Water Efficient Schools
Chesswood Middle School Project
Final Project Report
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Southern Water

A ScottishPower Company

ENVIRONMENT AGENCY

Authors

Magda Styles & Terry Keating

Southern Water, Southern House, Yeoman Road, Worthing BN13 3NX. Telephone 0845 278 0845

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Executive summary

This project is a result of a joint initiative between Southern Water, the Environment Agency and West Sussex County Council. The purpose was to demonstrate the water and cost savings achievable in a practical school environment and to provide information and know-how that could be applied more widely.

Southern Water's 'Water Efficient Schools' programme has previously identified that substantial water savings can be achieved in schools by the installation of water efficient equipment.

This project aimed to find out which particular fittings are likely to provide the largest water savings and to establish the financial paybacks. Additionally the results will be used to produce a case study with low budget, but effective water efficiency advice that can be used by other schools in the region.

The project was conducted in Chesswood Middle School, Worthing. To keep the costs down, all monitoring was done by logging the main meter on the incoming supply.

The equipment installed included passive infrared urinal controls, self-closing taps, in-line flow restrictors, save-a-flush cistern displacement devices and water butts for rainwater collection.

The project demonstrated that the largest savings are likely to be gained from the installation of urinal controls, with the installation costs fully recouped in less than a year and around 68% reduction in water consumption. Significant savings also arose from the installation of self-closing taps, although the payback period was much longer. The savings attributable to other measures were less clear, although reasons other than simple reduction in consumption may prompt schools to consider them in their water efficiency strategy.

The project resulted in overall savings in water of about 73% of the initial consumption, with the school using less water during a school day now, than it did previously during a holiday period.

Introduction

This project arose from a joint initiative between Southern Water, the Environment Agency and West Sussex County Council. It was conceived as a pilot project to demonstrate the water and cost savings achievable in a practical school environment, and to provide information and know-how that could be applied more widely.

Southern Water's previous work with schools in the region has identified that substantial water savings can be made by installation of water efficient equipment. So far, however, the advice on what are the most cost-effective measures that can be easily adopted by schools, has been sparse. This detailed study was established to provide this advice.

Chesswood Middle School, in Chesswood Road, Worthing, is a mixed primary school with 480 pupils aged between 9 and 13 on the register, while the adults on-site comprise 24 teaching staff, 15 teaching assistants and 4 office staff.

During the 1999/2000 school year, a water efficiency project has been conducted to assess the cost effectiveness of various water efficient fittings installed throughout the school.

The purchase of the equipment and the installation costs were jointly funded by Southern Water, West Sussex County Council and the Environment Agency, and the budget available was £4500. Southern Water provides the water supply and sewerage services to the school. The project was managed by Southern Water.

Objectives and scope of the project

The project developed from the experiences gained during the Worthing High School Water Efficiency Project[1] and aimed to establish, in more detail, the water savings attributable to specific fittings and, in particular, their cost effectiveness. The main objectives of the project were:

- to measure the water savings arising from the installation of cost effective, water efficient equipment throughout the school;
- to establish the financial payback period attributable to each specific measure;
- to produce a case study containing advice on low budget, cost effective retrofit water efficiency measures that can be easily adopted by other schools in West Sussex and beyond.

All washroom, classroom, and outside water use facilities were included in the project's scope. The school also has a kitchen, but this is now unused because cooked meals are no longer provided.

Method

A water efficiency audit was conducted in June 1999 by Southern Water's Bylaw Inspector to determine the type and numbers of existing fittings. These are summarised in Tables 1 and 2 below.

The school's water supply is delivered through one service pipe in Chesswood Road and the meter is read by Southern Water staff approximately every three months. The meter on the incoming service pipe was replaced with one having a pulsed output and logging of the flow commenced on 13th July 1999. The logger was set to record at 15 minutes intervals, and measurements continued until 30th March 2000.

Before logging commenced, the Southern Water Leakage Team conducted a site survey, which confirmed there were no leaks on the supply pipe.

Due to the limited project budget, all changes in consumption were monitored through the main meter and logger on the incoming supply. Three

[1] *Worthing High School: Water Efficiency Project (1999). Southern Water Report*

Table 1: Washroom facilities in Chesswood School

	BASINS				URINALS		TOILETS					
	No.	Hot	Cold	Plug	No.	Control	No.	Type*	Vol.(l)	Shower	Other Fac.	Comments
Male staff	2	Y	Y	Y	1	petcock	1	LL	9	2		Showers not used
Female staff	1	Y	Y	Y			2	LL/CC	9+7	2		Showers not used
Disabled	1	Y	Y	Y			2	LL	9			blender tap
Year 4 boys	2	Y	Y	N	2	pressure drop	1	LL	7			malfunctioning urinal control
Year 4 girls	2	Y	Y	N			2	LL	7			
Year 5 boys	2	Y	Y	N	2	pressure drop	1	LL	7			malfunctioning urinal control
Year 5 girls	2	Y	Y	N			2	LL	7			
Year 6 girls	2	Y	Y	N			2	LL	7			
Year 6 boys	2	Y	Y	N	1	trough, pressure drop	1	LL	7			malfunctioning urinal control
Year 6 W+WH girls	1	Y	Y	N			1	LL	7			point of use heater
Year 6 W+WH boys	1	Y	Y	N			1	LL	7			point of use heater
Year 7 girls	2	Y	Y	N			2	LL	7			
Year 7 boys	2	Y	Y	N	1	trough, pressure drop	1	LL	7			malfunctioning urinal control
Boys changing	1	Y	Y	Y			1	HL	7	5	lockshield bib tap	Push taps on showers; very long hot water run.
Girls changing	1	Y	Y	N			1	HL	9	5		
Playground boys	4	Y	Y	N	2	gate valve	2	LL	7			Point of use heater; all services by roof system, no drinking water
Playground girls	4	Y	Y	N			4	LL	7			
TOTALS	32				8		9		26			

