Climate Change

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Climate Change and how we as an industry are proposing to adapt to its impacts are currently towards (if not at) the top of peoples in trays.

This paper will set out the high level impacts that are predicted for the North West of England, the approach that we at United Utilities are taking to prepare our adaptation report for Defra and other areas of climate change related work.

Predicted impacts for the North West

Climate change itself is not a new phenomenon; the aspect that is currently causing problems for society is the rate of change and the fact that the manner in which we live today is so heavily reliant on the current climatic conditions. Previous changes in climate have occurred over a reasonably long period of time and hence the short term impacts have not been severe.

The UK Climate Impacts Programme [1] (UKCIP) provides a range of tools, methods and guidance that can be used to help organisations identify how they might be affected by climate change and what they can do to minimise their risks or exploit the opportunities.

The latest set of predictions CP09 were published in 2009 and cover the following areas:
- Briefing
- Trends
- Climate Change (Land)
- Marine & Coastal Projections
- Weather Generator
- Pre-prepared Maps & Graphs

From the huge amount of data that is available from the CP09 projections we have focused on the following four:

- Increase in temperature
- Decrease in precipitation
- Increase in precipitation
- Sea level rise

The 'High Emissions' scenario was used on the basis that all evidence to date is that we are currently on or above the projected path, together with the fact that there is no global agreement to control the release of greenhouse gasses. We have also focused on the 50%ile central estimate.

The data was translated in the following graphs to ease understanding and presentation to a variety of audiences. The graphs show the predictions at 3 time periods 2020, 2050 & 2080 and for 3 different %ile probabilities 10, 50 & 90. As described later a separate time period for 2035 was interpolated to assist in the preparation of our adaptation report.

