

5. Environmental Quality



Image 5a: **The mouth of the Exe Estuary**
Source: Exe Estuary Management Partnership

Improvements in the environmental quality of the Exe Estuary will lead to improvements in the quality of life for the local human and wildlife populations. In order to gain maximum benefit from the Estuary environmental quality must be maintained or improved, which is particularly challenging due to increased pressures from a larger population and a greater variety of activities taking place on or around the Estuary.

The South West European Marine Sites characterisation of the Exe Estuary in 2003 came to the following conclusions on the state of the Estuary's environment:

- There is a long-term **decline in the diversity of algal species and a reduced coverage of eelgrass**. The cause of these changes is unknown.
- The intertidal sediments and fauna of the Exe remained unchanged for much of the twentieth century. An assessment of faunal diversity showed there was **no adverse effect from chemical pollution**, or organic enrichment from sewage and bait digging.
- The British Trust for Ornithology has indicated declines in wigeon, dark-bellied Brent goose, oystercatcher and avocet, though this is not considered a concern.
- The review of toxic contaminants shows that there is little direct threat to biota although many chemicals are not robust enough to provide detailed analysis.
- Rivers entering the Exe are not considered a concern for metal contamination although elevated levels of zinc have been found at the head of the Estuary at Countess Wear. Metal concentrations in sediments were highest in the upper Estuary due to the sewage treatment works. The only metal above 'probable effects level' was zinc although cadmium, mercury, lead, copper and arsenic were exceeded at the lower guideline level. These levels decrease to background levels at the mouth of the Estuary. There is **no significant bioaccumulation of these metals in the Estuary**.
- Organic compounds are below detection limits and generally considered of little toxicological importance in the designated shellfish areas.
- **Some guideline levels of pesticide and herbicides exceed quality guidelines** and are, therefore, of possible biological significance in sediments upstream. Any impacts, if they occur, are likely in the head of the waters rather than downstream.
- The River Exe appears to be the source of the majority of nutrient build ups due to agricultural run off and sewage discharges. The Exe Estuary is **exhibiting symptoms of eutrophication** including phytoplankton blooms.
- **Ammonia concentrations are a concern for wildlife** as toxic levels had been recorded. The Exe was, therefore, investigated as a Sensitive Area during 2001.

Source: Langston *et al.*, 2003

5.1 Air Quality

Air quality management is necessary to bring down the air pollution to levels that are safe for people to breathe and to prevent air quality from worsening in areas where it is currently acceptable. There is still a great deal of uncertainty over the health effects of air pollution and, although it is believed that the risks to individuals are relatively small, there is increasing medical evidence that air pollution damages health and can trigger asthma and other breathing illnesses. Pollution from traffic can cause lung damage and is associated with a number of breathing illnesses, such as bronchitis and cancers.

At local level, air pollution policy is focussed on the potential impacts on human health, whilst at a European level the concerns extend to biodiversity and wildlife.

Local Air Quality Management



Image 5b: **Air pollution from boat emissions**
Source: Exe Estuary Management Partnership

The most recent Air Quality Strategy was published in January 2000 (DEFRA, 2000). The Strategy sets air quality standards and objectives for eight key air pollutants to be achieved between 2003 and 2008. For seven of these pollutants local authorities are charged with the task of working towards the objectives in a cost-effective way. The seven pollutants are carbon monoxide, benzene, 1,3-butadiene, lead, nitrogen dioxide, sulphur dioxide and fine particles (PM¹⁰). However, not all of these pollutants are regarded as a threat for the Estuary.

The main pollutants affecting human health and wildlife on the Estuary and its fringe are:

Nitrogen dioxide (NO₂) is an important pollutant its main source locally is road traffic but it is also emitted from marine diesel engines on the estuary. This gas can irritate the airways of the lungs, increasing the symptoms of those suffering from lung diseases. Nitrogen dioxide can also bring about acidification of water & add to the nitrogen loading in soil.

Particulates (PM₁₀) are pollutant particles up to the 10 microns size. They can have an impact on the respiratory system and can carry carcinogenic compounds. In high levels, they could affect plant photosynthesis.

Ozone is a powerful oxidising agent which can affect the respiratory system. This can be a threat for humans and wildlife. The chemicals that react in sunlight to produce this gas are capable of travelling long distances and could come from other parts of Europe. The main chemicals involved in this reaction are nitrogen dioxide and volatile organic compounds. The latter are released from, among other things, paints & varnishes labelled as "high VOC content" often used in boat maintenance. Its concentration would be greater on high ground and on still warm days, where there is very little air movement and intense sun.

Local Authorities and Air Pollution around the Exe Estuary

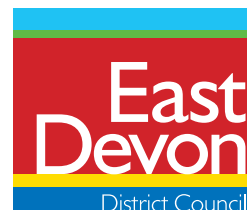
Part IV of the Environment Act 1995 introduced the concept of Local Air Quality Management. Local Authorities are required to review and assess Air Quality in their area against a range of standards and objectives. Where objectives are not likely to be achieved, then the local authority is required to designate an Air Quality Management Area (AQMA) at the relevant locations.

Although nitrogen dioxide and particulates levels are monitored by local authorities, the other important pollutant, ozone, is not currently monitored.

The quality of the air around the Exe Estuary is relatively clean compared to more urban locations nearby. There are no significant industrial processes along the Estuary. The Marsh Barton Trading Area is the only potential source of industrial pollution other than unmonitored marine business and commercial transport, and, therefore, industrial air pollution is not really considered to be an issue for the Exe. Monitoring at the level of the Exe Estuary Management Partnership boundary is not seen as a priority, and data is often quite difficult to obtain. Data can usually be obtained at district level, which does not necessarily reflect the actual quality of air on the Exe. The following is a breakdown of air pollution management within the districts around the Exe Estuary.

East Devon District Council

In 2003 East Devon District Council carried out its second full review and assessment of air quality which showed that there were no sites over specified limits at the time in East Devon. However, the report highlighted a number of potentially significant sources of pollutants in the area namely; Exeter International Airport, industrial sites in bordering authorities, petrol stations and road traffic. A series of checklists are currently used for monitoring pollutants, and different screening tools for monitoring industrial and road traffic sources. These checklists are used to determine potential breaches of the air quality objectives.