*Type of cistern: Low level (LL), High level (HL), Close coupled (CC)

Table 2: Other school facilities

SINKS

	No.	Hot	Cold	Plug	Other Fac.	Comments
Staff Room	1	Y	Y	Y	Drinking water point with filtered water; wall kettle	
Garden area					Lockshield bib tap; 2 rainwater down pipes	
Porta-classrooms (2)	2	Y	Y	N	Point of use heater	
PRU unit	4	Y	Y	Y	Heatrae Sadia heater	
ICT Room	4	Y	Y	N	Hoover Logic washer drier 1300	Hot water slow to come
Laboratory	*	Y	Y	N	4 lab sinks with triple water points	
Year 6W & WH (portacabins)	2	N	Y	N	Point of use heater	
Classrooms	16	Y	Y	Y/N		
Drinking water					3 Novus fountains & 1 other	
First aid room	1	Y	Y	Y		
TOTALS	31					

* Belfast sink

additional meters were installed on outside taps to allow the assessment of any outside use, but these were not logged.

The daily occupancy of the buildings, including both adults and children, was recorded and regularly provided by the school staff.

The programme equipment installation commenced at the end of September 1999 to allow three weeks monitoring of background consumption after the return of the pupils from the long summer break. Although logging commenced in July 1999 the July readings were not used to provide background consumption data because the kitchen was operational at that time.

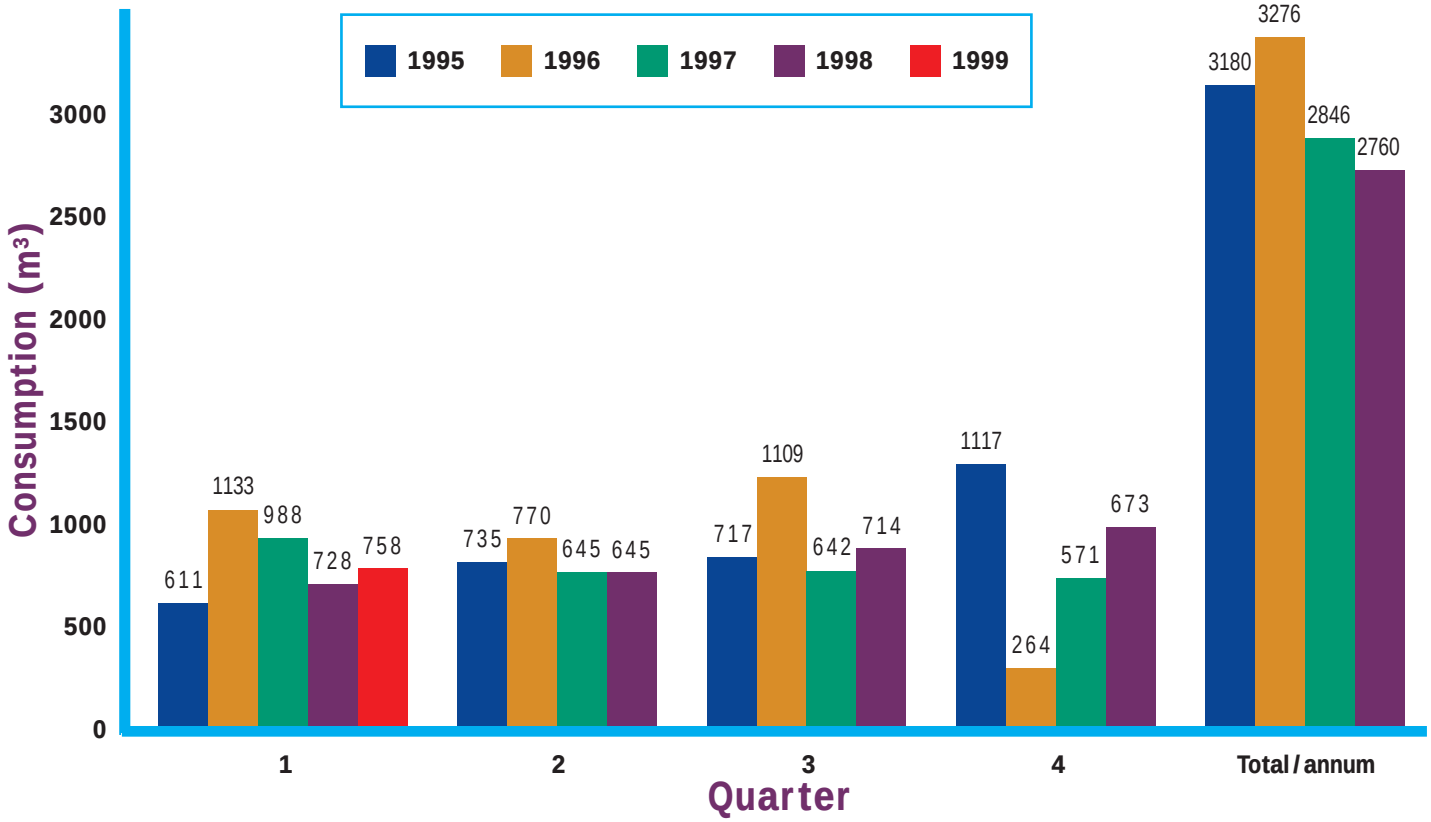
For details of statistical analysis see Appendix 1.

