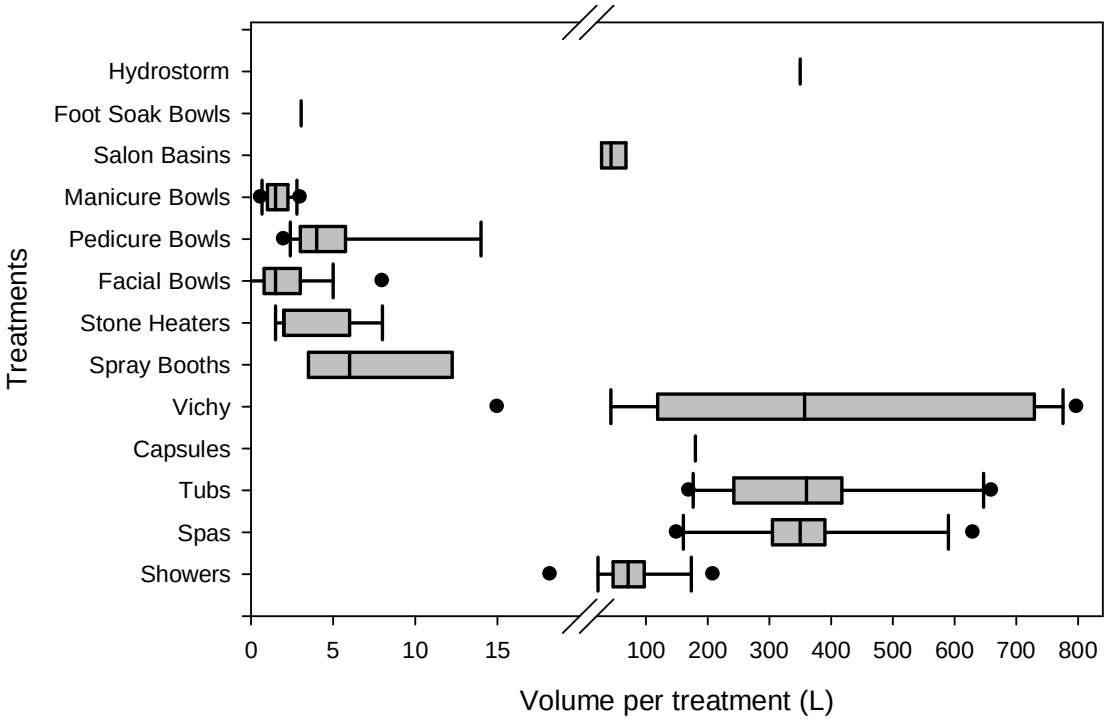

Figure 4 **Water used in different water treatments practiced in the 20 spas audited. Line in middle of grey box = median, ends of grey box = 25th and 75th percentiles, end of T is 5th and 95th percentile, filled circles are outliers (Note: in some cases there due to the data distribution or number points and only the median, 25th or 75th percentiles are shows)**

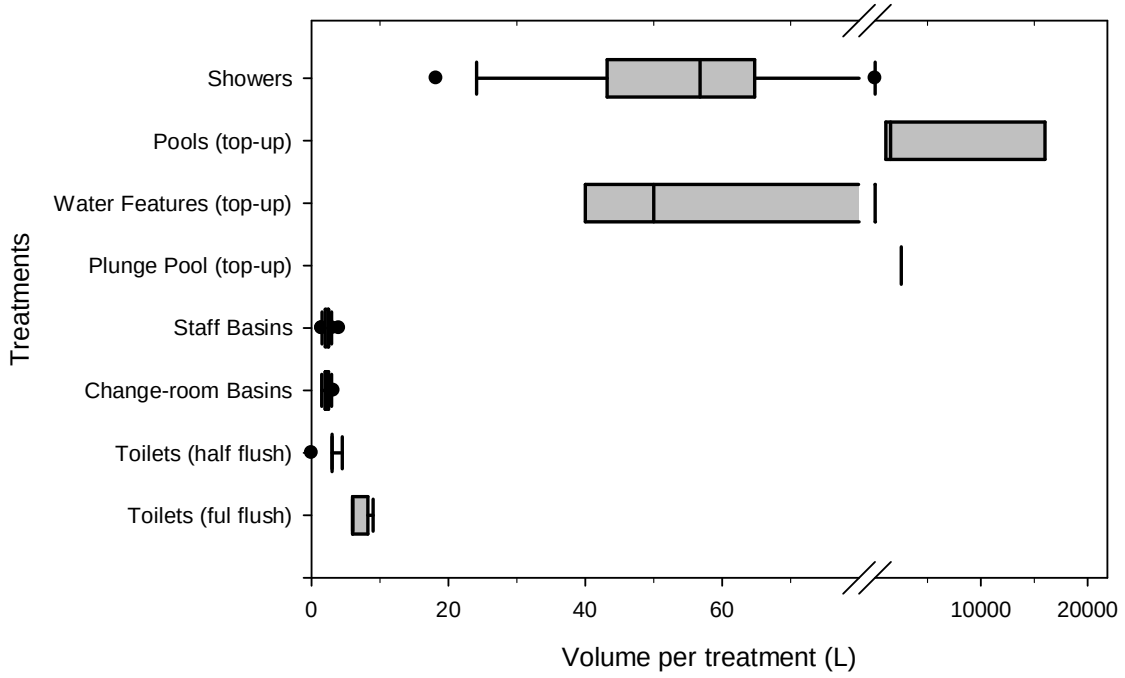

Figure 5 **Water use of water accessory used in the 20 spas audited. Line in middle of grey box = median, ends of grey box = 25th and 75th percentiles, end of T is 5th and 95th percentile, filled circles are outliers (Note: in some cases there where <4 data points and only the median, 25th or 75th percentiles are shown.**