1. UKCIP website http://ukclimateprojections.defra.gov.uk

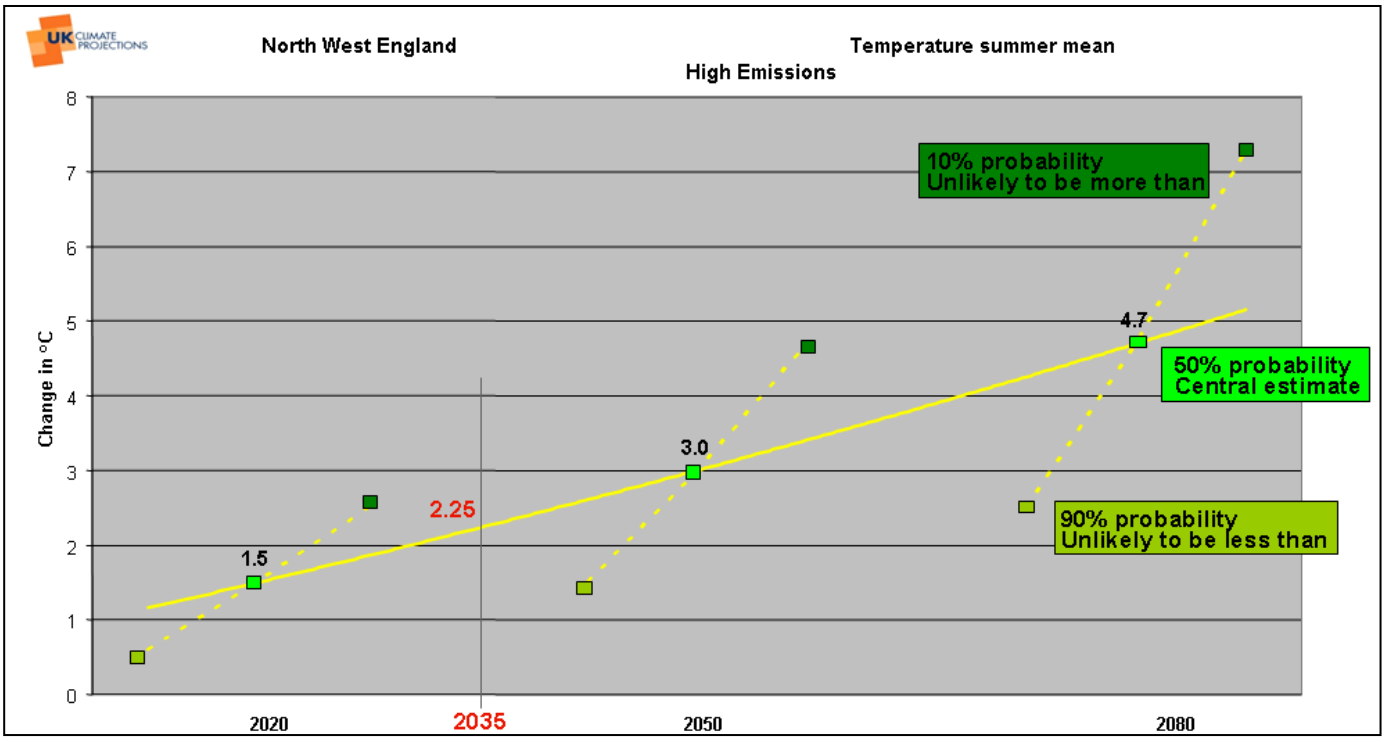

Fig 1 Summer mean temperature

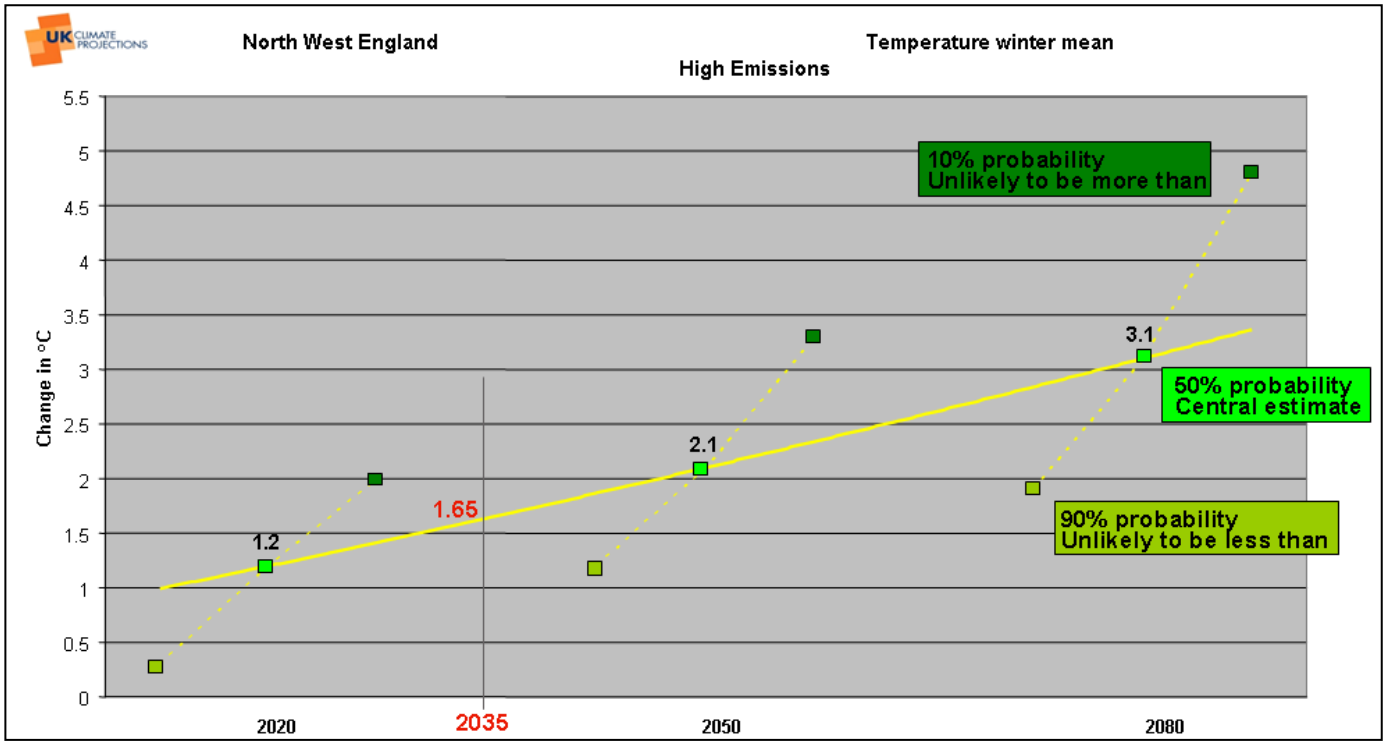

Fig 2 Winter mean temperature

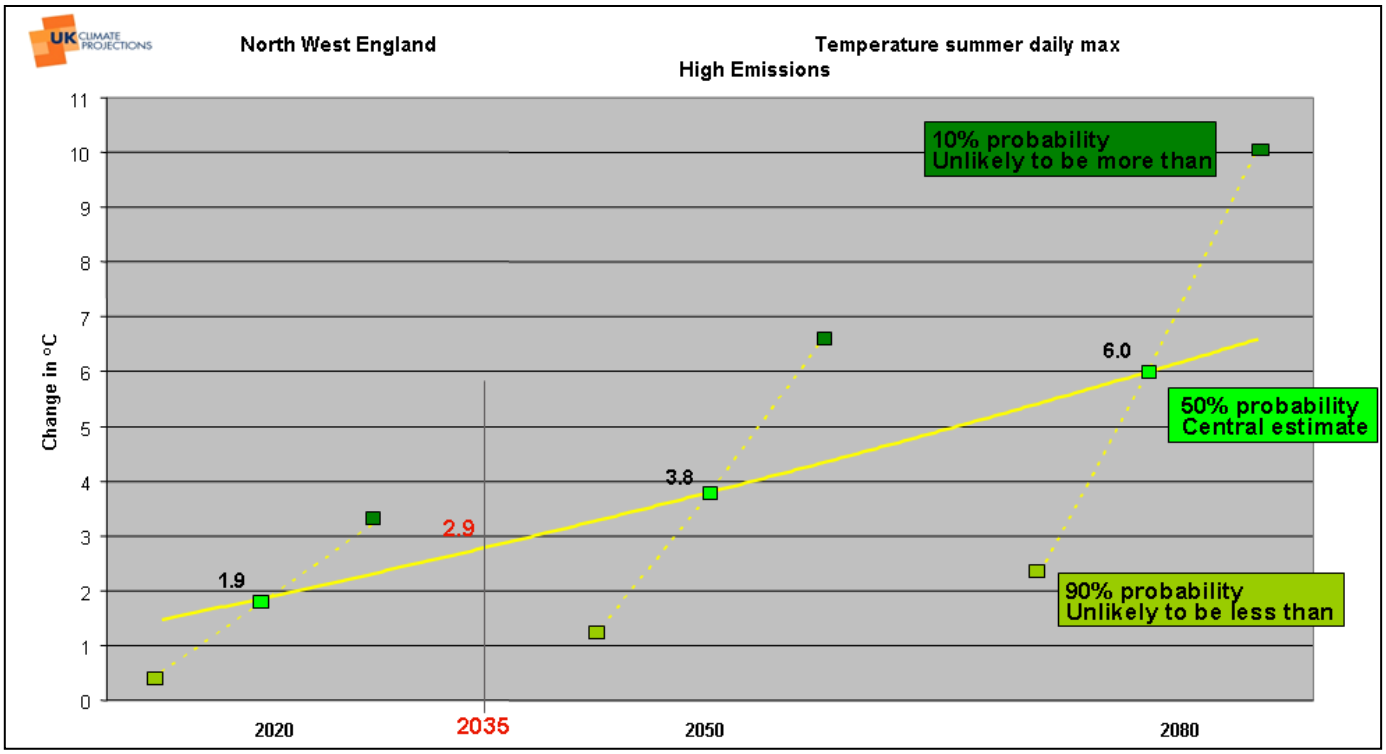

Fig 3 Summer daily maximum temperature

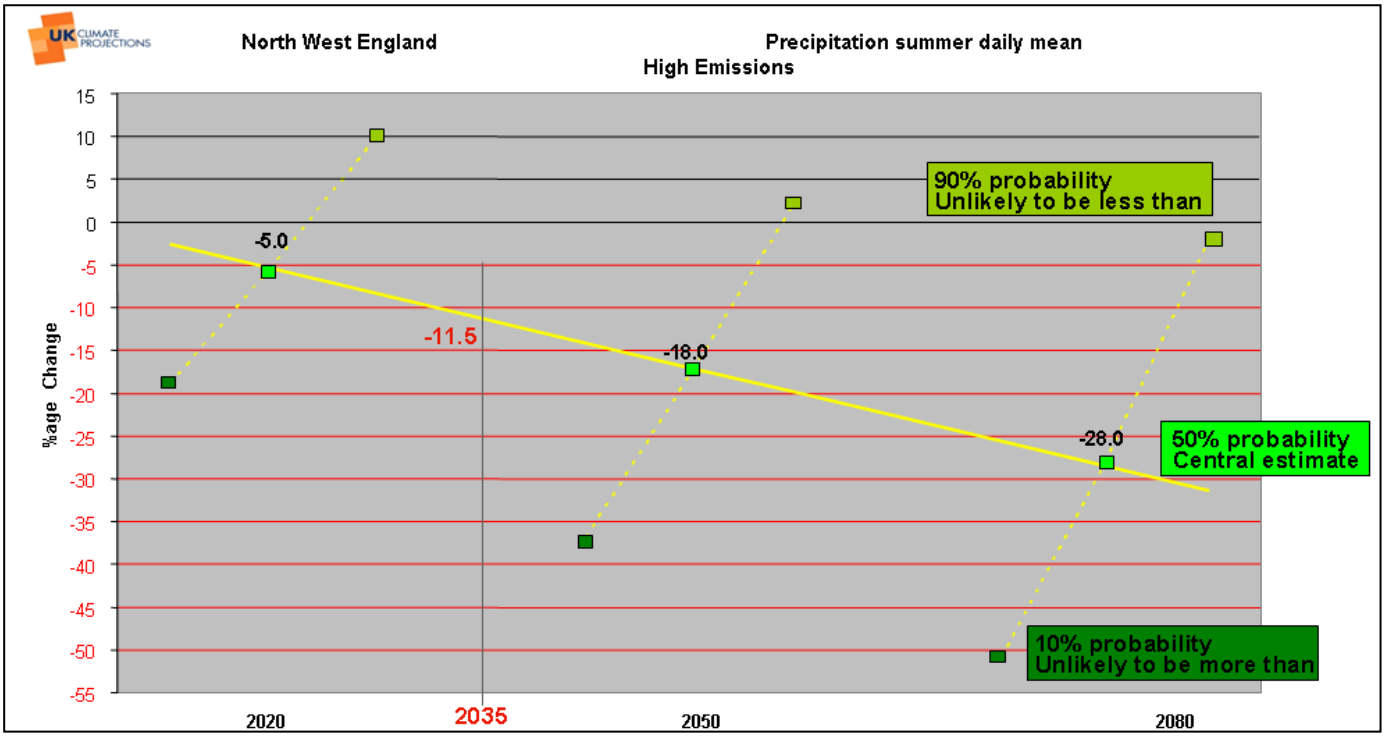

Fig 4 Summer daily mean precipitation

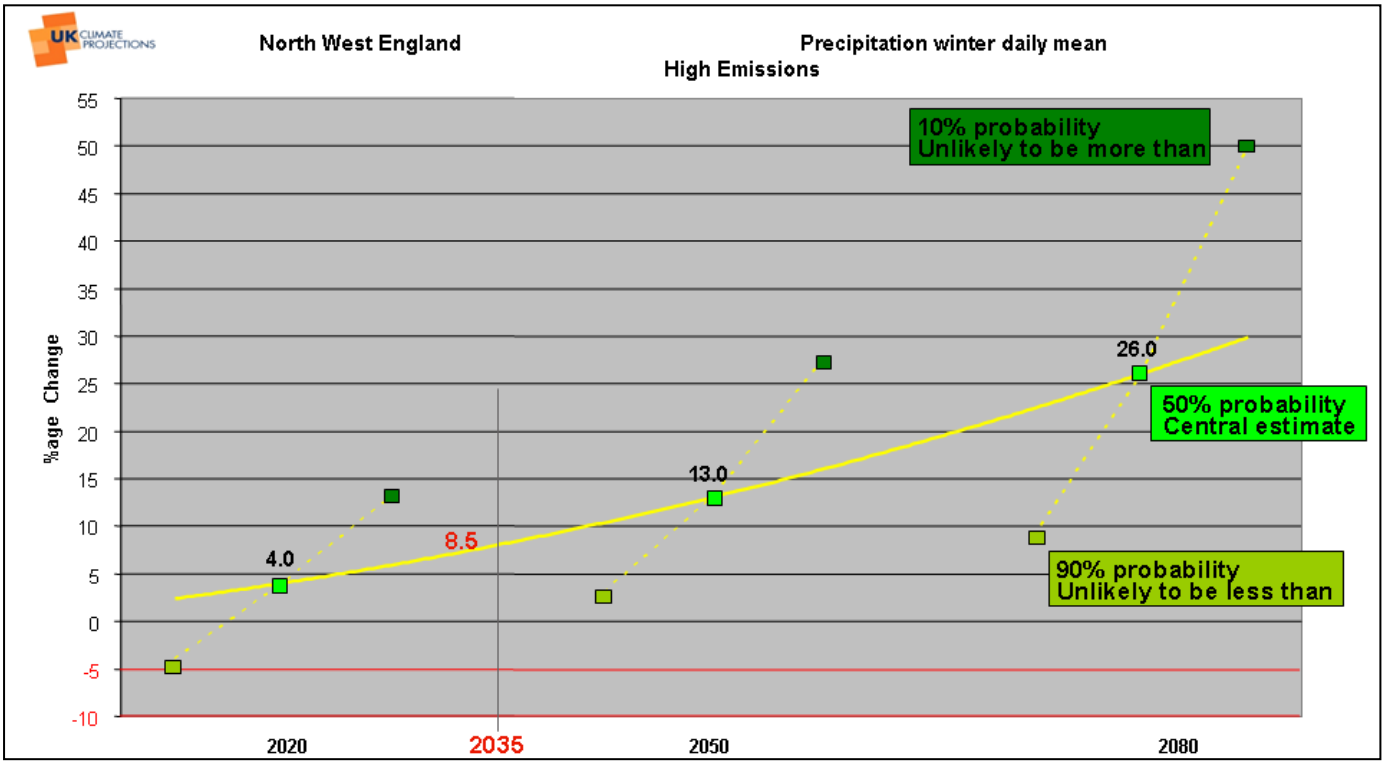

Fig 5 Winter daily mean precipitation