The school's water consumption

The school water consumption over the last four years is illustrated in Figure 1. In the year to April 1999, the last full year before the commencement of the project, the total consumption was 2760 m^3.

The West Sussex County Council benchmark figure for water consumption per pupil in the County schools is 4000 litres per year. In Chesswood School the consumption to April 1999, at 5750 litres per pupil, was over 40% greater than this benchmark figure.

Figure 1: Water consumption in Chesswood School prior to the commencement of the project.



Implementation of water efficiency measures

Choice of fittings

TOILETS

The options considered included high level/low volume cisterns, retrofit dual flush mechanisms and cistern displacement devices. The latter were chosen for implementation on the grounds of low cost and ease of installation. Specifically, Save-a-flush bags which, as a component part of Southern Water's current water efficiency strategy are provided free to all customers, were installed throughout the school. These bags displace approximately one litre of water with each flush and tend to work well in the majority of older cisterns.

URINALS

The possible options were passive infra red controls (battery or mains operated) and waterless urinals. After considering the patterns of urinal use, cleaning regimes at the school and maintenance costs, the battery operated PIR controls were chosen as the preferred option. These were supplied and fitted by Flow Control plc, with a one-year guarantee and an option of an annual maintenance service.

WASHROOM TAPS

Options considered included retrofit push taps, spray taps and spray inserts. Ease of use, costs and likely misuse by pupils were discussed and finally, the self-closing push taps were chosen over the other options. The chosen model was the "Plush" tap, which retrofits to an existing tap.
The "Plush" tap has an in-built flow restricting device which provides the means to further reduce consumption. These were supplied and fitted by Flow Control plc with a one-year guarantee. The timing was adjusted to allow a flow of six seconds duration and the flowrate was restricted to six litres/minute.

SHOWERS

The staff showers are not used at all and pupils shower only very sporadically. The showers already have push controls fitted and therefore it was decided that any improvements would not be cost effective.

CLASSROOM SINKS

These are normally used for washing brushes and other similar activities, and push taps would not have been suitable. It was decided therefore to install in-line flow restrictors, which reduce the flow to six litres/minute, and to provide standing plugs. "Restrictaflow" units were chosen because they can also be used as isolating valves, making maintenance easier.

GARDEN

The school has a small garden which is tended by pupils, and which requires a small amount of watering in the summer. This is normally done via a hosepipe fed from the outside tap.

Two water butts and associated stands, provided free of charge by Southern Water, were fitted in February by a local plumber to collect rainwater from the building roof. During the summer these butts should provide a source of water from which the pupils can fill watering cans or connect a hosepipe to water the garden. However, monitoring the use of the butts during the forthcoming summer was not part of this project.

Installation timetable

The detailed timetable of consumption monitoring and equipment installation can be found in Table 3. Daily consumption is considered over the nine separate intervals, corresponding to the progressive installation phases of each efficiency measure.

The Save-a-flush bags were initially inserted into the toilet cisterns in late September, following the three-week background monitoring period. But due to the highly variable consumption during these first few weeks of term, it was not possible to determine the water savings attributable to the bags, even with pupil numbers taken into account. It was therefore decided to repeat this part of the project during February/March 2000. In the event, the bags were removed on February 7th, 2000 and reinserted on March 7th 2000.

Table 4 gives the numbers and types of each unit installed, together with the purchase and installation costs. The total project cost of £2834 includes the purchase of meters, but for the purpose of calculating the payback period on the various fittings, these costs should be excluded. The cost of the installation and purchase of the equipment only is therefore £2452.

Table 3: Programme of installation

Phase	Start	End	Activity
1	13 July	23July	Pre trial monitoring - but school canteen in operation
2	24 July	5 Sept	Summer vacation
3	6 Sept	29 Sept	Pre trial monitoring
4	30 Sept	25 Oct	Save-a-flush introduced
5	26 Oct	21 Nov	Urinal controls introduced
6	22 Nov	10 Jan	Washroom controls - push button taps - introduced
7	11 Jan	6 Feb	Flow restrictors introduced
8	7 Feb	6 Mar	Save-a-flush removed
9	7 Mar	30 Mar	Save-a-flush re-introduced

Results

Daily water consumption in the school from July 1999 to March 2000 is illustrated in Appendix 3. The changes in the daily pattern of consumption following each installation are presented in Appendix 4 and illustrate where the savings resulting from each type of installation were made. The average weekday volume of water used in each phase of the project is listed in Table 5.