Teignbridge District Council

Teignbridge District Council completed an Updating and Screening Assessment (USA) in 2003. In this report the pollutants sulphur dioxide (SO₂) and fine particles (PM₁₀) were identified as possibly not meeting the air quality objectives. Although the USA 2003 confirmed that the air quality objectives for nitrogen dioxide would be met at all locations in Teignbridge, the results of further monitoring carried out in 2003 have identified that this is now not the case. Nitrogen dioxide has, therefore, been considered in more detail. The pollutants carbon monoxide, benzene, 1,3-butadiene did not occur at concerning levels.



Teignbridge District Council has designated a number of AQMAs, each with an Action Plan which will require a "Teignbridge Air Quality Steering Group" to be set up. The first step of producing an Action Plan is to carry out a detailed investigation of where emissions are coming from in order to enable effective targeting of the sources which are causing the greatest contribution to the problem, e.g. bus stops, pedestrian crossings, traffic lights or junctions. None of the AQMAs is situated within the management boundary of the Exe Estuary Management Partnership.

Exeter City Council

Exeter City Council has designated five AQMAs which are located on the main routes into the city. These are in response to nitrogen dioxide emissions from road traffic, which are predicted to exceed the government guideline levels. The main cause of the problem is nitrogen dioxide from traffic in the city. Although government standards for this pollutant were not met at the end of 2005, the levels measured do not demonstrate a significant health problem. Only the most sensitive people – those with existing respiratory or heart conditions – may experience mild effects.



Exeter City Council

Now that AQMAs have been declared, Exeter City Council will draw up an action plan in conjunction with interested parties such as Devon County Council, who are the Highway Authority for the area, setting out a range of measures to improve air quality.

Improvements to vehicle technology (engine & exhaust systems) together with more environmentally friendly fuels (resulting from European legislation) are likely to bring about a progressive improvement in air quality. The use of older marine diesel engines could well mean that boating activity will then become the most polluting activity on the Estuary. However, due to the fact that air does not stop at management frontiers, the Estuary's air quality will also be affected by transboundary pollution caused by a multitude of other sources.

Local Air Quality Management Programme Model Estimates

Results from the Local Air Quality Management Programme (DEFRA, 2002) start in 1997 and give an estimation of air pollution levels (see Figures 5a and 5b). The model used estimates the concentrations of nitrogen dioxide and particulates for every square kilometre of Britain. Information from a number of weather stations and field studies has been analysed to provide an idea of air pollution levels now and in the future. The model assumes that concentrations of pollutants are consistent over the whole square kilometre.

Nitrogen Dioxide

Around the Estuary, levels of nitrogen dioxide have always been higher near the city of Exeter, which is the main source of pollutants from traffic. In 2001 all areas around the Exe Estuary were recorded to have had relatively high concentrations of nitrogen dioxide. The centre of the Estuary had lower concentrations due to its distance from sources of traffic pollution and a higher wind speed in the Estuary channel. Current estimations of nitrogen dioxide concentrations show improvements throughout the area of the Exe Estuary Management boundary, which are expected to continue into 2010. These predictions are based on the model which assumes that pollutants from vehicle combustion engines will reduce over time.

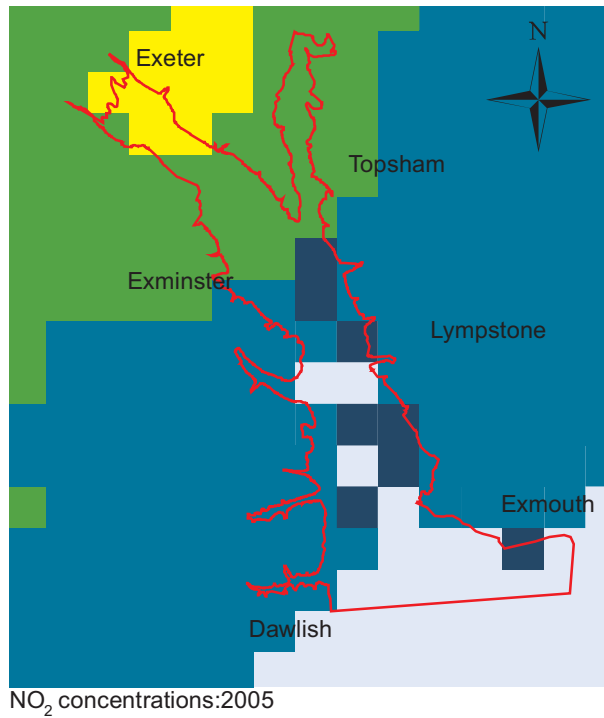
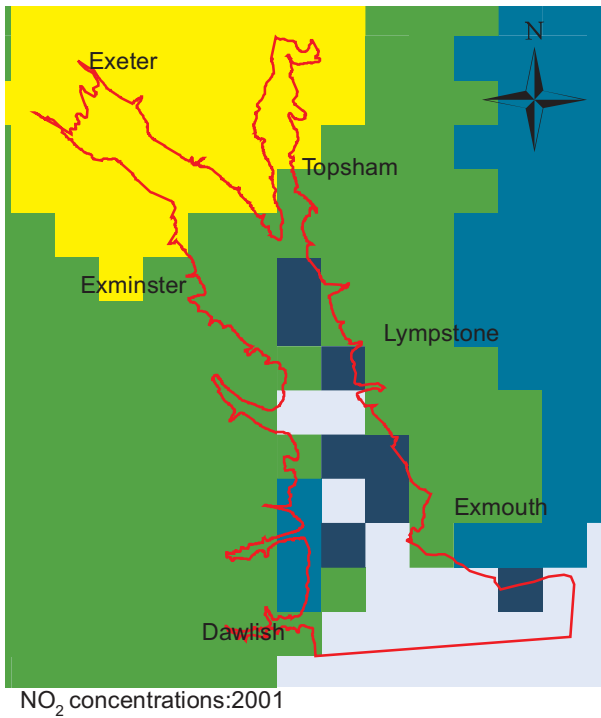
Results from the DEFRA-sponsored NETCEN give an estimation of background levels of air pollution and show that, in comparison with the Severn and Solent Estuaries, NO₂ levels on the Exe are relatively low. This is because road traffic is a much more influential factor on the Severn and the Solent.

Please see Figure 5a for an estimation of nitrogen dioxide levels around the Exe Estuary.

Particulates

Particulate levels within the Exe Estuary Partnership's Management Boundary have been consistently low. Exeter is the main source of traffic pollution, including particulates, so concentrations have been higher to the north of the Estuary than in the rest of the area. The model estimates that concentrations of particulates will continue to decrease.