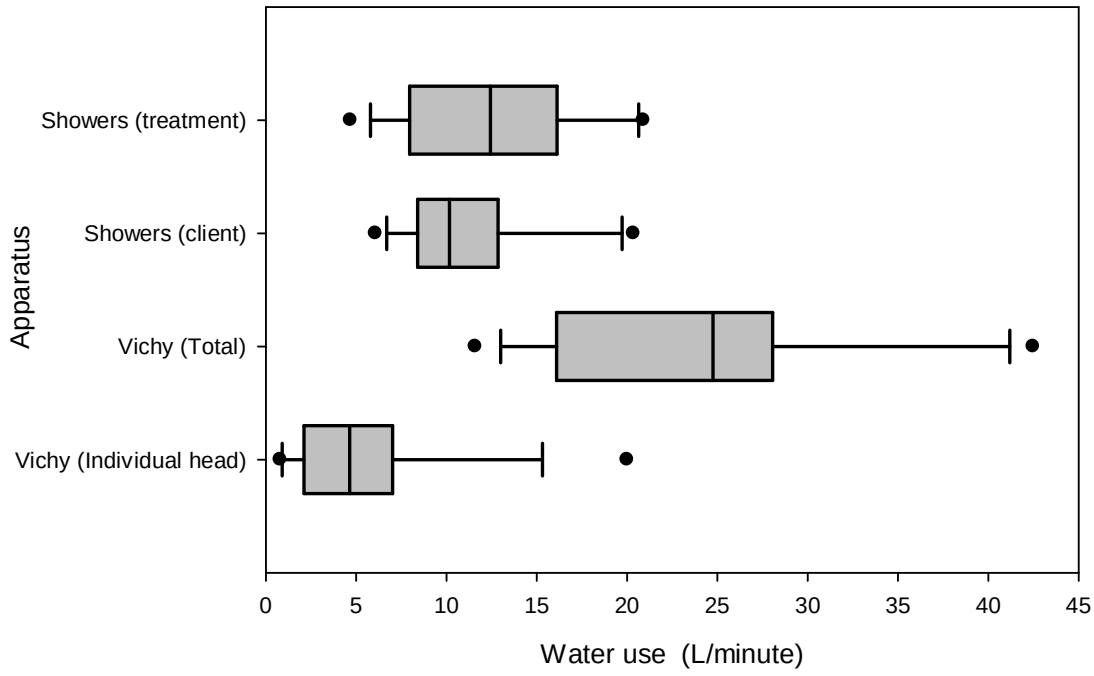

Figure 6 **Water use efficiency of selected apparatus from 20 Spas audited, Line in middle of grey box = median, ends of grey box = 25th and 75th percentiles, end of T is 5th and 95th percentile, filled circles are outliers**

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3.3. Water source or wastewater disposal

3.3.1. Effect of water source on water use per water treatment client

Water use per a treatment was much lower for the single tank water source compared with other water sources (Table 6). These data were not statistically significant ($p<0.05$) and because of single data point for tank water only, based on limited data. However, the data reflect the observation during the audit that spas on water with restrictions or limited supply tended to use less water per treatment than when spa water sources were from the sea or groundwater (Signature treatments)

Table 6 Predicted means for water sources (water treatment clients)

Water source	Predicted water use (L/water treatment)
Tank water only	94
mains water	204
spring/mains water	249
tank/mains water	267
spring water	282
sea/mains water	447

Minimum standard error of difference	92.4
Average standard error of difference	172.1
Maximum standard error of difference	204.0
Minimum least significant difference	198.1
Average least significant difference	369.0
Maximum least significant difference	437.4

3.3.2. Effect of wastewater disposal on water use per water treatment client

Water use per water treatment did not seem to be related to how the water was disposed (Appendix 6.4.2). However, the predicted means (185 L/water treatment if wastewater recycled compared to 241 L/water treatment if waste went to the sewer) suggested that spas were more cautious about water use if it was recycled. This could be interpreted as, if water is recycled generally this is because there were water shortages or Spa owners/operators were water conscious.

3.4. Effect of Spa type on water use

Difference in the use of water in different spa types per water treatment was not significant ($p>0.05$). The trend was that Day Spa used less that Destination Spa and Natural bathing spa used more than both Day and Destination Spas (Table 7).

Table 7 Spa types and predicted water use per water treatment

Spa Type	Predicted average water use per water treatment (L)
Day spa	196
Destination spa	258
Natural bathing spa	295

3.5. Total water use

Total water use in Spas audited varied considerably relative to the number of clients and type of treatments taken. External laundry water use was also estimated to be a large component of total water use for spas (Figure 7).

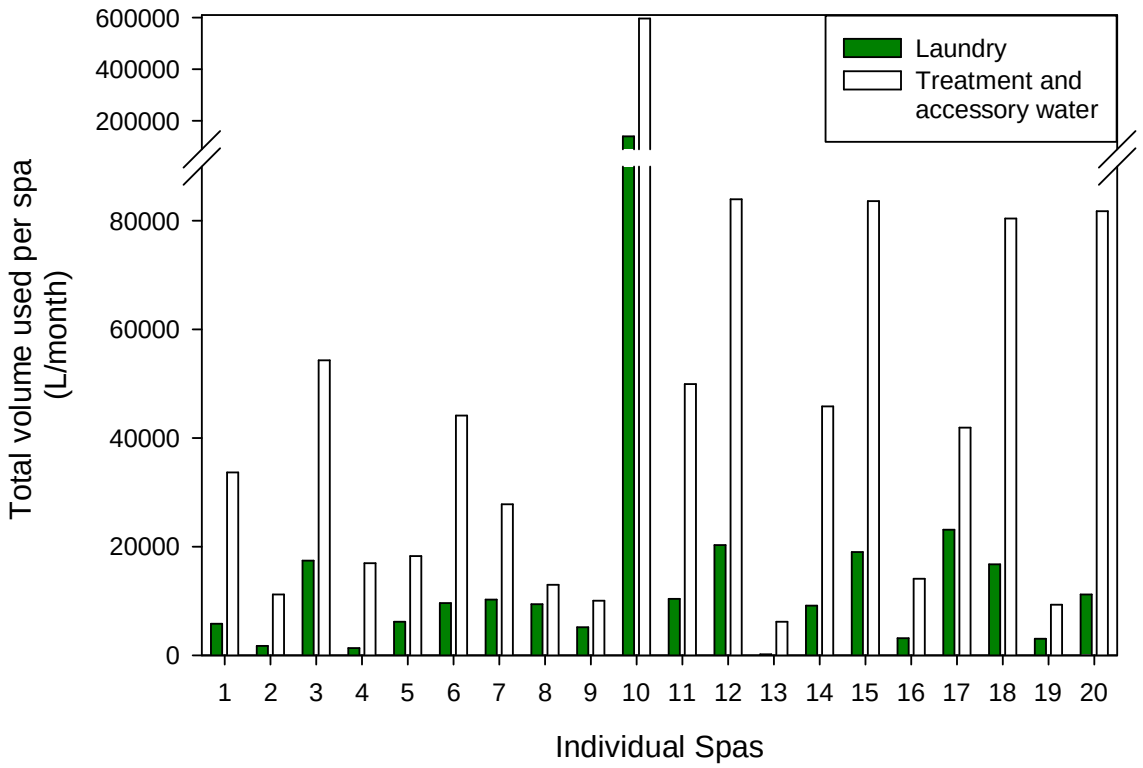

Figure 7 Water use in spas for treatments and accessory water, and laundry water used externally

Table 8 Assumptions use to estimate towel use during water treatments

Treatment	No of towels per use (estimated)	Water used to wash towels/treatment (L)
Showers	1	3.37
Spa	3	10.11
Tub	2	6.74
Capsule	2	6.74
Vichy	6	20.22
Spray booth	2	6.74
Stone heater and treatment	2	6.74
Facial	1	3.37
Pedicure	2	6.74
Manicure	1	3.37
Salon/hair	1	3.37
Foot soak	1	3.37
Hydrostorm	6	20.22

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Note: Estimate of pool usage was not available during the audit. CV Laundry, Bendigo (Trevor, Ph 03 54415690) estimated the water used to wash a standard towel is 3.37L. Paper towel or driers are used in toilets. All non water treatments were estimated to use 5 towels (massage, showers, etc)

3.6. Water conservation in spas

During the physical audit the spa manager and at least 1 staff member who administered spa treatments were asked four questions in relation to water use and conservation measures practiced in their spa.

