



water

# Contents

Hertfordshire water facts	1
Basic principles	2 - 5
Solutions	6 - 17
Case studies	19 - 31
Further information and references	32 - 33

## Key

Different development sectors are colour coded below. To aid navigation through the case studies in this Guide, the colour codes denote the applicability of case study sustainability solutions to each of the various development sectors. The colour coding can be found in the bottom corners of each of the case studies.



Home owner



Residential



Commercial



Retail



Infrastructure



Education



Health



Leisure

# Hertfordshire water facts

The East of England is the UK's driest region, and Hertfordshire is one of **the driest counties** with average rainfall returning only two thirds the national average.

Annual average **rainfall per head is less than that recorded in Istanbul**, Jerusalem and Yemen.

People in Hertfordshire use more water than any other county in the UK (**8% above the national average**).

On average **168 litres was used per person per day** in Hertfordshire in 2006-07. Only around 3.6% of this figure is used for drinking water. To find out your total household water use why not complete an online water audit at <https://central.veoliawater.co.uk/water-audit.aspx>.

Hertfordshire's **natural water environment is constantly at risk** to periods of drought and floods. Groundwater resources are now at or approaching full utilisation, and many rivers and streams suffer from low flows which detrimentally impacts upon water quality.

Studies show **having a water meter reduces water demand** by 12%. ([www.3valleys.co.uk](http://www.3valleys.co.uk))

**Only 35% of Veolia Water Central customers have a water meter.** Veolia Water Central aim to have **90% of customers on a water meter by 2020.** (<http://central.veolawater.co.uk>)

Hertfordshire's **population is expected to rise by 12% by 2035.** Careful management of water resources will be essential in coming years.

Provision of water and waste water services **contributes nearly 3% of the UK's CO<sub>2</sub> emissions** (more than 60kg of CO<sub>2</sub> for every person in the UK).

Since 1950 the number of people in the World has doubled, however **water use has increased by six times.**

Climate change impacts indicate a **5% loss of available water** resource by 2035.

**There are several areas in Hertfordshire that have significant flood risk** (i.e. a risk level greater than 1 in 75 years). The Environment Agency's indicative flood maps show areas that are susceptible.

The **average household bill** in 2008-09 for water and sewerage is expected to be £330.

This is a **44% increase** in real terms since 1989. ([www.ofwat.gov.uk](http://www.ofwat.gov.uk))

# Basic principles

## Principles of water

The water cycle is fundamental to the geography, ecology and quality of life in Hertfordshire.

Hertfordshire is located within the driest region in the UK. Its physical characteristics, such as the mix between growing urban settlements and productive rural landscapes, and different soil types, place it at risk from diminishing water resources. Economic development and increased housing numbers mean Hertfordshire's built environment can affect the natural water cycle in multiple ways:

- the rate of abstraction of groundwater;
- the fate of rainfall;
- the volume and quality of water run-off;
- the quality of water courses; and,
- the rate of recharge of the aquifer.

Maintaining a balance between each of the above is crucial for protecting sensitive habitats (such as chalk streams), for minimising the risk of flood damage and for ensuring a sustainable source of fresh water for human consumption. However, development has traditionally paid little attention to water efficiency or management.

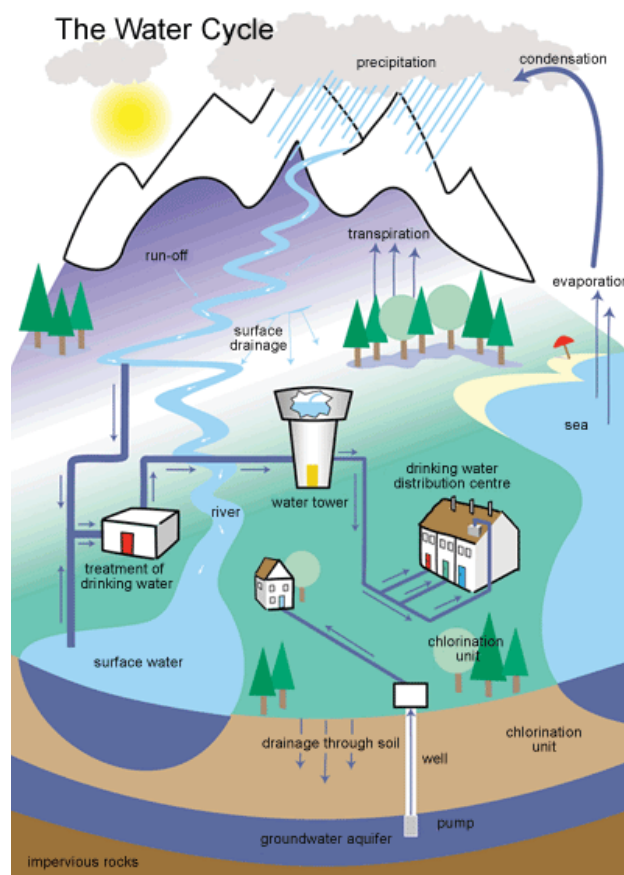
According to the Hertfordshire Quality of Life report, water consumption in Hertfordshire has risen during the last ten years from 802 million litres a day to 829 million litres a day. Leakage rates have decreased over this period but the absolute volume of water demanded has increased by more. Groundwater resources across the region are consequently at or approaching full utilisation.

Climate change projections forecast that by 2050, Hertfordshire could see a 17% increase in rainfall or snow in winter, and a 19% decrease in rainfall during the summer. The potential increase of drought conditions in summer is well documented. The increase in flooding episodes, in summer as well as in winter, is less obvious and must also be brought into planning consideration.

To avoid significant problems in the future, major improvements are required in the way the built environment is planned and designed. Developments must act in synchronisation with the natural water cycle to avoid an imbalance between water extracted and that returned to the groundwater and aquifers.

These improvements fall under the collective heading of 'Integrated Water Management'. This module reviews the importance of planning for Integrated Water Management and some typical solutions it entails.

To view the latest Hertfordshire Quality of Life Report visit <http://enquire.hertscc.gov.uk/qol/>



# Impacts of the built environment on the water cycle

The built environment, and new development in particular, can have a significant impact upon water cycle process both at the immediate site level and the larger, regional scale.

These impacts can be grouped into four interrelated areas: flood risk; water abstraction and treatment; climate change; and water quality. This section summarises the impacts in these four areas.

## flood risk

Development of land has traditionally resulted in the replacement of surfaces that are impermeable to rainwater, such as industrial and commercial estates, housing estates, roads and other urban areas. Each of these can increase the risk of surface water flooding ('pluvial' flooding), which, along with ground water flooding, is the greatest source of flood risk for Hertfordshire, more so than river flooding ('fluvial' flooding). The majority of pluvial flooding is caused by run-off from areas of impermeable surface.

New development on land that is at an inherent risk of flooding, both pluvial and fluvial, should be avoided if possible, even if measures are implemented to reduce its vulnerability. If the development is unavoidable, it is imperative that the flood risk is managed as far as practicable.

The principles of Planning Policy Statement 25, Development and Flood Risk, reflect this principles and must be followed in the preparation of planning applications. In Annex F, Managing Surface Water, PPS25 states:

*"The effect of development is generally to reduce the permeability of at least part of the site. This markedly changes the site's response to rainfall. Without specific measures, the volume of water that runs off the site and the peak run-off flow rate is likely to increase."*

PPS25 continues, *"Inadequate surface water drainage arrangements in new development can threaten the development itself and increase the risk of flooding to others."*

It is essential that surface water is removed quickly and safely in a manner that mimics the surface water flows arising from the site prior to the proposed development. This must be done without causing damage to any buildings or infrastructure, endangering people, or increasing the risk of flooding or pollution to the environment.

Local planning authorities (LPAs) should ensure their policies and decisions on applications support and complement on sustainable rainwater drainage. This is captured in requirement H3 of the Building Regulations Approved Document Part H (2002), which states:

*"Rainwater from a system provided to carry rainwater from the roof of a building or to drain from paved areas around the building shall discharge to, in order of priority:*

- 1. an adequate soakaway or some other adequate infiltration system*
- 2. a watercourse*
- 3. a sewer"*

(The only exception to the order of priority given above is when rainwater is captured for the purpose of reuse, e.g. for flushing of WCs or watering of garden plants.)

PPS25 continues: *"It will always be much more effective to manage surface water flooding at and from new development early in the land acquisition and design process rather than to resolve problems after development. Site layout should be influenced by the topography."*

# Impacts of the built environment on the water cycle (cont'd)

Appropriate questions to ask at the planning and design stage include:

- Is the development in an area at risk of flooding, and if so, could the development occur elsewhere where the risk is reduced?
- Might the development layout exacerbate flood risk in particular areas within the development?
- Might the development exacerbate flood risk for areas offsite and other developments downstream?
- Does the design of the development take into consideration measures to ensure resilience against severe weather events such as storms and heavy precipitation?
- Has a Sustainable Drainage System, or other design measures, been incorporated into the development?
- Is the development in an area that could be at risk from future fluvial flooding (e.g. from rivers or streams)? If so, what solutions have been incorporated to manage fluvial flood risk and minimise flood risk to building occupants on site, in adjacent areas and downstream?

Domestic consumption of water is higher in Hertfordshire than anywhere else in the country (see diagram below for a breakdown of domestic water uses). Groundwater provides a third of our drinking water.



## Did you know?

Environment Agency flood maps indicate that there are areas at risk of fluvial flooding in Hertfordshire. Indicative flood plain represents land which lies beneath either the tidal 1:200 year or fluvial 1:100 year return period water level.

The River Lee and its tributaries which rise in Hertfordshire and flow south to the Thames, have a significant flood plain area, especially to the south - Bishop's Stortford, Ware and Hertford all lie on or immediately adjacent to the floodplain.

There are a number of settlements along the flood plain on the Broxbourne-Epping Forest border, including Broxbourne and Cheshunt. There are also floodplains along the other rivers in the county, for example the Colne has historically been prone to flooding.

## water abstraction and treatment

The Environment Agency issue and manage licences for the abstraction and treatment of groundwater for domestic, commercial and industrial uses. Hertfordshire lies within three Environment Agency Regions: Thames, North East and Anglian (in Central Anglian and West Thames). Many of the sources within these regions are already close to or at their maximum abstraction level. For instance, the Anglian region is the driest region in England and Wales and there are large areas where no further water is available during summer and some areas where damage is already occurring. Parts of the River Lee catchment are also suffering from unsustainable abstraction. The Thames region also suffers from demand pressures.

