
# CHANGE YOUR WORLD

## ONE DROP AT A TIME

### CLIMATE CHANGE

### INTRODUCTION TO TEACHERS AND STUDENTS

# INTRODUCTION FOR TEACHERS AND STUDENTS

OVER THE LAST FEW YEARS WE HAVE SEEN MORE AND MORE EXTREME WEATHER EVENTS, BOTH IN THE UK AND AROUND THE WORLD.

## THE BIG QUESTIONS:

- ARE THEY LINKED TO CLIMATE CHANGE?
- WHAT CHANGES DO WE ALL NEED TO MAKE TO OUR LIFESTYLES?
- WHAT IMPACT WILL THIS HAVE ON OUR WATER SUPPLY, THE ENVIRONMENT, AGRICULTURE, AND ON OUR WAY OF LIFE?

These are critically important issues that affect us all. We have all experienced and witnessed the pressures of extreme weather, from flooding to increasing drought, and the impact this will have on food prices.

We need to ensure that through sustainable development, the needs of the present can be met without compromising the ability of future generations to meet their own needs.

Anglian Water believes that climate change is one of the most significant challenges facing society. As we provide such an essential service in the East of England, we have taken a leading role on tackling this issue with our own customers, other businesses and government locally and nationally. We also have high expectations of how our own business operates with sustainability at the core.


Anglian Water is committed to playing a leading role in educating students on this issue. This pack is, therefore, intended to assist teachers and students, at Key Stage 3 and 4, in understanding these issues in a local setting. Specifically it will help in the delivery of modules in the geography National Curriculum relating to climate change and sustainability. Aspects may also help schools who are pursuing the Eco-Schools award and becoming more sustainable within our own lives and communities.

These units will educate the reader with regard to the measures that Anglian Water are implementing to combat the threats posed by climate change in this region, and will enable teachers and students to understand climate change at a personal level.

# ACTIVITY: IN THE NEWS

## BEFORE STARTING ANY UNIT, COLLECT HEADLINE SNAPSHOTS OF WATER AND CLIMATE CHANGE AND WEATHER IN THE LAST THREE YEARS.

Which of these headlines directly affects the East of England, or your region? Refine the headlines by classifying them in terms of the impact on: the work of the Water Company (Anglian Water), domestic customers, business customers, farmers and the environment.

**Prioritise these headlines in terms of:**

1. Which will have the most impact on how you are provided with water and how your sewage is removed and cleaned day-to-day?
2. What will have the most impact on the sustainable management of water?

Here are some suggested web links (right) for articles relating to climate change:

| Article | Web links |
|---|---|
| Impacts of climate change. | http://www.metoffice.gov.uk/services/climate-services/uk/ukcp/impacts/water |
| Anglian Water, the case study for impact of climate change. | http://www.anglianwater.co.uk/environment/climate-change/ |
| Carbon management, managing greenhouse gas emissions. | http://www.anglianwater.co.uk/environment/climate-change/carbon-management/ |

**Units covered in this programme. Each unit consists of an information section and activities.**

**1. Climate change and water in the East of England:** on the front line – flooding, drought and demand

Units to be added later

**2. Future Water Resource: What is being done to adapt and mitigate the impact of climate change on water resources in the East of England?**

**3. What part do you play? How can you help? Water efficiency, pollution and biofuel**

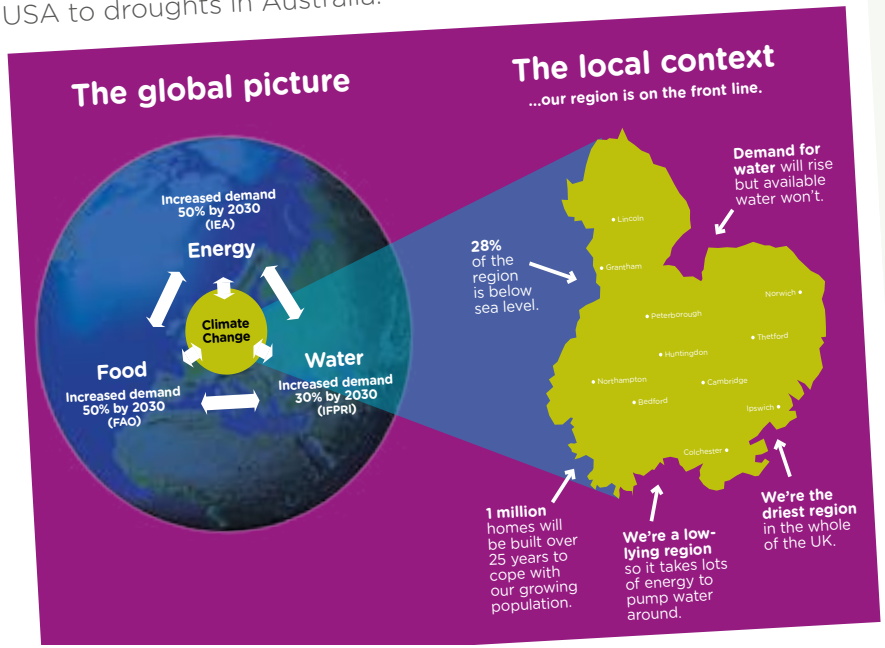
**4. Planning for a sustainable future –** Innovation

# CLIMATE CHANGE AND WATER IN THE EAST OF ENGLAND

## Anglian Water on the front line: Case Study

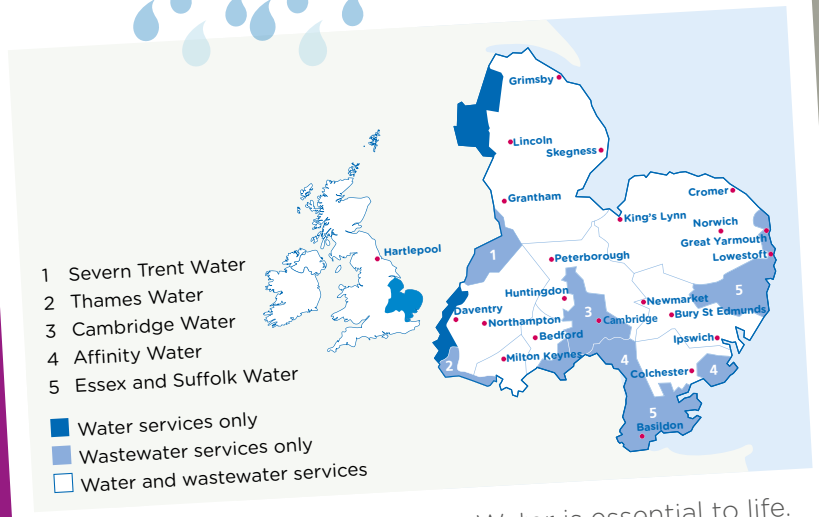
Climate change is the biggest risk to sustainable water management in the next 25 years, and the East of England is very vulnerable. One of Anglian Water's top priorities has been to create plans to evaluate the risks and take action to ensure that sites and operations are able to withstand the pressures of climate change.

Climate change is having an impact in many different ways and all round the world. Global weather patterns are showing trends of changing weather from freezing temperatures in the USA to droughts in Australia.

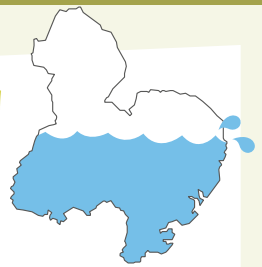



## CLIMATE CHANGE

CLIMATE CHANGE IS ANY SIGNIFICANT TREND IN THE WEATHER OF A REGION OVER A PERIOD OF AT LEAST SEVERAL DECADES, E.G. INCREASING AVERAGE TEMPERATURE OR CHANGES IN SEASONAL RAINFALL.




The service provided by Anglian Water is essential to life. Water is borrowed from the environment, treated to ensure it reaches excellent standards and over one billion litres of water every day is supplied to 4.5 million customers. Over 900 million litres of wastewater are collected every day from approximately six million customers and treated to the highest standards to clean it before returning it to the region's watercourses.



# IMPACTS OF CLIMATE CHANGE ON THE ANGLIAN WATER REGION

**Predicted impacts:**

- Under high emissions, the central estimate of increase in summer mean daily maximum temperature is 6.2°C; it is very unlikely to be less than 2.8°C and is very unlikely to be more than 10.6°C. A wider range of uncertainty is from 1.2°C to 10.6°C.
- Under high emissions, the central estimate of change in winter mean precipitation is 26%; it is very unlikely to be less than 7% and is very unlikely to be more than 57%. A wider range of uncertainty is from –4% to 57%.
- Under high emissions, the central estimate of change in summer mean precipitation is –27%; it is very unlikely to be less than –53% and is very unlikely to be more than 4%. A wider range of uncertainty is from –53% to 11%.
- Increased intensity of storms.
- Sea level rise of 22 – 77cm by 2080. *
- Anglian Water has a long, low-lying, soft coast line, making it particularly vulnerable to the effects of flooding, coastal erosion and sea level rises.
- There is a predicted increase in housing by 35% from 2006 to 2031. **
- One million new homes to be built in the region by 2031.

**UKCIP high emissions scenario for 2080*
*** Household projections 2031, England National Statistics 2009*

# THE KEY CLIMATE CHANGE CHALLENGES FOR ANGLIAN WATER HAVE BEEN IDENTIFIED AS

- Protecting vulnerable assets (water treatment works, pumping stations, water recycling centres etc.) from flooding.
- Dealing with increased wastewater flows while protecting the water environment.
- Maintaining supplies of water to a growing population in drier summers.
- Planning for uncertainty.
- Substantially reducing our carbon footprint.

# LESS WATER TO USE

WETTER WINTERS AND DRIER SUMMERS, TOGETHER WITH INCREASED DEMAND FROM CUSTOMERS, WILL AFFECT THE REGION'S WATER RESOURCES, WATER QUALITY AND BIODIVERSITY.

## Predicted impacts:

- **Drier summers** mean that there will be less water available to abstract from the environment.
- **More intense summer storms** will increase the chance of pluvial flooding.
- **Heavier winter rainfall** could lead to flooding and may impact on the water recycling systems. Flooding can also damage crops and soil quality for a long period.
- **Assets and infrastructure** will be increasingly vulnerable to rising sea levels and more intense storms and flooding.
- **Reserves of groundwater** may not be renewed each winter because of increased rainfall in the form of intense storms. A large proportion of storm water tends to run into drains rather than soak into the ground. The effect is exacerbated as regional development leads to natural surfaces being replaced by impermeable concrete and tarmac.

Over the next 25 years, the supply-demand balance is at risk from growth, climate change and the reductions in deployable output that we will make to restore abstraction to sustainable levels. In the worst case, the impact could approach 567 million litres a day, equivalent to approximately 50% of the water we put into supply in 2012/13. There is the need to manage the risks from drought, deteriorating raw water quality and the impact of cold, dry weather on the distribution system and customer supply pipes.

Through the Water Resource East Anglia (WREA) project, Anglian Water is working in partnership with the Environment Agency, Natural England and others to increase the resilience of the region to the effects of drought, climate change and growth. In the next 10 to 15 years, this could include delivering schemes for winter storage reservoirs, aquifer (underground) storage and recovery, water reuse and strategic raw water or treated water transfers. Together with a commitment to manage demand and increase water trading, this approach delivers a sustainable and affordable balance between the future needs of customers and the environment.

# Flooding in the East of England: Case study

**Flooding:** September 2006, Great Yarmouth experienced a huge storm, which led to flooding. Half a winter's rainfall fell in less than 8 hours. The storm flooded 300 properties, and was classed by the Meteorological Office as a 'one in 100 year storm', which is an event that in an ideal world, we would not expect to see for another 100 years.

There were a number of factors which contributed to the flooding. Great Yarmouth is low-lying and is, therefore, more susceptible to flooding. The area is so low that gravity cannot be used to get the water to flow to the water recycling works – in fact, gravity is working against us, because every time it rains or there is a high tide, water wants to settle at the lowest points in the town.

Sewers usually take rainwater away from the impermeable surfaces such as roads and pavements. Combined sewers will take rainwater and sewage to the water recycling works. Newer sewers can be separate systems: one to take rainwater to balancing lakes or sustainable urban drainage systems before releasing it back into a watercourse, and the other to remove sewage to the water recycling works.

Great Yarmouth's sewers rely on over 80 pumping stations to pump sewage and surface water through the sewer network to the treatment works.

The pumping stations push wastewater from Great Yarmouth and surrounding villages to Caister Water

Recycling Works. Each pumping station has several pumps: the smallest has 2 and the largest has 10. The larger pumps can weigh up to 1.5 tonnes and pump up to 5,000 litres a second: even they were overwhelmed by this storm.

The job of these pumps is often made more difficult by blockages caused by inappropriate items such as wipes and sanitary waste being disposed of into the sewers and drains via the toilet. If there is a blockage or pump failure, an alarm will be raised by the telemetry system and employees will ensure the problems are fixed, 24 hours a day.

The sewer system in the UK is designed to cope with the kind of storm we would only expect to see, on average, every 30 years. As the weather doesn't behave in an entirely predictable way, we are seeing more and more extremes of weather. Anglian Water, working in partnership with Great Yarmouth Borough Council and Norfolk County Council as part of the Surface Water Management Plan, has invested £5 million in the Northgate Street area of Great Yarmouth to alleviate the risk of flooding. The Environment Agency is also looking into the feasibility of constructing a tidal barrier on the River Yare.

The risk of flooding can be reduced, but not removed. Measures to reduce this risk require urban environments to become more resilient. This requires the adaptation of building layouts, careful planning when redeveloping or building on current flood plains.

