Environment Agency

hidden infrastructure

The pressures on environmental infrastructure

2007 Report

We are the Environment Agency. It's our job to look after your environment and make it a better place – for you, and for future generations.

Your environment is the air you breathe, the water you drink and the ground you walk on. Working with business, Government and society as a whole, we are making your environment cleaner and healthier.

The Environment Agency. Out there, making your environment a better place.

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Foreword

We cannot live in densely populated communities without a network of infrastructure to support us. Every day it provides essential environmental services, largely unnoticed by us. But it cannot afford to remain hidden, without it our towns and the surrounding environment would be in a mess.

But there is a shortage of housing and our towns and cities are going to expand. We cannot ignore the mechanisms that are required to support this growth and protect the environment. We know that these projects take a long time to plan and build so we need to think about them now.

This new growth can be achieved without harming the environment. But we have got to get on with it now. Early investment and careful planning is the key to success.

Barbara Young Chief Executive

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Overview

Our towns and cities would be uninhabitable without a network of services that protect us from flooding, deal with our rubbish and sewage and provide us with clean water. These are not optional extras but they're often taken for granted.

Growing communities are putting these services under pressure and in many places the infrastructure, and the environment it supports, is reaching a tipping point.

Serious or frequent failure of this infrastructure can harm health, damage the environment and cost money. The challenge is to provide these services and the protection that they offer at a price we can pay now and in the future. The best way to do this is to consider environmental infrastructure at the planning stage, and incorporate it in the design of new houses and communities rather than retrofitting existing ones.

The way forward

To make sure that our environmental infrastructure can cope with increasing development, we need to:

1. Build in the right place. Planning authorities and developers need to make sure that new development is away from the floodplain and away from areas where water quality is already threatened wherever possible. There are already over 4.5 million people at risk of flooding in England and Wales, and this number should not grow.[1]

2. Reduce demand. Every home and business needs to reduce the amount of water it uses, and the amount of waste water and solid waste it produces. This will extend the life of existing infrastructure, save money and help cope with climate change. It can make a big difference. For example water metering reduces the amount of water people use by an average 10 to 15 per cent.[2]

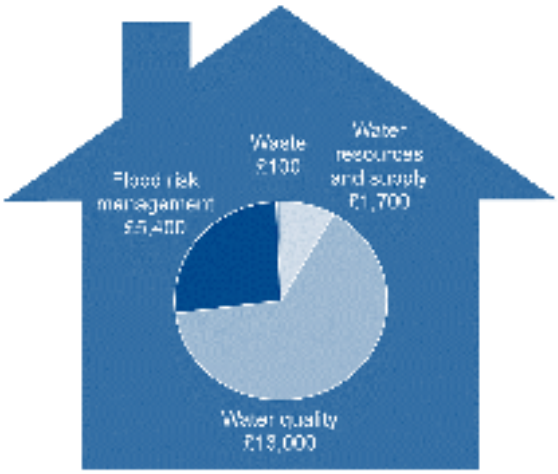
3. Increase capacity by building new infrastructure and extending old. Increasing reservoir storage, for example, will help to balance water resources in the area. Building additional sewage treatment works will ensure that dirty water does not pollute our rivers and coasts. Overall, providing sewage treatment for the new housing proposed under the South East Plan will cost an estimated £7.5 billion over the next 20 years.[3] Protecting water quality and providing water, waste management and flood protection is expected to cost £20,200 for each of these houses (Figure 1).

4. Change our approach. Reducing demand and increasing capacity reduce pressure on existing infrastructure. But new, sustainable approaches to environmental infrastructure will have to be developed and incorporated into future communities. This includes finding alternatives to burying our waste in the ground as we only have three to nine years of landfill capacity left.[4]

'*Hidden infrastructure*' outlines the issues faced in providing adequate water supply, waste management, waste water treatment and flood protection for new and existing developments. Westminster Government, the Welsh Assembly Government, local government, water companies, waste management businesses, developers, the Environment Agency and individuals are all part of the solution.

'*Hidden infrastructure*' is the evidence that supports the Environment Agency's policy paper, which presents our new ideas to make sure growth in England and Wales is sustainable, and has the environmental services it needs. The principles apply everywhere, but are more urgent in areas that have or are expecting high levels of growth.

Figure 1 **Average environmental infrastructure cost per house in the south east**[5]



Source: Environment Agency [6]

Box 1 **What do we mean by environmental infrastructure?**

Water
Water companies take groundwater and water from rivers and treat it to drinking water standard before pumping it through pipes to our homes. Sometimes it is stored in a reservoir before being treated and distributed.