The data has been split into schooldays (weekday) and weekend/holiday periods to enable the daily consumption to be normalised with respect to school occupancy and to highlight the consumption during the summer vacation when the building was empty. Detailed consumption statistics are given in Appendix 1.

The increase in consumption between phases 3 and 4 has already been noted. Because of the early term variations, it was decided to extend the background, pre-trial data by combining flow data from phases 3 and 4. Using the combined data over this period gives a pre–equipment installation schooldays consumption of 8746 litres/day, equivalent to 19.4 litres/head/day, and a weekend/holiday consumption of 5922 litres/day. Deviations from these figures have been used to assess the effectiveness of the various fittings (see section on impacts of the installations, overleaf), assuming that the changes are totally due to the fittings and not due to any other factors within the school.

Extrapolating these figures to a whole year of water use gives a pre-trial consumption of 2726 m^3/year. The post trial consumption based on extrapolation of figures from period 9, gives 730 m^3/year – an overall reduction of 73% (based on 200 school days and 165 days off per year). This extrapolated pre-trail figure is remarkably close to last year's actual water consumption of 2760 m^3/year. It has to be remembered however, that last year the school kitchen was still operational; also, extrapolation of consumption from a short period in one month in the year may not give a truly accurate picture of expected annual consumption. The 73% reduction has to be, therefore, treated as a guide only and the actual annual reduction will have to be calculated from future meter reads.

Table 4: Number of fittings and the cost of installation

Installation	Unit cost (£)	Number	Total cost (£)
Meter to kitchen	132	1	132
Meters to outside taps	125	2	250
Install IR battery urinal controls (total cost includes pipework modification of £120)	135	6	930
Fit retrofit "Plush" taps with 6 second duration and 6 1/min flow restriction	18	62	1,116
Install in-line flow restrictors on tap pipework in classrooms (6 1/min)	10	26	260
Supply missing standing plugs to sinks	3	6	18
Fit water butts on downpipes for watering the garden*	64	2	128
TOTAL excluding VAT			**2834**

** The cost for water butts is for installation only. The butts, which normally retail at £40 each, were supplied free by Southern Water*

Table 5: Average daily consumption during each phase of the project

Phase	Equipment/period	School Days			Weekends/Holidays	
		Number of days	Average consumption (litres/day)	Per capits consumption (litres/head/day)	Number of days	Average consumption (litres)
1	Summer Term	9	10614	*	2	4850
2	Summer Vacation	0	*	*	45	3585
3	Pre-trial	17	7966	17.4	6	4948
4	Save-a-flush installed	17	9525	21.3	9	6571
5	Urinal controls installed	14	4006	8.70	13	2143
6	Push-taps installed	24	3498	7.57	26	298
7	Flow restrictors installed	19	3567	7.60	8	194
8	Save-a-flush removed	16	3654	7.65	14	494
9	Save-a-flush re-installed	17	3420	7.28	6	280
Total days		**133**			**129**	

Impact of the installed efficiency measures

WATER SAVINGS

Following the installation of the measures described, the average daily consumption during the final weeks of the project was lower on a school day, than it was during the summer holidays before the commencement of the project, when the school was empty (respectively 3420 and 3585 litres/day). The impact of each of the measures in achieving this reduction in consumption is described below.

Urinal Controls

Following the installation of the PIR controls, the school's daily water consumption reduced from an average of 8746 litres over the 34 day base period (school days) to 4006 litres/day over the following 14 day period - a reduction of some 55% of the pre-installation levels. The savings arise mainly from the drastically reduced background night levels (see Appendix 3). However, it is unlikely that this entire reduction is due to the installation of the urinal controls because during the long summer holiday, the average daily consumption, probably due to the free flowing urinals, was reasonably constant at around 3600 litres/day.

Appendix 4 shows that, during term time, consumption within the school starts to rise around 8:00am and returns to the base flow some 12 hours later. Outside of this period, a consumption of some 1800 litres was typical before the installation of the urinal controls and arguably 1800 litres were also used during school hours. Following the introduction of the controls however, outside hours use effectively reduces to zero, whilst daytime use probably continues at around 1800 litres. This gives a saving of some 1800 litres/day.

During weekends and holidays, the picture is somewhat different. The average weekend consumption, which is likely to comprise the regular hygiene flushes only, is approximately 360 litres/day. Therefore, assuming a 40-week school year, the introduction of the urinal controls is estimated to save some 895 m^3, or 68% of the pre-installation consumption in a full 12-month period. (see Appendix 2).