Pumping Station

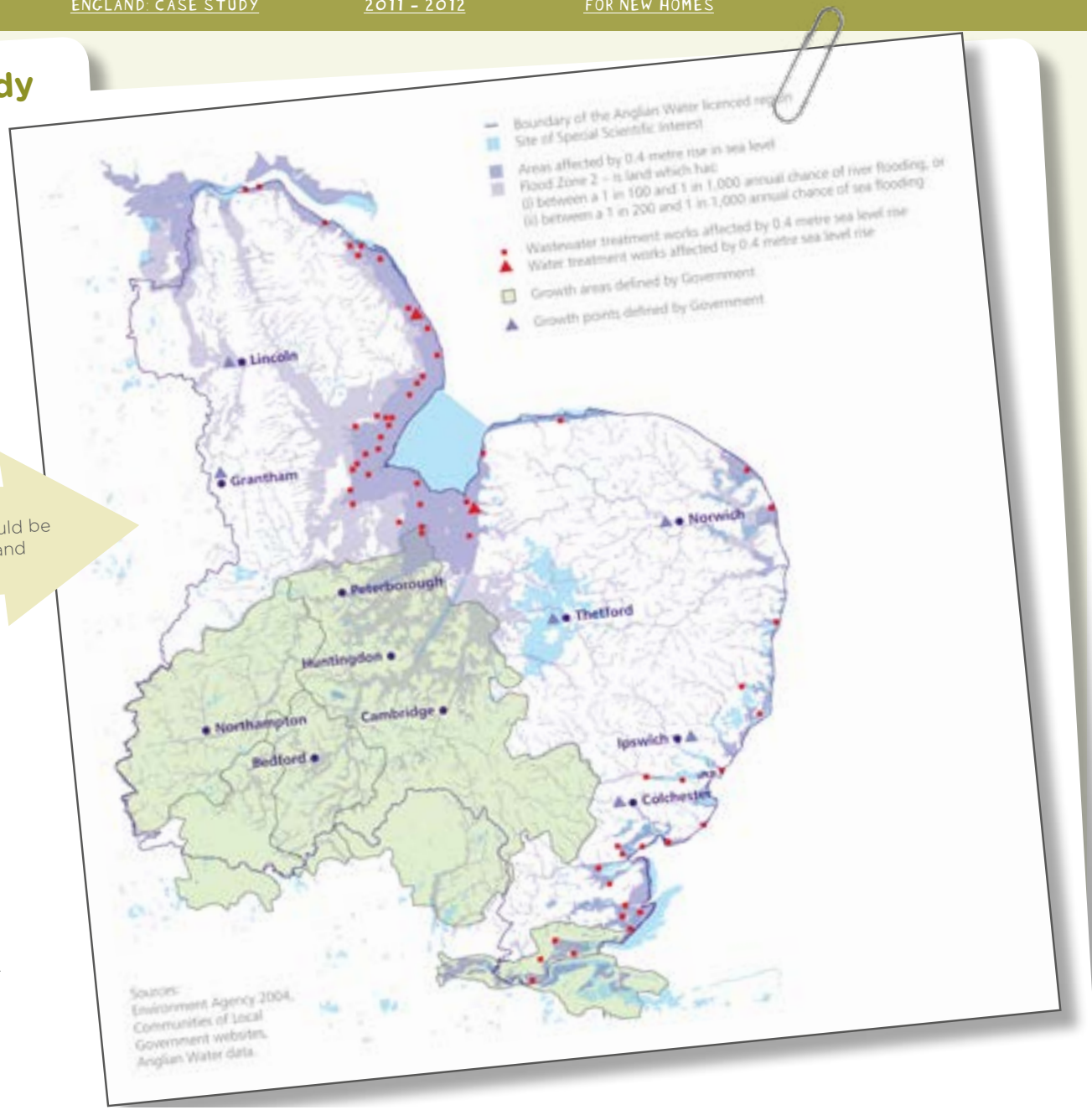
*Continued >*

# Flooding in the East of England: Case Study

*> continued*

## Essex August 2013

Parts of Essex saw 5 centimetres of rain in just 1 hour. The volume of water and the urban environment meant the water quickly began to pour down roads and through houses, looking for the lowest point. Towns and cities are generally composed of impervious surfaces, tiled roofs, tarmac and paving. Sewers and drains became overwhelmed by the volume of rushing water, so it is not just coastal regions that are liable to flooding. This type of rapid onset flooding is becoming more common in the UK.




**Future Flooding: East of England**
The map shows the areas which would be affected by a 0.4m rise in sea level and the Anglian Water sites in this area.

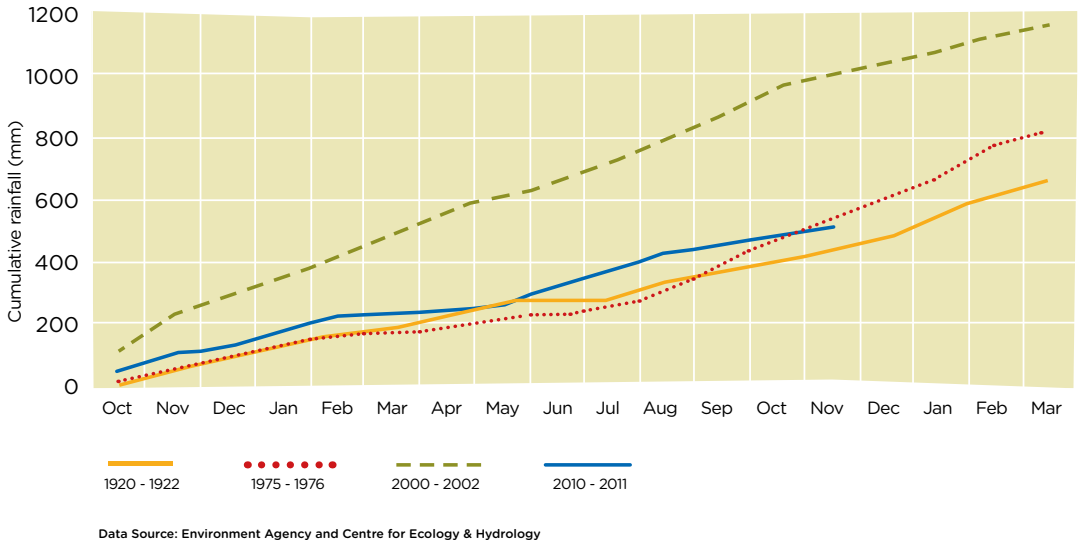
# DROUGHT 2011 – 2012

Two consecutive winters (2011/12) and the summer of 2011 were the driest on record with a third less rain falling than usual, leading to an official drought status being declared in June 2011 by the Environment Agency and a hosepipe ban coming into force between April and June 2012. Farmers in the region had already experienced reductions in the amount of water they could extract from rivers in the preceding months. Rainfall throughout June and September 2012 restored surface water levels (reservoirs) to the required levels for summer use.

The impact of the 2012 drought was mitigated by conserving water supplies and using water efficiently; however, there is still a lot more work to be done with customers, stakeholders and businesses to ensure a sustainable water supply and balance domestic customers' needs with industrial, agricultural and environmental requirements.

One of the ways this is being done is to encourage customers, both domestic and business, to be Waterwise: that is to act more responsibly in their water use. You can find out more about being Waterwise by visiting the Anglian Water website.

This graph shows the month on month rainfall. Compare the last few years with the famous drought of 1976 when some places in the UK had to collect water from standpipes in the street.




Data Source: Environment Agency and Centre for Ecology & Hydrology

**Anglian Water's water efficiency campaigns** helped save an estimated 1.5 million litres of water a day during 2011. In 2012, 70% of Anglian Water's domestic customers had **water meters**, with a target of 80% to be reached by 2015 – this will further improve water efficiency in the home. Anglian Water is providing a range of free water saving devices to help customers become more water efficient, from water displacement devices for toilets to plumbers installing tap aerators in homes.


In addition to domestic customers, there are over:

**113,000** businesses

**3,900** educational institutions

**2,800** health service providers

who depend on Anglian Water for a safe and secure supply of water and safe treatment of their sewage and wastewater.

# DEMAND FOR WATER

## NEW HOMES: THE GOVERNMENT HAS PLANNED UP TO A 20% INCREASE IN NEW HOMES IN THE EAST OF ENGLAND BY 2020

That is a sharp increase from the current 6.1 million customers; with less reliable rainfall predicted in the future, that means a larger population and less water available. Part of Anglian Water's strategy is to use the water that is available efficiently and find ways to encourage our customers to conserve this precious resource, and be water efficient.

## THE FACTS

**6.1m**
current customers.

**20%**
increase in new homes in the East of England by 2020.

**1m**
planned new homes in the East of England in the next 25 years.

**Future**
less reliable rainfall predicted.

**Less**
water means we need to recycle and conserve to be more efficient.

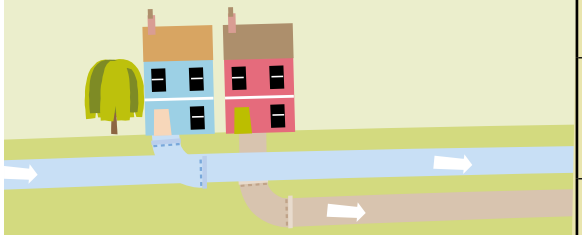
# ACTIVITY 1: IMPACTS OF CLIMATE CHANGE

## Answer the following questions:

- What impact will climate change have on your locality?

- What impact will climate change have on Anglian Water's ability to manage the region's water sustainably?

There are many areas to consider. Use the table to answer the questions. There are some blank spaces for you to add your own ideas at the bottom.



| | The East of England | Anglian Water |
|---|---|---|
| **Financial impacts** – to the whole region, certain businesses | | |
| **Assets** – machines, offices, pipe networks, etc | | |
| **Customers** – bills, housing, transport, health, work | | |
| **Stakeholders** – other organisations who we work with, e.g. councils, conservation groups | | |
| **Environment** – the habitats at reservoirs and the watercourses we extract and discharge into | | |
| **Economic impacts** – lack of new business investment, job losses | | |
| | | |
| | | |

# ACTIVITY 2: MAPPING PERMEABILITY

MAP OUT YOUR SCHOOL GROUNDS AND HIGHLIGHT AREAS WITH IMPERMEABLE SURFACES AND PERMEABLE SURFACES.

**Answer the following questions:**

- What percentage of the school grounds prevents water entering the soil?
- What impact do you think this has?
- Are there any actions you think the school could take to lessen this impact?

Use the space provided to map out your school gounds.

## SURFACES

**Impermeable surfaces include:**
asphalt, concrete, block or stone paving.

**Permeable surfaces include:**
gravel, grass, planting/flower beds.

# ACTIVITY 3: POTENTIAL IMPACTS OF FLOODING

USE AN OS MAP OF YOUR LOCAL AREA.

**Answer the following questions:**

- Identify low-lying areas where water will collect in heavy rain or from river water incursions.

- Imagine what the impacts would be if your local area flooded
  - Who would be affected? Businesses, schools, shops, pubs, homes
  - What sorts of flood defenses could help?

Complete the table:

| Location affected | Short-term impact | Long-term effects |
|---|---|---|
| | | |
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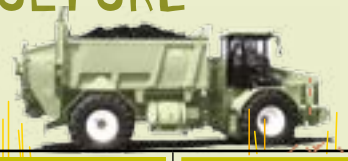
# ACTIVITY 4: EXTREME WEATHER IMPACT ON AGRICULTURE



**Answer the following questions:**

- Investigate what crops are growing in the East of England? What livestock is kept?
- Plot on a regional map.
- Have land use and farming methods changed in the last five years? If so, identify which crops are now being grown and what livestock kept? Are these changes the result of changes in weather patterns?
- Predict how the following will affect farmers in the future:
  - Increases in temperature
  - Rising sea levels
  - Lower annual rainfall
  - Extremes of weather

Present your predictions with supporting evidence.

Use the table for your notes.

| What crops are grown and livestock kept? | How has the weather affected agriculture? | How might the weather impact on agriculture in the future? |
|---|---|---|
| | | |
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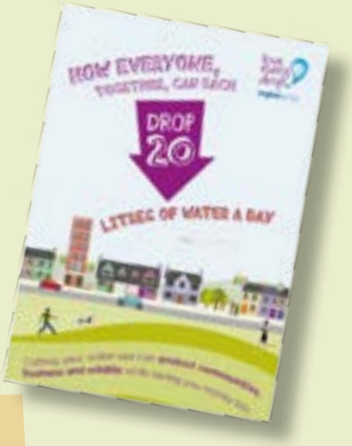
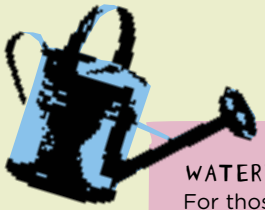
# ACTIVITY 5: DROP20 RESOURCES




WE ALL NEED TO DO OUR BIT TO SAVE WATER, WHICH IS WHY WE'VE LAUNCHED A CAMPAIGN ENCOURAGING EVERY SINGLE ONE OF OUR CUSTOMERS TO REDUCE THE WATER THEY USE BY 20 LITRES A DAY. HERE'S SOME IDEAS TO GET YOU STARTED...

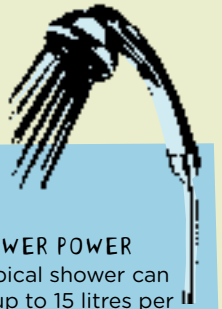

**GRAB A BUTT**
Collecting rainwater from your roof and downpipe in water butts to use in your garden will keep your beds blooming all summer.

