

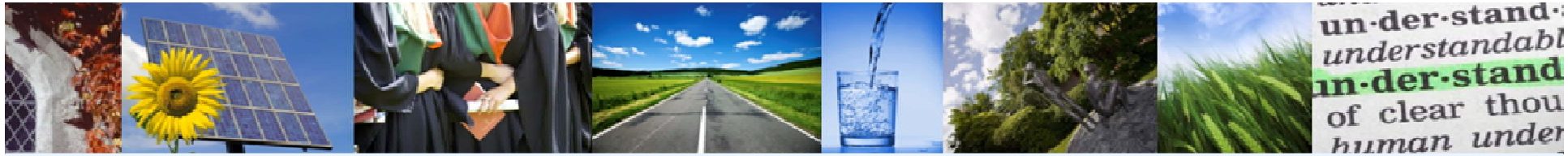
# Sustainability and Modern Society



Adult Continuing Education  
Seminar Series

*Moving to a sustainable societal  
construct:  
Freshwater for the future*

Dr Debbie Chapman  
School of Biological, Earth and Environmental Sciences



# The issues

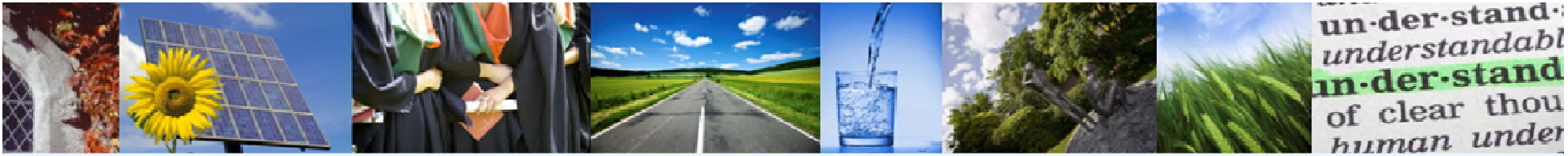
## Quantity

- A finite resource
- Freshwater is not distributed evenly over the Earth
- Climate change leading to new patterns of water availability
- Population growth leading to increased demand
- Unsustainable abstraction of surface and ground waters
- Profligate use

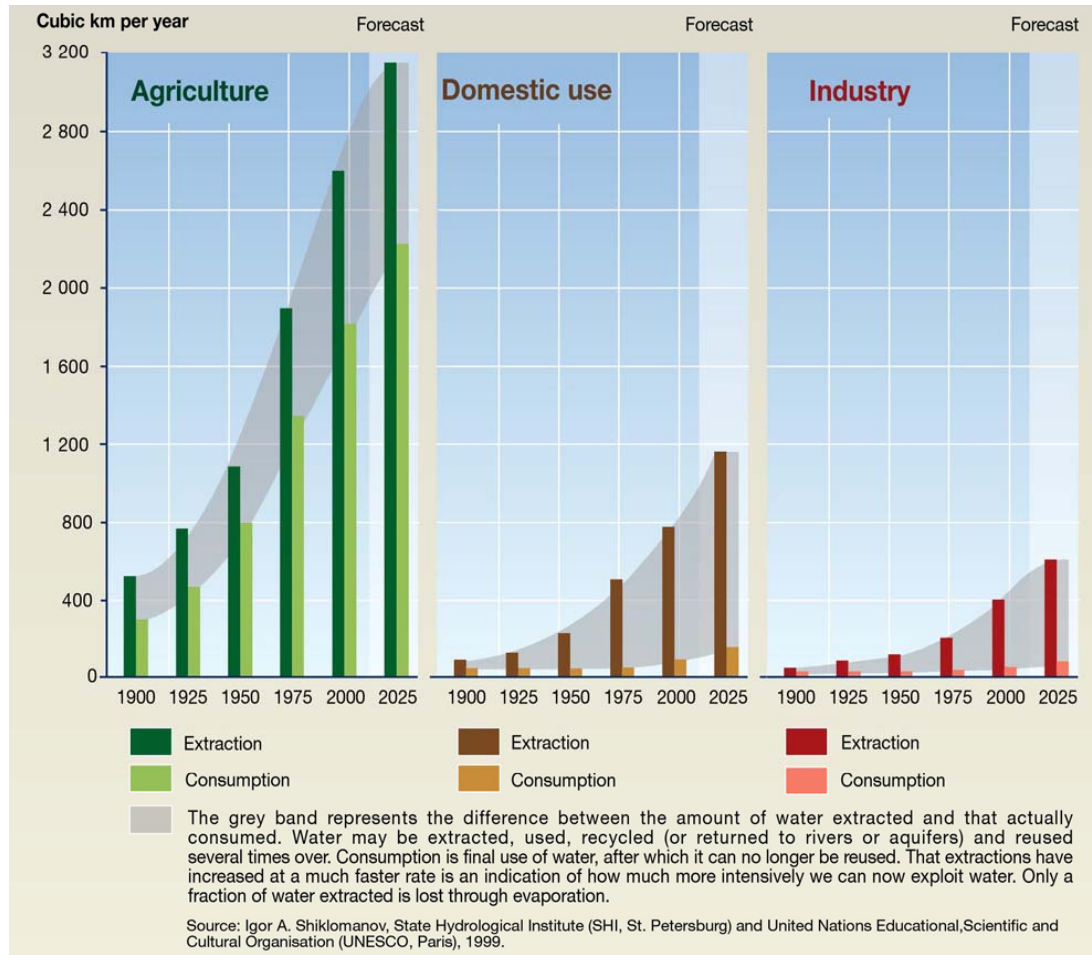
## Quality

- Water used generates wastewater
- Long-term degradation of available water resources
- Available water may not be of suitable quality for all uses
- Water treatment, especially to potable standard, is expensive

**Human demands for quantity, together with impacts on quality, affect aquatic systems, both nationally and internationally**