Washroom Push Taps

The reduction achieved by changing the taps was not on the same scale as that from the urinal controls, nor was it expected to be, but nevertheless, the savings were highly significant. Comparing the consumption during phase 5 with that during phase 6 shows a weekday reduction of around 508 litres/day, or 13% of the pre-installation (phase 5) consumption.

In terms of the daily water use patterns, the majority of the reduction was from peak use and late afternoon, (possibly by cleaning staff) use (see figure 3). However, there were no complaints from the cleaners regarding the ease of use of the taps. The quality of the cleaning was not affected, indicating that prior to the push taps fitting the use of water for cleaning may have been unnecessarily high. There was also a slight reduction in night use, possibly because push taps cannot be left turned on.

Classroom Sink Flow Restrictors

In-line flow restrictors were fitted to all classroom taps. However, there was no statistically significant change in the average weekday consumption between phase 6 (3498 litres/day) and phase 7 (3567 litres/day), suggesting that of the total daily volume of water used within the school, the proportion used in the classrooms is probably too small for any reductions to show up by monitoring the incoming supply.

Cistern Displacement Devices

Save-a-flush bags were fitted to all toilet cisterns early in September (phase 4), but no impact was visible on the overall water volume used by the school. There were large daily fluctuations in water consumption at the beginning of the new school year and pupil numbers fluctuated as whole classes were out of school on outdoor activities. It was therefore decided to remove and then re-install the bags after the installation of the flow restrictors when conditions were assumed to be more stable (phase 7).

Consequently the bags were removed on 7th February 2000 (phase 8) and reinserted on 8th March 2000 following a three school week monitoring period. Another three-week monitoring period (phase 9) followed before the project was concluded.

The average weekday consumption during phases 6 and 7 (43 days) was 3528 litres/day, while during the 16 day period in which the bags were removed (phase 8), the consumption rose to 3654 litres/day, an increase of 125 litres/day. Given the daily variability however, this is not statistically significant (see Appendix 1). Following the re-introduction of the bags, the average consumption dropped by 234 litres/day to 3420 litres/day (phase 9). Again, this change is not statistically significant, but it does suggest that the bags are operating effectively. Evidence from studies elsewhere[2] in fact, demonstrates the effectiveness of the one litre save-a-flush bags in reducing the volume of water used by around one litre per flush. The difficulty in observing this volume is in identifying the proportion used for flushing from the total consumed in the school.

Water Butts

Two water butts were installed, in February 2000, on the down pipes adjacent to the garden area. The garden is cultivated by the pupils and mains water has been used for watering during previous years. The butts were installed early in the year to allow for rainwater collection prior to the watering season. However, savings in consumption due to

[2] *The Water Efficiency of Retrofit Dual Flush Toilets (2000), Southern Water Report*

rainwater use for summer garden watering are likely to be small, and are not expected to show up as a measurable reduction in the overall consumption. Analysis of garden watering during the summer did not form part of this project.

OVERALL SAVINGS AND COST EFFECTIVENESS

Urinal controls

The introduction of the urinal controls is estimated to save approximately 895 m^3, or 68% of the pre-installation consumption over a full 12 month period. At £1.58 per m^3, this would cost approximately £1360 (see Appendix 2). The purchase and installation costs of the controls were £960. This cost could clearly be recovered in less than one school year.

Washroom taps

The total cost of installation was £1116. The volumetric savings over a 12 month period are estimated to be 102 m^3, which at £1.58 per m^3 would cost £161. The payback period, assuming a discount rate of 6% is therefore slightly over nine years.

Cistern displacement devices

Cistern displacement devices are effective in reducing the volume of water used in flushing toilets. Although the impacts of the one litre save-a-flush bags installed as part of this project could not be dissagregated from the total consumption within the school, nevertheless studies elsewhere have shown that they save around one litre per flush.

Save-a-flush bags are distributed free by Southern Water, as part of their ongoing water efficiency campaigns.

SUMMARY

During the final weeks of the monitoring programme, schoolday consumption averaged 3420 litres/day, while weekend consumption, following the introduction of the urinal controls, was reduced to some 280 litres/day. Based on a 40-week school year, this suggests a minimum annual consumption of approximately 730 m^3. This is significantly below the 2780 m^3 used during 1998/99, but direct comparisons cannot be made for the school kitchen is no longer in operation. Extrapolation from a limited monitoring period to a whole year may also give a somewhat exaggerated picture. Nevertheless, substantial savings have been recorded and the projected per capita consumption figure of 1520 litres/pupil/year, based on the 480 pupils on the register, is significantly below the County Council's existing benchmark consumption figure.

RECOMMENDATIONS

Cistern displacement devices

Small savings attributable to save-a-flush bags were observed during this project, although statistically the reductions were not significant. The bags displace one litre with every flush, and were intended originally for use in larger, older type of cisterns.

As the bags are a very low cost measure, the inconclusive evidence on savings should not deter potential users from installing them, provided that the quality of the flush is not affected.

Urinal controls

Clearly, the largest water savings in this project have been provided by effective urinal controls and they should be considered before any other measures are implemented. Passive infrared controls limit drastically the amount of water flushed without compromising the overall washroom hygiene. It is important to bear in mind that regular maintenance and, with battery operated systems, change of the battery, is essential to sustain the level of savings.