# Impacts of the built environment on the water cycle (cont'd)

If sufficient water is to be available to support the current and predicted future demands of Hertfordshire's population, there will have to be significant changes to the rate at which groundwater is abstracted and recharged, so that they are balanced and sustainable in the long term.

Increasing the rate of recharge of the groundwater source will be a critical factor for reaching a sustainable level of abstraction. Surface water drainage maintains the flows into the local water bodies (rivers, streams and lakes) and recharges the ground water. Therefore, by improving surface water drainage to natural watercourses, we are able to maintain a higher groundwater abstraction rate. Failure to improve surface water drainage will mean abstraction rates will have to fall further.

To protect groundwater the Environment Agency has defined Groundwater Protection Zones, where the Environment Agency seeks to restrict certain types of development. Groundwater protection zones cover all the land draining the groundwater resource. For instance, a groundwater protection zone serves to protect the major aquifer which covers North and East Hertfordshire and also extends east into Essex.

## Climate change

The emissions arising from constructing, heating, cooling and servicing buildings are recognised as significant factors that contribute to global climate change. Climate change in turn presents a number of risks to buildings and the built environment in general, with many revolving around the water environment and cycle. The effects of climate change therefore provide further incentive for Integrated Water Management.

Climate change projections for Hertfordshire forecast an increase in average temperatures and an increase in the number of extreme weather events. Hertfordshire County Council commissioned a Climate Change Risk Assessment using the latest UK Climate Projections (UKCP09). The headline messages from the Risk Assessment are provided in the Climate Change Adaptation module, but key findings included:

- General precipitation - More variable patterns of rainfall and snow, which is anticipated to result in drier summers, increased rainfall during the winter, and more frequent severe weather.
- Extreme rainfall - More intense rainfall falling in winter months. Towards the end of the century rainfall on the wettest day in winter could increase from 2009/10 levels by up to 56%.

Both of these may result in increased flooding episodes, particularly in urban areas.

Less rainfall is expected during the summer months; however, a prolonged period of dry, hot weather causes the ground to dry, which reduces its ability to allow water to infiltrate quickly enough when a short but heavy rainfall event does occur. The resulting excess water run-off can lead to flash flooding, particularly where there are also impermeable man-made surfaces.

For instance, the hot summer of 2006 triggered thunderstorms and torrential rain which caused localised flooding across England. The town of Royston, North Hertfordshire suffered from flash flooding that blocked roads and caused damage to properties.

# Impacts of the built environment on the water cycle (cont'd)

More information on reduction greenhouse gas emissions from the built environment, and on how to adapt the built environment to climate change impacts can be found in the Energy and Climate Change Adaptation sections of the Climate Change module.

## water quality

The abstraction and discharge of water used in the built environment can have a detrimental impact on the quality of the local waters, which in turn can impact biodiversity and the ecological habitats of wildlife.

The Hertfordshire Environmental Forum (HEF) published in 2006 an update to the “50-year vision for the wildlife and natural habitats of Hertfordshire”. This Local Biodiversity Action Plan identifies many important ecological habitats particularly sensitive to water quality. The list provided in the Wetlands Habitat Action Plan section includes:

- **Wetlands** - within Hertfordshire this includes rivers, streams, springs, water-cress beds, ponds, lakes, reservoirs, sewage works, marshes, fens, swamps, wet grassland and carr woodland;
- **Chalk rivers** - all chalk rivers are fed from groundwater aquifers, producing clear waters and a generally stable flow and temperature regime. The majority of European chalk rivers are found in southern England;
- **Open water** - can be remarkably rich in plant and animal life; however, many are prevented from reaching their full potential due to factors such as pollution, lack of water and poor management;
- **Wet grasslands** - to be found where groundwater levels are close to, but not permanently at, the surface and where the grassland is affected by seasonal flooding;

- **Urban habitats** - such as urban wetlands, encapsulated countryside, managed green space, naturally regenerating habitats and ‘urban commons’.

69% of rivers in Hertfordshire are achieving ‘very good’ or ‘good’ chemical quality. This is a substantial improvement on previous years (the figure for 1996-1998 was 30%). Only 1.3% of river length is classified as ‘poor’, and none is classified as ‘bad’.

Achieving this improvement has required significant efforts. To improve yet further, the following need to be monitored and controlled:

- abstraction of water from the water environment;
- point source discharges and diffuse sources liable to cause pollution;
- catchment of surface water;
- potential impacts to surface water habitats;
- artificial recharge or augmentation of ground water.

The protection and restoration of water quality is required by the Water Framework Directive, which has the overall objectives to prevent deterioration of the water environment and to restore waters to good status by 2015.

(WFD) (Directive 2000/60/EC) provides common objectives, guidelines, strategies and requirements for the member states of Europe to prevent deterioration and to provide improvement of water quality. The Water Environment Regulations 2003 (England and Wales) provide the framework to meet the WFD objectives of protecting and enhancing the country’s water bodies and groundwater by 2015.

# Principles of integrated water management

As mentioned previously, to avoid significant problems in the future, major improvements are required in the way the built environment is planned and designed. Developments must act in synchronisation with the natural water cycle to avoid an imbalance between water extracted and that returned to the groundwater and aquifers.

The improvements required fall under the collective heading of Integrated Water Management (IWM).

IWM aims to ensure that the manmade built environment is planned and designed to function in partnership with the natural water environment, so that they can both be of high quality and sustainable. IWM has a number of sub-management processes, which can each be related to the previously provided diagram for the natural water cycle:

1. minimising the consumption of water;
2. using and reusing alternative sources of water;
3. minimising the wastage in water distribution;
4. managing surface water drainage and storm overflow; and
5. improving water quality.

## 1. minimise the consumption of water

Hertfordshire has one of the highest domestic levels of demand for potable water. As additional built development takes place, the abstraction, treatment, distribution and consumption will become increasingly challenging. A significant amount of energy and chemicals is consumed in treating water to drinking water standards and transporting it to consumers. It is therefore vital that the demand on primary water resources is reduced or managed as far as practicable.

In 2008 DEFRA published the Government's water strategy for England, "Future Water". It contains some relevant facts:

- Household water demand has been increasing since the 1950s, due to population growth and changes in the way we use water in the home, and is now more than half of all public water supply use.
- Almost one third of the water we use is, after being treated to what is among the best drinking water quality standards in the world, at significant financial and environmental cost, simply used to flush our toilets.
- Average water use in England is about 150 litres per person per day (l/p/d)

Building Regulations Approved Document Part G addresses sanitation, hot water safety and water efficiency. The 2010 revision requires the total water consumption of a new home to not exceed 125 litres per person per day. Achieving this requires the installation of more efficient fittings and solutions such as:

- efficient toilets, taps, showers and household appliances;
- leakage detection and prevention;
- minimal use of potable water for landscape irrigation; and
- rainwater, greywater and surface water runoff collection and reuse systems.

The Environment Agency is a useful source of information on water efficiency solutions. They published their research entitled 'Conserving Water Use in Buildings': [www.environment-agency.gov.uk/business/topics/water/default.aspx](http://www.environment-agency.gov.uk/business/topics/water/default.aspx)

# Principles of integrated water management (cont'd)

## 2. use and reuse alternative water sources

Most water is used for non-potable purposes and therefore does not actually require wholesome mains water. Alternative sources can be used, for example, for washing clothes and vehicles, flushing toilets and watering plants. Once used, water can often be filtered, treated and reused. Harvesting and storing alternative water sources (e.g. in cisterns, underground tanks, or ponds) can significantly reduce or eliminate the volume of mains water consumed. This presents environmental and financial benefits, including:

- reduced pressure on the water supply infrastructure
- less flowing into surface water drainage systems
- lower water bills to the owner

Five alternative sources are considered further in the solutions section:

1. rainwater
2. greywater
3. blackwater
4. open water
5. lower grade water

Once further reuse of water is not practicable, the discharge should if possible be to a sustainable soakaway or watercourse, which will subsequently assist in recharging the groundwater and aquifer. An exception must be made if the chemical content of the wastewater dictates a discharge to sewer.

## 3. minimise the wastage in water distribution

Future Water contains more relevant facts regarding the wastage in water distribution systems:

- Almost one quarter of all water supplied is lost through distribution leakage.
- Completely eliminating leakage would be impossible, particularly as in many cases we are left with Victorian infrastructure.
- Since total leakage peaked in 1994/95, it has been reduced by 33% in England and Wales.
- Of the water lost through leakage, about one quarter is lost through customers' supply pipes.

The final point is important as it emphasises the benefit of detecting and preventing leakages within the demise of development. Smart water meters are capable of highlighting any abnormal patterns of water consumption, which often leads to the identification of a leak. Non-domestic developments targeting a BREEAM rating can gain a credit for water leak detection systems, when they extend the full distance between the building and the point of mains connection.

## 4. manage surface water drainage and storm overflow

To recall, Building Regulations Approved Document Part H (2002), requirement H3, prioritises the options for runoff as:

- an adequate soakaway or some other adequate infiltration system
- a watercourse
- a sewer

This hierarchy is matched by planning policy. PPS1: Sustainable Development, states: "Regional planning authorities and local authorities should promote ... the use of sustainable drainage systems in the management of run-off."

The various components of a sustainable drainage system (SUDS) are reviewed in the solutions section.

# Principles of integrated water management (cont'd)

As well as managing surface run-off and pollution, SUDS are increasingly being used to mitigate the excessive flows from stormwater. This is actively promoted by planning policy. PSS25 states:

*“Those proposing development should seek opportunities to use multi-purpose open space for amenity, wildlife habitat and flood storage uses. Opportunities should be taken to lower flood risk by reducing the built footprint of previously-developed sites and using sustainable drainage systems (SUDS).”*

Therefore, where practicable, SUDS should be designed to ensure the sustainable drainage networks have the additional capacity required to cope with infrequent weather conditions and therefore to reduce the flood risk to the development.

Using SUDS to manage surface runoff and storm overflow has multiple benefits:

- increased recharge of groundwater and aquifers
- reduced runoff into sewer system (resulting in reduced energy and chemical costs of treatment)
- improved groundwater quality via natural infiltration
- reduced degradation of chalk stream
- habitats

It is essential that the ownership and responsibility for maintenance of every sustainable drainage element is clear; the scope for dispute kept to a minimum; and durable, long-term accountable arrangements made, such as the allocation of management companies.