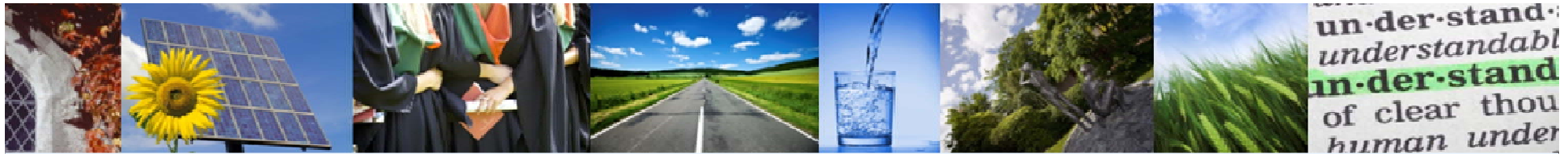
# Projected freshwater use



- Most of the water extracted for domestic and industrial use **can be** returned to aquatic systems or reused/recycled
- Agriculture is the major **consumptive** use of water

UNEP/GRID-Arendal, Trends in global water use by sector, *UNEP/GRID-Arendal Maps and Graphics Library*, <http://maps.grida.no/go/graphic/trends-in-global-water-use-by-sector> (Accessed 15 February 2012)

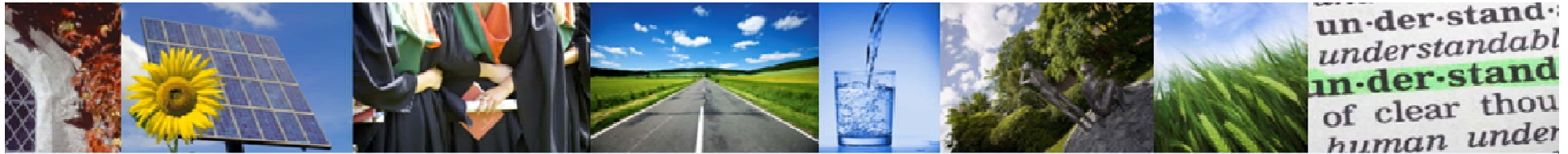




## If water is going to be more scarce or precious then we need to manage demand

- Shortage traditionally led to augmenting supplies rather than managing demand
- Developed countries have tended to maximise use of water resources (residual flows considered as wastage !)
- Previous approaches have paid little attention to “environmental” and downstream uses
- Typical short-term “demand management”:
  - Rationing
  - Prohibited uses (e.g. hosepipe bans)
  - Appeals for public co-operation
  - Standpipes
  - Disconnection of supplies



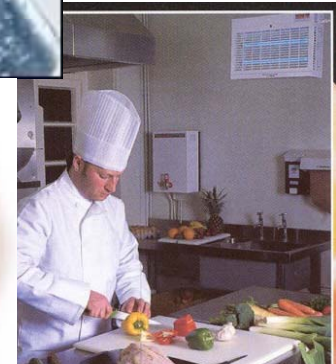


## Domestic use

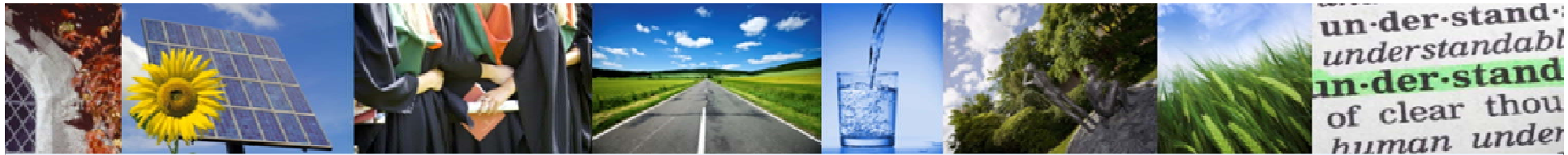
Average daily water consumption per person in Ireland

Average  
litres/person/day

Shower	35
Toilet	27
Laundry Wash	40
Hand wash	12
Teeth Brushing	12
Dish wash	10
Cooking	10
Drinking	2
<b>Total</b>	<b>148</b>

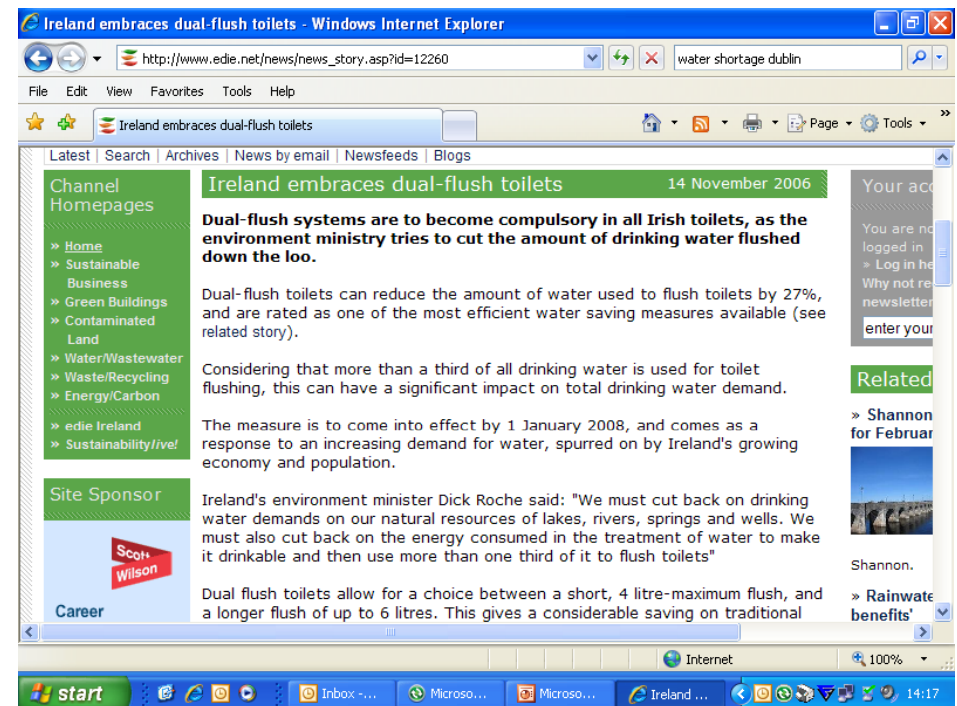


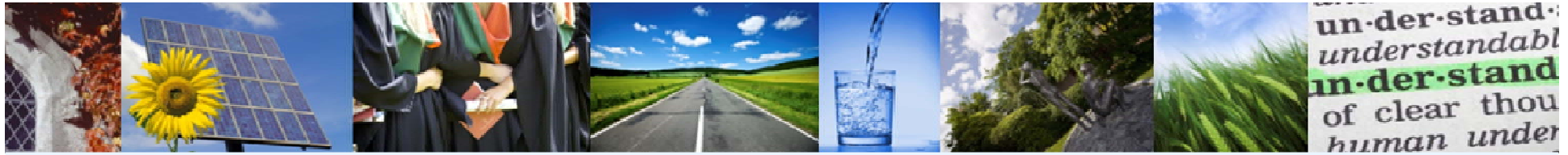
*Water used generates wastewater*



# Tackling domestic and municipal consumption

- Policy (e.g. legislation for water saving initiatives)
- Charges
- Public/corporate awareness
- Water efficiency measures