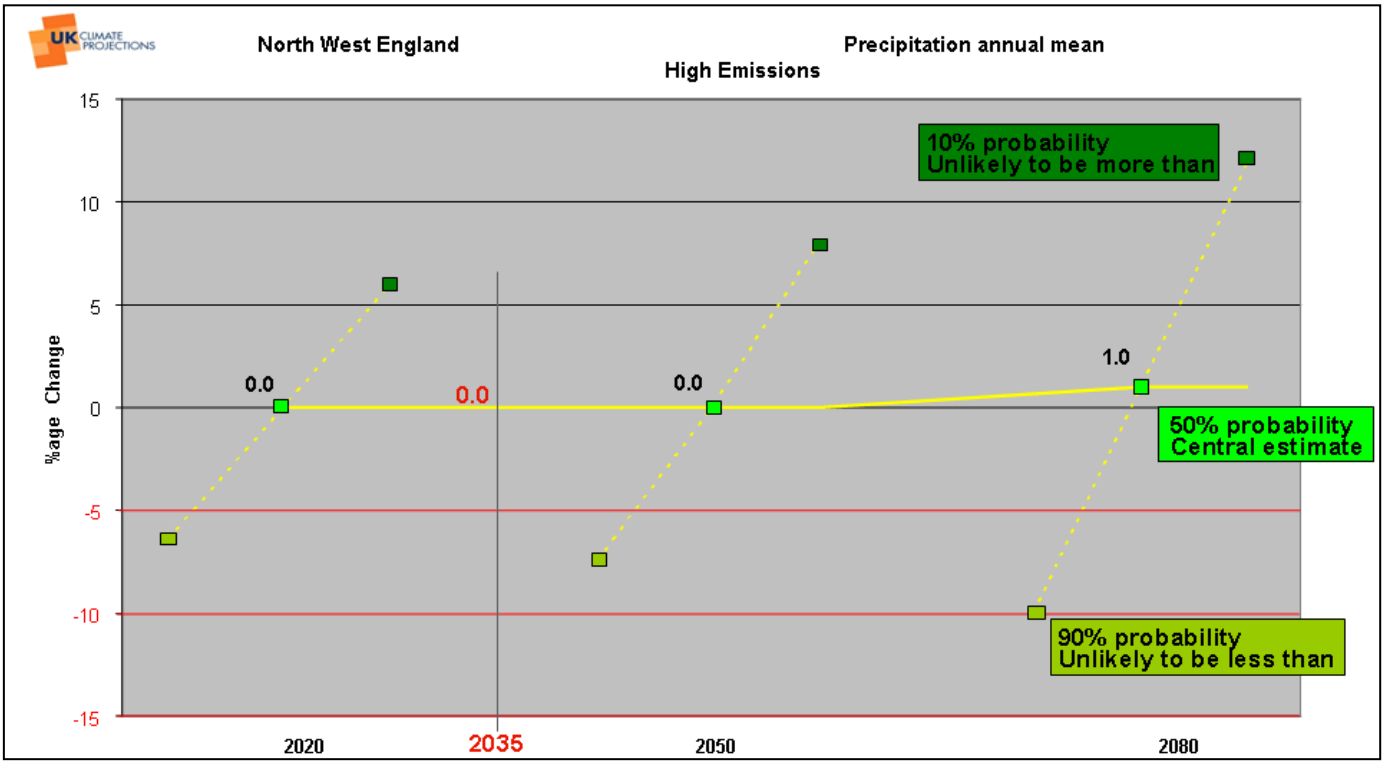

Fig 6 Annual mean precipitation

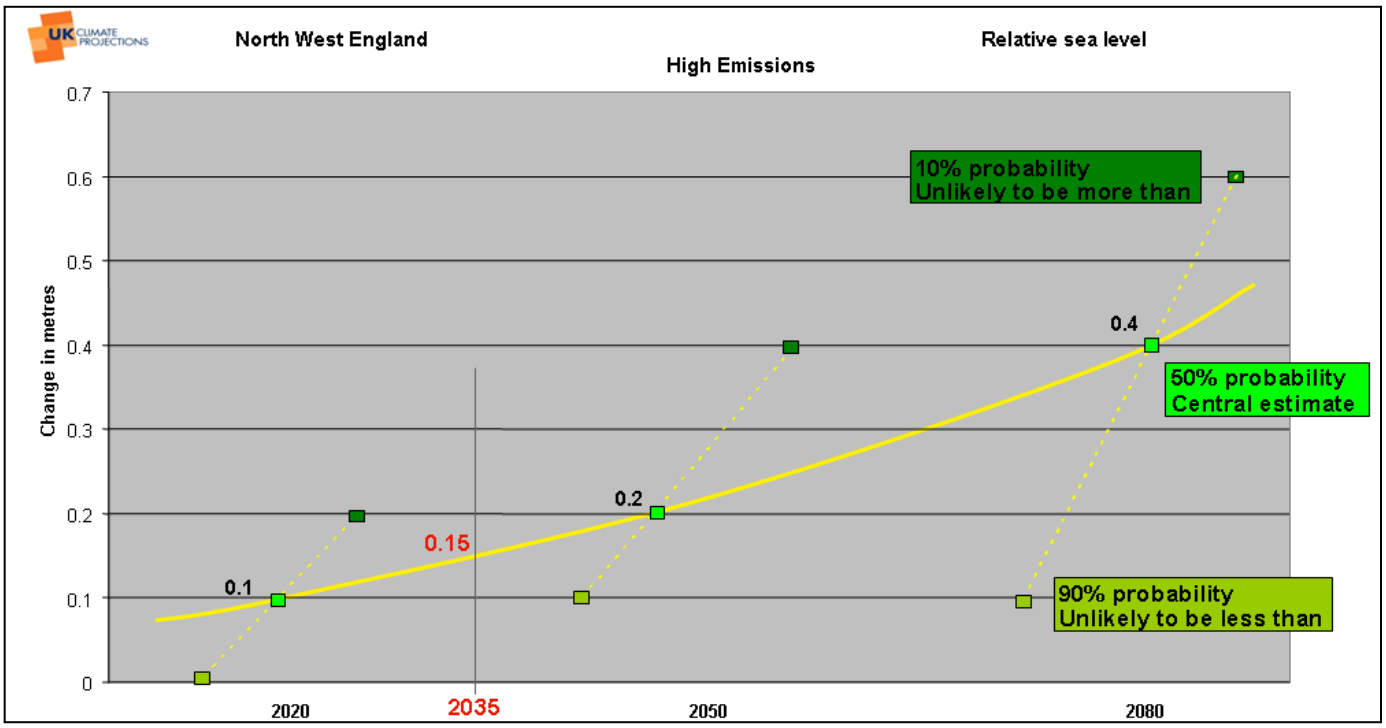

Fig 7 Relative sea level

There are notes of caution that are attributed to the predictions for precipitation in that because of the scale that the climate models work at it is not possible for them to accurately represent the changes in convective rainfall. Therefore the predictions for summer and annual may be