Please see Figure 5b for an estimation of particulate levels around the Exe Estuary



Results from the Local Air Quality Management Programme (DEFRA 2002) start in 1997 and give an estimation of air pollution levels (see figures 5a and 5b). The model used estimates the concentration of nitrogen dioxide and particulates for every square kilometre of Britain. Information from a number of weather stations and field studies has been analysed to provide an idea of air pollution now and in the future. The model assumes that concentrations are consistent over the whole square kilometre.

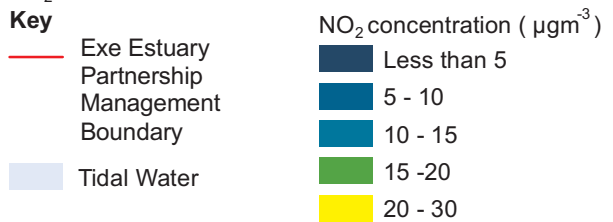
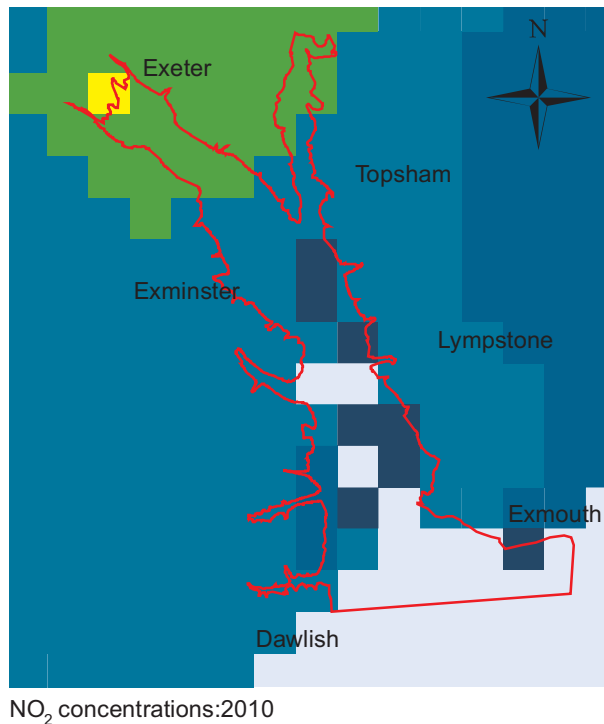
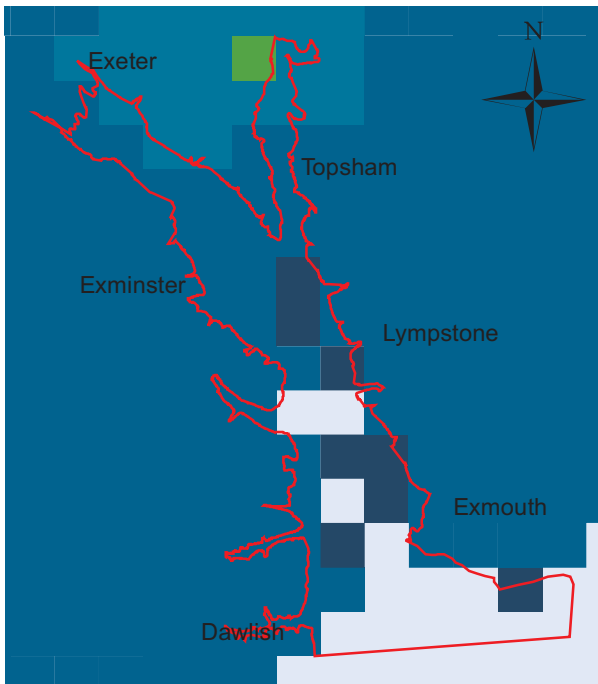
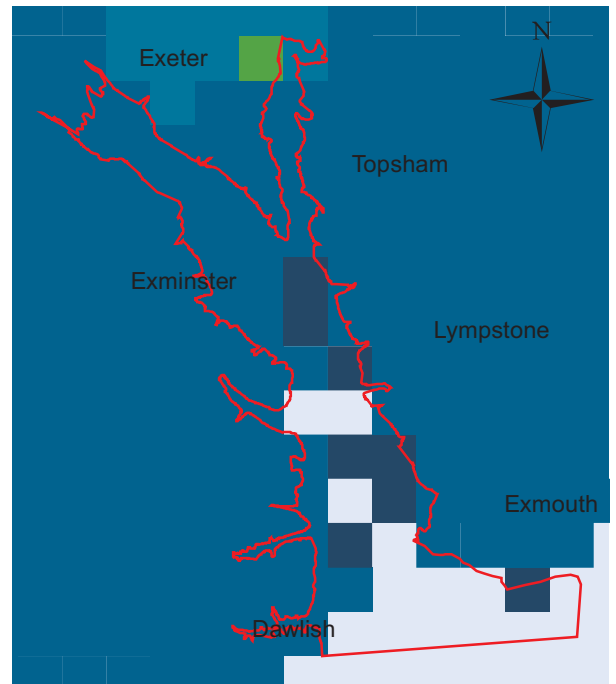


Figure 5a: **Estimated background annual mean air pollutant concentrations 2001 - 2010: Nitrogen Dioxide**
 Source: DCC 2006 background mapping. NAQIA 2001 data. © Crown copyright. All rights reserved. 100019783. 2006

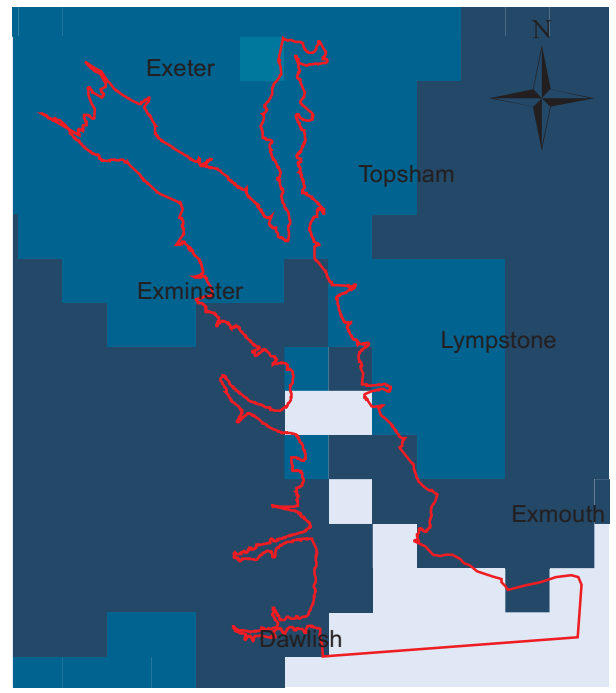


PM₁₀ concentrations:2001



PM₁₀ concentrations:2004

Results from the Local Air Quality Management Programme (DEFRA 2002) start in 1997 and give an estimation of air pollution levels (see figures 5a and 5b). The model used estimates the concentration of nitrogen dioxide and particulates for every square kilometre of Britain. Information from a number of weather stations and field studies has been analysed to provide an idea of air pollution now and in the future. The model assumes that concentrations are consistent over the whole square kilometre.