## 5. improve water quality

In the words of Hertfordshire Environmental Forum’s “50-year vision for the wildlife and natural habitats of Hertfordshire”:

*“Water quality deteriorates with increasing urbanisation as surface run-off carries with it increasing loads of pollutants and sediments. Rain falling onto towns has the beneficial effect of washing away much of the accumulated dirt from the previous dry period. However, the result is that stormwater may contain a wide variety of pollutants including suspended solids, nutrients (nitrogen and phosphorus), toxins (including heavy metals and pesticides), pathogenic microorganisms (bacteria, viruses and others), oil, detergents and de-icing chemicals. The problem of pollution by sewage and industrial wastes is not confined to urban areas. However they more often have their origins in urban areas and so the effects are most concentrated there.”*

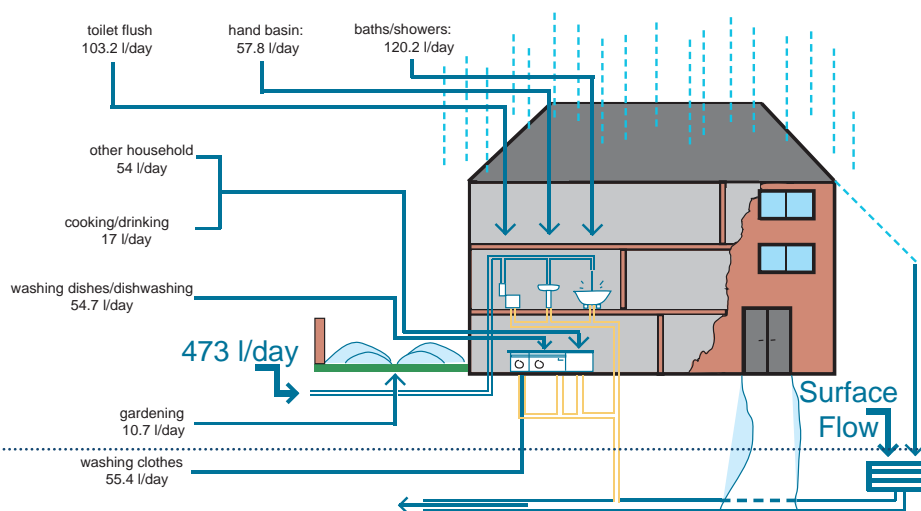
Effective development drainage strategies as part of an Integrated Water Management strategy to mitigate overflow following heavy rainfall will help to prevent unmanaged surface water contamination.

# Benefits of integrated water management

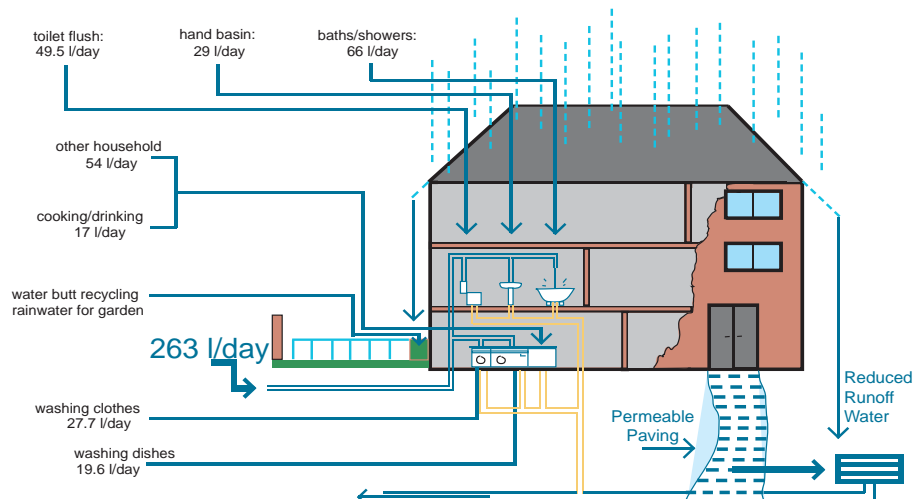
## Choosing the right solutions delivers lots of benefits!

- water efficient appliances in homes, to reduce the water bills of consumers and the abstraction of fresh water
- alternative water sources, to allow the groundwater and aquifers to recharge
- using non-potable water for activities that do not require it (e.g. toilet flushing), to reduce the consumption of energy and chemicals in treating and transporting water
- applying onsite management of water runoff, to reduce water utility infrastructure (e.g. stormwater drainage)
- laying out a development to promote natural drainage, to reduce the risk of surface water flooding
- enabling the groundwater and aquifers to recharge, to reduce the pressure to control lifestyles and water use (e.g. summertime hosepipe bans)
- use vegetation to improve the quality of runoff water, to benefit natural habitats and biodiversity

### Hertfordshire Typical Household Water Use



### Hertfordshire Good Practice Household Water Use



**Note:** These graphics are specifically relevant to the minimising water consumption section

# Solutions

In most cases, solutions are applicable to all types of development and both new projects and refurbishments.

However, some solutions such as rainwater harvesting or certain sustainable drainage techniques are only applicable to particular types of location or development. For example, rainwater harvesting is more suitable to buildings that have a large roof area or a concentrated water demand.

WRAP very recently launched Rippleffect; a free water efficiency initiative that can benefit businesses of all sizes. For more information see: [www.wrap.org.uk/business/sme/rippleffect](http://www.wrap.org.uk/business/sme/rippleffect)

## Did you know?

A design team can use a Water Efficiency Plan to structure their efforts to reduce water use. The plan could either be developed as part of the design process for new build projects, or initiated as part of a facilities management contract for an existing building. The Plan should address the selection of fittings and appliances, user behaviour and should include for reductions in both potable water and hot water supply and use.

For more information, see: [www.wrap.org.uk/construction/tools\\_and\\_guidance/water\\_efficient\\_proc.html](http://www.wrap.org.uk/construction/tools_and_guidance/water_efficient_proc.html)

## 1. minimising water consumption

There are various calculators available to predict water use at the design stage.

When undertaking a Code for Sustainable Homes or BREEAM assessment, the BRE's own tools should be used. These are the Code Water Calculator for homes and the BREEAM Wat1 Water Consumption calculator.

WRAP have developed a prototype spreadsheet based tool. The tool uses the same water consumption parameters as the BRE's calculators. Where WRAP's tool goes further is by demonstrating how design teams and facilities management contractors can quantify the savings from investing in water-efficient fittings and appliances.

The installation of water efficient fittings and appliances can also receive credits in both the Code for Sustainable Homes and BREEAM. Credits are awarded where the following measures are in place:

- Overall water efficiency better than Part G standards
- Water metering technologies
- Leak detection systems
- Water butts for homes
- Surface water management (i.e. SUDS)

The table on the next page provides an example of the cost saving benefits that can be secured by minimising mains water consumption through taking an Integrated Water Management approach in new build or refurbishment projects.

# Solutions

## Example water efficiency costs and savings

Solution	Cost / unit	Typical Savings (%)	Savings* (Litres)
Low flow taps	£	60% compared to regular taps	33 per person per day (based on 30% of water use for taps)
Urinals with flow control	£	50%+ compared with regular flush urinals	5 per bowl per hour
Waterless urinals	£	100%	10 per bowl per hour
Dual/low flush toilets	0-£	20-50%	3-6 per flush
Low flow showers	0	50% compared to regular showers	30 per use
Rainwater harvesting	£-££**	30% of household water use	55 per person per day
Greywater recycling	£££	30% of household water use	55 per person per day

### Key

\* Based on Hertfordshire average consumption rate of 182 litres per person per day (66.43m<sup>3</sup>/year)

\*\* Variation in cost dependant on nature of harvesting product, i.e. rainwater butt = low cost, basement rainwater harvesting tanks + additional pipework = medium cost

0 = no additional cost    £ = low cost    ££ = medium cost    £££ = relatively high cost

# Solutions

## Appliances

White goods are major sources of domestic water consumption (a typical washing machine accounts for 14% of the average Hertfordshire household's water use) and can also be significant consumers when used in offices or other building types (e.g. in catering or service areas).

Water efficient white goods can achieve major water savings. Highly water efficient washing machines currently use less than 50 litres of water per wash, which is less than half the amount used by a machine that is 10 years old. Similarly, highly water efficient dishwashers use less than half the water required to wash the same dishes by hand.

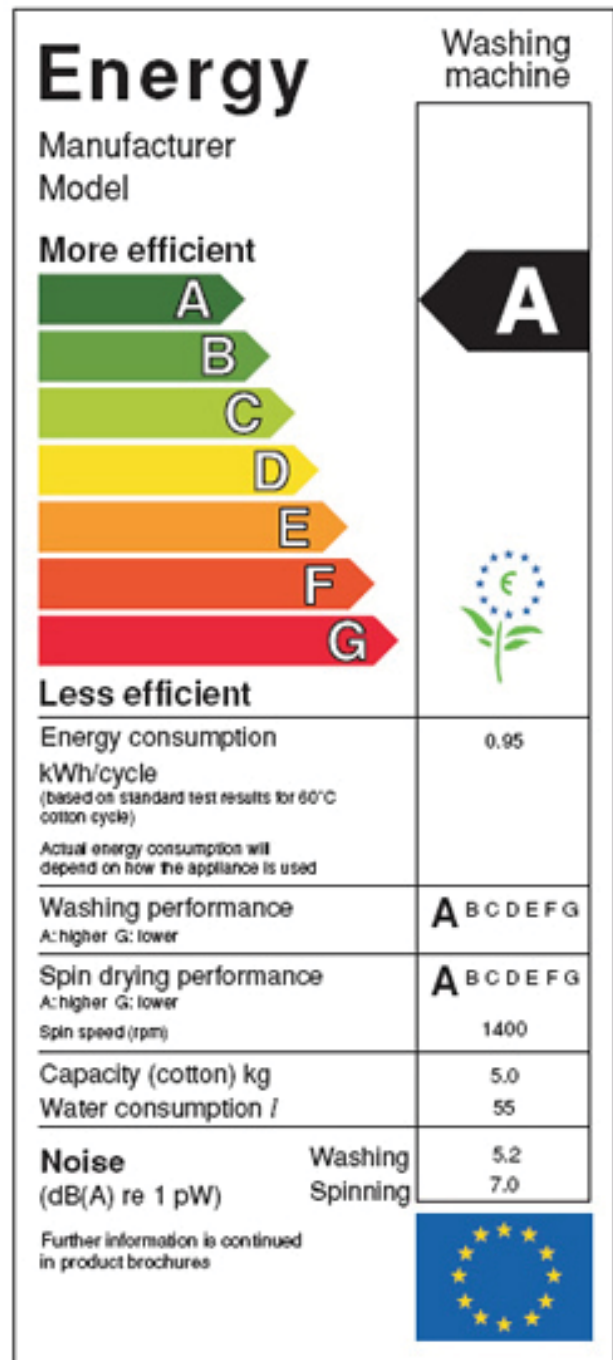
Where white goods are included within a development, highly efficient models (e.g. A rated) can deliver water bill reductions of £20-£40 a year together with lower energy bills. Where white goods are not included, developers can encourage occupiers to purchase suitable products by providing information (in buyer or tenant packs) on the benefits of using A-rated products.