Waste water
Our homes and communities are drained by a system of sewers. Foul sewers carry sewage to sewage treatment works where it is treated to make it clean enough to be returned to rivers, groundwater or the sea. Surface water sewers carry water from roofs, roads and other surfaces directly into the water environment, usually without treatment. Sometimes both sewage and surface water are conveyed in a single 'combined' sewer.

Waste
The waste industry manages the waste from our homes and businesses. Most waste in England and Wales still goes to landfill, but an increasing proportion is recycled or composted.

Flood
Sea walls, flood barriers, flood storage areas and other defences protect our homes from coastal and river flooding.

Where is the development going?

There is a high demand for new housing across England and Wales. Increased housing provision has an important role in driving economic productivity and in regenerating deprived communities.

Much of the planned growth will be in the south east of England. The problems and solutions developed to meet the growth in south east England will apply to other areas of the country, such as south and west Wales, where significant new developments are planned to meet the high demand.

In England, the Government would like to increase the rate of house building to 200,000 homes a year. Initiatives to help reach this figure include four Growth Areas where planning for high-quality developments will take into account sustainable growth in housing, employment, transport, services, and social and environmental infrastructure (Figure 2). The Government has also set up 29 New Growth Points (NGPs) where demand for housing is high. If all of the proposed growth is realised NGPs would contribute around 100,000 additional dwellings by 2016. Central Government has allocated £40m in start up funds to the NGPs to make sure they can provide necessary infrastructure. It is essential that this includes environmental infrastructure.

The number of homes in Wales is forecast to increase by one fifth by 2026. Household numbers are expected to increase most in the south east of Wales, where nearly 130,000 are due to be built. There are particularly high rates of growth around Cardiff, Swansea and Pembrokeshire. Wales does not have growth areas or growth points, but the Welsh Assembly Government's Wales Spatial Plan will make sure that new growth in Wales is properly planned with appropriate infrastructure for new homes.

Figure 2 **Growth points and areas**

Source: DCLG

Water resources

All of our homes and businesses require a clean, safe and secure supply of water. In the south and east of England resources are already under stress and new housing in these areas will make the problem worse. Water from new reservoirs will not solve the problem; new and existing households also need to use less water. Environmental needs and climate change may limit the amount of water available for public supply in the future.

The issues

People are expected to use even more water in the future. Water companies in the south east expect household demand in the region to increase by about one fifth by 2030.[7] Nearly three quarters of this additional demand is from new housing, but the amount of water each person uses is expected to rise too. At the moment people use about 150 litres of water every day, [8] but in some parts of south east England this could increase to as much as 200 litres by 2030. [9]

Leakage rates are still high. Last year over 3,500 Ml/day[10] was lost through leakage.[11] This is enough to supply about 9.5 million households – more than 40 per cent of all households in England and Wales. Leakage has decreased in the past 10 years because of increased investment, but about one fifth of the water we take from the environment for public water supply is still being lost through leakage. It's a waste of energy too – most of the leaked water has already been pumped to treatment works and treated.

Climate change could alter the availability of water through the year. More of our rainfall is expected to fall in heavier winter downpours. This could mean that water supplies are more limited, especially in the south east where the groundwater supplies depend on steady winter rainfall. Climate change may also affect water demand from households and others. Water use can increase in very hot weather like the summer of 2003, which can lead to water restrictions and hosepipe bans.