PM₁₀ concentrations:2010

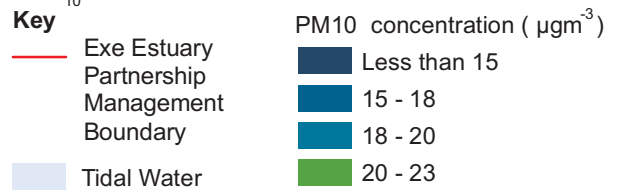


Figure 5b: **Estimated background annual mean air pollutant concentrations 2001 - 2010: PM₁₀**

Source: DCC 2006 background mapping. NAQIA 2001 data

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5.2 Water Quality

Water quality is crucial to the life in and around the Estuary. Poor water quality would affect people and wildlife and generate serious consequences for the local economy. If water quality is threatened, the sectors that are at the highest risk on the Estuary are the shellfish fishery and tourism industry.

To ensure good water quality on the Exe, international, national and local statutory requirements are in place and implemented around the Estuary.

Water Directives



Image 5c: Exe Estuary mussels
Source: Exe Estuary Management Partnership



Image 5d: Sampling sea water
Source: Environment Agency



Image 5e: Bathers at Dawlish Warren
Source: Exe Estuary Management Partnership

Shellfish Waters Directive

The whole of the Exe Estuary has been designated as 'Shellfish Water' under the Surface Water (Shellfish) (Classification) Regulations 1997. The Environment Agency regularly test the quality of the water and the Exe has met the necessary standards since the regulations were implemented in 1997. In addition the shellfish beds of the Estuary are classified under the Food Safety Regulations (MAFF, 1992). Since 1992 Exe shellfish have been classified as 'class B' which means that they can be harvested but must be depurated before consumption. In 2005 one area on the west bank of the Exe achieved 'class A' classification so the shellfish can be eaten with no prior treatment necessary.

EC Bathing Waters Directive

The EC Bathing Waters Directive outlines the legislation relating to the quality of bathing waters in England and Wales. It classifies the quality of water at bathing beaches during the bathing season, monitoring the presence of coliforms and faecal streptococci. The bathing season is between 15 May and 30 September. Water is sampled throughout the season and starts 2 weeks prior to the beginning of the season.

The standards of the Directive are based on the counts of bacteria in the water. The bacteria count must not exceed the Imperative 'I' values, and the Guideline 'G' value is the ideal maximum bacteria count. The grading is assessed as follows:

Grade	Condition
Excellent	Passes Coliform 'G' and Faecal Streptococci standards
Good	Passes Coliform 'I' standards but fails at least one Coliform 'G' standard
Poor	Fails at least one Coliform 'I' standard

Table 5a: EC bathing water standards scheme grades
Source: Environment Agency

Bathing Water Quality around the Exe Estuary

The quality of bathing water at beaches around the Exe Estuary is generally 'good' or 'excellent'. There are 4 designated bathing beaches within the vicinity of the Exe Estuary whose water quality is regularly monitored (see Figure 5c).

The records for each beach are:

Dawlish Town Beach Apart from one occasion in 1996 when it was graded as 'poor', Dawlish Town beach had 'good' quality bathing waters between 1995 and 2001. The bathing water quality is recorded to have increased to 'excellent' from 2002 – 2005.

Dawlish Warren Beach Between 1995 and 2005 the beach at Dawlish Warren has consistently had 'excellent' quality bathing water.

Exmouth Beach Exmouth beach is recorded to have had 'excellent' bathing water quality every year from 1995 to 2005, except in 1999 and 2005 when quality dropped to 'good'.

Sandy Bay From 1995 to 2000 Sandy Bay beach was graded as 'good', but from 2001 to 2005 the bathing water quality has been recorded as 'excellent'.

On 18 January 2006, the European Parliament voted to adopt a revised Bathing Water Directive, which contains improved statutory standards for bathing water quality on Europe's beaches. It replaces the existing Directive, which dates from 1976, with standards that reflect current public health research on water-borne diseases. It will mean better water quality standards on UK and Irish beaches and better public information about coastal pollution. The new Directive will be transposed into UK law by January 2008 and the Government has until 2013 to ensure that all officially designated beaches are compliant.



Figure 5c: **The bathing areas monitored by the Environment Agency**
 Source: DCC 2006 and OS 2006 background mapping. EA 2006 data

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River Quality within the Exe Catchment