Even larger savings in the overall water consumption could be provided by the conversion to waterless urinals. The suitability of these, however, has to be assessed on a case-by-case basis; they are not suitable where trough urinals are installed, good cleaning regimes are essential and there is an ongoing commitment to material costs.

Push control taps

Although in this project the payback period for push taps was much longer than for urinal controls, there are other factors which should be taken into consideration when deciding on the choice of efficiency measures. One of the main benefits of self-closing taps in the school environment is that they cannot be left on, and therefore they reduce the unnecessary waste of water.

Washroom flooding can be a recurring problem in schools and self-closing taps can help overcome this, as well as reducing water consumption.

In Chesswood School the taps were served by an indirect feed and the initial flows were around 15 litres/minute. In schools where the flows and pressures are higher, the scope for reducing water use from taps, and increasing savings, may be greater.

Flow restrictors

The in-line flow restrictors act as servicing valves, making maintenance easier and this function should be considered when deciding whether to install them. To keep costs down, fitting of the restrictors could be done on an opportunistic basis, or as part of routine maintenance visits.

Water butts

The timing of the project has not allowed the effectiveness of the water butts to be assessed, but any savings are likely to be too small to register.

In Chesswood School, the garden area is relatively small and the total volume of water used for tending it is also likely to be small. However, during hot, summer days garden watering could lead to peaks in consumption, especially if a hosepipe is used.

Water butts arguably serve a different role to the other measures implemented in the school. They are generally viewed as being useful in reducing peak summer demands, but also act as a reminder of the need for water conservation. They may encourage the use of watering cans, rather than hosepipes. While the impact of the other measures may not be immediately obvious to the pupils, staff and visitors, the presence of the water butts in the garden should serve as a lasting reminder that the school took part in the project, and of the need to use water wisely.

Conclusions

1. The most cost-effective way to save water in schools is the installation of effective urinal controls, with a payback period likely to be less than one year. This measure should be considered before any other water efficiency options are implemented.

2. Push taps, although payback in Chesswood School was calculated to be nine years, serve a useful role in preventing accidental or malicious wastage and should therefore be considered as part of overall water conservation strategy in schools.

3. In-line flow restrictors are unlikely to give statistically significant water savings, but could be financially attractive if considered as an alternative to water-efficient taps. They aid maintenance and the costs could be kept down if installed as part of routine maintenance visits.

4. Save-a-flush bags are an easy retrofit measure, and although unlikely to contribute large water savings, offer a low cost solution for older type toilets. Where washrooms are due to be refurbished, consideration should be given to water-efficient toilets.

5 Regular maintenance and checks should form a part of every school's routine to ensure that water savings achieved by water efficiency programmes are sustained into the future.

APPENDIX 1 :

Consumption statistics

The 262 day monitoring period within the school has been split into nine phases corresponding to the progressive sequence of equipment installation. For each period the Tables opposite give the mean daily consumption in the school on weekdays (days on which the pupils were in attendance), and weekends/holidays/inset days (days on which pupils were not in attendance), together with the standard deviation (litres) of the daily data. This statistic, relative to the daily average, gives an indication of the variability in the data. Changes in consumption between each phase were assessed using the independent samples t-test for equality of means. Differences have been considered statistically significant whenever the probability of the change occurring by chance was less than 5%.

There are 480 pupils on the register together with 24 teachers, 15 teaching assistants and 4 office staff. Actual daily attendance figures were provided by the school for the period following the summer holidays. The daily per capita consumption figure has been derived by dividing the total daily consumption by the actual attendance figure for the day and is expressed as litres/head/day.

Phase 5, in October, included a period of school holiday, but the consumption data for the weekdays during this time suggest that the urinals were operating, thereby raising the average value significantly above that measured during the following weekends.

Weekday Consumption (School days)

Phase	Equipment/period	Number of days	Average consumption (litres/day)	Standard deviation (litres)
1	Summer Term	9	10614	1258
2	Summer Vacation	0	*	*
3	Pre-trial	17	7966	1682
4	Save-a-flush installed	17	9525	728
5	Urinal controls installed	14	4006	494
6	Push-taps installed	24	3498	397
7	Flow restrictors installed	19	3567	513
8	Save-a-flush removed	16	3654	230
9	Save-a-flush re-installed	17	3420	472
Total days		133		

Per capita consumption (School days)

Phase	Equipment/period	Number of days	Average consumption (litres/day)	Standard deviation (litres)
1	Summer Term	9	*	*
2	Summer Vacation	0	*	*
3	Pre-trial	17	17.4	3.6
4	Save-a-flush installed	17	21.3	2.1
5	Urinal controls installed	14	8.7	1.1
6	Push-taps installed	24	7.57	0.9
7	Flow restrictors installed	19	7.6	1.0
8	Save-a-flush removed	16	7.65	0.5
9	Save-a-flush re-installed	17	7.28	0.9
Total days		133		