**CLEANING THE CAR**
Using a hosepipe to wash the car uses a whopping 225 litres of water in minutes – that's why we are asking you to use a bucket and sponge instead.



**WATERING THE GARDEN**
For those plants that need water use a watering can and water them later in the day to avoid evaporation.

**HUSH THE FLUSH**
A water displacement device in your toilet cistern saves 1 to 2 litres every time you flush. Our Bits and Bobs team can help – go to anglianwater.co.uk for more info.



**SHOWER POWER**
A typical shower can use up to 15 litres per minute – so shower for 60 seconds less each day to make a massive difference.

Take a look at drought activities including video, teacher's notes and a drought mystery lesson – visit:

**www.anglianwater.co.uk/drop20education**

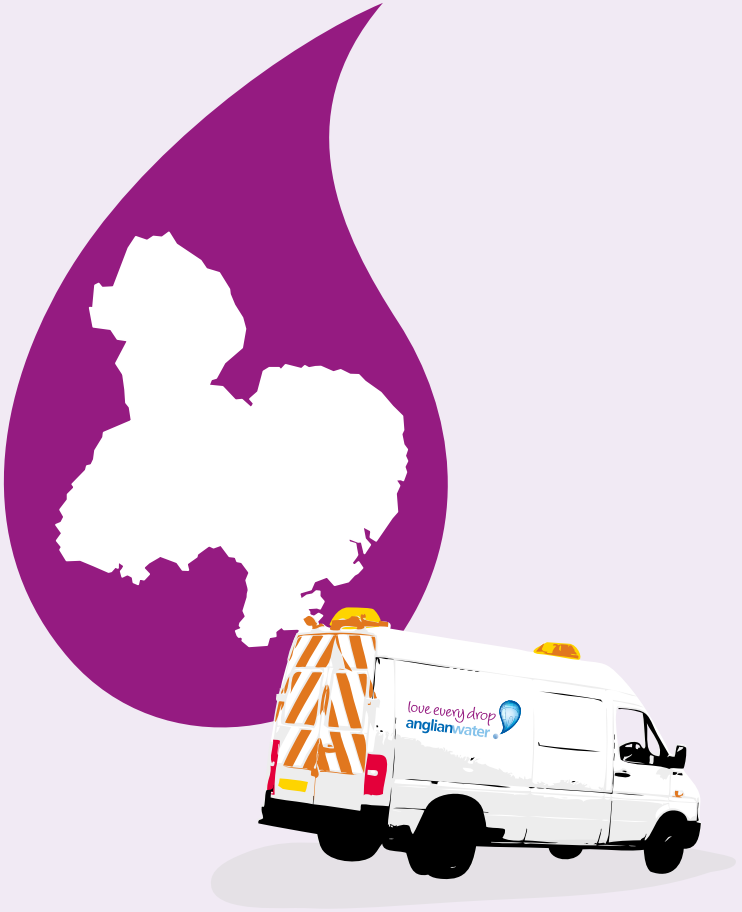
# FUTURE WATER RESOURCES - RESPONDING TO CLIMATE CHANGE

## ANGLIAN WATER AND CLIMATE CHANGE

CLIMATE CHANGE IS DRIVEN BY THE RELEASE OF GREENHOUSE GASES, SUCH AS CARBON DIOXIDE, METHANE AND NITROGEN OXIDES, INTO THE ATMOSPHERE. AS A COMPANY WE CONTRIBUTE TO CLIMATE CHANGE THROUGH:

1. our emissions from our activities (e.g. transport, heating, water recycling etc.), and
2. emissions from the production, by others, of products that we use (e.g. chemicals, concrete).

**For the purpose of reporting, all of these emissions are converted to a carbon dioxide equivalent and referred to as carbon emissions. Both types of emissions combined form our carbon footprint.**



# SETTING OUR GOALS

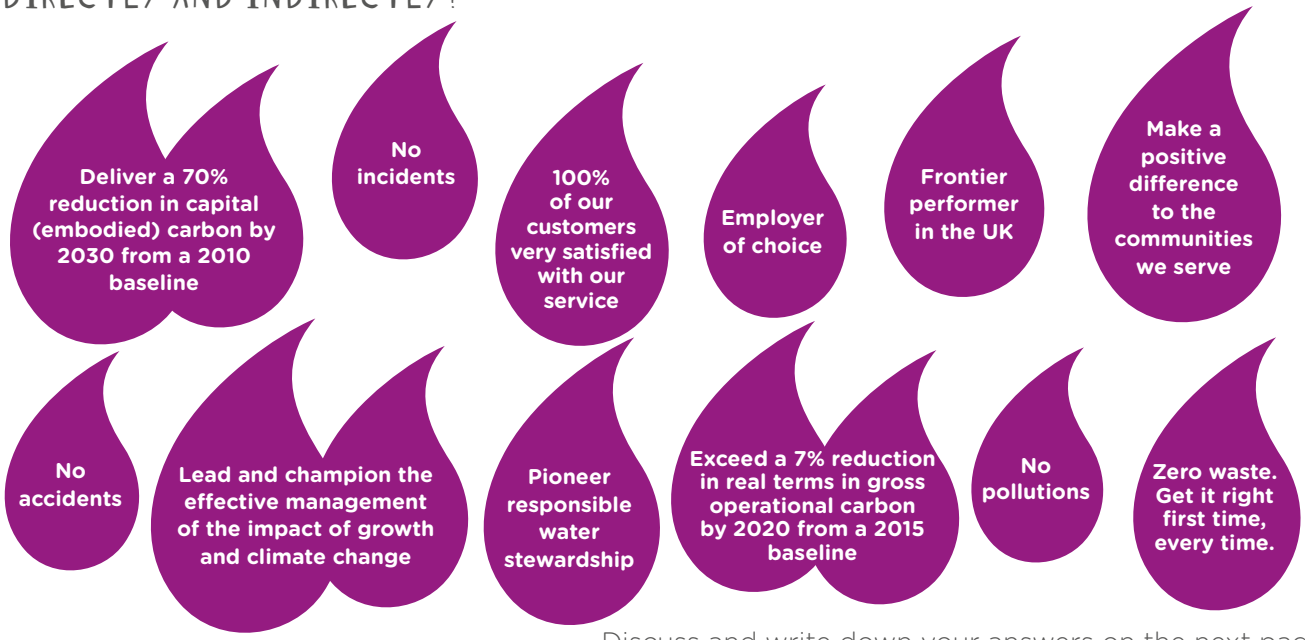
ANGLIAN WATER HAS DEVELOPED A NEW WAY OF WORKING CALLED LOVE EVERY DROP. TWELVE AMBITIOUS GOALS HAVE BEEN SET TO PUT SUSTAINABILITY AT THE CENTRE OF EVERYTHING WE DO. SEVERAL OF THESE GOALS RELATE TO CLIMATE CHANGE AND ARE AIMED AT EITHER REDUCING OUR CONTRIBUTION TO CLIMATE CHANGE (OUR CARBON FOOTPRINT) OR BY ADAPTING TO THE CHANGES THAT IT WILL DRIVE.

By the end of 2020, over £5 billion will have been invested to maintain and improve essential services, securing long-term water supplies in our fast-growing region that remains very vulnerable to climate change.

For example, ensuring water supplies for the future in areas of demand has already led to huge investment. A new water treatment works has been built at Newton on Trent at the cost of £80 million. The work was completed in 2014 and has secured water for Lincoln and surrounding towns for many years to come.

## QUESTION

WHICH OF ANGLIAN WATER'S GOALS RELATE TO CARBON AND CLIMATE CHANGE, DIRECTLY AND INDIRECTLY?




Discuss and write down your answers on the next page.

## CLIMATE CHANGE CHAMPIONS AND LEADERS

Anglian Water's current emissions are 442,470 tonnes of carbon a year, meaning we are the biggest emitter of carbon in the East of England.

*(Figure from 2014 Annual Report)*

Reducing the energy and carbon footprints of the company's operations are key business objectives for mitigating the effects of climate change. Through the application of appropriate technology and innovation, further reductions in energy use and our carbon footprint can be achieved.

# DISCUSS AND WRITE DOWN YOUR ANSWERS TO THE FOLLOWING QUESTION BELOW

WHICH OF ANGLIAN WATER'S GOALS RELATE TO CARBON AND CLIMATE CHANGE, DIRECTLY AND INDIRECTLY?

| CARBON AND CLIMATE CHANGE | DIRECTLY | INDIRECTLY |
| --- | --- | --- |

# TACKLING CLIMATE CHANGE

## ANGLIAN WATER IS A MEMBER OF THE ALDERSGATE GROUP, AND WORKS AT A NATIONAL AND INTERNATIONAL LEVEL TO SUPPORT EARLY ADOPTION OF MEASURES THAT WILL INCREASE THE RATE OF MITIGATION AND ADAPTATION TO THE EFFECTS OF CLIMATE CHANGE.

We are working with a wide range of stakeholders and interested parties, including government, regulators, Sustainability East (East of England Climate Change Adaptation Network), Water UK Climate Change Network, local authorities, suppliers and agriculture. Tackling the challenges of climate change isn't something that can be done in isolation.

### ADAPTATION AND MITIGATION

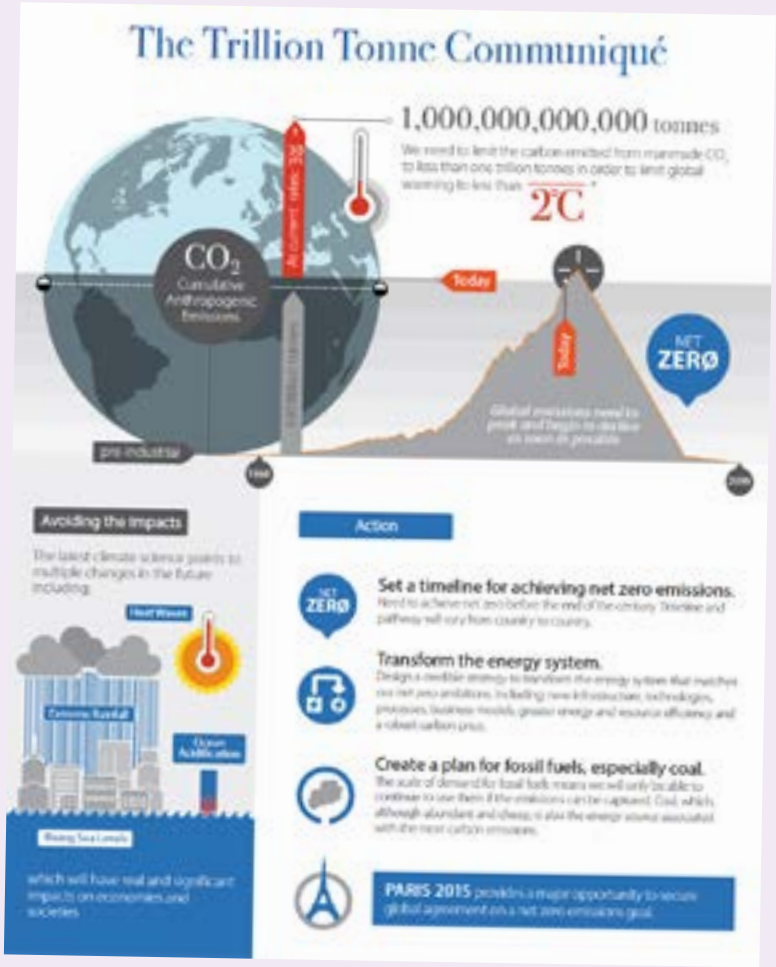
A combination of mitigation and adaptation actions is key to reducing and dealing with the impacts of climate change, both globally and locally.

The International Panel on Climate Change (IPCC) defines adaptation as adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderate harm or exploits beneficial opportunities.

To Anglian Water, this means reducing vulnerability to climate change and its impacts, such as severe weather, sea level rise and changes in seasons by assessing the risk and impacts, planning new assets and investment appropriately, protecting existing assets, securing water supplies, and making the biodiversity of their sites resilient to a changing climate. This requires significant amounts of planning and appropriate investment.

**Mitigation** tackles the causes of climate change, any action taken to permanently eliminate or reduce the long-term risk and hazards of climate change to human life and property.

Action to reduce our carbon footprint will substantially mitigate Anglian Water's contribution to climate change, for example using less fossil fuels, increasing energy efficiency, developing more renewable energy supplies and reducing embodied carbon in their new assets.



# WHAT ARE WE DOING TO REDUCE ENERGY CONSUMPTION?

DROP $CO_2$

ANGLIAN WATER'S MITIGATION AND ADAPTATION STRATEGY IS CALLED DROP $CO_2$. THE DROP $CO_2$ INITIATIVE AIMS TO REDUCE ENERGY COSTS, AS WELL AS REDUCING THE IMPACT ON THE ENVIRONMENT BY REDUCING CARBON EMISSIONS.

Environmental impacts are not the only consideration. The Anglian Water region is the largest and flattest in the country, so treating and pumping water and sewage to and from around 6.2 million customers uses considerable amounts of energy and makes the company one of the largest users of energy in the region.

## DROP $CO_2$ IS BROKEN DOWN INTO THESE SEVEN STRANDS

DROP $CO_2$ DROP COST

1 **Energy initiative**

Primary focus is the delivery of energy efficiency projects.

2 **Sustainability in design**

Reducing the carbon in our capital investment programme.

3 **Renewables**

Development of our own renewable power.

4 **Supplier engagement**

Reducing carbon in the supply chain.

5 **Transport initiative**

Reducing transport emissions.