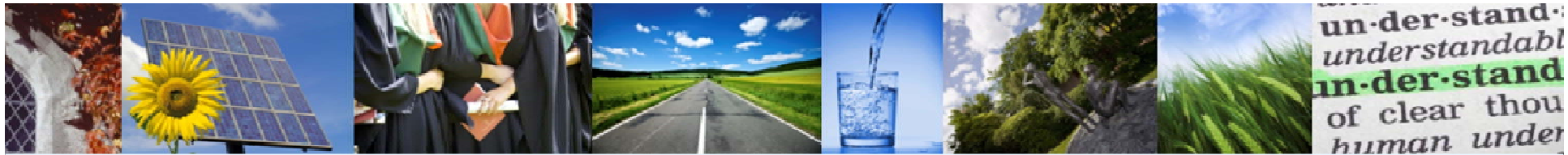


# Water charges in Ireland

- Recover cost of supplying drinking water to domestic users
- Encourage conservation and economic use
- Likely to commence in January 2014
- Customer database to be constructed
- Metering for public water supplies only
- Installation of meters will commence in 2013
- Pricing model and tariff structure to be agreed

Ivan Grimes, Water Services Policy Section, DECLG, Nov 2012





# Public awareness

Tap Tips House & Garden - Windows Internet Explorer

http://www.taptips.ie/house-and-garden.htm

File Edit View Favorites Tools Help

Tap Tips House & Garden

www.taptips.ie

Home House & Garden At Work Kids Downloads

## House & Garden

As our country grows, so does the demand on our water resources. If we're all to enjoy our precious reserves we must be more aware of water conservation.

**Water is precious. Let's conserve it.**

On average each person in the Greater Dublin Region consumes 150 litres per day!

## 10 Tips to Conserve Water in the House

- Keep a jug of water in the fridge
- Use a basin to rinse/clean your fruit and vegetables

**Use a bucket of water not a hose**

A hose uses more water in one hour than the average family uses in a day. The car will

**NO!**

<http://www.taptips.ie/>

Tap Tips | Where water comes from - Windows Internet Explorer

http://www.taptips.ie/water-usage-calculator.htm

File Edit View Favorites Tools Help

Tap Tips | Where water comes from

www.taptips.ie

Home House & Garden At Work Kids Downloads

## Water Usage Calculator

**Instructions**  
Enter your data in the calculator to find out how much water your household uses.

**Personal and drinking sections are your daily usage.** Estimate how many times a day these activities take place in your home. eg. if there are four people and they each wash their hands and face twice a day then write 8 in the box.

**Washing and Others are about weekly usage.** If your household uses the washing machine 3

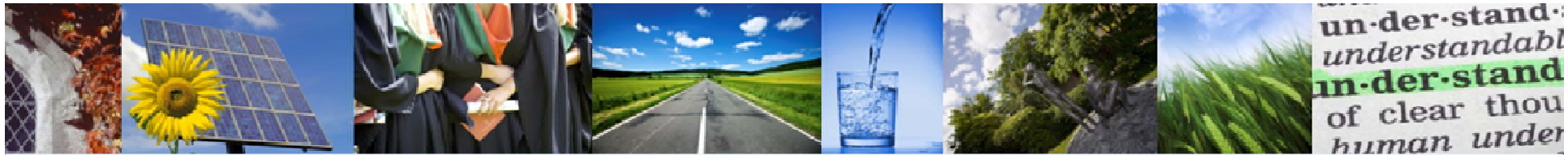
First enter the number of people in your household

Start on Personal, work across to Others, enter the number of times every day each activity takes place in your house.

Personal Drinking Washing Others

The following totals are calculated from your answers





## Taking public awareness to the next level

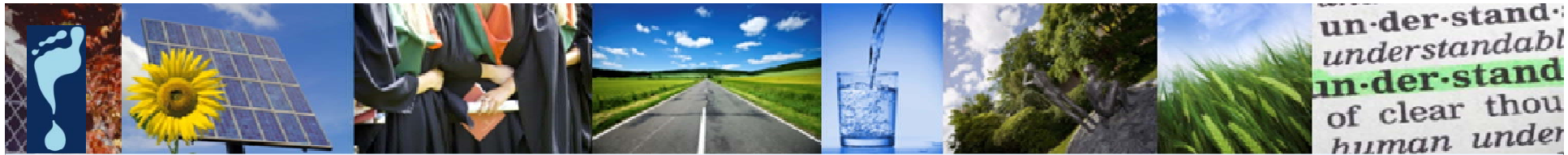


### Global average virtual water content of some selected products. per unit of product

Product	Virtual water content (litres)
1 glass of beer (250ml)	75
1 glass of milk (200ml)	200
1 glass of wine (125ml)	120
1 glass of apple juice (125ml)	190
1 cup of coffee (125ml)	140
1 cup of tea (125ml)	35
1 slice of bread (30g)	40
1 slice of bread (30g) with cheese (10g)	90

Product	Virtual water content (litres)
1 potato (100g)	25
1 bag of potato crisps (200g)	185
1 egg (40g)	135
1 hamburger (150g)	2400
1 cotton T-shirt (medium, 500g)	4100
1 sheet A4 paper (80g/m <sup>2</sup> )	10
1 pair of shoes (bovine leather)	8000
1 microchip (2g)	32