under estimated. Also the expected increase in extreme events implies that the means shown above may not truly reflect reality.

As mentioned previously climate change is not a new phenomenon and for all of the above data sets the CP09 data also provides information on historic trends. The example in Fig 8 below shows that over the last 150 years we have already seen 250mm of rise in mean sea level at Liverpool.

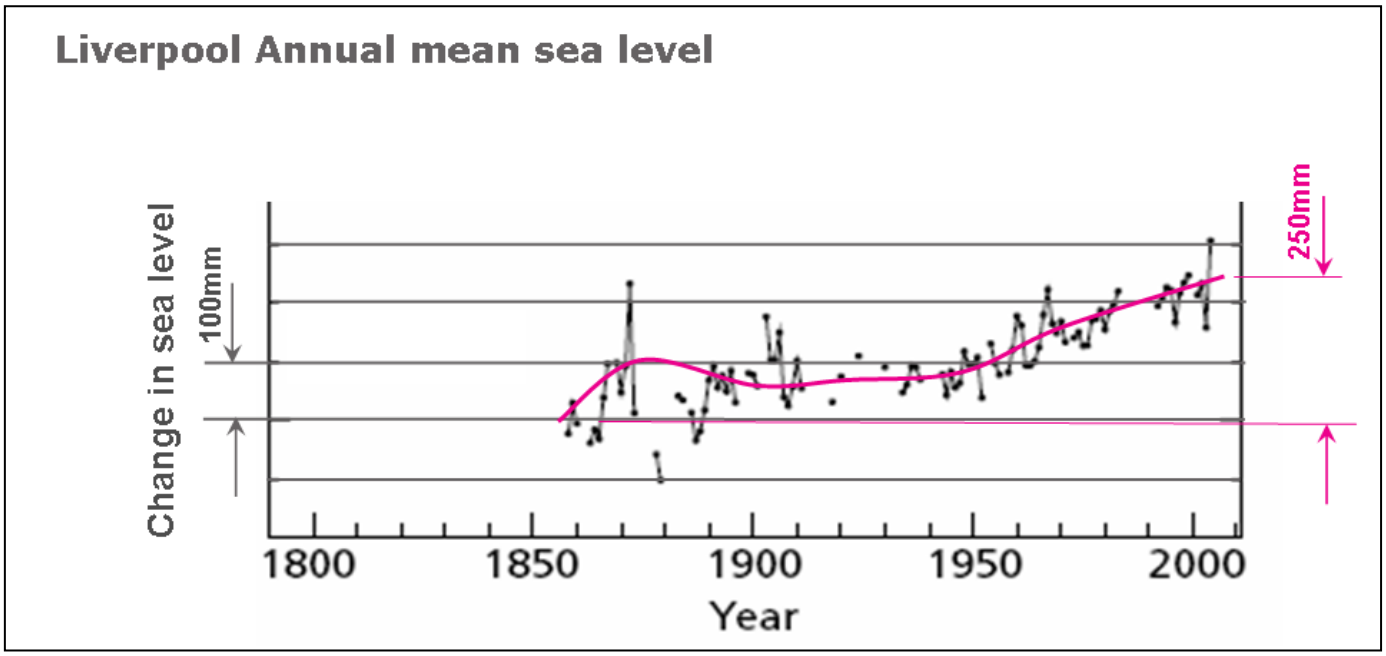

Fig 8 Historic rise in mean sea level

Adaptation reports

Under the Climate Change Act 2008 'Reporting Authorities' are required to produce a report on their adaptation work to enable Defra to produce a UK climate change risk assessment by 2012. Reporting authorities have been grouped into sectors and the diagram below shows how these fit together. Those in the centre are required to produce reports at this time.