6 **Process emissions**

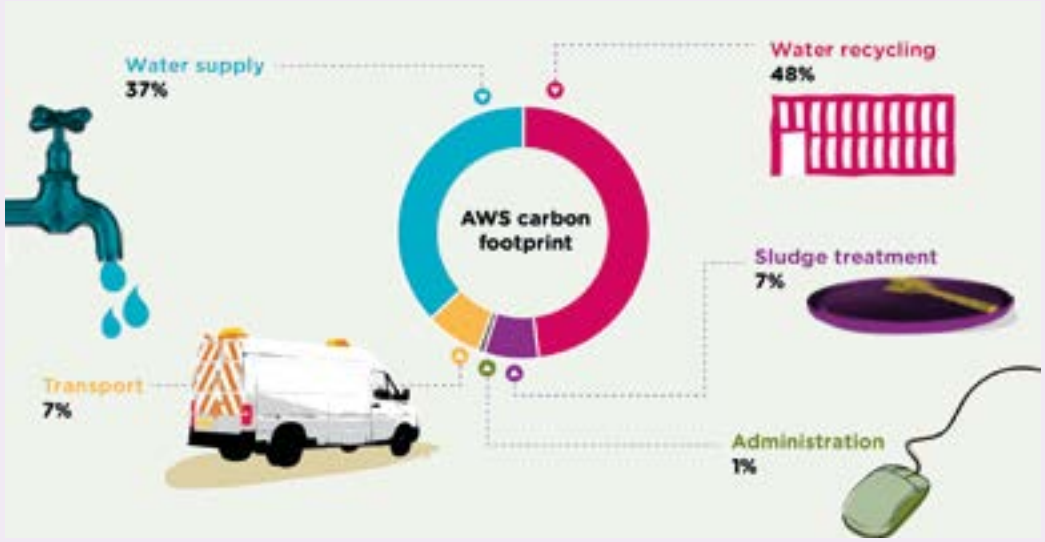
Measuring, managing and reducing process emissions.

7 **Water efficiency**

Helping our customers to deliver water and carbon efficiencies.

# 1. ENERGY INITIATIVE

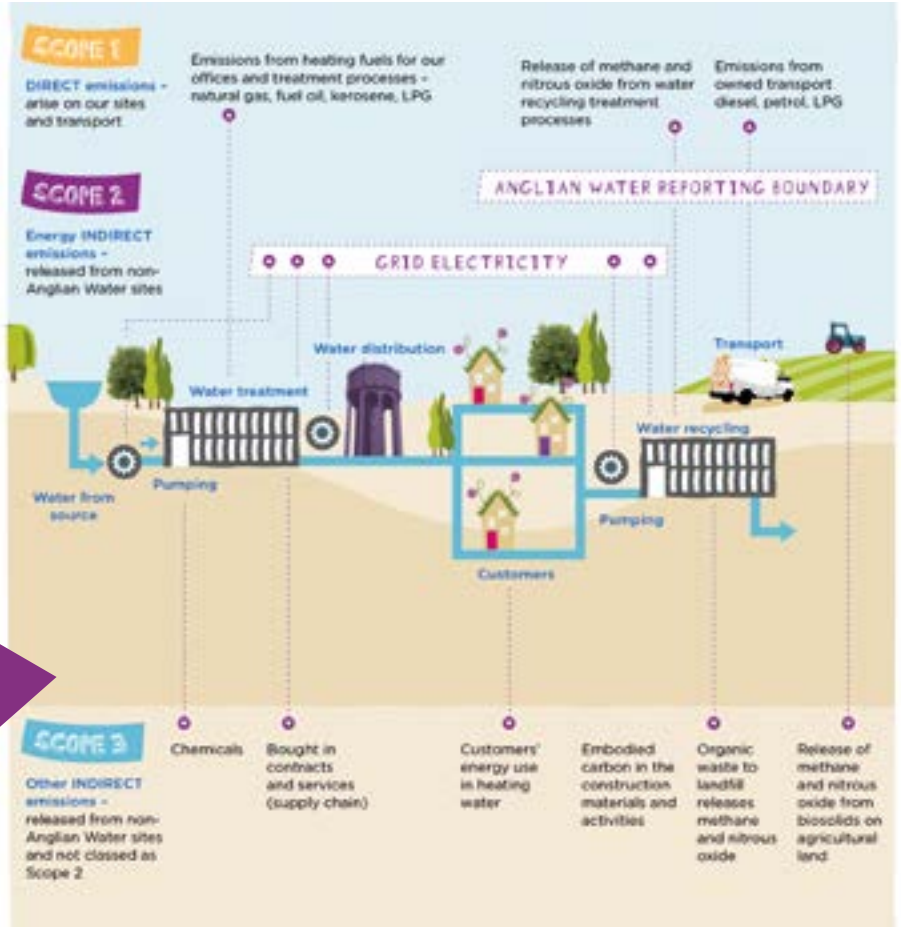
Rising energy prices and climate change has made it essential to reduce energy usage. Anglian Water's energy consumption is the company's second highest running cost. Consideration must also be given to the adverse effect on the environment through the resulting indirect carbon emissions.




CARBON EMISSIONS REDUCTION VIA:
- Embodied carbon
- Operational carbon

Of our carbon emissions, 99% come directly from treating, pumping and recycling water. This means these are where carbon saving can be focused.

As the diagram below shows, the carbon in this part of the business is divided into direct emissions, energy and indirect emissions.



# 2. SUSTAINABILITY IN DESIGN AND 4. SUPPLIER ENGAGEMENT

ANGLIAN WATER IS CONSTANTLY REQUIRED TO REPLACE AGEING MACHINERY, IMPROVE OR EVEN BUILD WHOLE NEW TREATMENT WORKS TO DEAL WITH POPULATION GROWTH AND EACH OF THESE PROJECTS IS AN OPPORTUNITY TO REDUCE CARBON AND ENERGY.

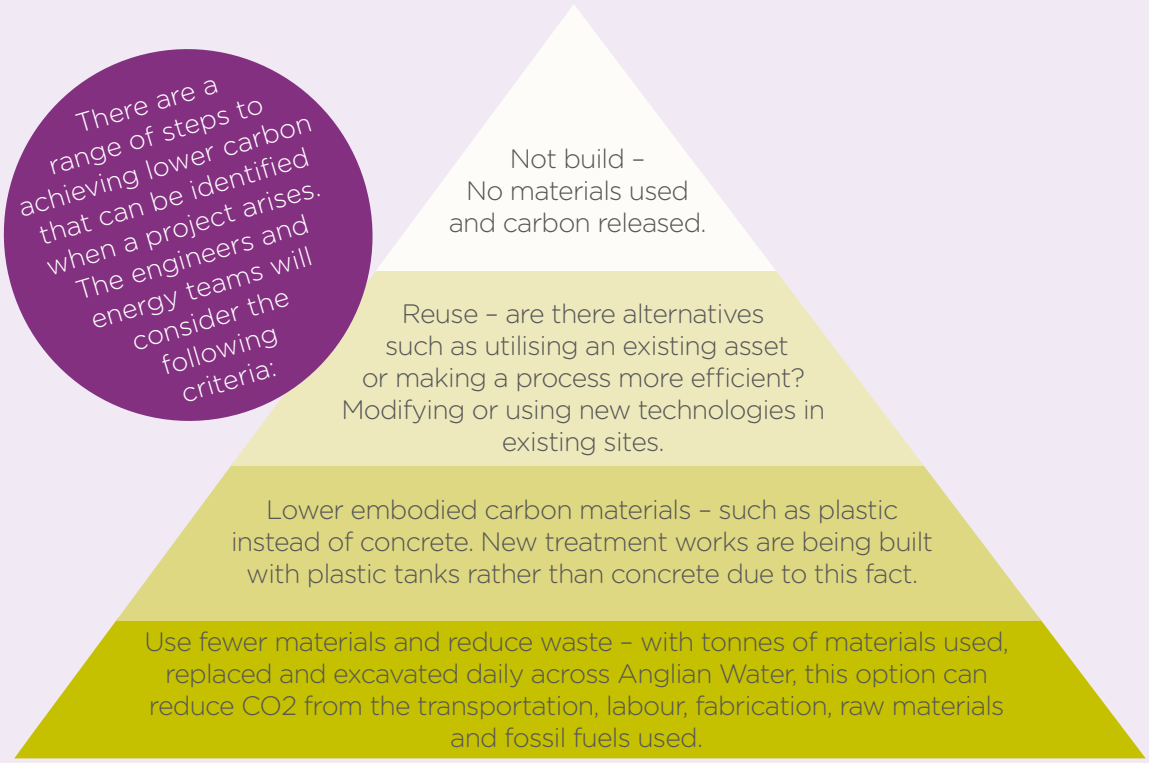
## REDUCTION

Challenging ourselves, our contractors and suppliers resulted in 2013/14 in a **reduction in carbon emissions of 41%** in our new assets.

## EMBODIED CARBON

THIS IS THE CARBON AND ENERGY USED WHEN BUILDING NEW ASSETS FROM WHOLE TREATMENT WORKS TO FIXING BURST PIPES. THAT IS PROCESSING, TRANSPORTING AND ASSEMBLING THE MATERIALS USED FROM PLASTIC PIPES TO THE STEEL USED IN PUMPS.

There are a range of steps to achieving lower carbon that can be identified when a project arises. The engineers and energy teams will consider the following criteria:



## Dobbs Lane Pumping Station – operational carbon reduction: Case Study

The Energy Optimisation Team called in Panks Pumps, who quickly established that there were more efficient pumps available and by replacing the existing pumps with the same motor size the hours run could be reduced from 8,760 per annum to 2,170, simply by increasing the flow. The knock-on effect is a massive reduction in energy cost and a 33% reduction in chemical costs.



**The stats:**

| | |
|---|---|
| **Time to deliver** | **12 weeks** |
| **Cost to deliver** | **£66k** |
| **Energy savings per annum** | **£14.5k** |
| | **144,886kWh** |
| | **78.23 tonnes CO2** |
| **Operational savings** | **£53k/year in chemicals** |
| **Energy payback period** | **3.29 years** |

**Other benefits**

- Improved asset reliability
- Reduced site call-outs and maintenance visits
- Old pumps reused at Ipswich Toller Road
- Safe work environment due to less toxic hydrogen sulphide build-up.

*"Dobbs Lane started causing operational problems in August 2009, and we were receiving significant odour complaints from residents. Panks Pumps identified that the rising main wasn't self-cleaning and the retention time was calculated at 16 hours. The scheme was fast tracked, the pumps were replaced as part of an energy scheme and Operational Capital replaced five air valves along the rising main. Work started in October 2009 and was complete by the end of December."*

*Hugh Crerand, Collection Manager.*

## Concrete v. plastic – capital carbon reduction: Case Study

When the business needed to build a new Water Recycling Centre due to population growth, the challenge was to make it with the lowest carbon emissions possible. This meant challenging our contractors, ourselves, the traditional building techniques, materials and even developing new processes and skills in the workforce.

**Advantage of using plastic over concrete:**

**Lighter** reduced transport costs.

**Volume** is less than concrete, easier to transport and safer for workforce.

**Greater lifespan**.

**More versatile uses** – tanks are made from inverted pipes.

## Supply Chain Competition – the benefit...

**Conventional in-situ reinforced concrete**
conventional techniques are labour and material intensive.

**Structured plastic with conventional bedding**
Lower cost solution with lower embodied carbon but still requires bedding and surround to be craned into position.
**34% cost saving – 39% reduction in embodied carbon.**

**Precast Concrete**
Precast concrete units provide a more cost-effective solution than plastic for certain ground conditions.
**28% cost saving**
**19% reduction in embodied carbon**
**(50% reduction with cement replacement)**

**Structured plastic in curved trench**
A specially fabricated bucket enables a curved-bottom trench to be dug, making significant savings on imported bedding and surround materials.
**38%cost saving**
**50% reduction in embodied carbon**
**(55% reduction with SMR)**

# 3. RENEWABLES

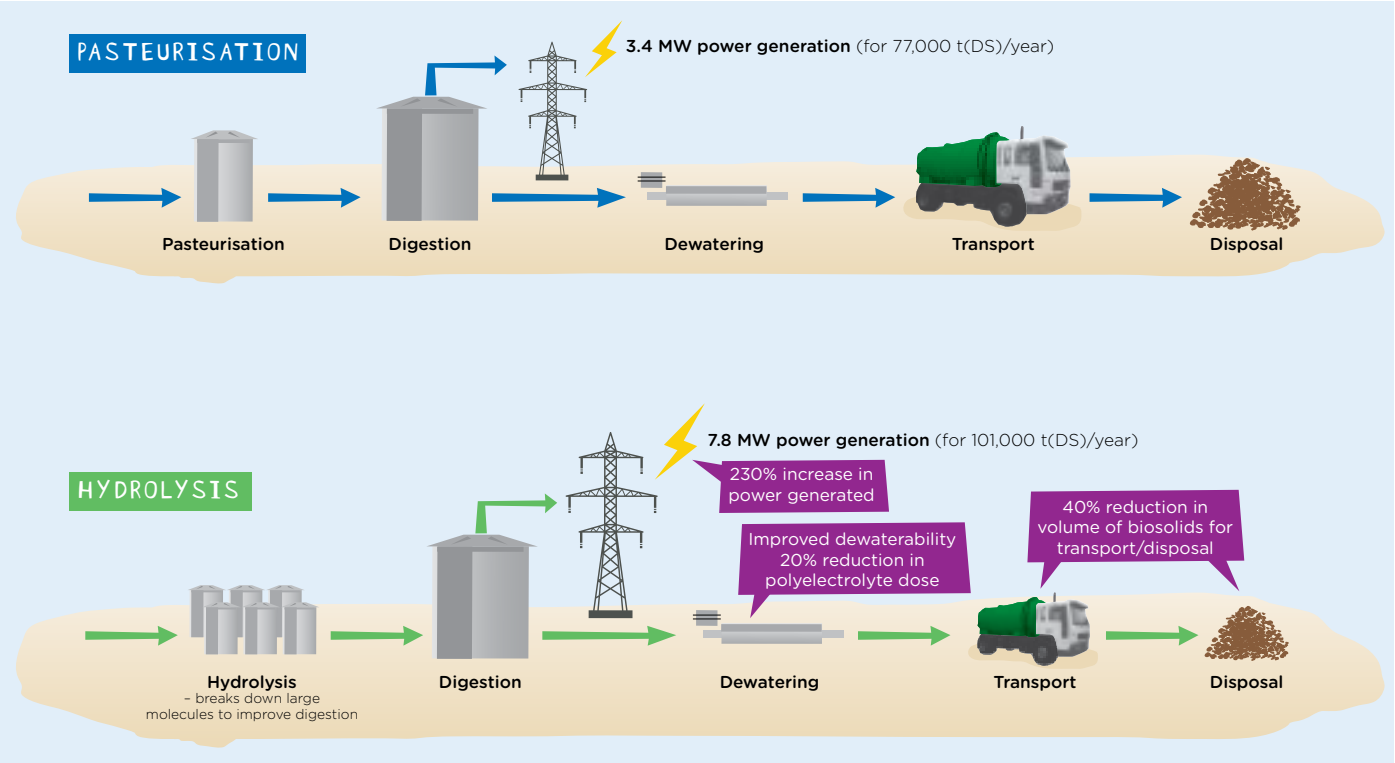
AS ONE OF THE BIGGEST ENERGY USERS IN THE EAST OF ENGLAND, DEVELOPING OUR OWN RENEWABLE SOURCES IS A MAJOR COMMITMENT. OUR PRIMARY SOURCE IS THE BIOGAS RELEASED DURING THE WATER RECYCLING PROCESSES.