The four questions were:

1. Do you verbally notify clients of water restrictions and to be conscious of this whilst showering or selecting treatments?
2. Do you put signage around the spa to inform people of water restrictions/shortage and to use water wisely? (This was also visual verified on site during the audit)
3. Do you train your staff (or have you been trained) in water efficient use during treatments and cleaning? (This question was cross checked between staff and managers)
4. Do have any restrictions on the treatments given because of the amount of water they use? (This was consider yes if management or staff giving the treatment had modified the treatment to decrease water use)

There were no significant differences between the 5 regions within the state and communication to the spa client regarding water conservation ($p>0.05$) (Appendix 6.2). However, up to 65% of spas informed staff or clients of water conservation measures (Figure 8). Even though differences were not statistically significant, during the audit interaction with spa owners and operators indicated a much greater awareness and concern for water management in most country areas but less so in parts of Eastern Victoria. This may be due to the higher rainfall in this area.

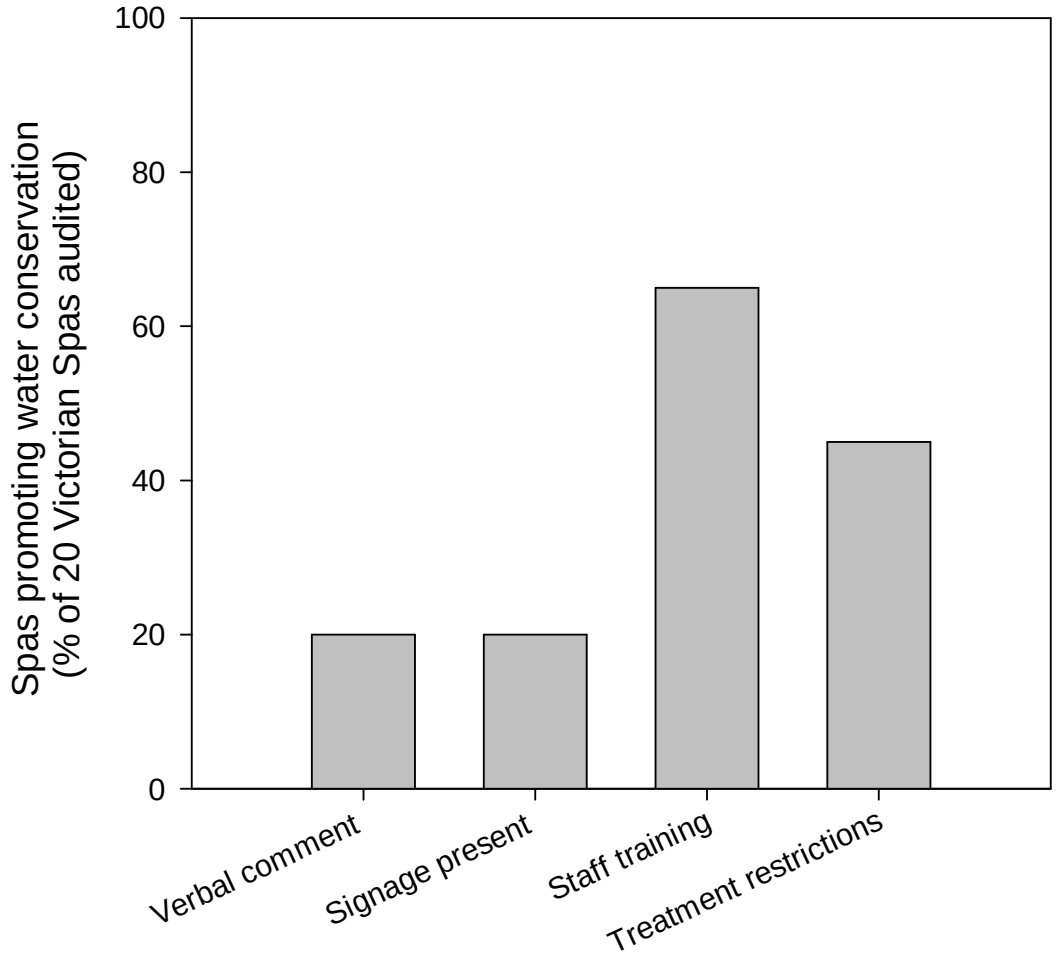


Figure 8 **Summary of four approaches being used by the spa industry in Victoria to promote water conservation**

3.7. Comparison of water use

The average household water consumption for country Victoria was 204 Kilolitres/year or 558 L/day where for metropolitan Melbourne these figures were slightly lower at 191 KL/year or 523 L/day. Table 9 shows comparisons between average annual water bills and water consumption in Victoria. World wide water use in hotels range from approximately 90 -3200 L/room/night and averaged approximately 250 to 1000L/room/night (Table 10). This is much greater than the average client use of water in the spas audited (79±39 L/client) or use of water per water treatment (176±104 L/treatment) (Errors are one standard deviation from the mean).

Table 9 Average annual water bills and average household water consumption for 18 water service providers in Victoria

WATER BUSINESS	ANNUAL AVERAGE HOUSEHOLD WATER BILL ($)	AVERAGE ANNUAL WATER CONSUMPTION (KILOLITRES)
City West	$457	183
South East	$463	187
Yarra Valley	$499	198
Barwon	$608	216
Central Highlands	$668	185
Coliban	$525	210
East Gippsland	$595	196
Gippsland	$587	219
Goulburn Valley	$479	315
GWMWater	$723	231
Lower Murray	$594	552
North East	$599	304
South Gippsland	$699	152
Wannon (Glenelg)	$604	217
Wannon (Portland Coast)	$446	184
Wannon (South West)	$608	195
Western	$697	232
Westernport	$695	113

** Pricing figures based on prices effective October 2005. Average price may vary within regions, reflecting the differing cost of delivery to different towns. On 1 July 2005, Wannon Water was formed by a merger of Glenelg Water, Portland Coast Water and South West Water.*

