Drought prospects for winter and spring 2011/12

Report – GEHO1111BVBT-E-E

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Executive summary

Dry weather and drought continue to affect central and eastern England, with extremely low river flows and dry soils in an area stretching from east Gloucestershire, Oxfordshire and Shropshire across the east Midlands into Bedfordshire, Cambridgeshire and west Norfolk as well as Kent and East Sussex. In the Midlands it has been the driest 12 month period from October to September since records began in 1910. Some parts of south Yorkshire and south west England also have low flows for the time of year, mainly as a result of low groundwater levels. Wales and northern England are within normal ranges for resources for this time of year.

Without sustained rainfall, groundwater levels will continue to decline in east, south west, south east and central England. We expect the decline to continue until substantial rainfall infiltrates the very dry soils in these areas and starts to replenish groundwater resources. We would normally expect groundwater levels to start increasing in the autumn but the lack of rainfall this autumn will delay this winter's recharge.

The dry weather in 2011 has affected most of southern, central and eastern England. Impacts included a higher than average number of environmental incidents such as fish rescues and algal blooms, reduced cereal and potato yields, wildfires affecting valuable habitats, navigation restrictions and water companies making additional efforts on leakage reduction and working with their customers to use water wisely. There were some positive effects too especially from the warm sunny spring, with good soft fruit crops and early potato harvests.

If rainfall over the rest of autumn and winter is below average, then the band of central and eastern England that has experienced the driest weather over the last year is at high risk of drought impacts on all sectors next spring and summer. South east England is also at a high risk of drought next year due to the continued low rainfall totals in autumn across the region. Impacts across these areas could include significant effects on the environment and habitats, agriculture, navigation and more drought permits and the possibility of customer restrictions on public supplies. In these areas, even with average rainfall over the winter and spring, there is unlikely to be a full recovery from drought conditions during 2012.

The remaining parts of south west, central and eastern England are at moderate risk whilst for the rest of England and Wales the risk of impacts from drought in spring and summer in 2012 is no higher than normal.

We are continuing to work with partners across all sectors, planning ahead to mitigate potential impacts, regularly reassess the situation and risks, and implement actions from the May drought summit and subsequent meetings.

It is too early to fully assess the risks for next summer, however the risks for 2012 are rising with every additional week of dry weather. We will continue to monitor the water resource situation, and report again in late winter if rainfall continues to be below average.

Acknowledgements

We would like to thank the following organisations that have contributed to preparing this document:

- British Waterways
- Defra
- Met Office
- National Farmer's Union
- Natural England
- UK Irrigation Association
- Water companies
- Water UK

Contents

1 Current situation

Dry weather and drought continue to affect central and eastern England, and now south east England. Extremely low river flows and dry soils are affecting an area stretching from east Gloucestershire, Oxfordshire and Shropshire across the east Midlands into Bedfordshire, Cambridgeshire and west Norfolk as well as Kent and East Sussex.

Some parts of south Yorkshire and south west England also have low flows for the time of year, mainly as a result of low groundwater levels. Wales and northern England are within normal ranges for resources for this time of year.

1.1 How did this position arise?

A relatively dry winter followed by a very dry spring dried out the soil and caused river flows to drop earlier than usual. Last winter (December to February) England and Wales received 84 percent of the 1961-1990 average rainfall and spring 2011 (March to May) was the equal driest spring (with 1990) across England and Wales in the last 100 years. Most areas saw less than 50 percent of average rainfall and much of East Anglia and Kent only 30 percent or less.[1]

Despite a cool summer, not everywhere was wet. A large area of central England from the Welsh borders to the Wash remained dry with around 70 percent of the average rainfall, or less. The dry conditions eased slightly in the southern counties of England with above average rainfall during summer 2011 (June to August). Autumn though has seen a return to dry conditions, particularly in East Anglia, south east England and central England (Figure 1.0)

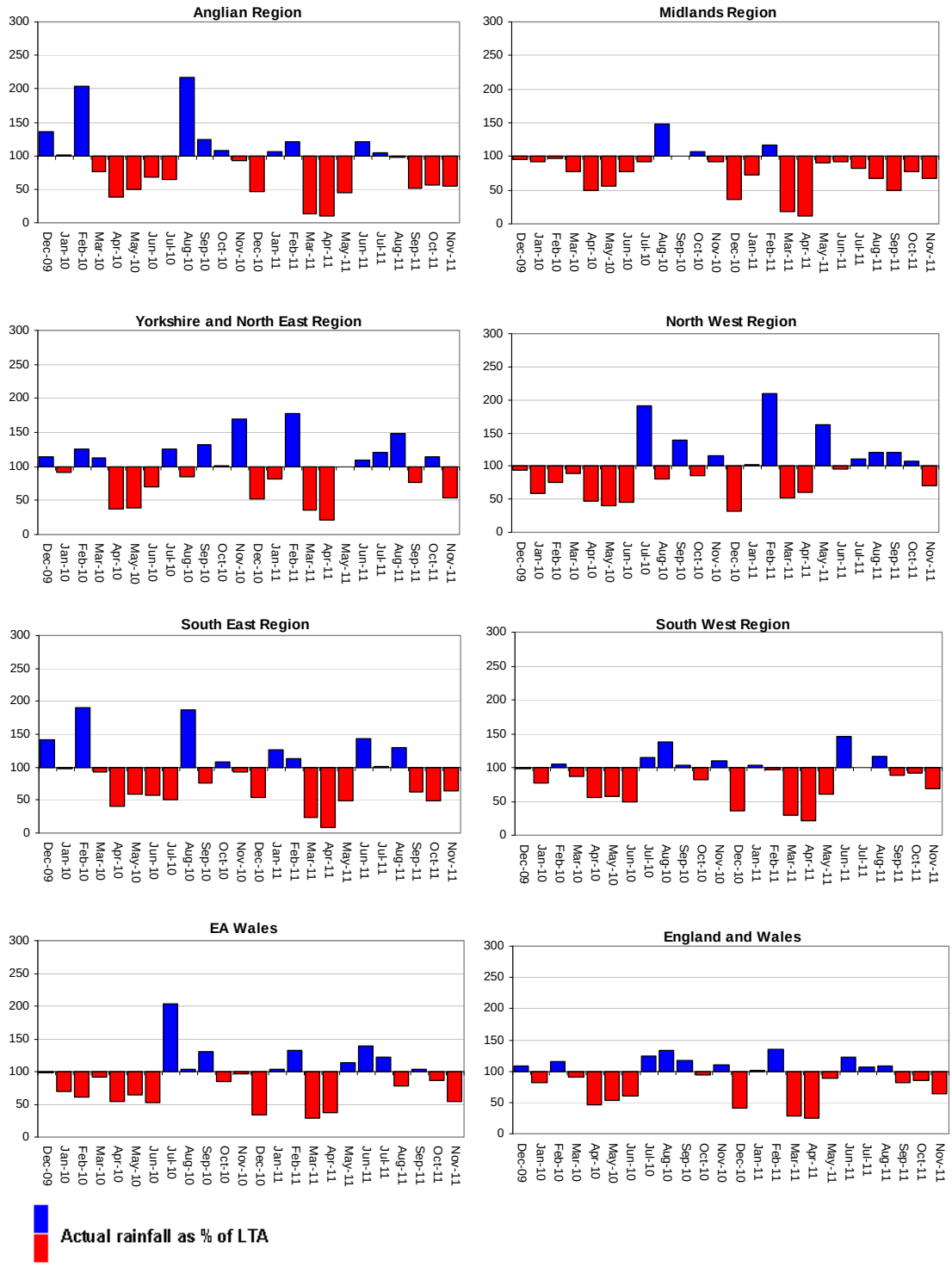
Groundwater recharge and reservoir refills have been delayed in central, south east and eastern England with provisionally only between 54 and 64 percent of the average rainfall in the autumn period (September to November (Figure 1.0). Groundwater levels continue to fall in many areas including east, south west, south east and central England. We expect the decline to continue until we see some substantial rainfall which will soak through the very dry soils in these areas and start to replenish groundwater resources. We would normally expect groundwater levels to start increasing from late October onwards.

In the Midlands, October 2010 to October 2011 overall rainfall totals were between 60 percent and 70 percent of the long term average (LTA) (Figure 2.0), making this the driest 13 months on record. The driest counties were Shropshire, Staffordshire, Worcestershire, Herefordshire, and parts of Derbyshire, Leicestershire, and Northamptonshire. The last month with average rainfall was February 2011, but only in the north of the region. The rainfall deficits across the Midlands had already begun with above average rainfall during only four of the last 25 months.

In our Anglian region, the Upper Welland and Nene catchments in Northamptonshire received the second lowest 13 month rainfall totals (October 2010 to October 2011) on record second only to 1921.

