



Water Awareness and Water Efficiency in Hackney Schools

A report for Hackney City Farm as part of the "60 steps to 60%" initiative • July 2009



Ali from Queensbridge School measuring flow rates as part of the School Water Audit.

Headline figures

Yearly savings from water efficiency measures installed across 11 schools in Hackney are:

- 6,004m³ of cold water
- 4.5 tonnes of CO₂
- £10,267

Yearly savings from behaviour change at home from pupils in 10 schools in Hackney are:

- 16,751m³ of hot water
- 174.5 tonnes of CO₂

Important notes

This report has been produced for Hackney City Farm to show the effect that the Thames Water Schools Water Makeover Project has had on Hackney Schools and their pupils. The project was funded by Thames Water and delivered by Aqualogic and ech₂o.

Overall savings from water efficiency measures and the break down of water efficient solutions have been compiled from the individual reports that each school received as part of the Water Makeover.

Savings from behavioural changes have been calculated by ech₂o for Hackney City Farm and are not provided to the schools as part of the Water Makeover.

Schools have been given a number to ensure anonymity. Please note that numbers are **not** in alphabetical order but have been assigned randomly.

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Acknowledgments

Hackney City Farm would like to thank Thames Water for agreeing to support the 60 steps to 60% initiative by funding the Water Makeover in Hackney Schools.

With special thanks to all the schools, pupils and teachers who have been a part of this project.

Engaging with the Local Community

- As part of the Big Green Challenge, Hackney City Farm understands the importance of engaging with the local community to help them actively reduce their carbon footprint.
- They have held open days at the farm specifically showcasing carbon reduction solutions for the home (behavioural as well as technological).
- They are displaying multiple signage around the farm about Hackney City Farm's historical, current, and targeted CO₂ emissions.
- They are displaying signs around the farm about ways to reduce CO₂ emissions in the home.
- The farm recognises that working with local schools has the double benefit of the message getting through to the pupils' families as well as to the pupils themselves, and partnerships with local schools has always been a core part of their education agenda.
- The south east of the UK is under increasing water stress and heating hot water for domestic use contributes over 5% of the UK's total CO₂ emissions. Engaging schools to become water aware will result in water, CO₂ and monetary savings.

Thames Water's School Water Makeover Project

- As part of Thames Water's water efficiency programme, aiming to promote water conservation and support the aims of Defra's water strategy, the school Water Makeover was launched to successfully showcase how schools can reduce the water they use and to encourage their pupils to use water wisely.¹
- The water makeover aimed at a whole school approach. This involved monitoring the school's water use, undertaking a comprehensive survey of the way water was used across the site, identifying and installing suitable water efficient retro-fit technologies, presenting facilities staff and bursars with the financial benefits of water efficiency, and engaging pupils and teachers with a series of water awareness assemblies and workshops. Thames Water engaged water specialists Aqualogic to monitor, analyse and improve the School's water use, and environmental and education specialists ech₂o to design and deliver the assemblies and workshops.
- Thames Water delivered the Water Makeover within 3 London boroughs. At ech₂o's suggestion, Thames Water supported Hackney City Farm's 60 steps to 60% initiative, delivering the water makeover at 10 Hackney Schools², between January and July 2009.
- Nine primary schools and one primary/secondary school were chosen to take part in the project. They were: Brook Community School, Gainsborough Primary School, Grasmere Primary School, Holmleigh Primary School, Lubavitch Girls School, Parkwood Primary School, Queensbridge Primary School, Springfield Community School, St John the Baptist Primary School and Tyssen Community School. In addition, Benthall Primary School was audited and had some water efficiency upgrades fitted but was not a full project participant. Their overall estimated savings are included in the project outcomes, with detailed analysis of the data from the school still underway.
- By working with Thames Water's School Water Makeover project, Hackney City Farm's 60 steps to 60% initiative was able to directly reach 2,403 school pupils and 120 teachers to explain the link between reducing water use and reducing CO₂ emissions.

¹ The water efficiency programme has been implemented since 1996 to support Thames Water's twin track approach to water resource management.

² Thames Water is also supporting the 60 steps to 60% initiative by providing for free a selection of easily retrofitted water efficiency devices for the farm building.