The processes of recycling human waste into fertiliser either by pasteurisation or hydrolysis creates a valuable biogas which is converted into energy. The hydrolysis process is more efficient and the biogas created is used to power high-efficiency CHP engines, providing heat to power the hydrolysis processes and electricity to run the water recycling works. This sustainable, non-fossil energy source is being used to produce green energy, making some of the treatment plants entirely energy self-sufficient.

This process also reduces the carbon footprint by reducing the need for energy produced from burning fossil fuels. Anglian Water is able to produce enough 'Poo Power' to export some electricity to the national grid.

The vast majority of the energy we buy comes from a renewable source and what we generate ourselves continues to grow. In 2013/14 we produced 58,8GWh from our combined heat and power engines, which are powered by biogas from our water recycling process. The wind turbine at our March Water Recycling Centre contributed an additional 5.3GWh. The success of the wind turbine at March has led to two more turbines being commissioned at Newton-Marsh WRC.

## CPH (COMBINED HEAT AND POWER):



# 5. TRANSPORT INITIATIVE

ANGLIAN WATER TRANSPORT AND MOBILE PLANT FLEET, CONSISTS OF AROUND 2,000 COMMERCIAL VEHICLES, 500 COMPANY CARS AND 1,400 ITEMS OF MOBILE PLANT.

**People are constantly moving acoss the region.**

- Works technicians driving to jobs, cleaning blockages and sewers.
- Transporting recycled organic matter.
- Waste from construction sites such as materials removed when laying new pipes.
- All drivers who drive on company business are surveyed on their driving style.
- Training given on how to reduce fuel consumption by modifying their driving style.

# 6. PROCESS EMISSIONS INITIATIVE

DURING THE SEWAGE TREATMENT PROCESS THERE IS A RELEASE OF NITROUS OXIDE ($N_2O$).

$N_2O$ is a gas with very high greenhouse gas properties; its Global Warming Potential (GWP) is 298 times higher than that of carbon dioxide.

Nitrates can be removed by the biological process used to clean sewage. Designing works to enhance this process to remove increased nitrate levels can happen, but may involve investment of new treatment processes or enhancement at works.

# 7. WATER EFFICIENCY

WATER EFFICIENCY BY OUR CUSTOMERS IS VERY IMPORTANT AND WILL BE DEVELOPED IN UNIT 3.

Simply by using less water Anglian Water is going to be using less energy and carbon. Reducing the amount of water abstracted, cleaned and used in homes and business, reduces energy used in the processes and embodied carbon requirements to repair and build new treatment works.

# ACTIVITY 1: IMPACTS OF CLIMATE CHANGE

## Identify these actions as mitigation of, or adaptation to climate change:

| | Mitigation | Adaptation |
|---|---|---|
| • Building flood defences. | | |
| • Dredging river channels for silt build-up. | | |
| • Collecting methane from sludge treatment to generate electricity. | | |
| • Building water recycling centre tanks and machinery off site. | | |

• Can you identify any other examples of mitigation or adaptation Anglian Water have put in place?

# ACTIVITY 2: ADAPTATION

**You have two scenarios which are possible impacts of climate change and require adaptation. You need to choose the best option and explain your argument. Consider the possible implications to all interested parties.**

## SCENARIO 1

Anglian Water has been working with a local council to develop a flood plan. In the last five years the area has seen a decrease of average annual rainfall by 5% but an increase in flash flooding. These floods have seen up to a month's worth of rain fall in just 24 hours. This has caused millions of pounds of damage to homes and businesses.

At the moment there are three possible strategies which have been selected to move forward. However, there is only enough funding to develop one in the next five years. Which would you choose and why?

1. Map high-risk zones for flooding. All homes and businesses in these areas have flood gates installed in doorways to reduce the chance of flood water entering properties. This also applies to Anglian Water's pumping stations and treatment works.

2. Build larger storm drains and replace the high street paving with a permeable material to allow greater run-off into these drains. These drains will be piped to existing water courses, away from main areas of habitation and will be able to cope with 90% of all the storm water that has affected the town in the last five years.

3. Build Sustainable Urban Drainage Systems in the town (find out more about these in unit 4). This means there will be natural drainage ditches built alongside roads and channels to return the rainwater to the environment naturally.

In groups or as a class, debate the options. Vote for your choice.

### WHAT IS YOUR SOLUTION?

Turn over the page for scenario 2

# ACTIVITY 2: ADAPTATION

## SCENARIO 2

A coastal town is predicted to be an area affected by sea level rise. To protect the town, it comes down to three options – which would you select?

There are lots of pros and cons for each solution. Have a look at the table which breaks down some of them. Which would you pick? Justify your choice.

Take a vote in your class to see which you agree on.

| | Short term solution | Long term solution | Cost | Sustainability | Disruption | Community perception | Your choice |
|---|---|---|---|---|---|---|---|
| Flood farmland near the town to protect the town | √√ | √√ | √√ | √ | √ | √ | |
| Build sea walls | √ | | √√√ | | √√ | √ | |
| Managed retreat – don't build any defences | | √√√ | √√√ | √√√ | √√√ | √√ | |

√ low, √√√ high

Many of the decisions about how to tackle climate change involve many different groups and interested parties and require planning for the unexpected. Many of the solutions are not simple and require a mixture of options to be used. Balancing short, medium and long term benefits with the uncertainties of climate change impacts means that decisions can sometimes take months and years to be put into practice.

## WHAT IS YOUR CHOICE AND WHY?

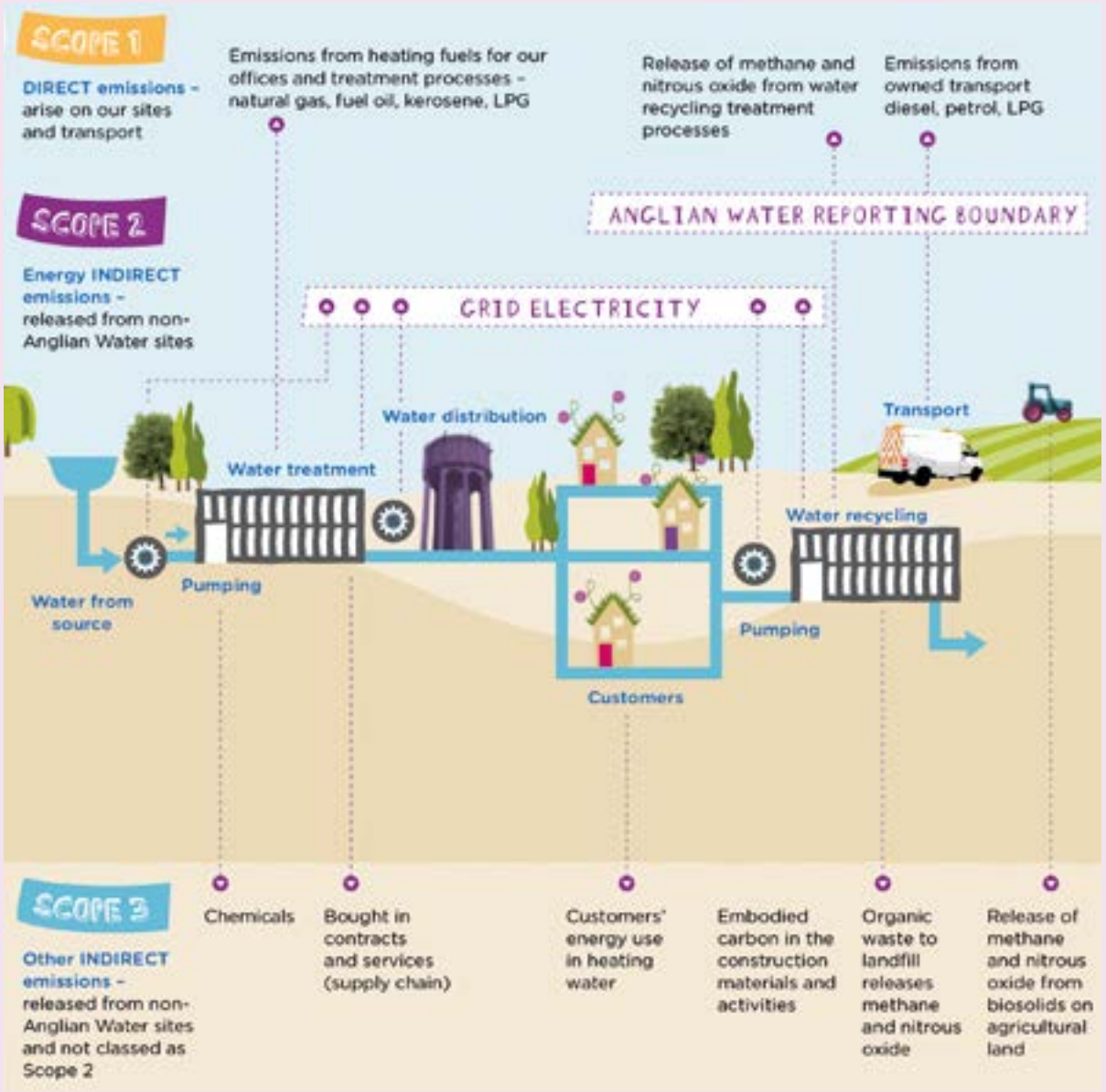
# ACTIVITY 3: MITIGATION

**Prioritise these emissions, which ones do you think should be the most important three to tackle and why?**

1.

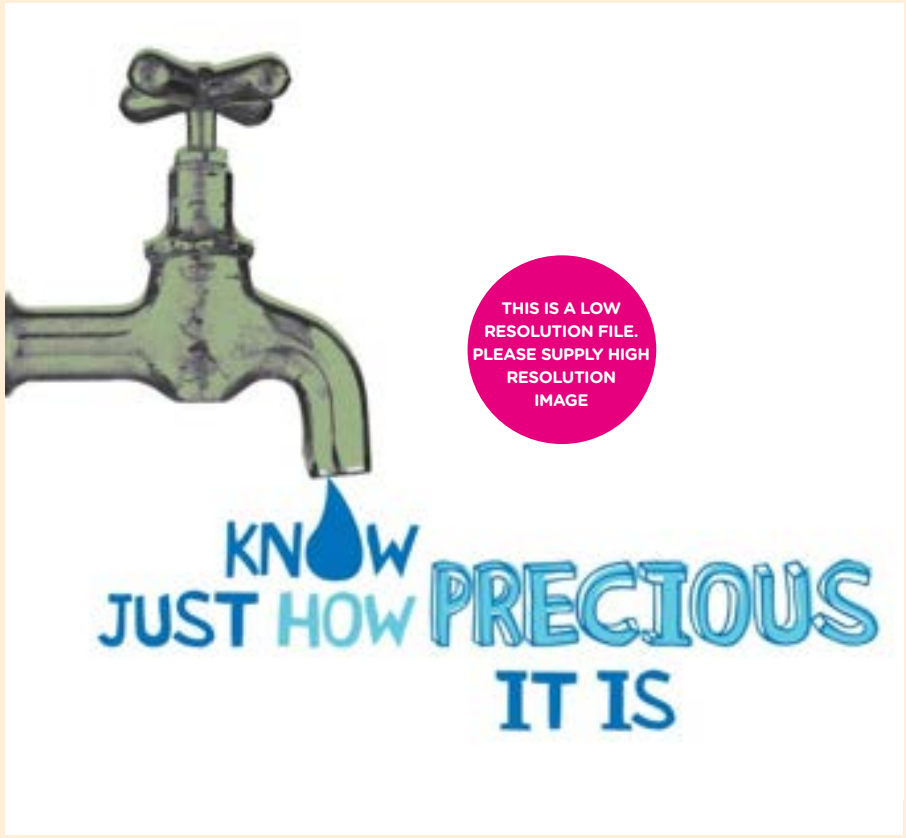
2.