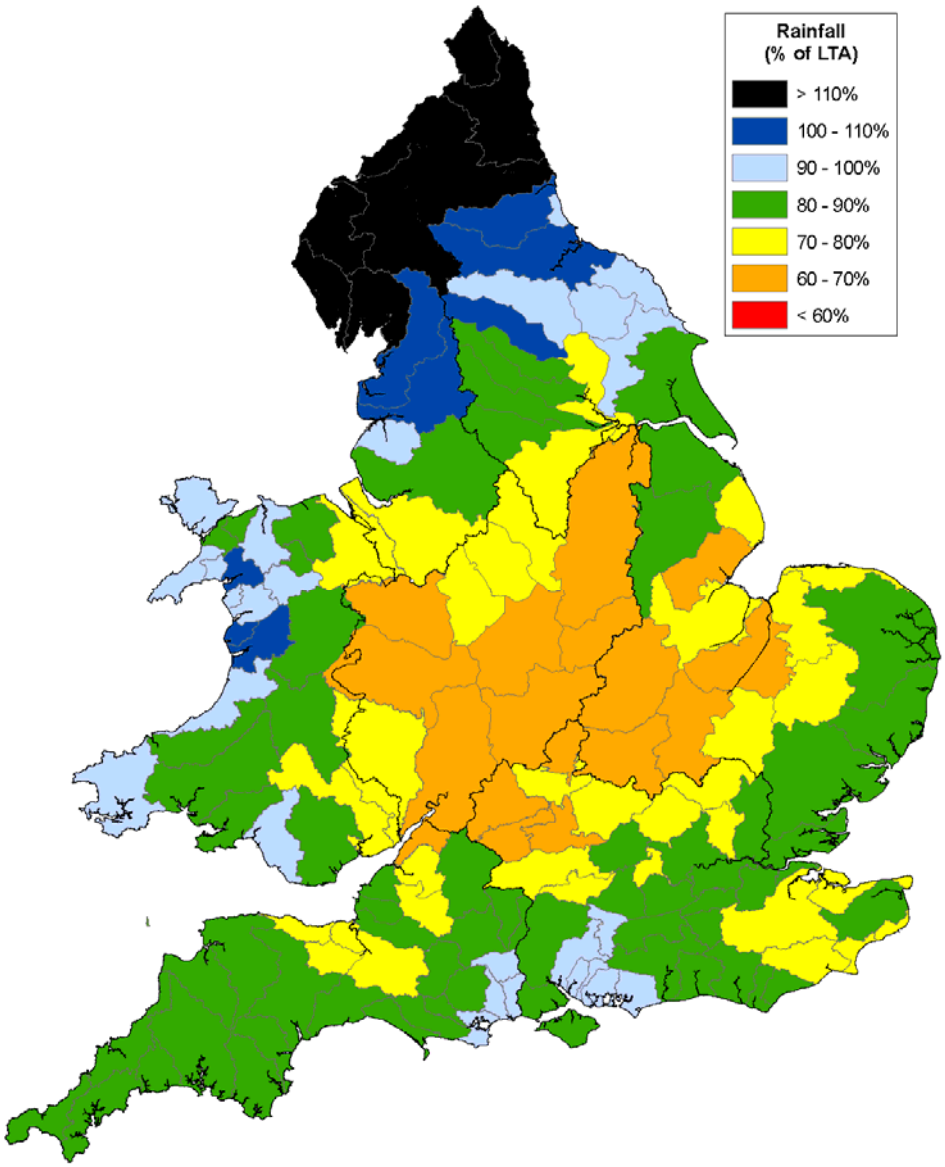
[1] Assessment provided by National Climate and Information Centre, Met Office © Crown Copyright

Figure 1.0 Monthly rainfall totals for the past 24 months as a percentage of the 1961 – 1990 long term average for each Environment Agency Region and for England and Wales[2]



[2] NCIC (National Climate Information Centre) data. (Source: Met Office © Crown Copyright). Values for November 2011 are derived from actual totals up to 22 November and forecast totals for 23 - 30 November.

Figure 2.0 – Cumulative rainfall for October 2010 to October 2011 for hydrological areas across England and Wales[3].



1.2 What are the impacts of this drought?

With the help of other organisations, we have monitored the drought across the country and recorded impacts on water resources, wildlife and habitats and on those who use the water environment.

[3] Classed as a percentage of the 1961-90 long term average. Final and provisional NCIC (National Climate Information Centre) data based on the Met Office 5km gridded rainfall dataset derived from rain gauges (Source: Met Office © Crown Copyright). Crown copyright. All rights reserved. Environment Agency, 100026380, 2011.

Our officers report drought incidents relating to water availability and water quality and the public inform us through our national hotline. The number of dry weather-related incidents such as algal blooms, fish kills or dried up streams recorded across the country for April to September 2011 (Figure 3.0) shows that the Midlands was hardest hit. The North West had none but we expected this because it has not been affected by the dry weather. Not all incidents will have been reported so this is only a broad view across England and Wales and many more may be unnoticeable in the short term but affect local populations of wildlife.

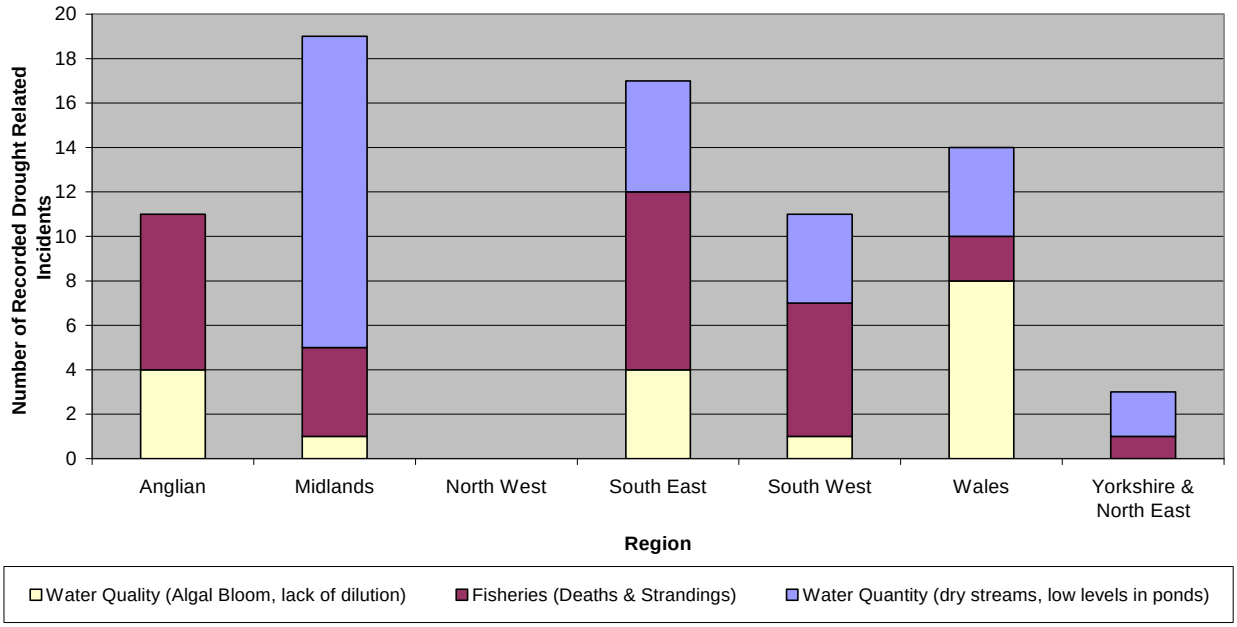
Water availability

Lack of rainfall has reduced the amount of water in rivers and lakes and the amount of water that reaches aquifers, which means water levels and flows have dropped. Some water bodies have dried up completely or disappeared into the river bed for a stretch before they re-emerge downstream, such as a stretch of the River Dore at Peterchurch in Herefordshire which dried up in early September. Many streams dry up naturally and this year more streams have dried up and done so earlier than usual, as occurred in the Lincolnshire Wolds.

Water Quality

Low water levels with high temperatures can cause algal blooms in ponds, lakes and some estuaries, especially when there are high nutrient levels. This summer, these factors have led to some water quality problems which have affected wildlife but also recreation uses, with risks to public health. We responded quickly to these incidents and our actions helped to reduce their impact. The blooms appeared earlier and in greater numbers because of the dry and bright spring conditions, but the relatively cool summer helped to limit the extent of the problem.

Figure 3.0 - Recorded drought related incidents in England and Wales during April to September 2011[4]



[4] Data from Environment Agency National Incident Recording System 2011 based on type of incident (not size or scale of incident).

Ecological indicators

The invertebrate ecology of a river can be an indicator of drought and of recovery from drought. The Centre for Ecology and Hydrology (CEH) did a provisional analysis of 16 catchments across our Anglian, Midlands, South West and South East regions to assess the ecological response to reduced spring and summer river flows this year. They used macro-invertebrate data from this spring and autumn alongside long-term ecology and flow information to assess the current impact. Initial results show a downward trend in the rivers' ecological quality, though for most catchments this was less than the decline in 1996 and/or 2003. This was probably because river flows in summer 2011 were slightly higher and temperatures were comparably low for the season. Rivers which showed the most marked declines include the River Piddle in Dorset, the River Chater in Leicestershire and the River Creedy in Devon. The CEH will do a wider analysis once the full autumn data is available.

Fish and wildlife

Fish are often most vulnerable during dry hot weather. This year, some fish populations have become overcrowded or stranded because of low water levels in some areas. High temperatures cause drops in water oxygen levels and in these conditions, fish are vulnerable to predators, stress, disease and death. Some of these effects are normal as streams and ponds dry naturally. However, the dry conditions have made the problem worse and we have had to take action sooner and in more places to aerate waters and rescue fish where it was practical (for example River Lathkill in Derbyshire and River Slea in Lincolnshire).

The early dry spring exposed the salmon rivers of southern Wales to unusually low water levels. This may have affected smolt runs exposing them to higher predation and losses. Fisheries on these rivers also suffered with late starts to the salmon runs and poor fishing in the sluggish flows and bright conditions. Similarly the chalk streams of southern and eastern England had poor Ranunculus growth due to low flows. Important for their habitat and retention of water levels, these rivers exhibited some very poor conditions for their fish and plant species.

Impacts on habitats will have constrained juvenile salmon production, particularly in rivers with mixed trout /salmon zones. The low summer flows meant returning adult salmon and sea trout may not have entered river fisheries during much of the fishing season, further impacting on the fisheries and the economic activity they support.

The low flows and localised events of strong growth of surface weed cover on slow flowing watercourses was more widespread and occurred earlier in the year. Dips in oxygen levels under these conditions may have led to many undetected localised fish losses for some fishery owners. However, elsewhere and in the majority of these waters, the warmer temperatures and favourable feeding conditions will have helped coarse fish to flourish.

The dry weather in the spring had an impact on breeding for birds and amphibians. Natural England highlighted some examples where it affected habitats. Some of the impacts recorded this year will probably be short-term unless the dry conditions continue.

- Breeding ponds for Natterjack toads on some sites dried up during the spring, so site staff moved some tadpoles and artificially topped up some ponds (for example, Holkham NNR; Saltfleetby and Theddlethorpe Dunes NNR).

- Wetland habitat partially dried up at some sites, in some cases water level management was able to reduce the impact of the dry conditions.
- Dry ground made it difficult for some bird species (for example, waders) to probe for food.

While some species have suffered this year, there are records of others doing well thanks to the dry conditions. For example Herts and Middlesex Wildlife Trust recorded the earliest chick ever hatched by the only pair of black necked-grebes in the county.

The hot, dry spring brought such dry conditions that fire was a significant risk. During the spring and summer 85 damaging fires were reported, affecting 3,045ha of land. On Upton Heath Site of Special Scientific Interest (SSSI) in Dorset, a fire in June damaged about a third of the heath and affected many species.