Water Benchmarking

- Water consumption is measured in m³ per pupil per year. This allows comparisons to be made between schools of differing pupil numbers.
- From research in 2005, the DCSF³ considered that on average primary schools use 7m³ of water per pupil per year and secondary schools use 11m³ of water per pupil per year. They stated that usage could be reduced to 4m³ per pupil per year with good practice.
- Currently the DCSF uses the information in Table 1 to rate all schools against a series of benchmark figures.

Water Benchmarks DCSF				
Water consumption (m ³ /pupil/annum)	Primary school (with pool)	Primary school (no pool)	Secondary school (with pool)	Secondary school (no pool)
Good practice	3.1	2.7	3.6	2.7
Typical practice	4.3	3.8	5.1	3.9
Poor practice	6.1	5.6	7.5	5.8

Table 1

- Under this project schools were rated against the water benchmark both before (from actual historical bill data) and after (from calculations based on current consumption, the water audit and the water efficiency measures implemented) the project.

Historical Water Consumption

- Three years worth of bills were analysed for all schools to ascertain historical water consumption up to (or as near as possible to) the end of August 2008. (See Figures 1 and 2.)

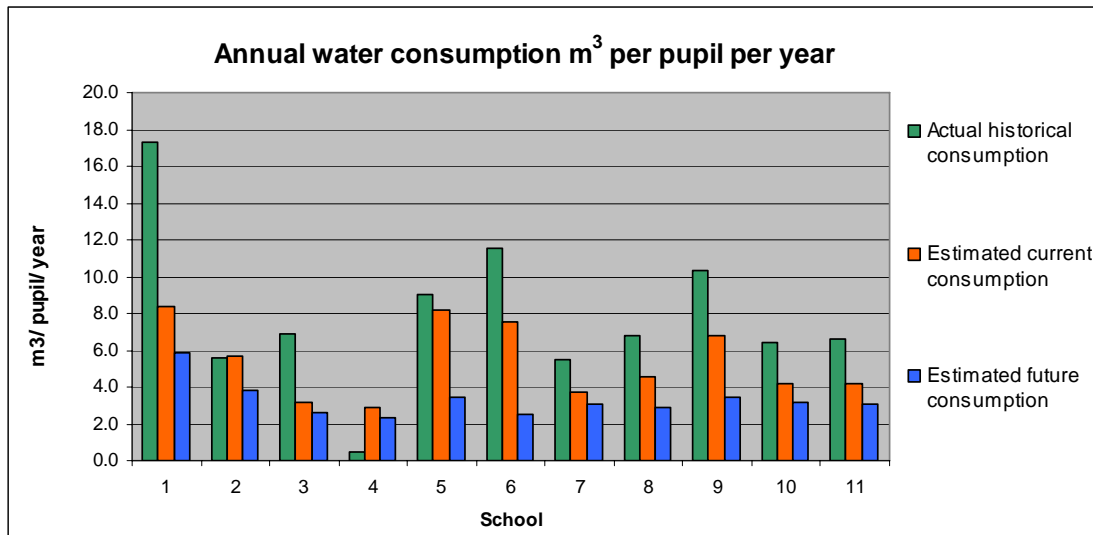


Figure 1⁴

³ Department for Children, Schools and Families



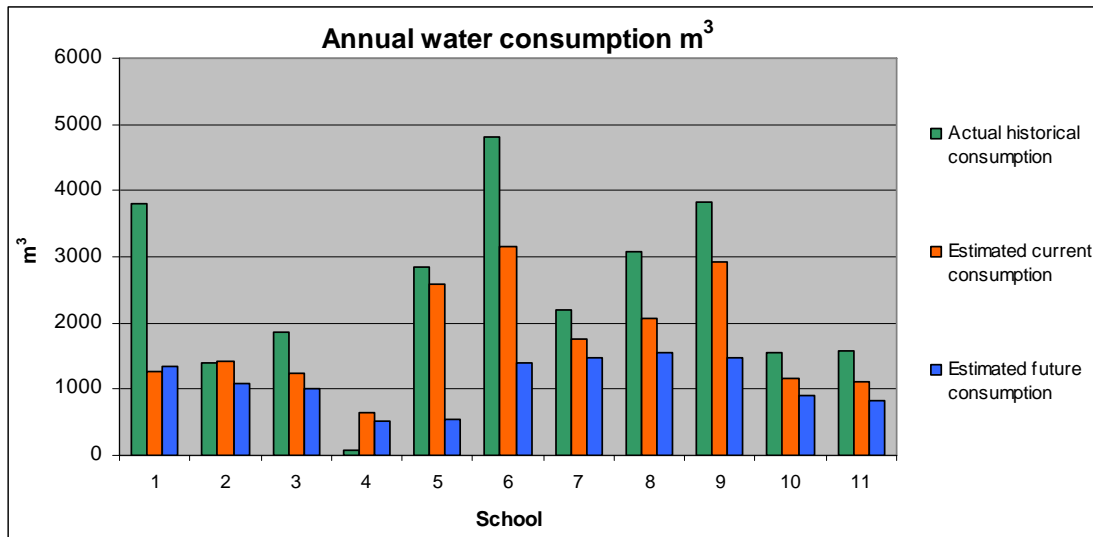


Figure 2⁵

~ Water consumption per school

- Gross historical water consumption per school ranged from 1,399m³ to 4,805m³ per year.⁶
- Average historical water consumption per school was 2,537m³ per year.

~ Water consumption per pupil

- Historical water consumption per pupil ranged from 5.5m³/pupil/year to 17.3m³/pupil/year.
- Average historical water consumption per pupil was 8.0m³/pupil/year.

~ Rating against DCSF benchmark

- Before water efficiency measures were implemented none of the schools met the good practice benchmark figure and ten of the schools exceeded the poor practice benchmark figure.⁷

Current Water Consumption

- Schools were logged to record water usage at 15 minute intervals. Schools were logged before, during and after the project to enable comparisons of volumetric and patterns of water use.
- Only four out of the eleven schools had meters that were suitable to be logged; most meters were too old.
