Draft Water Resources Management Plan

Statement of Response – Appendix B

Prepared by the Water Resources Strategy Team
03 September 2018

WONDERFUL ON TAP

Appendix B: Additional information

We received a large number of technical queries around our draft WRMP. These were generally requests for more explanation or more evidence to support the methodologies and decision making used to arrive at the recommendations set out in our draft WRMP. To address these queries we have expanded the relevant sections of our WRMP narrative to provide more detail and clarity were requested. Here we provide more detail on these topics and we provide the additional narrative that will be included in our final WRMP publication. It is important to note that while we are providing stakeholders with more information on these topics, we have not made any material changes to the recommendations set out in our draft WRMP.

The main topics that we are providing additional evidence on are:

- Biodiversity & catchments
- Climate change & uncertainty
- Decision making & assurance
- Demand forecast
- Drought risk
- Outage
- Resilience
- Working with retailers
- WRMP table corrections

B1 Biodiversity & catchments

B1.1 Biodiversity

We acknowledge our ability to influence, protect and enhance the biodiversity of our region as a result of the scale and scope of our operations. Promoting biodiversity, particularly in the aquatic ecosystem, is one of the cornerstones of our business objectives.

When developing our water resource supply options we have regard for all Government strategies, including the 25 year Environmental Plan, published by the UK Government in 'A Green Future: Our 25 year plan to Improve the Environment', as well as other government guidance. Our options appraisal process ensures that we undertake water resource solutions which are deemed the most environmentally beneficial - including enhancements to biodiversity – whilst also achieving the needs of our customers. When developing our biodiversity strategy for next AMP we will make sure it aligns to all company activities, including our water resources supply options.

B1.2 Natural Capital

As a company we look for solutions which are the most environmentally beneficial. Incorporating natural and social capital into our decision making processes allow us to quantify and compare the environmental and social benefits of each option.

We were actively involved in the UKWIR Implementing Ecosystem Service and Natural and Social Capital Accounting Approaches project and working group. Led by the consultant Eftec, this working group created a tool intended for water companies to incorporate Natural and Social Capital into PR19 business decisions and beyond. We have since commissioned further work on a number of case studies to investigate the practicality of this tool when applied to both PR19 and wider business decisions.

As part of our AMP7 biodiversity commitments, we have consulted with Natural England and RSPB to develop an approach of measuring natural capital through a biodiversity stock take at our larger sites and those which are known to have habitats that require protection, for example Sites of Special Scientific Interest (SSSI) and Special Areas of Conservation (SAC) etc. We have chosen to focus our efforts on our larger sites to maximise the habitat we can cover whilst being the most cost effective for our customers.

B1.3 Catchment Management

Our drinking water protection strategy is to, where possible, use catchment management techniques to reduce the number of drinking water failures and minimise or delay future water treatment expenditure on raw water quality deterioration. Over the last two AMPs our catchment management programme has been both ambitious and pioneering.

This programme of catchment management activities has allowed us to manage water quality risks in a sustainable and cost beneficial manner in accordance with regulatory requirements in Article 7 of the Water Framework Directive and Water Supply (Water Quality) Regulations.

Our plan for AMP7 and beyond includes the continuation of our 27 current catchment schemes plus eight new schemes recommended through our AMP6 investigations.

The scope of our future drinking water catchment management activities includes the following:

- STEPS (Severn Trent Environmental Protection Scheme)
- Payment for Ecosystem Services – 'Farm to Tap' previously known as 'Farmers as Producers of Clean Water' (FaPCW)
- Advice and Training

Severn Trent strongly advocate the new Farming Rules for Water. We have a number of Agricultural Advisors that offer advice and guidance on legislative requirements when carrying out farm visits. Our schemes are voluntary and are designed to enable farmers to go above and beyond good agricultural practice rather than specifically to meet regulatory requirements. Where there is evidence that voluntary measures are insufficient to meet these requirements and all voluntary measures have been exhausted then we will liaise with the appropriate regulators.

In our draft WRMP we highlighted our partnerships with third party organisations such as Wye & Usk Foundation, Trent Rivers Trust, Severn Rivers Trust, Catchment Sensitive Farming and Nottinghamshire Wildlife Trust who are key to helping us deliver our AMP6 catchment ambitions. In addition to these organisations, since writing our draft WRMP we have also established recent partnerships with the West Midlands Wildlife Trusts. We fully recognise and appreciate the cost effective, reliable and extensive expertise these partnerships bring to our current catchment programme.

Referring to our partnership with the West Midlands Wildlife Trusts, we fully support the work being planned for the Sherborne catchment and look forward to hearing the outcome of the recent Water Environment Grant bid.

STEPS (Severn Trent Environmental Protection Scheme) is a competitive scheme run across all priority catchments in the Severn Trent Region. We recognise that there has been high uptake of the STEPS scheme and that this has been popular with farmers. Similarly, the support that we have received during the consultation regarding our innovative 'Farm to Tap' scheme is acknowledged. We recognise that we need to communicate the benefits and outcomes of these schemes more widely to promote the benefits of these schemes and drive wider confidence in these programmes and similar new products and practices elsewhere. This is something we are currently looking to address and we would welcome support and input from the NFU in ways to establish ways of strengthening communication links with farming networks.