Source: http://www.esc.vic.gov.au/NR/rdonlyres/74666778-DA78-405E-9401-E9438A4EC629/0/MR1_2007_WaterPerformanceReport.pdf

Table 10 Average water consumption for hotels worldwide, l/room or l/guest-night

Country (data for the year)	Average water use, l/room/day, unless specified otherwise
Thailand (1990s)	913–3424
Australia (1993)	750
Hong Kong (1996–1997)	336–3198, average 939.2
Philippines (2000)	1499
USA (2000)	382–787, average 583 Forecasts for 2010: 1798
Germany (1990s)	90–900, average 342 l/guest-night 275 l/guest-night
Jamaica (1999)	527–1595.7, average 981.9 l/guest-night
Spain (2000)	440–880 l/guest-night
Zanzibar (2000)	200–2000, average 930.9 l/guest-night
Sweden (Sånga Säby Course & Conference Centre, 2002)	314 l/guest-night

Source: Bohdanowicz and Martinac 2007

3.8. Potential Water savings

This water audit confirmed that, in many cases, spa operators are indeed conscious of water usage within their spa operation. The relatively wide variance in water usage across spas can be attributed to spa size, volume of treatments, equipment used and treatments performed and to some degree, the water source used.

The essence of a spa is its water treatments as shown in figure 3. The emphasis here is not to minimise the use of, or reduce the quality of these treatments but rather maximise the efficiency of such treatments. The whisker chart at figure 4 highlights a wide variance in total water volume and on water flow rates within treatments (figure 6). The inference here is that there are significant differences between equipment flow rates and just as importantly, variances between therapist usages of such equipment in similar treatments.

It is vital therefore, that staff training be expanded to include water awareness and efficient water management within treatments. Such training should also include a comprehensive understanding of optimum usage for various spa equipment. The potential water savings across the industry from this initiative, whilst difficult to quantify at this time, should be targeted at reducing the median water use per treatment by decreasing the treatment variance as highlighted figures 4 & 6.

Training should not only encompass current spa staff but also include training colleges, product suppliers & industry consultants as part of a comprehensive spa water education process. This training awareness process could be integrated within part of the industry accreditation process and adopted as an action item within the Spa Education portfolio held by a sitting ASpa Board Director.

Water flow rates between equipment performing a similar function also varied considerably as shown in figure 6. It is recommended here that further work be done with manufacturers to identify an industry benchmark and publish this benchmark within an accreditation program for the Australasian Spa industry.

Areas where potential water savings were identified are shower heads and laundry. Most spas already had low volume toilet flush systems so a negligible saving could be made here. Laundry use could potentially be lowered by the number of towels used and shower heads for various treatments could be more water efficient . Potential water savings across the spa industry by increasing these efficiencies were approximately 7,500,000 L or 8% of total water used in the industry (table 11). Conversely, if spas were to become more extravagant with water (75%tile increase, table 11), water use could increase by 20%. To put these volumes into perspective, if a household use approximately 500L/d (182,500L/year). The water saving is equivalent to 45 households/year.

More detailed analysis of water treatments were also undertaken to identify the sensitivity of the variables that influence potential savings. Take showers for example. Showers included as part of treatments (i.e Treatment showers) or showers that clients have before or after treatments (ie Client showers). Is it the duration of the shower or the flow rate of the shower head?

Table 11 Estimates of possible water saving for the Victorian spa industry

Survey of 20 spas (actual data)								
	Median		25%tile of flows recorded			75%tile of flows recorded		
Water uses	Flow rate	Total water use	Flow rate	Saving		Flow rate	Increase	
	(L/use)	(L/mth)	(L/use)	(L/mth)	(%)	(L/use)	(L/mth)	(%)
Shower clients	10	240,874	9	10,668	4%	13	161,058	67%
Shower Treatments	12	64,101	9	16,459	26%	14	20,690	32%
Vichy treatments	357	66,567	129	43,690	66%	668	74,352	112%
Laundry[A]	5	323,112	4	55,155	17%	6	55,155	17%
Totals		694,654		125,972	18%		311,256	45%
Totals water use of surveyed spas		1,640,109						
All Victoria Spas [B]								
		L/year		L/year			L/year	
Shower clients		14,452,429		640,098			9,663,497	
Shower Treatments		3,846,057		987,526			1,241,394	
Vichy treatments		3,994,037		2,621,405			4,461,440	
Laundry		19,386,720		3,309,300			3,309,300	
Total		41,679,243		7,558,329			18,675,331	
Total Spa water use in Victoria		95,097,2065						
% decrease/increase all spa water use				8%			20%	

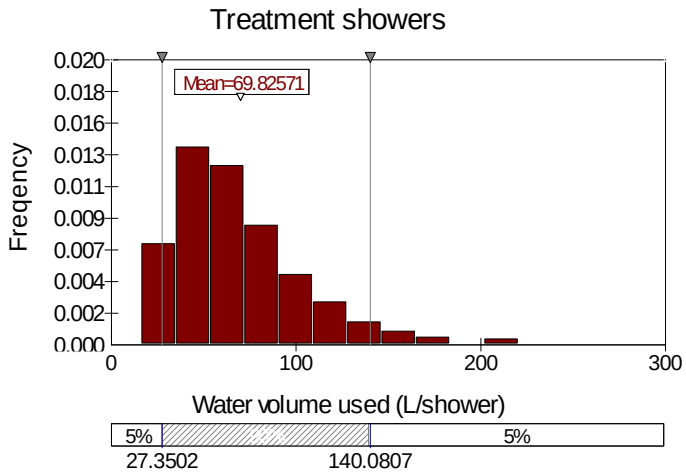
[A] Laundry assumes a 25% increase/decrease in the use of towels for water base treatments and 20% reduction/increase in use of towels for non-water treatments (data show; unit = towels/non water based treatment). If spa s were already below or above the percentile measured then no decrease or increase in water use was recorded.