- Data from the loggers was used by ech₂o to ascertain current water consumption. The information was presented to the school pupils at assembly.
- Where no data was available from the loggers, Aqualogic estimated water consumption based on the number of pupils and staff at the schools, the type of water fittings installed, and an

⁴ School 4 had two mains supply, but only one was metered. Therefore the historical figure of water consumption is lower than current or future consumption.

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⁶ One school had an annual consumption of under 90m³ per year. This was due to an unmetered supply that fed most of the school's appliances. This school's usage was ignored when working out average consumption per school.

⁷ An unmetered supply at one of the schools meant that this school could not be rated against national benchmarks as actual consumption of the school was unknown.

estimated usage rate of appliances.⁸ Estimated current water consumption was usually less than historical consumption, either due to various water efficiency measures having been implemented in the recent past or because of the difficulty in estimating usage from limited data.

- Current estimated water consumption is shown in Figures 1 and 2.

~ Water consumption per school

- Estimated gross current water consumption per school before water efficiency measures were implemented ranged from 646m³ to 3160m³ per year.
- Estimated average current water consumption per school before water efficiency measures were implemented was 1819m³ per year.

~ Water consumption per pupil

- Estimated current water consumption per pupil before water efficiency measures were implemented ranged from 2.9m³/pupil/year to 8.4m³/pupil/year.
- Estimated average current water consumption per pupil before water efficiency measures were implemented was 5.3m³/pupil/year.

Unexplained Usage

- Analysis of data loggers identifies unexplained water use which cannot always be picked up during an audit of a school. Analysis of data loggers accurately records the amount of unexplained water use per hour. This data is invaluable for schools.
- Figures 3 and 4 are examples of data logger analysis for one school. Figure 3 shows that 4m³ of water is used when the school is shut on a Saturday and Sunday.⁹