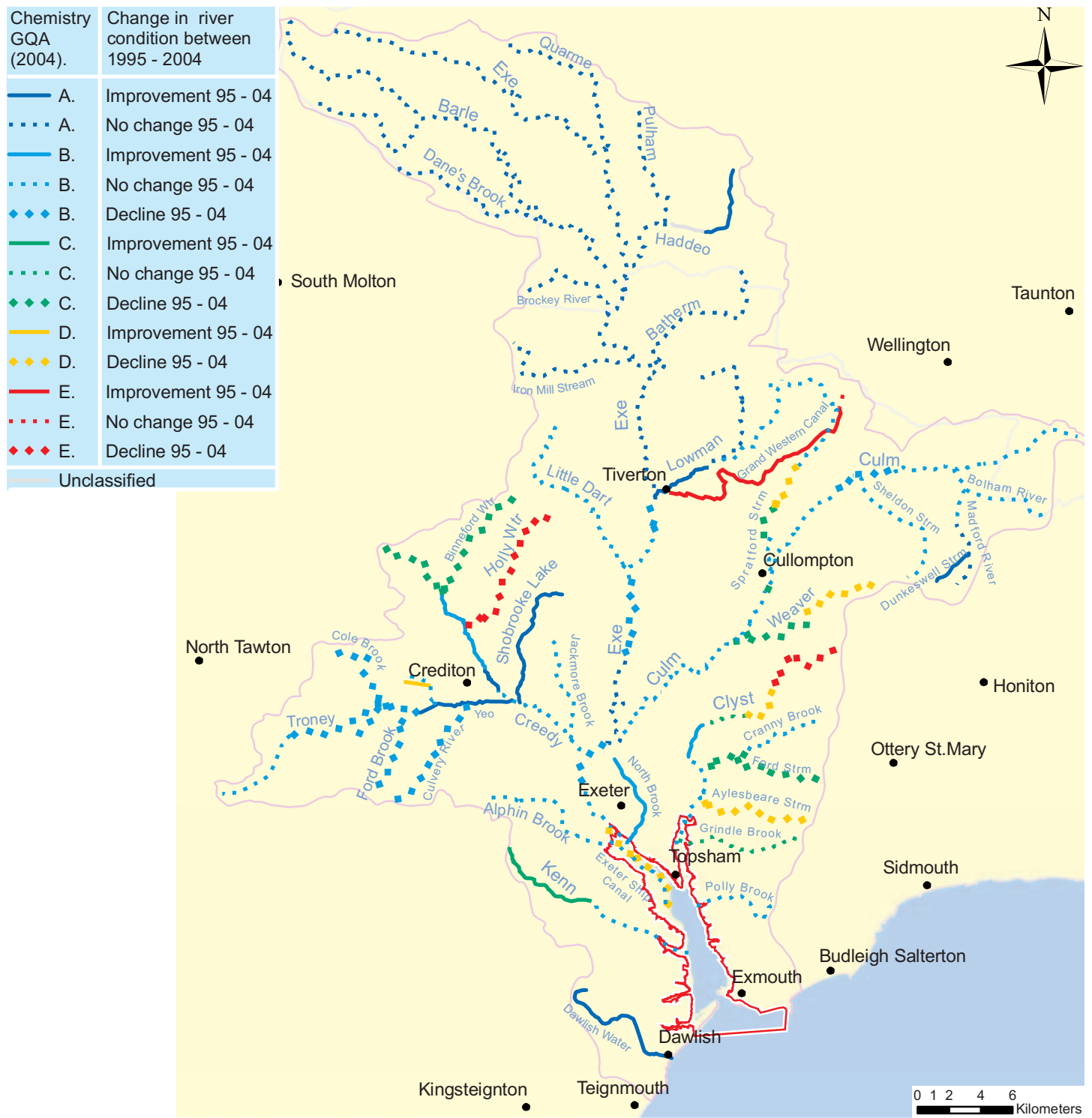
Good water quality within the Estuary can only be achieved if the water quality is also good upstream. The quality of river water within the whole catchment is an essential factor affecting people and wildlife, and monitoring is regularly carried out by the Environment Agency through General Quality Assessments.

General Quality Assessment

The Environment Agency monitors nearly 600km of the River Exe catchment for water quality. Chemical quality is assessed annually and biological quality is assessed every three years. The results of this monitoring are used to classify the quality of these watercourses and to report compliance against water quality requirements of various EC directives. The national classification system used by the Agency, the General Quality Assessment (GQA) scheme, is used to classify rivers and canals into one of six water quality classes using data collected on a rolling three-year basis.

Of the surface waters in the Exe catchment classified by the Agency, the chemical GQA has been graded as fair to very good on most river reaches. A similar pattern can be seen for the biological GQA.

The Agency has also set river quality objectives using a classification system known as the River Ecosystem Classification. Approximately 10% of river reaches are failing their objectives at present. Failures are located on the River Culm and tributaries of the River Clyst to the east of the catchment and a tributary of the River Yeo to the west of the catchment. Discharges from sewage treatment works were improved through the water companies' investment programme for the period 2000 – 2005, known as Asset Management Plan 3. Agricultural runoff is believed to be the primary cause of poor water quality in the Exe catchment (Environment Agency, 2004).



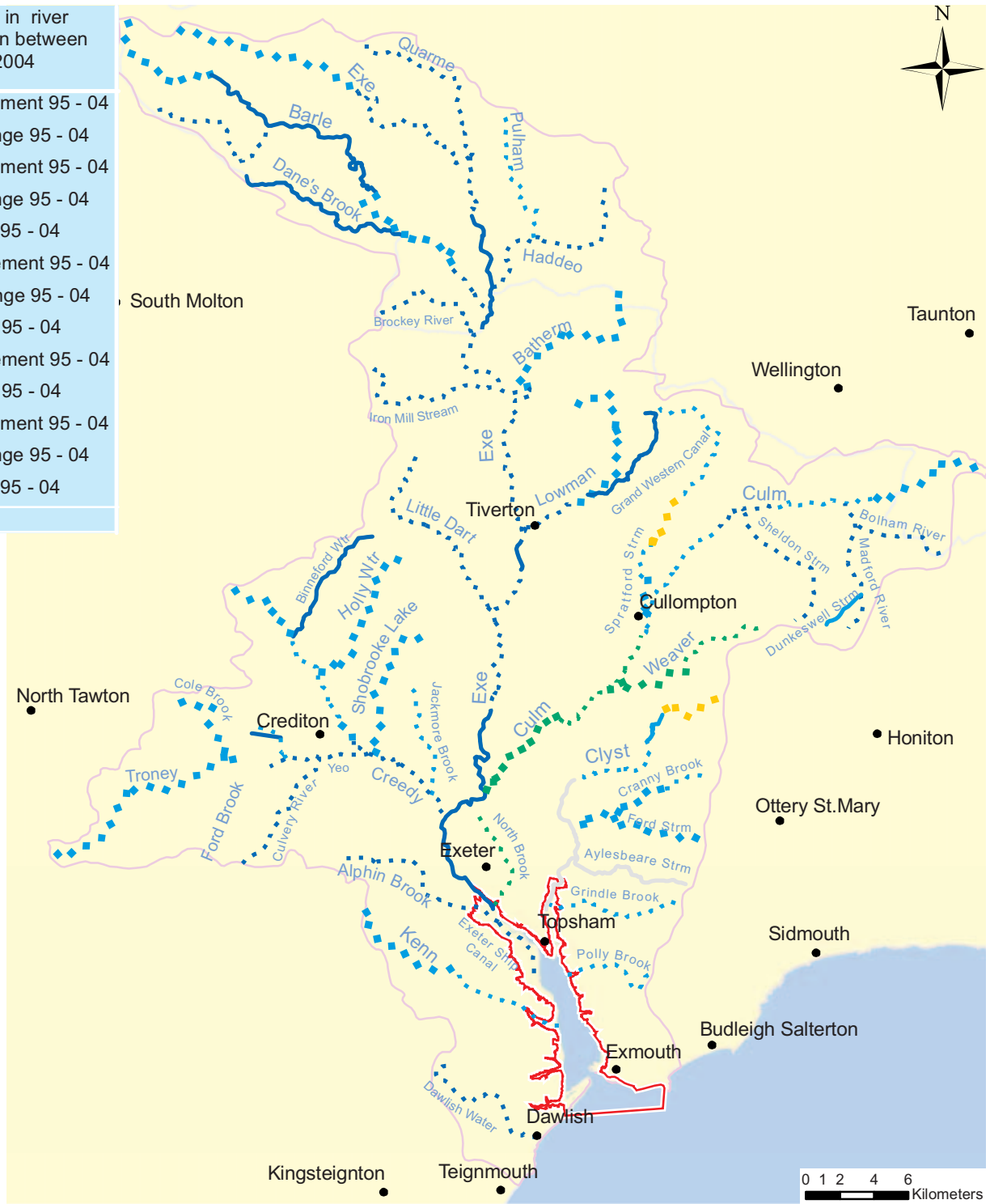
- Key**
- Exe Estuary Partnership Management Boundary
 - Catchment of River Exe
 - Location of Settlement
 - Land
 - Water