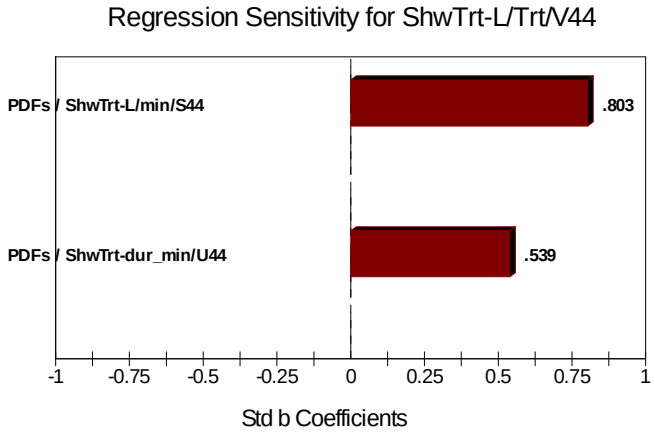
[B] Assumes 100 spas in Victoria and survey sample is representative of these spas; ie 5 x 12 x equivalent value above)

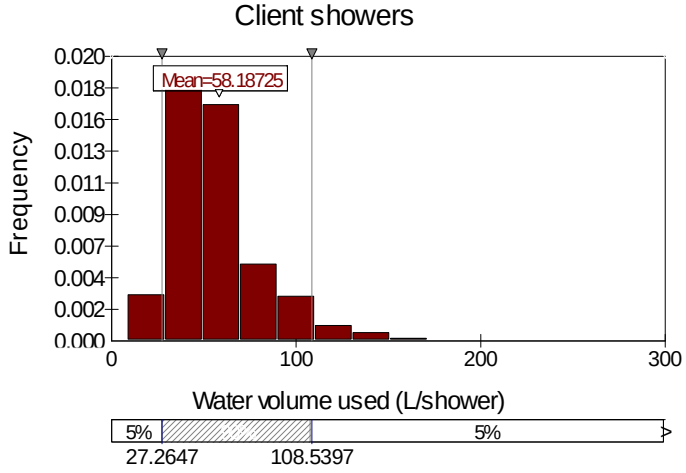
Figure 9 indicates that for treatment and client showers variation can be positively attributed to the flow rate and duration of the shower. However, in both cases duration has a more positive impact on water use. These observations indicate that by shorting the length of showers, great water saving could be made (see Table 12 for use times and percentiles).

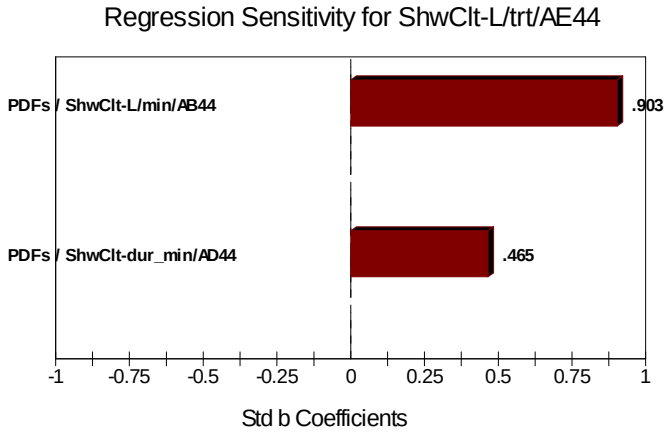
For Vichy showers (Figure 3, bottom two graphs), treatment time had the largest positive influence on water usage per a treatment. Flow rates and number of heads had similar positive sensitivities to water use per a treatment, but were about one third that of treatment times. These observations indicate modifications to treatment time would have the biggest impact on water usage.

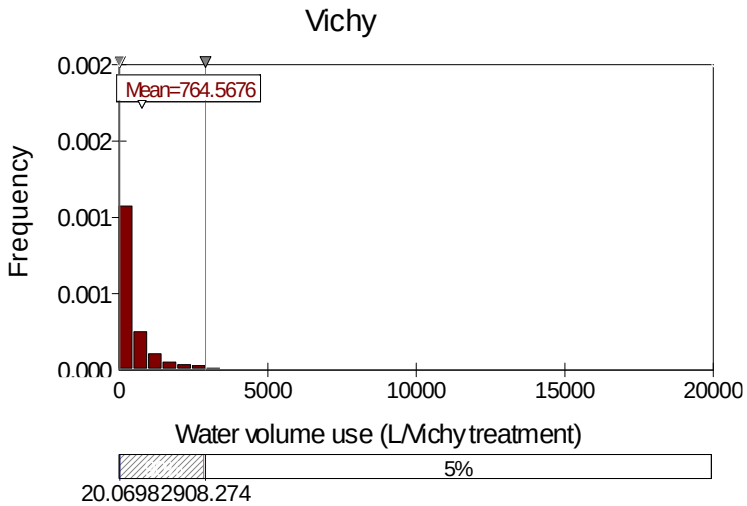
It should be noted that the modification to treatments suggested above to save water may have impacts on the quality of treatments provided and further work is required to ensure the quality of treatments is not compromised.











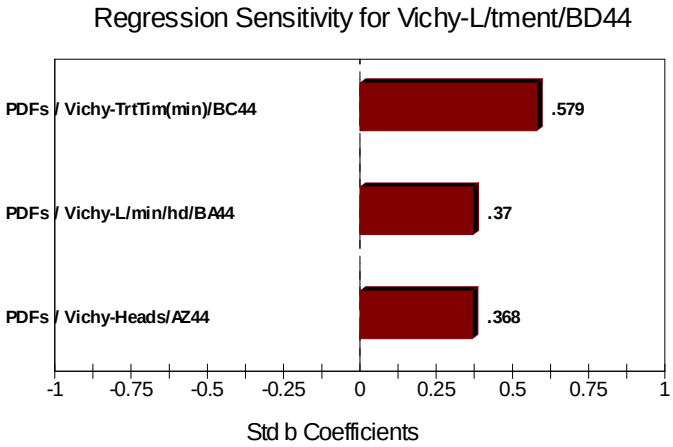


Figure 9 **Distribution of shower and Vichy volumes of water use per shower/treatment and regression sensitivity for number of heads (Vichy only), flow rate (L/min) and duration/treatment time (min).**

Table 12 Summary of statistical parameters modelled to assess variation in water use when using showers and Vichy in the 20 Spas surveyed