Within our current STEPs grants we offer a number of options which help support improved soil biodiversity for example low input grasslands and arable reversion. There are also grant options for water retention such as farm wetlands, grass swales and sedimentation ponds. More information can be found about these items at https://www.stwater.co.uk/about-us/environment/catchment-management/steps1/

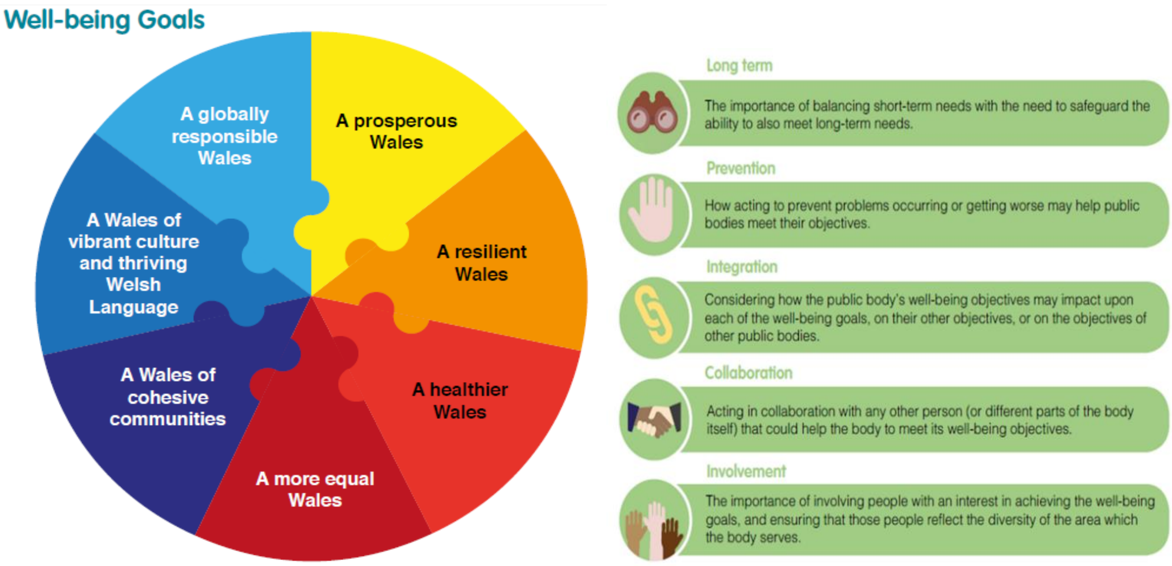
A large number of our current catchment schemes seek to address multiple water quality parameters, covering issues such as multiple pesticides, cryptosporidium, nitrate, colour/sediment and metaldehyde. Moving into AMP7 our catchment approach will be extended to include biodiversity, flooding and managing Phosphorus (P) inputs upstream of sewage works. We will also aim to further utilise our partnerships with Wildlife and Rivers Trusts along with Catchment Based Approach (CaBA) groups to explore large integrated catchment management.

B1.4 Water in Wales - Well-being of Future Generations (Wales) Act 2015

The Well-being of Future Generations (Wales) Act 2015 is a unique piece of legislation which is about improving the social, economic, environmental and cultural well-being of Wales. It is intended to make public bodies working in Wales think more about the long-term, work better with people, communities and each other, look to prevent problems and take a more joined-up approach.

The definition of public bodies within the Act does not include water and wastewater companies. However, in 2015 Welsh Government also published their Water Strategy for Wales, the priorities of which were strongly underpinned by the well-being goals (see Figure B1.1) as set out in the Act. As we strive to meet the expectations for water companies set out in the Strategy, we will work to embed the principles of the well-being goals into our water resources planning and business planning processes, and from there into our day-to-day working practices.

Figure B1.1 The seven well-being goals and five aspects of the sustainable development principle



(From *Well-being of Future Generations (Wales) Act 2015: The essentials* – Welsh Government, May 2015)

While there is potential for us to contribute to most, if not all, of the well-being goals, there are three that are particularly relevant to us in the context of our WRMP:

- **A prosperous Wales**: *An innovative, productive and low carbon society which recognises the limits of the global environment and therefore uses resources efficiently and proportionately (including action on climate change); and which develops a skilled and educated population in an economy which generates wealth and provides employment opportunities, allowing people to take advantage of the wealth generated through securing decent work.*

- **A resilient Wales**: *A nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems that support social, economic and ecological resilience and the capacity to adapt to change (for example climate change).*

- **A healthier Wales**: *A society in which people's physical and mental well-being is maximised and in which choices and behaviours that benefit future health are understood.*

A Prosperous Wales
The Welsh Government have clearly indicated that there needs to be a move towards a more integrated management of our water resources. As one of the largest abstractors of water in Wales, we have a responsibility to help shape what that approach looks like, for example through the expansion of our current catchment management programmes, and seeking opportunities for collaboration with neighbouring water companies, NGOs, land owners, local industry etc.

By working more closely with our customers to explore opportunities for increasing and understanding water efficiency and demand management messages, we can help Welsh Government achieve their objective that the people of Wales recognise how valuable water is to Wales as a resource and to their daily lives.

The Welsh Government recognise that a reliable source of water is essential to a thriving economy in Wales. By building a resilience and flexible WRMP for the future, and continuing to review how we interact with local authorities, developers and industry, we can ensure that access to a reliable water network is not a barrier to encouraging new industry into our supply area.

A Resilient Wales
In 2016, the National Assembly for Wales passed the Environment (Wales) Act 2016 which put in place the legislation needed to plan and manage Wales' natural resources in a more proactive, sustainable and joined-up way. The Act introduces a new duty on water companies in Wales, to maintain and enhance biodiversity, and promote the resilience of ecosystems; we will work with all relevant parts of the business to ensure this duty is delivered through our capital investment programmes and responsible management of our land assets.

We will build on our current catchment management programme and explore opportunities for achieving wider environmental benefits by working with landowners and other partners to encourage more sustainable working practices. By reducing the risk of pollution to water courses and addressing problems at source, we can reduce treatment costs and have year-round access to sources that currently have seasonal use restrictions.

A Healthier Wales
The Welsh Government recognise that there are a wide range of benefits, both mental and physical, to be had from encouraging access to water. They also want to ensure that everyone in Wales has access to clean, wholesome drinking water.

We will be reviewing our impoundment reservoirs over the next couple of planning periods, both to see what can be done at source to improve water quality, so reducing potential for taste and odour issues and reduce treatment costs, but also to assess potential for recreational use opportunities.