3.



# WHAT PART DO YOU PLAY?

ANGLIAN WATER BELIEVES THAT EVERYONE CAN PLAY A PART IN OUR WATER'S FUTURE. WE ASK YOU TO LOVE EVERY DROP BY PUTTING WATER AT THE HEART OF A WHOLE NEW WAY OF LIVING. IN THIS UNIT WE LOOK AT THE KEY WAYS EVERYONE CAN HELP MAKE A DIFFERENCE.




## SAVE WATER, SAVE ENERGY

Water efficiency is vital to reducing carbon and energy use at Anglian Water. The processes we use to supply drinking water and in the collection and treatment of sewage have a direct impact on carbon emissions. Imagine if you, your school community and your local community all reduce the amount of water you used by a couple of litres a day. Think of the difference that this could make. Or you can do the maths... in the activity.

**FACT**

25%

**of your energy bill at home relates to heating water, so reducing water use can save money on other bills too.**

There are many simple ways we can help preserve water. It's estimated that everyone in the UK uses an average of 133 litres a day.

DROP 20

## YOUR CHALLENGE

**Challenge yourself, your family and friends to reduce the amount of water they use every day by 20 litres. That's equivalent to about two buckets full.**

You can find out more about water efficiency – go to: DROP 20 education materials on the Anglian Water website or check out our Facebook page.

http://www.anglianwater.co.uk/environment/how-you-can-help/why-drop-20.aspx

https://www.facebook.com/AnglianWater/

# WATER EFFICIENCY: INSIDE AND OUT

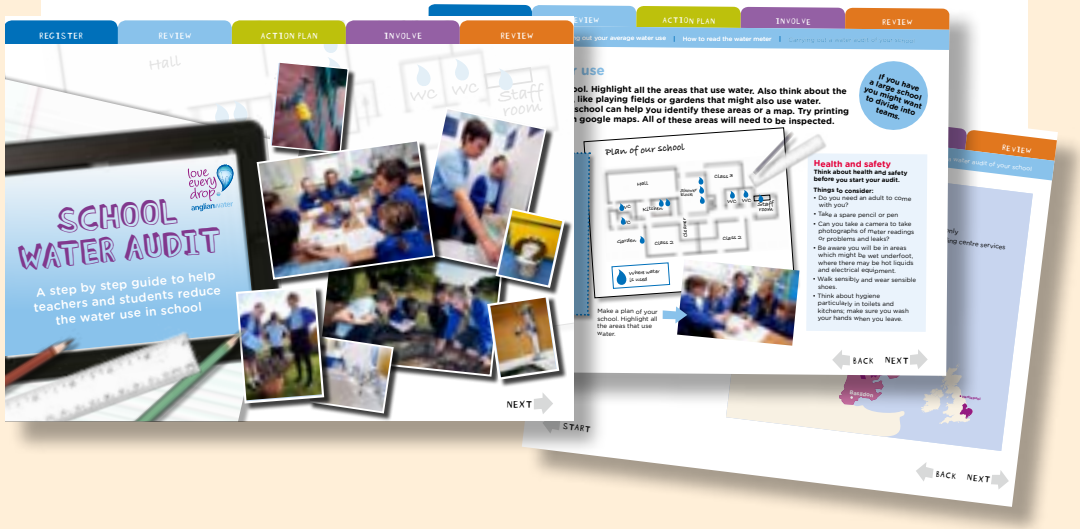
## SCHOOL WATER AUDIT

Become a Waterwise school, and help to protect and sustain the planet with Anglian Water. Project contents include instructions, guidance and tips on completing a water audit in schools and developing water efficiency messages in your school and community (can be used in the home too).

- Download the Schools water audit pack from Anglian Water

http://www.anglianwater.co.uk/community/education/resources/water-audit/

- Register your school and your meter readings to get special rewards from us.




## GREAT GARDENS

Take a look at our garden pack. Pupils can

- Discover how to create their own sustainable water gardens to grow fruit and vegetables.

- Get advice on the type of planting and how to create a sustainable garden that needs little water.

http://www.anglianwater.co.uk/environment/how-you-can-help/using-water-wisely/great-gardens.aspx

# KEEP IT CLEAR

APPROXIMATELY 75,000KM OF SEWER PIPES RUN ACROSS THE FLAT, LOW-LYING REGION, TRANSPORTING SEWAGE TO ONE OF ANGLIAN WATER'S WATER RECYCLING CENTRES. DISCARDED ITEMS LIKE WIPES, NAPPIES, SANITARY PRODUCTS FLUSHED INTO THE SYSTEM CAN HAVE A NUMBER OF IMPACTS.

## NOT DOWN THE KITCHEN SINK

Think about what you do after dinner – where do you rinse the food scraps, oil and grease from your plate? Where does the fat from the frying pan go? Down the sink or in the bin?

The problem is that some people put it all of this down the sink. But the fat, oil and grease doesn't just disappear. **It cools and sets hard in the sewers, sticking to the walls and blocking up the pipes.** This results in sewers flooding, blockages and nasty smells and a repair bill that cost millions of pounds. This money comes from your water bills.
It could be spent elsewhere, fixing leaks, reducing our carbon footprint to provide a more sustainable water supply.

**Following these simple tips will result in fewer blockages and fewer pump failures, and will help protect our wildlife and the environment.**

## RECYCLING COOKING OIL

All food premises, large or small, have a legal responsibility under the Environmental Protection Act 1990 to safely manage, store and legally dispose of any waste they produce. This includes used fats, oils and grease which must be collected by a registered waste carrier. These waste carriers collect used oil free of charge from food premises, or pay a small price for each full sealed barrel.

In the current economic climate, with fluctuating oil prices, used cooking oil and fat is an important commodity, which waste carriers take away and turn into useful materials, such as biofuel.

# KEEP IT CLEAR

## NOT DOWN THE KITCHEN SINK

Wherever you live, used fat, oil and food scraps should never be put down the sink or loo.

- Across our region, local authorities provide door-to-door domestic waste collection services. Each council has a different policy and assorted coloured waste bins. Check to see if there is a local doorstep food waste collection service – and how the council advises you to dispose of waste cooking oil and solid fat in your area. Small amounts can be recycled at home through your council's doorstep food waste collection service or in your own composting.
- Cooled oil or grease may be poured or scraped into a sealable container and put in the bin.
- The preferred option is to save up larger amounts of used cooking oil and fat and take it to your nearest household waste recycling centre.

**Check out Anglian Water's YouTube channel for 'Keep It Clear' videos made by a student in Kibworth High School. https://www.youtube.com/watch?v=5vNLKrAvUNg**

## Case Study: Living Fuels

**Living Fuels is a Norfolk-based company with a network of collection points for domestic waste cooking oil and fat at many household waste recycling centres across the region.**

They produce a patented biofuel called LF100 – a naturally refined waste cooking oil without any mineral or chemical supplements, which is added to biodiesel to make it burn better. They use the oil to generate renewable electricity and heat for customers throughout the UK.

One litre of used cooking oil can generate enough electricity to make 240 cups of tea (i.e. 4.5kWh).

**4.5kWh is equivalent to:**

- Using a toaster for three hours, which is the same as using a toaster 60 times at three minutes (for a toaster that uses 1.5kW, and takes three minutes to toast)
- Running a dishwasher for three hours (for an A-rated dishwasher that uses 1kW)
- Running a washing machine at 40C for eight cycles (for a very efficient A-rated machine which needs 0.56kWh per cycle at 40C)
- Switching on an old-fashioned 100W light bulb for 45 hours – or a new energy saving light bulb which gives you the same amount of light (using only 20 watts) for 225 hours!
- Having just one 30-minute shower with a 9kW electric shower

# ACTIVITY 1:

## CHOOSE A CARBON FOOTPRINT CALCULATOR

- Calculate your carbon footprint, using an on-line calculator.
- There are many to choose from – which is the easiest to use?
- Which presents the information in the most understandable way and makes the results easiest to use?

www.footprint.wwf.org.uk/

www3.epa.gov/climatechange/kids/calc/

www.parkcitygreen.org/Calculators.aspx

# ACTIVITY 2:

## CALCULATE YOUR CARBON FOOTPRINT

- Calculate the carbon emitted from your water use. On average you will use about 133 litres a day. For each litre of water 0.3g of carbon are emitted.
- How much carbon is that in a day?

**133L x 0.3g =**

- How much in a week?

**133L x 7 x 0.3g =**

- How much in a year?

If you include all the people who live with you, how much is that? Make a pledge to reduce your carbon footprint.

# ACTIVITY 3:

## PRIORITISE THE IMPACT

- Rate these impacts in the order of importance. (Cut out the cards on the right)
- Why have you ordered them in this way? Discuss.
- Do you think Anglian Water would place them in a different order to you or a customer – if so ask why?
- Explain and justify any changes you have made?

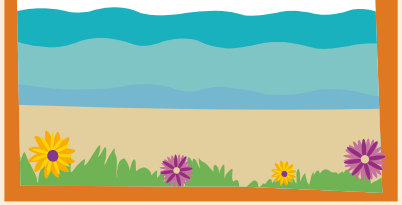
ENVIRONMENTAL IMPACT OF RUBBISH REMOVED FROM SEWERS BEING SENT TO LANDFILL.

SEWER FLOODING IN CUSTOMERS' HOUSES AND BUSINESSES.

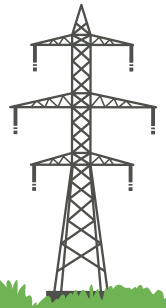
STAFF FOR REMOVING BLOCKAGES.

POLLUTION IN RIVERS. RAW SEWAGE CAN KILL PLANTS AND ANIMALS IN RIVERS AND SURROUNDING HABITATS.

DEGRADED BEACH QUALITY COULD MEAN FAILING TO ACHIEVE BLUE FLAG STATUS.



ENERGY INCREASE REQUIRED TO PUMP SEWAGE AND ALL THE BLOCKED ITEMS.



BLOCKAGES CAUSE BAD ODORS AND FOOD STUFFS ATTRACT RATS.

IMPACT OF WATER QUALITY FOR THE HYDROLOGICAL CYCLE, AFFECTING RIVERS AND POTENTIAL DRINKING WATER SOURCES.

COST OF CLEANING SEWERS AFFECTING CUSTOMERS' BILLS.

PUMPING STATIONS USED TO MOVE THE SEWAGE TO THE WATER RECYCLING CENTERS BLOCKING UP AND FAILING.

PUMPING STATION MAINTENANCE TO REMOVE UNFLUSHABLES.

FINE FROM THE ENVIRONMENT AGENCY.

# ACTIVITY 4: GUILT FREE?

Did you know not all storm drains feed into your local sewers and water recycling centre – some will be going into rivers and the sea. Think about all the litter you might see on the roads that could be washing into a river the next time it rains – things like cans, sweet wrappers, oil from cars and broken glass.

**Can you arrange for a litter pick at your school or in your local area?**

Have a look at the RiverCare website to see if there are any groups working in your area.

**IMPORTANT**

**It is important that you consider health and safety plus hygiene when carrying out any litter picks.**


river care

Find out more about River Care here:
http://www.anglianwater.co.uk/environment/our-commitment/our-projects/rivercare.aspx

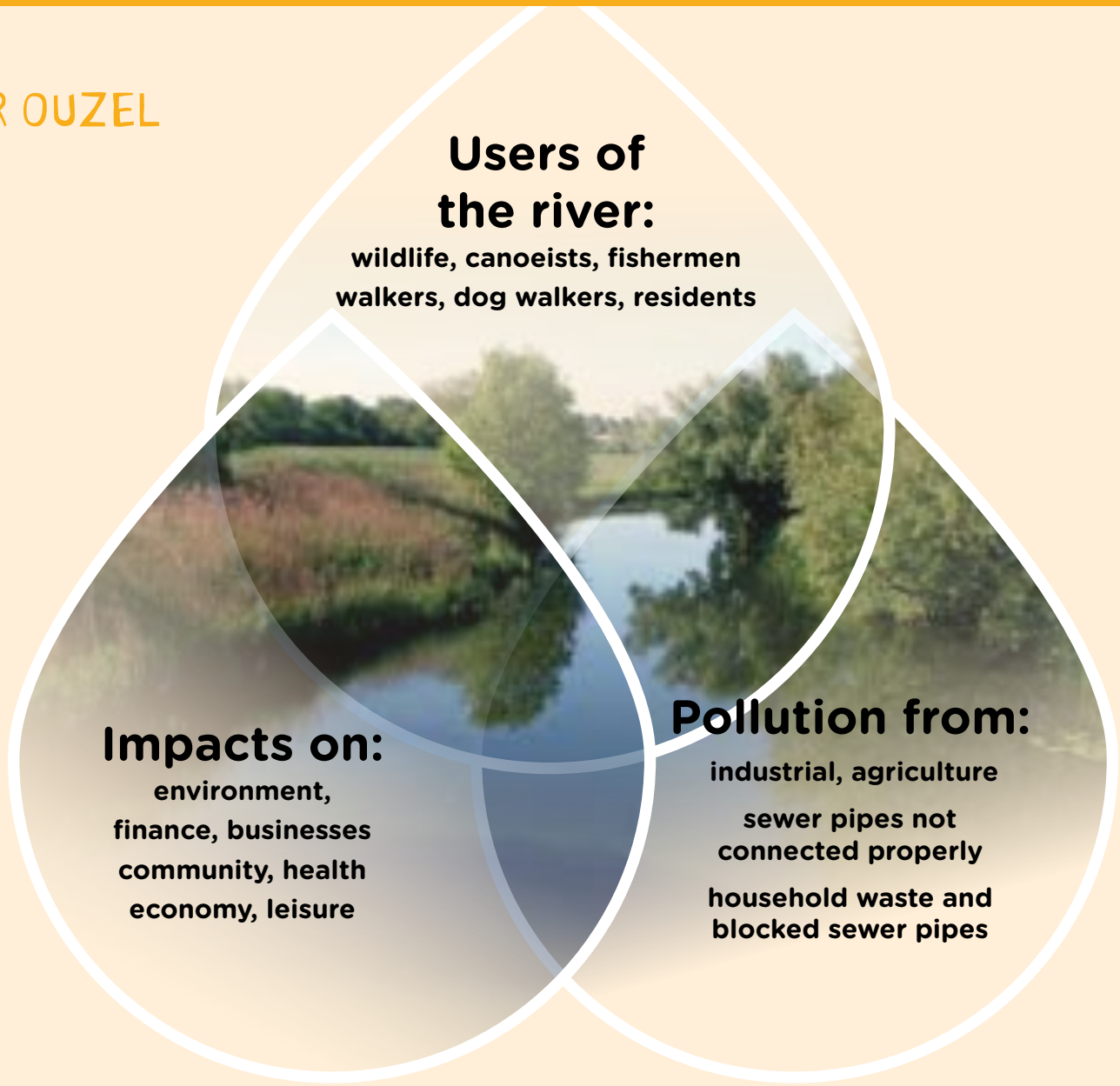
# ACTIVITY 5: SAVE THE RIVER OUZEL

Blockages in sewers could also lead to litter and sewage in a water course.