	Use			Shower Treatment		Shower Client		Vichy		
	Shower Treatment	Shower Client	Vichy	Flow rate	Duration	Flow rate	Duration	No. Heads	Flow rate	Duration
Statistic	(L/use)			L/min	min.	L/min	min.		L/min/head	min
Minimum	16.4	8.8	1.0	4.2	2.5	5.0	0.7	0.3	0.1	0.2
Maximum	295.1	313.9	19667.5	30.8	14.0	70.7	10.7	109.9	43.1	446.3
Mean	69.8	58.2	764.6	11.8	5.9	11.5	5.1	7.5	5.6	19.3
Std Deviation	37.0	29.0	1618.8	4.8	1.7	5.5	1.2	7.5	5.1	27.9
Skewness	1.8	2.8	5.9	0.9	1.1	4.2	0.1	6.4	2.6	8.3
Kurtosis	8.1	18.5	51.5	3.7	4.8	34.4	4.3	75.6	13.6	115.7
5% Perc	27.4	27.3	20.1	5.4	3.7	6.5	3.1	1.7	0.8	2.2
10% Perc	33.0	32.1	41.6	6.2	4.1	7.1	3.6	2.4	1.2	3.2
15% Perc	37.0	35.7	58.8	6.9	4.3	7.6	3.9	2.9	1.6	4.2
20% Perc	41.0	38.2	78.0	7.5	4.5	8.0	4.2	3.3	1.9	5.1
25% Perc	43.6	40.7	91.9	8.1	4.7	8.4	4.4	3.7	2.3	6.1
30% Perc	46.7	42.8	117.1	8.6	4.9	8.8	4.5	4.1	2.6	7.1
35% Perc	50.0	45.1	144.5	9.2	5.1	9.1	4.7	4.5	3.0	8.1
40% Perc	54.6	47.8	177.3	9.7	5.3	9.5	4.8	4.9	3.3	9.2
45% Perc	58.6	50.3	215.6	10.3	5.5	9.8	5.0	5.3	3.7	10.5
50% Perc	62.8	52.2	273.3	10.9	5.7	10.2	5.1	5.8	4.1	11.8
55% Perc	66.1	54.5	338.7	11.5	5.8	10.6	5.2	6.3	4.6	13.4
60% Perc	69.7	57.2	415.7	12.2	6.1	11.1	5.4	6.8	5.1	15.2
65% Perc	74.3	60.1	476.1	12.9	6.3	11.6	5.5	7.4	5.7	17.3
70% Perc	78.2	63.5	574.1	13.7	6.5	12.2	5.7	8.1	6.4	19.8
75% Perc	86.2	66.9	737.8	14.6	6.8	12.9	5.8	8.9	7.1	22.8
80% Perc	93.7	73.2	917.7	15.6	7.2	13.8	6.0	10.0	8.2	26.9
85% Perc	100.6	79.6	1219.7	16.8	7.6	14.9	6.3	11.4	9.5	32.4
90% Perc	114.6	92.9	1769.8	18.4	8.2	16.8	6.6	13.7	11.4	41.1
95% Perc	140.1	108.5	2908.3	20.9	9.1	20.3	7.1	18.3	15.0	58.2

Note: Modelling was undertaken using Latin Hypercube sampling (Palisade 2007 The Decision Tools Suite. Complete risk and decision analysis toolkit. Industrial Version 4.5. *In* Palisade ASia-Pacific Pty Ltd, Milsons Point, NSW, Australia.)

3.9. Verification of audit process

Water bills were made available from 10 spas. Monthly averages (usually 6 mth, but in 2 cases 1 month) were cross checked against water use calculated on site via the water audit (Errors for 8 spas were -3% ± 5% (standard deviation). This verification step indicated that the audit process was relatively accurate. Spa 11 and 18 had accommodation and restaurants or gym attached to the same water bill and error for these spa were much higher (~50%). It should also be noted that water leakage and maintenance is important to prevent water wastage several spa had showerheads with leakage at pivot points or dripping taps.

4. Summary

4.1. Feed back to spas audited

A summary report highlighting individual spas together with summary water audit data sheet will be provided to all participating spas.

4.2. Water use by Victorian Spas

Water use by spas was most related to the types of treatments, the equipment used for the treatment and their frequency of use. The total volume used for specific treatments varied considerably; some spas using up to 7 times more water for the same water based spa treatment. The findings indicate that some water saving may be possible in some spas. However, work is required to determine if the same standard/quality of treatment is given with less water.

Water use in spas per a client visiting the spa ranged from 37 to 201 L/client, this is lower than most household and hotels use for a household or room per day (550 and 250-1000L/day, respectively).

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5. Recommendations

Water is a part of the spa corporate and industry brand image. The water audit auspiced by ASpa with funding provided by the Victorian Government, Smart Water Fund has enabled ASpa to proactively gather data and consider opportunities for further water efficiencies as a part of a wider business accreditation program. Some recommendations for action resulting from this audit are highlighted below:

a. Production and distribution of a self assessed water audit toolkit to enable all spas to self assess their water usage.

b. That a “Spa Operations – Water Efficiency” guide (flyer) be produced & implemented for distribution to ASpa membership. This guide (flyer) to provide internal staff with water efficiency hints for individual activities conducted within a spa.

c. The production of a waterproof information tag to be inserted in all showers highlighting water flow & usage of showers.

d. That signage is improved within spas to educate the consumer of water efficiency measures being undertaken.

e. That vocational training competency standards are reviewed to provide elements associated with water efficiency measures in treatments.

f. That on-site training in water efficiency measures is conducted as part of therapist inductions.

g. That all spas consider the option of water efficient shower heads, flow meters and grey water systems where possible.

h. Further consultation with industry equipment manufacturers to highlight manufacturing best practice

i. Investigate the potential for a “water offsetting” scheme run through the Australasian Spa Association in consultation with community. Participating spas to identify water usage & donate equivalent water catchment to community facilities, schools etc.

j. That spa water efficiency measures be incorporated into a wider spa accreditation model that is readily identifiable to the community.

k. That funding be sought to select an industry best practice spa to be engaged to speak at select national and international spa events on water efficiency initiatives undertaken by the Australasian spa sector.

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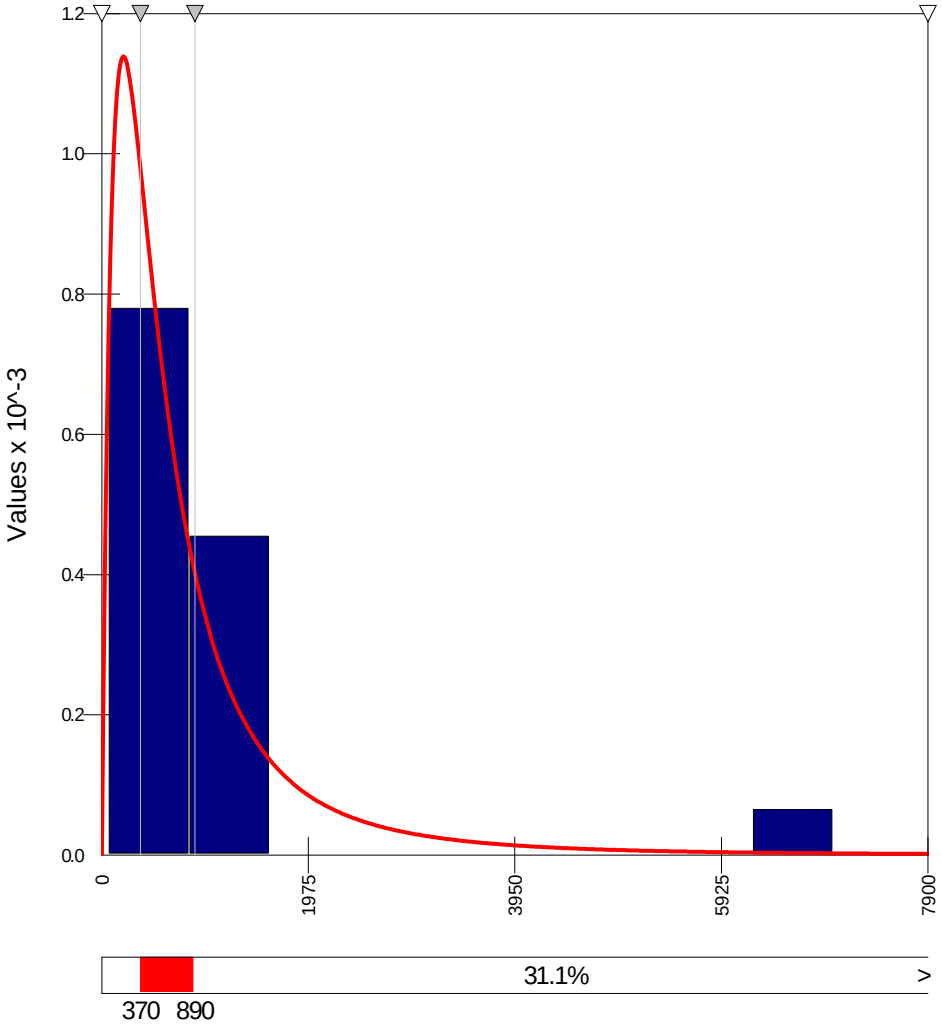
6. Appendix - Statistical analysis