B1.5 Water in Wales - Environment (Wales) Act 2016 & the biodiversity duty

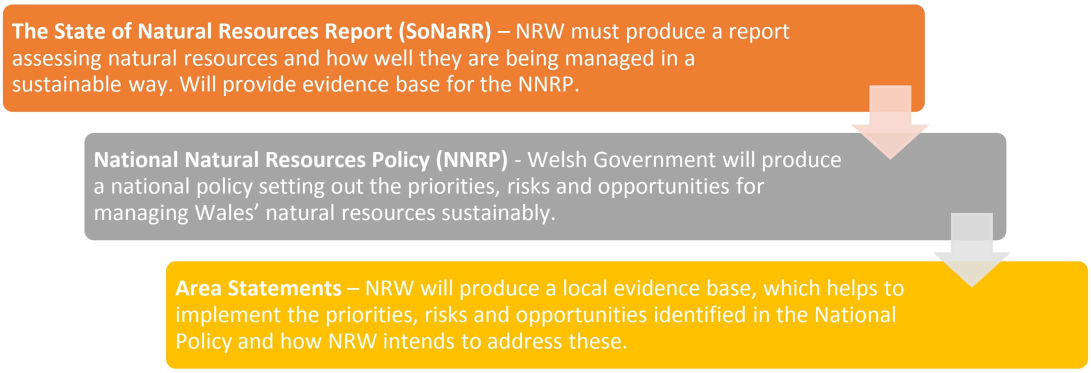
As described previously, the Welsh Government have recently introduced a new piece of environmental legislation - the Environment (Wales) Act 2016. The Act will mean significant economic, social and environmental benefits for Wales. It has been carefully designed to support and complement the Welsh Government's work to help secure Wales' long-term well-being, so that current and future generations benefit from a prosperous economy, a healthy and resilient environment and vibrant, cohesive communities. Section 6 of the Act introduces a duty on public authorities operating in Wales to *'maintain and enhance biodiversity in the exercise of functions in relation to Wales, and in so doing promote the resilience of ecosystems, so far as* *consistent with the proper exercise of those functions'.* The definition of public authority in this instance does include water and wastewater companies.

We recognise that we have the potential to have a significant impact on a wide range of ecosystems in Wales, and to ensure that we maintain and enhance biodiversity and promote the resilience of ecosystems in the exercise of our functions we will:

- Be a responsible environmental steward by minimising the impact of our activities, ensure we have robust environmental control systems and work within our catchments to reduce risk to quality and enhance ecosystems.
- Maintain and enhance biodiversity, and promote the resilience of ecosystems through our capital investment programmes and responsible management of our land assets.
- Ensure all employees are aware of the impact of their activities on biodiversity and ecosystems through the development and implementation of relevant training.
- Develop plans for asset improvement based on robust environmental impact assessments and ecological surveys to identify any potential impact on biodiversity. Where potential impact is identified, we will seek to introduce ways of working that minimise the impact as well as seeking opportunities to enhance the resilience of the local ecosystems through the asset improvements.
- Have regard to the Welsh Government's National Natural Resources Policy (due to be issued in mid-2017), which will set out their priorities in relation to the management of natural resources in Wales.
- Develop a robust catchment management programme which will take account of findings set out in Natural Resources Wales' State of Natural Resources Report (SoNaRR) and the subsequent Area Statements. We will also refer to the Welsh Government's Nature Recovery Plan for Wales to identify any actions that we can help to deliver while enhancing the quality of our water resource assets.
- Continue to work closely with industry partners to identify opportunities for increasing our resilience, and that of the ecosystems we work in, to the effect of climate change.
- Seek opportunities for working with partners and local communities to maintain and enhance the biodiversity at our publicly accessible sites. We will also consider whether any of our sites which are not currently accessible could be made so, to increase their value to the local community as well as providing opportunities for better maintaining the resilience of their ecosystems.

The Environment (Wales) Act 2016 introduced a new approach to managing the essential natural resources of Wales – *Sustainable Management of Natural resources (SMNR)*. The SMNR approach is designed to ensure that the use of and the impacts on our natural resources do not result in their long term decline. The aim is to sustainably manage natural resources in a way and at a rate that meets the needs of the present generation without compromising the needs of future generations, while contributing to the seven well-being goals. Figure B1.2 illustrates the framework which will support the delivery of this approach.

Figure B1.2 - Welsh Government / NRW's framework for delivering SMNR



While the SoNaRR sets out the Wales-wide baseline for the current state of natural resources, Area Statements will form the main evidence base that we can feed into and refer to when developing our future investment programmes. We will need to work closely with NRW and other key stakeholders to understand what the Area Statements might mean for us; the key risks and issues, and associated mitigating actions that water companies can have an impact on.

We will need to continue to work closely with key stakeholders and our Customer Challenge Group to help engage with our customers to ensure they understand and accept solutions that may be more costly but will deliver wider, long term social, economic and environmental benefits.

In our final WRMP, the Llandinam and Llanwrin WRZ will be part of our Hafren Dyfrdwy WRMP. Our approach to managing water resources in Wales means that we will embed the principles of the Well-being of Future Generations (Wales) Act and the Environment (Wales) Act into our investment planning and operational activities. To achieve this we will build on our current successes, such as our catchment management programme and our water efficiency and customer education programme. We will continue to seek opportunities for collaboration with other stakeholders including neighbouring water companies, NGOs, land owners and local industry.

B2 Climate change & uncertainty

Selecting climate change scenarios

Our draft and final WRMPs use the 2030s UKCP09 'timeslice' to inform both the reduction from baseline deployable output (as reported in the Water Resource Planning tables) and the range of uncertainty used in the target headroom assessment. Since the draft WRMP, we have carried out analysis using the 2080s 'timeslice' to determine how sensitive the plan would be to more extreme climate change scenarios. The 2080s projections have not been used to determine the strategy for the 25 year plan. However, they have been used as part of the long time-horizon modelling we have carried out, which looks ahead to 2100.

For each time-horizon and emission scenario UKCP09 provides 10,000 projections (as monthly, seasonal and annual changes) which have all been assigned specific scenario IDs. UKCP advise caution if attempting to 'stitch together' time series. However, projections with the same scenario ID at a different 'timeslice' can be used for comparison purposes. As part of our 2080s assessment we wanted to understand where our 20 sub-sampled UKCP09 2030s projections sat within the full range of 10,000 UKCP09 2080s projections. We used the same drought indicator (April to September precipitation changes) to select the 20 projections from the 2030s 'timeslice' and to rank the 2080s projections. The rankings are shown in Table B2.1.