Put yourself in the position of an Environmental Conservation Group on the River Ouzel.

**How would you communicate the impacts of sewer pollution and advocate responsible sewer use?**

Don't forget who your audience would be.




Check out Anglian Water's YouTube channel for Keep It Clear videos made by students.

# PLANNING FOR A SUSTAINABLE FUTURE - INNOVATION

THE LIST OF THINGS WE MIGHT NEED TO CHANGE TO ADAPT TO CLIMATE CHANGE IS ENDLESS, FROM THE FOOD WE EAT TO THE CLOTHES WE WEAR, AND EVEN HOW AND WHERE WE LIVE. IT IS EASY TO FOCUS ON RENEWABLE ENERGY, BUT WE MUST BE THINKING ABOUT WATER TOO.

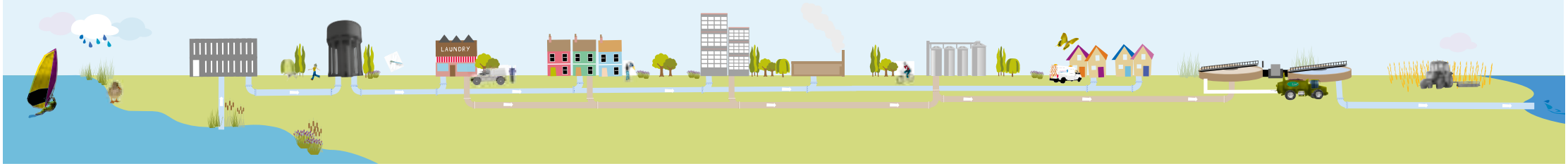
- How will we ensure flooding of people's homes and workplaces doesn't become all too familiar?
- How will we deal with future droughts?
- How to manage our water supply so agriculture, the environment, industry and households all have access to the water they need?
- Do we need to think about the crops we grow?
- How should we plan future housing developments?
- What will our homes look like?

There are lots of possible solutions to these questions, many yet to be discovered. This unit will explore some of the possible challenges and solutions.

## CHANGING HOW WE USE WATER AS RESOURCE

In the Anglian Water region, we have numerous pressures on our water resources. These come from a growing population, climate change, agriculture, tourism, industry and recreation. We need to find a co-ordinated response to manage all of these. The Water Framework Directive has set ambitious targets to find a more sustainable way to do just this.

**Catchment management** is the UK government's preferred approach to achieving a sustainable approach to water in the whole water cycle.



# WHAT IS CATCHMENT MANAGEMENT?

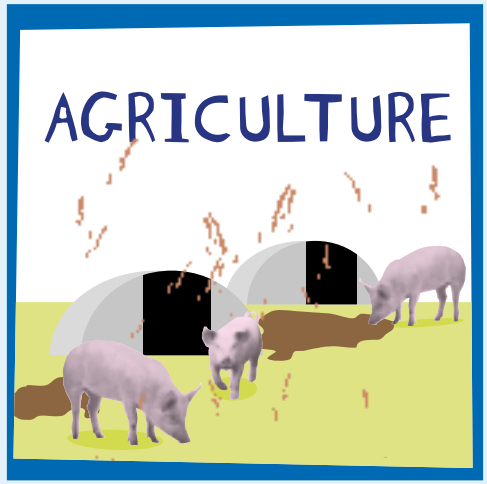
This is to make sure water quality is consistently good, wherever there is water in the environment. Key to this is preventing pollution from getting into water sources, improving overall quality in rivers, steams, etc., and, therefore, reducing the amount of treatment required at water treatment works. To achieve this we're working with farmers and businesses to look at how they use water and what might go back into watercourses from their use, such as chemicals.

**FACT**

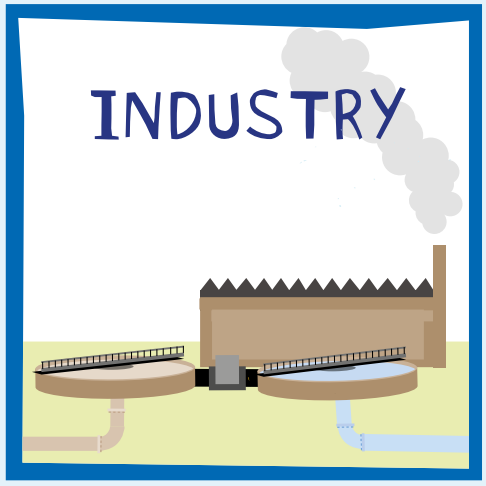
**As a water company, we also practice catchment management to ensure the amount of water we take out and what we return has a minimal impact on the environment.**

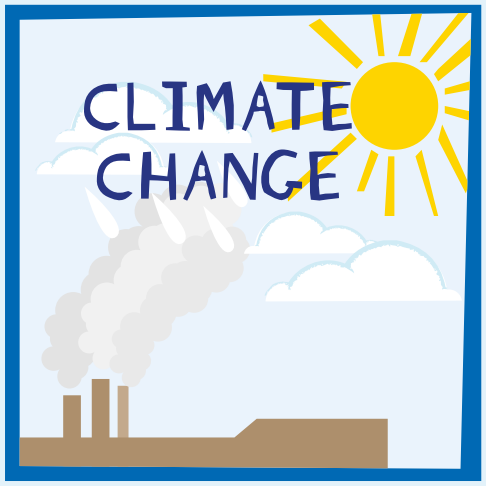
## OUR CHALLENGES

The UK enjoys drinking water that is among the best in the world. It is treated to extremely high standards and thoroughly tested. There are some challenges:







# AGRICULTURE

Our region produces more than two-thirds of England's sugar beet crop and one-third of all the potatoes. It is also a major producer of cereals, fruits, vegetables, eggs, pigs and poultry.

Over three quarters of the region's land area is used in agriculture. This brings massive benefits for the region, but also massive challenges for the region's environment and water quality. For example, the fertilisers, herbicides and pesticides can find their way into watercourses.

By working with farmers to promote best practice such as sustainable pesticide use, the prevention of soil erosion and managing the catchment in a more sustainable way, we can maintain a profitable agricultural industry and deliver environmental and legal requirements for water quality.

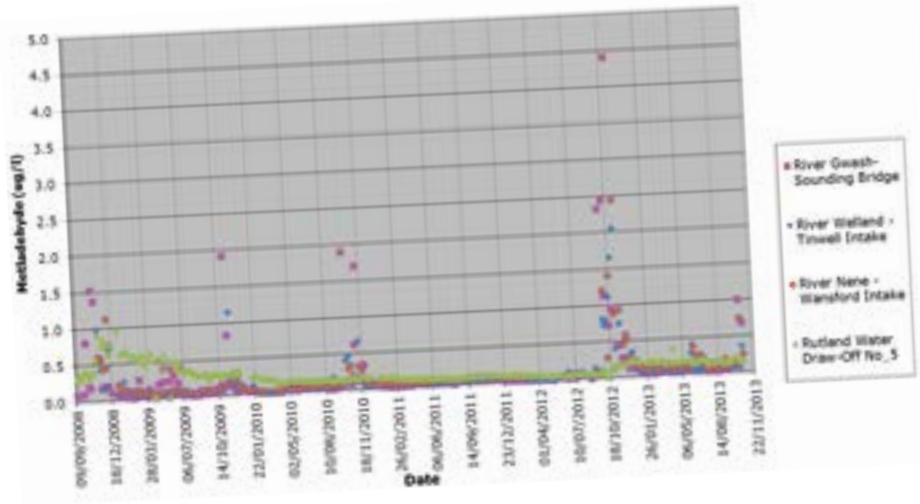
## Metaldehyde: Case Study

Metaldehyde is a chemical farmers use to kill slugs. This chemical gets into water, particularly during autumn, but cannot be removed by the traditional water treatment methods. The concentrations are nowhere near levels that might affect human health, but they can still exceed drinking water standards in the Drinking Water Directive.

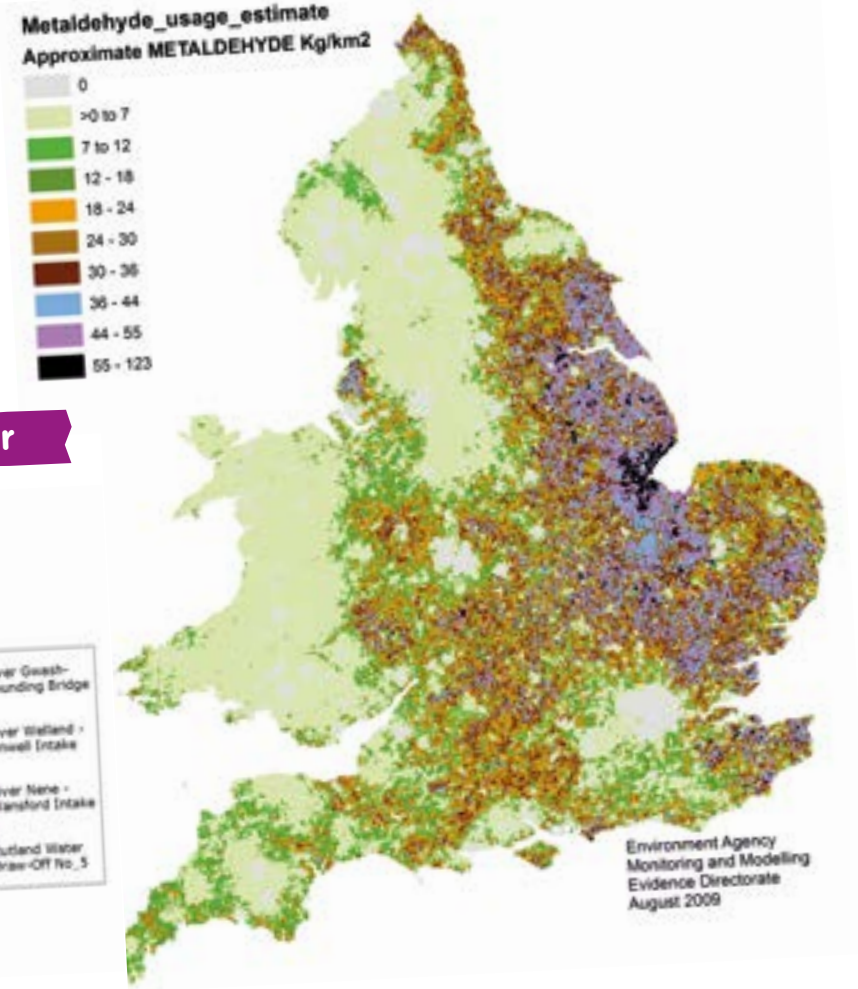
Water UK recommends the best way to stop this chemical getting into the water is not to use the pesticide as slug killer and find a sustainable pesticide that will not have a long term impact on the water.

During the summer of 2014, Anglian Water had to stop extracting water until the metaldehyde levels dropped. This is shown in the graph below.

### Rutland reservoir – metaldehyde in raw water




### Estimated use of metaldehyde in agriculture



## Nitrates and Phosphates: Case Study

Nitrates and phosphates are essential ingredients of fertilisers needed for growing crops; however, they leach through the soil into the ground water. These chemicals pollute the watercourse and cause eutrophication – 20% of water is treated to remove nitrates and 55% is treated to remove pesticides.

Phosphorus is one of the biggest issues to be addressed as it is found in household cleaning products and food stuffs, as well as being washed into water from land. It has been banned in laundry products but is still found in high quantities, which can do harm to the environment.

Famers have a large part to play in reducing phosphorus in watercourses. They can test their soil to ensure they use the right fertilizers and the right amounts, i.e. the one that provides the nutrients that are lacking, as well as finding sustainable pesticide solutions.

The other main strategy for reducing levels of chemical fertiliser in the environment is by investing in further processes at Water Recycling Centres. One hundred and seventeen of Anglian Water Recycling Centres have had phosphate removal treatments installed; this is a short term solution as it is more effective to prevent it getting into the watercourse in the first place.