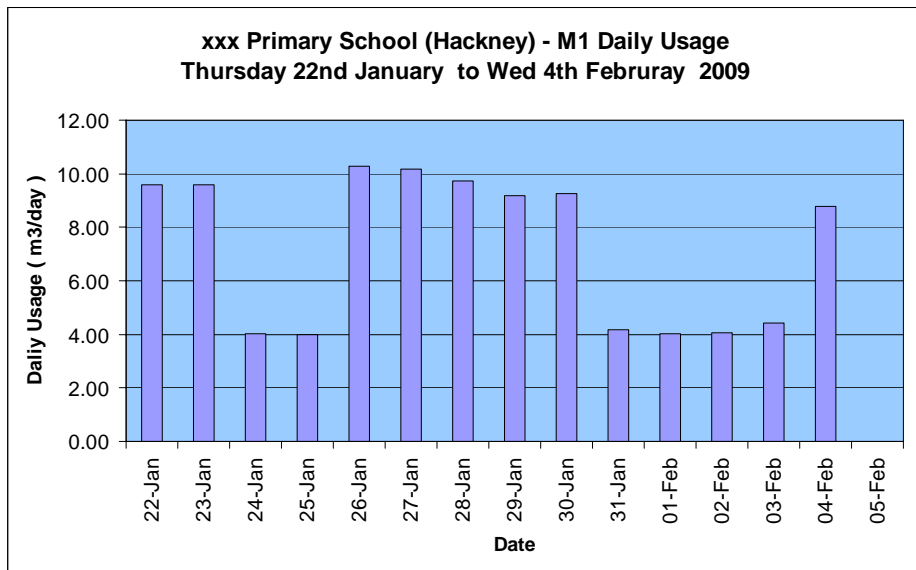


Figure 3

⁸ ech2o has used Aqualogic's figures to calculate current water consumption.

⁹ The school was also shut on Monday and Tuesday 2nd and 3rd of February due to snow, and a further 4 m³ was used on each of those days.

- Figure 4 shows that throughout the night unexplained usage is at an average rate of 0.25m³ (250 litres) per hour.
- By knowing the amount of water that is being wasted per day, the cost to the school can be easily calculated. Payback times of repair work can also be calculated.
- All four schools in Hackney that were able to be logged showed a level of unexplained water use.
- The subsequent audit showed that some or all of the unexplained water use in three of the schools was from uncontrolled urinals. In the fourth school unexplained usage may be from the swimming pool, or may be from an underground leak. The school has been given this information. Repair of underground leaks or upgrades to swimming pools are not part of the project deliverables.

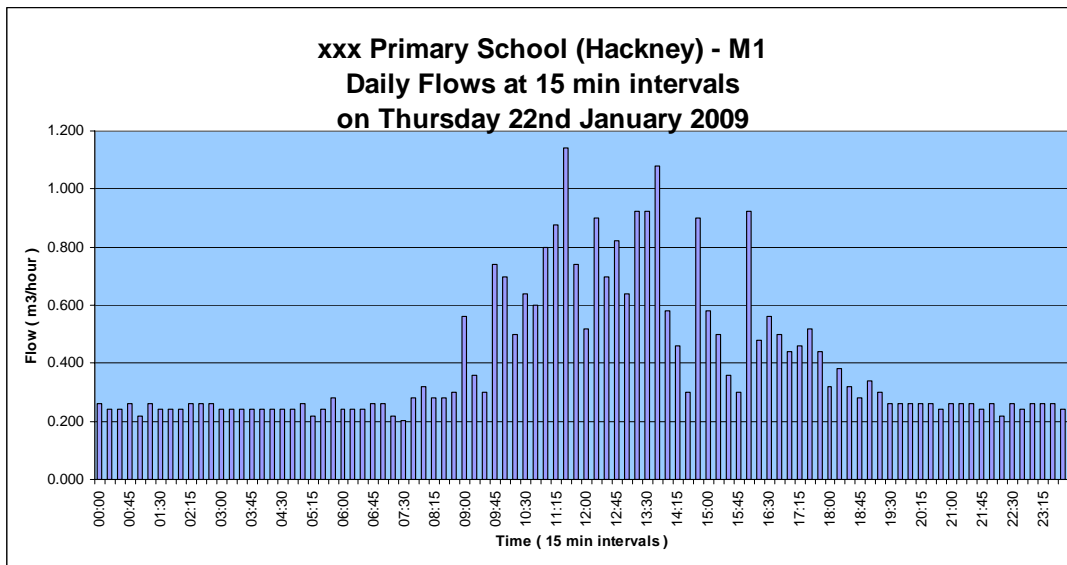


Figure 4

The Water Audit

- A comprehensive water audit was carried out at each school. The audit detailed WC flushing volumes, whether urinals were controlled, and, if so, whether the existing controls were working, type of tap control and flow rate from taps.
- As with most schools in the UK, the schools in Hackney that were part of this audit had mostly old fittings.
- All schools received a report estimating their current water consumption using historical bill data, logging data (where available) and water use of appliances currently fitted.
- The report detailed the water efficiency measures to be installed and estimated future consumption and savings.