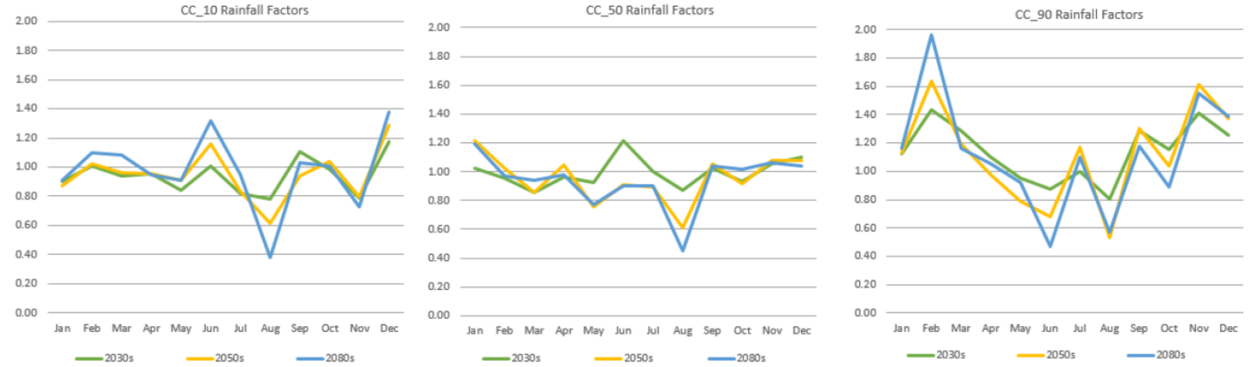
The comparison highlighted that the scenarios provide a reasonable coverage of the UKCP09 ensemble for the 2080s when considering seasonal and annual climate metrics. They were therefore suitable for carrying out sensitivity analysis.

Table B2.1: 2030s UKCP09 projections with 2080s ranking based on April to September rainfall

UKCP09 ID	2030s rank	2080s rank
8632	1	2
9855	2	8
3111	3	15
6108	4	29
1090	5	8
2203	6	9
1345	7	57
8282	8	35
6461	9	9
684	10	64
2726	15	60
9701	20	12
3521	30	26
281	40	36
3903	50	39
2745	60	58
3306	70	39
9623	80	53
1467	90	58
8764	95	99

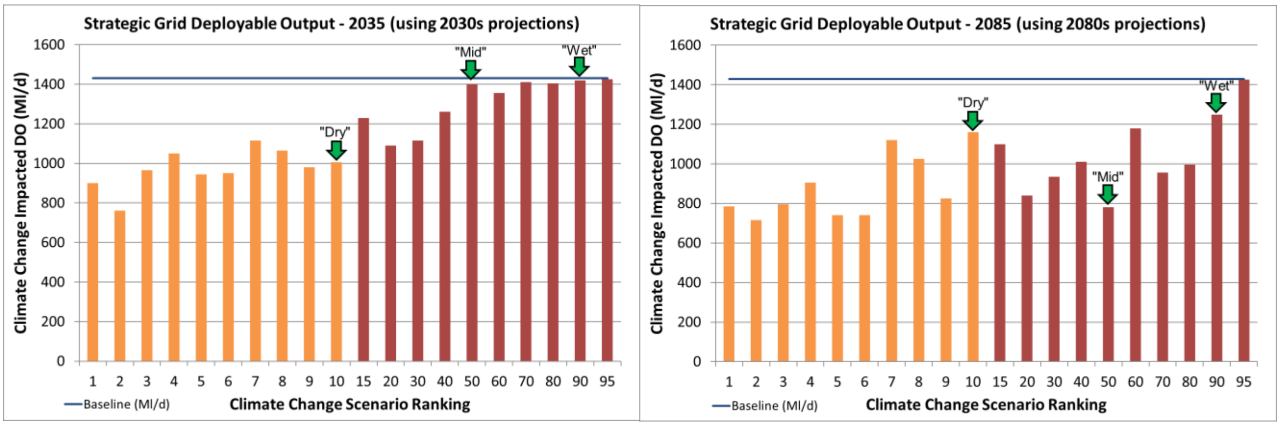
Figure B2.1 shows the range of percentage change in precipitation captured in our climate change assessments for the 2030s and 2080s. The 2050s has been included for comparison as this represents a 'tipping point' in the projections – beyond the 2050s the projections become much more severe particularly in the summer reductions in rainfall. Rank 90 (CC_90) represents our 'wet' scenario, rank 50 (CC_50) is our 'central estimate' and rank 10 (CC_10) is our 'dry' scenario.

Figure B2.1: Percentage change in precipitation in UKCP09 projections



Assessment of the maximum deployable output that can be achieved during each climate change scenario in our largest WRZ (the Strategic Grid) is illustrated in Figure B2.2. This shows that by the 2030s, almost all scenarios suggest some loss of deployable output compared with our current baseline deployable output. Figure B2.2 also shows that by the 2080s almost all scenarios suggest an extreme impact on deployable output. Having analysed and understood the extreme impacts suggested by the 2080s scenarios, we have chosen not to use them in our WRMP and PR19 investment planning decisions. The scale of investment needed to accommodate these potential impacts would be disproportionate given the very long timescales involved and the increasing uncertainty in the UKCP09 projections themselves in the later 'timeslices'. Instead we have used the less extreme 2030s climate change scenarios to inform our WRMP 25 year plan and PR19 investment plan. Our approach is to accommodate the range of uncertainty implied over this shorter time horizon. This approach avoids us having to commit to very long term investment decisions and instead focus on more modular solutions matched to nearer term deficits.

Figure B2.2: Modelled impact of climate change on the Strategic Grid deployable output using 2030s and 2080s UKCP09 projections



Consideration of climate change in our WRMP – Demand Forecast

Our assessment of climate change impact on demand follows the EA WRMP Guideline and is calculated in accordance to UKWIR 13/CL/04/12 Impact of Climate Change on water demand. The assessment for baseline consumption has shown the predicted impact on household demand is a minimal 0.9% increase by 2040. The impact of climate change on demand-side options, particularly those targeting household demand, will therefore be negligible.