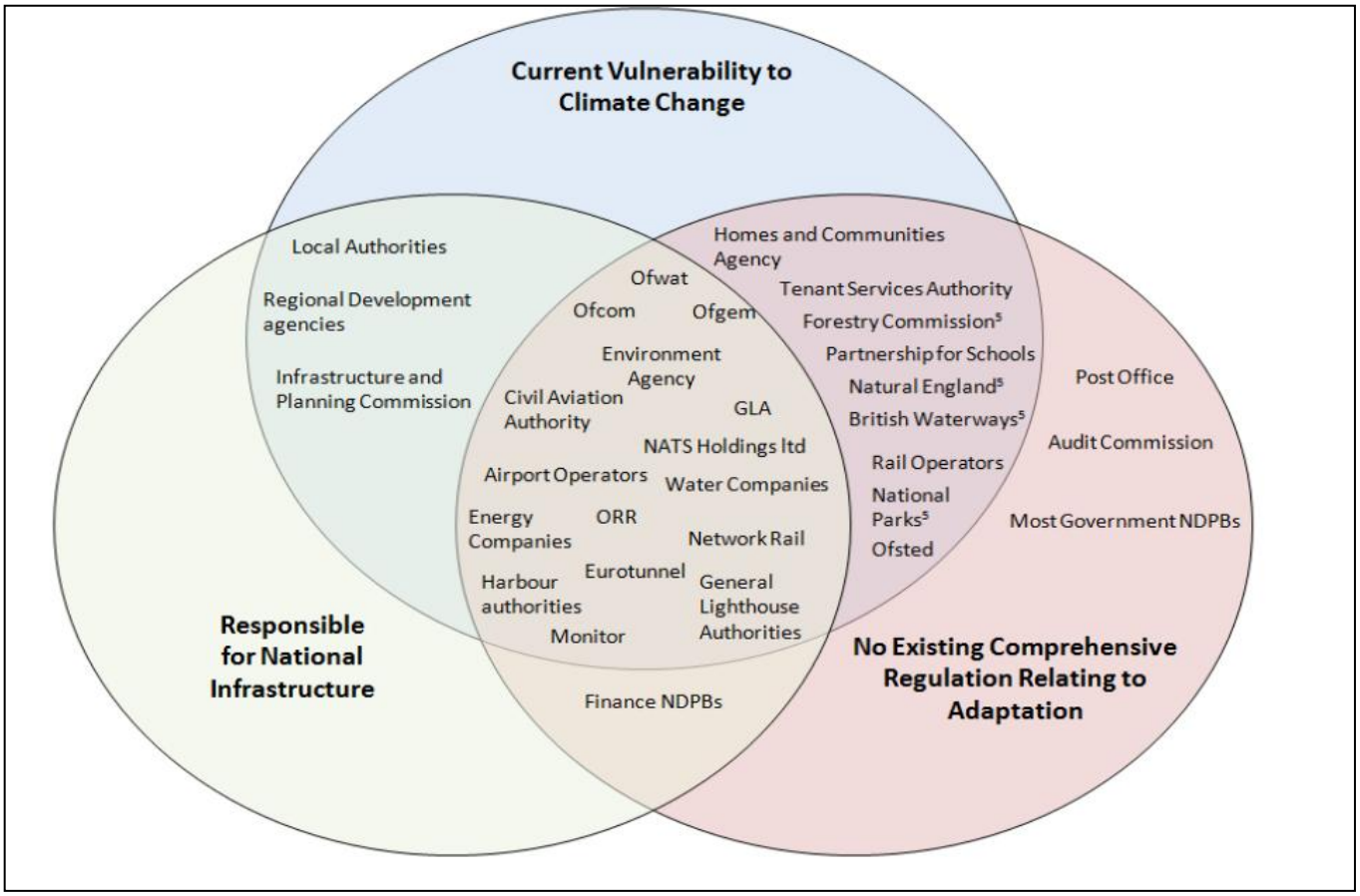

Fig 9 The roles, vulnerability and regulation of various reporting authorities

The deadline for water companies to report is 31st Jan 2011 and cover the following 7 areas:

1. Functions impacted by CC
2. Approach
3. Summary of risks
4. Proposed actions
5. Uncertainties & assumptions
6. Barriers and interdependencies
7. Monitoring & evaluation of adaptation programme

Individual company reports will be assessed by Cranfield University on behalf of Defra against set criteria to ensure that they are fit for purpose. Constructive feedback will be provided.

Individual company reports will then be rolled up to produce a water sector report and then individual sectors will be rolled up to produce the UK report.

Climate Change Act reporting requirements	
2009	First report to Parliament on the intended use of the Adaptation Reporting Power
2010	First Directions issued to reporting authorities
By end 2011	First reports from authorities published
By 26 January 2012	First UK Climate Change Risk Assessment published
Late 2012	First National Adaptation Programme and second strategy and list on the use of the Adaptation Reporting Power published
2013	Second Directions to reporting authorities
2014/15	Second set of reports from authorities
2016	Second UK Climate Change Risk Assessment published
2017	Second National Adaptation Programme and third report (strategy and list) on the use of the Adaptation Reporting Power published.

Fig 10 Timeline for producing adaptation reports

We see this report as the first in the PR14 process as a number of the proposed actions listed under 'proposed actions' will be implemented in the period 2015 -2020 and hence it is going through a formal approval and sign off process.

In developing our report we have used the CP09 data and graphs mentioned previously in a series of workshops with experts from across the business. The workshops covered 3 core areas:

Water	**Wastewater**	**Support services**	
Resources	Network	HR	Customer
Treatment	Treatment	Supply Chain	Legal
Distribution	Sludge	IT	Investor relations

Our report is based around the standard 25 year horizon for business planning and hence the 2035 time point on the CP09 graphs. However, the potential impacts at 2050 and 2080 were also considered to ensure the longer term impacts were identified.