YOU CAN MEASURE PHOSPHATES AND NITRATE LEVELS WITH KITS WIDELY AVAILABLE FOR FISH TANKS.

## COASTAL CATCHMENT MANAGEMENT

On the coastline we are committed to ensuring we meet European requirements for high quality clean beaches. We monitor water quality with a state-of-the-art system called BeachAware. This means we can inform people when there are issues.

**These issues can arise from:**

- When people don't connect sewer pipes to the network,
- Runoff from highways and farm land,
- Dog and wild animal fouling,
- Littering and fly-tipping,
- Storm run-off.

### FIND OUT

#### BLUE FLAG BEACH

**Which beaches meet Blue Flag status?**

**Where is your nearest Blue Flag beach?**

**How do beaches qualify for this status?**

# INDUSTRY

Different industries extract water from rivers and return it after being used. The returned water could have any number of substances in it from plastics and food waste to cyanide (used in printing). The Trade Effluent team at Anglian Water and the Environment Agency work with these businesses to ensure the water going back into the environment or to water recycling centres is not dangerous.

## FIND OUT

**Have a look at your local area map – what industries are there in your area?**

**Do you know what might be going back into the water?**

# SUSTAINABLE URBAN DRAINAGE (SUDS)

Catchment management oversees water from source to tap and its return to the water cycle. Sustainable Urban Drainage is a smaller scale method of returning water to the water cycle without treatment, focusing on housing developments.

**Riverside Court, Stamford**, **Lincolnshire,** has employed SUDS in this new residential scheme. Classed as a high-density development, it has 104 units (72 units per hectare). Water management is important as the housing development is located next to the River Welland and water runs off from higher in the catchment area, through the development.

## WHAT ARE SUDS?

**SUDS at Riverside Court**

SUDS are Sustainable Urban Drainage Systems. A sustainable urban drainage system aims to copy as closely as possible the natural drainage to reduce surface water run off. SUDS collect rainwater and manage its flow back into the natural watercourse without the need for it to enter the sewage network, so saving expensive pumping and lower carbon emissions.

Riverside Court uses several methods such as permeable parking surfaces, and planted rills (a narrow or shallow channel just below ground level).

Many built environments have impermeable surfaces, which means the rain cannot filter into the ground. In Riverside Court, impermeable surfaces in parking areas and access roads are designed to direct surface water to a collection courtyard canal and rill. This allows the runoff to be stored and cleaned before entering the river through a weir. Permeable pavements are also used to allow water to naturally filter through the ground.

Roof water is collected and then runs through silt traps that eventually flow into planted rills. The pavement feeds surface water to a courtyard canal and rill before flowing through three control points into a riverside canal, that reflects the three sub-catchments identified within the development. A slot weir to the River Welland controls the flow down a stepped rill to the water's edge. The planted landscape beds control the flow.

*The information and images on the Stamford project was provided by: Bob Bray, Robert Bray Associates, Fairfield.*

# BENEFITS OF SUDS

The primary benefits of SUDS are to control the flows, volumes and frequencies of runoff, preventing flooding to the watercourse, sewer system and urban environment. However, there are many additional benefits to the environment and community:

1. Permeable paving can perform well after heavy rain, reducing the amount of standing surface water.
2. SUDS can improve the quality of the water by controlling and treating pollution.
3. Permeable surfaces can deliver a source of clean water for amenity features such as canals, rills and other water features.
4. An urban design approach delivers high quality urban landscapes with visual and social benefits for the community.
5. Flexibility in design delivers exciting and easily maintained urban spaces.
6. Provides ecological diversity and biodiversity within new habitats.

# DISADVANTAGES / CHALLENGES

1. The design needs to consider the 'whole life' of the development and possible future impacts of climate change with possible increased or decreased rainfall.
2. Regular maintenance is planned and carried out: silt traps can require monthly checks.
3. Planting needs to be maintained and planned to ensure native and not invasive species are used.
4. Residents need to be educated to ensure that they understand how the system works and not to be alarmed by low levels of water during periods of low rainfall. The water will still be clean as long as planting is maintained.

## FIND OUT MORE

**To find out more, have a look at 'Towards Sustainable Water Stewardship, Sustainable drainage systems (SUDS) adoption manual' available at http://www.anglianwater.co.uk/developers/suds.aspx**

# FUTURE HOUSING

In the future every new housing development may have:

- Green roofs which reduce peak flow and the volume of water discharged from roofs and improves water quality.
- Rainwater harvesting, collecting and storing rainwater for reuse, for example, watering gardens, and in some cases substituting for mains water, used for flushing the toilet.
- Permeable pavements, concrete blocks or crushed stone – these materials allow water to infiltrate into subsoil or stored in reservoir with outlet.
- Swales and basins: grassy depressions which save construction and maintenance costs. Theses basins provide temporary storage in heavy or prolonged storms. This reduced the amount of flooding and allows for natural treatment (filtration).
- Infiltration trenches and filter drains are excavated trenches filled with stones and drained with perforated pipes. They allow collection and storage of the water during rainfall and treatment.
- Ponds and wetlands are a visual amenity – they encourage biodiversity and are flexibile in their water levels and storage capacity.

# ACTIVITY 1: SOURCE TO TAP AND BACK TO THE RIVER

## FIND OUT WHERE YOUR WATER COMES FROM

**Websites**

http://magic.defra.gov.uk

http://anglianwater.co.uk

a. Which company supplies your drinking water and your sewage service? These are not necessarily the same.

b. What type of raw water source does your water come from e.g. surface reservoir or borehole (there are many options).

c. Can you locate your nearest Water Recycling Centre?

d. What's the nearest river?

e. Is there any industry near you?

f. What sort of agriculture is there in the area?

g. Find out if there are environmental sites.

**Annotate a Google map image or OS map with your findings.**

**Do your findings make you think differently about water?**

**What are the concerns in your area?**

# ACTIVITY 2:

## DESIGN YOUR OWN SUSTAINABLE DEVELOPMENT

- What materials will the houses be constructed from?
- How could you lessen the impact of heavy rain? SUDs, houses on stilts, etc.
- Think about the roads and paths. What material will they be made from?
- Will your houses have green roofs?

**CAN YOU CREATE A MODEL OF YOUR PROPOSED DEVELOPMENT?**

# ACTIVITY 3:

## SOLUTIONS TO THE PROBLEMS

Have a look at questions from the introduction of the unit. Discuss your solutions to these issues. Can you develop any innovative solutions to these problems? How will you share them with your fellow students?

How will we ensure flooding of people's homes and lively hoods does not become all too familiar?

How will we deal with future droughts?

How to manage our water supply so agriculture, the environment, industry and households all have access to the water they need?

Do we need to think about the crops we grow?

# ACTIVITY 4: LOVE EVERY DROP

Anglian Water are committed to a sustainable water management system for the East of England to ensure we can continue providing safe, clean drinking water while protecting the environment and sharing our natural water resource with farmers and industry. To do this we need to work with not just our own staff, but all our customers and users of water.

Our aim is to get everyone to think differently about water, to act differently, to encourage collaboration, innovation and transformation in order to create a truly long term future for the East of England.


**Complete the table below:** Consider what we need water for in order to live a healthy lifestyle and what we would like?

| Healthy life style | Wants | Needs |
|---|---|---|
| Tap water to drink and cook in | | Y |
| Tap water to flush the toilet | Y | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

**Now consider the impact of climate change on your lifestyle and create your own.**

Plan for water sustainability in your region.

- How will you ensure supply to domestic customers?
- How will you protect the environment?
- Don't forget to consider the needs of agriculture and industry.

# SUMMARY ACTIVITY: SMALL STEPS

EXPLORE THE ENVIRONMENT PART OF OUR WEBSITE AND ANSWER THE QUESTIONS BELOW.

www.anglianwater.co.uk

1. Name three things Anglian Water is doing to reduce carbon?

2. There are many things Anglian Water's customers can do to save carbon through water efficiency. What can you get from us for free to save water in your home?

3. Name one thing you could do to save water?

## USEFUL WEBSITE LINKS

www.anglianwater.co.uk

www.anglianwater.co.uk/drop20education

www.environment-agency.gov.uk

www.metoffice.gov.uk/climate-guide

www.keepbritaintidy.org

www.water.org.uk

You can check your flood risk from rivers and the sea and sign up to the Environment Agency's free flood-warning service. Phone 0845 988 1188 or visit https://fwd.environment-agency.gov.uk/app/olr/home

**Adaptation:** Responding and changing behaviours, practices and procedures to predicted climate change to minimise the impacts.

**Assets:** Any item of economic value owned by Anglian Water. Anglian Water's assets include pipe networks, water and wastewater treatment works, company vans and vehicles, offices and buildings, land, plant and equipment etc.

**Biogas:** Gas produced from biological breakdown, usually a mix of methane and carbon dioxide. A by-product of the sewage treatment process and from food waste which can be used for fuel.

**Biodiversity:** The diversity of a plant or animal life in a particular habitat.

**Capital carbon:** The carbon and energy which goes into producing a product, from raw materials to construction, transportation etc.

**Carbon emissions:** Any of the atmospheric gases that contribute to the greenhouse effect.

**Catchment:** The area contributing surface water and runoff to a drainage point or to a water course e.g. river.

**CHP (Combined Heat and Power):** The process used to convert biogas from sewage treatment into renewable energy source.

**Climate change:** Climate change is any significant change in the weather of a region over a period of at least several decades, e.g. increasing average temperature or rainfall, or a change in the usual wind direction.

**Combined sewer:** A sewer that takes surface water and foul water (sewage) in the same pipe to the sewage treatment works.

**Contractors:** Organisations or individuals hired to carry out work on behalf of Anglian Water.

**Customers:** Householders or businesses that we provide services to namely providing safe, clean drinking water and wastewater treatment.

**Drop 20:** Anglian Water's 2012 water efficiency campaign to reduce everyone's daily domestic water consumption by 20 litres. In the UK domestic water consumption is on average 133 litres a day.

**Drought:** Extended periods of low rainfall or without rainfall at all.

**Ecosystem:** Interacting organisms in their physical environment.

**Filter strips:** An area of planting on gently sloping ground, designed to drain runoff from impermeable areas and filter out silt and other particulates.

**Groundwater:** This is the water that is below the surface of the ground in soil and rocks.

**Hosepipe ban:** Restrictions of outdoor water use when water reserves are low to ensure water resources for an extended period.

**Impermeable:** A material that does not allow water to pass through.

**Impermeable surface:** A surface material which does not allow water to pass through so causing surface water to run off.

**Infrastructure:** The extensive pipe network and pumping stations needed to supply water and wastewater services.

**Landfill:** Waste disposal in quarry or low lying land, covered with soil.

**Methane:** A colourless, odourless, flammable natural gas CH4.

**Mitigation:** Any action taken to permanently eliminate or reduce the long-term risk and hazards of climate change to human life, property.

**OFWAT:** The main regulator, part of the government, which monitors water companies performance, charges and the money allocated to large projects.

**Operational carbon:** Carbon that is used in the day-to-day running of our assets to pump and clean water and the greenhouse gases emitted from the sewage its self.

**Permeable:** A material that does allow water to pass through.

**Pollution:** The introduction of a substance which contaminates the soil, water or atmosphere.

**Renewable energy:** Energy which comes from natural resources such as sunlight, wind, rain, tides, and geothermal heat, which are naturally replenished. Anglian Water's main renewable source is CHP.

**Rill:** A narrow or shallow channel to direct water.

**Runoff:** Water that flows over the ground to a drainage system. This usually occurs following rainfall which cannot filter into the ground due to impermeable surfaces or when rainfall is particularly intense and ground is saturated.

**Sewer:** Infrastructure to transport wastewater from homes, businesses and other buildings to a sewage treatment works to be cleaned to return it to the environment.

**Sewage/wastewater:** Water that has been used domestically or for businesses, which as a result is contaminated with human waste, chemicals, solids etc.

**Silt:** Particles of soils, stone e.g. clay or sand, suspended in water.

**Stakeholders:** A person, group or organisation who is directly or indirectly affected by Anglian Water's work from customers to councils, policymakers and national organisations like Natural England.

**SUDS:** Sustainable Urban Drainage System – water management to drain surface water in a more natural and sustainable way.

**Surface water:** Water that is collected on land such as rivers, lakes, reservoirs, ponds, puddles.

**Sustainable Development:** Meeting the needs of the present without compromising the ability of future generations to meet their own needs.

**Wastewater:** Water has been used domestically or for businesses, which as a result is contaminated with human waste, chemicals, solids etc.

**Wastewater treatment:** The treatment process using a natural process of filtration and micro-organisms to break down organic material and produce clean water which can be returned to a watercourse and the water cycle.

**Water displacement device:** An object that is placed in a toilet cistern such as a bag or gel sachet to reduce the volume of water filling the cistern with each flush, such as a Save-A-Flush or Hippo bag (available on the Anglian Water website).

**Water efficiency:** Reducing water consumption from behaviour change or water saving devices.

**Water meter:** Device fitted either inside or outside a building to measure the volume of water going in. Meter readings are taken for water bills to only pay for what is used.

**Water recycling process (sewage treatment):** The treatment process using a natural process of filtration and micro-organisms to break down organic material and produce clean water which can be returned to a watercourse and the water cycle.

**Water treatment:** The process of cleaning water to make it safe to drink, using ozone and chlorine to remove bacteria and harmful elements, through filtration and coagulation to remove dirt particles.

**Watercourse:** A flow of water, natural or man-made, which includes all rivers, streams, brooks, canals, ponds, ditches, drains etc.

# THANK YOU

## TOGETHER WE CAN CHANGE THE WORLD ONE DROP AT A TIME

love every drop
anglianwater