Consideration of climate change in our WRMP – Supply Schemes

To help inform our supply-side option selection process we carried out deployable output (DO) modelling of options on our constrained list using our water resources model, Aquator. This established a 'central estimate' of deployable output benefit for each option that we subsequently used in our investment optimisation and least cost planning modelling, described in Section 8 of our draft WRMP.

There were several iterations of the investment optimisation modelling. A number of options that were selected most frequently (including all options in our preferred programme) were subject to further scenario assessments using our Aquator model. These scenarios assessed the sensitivity of the options to the potential impacts of climate change and changes made to our abstraction licences as a result of the Water Industry National Environment Programme (WINEP). These assessments were carried out using zonal and 'local' modelling using our Aquator model to estimate the DO benefits at both a water resource zone and localised supply area level. In some cases the zonal modelling approach masked the predicted benefit of the option. Consequently, local supply area modelling was carried out to provide greater transparency and granularity in terms of the predicted magnitude and location of the benefit.

We have assessed the potential impact of combining the rank 50 2030s climate projection with likely WINEP licence changes to better understand the future supply network constraints in the 2030s. The rank 50 climate projection represents our 'best central estimate' for climate change within our plan and has been used to inform the predicted reduction in DO due to climate change in the water resources planning tables. This combined scenario results in a reduced zonal DO across most zones when compared to our baseline position.

Table B2.2 Preferred programme of options and deployable output benefit

Scheme Code	Scheme Name	Central Estimate DO (Ml/d)	DO under climate change with WINEP combined scenario (Ml/d)
MEL29	Carsington Reservoir support to Site Q WTW with Site Q WTW enhancements	26	25
CRO06	River Soar to support Site B WTW	17	19
GRD18	Peckforton Group BHs rehabilitation and treatment enhancement	36	30
WTW05	East Midlands raw water storage (Site CQ) including new WTW	45	38
DAM07	Draycote Reservoir capacity increase (Size A) with transfer main from Site C WTW to Coventry	9	17
NOT04	Heathy Lea to North Nottinghamshire transfer solution	25	22
WIL05	Site E WTW expansion and transfer main supported by raw water augmentation of the River Trent	35	50
CRO05	Thornton Reservoir to support Site B WTW	8	8
DOR08	Site B WTW enhancements	3.6	14
BAM03	Site R WTW to Grindleford pipeline capacity increase	7.5	7.5
OGS01	Site J WTW expansion	15	4
BHS06	Maximise deployment from Diddlebury WTW and Munslow BH	0.9	19
DOR05	Site C WTW enhancements	8	8
LIT01	Site F WTW expansion	10	8
BHS07	Ladyflatte BHs recommissioning	2.7	7
DAM01	Stanford Reservoir capacity increase (Size A)	2.5	7
DAM02	Lower Shustoke capacity increase (Size A)	2.5	11
DAM03	Site A Reservoir capacity increase (Size A)	2.5	7
DOR02	Site I WTW enhancements	2	2
NOT01	Ambergate to Mid Nottinghamshire transfer solution	30	18
NOT05	Site E to South Nottinghamshire transfer solution	30	19
UNK07	Improve Site L WTW outputs during low raw water periods	7	54

Table B2.2 shows the modelled deployable output benefit of the options within our preferred programme in our final WRMP for the central estimate (which is modelled using our baseline Aquator model) and the combined climate change with WINEP scenario. Although showing some variability, generally the benefit of each option is greater under the combined scenario than the baseline in most cases. This is because the option deployable output benefit has been optimised to help us regain some of the DO lost by WINEP licence changes as well as make the most of water when it is available in the climate change scenario. We will carry out further scenario modelling as part of our feasibility assessments during AMP7.

Consideration of climate change in our WRMP – Target Headroom

Since we published our draft WRMP we have improved our overall assessment of target headroom to better account for uncertainty in both supply side and our demand projections. The overall impact on total target headroom is a reduction of approximately 5Ml/d across the first 10 years of the planning period. We reviewed the inputs to our target headroom model to ensure that we were not double counting any uncertainty. As described in Appendix C1 of our WRMP, we made an allowance for supply side data uncertainty, groundwater sources at risk of gradual pollution, impacts of climate change, accuracy of sub-component demand and demand forecast variation. We did not make an additional allowance for time limited licences or bulk supplies as we had already made an allowance for uncertainty of supply side data under UKWIR publication '*An improved methodology for assessing headroom*' key component S6 (accuracy of supply side data) issues.

One consultee requested improved transparency regarding the climate change allowance in our target headroom assessment. To address this matter we are now stating the 'relative' contribution of the climate change component compared to the other components. Having now reviewed the other water companies' draft WRMPs, we have found this change brings us more in line with the industry average. The climate change component of our target headroom at a company level has reduced to a maximum 10.2% of total water available for use (compared to an industry average of 8%). We also note that several other companies have been asked to review their methodologies as the Regulators believe their assessments of climate change uncertainty are too low.

The WRMP data tables have been updated for submission with the final WRMP. Table B2.3 shows the contribution of the climate change component for each water resource zone. Table B2.4 shows the contribution of all other components and Table B2.5 shows the total target headroom for each zone.

Table B2.3 Contribution of climate change components to target headroom (WRMP data table 4.BL SDB row ref 14BL and table 9.FP SDB row ref 14FP)