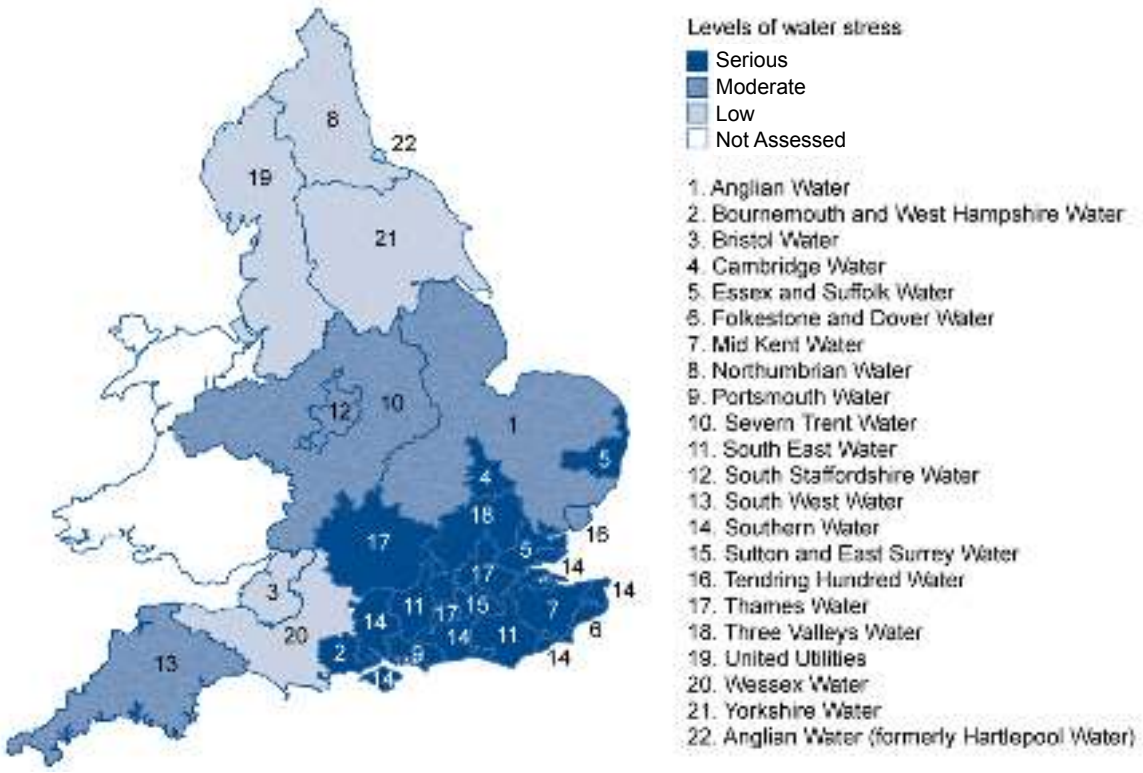
The state of the network. Nearly 4,300 km of the water distribution network was replaced or repaired last year – about 1.3 per cent.[12] It is difficult to establish whether there is a link between the age of the network and leakage rates. But at the current rate of replacement parts of the network built in Victorian times will still be around at the beginning of the next century. It is uncertain how this ageing infrastructure will cope in the future with increased water demand and the effects of climate change.

Where's the problem?

There are particular problems in the south east because the region is the driest in England and Wales and population density in many areas is high. These factors combine to put stress on water resources and the environment that they support. Yet the number of households will grow and generate a demand that cannot be met by the current water resources. Other parts of England and Wales face a similar but less severe situation.[13]

Figure 3 shows how and where these factors combine to put water resources under stress.

Figure 3 **Water stress areas (under consultation)**[14]



Source: Water Stress Group

Why does it matter?

People and the environment depend on a supply of water. If there are shortages our quality of life will suffer and ecosystems will be harmed or lost. The drought orders and hosepipe bans in force last summer show how hard it is to manage water resources in some places – even without the additional new housing.

Limited water resources could limit growth. At the moment, water companies have provided an extra 218 Ml/day for growth areas in their resource plans. But if all the housing planned for these areas is factored in, 42 Ml/day more (or another 19 per cent) will be needed by 2016.[15] This will be provided by the 'headroom' that water companies build in to their plans to deal with uncertainties. But this means their ability to cope with unforeseen water shortages is put at risk.

The cause of the shortfall is that only some water companies have taken the total central government housing targets into account. [16] This is mainly because housing growth forecasts from central government often differ from regionally generated figures. In addition the boundaries used to define growth areas do not match the water resource zone boundaries that the water companies use, leading to under or double counting and further uncertainty.

The way forward

The 'predict and supply' approach to water supply used in the past is not sustainable with the increased demand for water we expect in the future. Instead we need a twin track approach, reducing the demand from new and existing housing at the same time as developing new water resources.

Reduce demand

Water efficiency has an important role in managing resources for new growth. Measures can be implemented in stages and are more flexible than large engineering solutions, like reservoirs. Water efficient homes and metering can both reduce the amount of water households use, so helping to offset the extra demand for new housing.

Metering significantly reduces people's demand for water by making them aware of the amount they use and pay for. Metered households use 10 to 15 per cent less water than non-metered houses and variable (or

sliding scale) tariffs can lead to an extra 10 per cent saving.[17]

It is not just new houses that need to be more efficient. Up to 40 per cent of the extra water needed for growth in the south east could be supplied from the water saved by installing meters and water efficient fittings in existing housing.[18]

Reducing leakage would also ease the pressure on existing resources. Water companies manage an extensive network of water mains (over 335,000 km) and stopping this network from leaking at all would be very expensive. Water companies aim for an acceptable economic level of leakage which balances the cost of preventing leakage with the cost of replacing the lost water.

This approach has been relatively successful, but forecasts only show a small future reduction.[19] Management now needs to take more environmental factors into account, and leakage levels should be reduced further.

Increasing efficiency and decreasing leakage will also save energy. Pumping and treating water is energy intensive, so using (and losing) less will help to reduce greenhouse gas emissions.