Weekend/Holiday/Inset Days Consumption

Phase	Equipment/period	Number of days	Average consumption (litres/day)	Standard deviation (litres)
1	Summer Term	2	4850	85
2	Summer Vacation	45	3585	300
3	Pre-trial	6	4948	1441
4	Save-a-flush installed	9	6571	1698
5	Urinal controls installed	13	2143	3284
6	Push-taps installed	26	298	200
7	Flow restrictors installed	8	194	63
8	Save-a-flush removed	14	494	377
9	Save-a-flush re-installed	6	280	106
Total days		129		

APPENDIX 2 :

Savings due to urinal controls

Definition: 1000 litres = 1 m^3

BEFORE INTRODUCTION OF URINAL CONTROLS:

Daily water use attributed to free flowing urinals = 3600 litres	3.6 m^3	
Annual consumption:	365 days x 3.6 m^3	1314 m^3
Total annual consumption:		**1314 m^3**

AFTER INTRODUCTION OF URINAL CONTROLS:

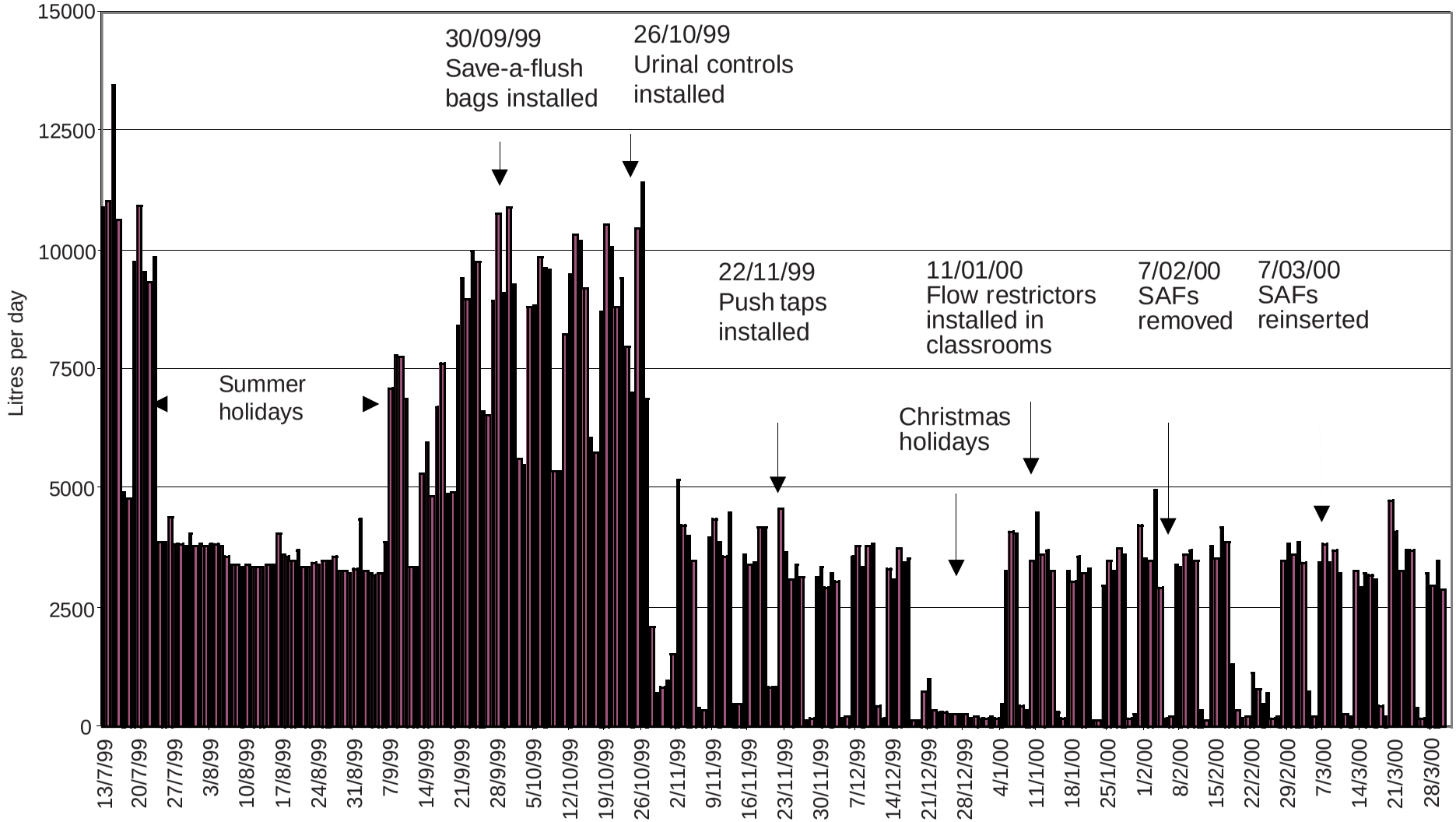
Daily water use attributed to urinals after introduction of controls on a schoolday = 1800 litres		1.8 m^3	
Annual consumption:	Schooldays	1.8m^3 x 5 days x 40 weeks	360 m^3
	Weekend/holidays	.36 m^3 x 165 days	59 m^3
	(assuming hygiene flushing of .36 m^3/day)		
Total annual consumption:			**419 m^3**
Reduction in consumption: (by 68% of pre installation figure)		1314 m^3 - 419 m^3	**895 m^3**