Water Resource Zone	2016-17	For info 2017-18	For info 2018-19	For info 2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45
Bishops Castle	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Forest and Stroud	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02	-0.02	-0.02	-0.02	-0.03	-0.02	-0.02	-0.03	-0.03	-0.02	-0.02	-0.02	-0.02	-0.03	-0.02	-0.03	-0.03	-0.03	-0.03
Kinsall	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Llandinam and Llanwrin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mardy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Newark	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
North Staffs	0.00	0.25	0.48	0.71	0.97	1.16	1.34	1.65	1.89	1.92	2.14	2.42	2.65	2.96	3.13	3.13	3.23	3.32	3.28	3.39	3.41	3.50	3.66	3.67	3.79	4.03	4.25	4.50	4.86
Nottinghamshire	0.00	0.27	0.52	0.72	0.89	1.04	1.23	1.37	1.59	1.28	1.35	1.53	1.72	1.83	2.01	2.00	2.08	2.12	2.08	2.15	2.22	2.38	2.33	2.38	2.50	2.41	2.58	2.60	2.64
Rutland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ruyton	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shelton	0.00	0.06	0.12	0.17	0.22	0.27	0.32	0.37	0.42	0.40	0.44	0.48	0.52	0.56	0.57	0.57	0.57	0.59	0.60	0.62	0.60	0.64	0.64	0.65	0.66	0.67	0.68	0.69	0.70
Staffordshire	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Strategic Grid	0.00	11.35	24.06	37.67	52.93	69.63	86.43	104.98	121.00	124.52	138.06	162.01	174.57	190.76	168.50	168.23	171.89	173.49	177.16	153.13	153.88	158.28	157.08	162.80	140.90	140.63	144.18	145.78	147.00
Whitchurch and Wem	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wolverhampton	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table B2.4 Contribution of all non-climate change components to target headroom (WRMP data table 4.BL SDB row ref 15BL and table 9.FP SDB row ref 15FP)

Water Resource Zone	2016-17	For info 2017-18	For info 2018-19	For info 2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45
Bishops Castle	0.18	0.18	0.17	0.17	0.17	0.17	0.17	0.16	0.16	0.13	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.12	0.13	0.12	0.13	0.13	0.13	0.13	0.13
Forest and Stroud	2.12	1.98	1.91	1.82	1.69	1.65	1.58	1.50	1.41	0.96	0.91	0.81	0.80	0.75	0.75	0.70	0.65	0.70	0.69	0.65	0.67	0.62	0.67	0.73	0.66	0.69	0.69	0.69	0.68
Kinsall	0.17	0.17	0.17	0.16	0.15	0.14	0.14	0.14	0.14	0.11	0.11	0.11	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.13
Llandinam and Llanwrin	0.66	0.64	0.63	0.61	0.60	0.59	0.59	0.57	0.57	0.46	0.44	0.45	0.46	0.45	0.45	0.46	0.46	0.47	0.46	0.47	0.47	0.48	0.48	0.50	0.48	0.49	0.50	0.53	0.52
Mardy	0.40	0.39	0.40	0.39	0.38	0.39	0.38	0.40	0.40	0.29	0.29	0.29	0.29	0.29	0.29	0.28	0.29	0.28	0.28	0.28	0.29	0.28	0.28	0.28	0.27	0.28	0.28	0.28	0.29
Newark	0.53	0.52	0.50	0.48	0.46	0.45	0.45	0.43	0.42	0.32	0.33	0.34	0.33	0.33	0.32	0.33	0.34	0.33	0.34	0.34	0.34	0.36	0.36	0.36	0.35	0.37	0.38	0.37	0.40
North Staffs	4.43	4.23	4.00	3.85	3.80	3.65	3.52	3.71	3.65	2.84	2.87	3.01	3.00	3.18	3.33	3.26	3.34	3.28	3.37	3.34	3.37	3.50	3.63	3.62	3.69	3.78	3.88	4.09	4.32
Nottinghamshire	7.98	7.44	6.98	6.26	5.92	5.28	5.20	5.04	4.96	3.37	3.24	3.38	3.46	3.51	3.69	3.62	3.79	3.83	3.73	3.96	3.99	4.23	4.21	4.49	4.51	4.29	4.72	4.72	4.95
Rutland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ruyton	0.20	0.20	0.19	0.18	0.18	0.17	0.17	0.17	0.16	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.14	0.13	0.14	0.13	0.14	0.14	0.14	0.14	0.14
Shelton	5.87	5.55	5.55	5.20	5.08	4.93	4.87	4.74	4.77	3.51	3.42	3.44	3.49	3.53	3.52	3.55	3.48	3.57	3.63	3.69	3.61	3.86	3.89	3.88	4.03	3.96	4.06	4.10	4.16
Staffordshire	1.26	1.24	1.25	1.18	1.15	1.11	1.12	1.10	1.05	0.76	0.75	0.74	0.73	0.75	0.76	0.76	0.77	0.75	0.76	0.81	0.85	0.83	0.87	0.88	1.05	1.08	1.10	1.11	1.15
Strategic Grid	26.34	22.79	23.51	23.69	24.51	25.45	25.88	26.29	27.51	20.55	21.65	22.10	22.77	23.56	12.33	11.82	12.07	13.01	14.28	3.22	3.57	4.09	3.87	3.51	-7.15	-7.17	-7.77	-6.14	-4.26
Whitchurch and Wem	0.39	0.37	0.36	0.34	0.34	0.33	0.33	0.31	0.31	0.29	0.29	0.29	0.28	0.29	0.30	0.30	0.28	0.29	0.30	0.31	0.31	0.31	0.31	0.32	0.32	0.32	0.33	0.34	0.33
Wolverhampton	2.12	2.03	2.00	1.88	1.78	1.72	1.69	1.64	1.55	1.22	1.21	1.14	1.16	1.18	1.18	1.16	1.15	1.21	1.23	1.26	1.17	1.25	1.30	1.33	1.43	1.39	1.38	1.39	1.49

Table B2.5 Total target headroom (WRP table 4.BL SDB row ref 16BL and table 9.FP SDB row ref 16FP)