Increase capacity
Seven large-scale and costly water storage facilities are being considered for the south east of England, including four new reservoirs and increasing capacity at three existing reservoirs. This would provide an extra 528 Ml/day (468 from new, 60 from existing) by 2020, enough water for nearly 1.5 million households.

It takes a long time for reservoirs to be built and they are expensive. We need to make sure that the benefits justify both the cost and the impact that reservoirs can have on the landscape and local people.

Change approach
The twin track approach is already being used, but more emphasis needs to be put on using water efficiency measures to reduce demand rather than relying on new supplies. This will mean that fewer large, new resource schemes will be needed, reducing both economic and environmental costs.
About a third of the water we use in our homes does not need to be treated to drinking water standards because it is used for flushing toilets or in the garden. Rainwater and treated grey water from baths, showers and wash-basins is clean enough, and using this water reduces the amount of drinking water householders need to take from the mains. Water recycling systems are currently too complicated and expensive for single houses, but commercial and community scale systems are becoming more cost effective.

Large scale water transfers across England and Wales using a national water grid have been proposed as a solution to the south east's water shortages, but the Environment Agency believes this is unnecessary. This would be an extremely costly option and damage the environment. The capital cost of transferring water from a reservoir in the north of England to London would be about £2.4 to £11 million per Ml/day, more than the £1.6 million per Ml/day to provide the same resource from new reservoirs.[20]

Waste water

Waste water includes sewage from houses and some runoff from surfaces such as roads and roofs. It is managed by water companies via a network of sewers, sewage treatment works (STWs), combined sewer overflows (CSOs) and other outfalls.

Rainwater runs into separate surface water sewers and straight into receiving waters. In many urban areas it runs into combined sewers which takes both surface runoff and sewage to sewage treatment works. During heavy rainfall they may become full and have to overflow into rivers to avoid flooding, releasing diluted untreated sewage.

More housing means more sewage and new surfaces will increase runoff. The impact of this on the existing network and on the environment needs to be considered at the planning stage.

The issues

Not enough capacity. Water companies already manage more than 6,000 STWs, more than 310,000 km of sewers and 25,000 CSOs in England and Wales. But the capacity of that infrastructure is finite. New houses cannot always be simply connected to existing foul and surface water sewers without overloading the network. Some properties are already unable to connect to the sewer.

The environment has a finite capacity too. The limit of the environment's ability to take in discharges from STWs and CSOs is being reached in some places. Large, fast flowing rivers or the sea have a greater capacity to dilute and absorb discharges than small vulnerable rivers, where a higher standard of treatment will be needed.

Surface drainage. Usually water in surface water sewers is relatively clean and does not need treatment before going into receiving waters. But it can sometimes cause pollution, picking up bacteria, nutrients, oil, detergents and sediment from roads, roofs and gardens.