6.1. Data tally from spa area and size

Size	large	medium	small
Area			
Eastern Victoria	1	1	2
Metropolitan	2	1	1
Northern Victoria	2	2	0
Southern Victoria	1	1	2
Western Victoria	2	1	1

Pearson6(2.0118, 2.5754, 726.95)

Table



13 Distribution of the number of clients per month visiting the 20 spas where physical audits were completed. 370 = 35% of the population, 890 = 70% of the population.

6.2. Spa clients made aware of water conservation

Accumulated analysis of variance

Change	d.f.	s.s.	m.s.	v.r.	F pr.
+ Area	4	6.500	1.625	1.32	0.308
Residual	15	18.500	1.233		
Total	19	25.000	1.316		

Predictions from regression model

Response variate: WatMssge

	Prediction
Area	
Eastern Victoria	0.750
Metropolitan	1.500
Northern Victoria	1.250

Southern Victoria	2.500
Western Victoria	1.500

Standard error of differences between predicted means 0.7853
Least significant difference (at 5.0%) for predicted means 1.674

6.3. Water use per client (L/client)

6.3.1. All clients (includes non water treatments)

Response variate: ALL_L_client

	Prediction		
Size	large	medium	small
Area			
Eastern Victoria	55.02	105.84	128.95
Metropolitan	73.42	40.39	89.52
Northern Victoria	68.68	117.42	*
Southern Victoria	105.16	37.29	73.00
Western Victoria	66.95	69.16	58.94

Minimum standard error of difference	46.78
Average standard error of difference	58.29
Maximum standard error of difference	66.16
Minimum least significant difference	114.5
Average least significant difference	142.6
Maximum least significant difference	161.9

Response variate: ALL_L_client

	Prediction
Area	
Eastern Victoria	100.84
Metropolitan	71.52
Northern Victoria	99.20
Southern Victoria	68.13
Western Victoria	66.84

Minimum standard error of difference	28.64
Average standard error of difference	29.41
Maximum standard error of difference	30.63
Minimum least significant difference	61.87
Average least significant difference	63.54
Maximum least significant difference	66.16

6.3.2. All clients using water treatments

Predictions from regression model

Response variate: All_WatL_Wclient

	Prediction		
Size	large	medium	small

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Area			
Eastern Victoria	68.8	208.1	255.9
Metropolitan	338.6	41.1	171.2
Northern Victoria	442.9	256.9	*
Southern Victoria	282.2	61.6	142.2
Western Victoria	240.8	214.8	88.8

Minimum standard error of difference	142.0
Average standard error of difference	177.0
Maximum standard error of difference	200.9
Minimum least significant difference	347.5
Average least significant difference	433.0
Maximum least significant difference	491.5

6.4. Effect of water source or wastewater disposal on water use per client

6.4.1. Effect of water source on use water use per water treatment client water

Predictions from regression model

Response variate: All_WatL_Wclient
Prediction

WaterSrce	
mains water	204.3
sea/mains water	447.2
spring water	282.2
spring/mains water	248.7
tank water	93.8
tank/mains water	266.7

Minimum standard error of difference	92.4
Average standard error of difference	172.1
Maximum standard error of difference	204.0
Minimum least significant difference	198.1
Average least significant difference	369.0
Maximum least significant difference	437.4

	Count
WaterSrce	
mains water	13
sea/mains water	1
spring water	1
spring/mains water	3
tank water	1
tank/mains water	1

6.4.2. Effect of wastewater disposal on water use per water treatment client

Response variate: All_WatL_Wclient

	Prediction
Wstewater	
Recycled to plants	185.2
sewer	241.4

Standard error of differences between predicted means 68.70
Least significant difference (at 5.0%) for predicted means 144.3

6.5. Effect of Spa type on water use

Water treatment clients

Accumulated analysis of variance

Change	d.f.	s.s.	m.s.	v.r.	F pr.
+ SpaType	2	34056.	17028.	0.86	0.440
Residual	17	336012.	19765.		
Total	19	370068.	19477.		

Predictions from regression model

Response variate: All_WatL_Wclient
Prediction

SpaType	
day spa	199.0
destination spa	230.1
natural bathing spa	295.1

Minimum standard error of difference	73.2
Average standard error of difference	124.3
Maximum standard error of difference	154.0
Minimum least significant difference	154.5
Average least significant difference	262.2
Maximum least significant difference	324.9

All clients (water and non water treatments)

Accumulated analysis of variance

Change	d.f.	s.s.	m.s.	v.r.	F pr.
+ SpaType	2	2856.	1428.	0.99	0.393
Residual	17	24602.	1447.		
Total	19	27457.	1445.		