## The total water footprint of a consumer in the UK



About 3% of water footprint is at home  
150 litre/day

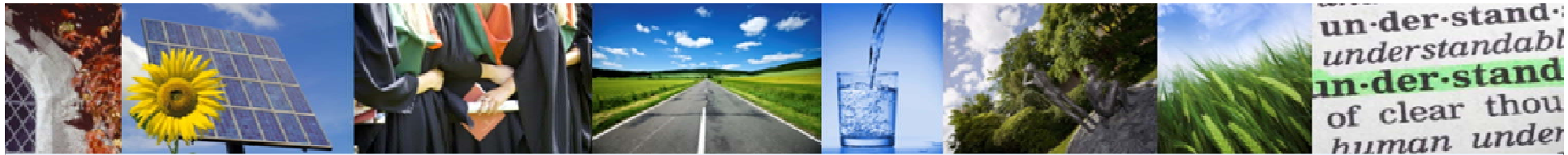


About 97% of water footprint is 'invisible',  
i.e. it is related to the products bought in  
the supermarket

- 3,400 litre/day for agricultural products
- 1,100 litre/day for industrial products

About 60 to 65% of water footprint lies  
abroad

© 2011 Arjen Y. Hoekstra



# Public and corporate awareness

Waterfootprint.org: Water footprint and virtual water - Windows Internet Explorer

http://www.waterfootprint.org/?page=cal/WaterFootprintCalculator

File Edit View Favorites Tools Help

★ Favorites | ★ University College Cork (UCC) | Suggested Sites | Free Hotmail | Web Slice Gallery | RealPlayer

Waterfootprint.org: Water footprint and...

Water Footprint NETWORK

## Water Footprint

Your Water Footprint » Extended Calculator

Introduction  
Agenda  
About WFN  
Product Water Footprints  
Your Water Footprint  
National Water Footprints  
Corporate Water Footprints  
Global Water Footprint  
Training  
Publications  
WaterStat Database  
Glossary  
FAQ  
Links

Your individual water footprint is equal to the water required to produce the goods and services consumed by you. Please take your time and feel free to use the extended water footprint calculator to assess your own unique water footprint. The calculations are based on the water requirements per unit of product as in your country of residence.

Note: put decimals behind a point, not a comma (e.g. write 1.5 and not 1,5).

Select a Country

**Food consumption**

Cereal products (wheat, rice, maize, etc.)  kg per week

Meat products  kg per week

Dairy products  kg per week

Eggs  number per week

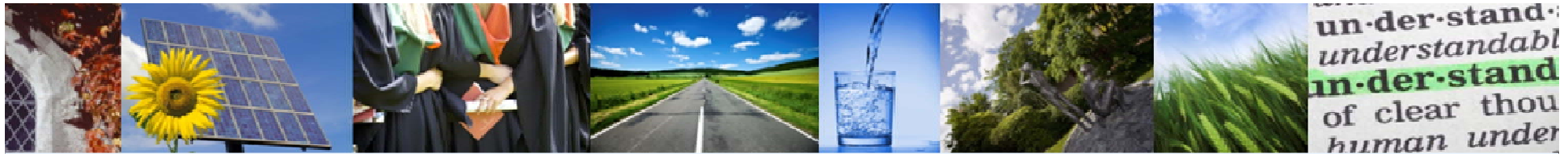
How do you prefer to take your food? High fat

How is your sugar and sweets consumption? High

Done

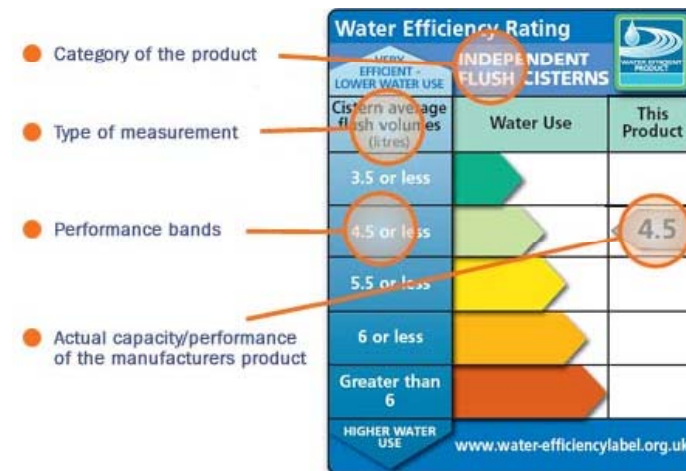
start | Chapman\_Virtu... | Tbilisi | Waterfootprint... | Search Desktop | EN | 20:03



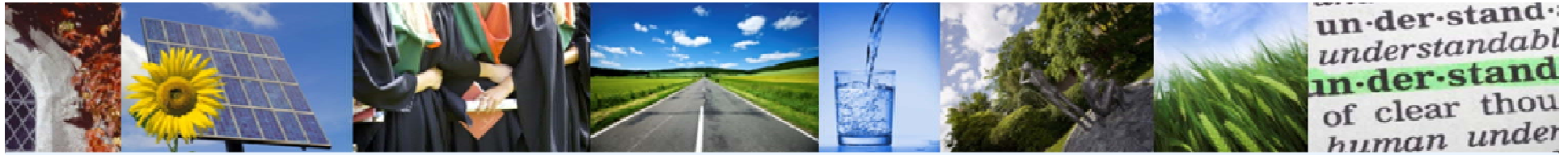


## Awareness will encourage water efficiency

- Efficient use of water – reuse and cycling
- Water efficient products
- Sustainable homes



<http://www.thewatercalculator.org.uk/faq.asp>



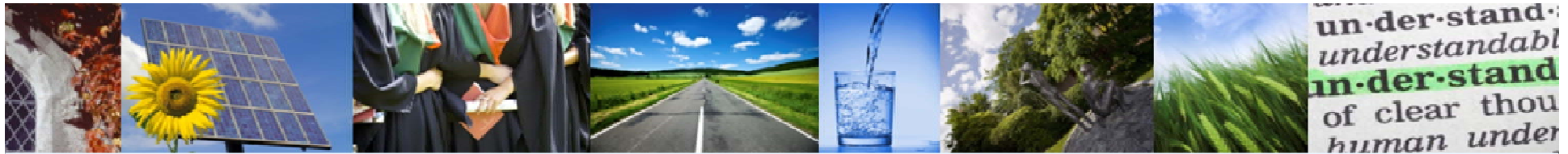
# Tackling domestic and municipal consumption

## Non-potable use

Do we need to treat all domestic and municipal water to drinking water quality?