Initial reports do not suggest there has been any significant long term damage to habitats from fire, but this may not be measured until the 2012 breeding season.

Waterways

The Leeds and Liverpool Canal and the Oxford and Grand Union Canal have experienced particular problems during the main 2011 boating season. The restrictions that were put in place on the Leeds and Liverpool Canal in the early part of the boating season, due to the exceptionally dry spring, were lifted in late July. Rainfall in the summer and early autumn helped to refill the reservoir group feeding the canal. The reservoirs and surface water feeders supplying the Oxford and Grand Union Canals were hit hard by the exceptionally dry spring and the localised rainfall shortage in the Midlands this year. Some of the boating restrictions put in place in late August are still in force to conserve remaining reservoir resources and protect the aquatic environment. More recently British Waterways closed a section of the Kennet and Avon canal in Wiltshire on 17 November until further notice due to lack of water supplies resulting from the low groundwater levels in the area.

Agriculture

The prolonged dry weather in the spring helped demand and production of soft fruit and vegetable and potato planting. The agriculture community were worried that the dry weather would affect arable crops, but fortunately the summer rainfall helped and resulted in the overall harvest yield being better than expected. However the national figure does hide some serious drought impacts affecting producers in certain areas. Among those most affected were those growing non-irrigated crops on sandy or light soils in southern and eastern England where some crops were lost, arable yields were, in certain cases as low as two tons per acre and some grass yields significantly reduced. The reduction in yield is leading to fears from livestock farmers about potential increased food and bedding costs this winter.

Low flows reduced the volume of water available for abstractions this year. Many licence holders reached their flow conditions earlier than normal or for prolonged periods. Parts of the central Fens and central Midlands were affected by higher abstraction restrictions than in normal dry years. We were flexible in our approach to allow winter only abstractors to apply to vary their licences to take advantage of high flows before 1 November 2011 when their abstraction season starts. Some farmers have had to irrigate to lift root crops from dry soils this autumn. We also fast tracked abstraction licence changes where possible to help them. As we move into December, in many areas of Anglian region flows will be below prescribed abstraction licence levels meaning farmers may not be able to abstract to fill winter reservoirs.

Public water supply

The cooler and wetter summer for most of the country led to lower demand for most water companies. Their water supplies were not fully stretched and the summer rainfall helped to maintain supplies which meant they did not have to put restrictions on any of their customers or apply for drought orders and permits.

Some water companies (Anglian Water and Severn Trent Water) did use their drought plans after approaching or reaching their initial drought warning zones. They targeted their communications to promote water-saving messages. As part of its plan, Severn Trent Water switched supplies from one of its reservoirs to groundwater sources early on to protect supplies. Other companies proactively promoted water efficiency to their customers during the dry weather as part of their longer-term strategies. After a harsh winter, some companies made more effort to reduce and control leaks.

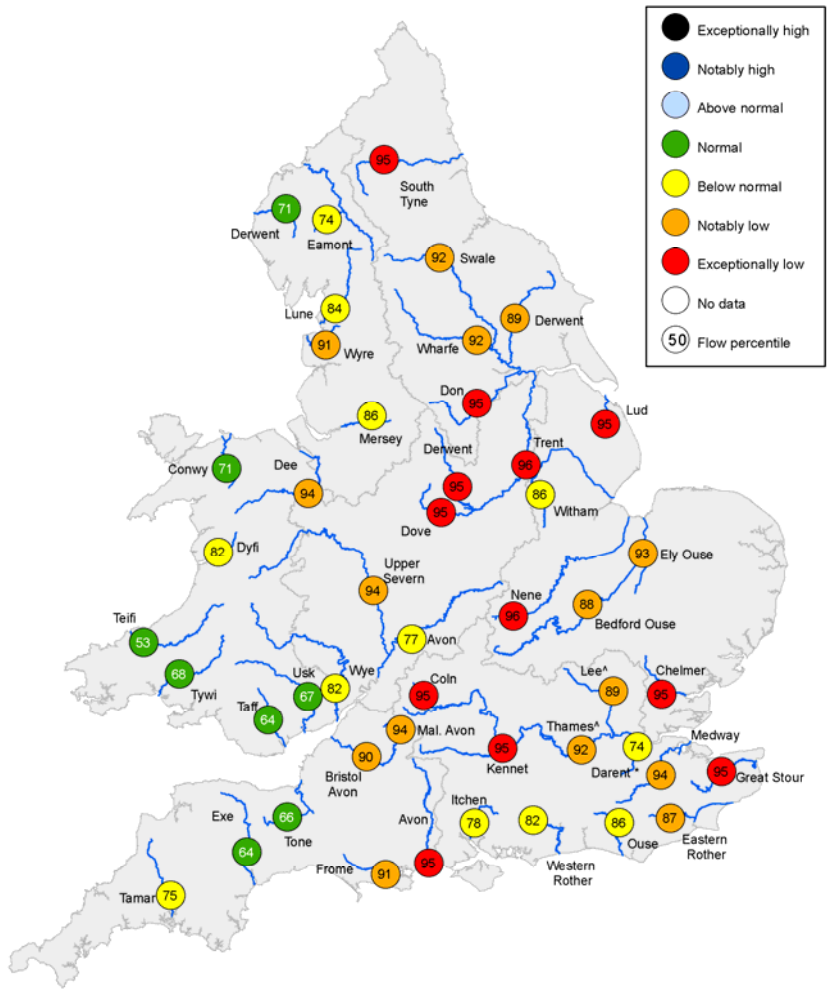
1.3 Current water resources situation

The current water resources situation for England and Wales is mixed, with a strong north, western and south eastern split of resource position.

River flows

Despite rainfall during the summer the autumn has been very dry, river flows are still very low in some parts of the country, particularly in catchments where groundwater supports river flows. We are starting to see some rivers nearing their lowest ever recorded flows for November. These include the Coln at Bibury (Cotswolds), Nene at Northampton, Trent at North Muskham (Nottinghamshire) and the Kennet at Theale (west Berkshire). Throughout central, eastern and south east England there are numerous rivers which have exceptionally low flows for the time of year. (Figure 4.0).

Figure 4.0 – Latest daily mean river flow for 22nd November expressed as a percentile and classed relative to an analysis of historic daily mean flows for the same time of year (Source: Environment Agency)[5]



[5] Flow percentiles describe the percentage of time that a particular flow has been equalled or exceeded compared to the historic flow record for that site for the time of year. For example, a flow percentile of 5 indicates that the current flow has only been equalled or exceeded approximately 5% of the time within the historic record for that time of year – i.e. a very high flow. A flow percentile of 95 indicates that the current flow has been equalled or exceeded approximately 95% of the time – i.e. a low flow. Flow percentiles presented relate to an analysis for the time of year and not a whole yea

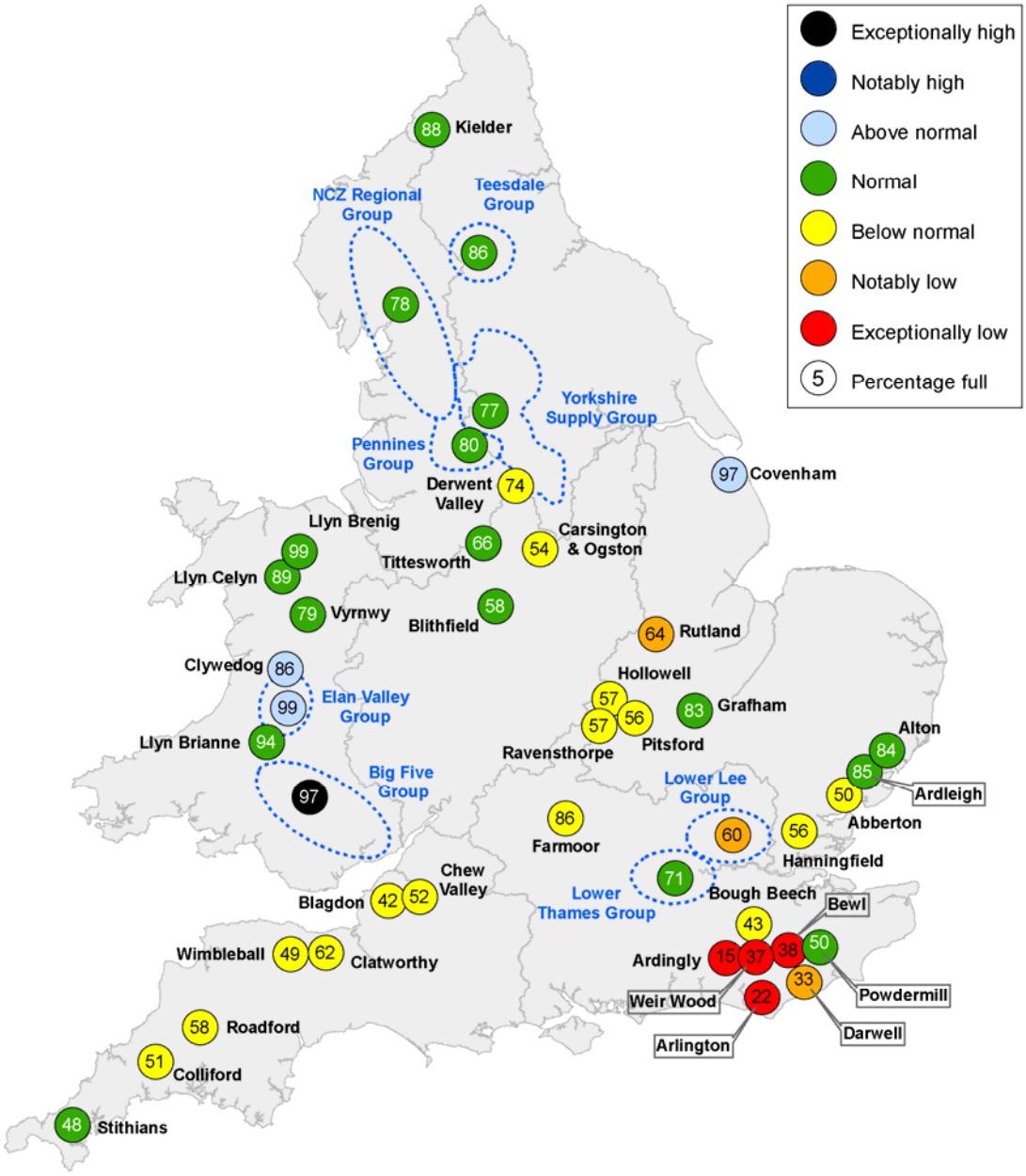
^ – 'Naturalised' flows are provided for the Thames at Kingston and the Lee at Feildes Weir.