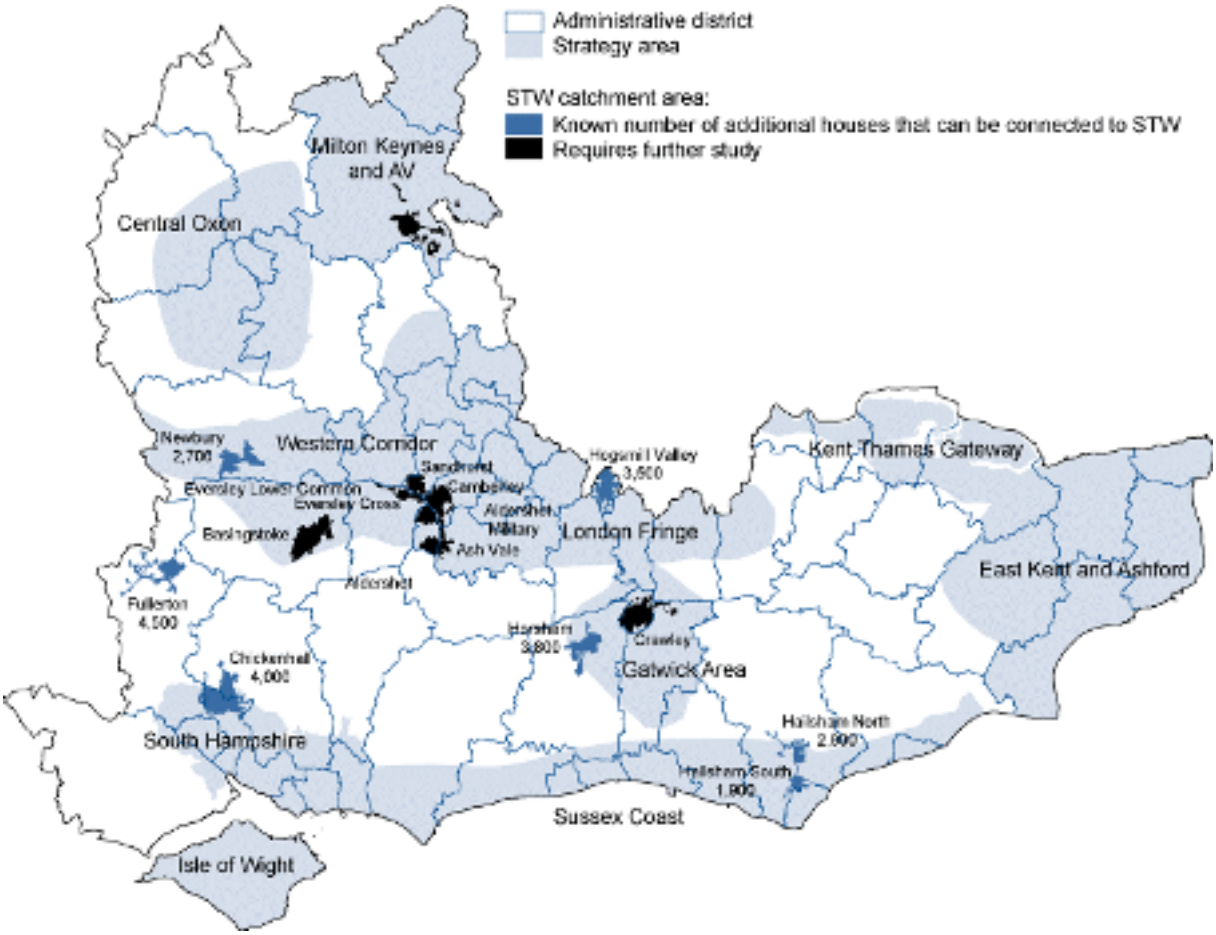
The state of existing infrastructure. It is difficult to predict how well the waste water network will cope with the larger volumes of water from new developments. The current condition of much of the underground sewer network is not known and the rate of deterioration largely uncertain.[21]

Climate change could exacerbate the impact of new developments. Climate change means more intense rainfall. Overflow volumes could increase significantly. At the same time, hotter, drier summers will make the environment less able to cope with discharges from STWs and CSOs. Low river flows during summer reduces the dilution of the waste water. Higher temperatures mean less oxygen in rivers and lakes. This is partly offset by STWs operating better at higher temperatures.

Where's the problem?

In the **South East**, there are seven places where development will be limited by the capacity of STWs (Figure 4).[22] Forty-five other works will need to operate to a higher standard to avoid harming the local environment. The cost of these upgrades varies from place to place. There will be no extra costs in areas that have spare sewage treatment capacity, but can be up to £10,000 per house. Overall, providing sewage treatment for the new housing proposed under the South East Plan will cost an estimated £7.5 billion over the next 20 years.[23]

Figure 4 **Limits to STW capacity in the South East Plan Area**



Source: Environment Agency

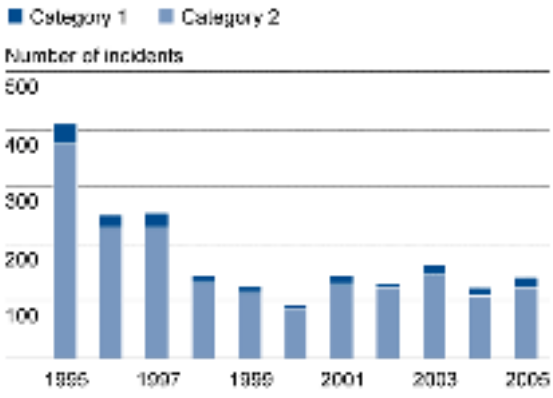
In the **Midlands** the gradual growth of Nottingham's population caused the quality of the Lower Trent River to deteriorate. Only substantial investment at the STW in the late 1990s reversed this.

Why does it matter?

An overloaded or inadequate waste water infrastructure can harm our health and the places we live. Nearly 5,000 properties were flooded from sewers last year, over half because of sewer blockage, collapse or equipment failure.[24] Bacteria and viruses from discharges can make people ill.

Waste water can also harm the environment. Already, water quality is poorer in urban than in rural areas. Only 41 per cent of urban rivers are good quality compared to over three-quarters of rivers in rural areas. In 2005, water companies seriously polluted the environment 152 times, mostly because of problems with the sewers. Figure 5 shows that the number of significant sewage related pollution incidents each year fell sharply between 1995 and 2000, but has started to rise again in the last five years.