It is possible to buy A-rated washing machines and dishwashers for comparable prices to non A-rated products. However, it is worth noting the specific water consumption of a product in addition to its rating because some products will be more efficient than others even with the same rating.

### Did you know?

The water and energy consumption of white goods are directly correlated because most energy consumption is related to water heating or pumping. In many cases the most water efficient product is also the most technically advanced product and also offers performance, noise and other benefits.

Energy rating label for a washing machine



# taps

For most buildings, the water drawn from taps is a large proportion of the total consumption (e.g. 30% in homes and 35% in offices). Modern water efficient taps use up to 80% less water than the pillar taps installed historically.

Water efficient taps can be bought as a new unit and existing taps can be retrofitted. Most water efficient taps are very low cost and present rapid paybacks.

There are three types of simple water efficient tap, these are:

- aerated taps
- flow regulated taps
- auto stop taps  
(e.g. percussion or push button)

Aerators and flow regulators come in varying sizes and flow rates and restrict the flow of the tap water whilst not appearing to do so.

Percussion taps release a limited amount of water per use and close automatically.

Some flow regulators are designed specifically for taps and are usually fitted in either the tail or the seat of the tap. In addition to restricting water flow and reducing water bills, regulators can last longer than conventional tap washers and can reduce maintenance costs.

In specialist environments such as healthcare, more complex taps such as proximity detection taps can be preferable, as the user does not need to touch the tap before or after washing hands.

## domestic taps

In Hertfordshire approximately 12% of household water is used at the hand basin. However, spray taps are not always desirable in homes as they increase the time it takes to fill the basin.

Water saving inserts/cartridges can address this problem. These devices can be fitted to most taps with a round outlet hole or standard metric thread and to single lever mixer taps. At low flows the devices spray enough water for washing hands or rinsing toothbrushes. As the flow is increased, the device opens up to allow unrestricted flow.

## commercial washrooms

Taps with a standard outlet thread can easily be fitted with spray heads and many round outlets can also be adapted. Metric fittings accommodate a greater number of water saving devices such as sprays and aerators.

The air gap between the tap discharge outlet and “spillover” level of the washbasin must be sufficient to prevent a backflow of contamination into the pipework.

### Did you know?

Technologies and products that are water efficient and fully approved can be found on the Water Technology List. See [www.eca-water.gov.uk](http://www.eca-water.gov.uk)

## urinals

Urinals typically use less water than WCs, but can still waste a lot of water if incorrectly installed. Typically, urinals account for about 20% of office water use.

Water efficient urinals are very affordable to install in both new projects and refurbishments and their maintenance costs are typically less than those for standard urinals. Payback periods are often very favourable.

Waterless urinals are a recent development that use no water other than for cleaning.

### urinal controls

Without controls urinals can use four times as much water as is necessary.

Urinals can be controlled according to time (e.g. set to operate during working hours), movement or mechanical movement triggers (e.g. a door opening, a tap being turned on or a person entering the washroom).

For larger washrooms it is important to use separate controls for each urinal, to prevent all the bowls being flushed from a single use.

Simply installing urinal controls is not sufficient, systems need to be commissioned and periodically tested to ensure they are operating as intended.

#### Did you know?

Installing waterless urinals can save 20% of office water use! Waterless urinals are comparable in cost to standard units, whilst installation and maintenance costs are typically lower than flushing urinals.

### waterless urinals

A range of urinals use no water. Some systems are supplied as a complete unit whilst others can be fitted to standard bowls and troughs. There are a variety of forms of waterless urinal:

- those with disposable chemical traps
- those with permeable one-way valves that seal the urinal opening
- those that create a negative air pressure to take odour from the washroom



Waterless urinals are simple to install and have no complex controls or plumbing exposed to potential damage or vandalism.

Waterless urinals also address scale, odour and flooding problems. Odour is often incorrectly perceived to be a problem with waterless urinals, so most manufacturers offer a scented block, stick or pad.

Waterless urinals typically require little maintenance and are increasingly being used in public facilities such as football stadiums and schools, and even in fast food restaurants.

# toilets

Typically, every person uses 40 litres of water per day for toilet flushing. This is more than 20% of domestic water use. The most efficient WCs can reduce daily water use to less than 20 litres. Vacuum and waterless toilets reduce consumption even further.

Water efficient toilets cost no more, or only a nominal amount more, than standard toilets. They are applicable to both new projects and refurbishments. Payback periods are favourable.

## new WCs

The 1999 Water Supply (Water Fittings) Regulations require that new WC flushes are no greater than 6 litres. Dual-flush cisterns are permitted if the method of operation is clear. The smaller flush should be no more than two thirds of the full flush. Low flush siphon toilets are also available and recommended, as they are less susceptible to leaks than dual flush valve toilets.

Waterless toilets are very effective in remote areas that do not have a mains water supply (e.g. country parks). They are similar in cost to conventional on-site drainage for rural new-build projects.

The most common form of waterless toilet is the composting toilet. These toilets compost waste into a fertiliser product. They range in size from a large box that fits in a bathroom to larger units installed underground. Smaller models use heaters and raking or tumbling mechanisms to accelerate decomposition, while larger models rely on natural processes, sometimes with the help of tiger worms and the addition of fibrous material such as shredded cardboard or sawdust.

The energy used by the heaters in small units offsets some of the environmental benefits of water saving.

Waterless toilets have no drains to block and no sewage sludge is generated. Dry toilets are also immune to freezing, which is a consideration for remote sites and outdoor toilets without power for frost protection.

### Did you know?

Dual-flush and low-flush toilets can cut total water use in the home by 20%.



## vacuum toilets

Vacuum toilets can be economic for larger projects, particularly where conventional gravity drainage is problematic, e.g. in historic buildings. Vacuum toilets have a typical 1.2 litre flush, which reduces typical toilet flushing consumption by about 90%.

## cistern displacement devices

Where WC replacement is not an option, the flush volume of older toilets can be reduced by displacing water in the cistern and reducing each flush by that amount (usually 1 litre). Veolia provide cistern displacement bags for free to its customers, along with many other water saving devices. See: <https://central.veoliawater.co.uk/water-saving-devices.aspx>

## retrofit variable flush mechanisms

Variable flush mechanisms can also be fitted to older toilets. These typically reduce water consumption more than cistern displacement devices.

# water saving showers

Bathing accounts for 25% of the average Hertfordshire household's water use. Showers typically use about a third of the water and energy of an ordinary bath. However, power showers have higher flow rates and can consume as much water as a bath.

Low flow showers cost no more than standard showers. Showers with a flow rate at the upper end of the 4-9 litre per minute range are preferred by users.

## mixer valves

The choice of mixer valve affects the water use for showering. Simple hot and cold tap controls require both taps to be adjusted (often for a period of time) before the correct temperature is found. Single level taps and thermostatic mixers typically enable the user to waste less water.

## shower flow rates

Shower flow rates can vary significantly. Water efficient showerheads work in the same way as an aerated tap, by creating finer drops or by introducing air. Water efficient showers typically work at a flow rate of 4-9 litres per minute but have the feel of a power shower.

Water saver showerheads and restrictors are not appropriate for use with electrically heated showers without the consent of the manufacturer.

### Did you know?

A shower uses 1/3 of the water of a bath, but power showers can use more water than a bath in less than 5 minutes!



# landscaping and irrigation

Watering of gardens and landscaped areas accounts for 5.6% of total water use in Hertfordshire and in summer can amount to up to 50% of total water use. Water efficient gardening could significantly reduce the pressures on Hertfordshire's water supply.

## Measures and techniques

The techniques and approaches suggested below can be instigated in a new area of landscaping or in existing gardens.

- use healthy soil with plenty of organic matter to retain moisture
- choose plants for drought tolerance, compatibility with the soil and planting position
- plant new shrubs and trees through plastic to retain moisture, loose mulches can be used around established plants
- low maintenance alternatives to planted areas include gravel and decking
- let the grass grow longer in lawns, this reduces the need for watering
- water in the early morning or late evening to prevent water loss from evaporation
- a Mediterranean-style garden needs far less water to maintain. The plants suitable for such a garden are used to hot and dry conditions and are adapted to poor, free draining soils
- Drip irrigation can save water in large planting schemes. Porous hoses irrigate by "weeping" water on to or below the ground surface. Technically, these are unattended watering devices and therefore need to be on a metered water supply.



## 2. using and reusing alternative sources of water

### rainwater harvesting

Rainwater harvesting is the collection of rainwater that would otherwise have flowed into the drainage system or ground, or been lost to the atmosphere through evaporation.

Large surfaces such as roofs are ideal for rainwater harvesting. The most simple example of rainwater harvesting is a domestic garden rainwater collection butt. To maximise the amount of water collected, water butts should be fitted to a drainpipe. Pumps are available to enable the use of hoses with trigger sprays.

Another typical solution is the diversion of rainwater from the roof via a drainpipe into a storage tank (usually underground). Leaves and debris are filtered out before the water is stored. The filtered water cannot be used for drinking, but can supply toilets, outside taps, washing machines, etc. through a separate pipe network.

A control unit monitors the water level in the tank. If levels are low, the system switches to the mains water supply and if levels are high, an overflow trap allows floating material to be skimmed off and water to flow to a storm drain.