Reservoirs

Reservoirs store water in winter to use in the summer. Reservoir storage to supply the public has fallen in areas affected since we last reported, as expected, but less than it would have done if the summer been hot and dry.

Nearing the end of November, storage in reservoirs in Wales and northern England is normal or above normal for the time of year, reflecting the wetter conditions in these areas during the autumn. Elsewhere, a number of reservoirs are within their normal range for this time in November though some are exceptionally low or r for the time of year such as Weir Wood, Ardingly and Arlington Reservoirs in East Sussex and Bewl Reservoir in Kent (Figure 5.0).

Figure 5.0 - Reservoir stocks at key individual and groups of reservoirs for the week ending 22 November, as a percentage of capacity and classed relative to an analysis of historic values for the same time of year[6]



[6] (Source: Water Companies).Note: Classes shown may not necessarily relate to control curves or triggers for drought actions. As well as for public water supply, some reservoirs are drawn down to provide flood storage, river compensation flows or for reservoir safety inspections. In some cases current reservoir operating rules may differ from historic ones

The level at Abberton Reservoir in Anglian Region is affected by ongoing engineering works to increase capacity by 60% - works are expected to be complete by the end of 2013. All rights reserved. Environment Agency, 100026380, 2011

Revised figure for Ardingly Reservoir and Arlington Reservoir in South East Region provided by South East Water.

Farmers have also had to use their stored water from on-farm reservoirs. Water companies and farmers plan to refill their reservoirs during the winter, relying on increased winter river flows. This is covered in section 3.

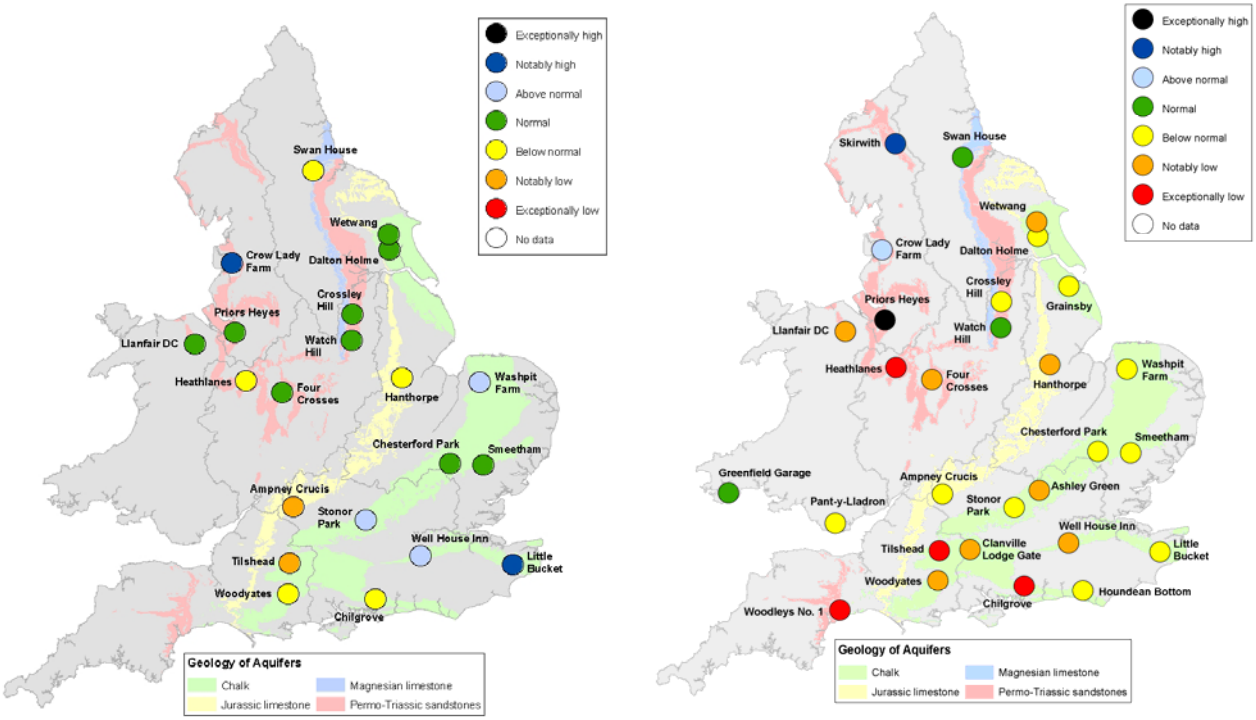
Groundwater

We reported in June, that the very dry weather in March stopped the recharge season earlier than normal in many areas. Since then, groundwater levels have fallen throughout the summer and autumn. Levels in the chalk and limestone aquifers in eastern England are generally below normal for the time of year. Further south in the Chilterns, parts of the North and South Downs and Salisbury Plain, levels in many aquifers are now notably or exceptionally low for the time of year.

Groundwater levels in the West Midlands' (Permo-Triassic) sandstones continued to decline throughout 2011 and are now low for the time of year in the Staffordshire Trent valley and Shropshire middle Severn sandstone. Some domestic private wells have dried up in the south Shropshire and North Herefordshire area. Levels in the Otter sandstone in Devon are exceptionally low.

Figure 6.0 shows that groundwater levels are at a lower starting position at the end of October compared to the same time of year during the 1975/76 drought.

Figure 6.0 – Groundwater levels for indicator sites at the end of October 1975 (left) compared to the end of October 2011 (right)[7],



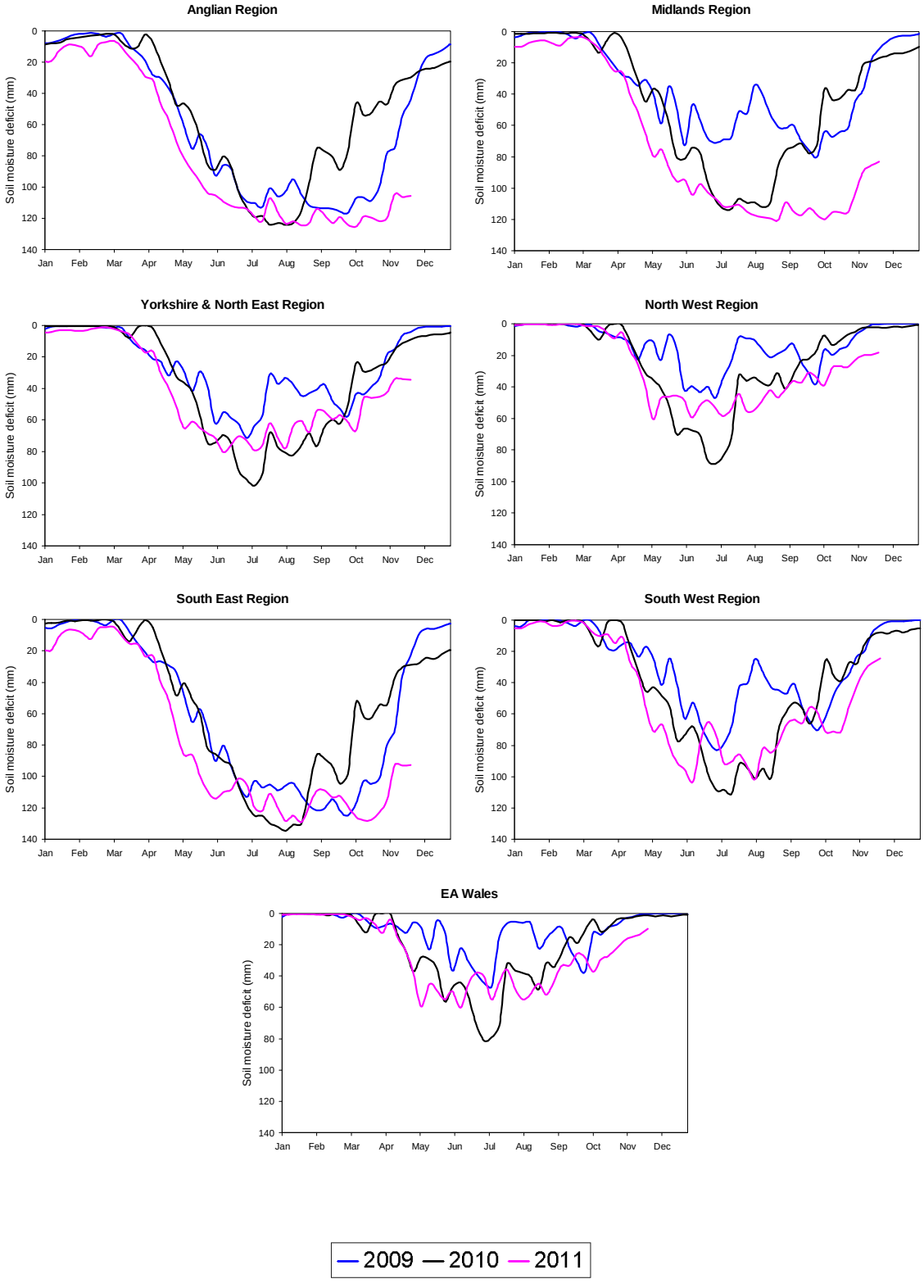
[7] Classed relative to an analysis of historic October levels (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Note: groundwater levels are reported at different times during the month and therefore may not be fully representative of levels at the month end. Crown copyright. All rights reserved. Environment Agency, 100026380, 2011

Soil moisture

We use soil moisture deficits (SMDs) as an indicator of how dry the soils are. SMDs usually return to values close to or at zero in the autumn as the soils wet up after the summer period. Due to the warm and dry spring, soils became very dry and SMDs climbed to record levels by the end of May. The rainfall and cooler weather helped to stop this from rising much further over the summer. The drier and warmer weather through the autumn means that SMDs are still unseasonably and exceptionally high, particularly in the Midlands, East Anglia and south east England (Figure 7.0). It is likely that these figures will remain exceptionally high at the end of November. Under normal circumstances, SMDs should begin to reduce towards zero during October and November, however they are still above 100mm in parts of these areas and need significant rainfall to reduce them. For example in our Anglian region, the soil will need two months average rainfall to lower the soil moisture deficit to zero.