On-site reuse for toilet flushing and urinals can offset potable water use by as much as 75% in a typical office building



# Tackling domestic and municipal consumption

## Non-potable use

- Rainwater
- Stormwater (external drains)
- Greywater (laundry, showers, kitchen, etc.)
- Blackwater (contains human waste from toilets)

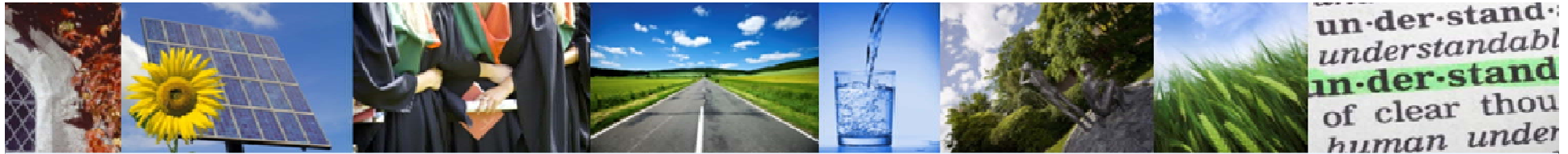


Bord na Mona Environmental Ltd



[www.waterwise.org.uk](http://www.waterwise.org.uk)



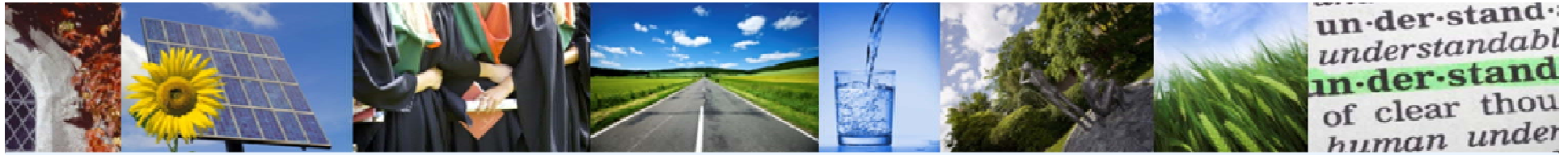


# Rainwater: Northern Ireland Water office complex

12,000 litre underground storage tank which collects rainwater from the roof  
The water collected is used for flushing toilets

The symbolism of NI Water pursuing water efficiency at a site adjacent to one of its largest service reservoirs (49,500,000 litres) is a powerful public awareness tool

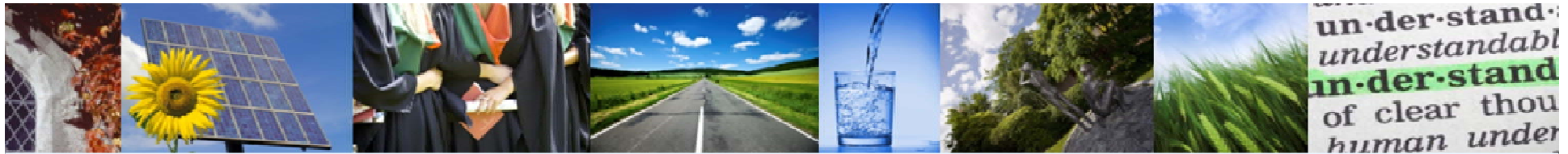




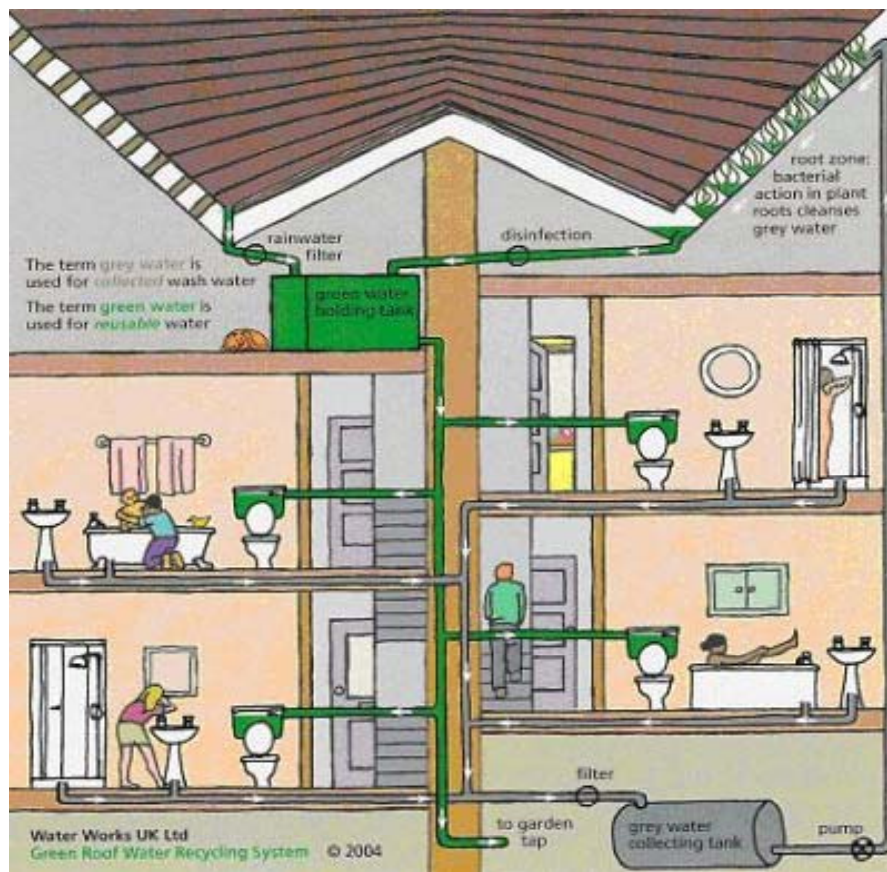
## Greywater

- Filtration to remove hair, skin and soap products from the water
- Chemical or biological treatment prior to reuse
- Level of human contact with the recycled water in its end use determines level of treatment required
- Kitchen sink, dishwasher and washing machine water often too greasy and/or contains too many detergents to allow cost effective treatment