At a household level, payback periods for the more complex systems (i.e. use of rainwater to flush toilets, etc.) are long, typically more than fifteen years. However, larger projects such as schools and offices have a shorter payback time, often less than 5 years.

### greywater recycling

Greywater is wastewater from baths, showers and washbasins which can be collected, cleaned and reused for non potable uses such as toilet flushing. As it only relies on wastewater, greywater systems are not subject to weather variations.

Greywater usually only requires basic disinfectant or microbiological treatment to be reused to flush toilets. Problems can arise however, when the warm, nutrient-rich greywater is stored, as this presents an ideal environment for bacteria to grow.

Greywater systems are isolated from the mains water to prevent any contamination that could arise from backflow (complying with the Water Supply Water Fittings Regulations 1999).

Greywater from baths and showers can be used safely on most non-edible plants, provided it is applied to the soil rather than foliage and is not hot.

At a household scale, greywater reuse can generate around 30% water savings. However, payback periods are not favourable and the maintenance burden can be significant. However, in other building types, particularly those where significant volumes of greywater (e.g. showers) are generated, payback periods are much shorter.

Greywater can be used for water reuse systems as long as suitable treatment is applied. Treatment systems that could be used include membrane technology, Submerged Aerated Filtration (SAF), biological treatment and Ultra Violet Light. Untreated wastewater should not be stored for long periods as it will naturally degrade and may create odours.

# blackwater recycling

Blackwater is waste water that is highly contaminated, e.g. water from toilets and kitchen sinks. Blackwater should not be used for domestic reuse systems.

Blackwater recycling systems use traditional biological methods as well as newer membrane filtration technology. In addition to holding tanks, often the systems have an attractive water feature planted with reeds, sedges or willows. These plants thrive on and clean up the nutrient rich water.

The treated water is clear, free of odour and contains little organic matter, allowing it to be stored and requiring little disinfection. The water can be reused for non-potable uses, or can be linked to a wider sustainable drainage network or local water feature.

Blackwater systems are expensive and typically have long payback periods. They are more affordable when the properties are distant from or have a small connection to the conventional sewage network. The integration of reed bed filtration within the landscape can also be aesthetically rewarding.

The space (e.g. pond) requirements for blackwater recycling can be significant; a small cluster of five homes could need up to 200m<sup>2</sup> of pond space.

## Did you know?

The Environment Agency's 2010 report, 'Energy and carbon implications of rainwater harvesting and greywater recycling', emphasised how important it is to specify the right system for each set of circumstances. Otherwise, the energy requirement introduced by a water recycling system can be greater than the environmental benefits of avoiding the use of potable water.

# Managing surface water drainage

Sustainable urban drainage systems (SUDS) mimic natural drainage from a site and enable rainwater to run back into natural systems, rather than the stormwater drainage network. SUDS also treat run-off water to remove pollutants.

The SUDS water management hierarchy is:

- 1 prevention – using good site design and housekeeping measures to prevent run-off and pollution (e.g. minimise impermeable paved areas)
- 2 source control – controlling run-off at or very near its source (e.g. rainwater harvesting, permeable paving, green roofs or soakaways)
- 3 site control – attenuate and/or treatment of surface water for a group of buildings on site or a commercial park or a stretch of highway. The principle SUDS devices for a site control may involve a combination of devices including: detention ponds, swales, soakaway and infiltration trenches and basins.
- 4 regional control – attenuate and/or treatment of surface water for a region, serving a number of sites. Retention ponds and wetlands are the major regional treatment facilities.

There are a number of sustainable drainage techniques. Choosing which sustainable drainage solution(s) to pursue depends on the attributes of the site and project, including:

- local hydrology and hydrogeology
- ground contamination
- depth of water table
- soil permeability
- ground stability
- size of catchment area
- development type

Below are series of typical solutions and techniques used within a sustainable drainage system. More information on SUDS solutions is provided in the Climate Change Adaptation module here.

The Light Imprint Handbook, produced in the US, is also a good source of guidance on SUDS solutions and the landscape types they are most appropriate for.

## natural on-site retention

Natural onsite retention includes drainage techniques that use natural features to infiltrate water, such as filter strips, swales, detention basins and balancing ponds.

### swales and filter strips

Swales and filter strips are vegetated surface features that drain water evenly off impermeable areas (e.g. roads). Swales are long shallow channels while filter strips are gently sloping areas of vegetated land on which runoff is directed.

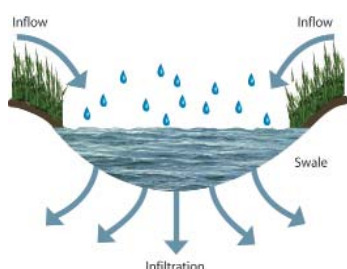
Both solutions mimic natural drainage patterns by allowing rainwater to run through vegetation, slowing and filtering the flow.

Swales work by attenuating and slowing down water flow to allow sedimentation and infiltration of pollutants.

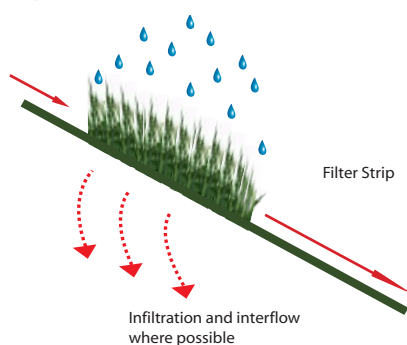
Filter strips only attenuate the flow slightly but they can be used to reduce the drained impermeable area.

# Managing surface water drainage (cont'd)

## Swale



## filter strip



## basins and ponds

An infiltration basin is a vegetated depression, which is normally dry except after storm events. Infiltration basins are built to store water temporarily to attenuate flows. They can also allow infiltration of water to the ground.

Adsorption, precipitation, microbial degradation and filtration are the main processes for treatment of surface wastewater for removing pollutants in infiltration systems. Sedimentation of suspended solids and particulates is important in infiltration basins.

A balancing pond attenuates flows by storing run-off during the peak flow and releasing it at a controlled rate during and after the peak flow has passed. The pond always contains water.

Basins and ponds can be designed to control flow rates by storing floodwater and releasing it slowly once the risk of flooding has passed (a balancing pond). Basins and ponds should be designed to function in both dry and wet weather.

Basins and ponds treat run-off in many ways:

- sedimentation
- microbial activities
- sorption and uptake by plants
- absorption by soil
- settlement of solids - plants in the water can promote settlement
- adsorption by aquatic vegetation/soil
- biological activity

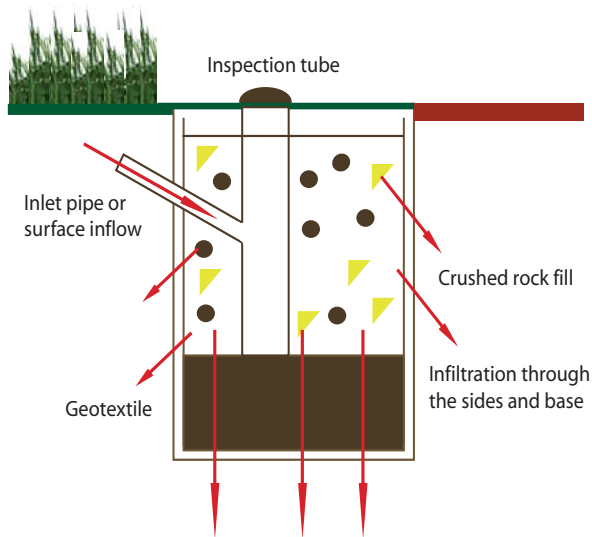
## engineered on-site retention

Common engineered solutions for onsite retention are soakaways, infiltration basins and filter drains.

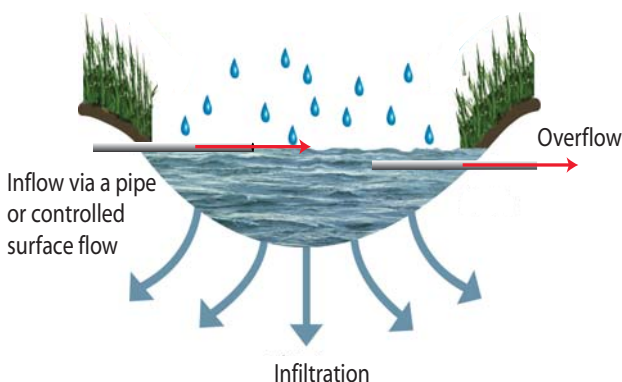
- Infiltration devices allow surface water to soak and percolate into the soil, thereby re-charging the ground water and maintaining the water levels in local waters.
- Ground water and soil type can limit the infiltration systems, especially in high groundwater and clay soil areas. The base of an infiltration system should have sufficient unsaturated soil immediately below it to allow filtering of stormwater. The soils around the base and sides of an infiltration system should not be compacted which would reduce permeability or the infiltration efficiency of the system.

# Managing surface water drainage (cont'd)

## cross-section through a traditional soakaway



## cross-section through an infiltration basin



Infiltration devices treat run-off in different ways:

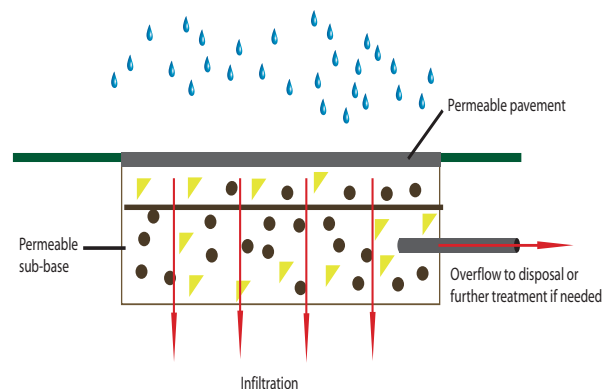
- physical filtration to remove solids
- sorption of pollutants by soils in infiltration devices
- biochemical treatment using micro-organisms

Infiltration systems are easy to integrate into a site. They are ideal for use as playing fields, recreational areas or public open space. Infiltration systems can be planted with shrubs and other plants, which improves their appearance and provides a wildlife habitat. Infiltration systems also increase soil moisture content and help to recharge groundwater, which can mitigate problems of low river flows.