Water Resource Zone	2016-17	For info 2017-18	For info 2018-19	For info 2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45
Bishops Castle	0.18	0.18	0.17	0.17	0.17	0.17	0.17	0.16	0.16	0.13	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.12	0.13	0.12	0.13	0.13	0.13	0.13	0.13
Forest and Stroud	2.12	1.98	1.91	1.81	1.68	1.64	1.57	1.49	1.40	0.94	0.89	0.79	0.77	0.73	0.73	0.67	0.62	0.68	0.67	0.62	0.64	0.60	0.65	0.70	0.64	0.66	0.66	0.66	0.66
Kinsall	0.17	0.17	0.17	0.16	0.15	0.14	0.14	0.14	0.14	0.11	0.11	0.11	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.13
Llandinam and Llanwrin	0.66	0.64	0.63	0.61	0.60	0.59	0.59	0.57	0.57	0.46	0.44	0.45	0.46	0.45	0.45	0.46	0.46	0.47	0.46	0.47	0.47	0.48	0.48	0.50	0.48	0.49	0.50	0.53	0.52
Mardy	0.40	0.39	0.40	0.39	0.38	0.39	0.38	0.40	0.40	0.29	0.29	0.29	0.29	0.29	0.29	0.28	0.29	0.28	0.28	0.28	0.29	0.28	0.28	0.28	0.27	0.28	0.28	0.28	0.29
Newark	0.53	0.52	0.50	0.48	0.46	0.45	0.45	0.43	0.42	0.32	0.33	0.34	0.33	0.33	0.32	0.33	0.34	0.33	0.34	0.34	0.34	0.36	0.36	0.36	0.35	0.37	0.38	0.37	0.40
North Staffs	4.43	4.48	4.48	4.56	4.76	4.81	4.86	5.36	5.54	4.76	5.01	5.43	5.65	6.14	6.45	6.39	6.57	6.60	6.65	6.73	6.78	7.01	7.29	7.29	7.48	7.81	8.13	8.59	9.18
Nottinghamshire	7.98	7.71	7.50	6.99	6.81	6.32	6.44	6.41	6.55	4.65	4.59	4.92	5.19	5.34	5.69	5.62	5.87	5.95	5.81	6.10	6.21	6.61	6.54	6.87	7.01	6.70	7.30	7.32	7.59
Rutland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ruyton	0.00	0.20	0.19	0.18	0.18	0.17	0.17	0.17	0.16	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.14	0.13	0.14	0.13	0.14	0.14	0.14	0.14	0.14
Shelton	5.87	5.61	5.67	5.38	5.30	5.20	5.18	5.11	5.20	3.91	3.86	3.92	4.01	4.09	4.08	4.12	4.05	4.17	4.23	4.31	4.21	4.49	4.53	4.53	4.68	4.62	4.74	4.80	4.86
Staffordshire	1.26	1.24	1.25	1.18	1.15	1.11	1.12	1.10	1.05	0.76	0.75	0.74	0.73	0.75	0.76	0.76	0.77	0.75	0.76	0.81	0.85	0.83	0.87	0.88	1.05	1.08	1.10	1.11	1.15
Strategic Grid	26.34	34.15	47.57	61.36	77.44	95.07	112.31	131.26	148.52	145.07	159.71	184.11	197.34	214.31	180.84	180.05	183.95	186.51	191.44	156.35	157.45	162.37	160.95	166.31	133.75	133.46	136.41	139.63	142.74
Whitchurch and Wem	0.39	0.37	0.36	0.34	0.34	0.33	0.33	0.31	0.31	0.29	0.29	0.29	0.28	0.29	0.30	0.30	0.28	0.29	0.30	0.31	0.31	0.31	0.31	0.32	0.32	0.32	0.33	0.34	0.33
Wolverhampton	2.12	2.03	2.00	1.88	1.78	1.72	1.69	1.64	1.55	1.22	1.21	1.14	1.16	1.18	1.18	1.16	1.15	1.21	1.23	1.26	1.17	1.25	1.30	1.33	1.43	1.39	1.38	1.39	1.49

As described in Appendix C2.3 of our draft WRMP, our strategy is based around delivering a target headroom that provides a 95% level of confidence during AMP7 that we will meet our target levels of service in all of our water resource zones. Over the 25 year horizon, our target headroom profile varies to reflect the fact that many of the medium to long term uncertainties can be managed over time.

In our Strategic Grid and Nottinghamshire WRZs, the longer term uncertainty around the impacts of climate change increases significantly and dominates our uncertainty analysis. Our chosen risk profile in these zones reflects the fact that we have already discounted some of the higher impact/lower probability scenarios by adopting a triangular distribution around the rank 10 (dry), rank 50 (mid) and rank 90 (wet) climate projections in our assessment. As a result, we have adopted a target headroom risk profile that gives us high confidence in the short to medium term that we can meet our planned levels of service while coping with the range of planning uncertainties.

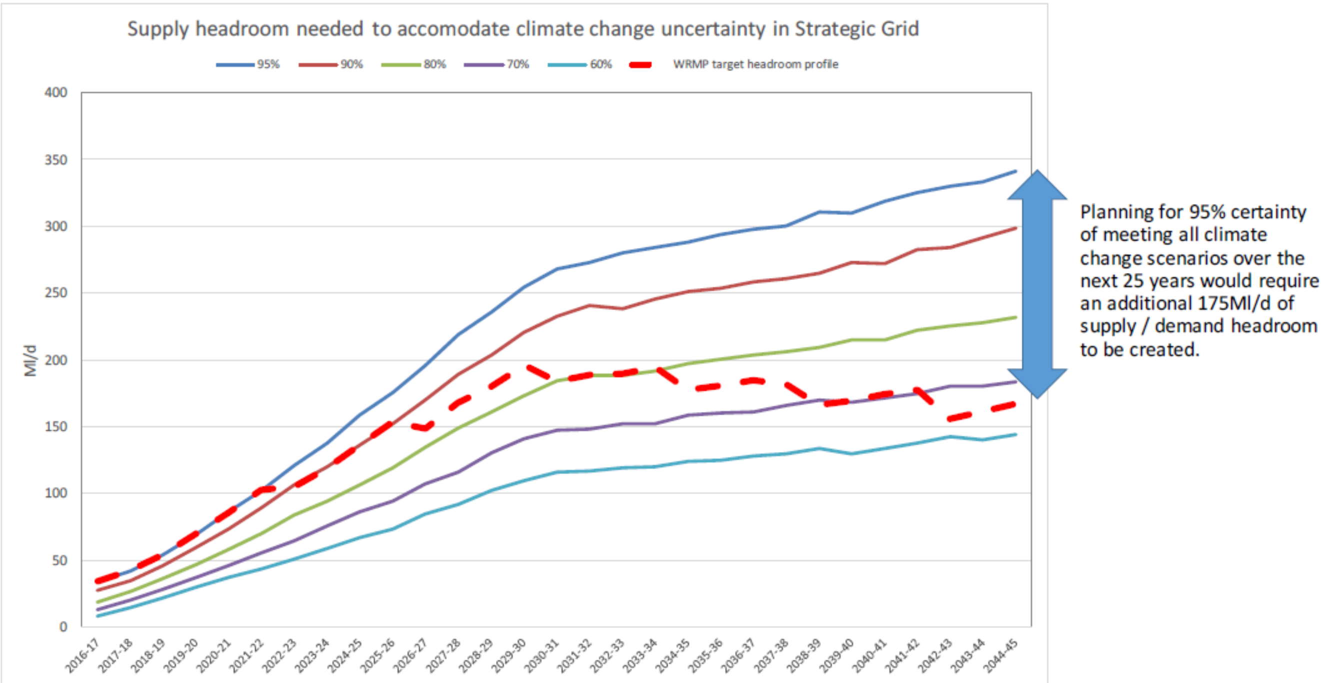
The stepped shape of the target headroom profile over time is a result of the headroom risk glidepath described in Table C2.5 of our WRMP. Table B2.6 shows the target headroom glidepath we have used for the Strategic Grid zone. The glidepath we have adopted causes a step reduction in target headroom at the start of each AMP. Between these glidepath changes target headroom continues to increase due to the climate change uncertainty which increases over time. We will review the options for smoothing the glidepath in our preparations for WRMP24.