Figure 5d: **The chemical quality of rivers within the Exe catchment: current condition and change 1995 - 2004**

Source: DCC 2006 and OS 2006 background mapping, EA 2006 data

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Biology GQA (2004).	Change in river condition between 1995 - 2004
— A.	Improvement 95 - 04
⋯ A.	No change 95 - 04
— B.	Improvement 95 - 04
⋯ B.	No change 95 - 04
◆◆ B.	Decline 95 - 04
— C.	Improvement 95 - 04
⋯ C.	No change 95 - 04
◆◆ C.	Decline 95 - 04
— D.	Improvement 95 - 04
◆◆ D.	Decline 95 - 04
— E.	Improvement 95 - 04
⋯ E.	No change 95 - 04
◆◆ E.	Decline 95 - 04
—	Unclassified



- Key**
- Exe Estuary Partnership Management Boundary
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Figure 5e: **The biological quality of rivers within the Exe catchment: current condition and change 1995 - 2004.**

Source: DCC 2006 and OS 2006 background mapping, EA 2006 data.

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Water Framework Directive

The Water Framework Directive (European Parliament, 2000) requires all inland and coastal waters to reach 'good' status by 2015. It will do this by establishing a river basin district structure within which demanding environmental objectives will be set, including ecological targets for surface waters. Thus recognising the importance of the entire catchment and how this may affect estuarine waters.

Water pollution can be caused by many activities within the catchment and the sources are not always easy to identify. Diffuse pollution from agricultural practices has been shown to have an impact on nitrogen and phosphorous loading.

Nitrogen and Phosphorous Loading

High levels of nitrogen and phosphorous in a waterway can cause excessive plant growth which reduces the oxygen content of the water. When the plant matter decomposes it can cause other organisms to die. This process is called 'eutrophication'. Nitrate pollution is also a concern because it can make water unfit for drinking without additional pre-treatment and can damage the aquatic environment.

Phosphorous enters river and estuarine water through soil erosion and sewage discharge, whilst nitrogen originates from fertiliser application, manure, and atmospheric deposition.

In 1991 Europe adopted the Nitrates Directive (European Commission, 1991). It is an environmental measure designed to reduce water pollution by nitrate from agricultural sources and to prevent such pollution occurring in the future. Under this directive (1991) 55% of the UK, including the River Exe (upper catchment) and the west side of the Exe Estuary, is classified as a 'Nitrate Vulnerable Zone' which means that it is an area of land known to be draining into nitrate polluted waters. Farms located within these Nitrate Vulnerable Zones are required to adhere to an Action Programme of measures to reduce the amount of nitrate lost from their land to the polluted waters.

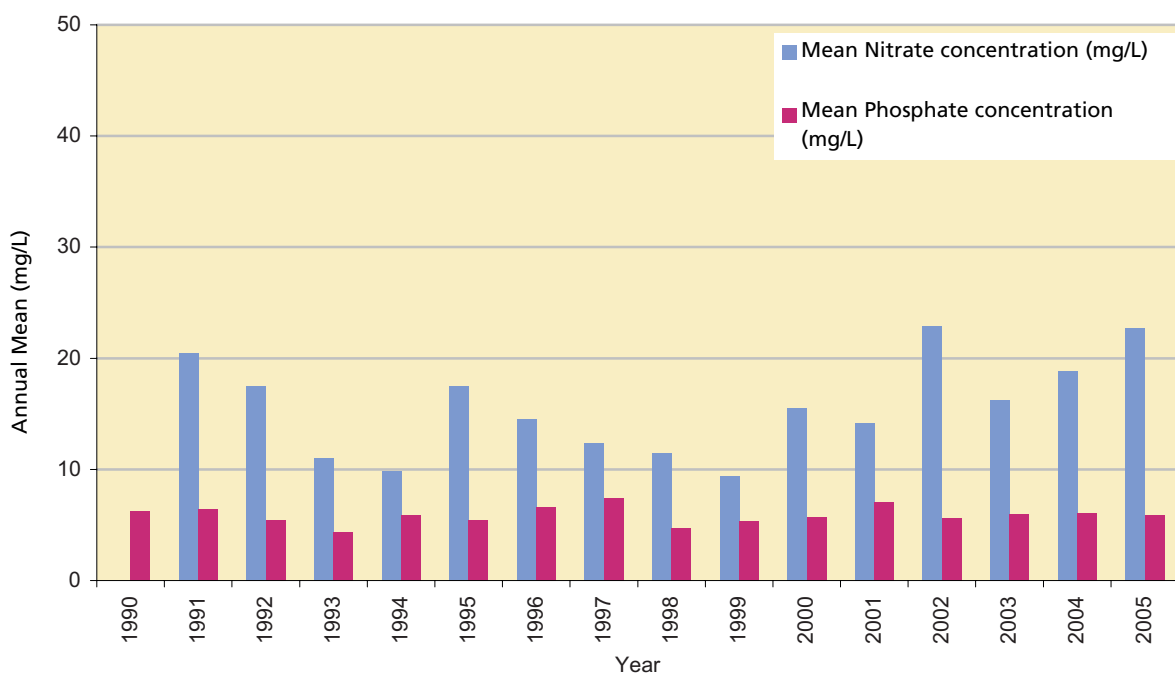


Figure 5f: Nitrate and Phosphate concentrations recorded at Countess Wear on the River Exe (1990-2005)
Source: EA 2006. Data not available for Nitrates in 1990