If the weather continues dry, soil moisture deficits will remain well above zero at the start of 2012. This will mean an increasing risk of limited groundwater recharge.

Figure 7.0 - MORECS soil moisture deficits for real land use for all Environment Agency Regions[8]



[8] Source: Met Office © Crown Copyright

2 Water resources outlook for winter and spring

Rainfall and cooler temperatures lessened the effects of drought on water resources and the environment this summer by helping to reduce demand for water, but the central, eastern and southern band of England still has extremely dry soils, low river flows and low groundwater levels. The risk of drought next year in these areas depends on rainfall over the next few months. This section looks at the outlook for water resources over the winter and into 2012.

2.1 Available water resources

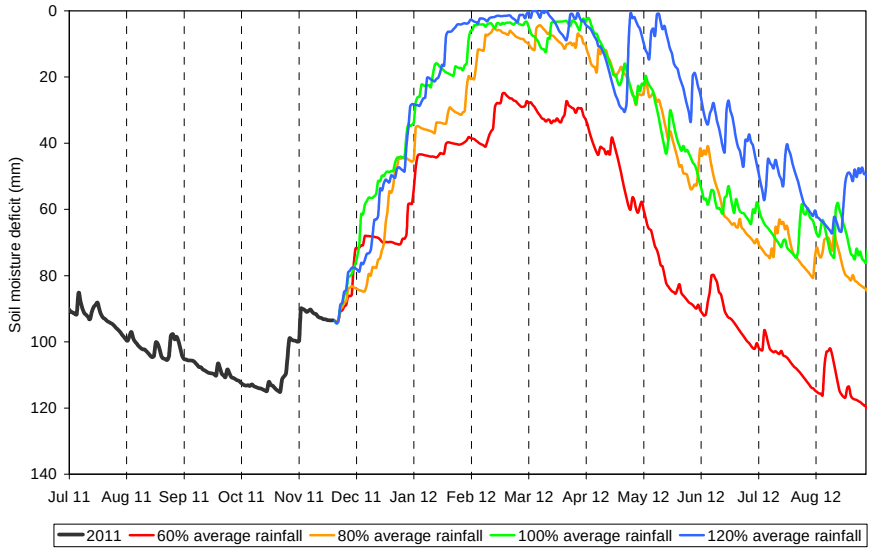
We have studied what might happen to groundwater levels and river flows over the winter. We used three different scenarios: average (100 percent), below average (80 percent) and extremely below average (60 percent) rainfall until spring 2012 and into early summer 2012.

The likelihood of each scenario depends on the length of time. For example, a six month period with 60 percent rainfall is less likely than one or three months with 60 percent rainfall.

2.1.1 Soil moisture deficits

With SMDs in excess of 100mm at the end of the third week of November across many parts of central, eastern and south east England, we have modelled how SMDs will change under the three rainfall scenarios. For example in the Upper Nene catchment in Northamptonshire we do not expect the soils to return to saturation until February 2012 under average rainfall (Figure 8.0). With more rainfall the return to saturation will be slightly quicker, with less rainfall it will be longer and under the extreme low rainfall scenario (60%) the catchment may not actually reach saturation.

Figure 8.0 – Forecast soil moisture deficits for Upper Nene - Northamptonshire[9].



2.1.2 Groundwater

Chalk aquifers

- If we have above average rainfall (120 percent) between now and March 2012 groundwater levels in the chalk aquifers in southern and eastern England are only likely to recover to normal or below normal conditions for the time of year. A number of aquifers may still be notably low for the time of year. If above average rainfall continued through to June the groundwater in the chalk should recover to normal or below normal levels. . 120 percent rainfall or above over the next 7 months occurs approximately 10 percent of the time based upon the historical record.
- If we have average rainfall (100 percent) between now and March 2012 groundwater levels in the chalk aquifers in southern and eastern England are likely to mostly be notably low for the time of year. This broad pattern would be sustained if average rainfall continued to fall over the following three months (Figure 9.0 and see Appendix 1).However some aquifers could still be classed as exceptionally low. Average rainfall or above over the next 7 months occurs approximately 50 percent of the time based upon the historical record.
- With 80 percent rainfall between now and March groundwater levels are likely to be notably or exceptionally low for the end of March. By June 2012, using the same scenario, most chalk aquifers will be exceptionally low for the time of year (Figure 9.0 and see Appendix 1) 80 percent rainfall or below over the next 7 months occurs approximately 15% of the time based upon the historical record.
- With 60 percent rainfall between now and June, which would be extremely rare, virtually all chalk aquifers would have exceptionally low groundwater levels for the time of year (Figure 9.0 and see Appendix 1). 60 percent

[9] Forecast from 22nd November 2011. Values close to, or at zero indicate that the catchment has returned to full saturation

rainfall or below over the next 7 months occurs approximately 2% of the time based upon the historical record.

With 100 percent or less rainfall, chalk winterbourne streams are likely to dry up early and many of these rivers' sources would be likely to migrate further downstream than usual. This will put greater stress on the water environment and wildlife. It might also impact on water companies' groundwater resources.

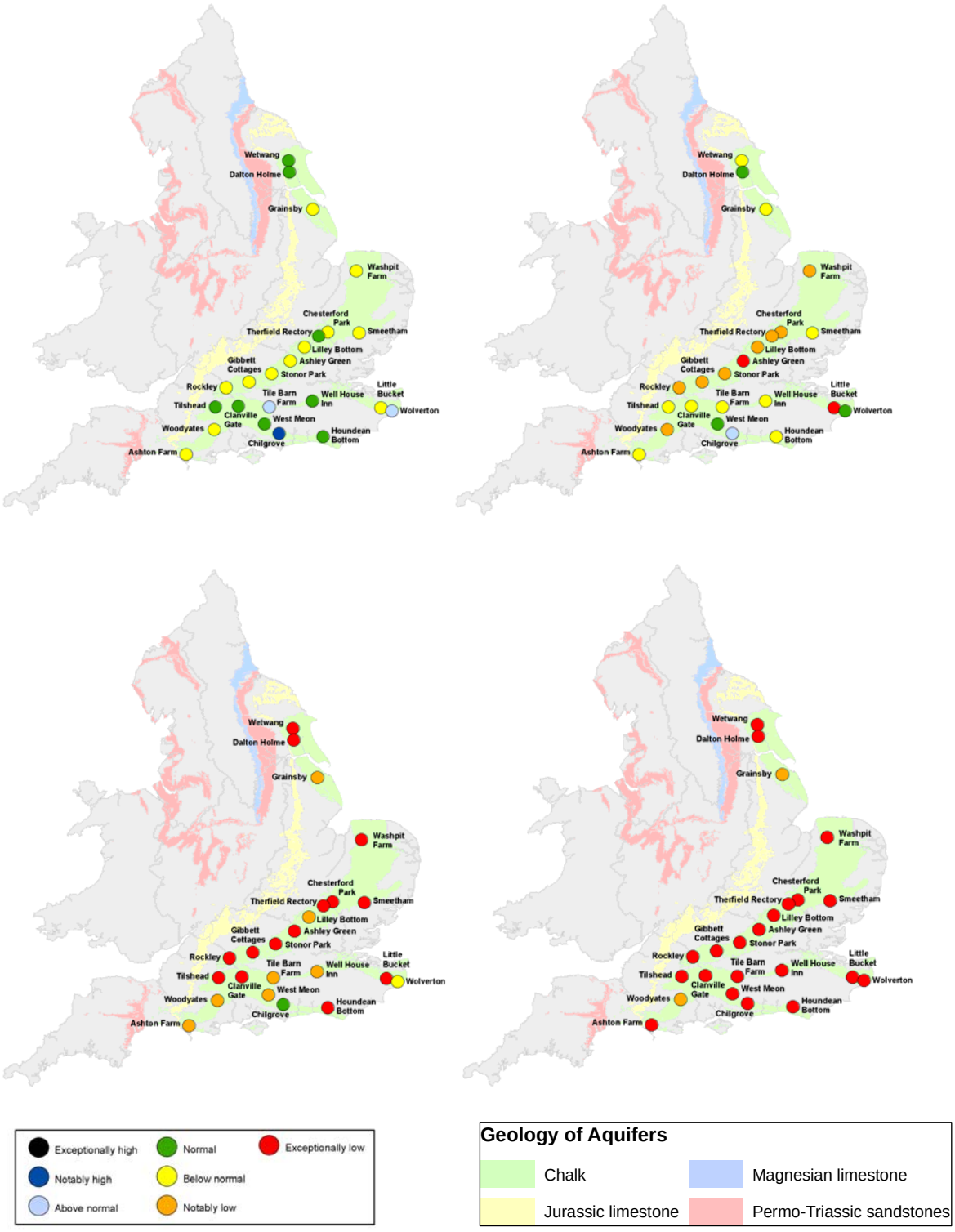
Permo-Triassic sandstone aquifers

- Within Permo-Triassic sandstone aquifers there is more storage capacity than in limestone or chalk aquifers. Consequently it takes much longer for water levels in these aquifers to respond to rainfall and subsequent recharge.
- Groundwater levels have fallen throughout 2011 in the Permo-Triassic sandstone aquifers in the West Midlands. Even with 100 percent average rainfall over the winter and spring groundwater levels are unlikely to recover. With sustained above average rainfall we should start to see some recovery in sandstone groundwater levels later in 2012.
- With less than 100 percent rainfall, groundwater levels in the Permo-Triassic sandstone will continue to decline and will probably be exceptionally low by summer 2012. More private wells will dry out, base flows in rivers will reduce and we will need regulation schemes earlier than usual. This is unlikely to impact water companies thanks to natural storage in the sandstone and deep abstraction boreholes.

Jurassic limestone aquifers

- Jurassic limestone aquifers are more responsive than both chalk and Permo-Triassic sandstone aquifers. For example with under 100 percent or 80 percent rainfall in the Cotswolds, groundwater levels should recover to normal levels by June 2012. However with an extremely dry scenario (60%), levels would be exceptionally low by June 2012.