# Greywater: award winning system for apartment complexes



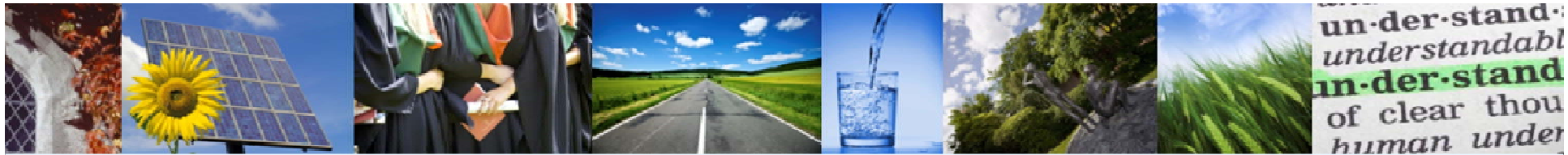
WaterWorks UK <http://www.wwuk.co.uk/>

Rainwater is collected and used to flush toilets

Greywater is collected and pumped to the roof where it passes through a biological filter system

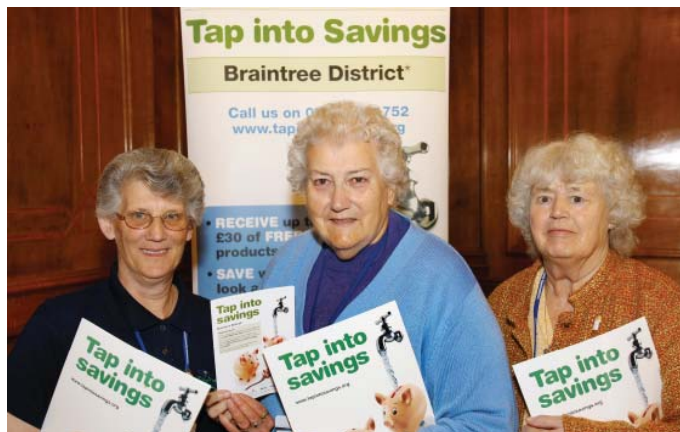


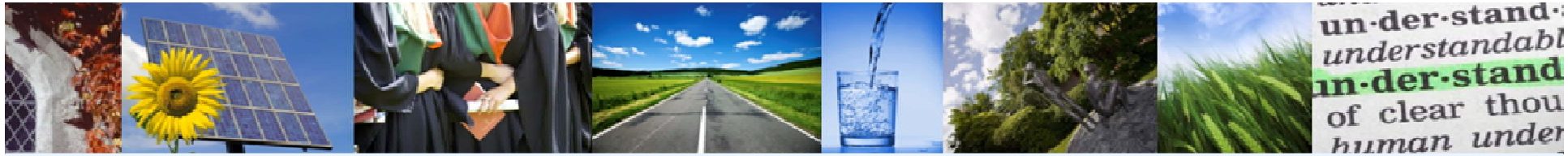




## Tap into Savings (Braintree) - Runner up in the UK Water Efficiency Awards (Built Environment) 2012

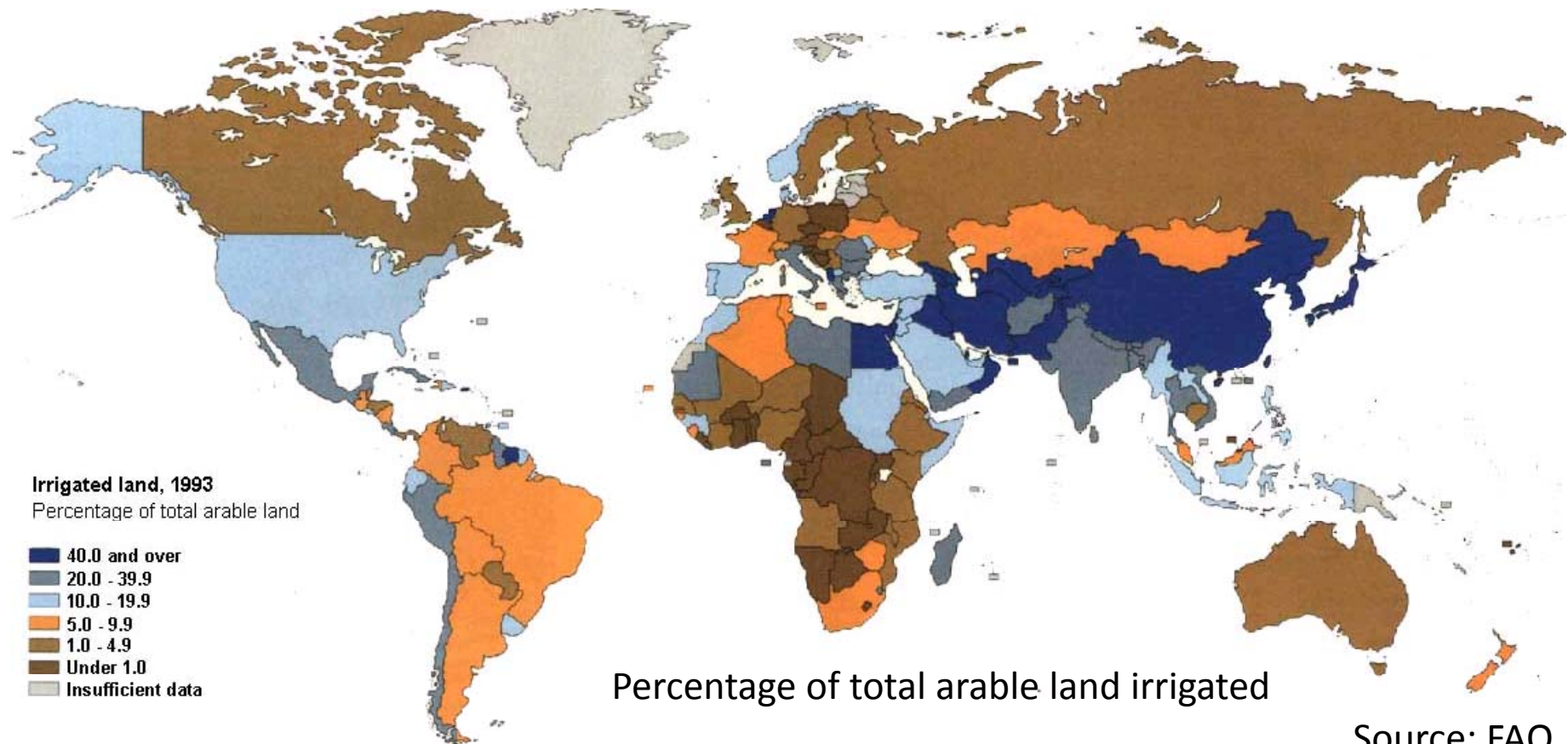
- Home retrofit visits, DIY pack distribution and EcoTeams
- 3,142 homes
- Savings of about 15% of water use per home
  - Just over 28 litres per day (£20 from annual metered water bill)
- A device to convert single flush to dual flush toilets
- Kitchen and bathroom tap inserts (saves up to 1,000 washing-up bowls of water or £5 per year from gas/electricity bill)
- Hose guns (reduces the amount of water used by 50%)
- A 'Shower-save' flow regulator (saves up to 2,000 watering cans of water or £25 from annual metered water bill)
- Cistern displacement devices