	A	B	C	D	F	G	H	J	K	L	M	N	O	P	Q	R
17											2035					
18													Company's residual risk			
19	ASSET LEVEL 3	CLIMATE VARIABLE	MVH score	PREVIOUS UU ASSESSMENT OF LEVEL OF RISK	DESCRIPTION	PRIMARY IMPACT OF CLIMATE VARIABLE	POTENTIAL IMPACTS ON ORGANISATION AND STAKEHOLDERS	Level of consequence (2 - 8)	Level of likelihood (1 - 4)	Level of risk (Consequence X Likelihood)	Detail of adaptation actions already being undertaken		Level of consequence (2 - 8)	Level of likelihood (1 - 4)	Level of risk (Consequence X Likelihood)	Proposed action to mitigate residual risk
20	All Wastewater treatment	FLOOD	3	M	Increased storm frequency and power supply flooding increases frequency of power loss.	Process loss and potential flooding - service failure	Power outages and service failure	6	4	24			6	4	24	id locations with power supplier and develop action plan
21	All Wastewater treatment	FLOOD	4	M	Direct asset flooding.	Asset loss and service failure	Asset loss and service failure	6	4	24	flood risk plans for PPC sites only		6	4	24	flood plans for all sites outputs feed into catchment planning process
22	Treatment works	DROUGHT	3	H	Lower river flows.	New consents from EA	Reduced water quality, increased risk of a consent failure / pollution incident	6	3	18	iom - sustainable catchment work. more likely to support the need for consent change than help adapt to it		6	3	18	Work with EA to ensure that the most sustainable outcomes are achieved.
23	Treatment works	DROUGHT	3	M	Lower average and peak flows increasing need for recirculation pumping	Increased need for recirculation pumping	Increased need for recirculation pumping	4	3	12			4	3	12	SHORT TERM - change the flow pattern at the WwTW LONG TERM - Change asset design standard to remove the need for recirculation.
24	Treatment works	DROUGHT	3	L	Lower average and peak 'carry' flows lead to settlement in the system, with shock loads.	Shock loading resulting in increased asset deterioration	Accelerated asset deterioration and H&S risk	4	3	12			4	3	12	Change asset design standard to oope with this mode of operation
25	Treatment works	TEMP. RISE	2	L	Increased septicity levels and odour.	Greater septicity and odour		4	3	12			4	3	12	odour management plans
26	Treatment works	FLOOD	3	L	Extended duration of FFT due to increased rainfall and/or storage return.	Accelerated asset deterioration and failure	Accelerated asset deterioration and failure	2	4	8	Removal of SW from system through SUDS - supply /demand controls		2	4	8	Change asset design standard to oope with this mode of operation

Fig 11 Risk assessment spreadsheet

The risk assessment process was as follows:

1. Identify the potential impact and score the current level of risk (consequence x likelihood) using the company standard 8x4 risk matrix (modified to 4x4 for ease of use) see Fig 12.
2. Identify any adaptation actions already under way
3. Re score the risk assuming the adaptation actions have been completed
4. Identify adaptations actions to mitigate this residual level of risk

Impact						
	Severe	8	8	16	24	32
	High	6	6	12	18	24
	Medium	4	4	8	12	16
	Low	2	2	4	6	8
			1	2	3	4
			Remote	Unlikely	Likely	Very Likely
			Likelihood			

Fig 12 Modified risk matrix used for scoring impacts

Fig 13 below shows an example of the results from the process. The reduction in risk through the implementation of current actions can be clearly seen (arrows indicating the movement from current level of risk to residual).

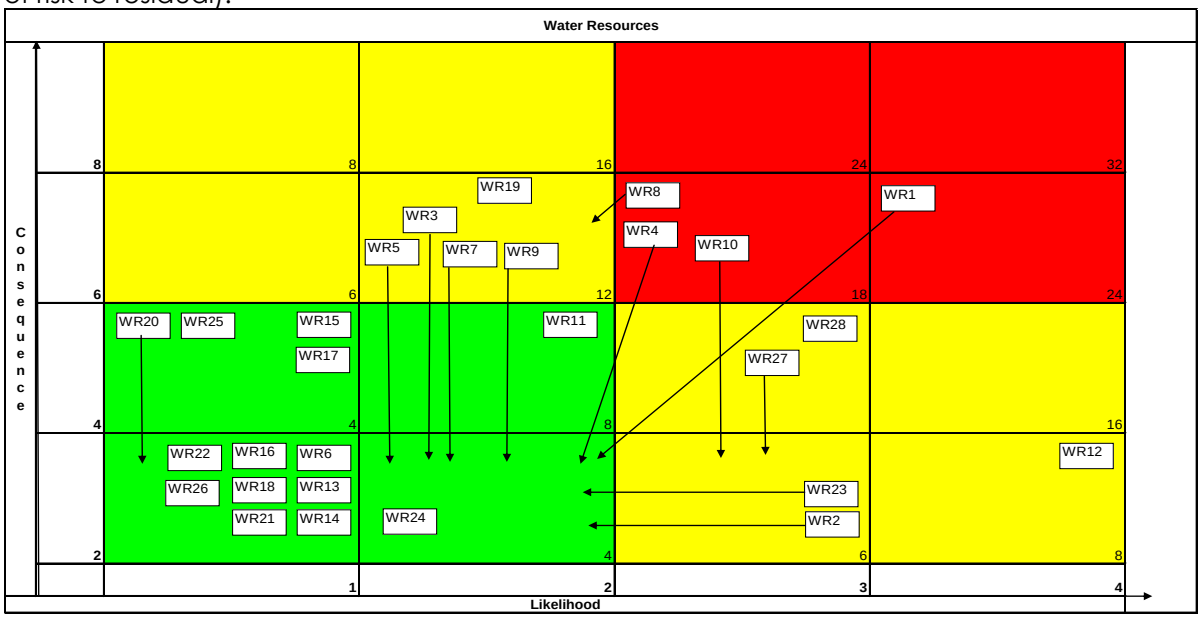

Fig 13 example of risk assessment results

Overall the process highlights:

- Focused on a 25 year horizon (2035)
- Hence projected impacts are not huge
- Biggest risk is from changes in precipitation
- Did not identify any surprises

It also reinforced existing perceptions:

- Water — Well covered through the WRMP process
- Wastewater — More work needed to ensure a consistent approach
- Support services — Need to reinforce awareness of the issues
- General — Need to work on the interdependencies with other sectors

The production of the report is on programme with work focusing on our second draft and the intention is to have the report in the post to Defra before Christmas.