~ WCs

- Most of the WCs used 9 litres per flush.
- Two schools had had some of their toilet blocks upgraded since 2001 and had 6 litre flush WCs installed, whilst still retaining a large number of 9 litre flush WCs.
- One school had upgraded most of their WCs with either 6 litre single flush or 6.4 litre dual flush.

- There were just two save-a flush bags already installed. These were at one school in the staff WCs.

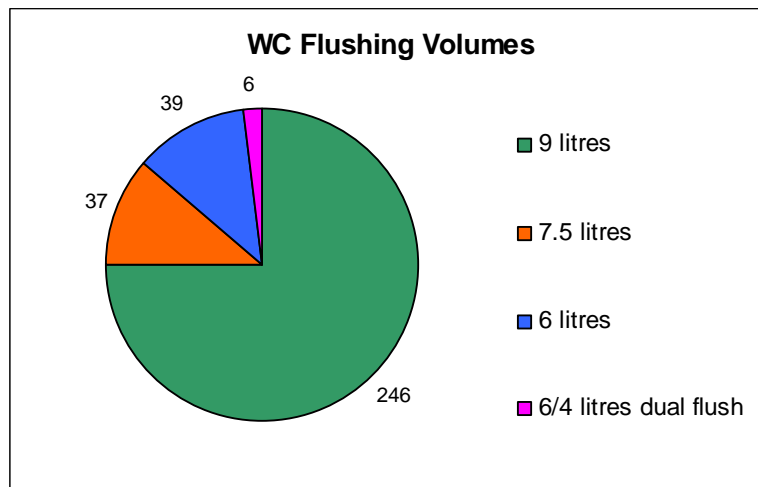


Figure 5

~ Urinals

- Out of 61 urinal spaces just 6 had working controls.

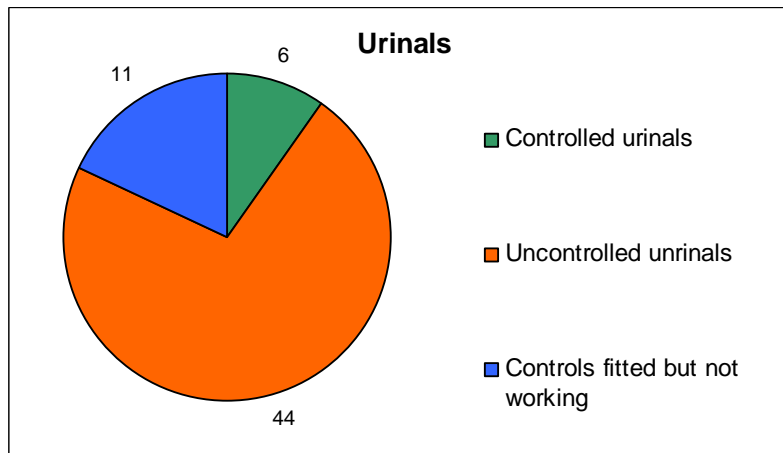


Figure 6

- 44 were uncontrolled and a further 11 had controls that were not working.
- A few of the urinals had been turned off completely to prevent wastage of water. Whilst saving water, this measure results in poor hygiene conditions with a high amount of unpleasant smells.

~ Taps

- A lot of the push taps in the schools performed poorly with shut-off times outside of the recommended 8-12 seconds.
- Flow rates at some taps were excessive.

Water Efficiency Upgrades

~ WCs

- A save-a-flush bag was fitted to every WC flushing with 7.5 or 9 litres of water. A save-a-flush bag saves 1 litre of water per flush.
- An EcoBETA was fitted to some 9 litre flush WCs. An EcoBETA converts a 9 litre flush WC into a 9/4.5 litre dual flush WC.