Predictions from regression model

Response variate: ALL_L_client
Prediction

SpaType	
day spa	74.67
destination spa	65.97
natural bathing spa	101.35

Minimum standard error of difference	19.82
Average standard error of difference	33.62
Maximum standard error of difference	41.67
Minimum least significant difference	41.81
Average least significant difference	70.94
Maximum least significant difference	87.92

6.6. Explanation of terms

Table 14. Explanation of terms used and assumptions made when conducting surveys and calculating data

ASpa Water Wise Physical Audit Recording Sheet			
Equipment	**Question**	**units**	**comment**
Pools	Volume of water	L/total	calculated by measuring the total volume of each pool. Pools and/or pool spas were defined as large volume of water with no specific treatments and for general use as part of a package or additional to the treatment if you wanted to use them
	Volume of topup	L/topup/mth	calculated by measuring the area of each pool and the depth of top up each week or month
	Frequency of replacement	tot-vol-L	question posed to participants on the frequency of replacement of pool water
Showers	Treatment shower water use	L/min	measured over 15 seconds, and calculated (x4) to get L/min
	Uses/month	Use/mth	obtained through discussions with participants
	duration of treatment	min	obtained through discussions with participants
	Client shower water use	L/min	measured over 15 seconds, and calculated (x4) to get L/min
	Uses/month	Use/mth	obtained through discussions with participants
	duration of treatment	min	obtained through discussions with participants
Spa	Volume of water	L/total	approximate volume of water used to fill the spas
	Source of water	source	a question posed to ascertain where the water came from (mineral, mains etc.)
	Uses/month	Use/mth	obtained through discussions with participants
Tubs	Volume of water	L/total	approximate volume of water used to fill the spas
	Source of water	source	a question posed to ascertain where the water came from (mineral, mains etc.)
	Uses/month	Use/mth	obtained through discussions with participants
Capsules/ Flotation tank	Water use	L/client	only one capsule was measured. The capsule was actually a flotation tank. The water is never emptied only topped up. Therefore topup volumes were recorded, and water used from the showers that clients take before and after entering the tank form the water
	Uses/month	Use/mth	obtained through discussions with participants
	hand held shower	L/client	measured over 15 seconds, and calculated (x4) to get L/min and multiplied again by duration of use
Vichy	Number of showers heads	no/heads	visual observation
	Water use	L/min-head	where possible individual head use was measured, however it was not possible to measure this in most circumstances
	Water use whole apparatus	L/min-whl-app	volume measured with all heads on
	duration of treatment	trt-time-min	obtained through discussions with participants

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	Water use per treatment	L/tment	this involves calculating the
	Uses/month	Use/mth	obtained through discussions with participants
Laundry Facilities	Make/Model of machine	make	through observation
	Water use per wash	L/wash	through research on internet or from manuals provided by audit participants
	No of wash cycles /month	cycl/mth	obtained through discussions with participants
Toilets		usage	asumption made that all clients use the bathroom once per visit. We also assumed that half the clients would use a full flush and half a half flush. With many treatments it is understood that the body cleanses therefore the bathroom may be used more often
	Water use	Use/mth-ful	looked at make and type of toilet to ascertain its usage per flush
	Uses/month	Use/mth-hlf	looked at make and type of toilet to ascertain its usage per flush
Change room basins	Water use	L/client	volume measured with tap on and hands being washed with soap to get accurate measurement
	Uses/month	Use/mth	assumption made that every client using a toilet washes their hands
water features	Water capacity	L/total	approximate volume of water used to fill the feature
	Top up/month	L/total	average volume of water to top up each month
Spray Tanning Booth	Water use	L/client	measured the volume of apparatus for 15 seconds then multiplied out to get actual time taken
	Uses/month	Use/mth	obtained through discussions with participants
Stone Heater	Water use	L/client	measured the volume of water in stone heater and asked questions about frequency of replacement
	Uses/month	Use/mth	obtained through discussions with participants
Hand basins staff use	Water use	L/client	volume measured with tap on and hands being washed with soap to get accurate measurement
	Uses/month	Use/mth	obtained through discussions with participants. Assumptions made that the staff wash their hands before and after evert treatment conducted. When wraps and scrubs are applied the frequency increases to 3 or 4 times.
Facial bowls	Water use	L/client	measurement of the volume of water used in the treatment
	Uses/month	Use/mth	obtained through discussions with participants
Pedi basins	Water use	L/client	measurement of the volume of water used in the treatment
	Uses/month	Use/mth	obtained through discussions with participants
Mani basins	Water use	L/client	measurement of the volume of water used in the treatment
	Uses/month	Use/mth	obtained through discussions with participants
Salon basins	Water use	L/client	measurement of the volume of water used in the treatment. Assumed that short hair uses less water than long hair, however or breakdown from all places with salons attached to ascertain individual numbers of short, long, colors etc.
	Uses/month	Use/mth	obtained through discussions with participants
Foot Soak bowls	Water use	L/client	measurement of the volume of water used in the treatment
	Uses/month	Use/mth	obtained through discussions with participants

Hydrostorm	Water use	L/client	assumptions made as to how the apparatus is used by clients. Instructions are given to clients on proper use of apparatus however this is not always adhered to. I had assistance from 2 staff members to hold buckets and a stop watch
	Uses/month	Use/mth	obtained through discussions with participants
Waste water	Disposal method	yes=1,no=0	to sewer, recycled, septic etc
	If recycled how where what		recycling, on to gardens, reused etc.
Additional staff water use	Number of clients		taken from data provided
	Clients/day		to obtain clients/day the total /month was divided by 30 days.
	Staff/day/_no_of_client/day		this is a estimate that there are approximately 5 clients to every staff member on site per day
	Staff/mth		staff per day x 30 days
	Total staff water/mth		assumption was made that each staff member uses a half and full flush toilet and washes their hands after each use each day
	Dishwasher/mth		dishwashers use on average20L/wash (www.choice.com.au/defaultView.aspx?id=102314&p=1&catId=100165)we assumed that a wash cycle was conducted at least once every day. And that there was one wash cycle for every 12 clients/day.
			For one spa there was a café as part of the spa complex. In the café there was a glass washer, dishwasher and washing machine for which we assumed used as much water as the dishwashers in the staff room.

7. References

Bohdanowicz P, Martinac I (2007) Determinants and benchmarking of resource consumption in hotels—Case study of Hilton International and Scandic in Europe. *Energy and Building* **39**, 82–95.

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8. Addendum

8.1. Arris contact for project

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8.2. Descriptions of Spa Equipment (Table 2)

Equipment	Description
Water based treatments	
Spas	Multi-jet water massage treatment
Tubs	Usually deep bath like tubs
Capsules	Self-contained, multi-purpose, enclosed treatment capsule
Vichy	Specialised treatment table with (generally) multiple shower heads located on a moveable arm above client
Hydrostorm	Shower style equipment with multiple shower heads located to distribute water simultaneously to various parts of the body.
Pools	Open, multi-use pool
Plunge pool	Small contained cold water pool
Foot soak bowls	Similar to pedicure bowl
Salon hair basins	Basins used for washing clients hair in hair and beauty salons
Manicure bowls/basins	Basins used to immerse clients hands for specialised treatments
Pedicure bowls/basins	Basins used to immerse clients feet for specialised treatment.
Stone heaters	Heating stones for use in treatments
Facial bowls	Basins used during facial treatments
Spray booth	Used for spray tanning treatments
Treatment showers	Showers used in treatment rooms
Accessory equipment using water	
Client showers	Private change room showers
Laundry Facilities	Washing machines and associated equipment
Water features	Display features