Figure 5 **Sewage premises related category 1 and 2 pollution incidents to water**



Source: Environment Agency

Water must be clean enough to satisfy a number of EU directives, including the Bathing Waters Directive and the new Water Framework Directive. Failure to achieve this puts the UK Government at risk of prosecution, which could result in millions of pounds in fines.

The way forward

Making sure that sewage and surface runoff from new developments does not cause pollution is going to be a challenge in some places. Ideally new housing should be built in places with enough existing sewerage and treatment capacity.

Reduce demand
The amount of waste water that houses produce is largely determined by the amount of water used. Any water use efficiency measures, like grey water recycling and lower water consumption, will reduce the volume of water that foul sewers and STWs have to cope with, and save money. The pollutant load coming from each household would stay about the same.[25]

Increase capacity
Adequate sewerage, surface water drainage and sewage treatment must be provided for new developments. In some places, the capacity of existing systems can be increased. In others, new systems may have to be built.

Change approach
There are ways to treat sewage other than pumping it to a few large works. Small, local sewage works in a new development would help to maintain more natural water flows throughout a river catchment. But this has to be balanced against the efficiency that large STWs can provide. Different options will be appropriate for different places.

Sustainable urban drainage systems (see Box 2) can help to prevent diffuse pollution from surface runoff. Artificial wetlands, ponds and other features intercept the runoff and remove pollutants before the water is returned to rivers and other receiving waters.

Box 2 **Sustainable urban drainage systems (SUDS)**

An alternative approach to surface water drainage, known as SUDS, can reduce and slow down runoff at the same time as improving water quality. The systems mimic the natural drainage pattern of each site as much as possible, incorporating features which prevent or delay runoff, like permeable surfaces, artificial wetlands or ponds. These can help to prevent large flows of often dirty runoff that characterise urban drainage. Instead cleaner water is returned more gradually to the natural drainage system.

The SUDS approach generally costs about the same as traditional systems, but drainage legislation is complicated. [26] It is not clear who will take ownership and who will be responsible for ongoing maintenance. This has made their incorporation into developments difficult in the past.

Waste

People in England and Wales produce too much waste, and the amount we are generating is increasing. Our capacity to deal with it – our waste management infrastructure – is not keeping pace. This is a problem across the whole of England and Wales but it is most severe in those areas set for major development.

The issues

Too much waste. About 335 million tonnes of waste are produced in the UK each year. Household waste is growing at a rate of 1.5 per cent every year.[27] Most waste comes from sources other than households, such as construction, commercial and industrial activities.[28,29] As our towns grow we will see more waste generated from these activities.

Too much is thrown away. For example, each person in England and Wales spends on average over £400 a year on food that never gets eaten.[30] The construction industry throws away nearly 13 million tonnes of unused material each year.[31]

Not enough space. If waste continues to increase it is estimated that by 2012 households in England will produce about 20 million tonnes more waste than we could deal with using current facilities.[32] Landfills take over two thirds of our municipal waste, although this is falling as legislation encourages recycling and other disposal routes. Current landfills provide as little as three years' capacity in some regions, nine years at most (Figure 6).[33]

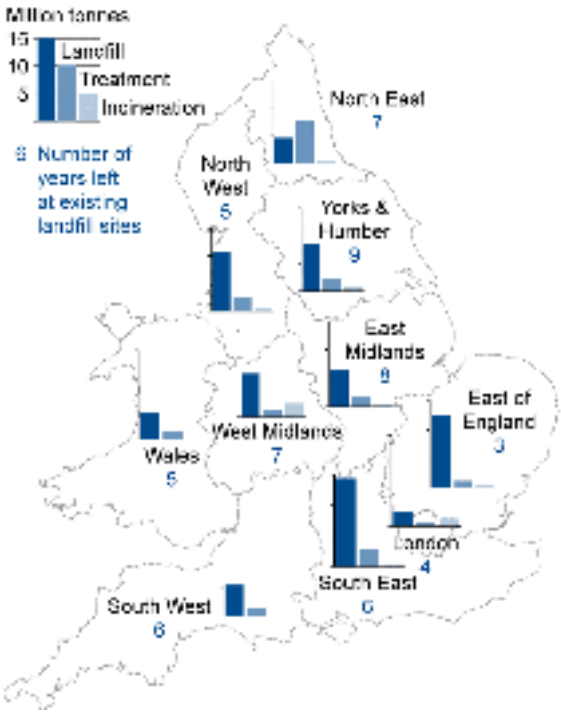
Not in my back yard. Planning applications for new waste management facilities are often delayed or rejected. The public perception of these applications is usually negative even when they are for recycling and composting facilities. In 2004/05 there were no planning approvals for major new waste management facilities.[34]

Where's the problem?