Pollution Incidents on the Exe Estuary

The Environment Agency responded to a small number of minor pollution incidents on the Exe Estuary in 2005. Most of the incidents consisted of sewage leaks or discharges which exceeded consent limits, but there was one occasion where oil from a damaged pipe entered the Estuary at Exton. In May there was also a 10 gallon diesel spill following the sinking of a trawler near Starcross. All incidents were dealt with and there was no significant environmental damage reported.

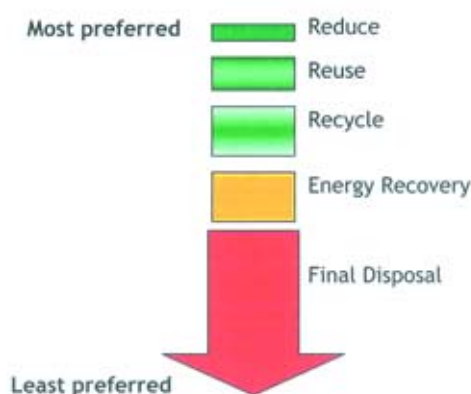
Source: National Incident Reporting System (Exe, 2005), Environment Agency

5.3 Waste Management & Recycling

The Government set statutory performance standards for household waste recycling and composting for 2005 - 2006. Devon has already exceeded its revised target of 30% and in 2004 - 2005 the recycling and composting rate achieved was 33%. This compares favourably with the national rate of 25%. As shown in Figure 5g, recycling rates in all three of the local authorities surrounding the Exe Estuary have been increasing since 2001 and all are now recycling nearly 35% of the total waste produced, which is well above the Devon County's target of 30%.

Kerbside recycling facilities are now available to 90% of Devon's residents and the recycling rate at Recycling Centres is nearly 70%. Large scale composting facilities for kitchen and garden waste are being developed whilst composting at home and in the community are encouraged. With the help of Devon's residents, who are already doing well, a rate of 40% recycling and composting is expected to be achieved by 2005 - 2006 with a target of 50% planned for 2009 - 2010.

Despite these recycling successes, further challenges lie ahead, particularly the need to send less biodegradable waste to landfill. To achieve this aim the growth in waste needs to be stemmed, greater participation in recycling schemes is required and more waste needs to be composted. The 'Don't let Devon go to Waste' campaign has raised awareness of waste issues resulting in zero growth in waste for 2 years. Since 2002 Teignbridge District Council has consistently reduced the total amount of waste produced, whilst East Devon District Council and Exeter City Council's waste production have not varied a lot in the same time span (see Figure 5h).



Under DEFRA's Waste Strategy (2000b) the 'Waste Hierarchy' became the guide for planning authorities on assessing the Best Practicable Environmental Option, which aims to ensure that the environmental benefits of a system outweigh the costs of initiating and operating that system. Figure 5i shows the steps of the waste hierarchy, the aim being to increase the proportion of waste which is managed by options towards the top of the hierarchy (i.e. reduction).

Figure 5i: The Waste Hierarchy

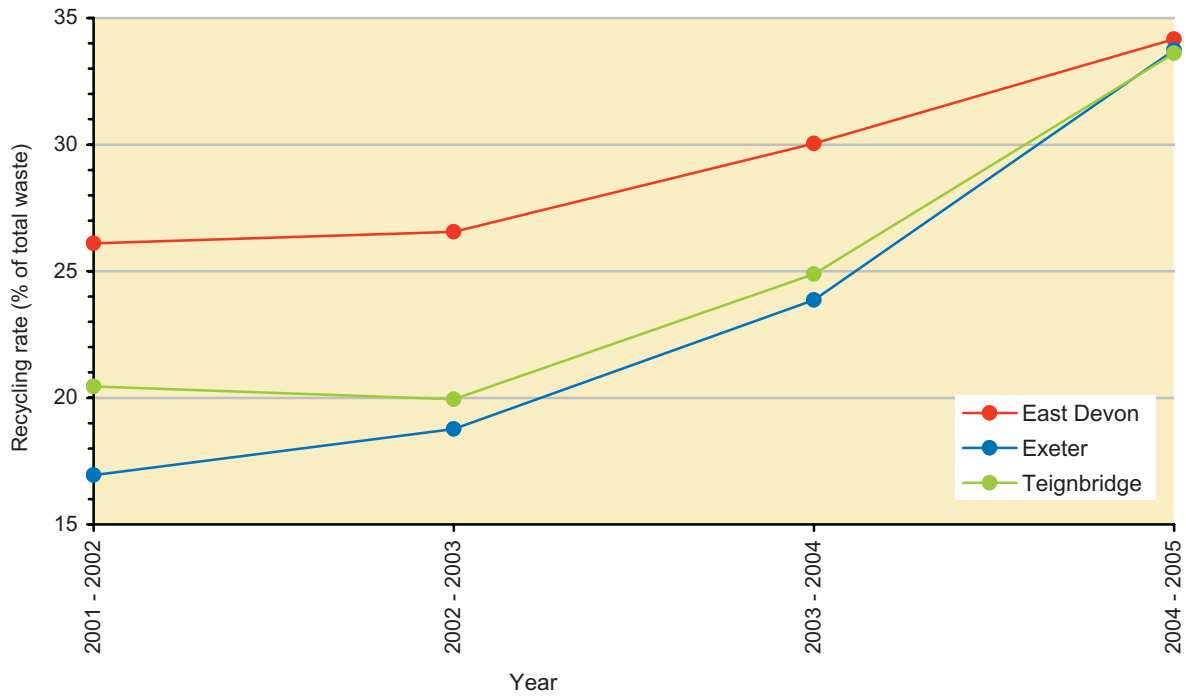


Figure 5g: District level changes in the volume of household waste arising: 2001-2005
Source: DCC 2006