Figure 9.0 – Forecast groundwater levels at key indicator sites for the end of June 2012. Forecasts based on four scenarios: 120% (top left), 100% (top right), 80% (bottom left) and 60% (bottom right) of long term average rainfall over the next 10 months [10]



[10] Classed relative to an analysis of historic end of June levels. (Source: Environment Agency). Geological map reproduced with kind permission from UK Groundwater Forum, BGS © NERC. Crown copyright. All rights reserved. Environment Agency, 100026380, 2011

River flows

Once the soils are saturated, river flows will be much more responsive to rainfall events. By looking at rainfall scenarios we can only give a very broad indication of what river flows might be in March 2012. From the rivers we have modelled in Jurassic Limestone and Boulder Clay catchments, we would expect river flows to return to normal or below normal conditions by March 2012 with average rainfall (see Appendix 1). With 80 percent rainfall these rivers are likely to be notably low. Only under the extremely dry 60 percent average rainfall scenario would river flows be exceptionally low for the time of year. By June 2012 an 80 percent average rainfall scenario would result in more exceptionally low flows, and the 60 percent average rainfall scenario continued exceptionally low flows. River flows within chalk catchments would mimic forecast groundwater levels shown in Figure 9.0

2.2 Met Office forecast

Rather unsettled weather is expected across the UK in the first week of December as low pressure systems and fronts move eastwards from the Atlantic. Many areas will see some heavy rain at times. [11]

Thereafter, whilst there is much uncertainty, the weather may tend to settle down with time with pressure rising, such that rainfall amounts for the second part of December could be below average in many places.

For the 3-month period December-January-February, for UK precipitation, the broad scale signal, although weak, is for somewhat wetter conditions than normal when averaged over the whole of the UK. However if the pressure patterns commensurate with this forecast were to be realised then higher than average rainfall would probably be seen in most western parts of the UK, whilst some eastern parts would probably see below average amounts. At the same time we cannot discount the possibility that the 3-month period will be very dry across the UK as a whole, the risk of this particular alternative outcome is very small, but it is not negligible[12]

The last two winters were very cold which led to increased water being lost through leakage from burst pipes. Cooler conditions this winter would increase the risk of higher leakage rates and the associated drier conditions would reduce groundwater recharge and reservoir refill. A dry but very cold winter would be the worst case scenario. We will ask the Met Office for updates and advice on seasonal forecasts but beyond the very short term, the forecast of what will happen is still uncertain.

[11] Input from the Met Office Forecasting team 24th November 2011

[12] Input from Met Office seasonal forecasting team 24th November 2011. Crown Copyright 2011

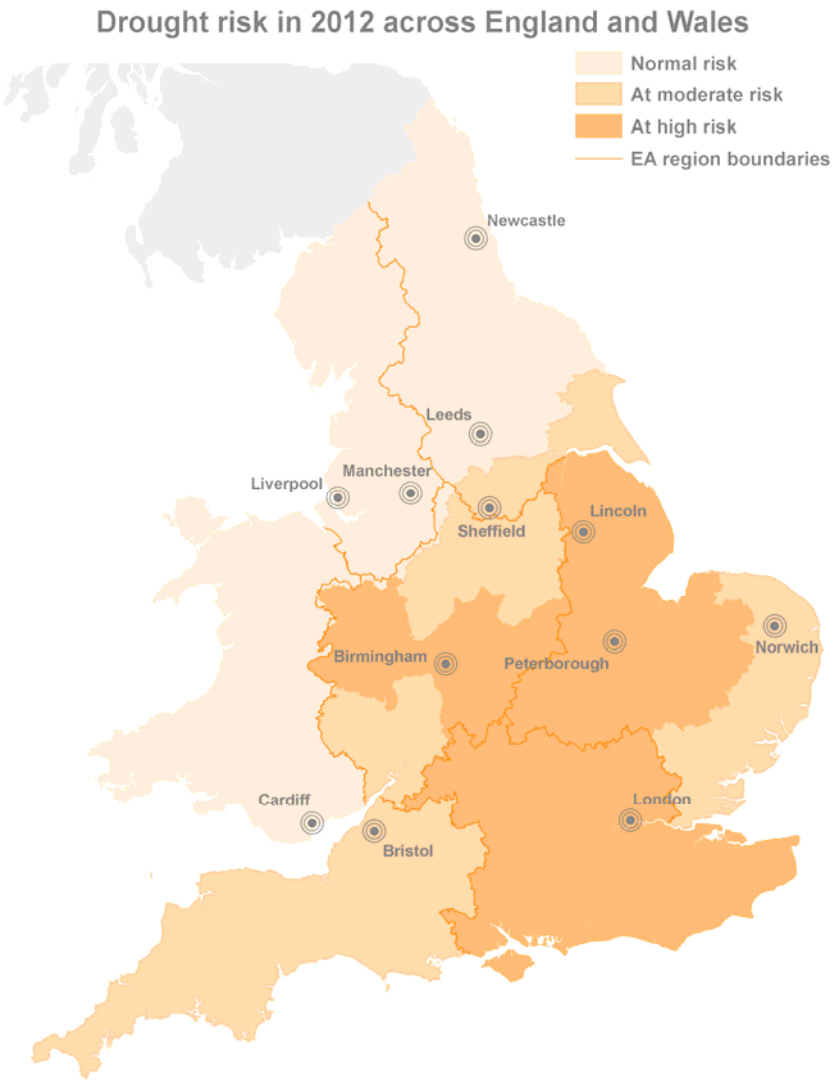
3 Prospects if it is dry

Figure 10.0 shows the areas at risk of drought next year if we have a drier than average autumn and winter as described in section two.

In the areas at risk of drought, the effects on agriculture, the natural environment and in some parts on water supplies, will vary according to competing demands for available water and what we and others do to manage the risks.

The following sections summarise the consequences of a dry winter for different sectors.

Figure 10.0 - Areas at risk of drought in 2012



The risk of drought is classified according to the current water resources position in Environment Agency regions and/or catchment areas, and the possible impacts on water resources, agriculture, wildlife and water supplies over the rest of autumn 2011 and winter 2011/12.

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3.1 Agriculture

Many areas of central, eastern and southern England are still very dry, so crops sown now will need rain or irrigation to get them started. If the winter is cold and dry, crops may fail unless farmers can establish newly sown crops this autumn.

Farmers who use winter storage reservoirs can store water ready for the irrigation season next year. In some areas the low river flows and groundwater levels are delaying or preventing refill over the winter because of conditions on abstraction licences.

Farmers and growers reliant on direct abstraction from groundwater or surface water sources may need to start irrigating crops earlier in the season if there is not enough rainfall during the winter and into next spring.

Livestock farmers continue to worry about food and bedding costs and availability. For many, there is no buffer leaving them more vulnerable in the winter weather. Heavy snow would cause further problems with increased pressure on food stocks and disruptions to transport.

3.2 Water companies

Despite a drier than average winter and spring in 2011, demand for water was suppressed by the cooler summer and water companies did not need to impose restrictions. This has helped companies to conserve their supplies and most water companies do not forecast any problems in maintaining public water supplies into spring and summer 2012.

Most companies, except Anglian Water, Severn Trent Water, South East Water and South West Water have said that reservoir storage and groundwater sources will not be excessively affected by a dry winter and do not predict they will need to take additional drought actions this winter to safeguard supplies.

Anglian Water applied to us in November for a drought permit. This is to alter the conditions on their abstraction licence to allow them to take water from the River Nene to help fill Pitsford reservoir this winter. It is also preparing a winter drought permit application for Rutland Water for submission in late November. The company has also introduced a special task force to deal with mains leakage and a communications campaign in the area supplied by the affected reservoirs. The implementation of the drought permits and other measures to support supplies will depend heavily on the amount of rainfall received over the winter.

Severn Trent Water forecasts a normal risk on supplies next year except for the North Staffordshire area covered by Tittesworth Reservoir. Severn Trent Water previously said it would need to apply to us for a winter drought permit to help refill Tittesworth reservoir in Staffordshire. Recent rain and a more detailed risk assessment mean the company now believes it is unlikely a permit will be required but the company continue to closely monitor the situation.

If the dry weather continues in autumn and early winter, South West Water has said it might have to apply for a drought permit to increase the annual intake for Restormel's abstraction licence. The company will monitor the situation over the winter.

We are concerned about reservoir levels in Kent and East Sussex that are at a low level for the time of year. South East Water's Ardingly Reservoir and its Arlington Reservoir are very low and this has prompted the company to plan drought actions to

manage resources over the winter. We are in pre-application discussions with South East Water regarding two potential drought permits to refill its reservoirs.

Thames Water said that a minimum of 80 percent of average rainfall is required over winter or there will be the risk of needing to impose water use restrictions on their customers across London, and Swindon and Oxfordshire resource zones in late spring 2012. Sutton and East Surrey Water have forecast a similar scenario and reported a low risk of restrictions on customers and possible drought permit application for River Eden in May. We will continue to monitor the situation and expect companies to follow their drought plans to ensure timely decisions are made to reduce potential problems with water supply later next year.

Table 1.0: Summary of each water company's position and prospects at start of October 2011

Water company	Position now	Position after a dry winter	Possible actions during winter and spring 2012
Anglian Water	Groundwater normal but below average reservoir levels	Several reservoirs (such as Pitsford and Rutland) would be low without action. Output from some drought vulnerable groundwater sources may be affected.	Apply for drought permits to help re-fill reservoirs this winter. Investment in drought mitigation schemes to include improvements to Ruthamford interconnectivity and three new boreholes. If winter is exceptionally dry and high demand in the spring, there is risk of customers restrictions
Sembcorp Bournemouth Water	Normal	Normal	Enhanced customer awareness, if dry spell continued.
Bristol Water	Reservoir storage is below average. Modified operational requirements to reduce water taken from reservoirs and take more from the River Severn.	Reservoir storage will not have recovered which will activate drought plan	Increase leakage detection and increase customer awareness. If winter exceptionally dry, activate drought plan to include customer campaigns in February to advise of possible restrictions in spring and summer.
Cambridge Water	Normal	Groundwater may be below normal	Increase customer awareness and enhance communications to promote wise use of water, and appeal for voluntary restraints through public campaigns. Increased leakage resources available in preparation for a cold winter