In **London**, the average household produces over one tonne of waste every year[35], of which two-thirds is sent to landfill.[36] London's waste is predicted to rise to 26.5 million tonnes by 2020.[37] With the development of 160,000 new homes as part of the Thames Gateway project, an alternative to landfilling London's waste is desperately needed.

Wales currently has about five years landfill capacity left and there are no commercial sites that take hazardous waste.

Figure 6 **Waste treatment and disposal by region 2004/05**



Source: Environment Agency

Why does it matter?

Waste is a resource and yet we are throwing it away. Minimising waste could save UK industry up to £3 billion in operating costs.[38]

Waste can harm the environment and the economy if the infrastructure is not in place or it is not managed properly. If the infrastructure is not adequate, we are likely to see more illegal dumping of the kind that cost taxpayers £51 million to clean up in 2005. Waste management infrastructure already suffers from poor management in some places. In 2005, waste management activities caused over a quarter of all serious industrial pollution incidents, and 1,057 licensed sites breached their licences to such an extent that there was a serious potential for harm.[39]

The UK has one of the worst waste records in the European Union (EU). We are one of only three member states to fail to meet 2006 targets to reduce the amount of municipal waste going to landfill, although our target has been deferred to 2010. Some EU countries have already met their 2016 targets. Without considerable investment in waste management facilities and waste minimisation, we are unlikely to achieve our UK targets, and risk heavy fines from the EU.

The way forward

Dealing with our waste is already causing problems, even before the increases caused by new development. We need to reduce, reuse or recycle more of the waste we produce.

Reduce demand
The highest priority for waste management in England and Wales is to reduce the amount of waste produced in the first place and treat it as a resource. Landfill tax provides an incentive for businesses to reduce their waste, but there are no direct incentives for households.

Charging households different amounts depending on the volume of waste collected is an option that has been successful in other countries. Businesses, particularly supermarkets, can help households by reducing the amount of packaging in their products.

Increase capacity
Fifteen million tonnes of new waste processing capacity is needed in England[40] and three million tonnes of municipal waste capacity is needed in Wales[41] just to achieve EU landfill reduction targets. The UK requires around £10 billion of investment in new waste infrastructure.[42] This does not take into account additional investment needed to provide for new housing growth.

The Environment Agency supports Defra's Waste Infrastructure Development Programme. This will attract new businesses into waste management, and develop markets for the outputs such as energy from waste, by increasing the availability of investment.[43]

Change approach
We cannot rely on legislative drivers alone to bring about changes in our approach to waste. EU directives and UK government initiatives are targeted at municipal waste. Targets need to apply to commercial waste.

Burying our waste is not the best choice. England and Wales are still a long way behind the recycling rates achieved across the rest of western Europe. Other options include re-using waste, which reduces the need for landfill and saves energy and resources associated with manufacturing new products. Recycling waste can similarly cut costs and make profit (see Box 3). Incinerating certain types of waste produces heat and power.

Box 3 **Recycling in Yorkshire and Humberside**

Recycling Action Yorkshire is a not-for-profit, regional programme to help develop market opportunities for recycled materials. It works in partnership with national and regional organisations to stimulate the market for recycled materials, from collection and reprocessing, to manufacture and sustainable procurement. The industry in Yorkshire and the Humber is already worth £400m and employs 5,000 people in over 120 companies. It is set to grow rapidly, driven by new targets, legislation and customer demands.

Flooding

Flooding is a natural process that we will never be able to stop entirely. We have to reassess the way we live and cope with the threat of floods and to learn how to manage them. This means reducing the likelihood of flooding and the impact of floods when they occur.

The issues

People and properties are at risk. Over one tenth of land in England and Wales is at risk of flooding from rivers or the sea, affecting over 4.5 million people and 2.3 million properties. In Wales alone there are 170,000 properties and more than 300,000 people at risk. More than £230 billion worth of property and assets in England and Wales are located in floodplains.[44]

Flooding and flood management is expensive. Currently, flooding and flood risk management in England and Wales cost around £2 billion each year. We spend over £600 million a year on flood and coastal defences, but even with existing defences, we experience an average of £1,400 million of damage annually.[45] Every pound spent on new flood defences saves seven pounds of damage.[46]

Risks are increasing. The threat from flooding is likely to increase with climate change. The financial consequences of additional flood risk in growth areas could increase by up to 12 times to £555 to £830 million per year by the 2080s.[47] The chance of flooding from rivers is likely to rise everywhere as high intensity rainfall becomes more common.

Where is the problem?