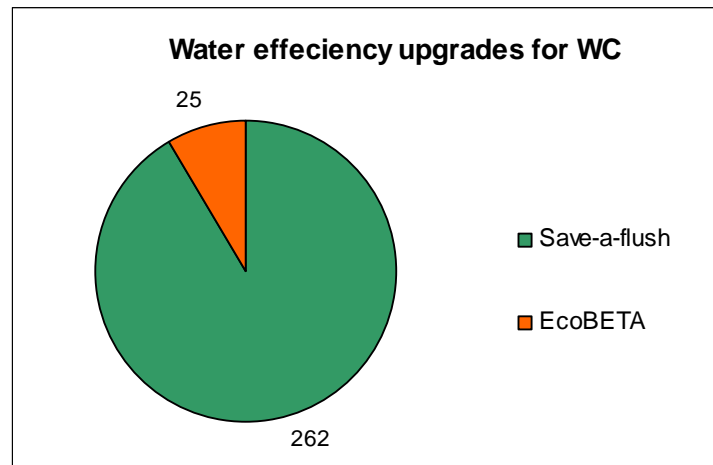


Figure 7

- Savings from WC flushing were calculated at a rate of 3 flushes per day per girl pupil or female staff member and 1 flush per day per boy or male staff member.

~ Urinals

- Under the project a total of 18 urinal controls were installed, controlling 55 urinal places.
- Installing urinal controls in a school can reduce the water required for flushing to 10,500 litres per urinal space per year, saving up to 55,200 litres of water.
- Savings per school were calculated depending on the amount of time the school was shut during an academic year. This differed between schools as some schools in the project are community schools and are open for longer than other schools.

~Taps

- Some twist taps with high flow rates were retrofitted with push tap controls.
- Overall savings were not calculated for these taps.

Projected Water Savings for the Schools

- Savings are calculated depending on the water efficient technologies that have been installed under the project, the number of pupils and teachers in the school and the amount of time the school is open.

Water, Financial and CO₂ Savings under the Thames Water School Water Makeover Project			
School number	Water m3	CO₂ Kg	£
1	582	378	995
2	335	255	573
3	227	173	389
4	130	99	222
5	549	417	938
6	344	261	587
7	282	183	482
8	1,543	1173	2,639
9	1,446	1099	2,472
10	271	206	463
11	296	225	506
Total	6,004	4,469	10,267

Table 2

- It is estimated that the 11 schools involved in the project will save 6,004m³ of water per year in total.
- Estimated savings per year range from 130m³ to 1,543m³.
- Estimated average saving per school is 546m³.
- After water efficiency measures were implemented it was estimated that three of the schools would meet the good practice benchmark figure of 2.7m³/pupil/year.
- After water efficiency measures were implemented it was estimated that seven of the schools would meet the typical practice benchmark figure of 3.8m³/pupil/year.
- After water efficiency measures were implemented it was estimated that one of the schools would still exceed the poor practice benchmark figure. This was the school with a swimming pool, no urinals and a large amount of unexplained water usage.

Projected Monetary Savings for the Schools

- The 2009-2010 price for water in the Thames Water area is £1.71/m³.¹⁰
- It is estimated that the 11 schools involved in the project will save £ 10,267 per year in total.
- Estimated savings per year range from £222 to £2,454 per school.
- Estimated average saving per school is £933.

¹⁰ Savings in the report submitted by Aqualogic to each school involved in the project were calculated using the 2008-2009 price for water which was £1.59 per m³.

Projected CO₂ Savings for the Schools

- There is a carbon load to using water.
- Thames Water has calculated that the energy required to provide 1m³ of unheated water generates 0.3kgCO₂ and to remove and treat the resultant waste water generates 0.35kgCO₂.
- The carbon load for hot water is far higher. To provide 1m³ of hot water at 35 degrees C from a gas boiler working at 75% efficiency has been calculated as producing 9.77kgCO₂.¹¹
- Most of the savings in the school will be from cold water use, and any CO₂ savings from reduced flow rates at hot taps has not been calculated.
- It is estimated that the 11 schools involved in the project will save 4,469kgCO₂ (4.5 tonnesCO₂) per year in total.
- Estimated savings per year ranged from 99kgCO₂ to 1,173kgCO₂.
- Estimated average saving per school was 406kgCO₂.