Cholderton and District Water Company	Normal	Normal	Increase leakage control activity if very cold weather
Dee Valley Water	Normal	Normal	No additional actions.
Essex and Suffolk Water	Normal	Normal – dependant on Ely Ouse to Essex Transfer Scheme (EOETS) to help refill the company's reservoirs.	Continue to promote 'Use water wisely' campaign.
Northumbrian Water	Normal	Normal	If cold, increase leakage activities.
Portsmouth Water	Groundwater sources below normal.	Below average rainfall in autumn/winter will result in groundwater levels declining further	Not specified.
Severn Trent Water	Reservoirs in Wales normal but reservoirs in the north of the area are low. River flows and groundwater levels below normal for the time of year.	Except for Tittesworth reservoir and Draycote reservoir, all other reservoirs should have enough storage. Groundwater sources should not be significantly impacted next year	Continue to take action to manage supplies in areas affected and monitor situation closely.
South East Water	Groundwater sources and reservoir storage declining	If a dry winter, overall position would be at moderate drought status	Monitor and manage risk of a potential developing drought including enhanced customer communications. Pre-application discussions for drought permits for Ardingly and Arlington reservoirs. Potential water restrictions next spring.
South Staffs Water	No immediate concerns on overall supplies. Blithfield Reservoir is below average for the time of year, and is within drought monitoring trigger levels. Resource utilisation in place to conserve	If below average rainfall, reservoir levels would be in drought monitoring zones or above	There is a very low risk of customer restrictions in spring or summer (based on recurring worst rainfall levels over the next 6 months)

	Blithfield Reservoir		
South West Water	Some reservoir storage lower than average for this time of year	Most reservoirs expected to recover even with a dry autumn and winter	Continue with pumped storage schemes. Possible drought permit application to increase Restormel abstraction licence in early 2012
Southern Water	Reservoir levels below normal for time of year.	After a dry autumn and winter resource position will remain below normal but will not be in breach of its drought triggers	Increased awareness and active management of sources
Sutton and East Surrey Water	Groundwater sources below normal. Surface water sources within normal levels	If below average winter rainfall, will activate further actions in drought plan	If average winter rainfall is less than 80 percent, may be risk of drought permit for River Eden and restrictions on water use during May
Thames Water	Overall storage is within normal range. Groundwater and surface water sources are below normal.	If significantly below average winter rainfall (80% or less), will activate actions in drought plan	Enhanced customer awareness in early 2012. If average winter rainfall is less than 80 percent, may be risk of restrictions at start of spring in London, and Swindon and Oxford zones.
United Utilities	Normal	Overall normal (low risk in two of UU's resource zones - West Cumbria and Carlisle, but this is normal because of rapidly responding hydrology).	No additional actions planned currently.
Veolia Water East	Groundwater levels lower than average but overall in normal operating range.	No drought problems anticipated in 2012, unless winter 2011/12 is much drier than previously experienced.	Customer awareness campaigns in line with current drought plan
Veolia Water Central	Overall resource position below normal for time of year	With below average rainfall, groundwater sources will decline. Surface water sources will remain normal.	Enhanced communications
Veolia Water South East	Normal	With below average rainfall, groundwater sources will decline	Increase awareness
Wessex Water	Overall position is good although reservoir storage below average for	Expect to be in same resource position as currently (based on 1975/76 scenario).	Will continue with zone two drought management actions including water efficiency campaigns and

	this time of year.		storage optimisation in their north and west zones.
Yorkshire Water	Normal	Normal	Increase leakage control activity to ensure that any more cold weather like the past two years' winters will not mean the company fails its leakage targets.
Welsh Water	Normal	Normal	No additional actions.

By spring 2012, the water companies will know more about how much resource they will have for summer 2012 and possible actions they will take. We propose to write an updated prospects report in early spring to report on the position should we receive less than the long term average rainfall for winter 2011/12.

Thames Water and other companies providing water supplies in the locations hosting the 2012 Olympics have plans in place to ensure that water supply is secure during the event.

3.3 Industry

We are not aware of any immediate risks to industry from the dry weather so far this year. There is a risk that if we have a drier than average winter, that low river flows may affect the power generation industry next year, although the industry does have a lot of flexibility in how it operates sources to supply the national grid. Other large industrial abstractors such as aggregate washing and concrete production may be affected by conditions of their licences being implemented earlier than normal. We continue to work with industrial abstractors to review the situation and consider the options available if we experience a dry winter.

3.4 Navigation

If the reservoir groups that support the Caldon Canal and Oxford and Grand Union Canals are not substantially refilled over the autumn and winter, British Waterways have some concerns for navigation next year. All other waterways are at normal risk for next year.

3.5 The water environment and wildlife

If we have a dry winter with below average rainfall, we are concerned that we will see more environmental problems compared to this year. Although most healthy freshwater and wetland sites will be resilient to lower than average rainfall, prolonged periods of dry weather do have a medium to long term impact. The main cause for concern is the impact on sites that are already under environmental stress, either through pressure from the dry period this year such as the groundwater dependant chalk streams of southern and eastern England, or from existing abstraction pressure or pollution.

A cold, dry winter will affect habitats reliant on groundwater such as chalk rivers, fens, some wet grasslands and valley mires. Surface water-fed systems are likely to be affected. We could see more dried up river sections as currently occurring in parts of the Lincolnshire Wolds. Low flows and levels can affect wildlife directly, such as

habitat drying up, killing fish or losing spawning areas, or indirectly, such as poor effluent dilution causing algal blooms and killing fish as a result of high concentrations of nutrients and low oxygen levels.

4 Recommendations

We cannot be certain about how much rain we will get over the next few months, so we need to be prepared in case the weather continues to be drier than normal. These preparations will help society, businesses and the environment to withstand the potential impacts of a long drought.

4.1 Environment Agency

We play a lead role in co-ordinating and managing what needs to be done to deal with the effects of drought on people, businesses and the environment.

Following the Defra drought meeting in May and the subsequent abstractors meeting in June 2011, the Environment Agency was asked to review the scope for flexible application of licence conditions to enable short term, low volume transfers within catchments. In response we introduced:

- a fast-track application process for taking high flows in the summer to top-up storage reservoirs. Farmers have told us the main obstacle to taking summer high flows is the relatively high cost of this water. We are looking at how we charge for this in 2012 and beyond.
- a position statement on extending the abstraction season to lift root crops. At the end of the growing season, some farmers need to abstract past the end of their licensed period to soften the ground to lift root crops. The position statement sets out how a farmer can apply to vary their licence and answers the concerns they may have about doing this.
- a national water resource and agriculture group with the National Farmers Union, the UK Irrigation Association and the Agriculture and Horticulture Development Board. The group is beneficial in sharing information and ideas to limit the impact of drought on the environment and abstractors.

Throughout the summer, we have attended and run local and national events to promote our key messages and enhance our relationships with the farming sector.

Our national drought team and our teams in areas at risk of drought next year will continue to lead on managing and monitoring drought and its effects locally. We will:

- work closely with the National Farmers Union, UK Irrigation Association and Agriculture and Horticulture Development Board on agricultural water resource issues locally and nationally.
- continue to write to farmers about the local risk of drought restrictions affecting spray irrigation next spring and summer.
- develop information and events to help farmers set up water abstractor groups and consider on-farm storage. We are preparing a water security pack for farmers in our Anglian region.
- publish a good practice guide for setting up water abstractor groups.
- carefully monitor reservoir storage refill over the winter and advise abstractors and the government of the situation and the risks.
- carry out environmental monitoring studies to determine the long-term impacts on fisheries and biodiversity and share the results with interested groups and communities.

- determine water company drought permits (and support government on drought orders) where required.
- ensure that our drought plans take full account of the lessons we have learnt in 2011.
- prepare more detailed action plans in consultation with others for 2012 if the dry weather continues.

Over the medium to longer term, we are reviewing existing initiatives and developing ways to increase resilience to future droughts. Working with the Met Office and other partners, we want to provide abstractors with more information about weather and water availability. The information will help abstractors to plan for and limit any impact on the environment. The Environment Agency is also looking at ways to provide better access to online information on river flows and cessation conditions to enable best use of licensed quantities.

In the longer term, we are working with the farming sector to ensure their abstractions are resilient to climate change. We are working with Government on legislative changes to facilitate this.

4.2 Water companies

All water companies monitor their resources carefully and the Environment Agency will regularly review the situation with them over the winter and into spring 2012. Companies will need to act as soon as they are aware of any increased risk to public water supply. The present water resources situation means that this particularly applies to companies serving central, eastern and southern England. We expect these companies to follow their drought plans to ensure timely decisions are made.

Actions we expect them to take include:

- Keeping their customers up to date with the latest position if they are at risk after a dry winter.
- Encouraging their customers to use water wisely now, which will put them in a better position at the start of 2012.
- Making sure they have enough resources to keep leakage under control. This will put them in a good position if the winter is exceptionally cold. Companies at risk should consider enhancing their leakage detection.
- Following their drought plans and talking to us about applying for winter drought permits and orders.
- Severn Trent Water and Anglian Water review how they will implement customer restrictions next summer if necessary, making full use of the new powers in the Flood and Water Management Act 2010. These companies have not immediately updated their drought plans following the introduction of the new powers.
- For all companies, regularly reviewing the need for future restrictions using the new powers in the 2010 Act and different supply strategies including drought permits, if the dry weather continues.
- Learning lessons from the dry weather and drought in 2011 and incorporating them into their drought plans.

4.3 Abstractors

All abstractors need to be proactive and make sure their abstraction licences will meet their needs in 2012 and beyond. It is better to make planned changes to licences in advance than to have to react to events. The Environment Agency will continue to work closely with sectors that may be affected to plan for drought.

Irrigators

- Consider the need to extend the summer abstraction period to wet the ground and lift crops at the beginning and/or end of 2012 and beyond. We have a position statement on our website (search for 'lifting crops').
- Consider options for scheduling irrigation. Abstractors should contact their local Environment Agency office to find out how to do this. The Environment Agency customer contact number is 03708 506 506** (Mon-Fri, 8am -8pm).
- In areas where prospects for irrigation next year are poor, farmers and growers will need to assess this risk and decide what to grow next year.

Winter storage abstractors (1 November - 31 March)

- Be aware that if flows and groundwater levels remain low, the Environment Agency may have to limit abstractions. We will warn farmers as soon as we can and work together to limit the impact.
- Farmers and growers with winter storage reservoirs should consider varying their licence to take high flows in summer or investigate topping up their reservoirs from another source, for example harvesting rainwater from roofs or sharing sources.

All abstractors

- Look for ways to share resources such as setting up a water abstractor group. The Environment Agency can offer advice on best practice and put abstractors in touch with groups working in their local area. Our customer contact number is 03708 506 506** (Mon-Fri, 8am -8pm).
- Consider doing a water audit and implement measures to improve water efficiency.