Other areas of work

We are also looking at the impacts of climate change in several other areas of work:

Ofwat

Climate change is being considered as part of their Sustainable Drainage project and one of the early outputs has been the Ofwat commissioned, Met Office report "Changes in the frequency of extreme rainfall events for selected towns and cities" [2].

This report looked at the 40 locations across England & Wales of which 4 were in our region:

1. Carlisle
2. Lancaster
3. Liverpool
4. Manchester

Whilst the report has lots of caveats attached to it that mean the detail cannot be used as definitive outputs it is a very useful piece of work to highlight the likely future scenarios.

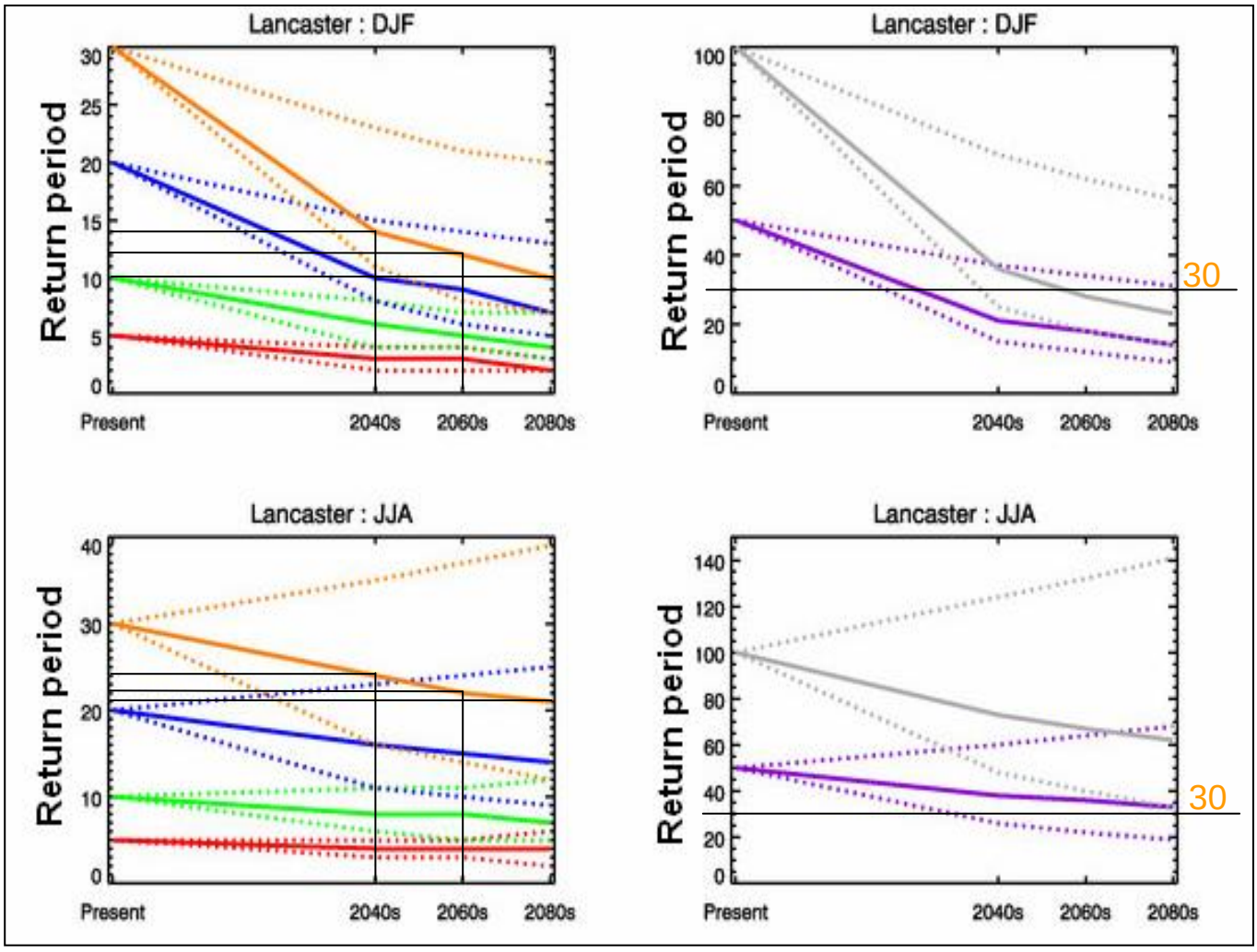

Fig 14 Outputs for Lancaster

2. Ofwat "Changes in the frequency of extreme rainfall events for selected towns and cities" July 2010 http://www.ofwat.gov.uk/sustainability/climatechange/rpt_com_met_rainfall.pdf

This example is indicating that in the Lancaster area the current 1 in 30 year storm will be equivalent to :

Winter (Dec – Jan – Feb)	Summer (Jun – Jul - Aug)
1 in 14 by 2040	1 in 24 by 2040
1 in 12 by 2060	1 in 22 by 2060
1 in 10 by 2080	1 in 21 by 2080

Note: solid lines are the 50%ile estimate dotted line 90 & 10%ile estimate

The main thing to note from this report is the timescales and the scale of change. 2040 is not that far away and some of the changes are very large. This is another piece of the evidence base that is suggesting that we all need to act sooner rather than later.

The big question is what we actually do with this knowledge; just using different storms is not the answer.

UKWIR

We are working with UKWIR to develop a R&D project that will assist asset managers by developing a process on how to take account of climate change impacts in a consistent manner.

Surface Water Management

Working with the EA on retrofitting SUDS in the urban area by implementing full scale demonstration projects. This work will highlight the issues and benefits associated with retrofitting SUDS. The aspiration is that capacity is freed up within the sewer network to assist in adapting to climate change impacts.

We are working in partnership with Lead Local Flood Authorities to develop innovative methods of managing surface water that will again assist in adapting to the impacts of climate change.

Resilience and/or resistance

Working with various bodies to understand the full linkages and benefits between resilience and resistance and climate change.