Workshops and Assemblies

- ech₂o water specialists¹² delivered a series of assemblies and workshops with the schools that informed pupils and teachers about the Water Makeover and helped them to understand why, from an environmental aspect, it is important to save water and how they can do this most effectively, both at school and at home.¹³
- A series of different workshops were offered to the school combined with a “Be Water Aware” assembly. (See Appendix 1 for details)
- ech₂o worked with pupils from reception class to Year 10. Whilst the message remained the same the content and delivery style changed to reflect the age difference.
- Pupils’ abilities varied widely within age groups. ech₂o are conscious of the importance of engaging with all pupils during the learning process. We would like to acknowledge the support we were given by both teachers and teaching assistants in many schools who gave one-to-one support with the more challenging pupils, thus enabling them to participate in our workshops.
- The UK is a multi-cultural society and the schools in this project reflected that fact. ech₂o design and deliver workshops that engage with pupils across all cultures.

Teaching Outcomes

- By the end of the project in July 2009 ech₂o had:
 - ~ delivered ten “Be Water Aware” assemblies to 2,403 pupils and 120 teachers,
 - ~ carried out seven School Water Audits with 212 pupils,
 - ~ ran and analysed “How do we use water at home?” with 27 pupils,
 - ~ enabled 555 pupils (and 38 teachers or teaching assistants) to gain a clear understanding of where precisely they use the most water at home with the “How much does it cost to flush your toilet?” workshop,
 - ~ demonstrated how to fit a save a flush bag with 794 pupils, 556 of whom took at least one save-a- flush bag home to install.¹⁴

¹¹ 46.5 kWh of gas (@ 0.21kgCO₂/kWh) to deliver 1m³ of hot water

¹² Cath Hassell, Farah Sharif, Jon Ferrie and Trevon Jervis

¹³ Benthall Primary School was not involved in this part of the project

¹⁴ On average 30% of pupils had a toilet fitted after 2001, (a figure that was higher than we expected), and therefore a save-a-flush bag was not appropriate.



Some of the eco team at Gainsborough School carrying out the school water audit.



Year 2 pupils at Springfield School identify where they use water at home



Jon Ferrie of ech₂o demonstrates how a save-a flush bag works

Savings from Reducing Personal Water Use

~ Water usage

- Average water use in the UK is 150 litres of water per person per day.
- We did not systematically record all water usage. However from the records we kept, the lowest daily usage was 64 litres and the highest was over 400.





Some of the pupils in year 5 at Gainsborough School. In a class of 16 just 4 used less than the UK average of 150 litres per day. Most of the pupils who used more than 200 litres had a bath or shower twice a day. The class used 3,729 litres per day and their average daily consumption was 241 litres.

~ Project savings

- If every pupil and staff member that ech₂o talked to at assembly reduced their hot water use at home by just 5 litres per day a total of 4,604 m³ of water and 48.0 tonnes of CO₂¹⁵ would be saved every year as a result of this project.
- If every pupil and teacher we worked with in a workshop reduced their hot water use by another 10 litres per day a further 3,037 m³ of water and 31.6 tonnes of CO₂ would be saved every year as a result of this project.
- If every pupil and teacher we worked with in a workshop were able to persuade three family members to reduce their hot water use by 10 litres per day a further 9,110 m³ of water and 94.9 tonnes of CO₂ would be saved every year.

~ Household savings

- If every pupil and teacher we worked with in a workshop were able to persuade three family members to reduce their hot water use by 10 litres per day, each four person household would save 14.6m³ of water and 152kg of CO₂ every year.
- Yearly savings per household from heating the hot water with a 75% efficient gas boiler would be £16.97.¹⁶
- If the household was one of the 30% of households that pay for water by volume used, savings from using less water would be £24.97 and total yearly savings would be £41.94.
- **Potential total savings from behaviour change under this project are 16,751m³ of water and 174.5 tonnes of CO₂.**

¹⁵ All CO₂ figures assume a hot water is heated by a gas boiler working at 75% efficiency.

¹⁶ Most pupils we worked with used gas to heat their water. If using electricity CO₂ savings would be approximately twice as high and monetary savings would be three times as high.