## permeable surfaces

Pervious surfaces are key techniques in SUDS for surface water management and source control of the quantity and quality of runoff. Surface water is infiltrated through the surface and into the underlying construction layers where water is stored prior to infiltration to the ground, reuse or being released to the watercourse or other surface water drainage system. Pervious surfaces are often used for pavement, walk paths, driveways, car parks, cycle routes and sports ground.

## Permeable pavement used for infiltration



## Managing surface water drainage (cont'd)

Pervious surfaces can be either porous or permeable involving the following materials and techniques:

- Porous surfacing infiltrates water across the entire surface of the material forming the paving/car parking areas; e.g. grass and gravel surfaces, porous asphalt and porous concrete.
- Permeable surfacing consists of impervious material to water, however, voids are built-in to these materials that allow infiltration of water through the minute void channels; e.g. concrete paving blocks.

They are effective to provide attenuation of water flow treatment. Pervious paving would ameliorate the need for surface water drains, allowing runoffs to permeate through porous pavements, such as permeable concrete surfaces, crushed stones or porous asphalts. Pollutants removal by filtration occurred within the surfacing or sub-base material itself, or by the filtering action of the reservoir or sub-soil. Some biological breakdown of organic pollutants can also occur.

Permeable surfaces can be designed to fit in with a variety of environmental settings, e.g. hard surfaces of a car park, town centre or gravel surfaces for light traffic. They can be grass-crete or soft landscape surfaces for rural areas. Infiltration devices can be incorporated into open space areas, e.g. playing field or car parks as part of a flood management scheme.

## Minimising wastage in water distribution: Leak Detection

Minimising the wastage of water through the mains water distribution network can provide significant reductions in water consumption to the building occupants or residents therefore reducing the demand upon the water treatment and supply infrastructure and our water resources. The key to achieving this lies in leak detection.

Leak detection devices are used mainly to prevent damage from pipe bursts in unoccupied buildings, with water saving as an added benefit. Many products are designed to detect pipe bursts and leaks and shut off the water supply to minimise water loss and damage. Most provide a simple switch to turn off the water when the building is unoccupied for any length of time.

# Surface water management

## Introduction

Aspenden is a small village about ten miles east of Stevenage in Hertfordshire. Aspenden Brook, a small tributary of the River Rib, flows through the village. This is a typical 'bourne' in the upper part of the Lee catchment and it is normal for it to be dry for most of the year. The location was appropriate for source control via a soakaway system. This option was promoted by the Environment Agency to the developer for a new development comprising five large detached houses.



## description

The surface water drainage from the front roof area is connected via a perforated pipe to a pond. The pond provides a focal point at the front of the site and a new habitat. Drainage from the road and driveways runs off naturally and is directed towards the pond or to shingle soakage strips. When the pond is full, it spills into an adjacent hollow which in turn soaks into the underlying gravel sub strata.

The roof water from the rear of the properties is collected in 1000 litre water butts. When these are full the water is diverted into a standard soakaway, a french drain or perforated pipe and connected to the pond. As the houses have water meters, the use of water butts makes both financial and environmental sense.

## project team

Environment Agency  
Leach Homes

## further information

[www.environment-agency.gov.uk/common/data/acrobat/25\\_case\\_studies\\_\\_1109423.pdf](http://www.environment-agency.gov.uk/common/data/acrobat/25_case_studies__1109423.pdf)

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### Environmental benefits

creation of new habitat  
significant reduction in surface water run-off

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### Cost

not available

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### Application

refer to key

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### Other considerations

not applicable



# Low cost water saving measures

## Introduction

Watford leisure centre is a sports centre that offers a range of sporting activities and attracts more than 300,000 visitors every year. The centre is among many buildings that Watford Borough Council has chosen to join a Government project, Watermark, aimed at promoting measures for reducing water consumption and establishing benchmarks for good practice.

## description

Watford Borough Council joined the Watermark project in December 2002 and under this project it accepted Water Services Contracts (WSCs) from ADSM, a utility management company with expertise in water efficient solutions. ADSM installed and monitored various water saving devices for 17 buildings, which were done at no cost to the Council.

Measures implemented at Watford Leisure Centre include leak detection and repair, installation of controls to reduce water consumption and water bill management and monitoring.

During the first year of the scheme the Council achieved a total reduction in all buildings of 13169m<sup>3</sup> in water consumption, equating to 22% of the annual bill. Five of the sites reduced water consumption by over 50%.

N.B. Watford Leisure Centre closed at the end of 2006 for refurbishment.

## project team

Watford Leisure Centre  
Watford Borough Council  
Advanced Demand Side  
Management plc (ADSM)  
Watermark

## further information

[www.adsm.com](http://www.adsm.com)  
[www.watermark.gov.uk](http://www.watermark.gov.uk)

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### Environmental benefits

water savings of 45%  
a reduction from 9000m<sup>3</sup> a year to 4800m<sup>3</sup>

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### Cost

not available

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### Application

refer to key

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### Other considerations

not applicable



# Water efficient gardening

## introduction

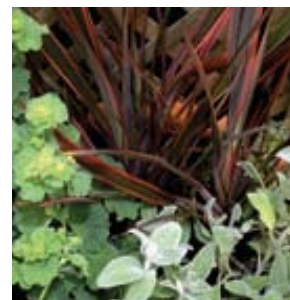
Three Valleys Water, part of Veolia Water, is the UK's largest water-only supply company. The company provides more than 765 million litres of water each day to over three million customers. Given the precarious water supply and demand balance in its supply area, which includes Hertfordshire, Three Valleys Water has a strong incentive to encourage its customers to use water wisely.

## description

The Gardens Roadshow project focuses on the use of water for gardening. Three Valleys Water recognised that the public was becoming more interested in gardening but lacked knowledge and understanding about water conservation.

The Roadshow primarily targeted domestic customers and schools. It has appeared at a large number of events, including the Chiltern Water Festival, the Finchley Carnival, and the Harlow Town Day. It has also been used as part of Environment Agency stands. The Roadshow also targeted employees of key business customers, including GlaxoSmithkline and Gatwick and Heathrow airports.

The roadshow provided an opportunity to promote a range of measures for saving water in gardening. Such measures include water efficient equipment used for gardening, water efficient plants and special soil types.



Research at the Three Valleys Water garden nursery has demonstrated that a water-efficient planter using water-retaining gel can save up to 23 litres of water per week compared to a traditional planter. Three Valleys Water is now set to increase links between the Roadshow and schools through an activity day of 'Making up Planters'. This is linked to the National Curriculum. It also provides a source of income for the school as order forms for planters are created by children and distributed to parents. Three Valleys Water supports the day with demonstrations, materials and aftercare sheets. The profits from the sale of the planters go to the schools. Trials in two schools generated 285 orders, worth £1,425 to the schools involved.

## project team

Three Valleys Water  
Environment Agency

## further information

[www.3valleys.co.uk](http://www.3valleys.co.uk)

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### Environmental benefits

significant potable water savings  
reduced rainwater run-off

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### Cost

planter sales in two schools of £1,425

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### Application

refer to key

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### Other considerations

not applicable



# Wastewater recycling

## introduction

East Kent and Canterbury Hospital is one of three main hospitals in the East Kent Hospitals Trust. The Trust identified an opportunity to save water and money at the Renal Unit at the hospital.

## description

Water savings were achieved through recycling wastewater that had been sent to drain by the Reverse Osmosis (RO) plant. Water is purified in the RO plant and used in the renal unit. Water is diverted to a holding tank via pipe work and then to a larger redundant tank in a separate plant room. Water is then reused to flush all the toilets and urinals in the main operating theatre areas and the accident centre area.

The Trust aims to recover the project costs in less than three years. Annual maintenance costs of the system are minimal.

## project team

East Kent Hospital Trust  
Environment Agency

## further information

[www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)



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### Environmental benefits

37% reduction in water use

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### Cost

annual savings of £7,000 - payback of less than three years  
minimal annual maintenance costs

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### Application

refer to key

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### Other considerations

not available



# Permeable paving, swales, rainwater/ greywater recycling

## introduction

The Wessex Water Operations Centre is part of Wessex Water Ltd. It contains office buildings, an operations centre, car parks, roads and landscaped areas. It has large roofing and paved areas (approximately 75% of the site area).

## description

The operations centre is a new building. Sustainable drainage, including surface and foul water, was designed at an early stage. Wessex Water Ltd was supportive of all water efficient solutions, attempting to demonstrate water savings. The project incurred additional capital costs compared to traditional drainage solutions. However, it is expected to generate significant lifecycle savings. The sustainable drainage solutions include:

- permeable paving in the car parking areas. Porous blocks transfer surface water run-off into soakaways and permeable grass paviers discharge via pipes into a storage tank
- a swale runs down one edge of the site and drains to the main storage tank from which water is pumped back to soakaway points and feeds an ornamental water feature
- rainwater and treated greywater are stored in 3 intermediate tanks and then used for toilet flushing



Notable benefits of the drainage solutions include reduced flows into the surface water sewer and integrating swales and grass paviers into the landscape.

## project team

Wessex Water  
Buro Happold Consulting Engineers

## further information

[www.wessexwater.co.uk](http://www.wessexwater.co.uk)  
[www.circa.org.uk](http://www.circa.org.uk)  
[www.suds-sites.net](http://www.suds-sites.net)

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### Environmental benefits

reduced flow into surface water sewer  
integration of swales and grass paviers into landscaping

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### Cost

not available

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### Application

refer to key

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### Other considerations

not applicable



# Rainwater harvesting

## introduction

Beaumont Community Primary School, near Ipswich is a primary school and nursery, with 102 pupils in total. The new building was completed in August 2003.

The brief demanded a school building that was low maintenance and environmentally friendly. The aim was to build a 'normal' school which took every possible step to reduce its impact on the environment (within budget constraints). One aim was to use as little mains water as possible.

## description

The school has a built-in system to harvest rainwater. This collects water from the roof and stores it in an underground tank. The water is then pumped into the school where it is used to flush toilets and urinals, and to water the garden. The building management system monitors the water, automatically collecting data on the use of mains water and rainwater. It also monitors any mains water top-up used during dry periods.

In the first year, the school used a 170 m<sup>3</sup> of water, of which 37% was harvested rainwater. This equates to an annual figure of 1.66 m<sup>3</sup> per pupil.



Key to success was teaching staff and children how to use water wisely. A colour information display screen in the school entrance shows the school's water use in tabular and graphical forms. Teachers use this information in maths and science lessons as a 'real life' example of data collection.