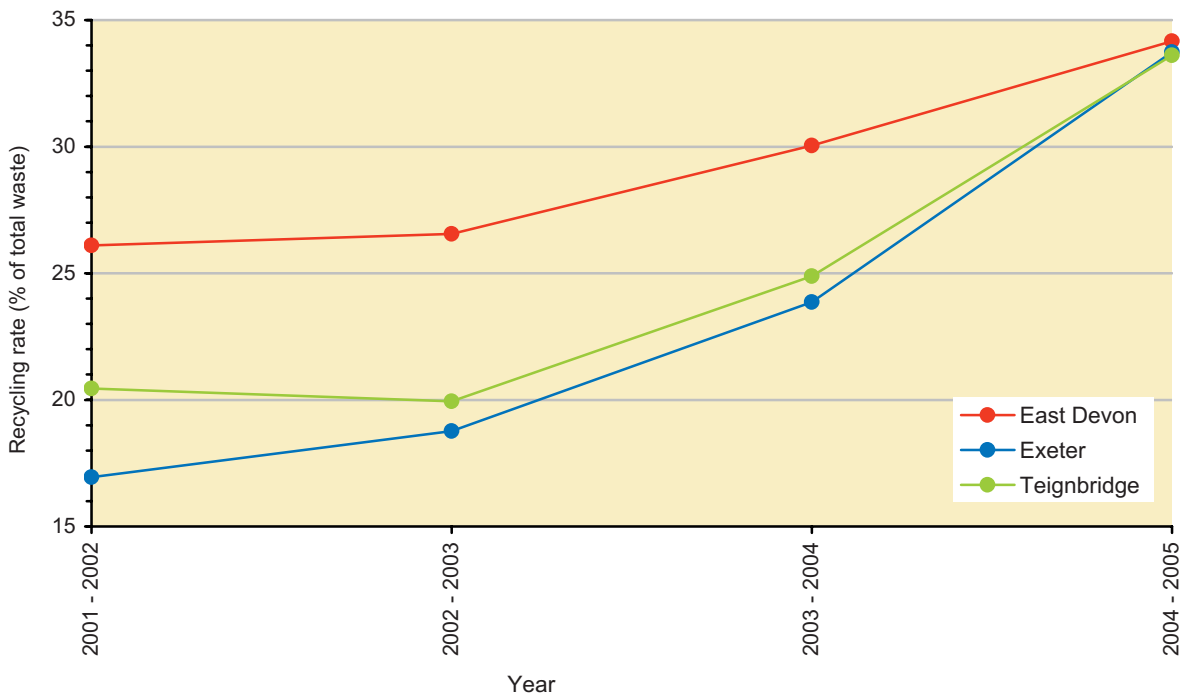


Figure 5h: District level changes in the proportion of household waste that is recycled: 2001-2005
Source: DCC 2006

Waste Management and Recycling on the Exe Estuary

Local Councils are responsible for providing bottle banks and recycling points in their area and, around the Estuary, there are recycling facilities at Exmouth, Lympstone, Topsham, Exminster, Starcross and Dawlish Warren.

There are a number of small litter bins and dog bins around the Exe. The provision and maintenance of these bins is also the responsibility of the relevant District Council.

There are facilities for the disposal of glass and oil at Exmouth Dock, Topsham, Trout's Boat Yard, Retreat Boatyard, and Exeter Quay. The Environment Agency is responsible for managing commercial waste and fly-tipping. Individual sailing clubs have been encouraged to provide facilities for boat owners to dispose of the rubbish that they bring ashore.

Litter around the Exe Estuary



Image 5f: **Rubbish on the mudflats at Exmouth**
Source: Exe Estuary Management Partnership



Image 5g: **Plastic bottles littering the Exe near Exeter Quay**
Source: Exe Estuary Management Partnership

The presence of plastic and non-biodegradable materials on the shores of the Exe is an eyesore and can pose a danger to people and wildlife. Litter arrives on the shoreline from a variety of sources including, down the river and from out to sea. At a one-day beach clean event on Dawlish Warren, 8 volunteers cleaned 1890m of beach recording an average of 1.4 items of litter per kilometre surveyed (Marine Conservation Society, *pers. comm.*, 2006).

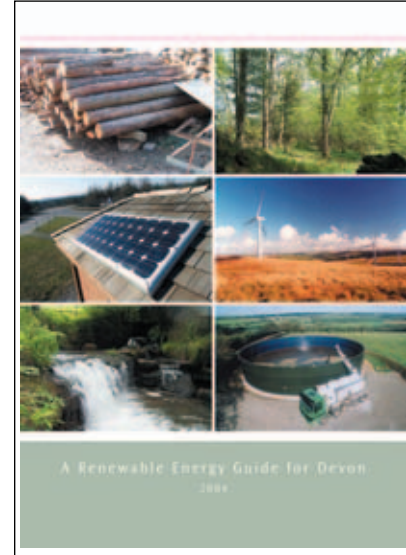
Local shoreline clean up events occur regularly around the Exe Estuary at Topsham, Exton, Exmouth and Dawlish Warren. A team of divers from Exmouth also organise underwater clean ups. The Marine Conservation Society collects the results of beach cleans from around the country and is working to reduce the amount of litter on our coastline by identifying and tackling the sources of the litter.

5.4 Renewable Energy

Devon Renewable Energy Strategy

The Devon Strategic Partnership (2003) launched a Renewable Energy Draft Action Plan in 2004 which detail relevant actions to be completed by 2007.

The "Renewable Energy Guide for Devon" (Devon County Council, 2004) is a complete guide to renewable energy for land-based industries in Devon. It suggests ways to become part of the growing renewable energy revolution in the UK and gives practical guidance on the technology and the economics involved. The guide encourages readers to invest in renewable sources now because of the current range of grant, subsidy and investment programmes now available for renewable energy developers. It also gives examples of small scale renewable energy initiatives in Devon.



Renewable Energy within the Exe Estuary Partnership Management Boundary



The potential for big scale renewable energy like wind turbines does not exist on the Exe Estuary, but there may be scope for small scale, domestic or commercial generation of renewable energy. At present there are no significant examples of renewable energy generation being practised on the Exe, but solar energy could be used to run outdoor, public facilities e.g. parking meters. Using renewable sources to generate energy would not only reduce the environmental impact of daily life on the Estuary, but could also bring financial savings and benefits in the form of grants available for individuals or businesses pursuing renewable energy generation.

Image 5i: **Solar panels on a house in Exton**
Source: Exe Estuary Management Partnership