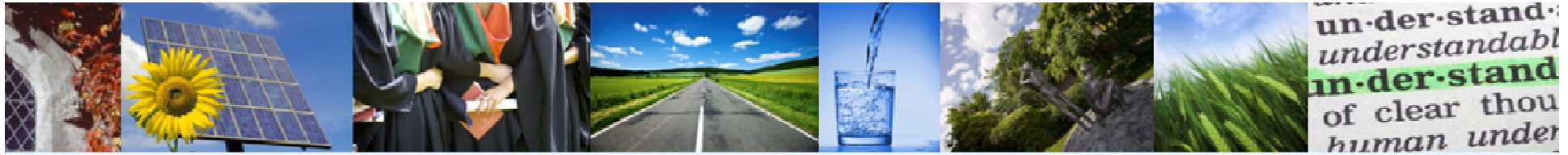


# Agricultural water use

Irrigation is the major agricultural water use at global scale

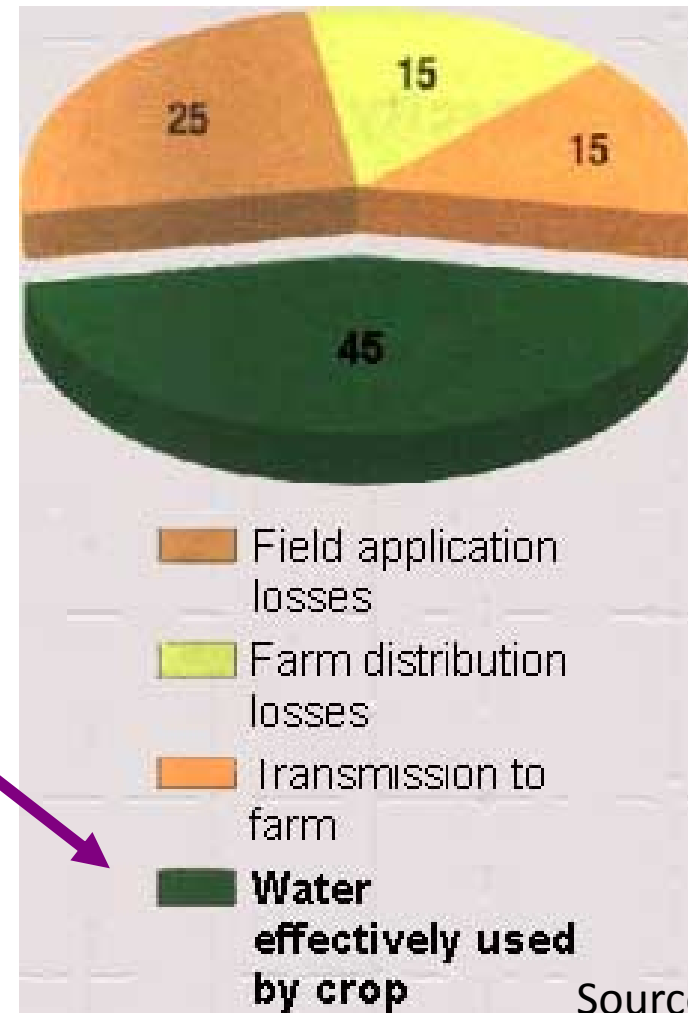


Source: FAO



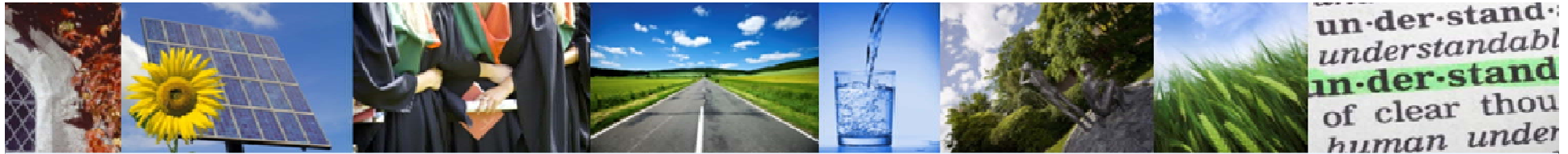
# Irrigation losses

Irrigation often leads to more water being wasted/lost than is effectively used by the receiving crops



Source: FAO

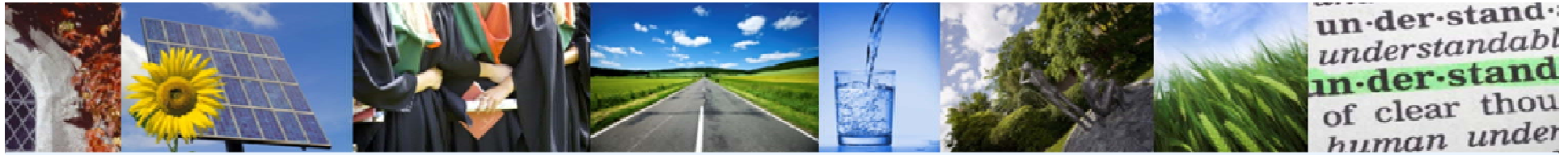




## Wasteful forms of irrigation

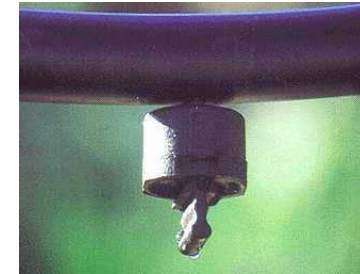
- Overhead pivot spray
  - Waters the ground like rain
- Irrigation canal
  - Distributes water to furrows from which water reaches roots through capillary action
- Flood irrigation
  - Water is applied over the whole field and allowed to infiltrate into soil
- [www.fao.org/docrep/U8480E/U8480E0c.htm](http://www.fao.org/docrep/U8480E/U8480E0c.htm)