## project team

Suffolk County Council Design Team

## further information

[www.suffolkcc.gov.uk](http://www.suffolkcc.gov.uk)

[www.environment-agency.gov.uk/commondata/103196/1009179?referrer=/subjects/waterres/286587/746671/996484/](http://www.environment-agency.gov.uk/commondata/103196/1009179?referrer=/subjects/waterres/286587/746671/996484/)

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### Environmental benefits

annual water savings of 1.66m<sup>3</sup> per pupil  
37% of all water supplied by harvesting rainwater

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### Cost

not available

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### Application

refer to key

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### Other considerations

not applicable



# Reducing water run-off using a pond

## introduction

This new hospital was designed to cope with the increased demands of modern healthcare and Swindon's rapidly expanding catchment area. The project was realised through a Public Finance Initiative (PFI) scheme (27 year contract) and includes 551 beds. It was completed in 2002.

Sustainable development principles were incorporated into the design process, and the construction and operation phase. In addition to addressing water management issues, waste management, construction materials and biodiversity were also targeted.

## description

A balancing pond was installed to capture the run-off of water at a cost of £135,000. The void space can take 33m<sup>3</sup> of water, although under normal operations, it will hold 2060m<sup>3</sup>. The pond was constructed early in the construction phase and will remain on the hospital site for the life of the building.

The pond serves to control floodwater and is capable of precipitating out suspended solids in the site run-off. This is achieved simply by providing two large 450 mm inlet pipes but only a single smaller 150 mm outlet pipe. The basin detains flood peaks of run-off and releases the water slowly. It has been designed to cope with the worst possible storm in 100 years. By installing a balancing pond, the toxicity of the site's run-off has been greatly reduced.



The balancing pond was planted with wild grasses and flowers and it is expected that this could become an attractive habitat for aquatic life and birds. The pond will form part of the exterior landscaped areas that visitors, staff and patients can visit and is just one feature of a wider habitat management plan, which has been implemented on the site.

## project team

Swindon and Marlborough NHS Trust  
Carillion  
Whicheloe Macfarlane  
HDR Architects

## further information

[www.swindon-marlborough.nhs.uk](http://www.swindon-marlborough.nhs.uk)  
[www.carillionplc.com](http://www.carillionplc.com)

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### Environmental benefits

additional habitat for aquatic life and birds  
volume and toxicity of site run-off greatly reduced

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### Cost

balancing pond installed at a cost of £135,000

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### Application

refer to key

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### Other considerations

not applicable



# Rainwater harvesting, water efficient devices

## introduction

Millenium Green comprises 24 houses and an office incorporating various water efficiency and other environmental measures. It was developed by Gusto Homes, a small housebuilding company committed to incorporating environmental good practice and sustainable development objectives into housing projects.



## description

All houses are fitted with a rainwater harvesting system, developed by Gusto Homes and Freerain, the system specialists. Severn Trent Water and the Environment Agency undertook a 12 month monitoring study.

The rainwater system uses underground storage tanks big enough to provide non-potable water to the home for 18 days. If the supply of rainwater becomes low, the tank is automatically topped up by the mains supply. Homeowners can see if their tank is being fed by the mains supply by a light in the control box.

The harvested water is used for toilet flushing, washing machines and gardening. Using rainwater in washing machines has the added advantage of reducing the amount of detergent required as it is softer than mains water. An additional benefit is that there is no storm water run-off into local drains. When the tank is full, any excess overflows to a soakaway.

The cost of a complete system is approximately £1000 for a 3.3m<sup>3</sup> tank and £1500 for a 6.5m<sup>3</sup> tank. The payback period can be 20 years, therefore the systems are not currently viable from a purely economic viewpoint.

### Environmental benefits

the combination of water efficiency and rainwater harvesting reduced total household consumption by 50m<sup>3</sup>/year

### Cost

£1000 for a 3.3m<sup>3</sup> tank or £1500 for a 6.5m<sup>3</sup> tank  
payback period of up to 20 years

Gusto Homes has also developed a system that integrates rainwater harvesting with sustainable urban drainage. This system allows any overflow from the rainwater tank to feed into an attenuation tank from which water can be released either through a permeable membrane to land or into the stormwater drain. The Millennium Green rainwater harvesting system won Gusto homes an Environment Agency 2003 Water Efficiency Award.

## project team

Gusto Construction  
Environment Agency  
Severn Trent Water Ltd

## further information

[www.freerain.co.uk](http://www.freerain.co.uk)  
[www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)  
[www.gustohomes.com](http://www.gustohomes.com)  
[www.gustogroup.biz](http://www.gustogroup.biz)

### Application

refer to key

### Other considerations

not applicable



# Rainwater harvesting, greywater recycling, waterless urinals

## introduction

The Sutton Courtenay Environmental Education Centre lies next to Didcot Power Station in Oxfordshire. It was designed for the Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust (BBOWT) with the aim to build a centre that would inspire and educate people about their impact on the natural environment.

The centre caters for more than 5000 visitors every year, many of which are school children. It sets a positive example of the alternatives to the usual mainstream approaches to energy, waste and water. In addition to water efficiency features, the centre has other characteristics that are energy-efficient and environmentally friendly.

## description

The centre has several water efficient features. The rainwater harvesting system supplies 49% of all water, including supplies to the low-flush WCs. Surplus rainwater runs to a soakaway. The ventilated waterless urinal design is estimated to save 70 litres of mains water each day and 20,000 litres per year. A mini reedbed system filters greywater from classroom and kitchen sinks through an underground system.

These features are regularly monitored and maintained by BBOWT at a low cost.



## project team

Simonds Mills Architects  
Elemental Solutions  
Green Building Store

## further information

[www.bbowl.org.uk](http://www.bbowl.org.uk)  
[www.greenbuildingstore.co.uk](http://www.greenbuildingstore.co.uk)

### Environmental benefits

rainwater harvesting system supplies 49% of all water  
waterless urinals save 70 litres mains water each day

### Cost

not available

### Application

refer to key

### Other considerations

not applicable



# Re-using treated wastewater, water efficient devices

## introduction

Sheepdrove is a 2,000 acre mixed organic farm in Berkshire. Approximately 60% of the land is devoted to livestock (sheep, cattle, pigs and poultry), with the remaining 40% used for arable farming (cereals, beans, borage and seed). In addition, the farm has a compost enterprise, a poultry-processing and butchery plant and a conference venue.

## description

A sustainable water management project was implemented through a whole farm approach to water conservation. Sheepdrove investigated water usage and identified opportunities for efficiencies and potential cost-efficient solutions.

A sophisticated reedbed water treatment system was installed to treat all wastewater from the farm, staff cottages and conference centre. Waste water from the processing plant is treated through a Dissolved Air Flotation (DAF) plant, before it enters the reedbed system.

The lake overflows to a willow plantation, before soaking back to the aquifer from which the farm abstracts. A research project by the Elm Farm Research Centre has shown that the water quality in the lake exceeds the Bathing Water Directive standards. The whole system supports a significant population of birds, fish and invertebrates.

Water is also removed from the lake for other uses, including pig wallowing, tree irrigation and compost production. This saves around 1626m<sup>3</sup> of water each year, approximately 10%

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### Environmental benefits

combined water efficiency measures have saved more than 1,600,000 litres to date

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### Cost

£33,000 to cover the initial cost of the reedbed and DAF system payback in 18 months, due to high cost of tankering waste off site



of the total water abstracted. To date, water efficiency measures have saved more than 1,600,000 litres.

The farm offices and the conference centre also have water-efficient appliances. These include waterless urinals (estimated to save 92 m<sup>3</sup> per year), dual flush toilets and stop taps. The farm also has two new dewponds. As well as being locally important habitat sites, these allow livestock to be watered without using either mains or directly abstracted water.

Sheepdrove Organic Farm has won a number of awards including the SEEDA Sustainable Business Award 2006 and the Environment Agency Water Efficiency Award 2005.

## project team

Sheepdrove Farm

## further information

[www.sheepdrove.com](http://www.sheepdrove.com)  
[www.seeda.co.uk](http://www.seeda.co.uk)  
[www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)

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### Application

refer to key

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### Other considerations

not applicable



# Water efficient devices, water butts

## introduction

Gallions Ecopark is an affordable housing scheme of 39 houses at Thamesmead, developed by Gallions Housing Association. The homes contain a combination of cost-effective and practical water and energy efficiency design solutions that are easy to use and maintain. A key objective of this project is to share the lessons learned and distribute monitoring information.

## description

The water saving features include small baths, water-efficient showers, spray taps, flow regulators, mixer taps (in the kitchens), low dual-flush toilets (4/2.5 litre) and water butts.

Gallions Housing Association has monitored the use of water in a number of houses using residents' water bills. Initial indications show that the average resident uses 109 litres per day. This is 27% less than the national average of 150 litres per day.

Throughout the development, paved areas are limited and the use of half-open pavement areas allows rainwater to penetrate the ground thereby reducing run-off. Rainwater is biologically treated before entering the local canal system and street water passes through oil separators before reaching the biological treatment area.

A visitor centre has been developed on site with an accompanying exhibition home that showcases the sustainable elements of the



design and construction.

Gallions Housing Association runs an educational programme with local schools to promote an understanding and acceptance of the principles of sustainability.

## project team

Gallions Housing Association  
Wilmot Dixon  
PRP Architects and Project Services  
Fulcrum Consulting

## further information

[www.gallionsecopark.co.uk](http://www.gallionsecopark.co.uk)  
[www.gallionsha.co.uk](http://www.gallionsha.co.uk)

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### Environmental benefits

residents use 27% less water than the national average  
reduced surface water run-off

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### Cost

not available

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### Application

refer to key

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### Other considerations

not applicable



# Water butts, mulches, leak detection

## introduction

Fallbarrow Park is set in the middle of wooded parkland that borders the eastern shore of Lake Windermere. It provides facilities for tourists and holiday makers including caravan sites, holiday homes and chalets, restaurants, pubs, and boat pitches.

## description

Fallbarrow Park has incorporated a number of water efficiency measures. Water meters are read every week to monitor consumption and detect leaks. To save time and effort, automatic leak detection devices will be installed in the near future.

Water butts have been installed and rainwater is used for garden areas. Gardens also use water straight from Lake Windermere where appropriate. Mulches are used throughout to reduce the amount of watering needed and 'slow release' water gel sachets are also used.