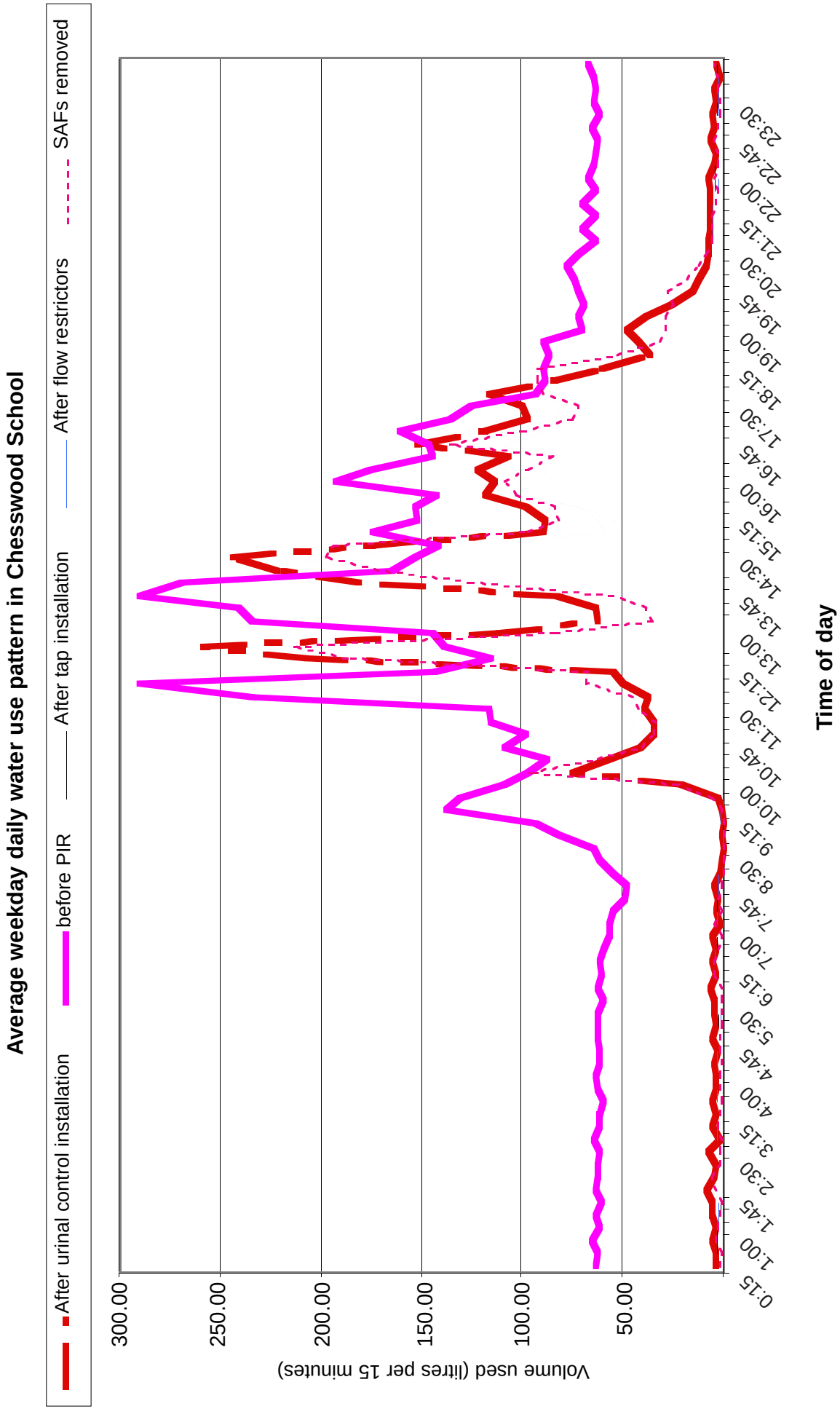
ESTIMATED SAVING:

Current cost of water delivered	£1.58 per m^3	
Estimated saving:	895 m^3 x £1.58	**= £1414**

The purchase and installation cost of the urinal controls was £960, which could be recovered within one school year.

Chesswood School water consumption




Average weekday daily water use pattern in Chesswood School
After urinal control installation
before PIR
After tap installation
After flow restrictors
SAFs removed
Volume used (litres per 15 minutes)
300.00
250.00
200.00
150.00
100.00
50.00
Time of day
0:15
1:00
1:45
2:30
3:15
4:00
4:45
5:30
6:15
7:00
7:45
8:30
9:15
10:00
10:45
11:30
12:15
13:00
13:45
14:30
15:15
16:00
16:45
17:30
18:15
19:00
19:45
20:30
21:15
22:00
22:45
23:30

Southern Water

A ScottishPower Company

ENVIRONMENT AGENCY

Southern Water, Southern House, Yeoman Road, Worthing BN13 3NX. Telephone 0845 278 0845