There are additional problems in the south east where storm surges and the gradual sinking of land add to the risk from climate change induced sea level rise. It is estimated that if flood defences in eastern England are not improved and, as predicted, sea levels rise by 0.4 metres, then the cost of a single flooding event will increase to as much as £16 billion.[48]

Floodplains in other areas are under pressure from development. For example in Greater Manchester there are 30,000 properties in the floodplain. Many new properties are planned in Manchester and Salford as part of a programme to regenerate deprived areas. Often these deprived communities are in or near floodplains, so careful planning will be required to avoid increases in flood risk.

In Plymouth development is planned in areas at high risk of coastal and river flooding. There are localised surface water flooding issues linked to high levels of urbanisation and the limited capacity of small receiving rivers. Work is being carried out to determine how and where development can be provided sustainably.

Why does it matter?

Development in floodplains puts both new and existing properties at risk. Any new flood risk management infrastructure could make existing communities elsewhere more likely to flood.

The Environment Agency estimates the cost of providing flood protection for existing homes to be between £14,000 and £53,000 per house, including initial and maintenance costs. The whole life costs of flood risk protection for new homes is likely to be similar. The average cost of damage to a household when it is flooded is £28,000.[49]

Up to 108,000 homes in growth areas could be located in the floodplain, of which 10,000 could be at significant risk.[50] Flood damage across these areas could be up to £55 million per year without additional protection measures, and the consequential losses (for instance from transport and infrastructure disruption) could add £19m to £27m. This would increase the cost of flooding in growth areas by 74 per cent by 2016.[51]

The way forward

Building homes outside of the most frequently flooded floodplains will reduce the amount of money needed for flood defences and result in less property damage in the future. Where building in flood risk areas cannot be avoided then resistance and resilience measures need to be built into the development. Long term planning is essential especially if we are to adapt to the effects of climate change.

Build in the right place
Floodplain development will interfere with the natural ability of the floodplain to absorb the impacts we expect from climate change. We should prevent further development in floodplains and in the longer term we will have to plan to reduce existing development through relocation. The Environment Agency objected to more than 4,000 planning consultations in England because of flood risk in 2005/06. In five per cent of cases planning permission was given against our advice.[52] The recent update to the planning guidance should be addressing this.[53]

Increase capacity
We have to plan ahead to deal with the consequences of climate change. Between £22 and £75 billion of new engineering will be required by the 2080s to reduce the risks of river and coastal flooding from the worst scenario of £20 billion damage per year, down to around £2 billion.[54]

Change approach
New and existing buildings in areas at risk from flooding should be made more flood resilient. We need to know more about how to make buildings resistant to flooding, reviewing modern methods of construction if necessary. Adequate escape routes are essential.

Flooding can also be caused by inadequate capacity in the drainage and sewerage system. SUDS schemes can help to slow down runoff and reduce the amount of water entering surface water and combined sewers (see Box 2). Although locally important, the schemes are unlikely to have a significant effect on big floods that could overtop flood defences.

Recommendations and conclusions

At the moment the environment is coming under pressure in densely populated areas. Good environmental infrastructure is essential if new houses are to be built within the environment's capacity to absorb the additional impacts. Early action on water, waste water, waste and flood protection infrastructure is vital for successful new housing and environmental protection.

The **location** of new developments is crucial. Small changes to the position of new homes can make a big difference, particularly for flood defence and waste water treatment.

Reducing the demand for environmental infrastructure makes the task of providing services much easier. All new houses need to be built to be more efficient and existing houses need to have water meters installed in areas where water resources are stressed. Recycling or reusing more waste will mean that we need fewer landfills.

Increasing the capacity of existing infrastructure to cope with new housing developments will delay the point at which it becomes inadequate. But it cannot continue indefinitely.

Providing adequate infrastructure is going to be expensive, but it will be cheaper to incorporate it from the start than trying to fix failed systems. Similarly, reducing the demands we place on infrastructure is cheaper than building new infrastructure. This can be done by making sure that development happens in the right places or encouraging people to change their behaviour.

We have to rethink the way these services are provided and **change our approach**.

Flooding can never be eliminated and some degree of flood risk has to be accepted. New homes must be built to be more resistant to flood damage and inappropriate development in floodplains avoided. Waste should be treated as a resource and the residual used to generate energy. Dividing water supply into water that is treated to be clean enough to drink and water that needs less treatment would give more scope for more water recycling. The use of sustainable drainage systems would help to prevent sewage overflows as well as reduce the risk of urban flooding.

Our approach needs to be flexible. Rainfall patterns are likely to change in future. This could affect groundwater resources and also increase the frequency of sewage overflows, unless the system is properly managed. Sea level rise will increase the risk of flooding in low-lying areas.

The infrastructure that removes our waste and sewage, supplies us with water and protects us from flooding also helps to stop our environment from becoming polluted and damaged. But it needs adequate investment, early planning and good management.

References and endnotes

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