All new caravans on site have 'space savers' inserted into toilet cisterns. Each one saves more than 1 litre per flush. This amounts to huge savings with 270 caravans on site. The park has also trialled waterless urinals but they were unpopular with users. As a result, a timed urinal system was utilised.

Fallbarrow Park won a David Bellamy Conservation Award.



## project team

Fallbarrow Park

## further information

[www.fallbarrow.co.uk](http://www.fallbarrow.co.uk)

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### Environmental benefits

significantly reduced potable water consumption

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### Cost

not available

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### Application

refer to key

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### Other considerations

not applicable



# Water efficient retrofit installations

## introduction

Chesswood Middle School is an existing mixed school with 480 pupils and 43 staff.

## description

The school was fitted with water saving features. This was part of a Southern Water, West Sussex County Council and Environment Agency initiative to measure water savings arising from new types of equipment, and the financial paybacks.

An audit of existing water using facilities and fittings was undertaken. Urinals, toilets and taps were the largest water users. The adopted water saving measures are detailed below.

**passive infrared urinal controls:** these detect people entering the washroom and flush 20 minutes after the first person has used the urinals. Water savings of 68%.

**retrofit push taps in washrooms:** only the top part of the taps was changed, incurring less cost than standard push taps. Such taps have an in-built flow restrictor so that flow rate and duration can be adjusted by the filter. Water savings of 13%

**flow restricting valves:** fitted to pipes supplying classroom taps and adjusted to provide the required flow of water. Water savings too small to be detected

**cistern displacement devices:** a small bag with water-retaining polymer inside was dropped into the toilet cistern. The polymer absorbs water, reducing each flush by 1 litre. Water savings of 3.5-6.4%

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### Environmental benefits

significantly reduced potable water consumption

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### Cost

urinal controls installed for £135/unit, annual maintenance £200, savings from installation of £1,300 of annual water bill, i.e. payback of less than 9 months



**water butts:** fitted to down pipes to collect rainwater from roof areas and used for watering garden plants

Before adopting these measures, water consumption in the school was 40% above the County benchmark figure (4000 litres/pupil/year). Following the introduction of these measures, yearly consumption went down by 73%, a reduction in bills of approximately £3,200.

During a full school day, water consumption dropped by 60% (from 8746 litres to 3420 litres). Consumption per pupil per year is 1520 litres, well below the County benchmark.

The cost effective measures set an example that other schools can adopt easily.

## project team

Southern Water  
West Sussex County Council  
Environment Agency

## further information

[www.southernwater.co.uk/homeAndLeisure/waterEfficiency/](http://www.southernwater.co.uk/homeAndLeisure/waterEfficiency/)

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### Application

refer to key

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### Other considerations

not applicable



# Permeable paving, swales, pond

## introduction

This office business park has a total area of 11.6 ha, comprising buildings of 1000m<sup>2</sup> to 2000m<sup>2</sup>. The site occupies the brow of a hill.

## description

Incorporating Sustainable Urban Drainage Systems was a planning policy requirement of South Gloucestershire Council, the local planning authority. Because the site was developed on a phased basis, the drainage designs were dictated by the capacity of the catchments.

### SUDS used

Permeable paving was used in the Phase 3 parking areas (total area approx 1.2 ha). Discharges from the paving connect to swales, which are conveyed by a conventional gravity drainage system. The water is discharged through a wet detention pond, and a control feature (Hydrobrake), which discharges into an off-site watercourse. Run-off from the roofs of the Phase 3 development also discharge into the permeable paving.

Initially, a large wet detention pond was proposed. However, this conflicted with the developer's aim to maximise the development area, and have high quality landscaped ponds in prominent areas, rather than a detention pond at the back of the development.

Through incorporating SUDS, the loss of land



to detention ponds was minimised and the SUDS planning policy requirements of the Local Authority was met. In order to achieve successful drainage systems, services and drainage were installed early. During construction, attention was given to avoiding contamination of the system, especially from sand and topsoil.

## project team

Bristol and England Properties  
Arup

## further information

[www.bristolandengland.co.uk](http://www.bristolandengland.co.uk)  
[www.arup.com](http://www.arup.com)  
[www.ciria.org.uk/suds](http://www.ciria.org.uk/suds)

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### Environmental benefits/water savings

loss of land to detention ponds was minimised

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### Cost

not available

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### Application

refer to key

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### Other considerations

not applicable



# Further information and references

- 1 Water Efficiency Advice  
Three Valleys Water  
PO Box 48  
Bishops Rise  
Hatfield Herts AL10 9HL  
Telephone: 01707 268 111

[www.3valleys.co.uk/index.shtml](http://www.3valleys.co.uk/index.shtml)
- 2 Water Efficiency Advice  
Southern Water  
Telephone: 0800 027 6152

[www.southernwater.co.uk/homeAndLeisure/waterEfficiency](http://www.southernwater.co.uk/homeAndLeisure/waterEfficiency)
- 3 Water efficiency and sustainable drainage  
best practice information  
Environment Agency  
Apollo Court  
2 Bishops Square Business Park  
St Albans Road West  
Hatfield AL10 9EX  
Telephone: 08708 506 506

[www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)
- 4 Climate change reports  
Sustainable Development Round Table for the East  
of England  
Government Office for the East of England  
Eastbrook  
Shaftesbury Road  
Cambridge CB2 2DF  
Telephone: 01223 372500

[www.sustainability-east.com](http://www.sustainability-east.com)
- 5 UK Sustainable Drainage Systems (SUDS)  
HR Wallingford Limited  
Howbery Park  
Wallingford  
OXON OX10 8BA  
Telephone: 01491 835381

[www.suds-sites.net](http://www.suds-sites.net)
- 6 Chartered Institution of Water and  
Environmental Management  
CIWEM  
15 John Street  
London WC1N 2EB  
Telephone: 020 7831 3110

[www.ciwem.org.uk](http://www.ciwem.org.uk)
- 7 Thames Water Utilities Ltd  
PO Box 436  
Swindon  
SN38 1TU  
Telephone: 0845 9200 800

[www.thames-water.com](http://www.thames-water.com)

# Further information and references

- 8 Construction Industry Research and Information Association (CIRIA)  
Classic House  
174 - 180 Old Street  
London EC1V 9BP  
Telephone: 020 7549 3300  
[www.ciria.org.uk/suds/icop.htm](http://www.ciria.org.uk/suds/icop.htm)
- 9 Greywater recycling information  
[www.greywater.com](http://www.greywater.com)  
[www.freewateruk.co.uk](http://www.freewateruk.co.uk)
- 10 Information on rainwater harvesting  
Rainharvesting Systems Ltd  
Unit S2 Inchbrook Trading Estate  
Bath Road, Woodchester  
Stroud GL5 5EY  
Telephone: 0845 235430  
[www.rainharvesting.co.uk](http://www.rainharvesting.co.uk)
- 11 UK Rainwater Harvesting Association  
c/o Millenium Green Business Centre  
Rio Drive  
Collingham  
Newark NG23 7NB  
<http://www.ukrha.org>
- 12 Water Supply (Water Fittings) Regulations 1999  
Department of Environment, Farming and Rural Affairs  
Customer Contact Unit  
Eastbury House  
30 - 34 Albert Embankment  
London SE1 7TL  
Telephone: 08459 33 55 77  
[www.defra.gov.uk/environment/water/industry/wsregs99](http://www.defra.gov.uk/environment/water/industry/wsregs99)
- 13 Department of Environment, Farming and Rural Affairs  
Customer Contact Unit  
Eastbury House  
30 - 34 Albert Embankment  
London SE1 7TL  
Telephone: 08459 33 55 77  
[www.defra.gov.uk/Environment/water/wfd/](http://www.defra.gov.uk/Environment/water/wfd/)
- 14 NHBC: A general Guide to SUDS for Housing (in draft) by BRE Environment Agency  
[http://www.environment-agency.gov.uk/business/444304/502508/464710/and\\_publications.environmentagency.gov.uk/pdf/GEHO0308BNSS-e-e.pdf](http://www.environment-agency.gov.uk/business/444304/502508/464710/and_publications.environmentagency.gov.uk/pdf/GEHO0308BNSS-e-e.pdf)
- 15 Hertfordshire Environment Forum (hef):  
[www.hef.org.uk/qol/update98/water.htm](http://www.hef.org.uk/qol/update98/water.htm)

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|----|----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 16 | Planning Policy Statement 25: Development and Flood Risk                                                                                     | <a href="http://www.communities.gov.uk/publications/planningandbuilding/pps25floodrisk">www.communities.gov.uk/publications/planningandbuilding/pps25floodrisk</a>     |
| 17 | Building Regulations Approved Document Part G 2010 (Sanitation, Hot Water Safety and Water Efficiency)                                       | <a href="http://www.planningportal.gov.uk/buildingregulations/approveddocuments/partg/">www.planningportal.gov.uk/buildingregulations/approveddocuments/partg/</a>     |
| 18 | Building Regulations Approved Document Part H 2002 (Drainage and waste disposal)                                                             | <a href="http://www.planningportal.gov.uk/buildingregulations/approveddocuments/parth/">www.planningportal.gov.uk/buildingregulations/approveddocuments/parth/</a>     |
| 19 | DEFRA – Future Water – the Water Strategy for England – Feb 2008                                                                             | <a href="http://www.defra.gov.uk/environment/quality/water/strategy/pdf/future-water.pdf">www.defra.gov.uk/environment/quality/water/strategy/pdf/future-water.pdf</a> |
| 20 | Hertfordshire Quality of Life report:                                                                                                        | <a href="http://enquire.hertsc.gov.uk/qol/">http://enquire.hertsc.gov.uk/qol/</a>                                                                                      |
| 21 | Hertfordshire Environmental Forum, “A 50-year vision for the wildlife and natural habitats of Hertfordshire”, 2006                           | <a href="http://enquire.hertsc.gov.uk/qol/2006/50yearvision.pdf">http://enquire.hertsc.gov.uk/qol/2006/50yearvision.pdf</a>                                            |
| 22 | Hertfordshire Mineral and Waste Development Framework, Waste Core Strategy & Development Management Policies, Pre-submission, November 2010: | <a href="http://www.hertsdirect.org/docs/pdf/w/wastecorestrat10.pdf">http://www.hertsdirect.org/docs/pdf/w/wastecorestrat10.pdf</a>                                    |