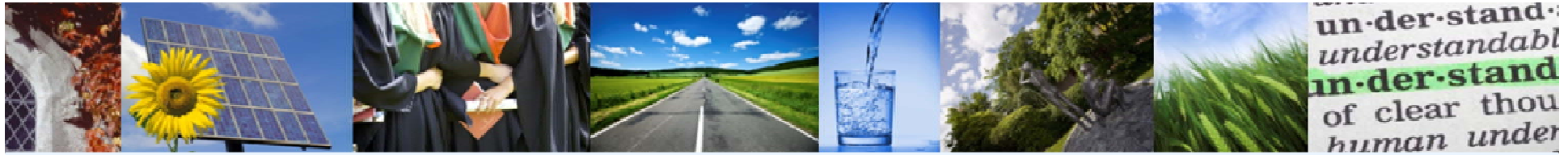


## Localised irrigation

- Water applied around each plant or group of plants
- Only the root zone gets wet e.g. drip irrigation, micro-sprinklers
- Drip irrigation can save 30-60% of water use compared with sprinkler systems
- Improves irrigation efficiency by 90-95% over furrow and flood irrigation techniques







## Sub-surface irrigation

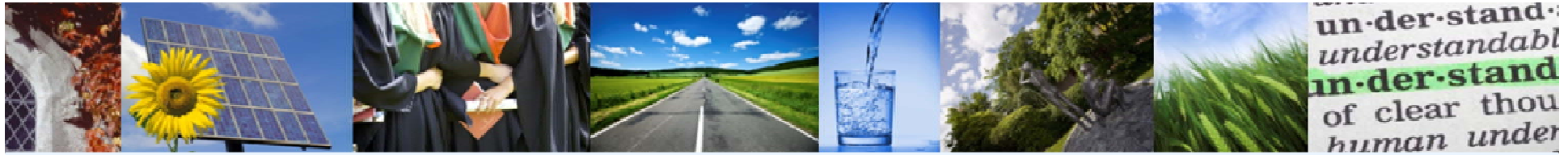
- Water applied to the root zone
- Water reaches roots by capillary rise  
e.g. buried pipes



Photo courtesy USDA [ARS](#)

Photo credit Pete Mortimer





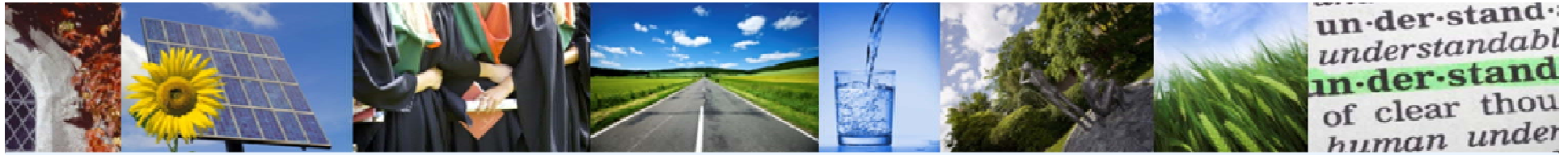
## East Malling Research and South East Water: Runner up in the UK water efficiency awards 2012

- New methodology for irrigating strawberries
- Water savings of around 30%
- Technology determines when the plants need watering and for how long



Eliminates the personal judgement of the grower 'feeling' the soil to judge for themselves if it is wet enough

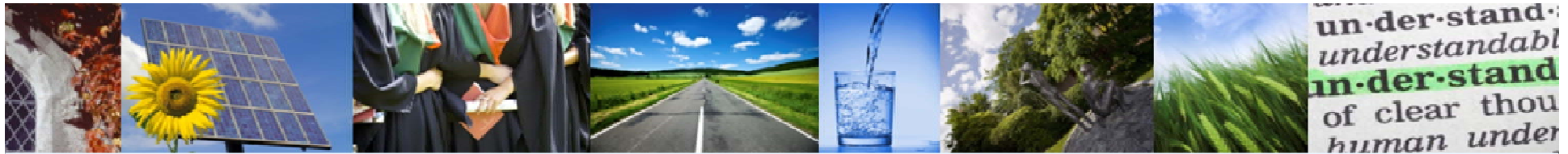




## What we haven't discussed

- Reducing wastewater quantity and quality
- Minimising the impacts of wastewater
- Restoring water resources for the future
- Impacts of major water development projects





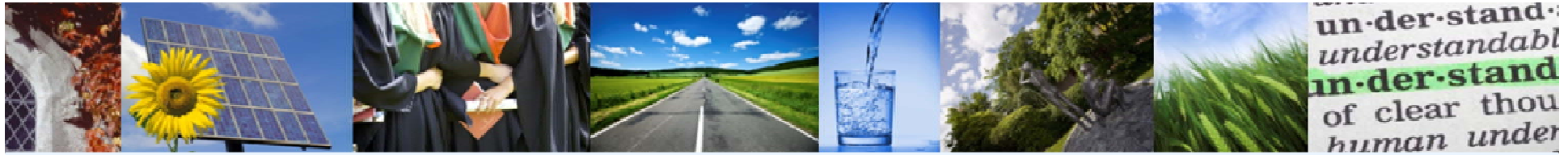
# The bigger picture: managing water as a resource

Successful water resources management needs to:

- Link water quantity with water quality
- Incorporate the needs of ecosystems, e.g. through recognition of importance of flow regimes
- Define resources according to watersheds, river basins, or aquifers
- Recognise that human societies need naturally functioning ecosystems
- Use ecological principles in resource restoration
- Increase communication between engineers, hydrologists, economists and ecologists

Based on Baron *et al.* 2002





## Take home messages

- We all need to be aware that water is a finite and precious resource
- We need to “value” water and not take it for granted
- We can all play a role in conserving water for the future

*Thank you for listening 😊*