Appendix 1 – Details of Workshops and Assemblies

Be Water Aware assembly

The “Be Water Aware” assembly lasted from 10 - 25 minutes depending on the usual length of the school assembly. A PowerPoint presentation was used to show how each school was using water. The graphs were provided by Aqualogic from data collected from automatic meter reading. One graph showed school use per day over a 2-4 week period. The second graph showed 24 hours use of water in 15 minute downloads. The school’s use of water over a three year period from historical bill data, and from the logged data, was presented against DCFS benchmarks. The improvements that the school could potentially make were presented as average savings per pupil (WC displacement device or conversion to dual flush, tap upgrade) or per appliance (urinal). The final message delivered was that a short shower (with emphasis on the short) is the way to save water with examples given of how a 20 minute shower will use more water than an average bath.

ech₂o delivered assemblies to pupils ranging in age from 4 years old (reception) to 11 years old (Year 6)

Workshops

There were a series of workshop choices as detailed below.

The School Water Audit: Pupils carried out a water audit of their school. They collected data about number of appliances, flushing volumes of WCs, whether urinals were controlled and flow rates from taps. They identified where the school was performing well with regard to water efficiency, and where improvements could be made. They also decided how best to promote the message of water efficiency.

ech₂o carried out the School Water Audit with pupils ranging in age from 5 (Year 1) to 14 (Year 9). The Audit was either carried out by a whole class (up to 30 pupils) or, in five schools, by the Eco Team or School Council.

How do we use water at home? The Home Water Audit: This audit is about use of water by pupils and their families, and enables pupils to understand how behaviour is the major factor in determining whether an individual uses above or below the UK average of 150 litres per day (160 in the Thames Water area). Pupils filled out the audit form with themselves as the first respondent, to appreciate the importance of methodical data input and to understand the data the question was asking for. Pupils filled the forms out with their families as homework. The sheets were collected by the school and returned to ech₂o for analysis. The school was sent an overview report and a PowerPoint presentation of the analysis, which was used with the pupils in a future lesson. Parkwood asked ech₂o to come back and run this session with their pupils, which we did, but it is usually run by the form teachers themselves. Data is anonymous. Pupils put their first name only onto the forms¹⁷ and no names are allocated to data on the report. This ensures that replies are truthful, rather than what the pupils or their parents feel is the right thing to say.

ech₂o carried out the Home Water Audit with Year 6 pupils at Parkwood School.

¹⁷ This is so we can acknowledge pupils by name thanking them for their input.

How much does it cost to flush your toilet? : The question is answered in a variety of ways. Pupils learn about the monetary cost of a m³ of water and the environmental cost of supplying mains water to our buildings and cleaning the corresponding foul water. They calculate how much water they use per day whilst learning how much water the toilets they have at home and at school use per flush; the advantages of using a urinal instead of a WC; how many litres of water they use to bathe ranging from a bucket bath to a deep bath; the effect that different flow rates have on the amount of water they use to shower, and whether they really are saving more water with a shower instead of a bath. Finally they can rate their use of water against the national average and see if they are above or below.

ech₂o ran “How much does it cost to flush your toilet?” with pupils ranging in age from 6 (Year 2) to 15 (Year 10). For younger pupils there is a simple version of this workshop that calculates the amount of water they use for bathing, showering and brushing teeth.

Customised workshops: ech₂o can deliver customised workshops under the project. No schools in Hackney requested a customised workshop.

Supporting resources

Save-a-flush bags: In all workshops ech₂o demonstrated to pupils how a save-a-flush bag worked and identified pupils in the class who had a WC that was installed pre 2001 and so was suitable for the device.

PowerPoint presentations: The school was given the “Be Water Aware” and “How much does it cost to flush you toilet?” PowerPoint presentations if they wanted them.

Assorted handouts: Schools were given various supporting handouts for pupils, including PDFs of the PowerPoint presentations, and worksheets that enabled the pupils to calculate the water, CO₂ emissions and money saved by fitting a save-a-flush bag and the water, CO₂ emissions and money saved by reducing the time they spend in the shower.

ech₂o



ech₂o are the lead consultants for Hackney City Farm as part of The Big Green Challenge

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