4.4 Navigation and recreation

Organisations, groups and individuals who regularly use the water environment for navigation and recreation need to prepare for the possibility of further impacts next year. The organisations with particular responsibilities for boating and leisure activities should:

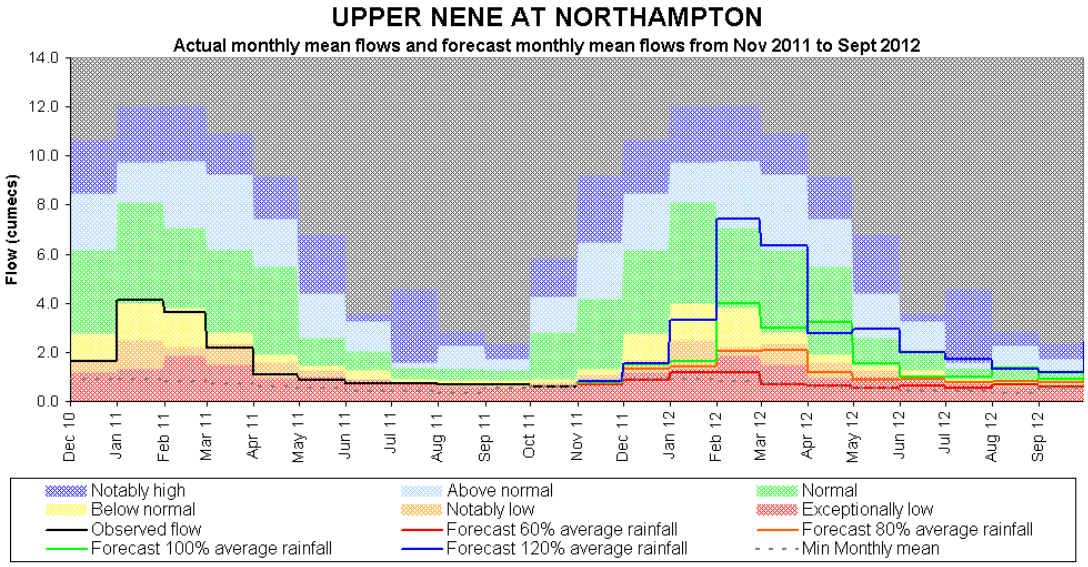
- Continue to target communications to river users.
- Promote water saving initiatives and early warning systems with boaters to reduce the likelihood, or severity of navigation restrictions later in the year.
- Make sure event organisers have contingency plans that take account of water availability and water quality issues on events and sporting competitions planned for next spring and summer.

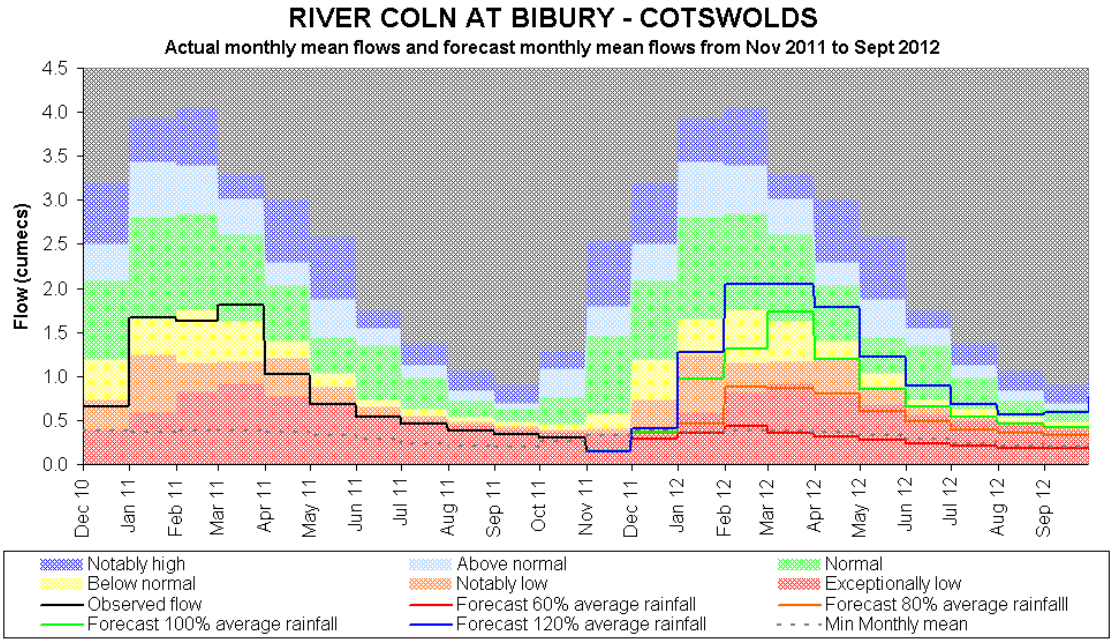
4.5 The natural environment and wildlife

Wildlife and habitats are adapted to cope with periods of natural drought but multi-season droughts can have longer term impacts. At the June 2011 drought meeting, the Environment Agency and Natural England agreed to review the resilience of wetland habitats to the affects of drought. Ensuring protected sites are being managed appropriately is an important way of enhancing the capacity of habitats and species to cope with and recover from drought. Natural England is currently leading on programmes of work to bring vulnerable SSSI's into favourable condition. Natural England and the Environment Agency will work with environmental organisations to consider what management actions should be taken to protect these most valuable and designated environments.

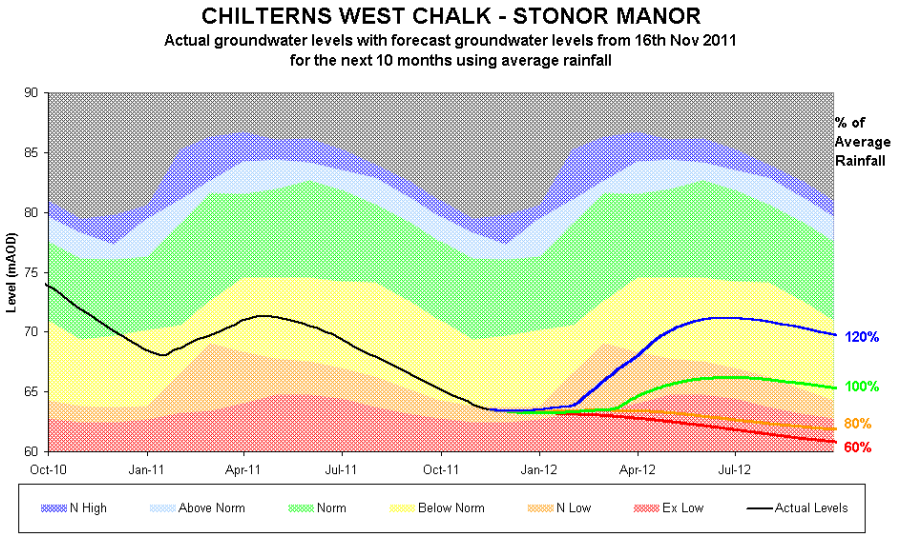
Appendix 1

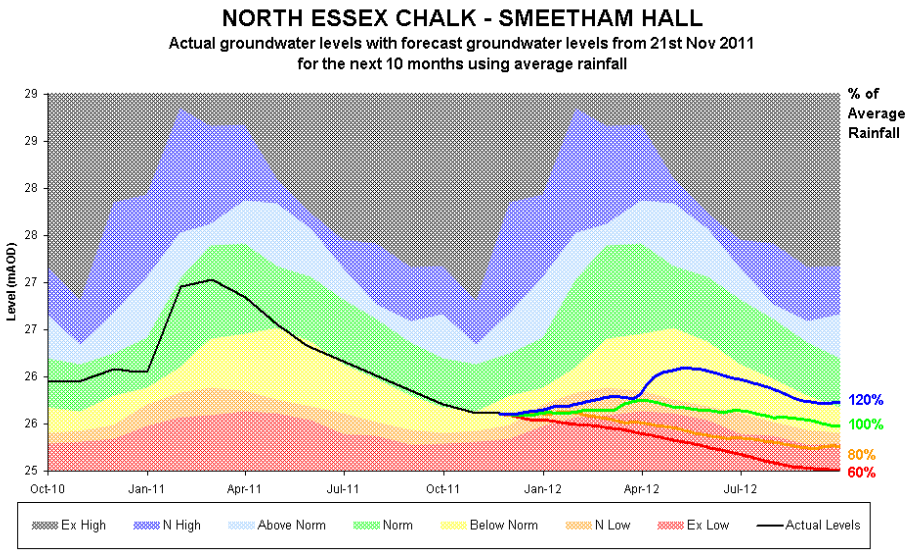
1.1 River flow forecasts

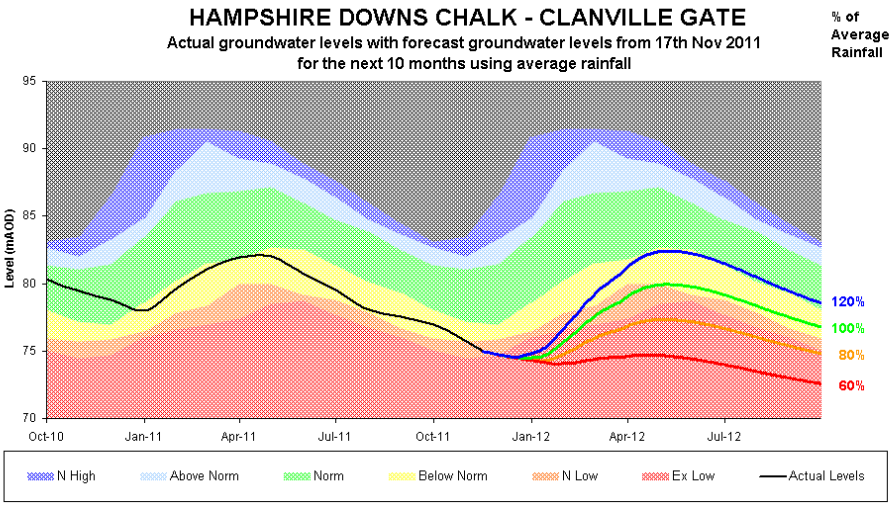




1.2 Groundwater Forecasts[13]







[13] See Figure 9 for locations

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