Table B2.6: Strategic Grid target headroom glidepath

AMP Years	7 2020-2025	8 2025-2030	9 2030-2035	10 2035-2040	11 2040-2045
Strategic Grid	95%	90%	80%	70%	60%

Figure B2.3 illustrates how our target headroom profile compares with other potential profiles that could have been adopted to accommodate an even wider range of uncertainty around the 2030s climate change outlook, ranging from 95% certainty to 60% certainty.

Figure B2.3: Planning for climate change uncertainty



Our approach to managing climate change risk and uncertainty, means we avoid having to commit to potential large scale investment decisions in AMP7 that would be driven by very uncertain long term scenarios. Our WRMP delivers a high level of confidence for AMP7 and AMP8, but accepts an increasing amount of climate risk beyond that. If we were to require the same level of planning certainty throughout the long term planning horizon, we would need to commit to even more investment to achieve this. Instead, Figure B2.3 illustrates that for the Strategic Grid zone, our approach avoids the need to invest in approximately 175Ml/d of supply / demand headroom capability by 2045.

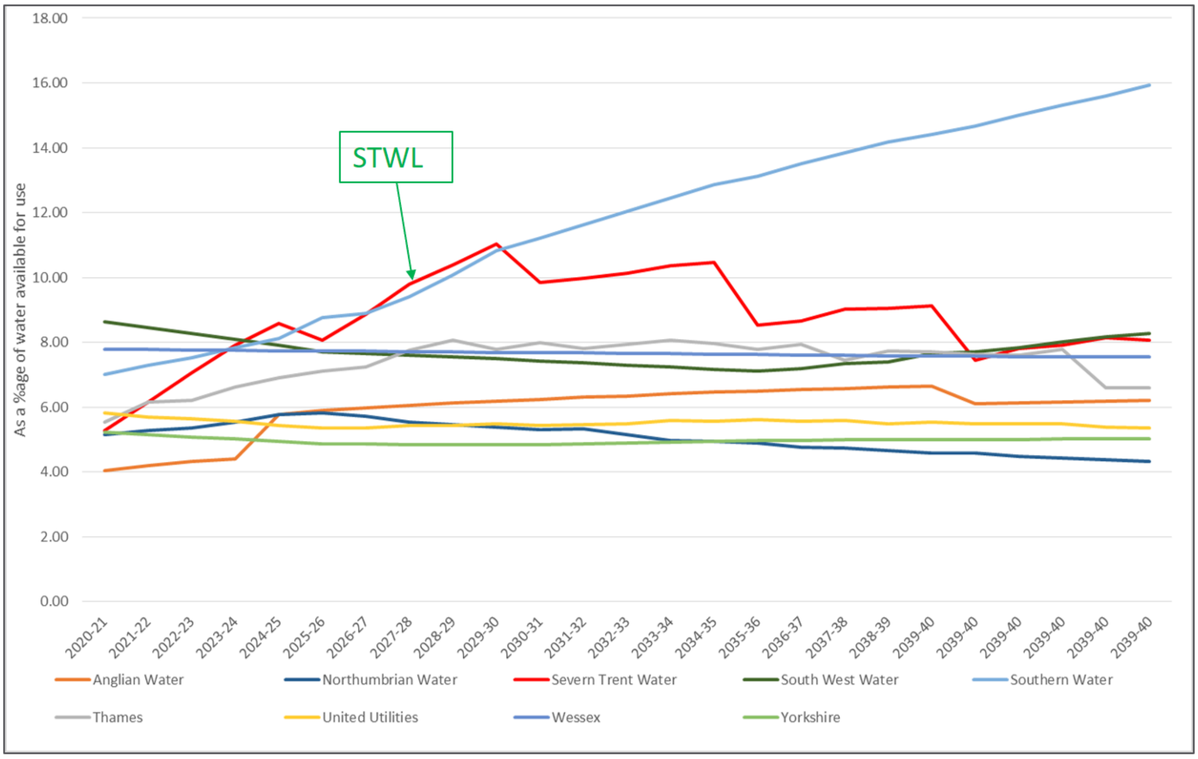
Using the Environment Agency's recent release of draft WRMP datasets (Figure B2.4), we have compared our projections of climate change impacts with other companies. We note that our projections of climate change impact on deployable output are comparable with other companies of a comparable size and similar composition of water resources.

Figure B2.4: Company comparison of projected loss of deployable output due to climate change impacts

We have also compared our target headroom with that used by other companies in their draft WRMPs (Figure B2.5), and we note that:

- Our assessment is in line with other companies of comparable size and mix of water resources.
- Our long term target headroom risk profile implies that we are accepting a greater degree of risk over time.
- Several other companies have been asked to review their methodologies as the regulators believe their assessments of climate change uncertainty are too low.

Figure B2.5: Inter-company comparison of supply / demand target headroom profile



<u>Using climate change scenarios to test investment decisions</u>

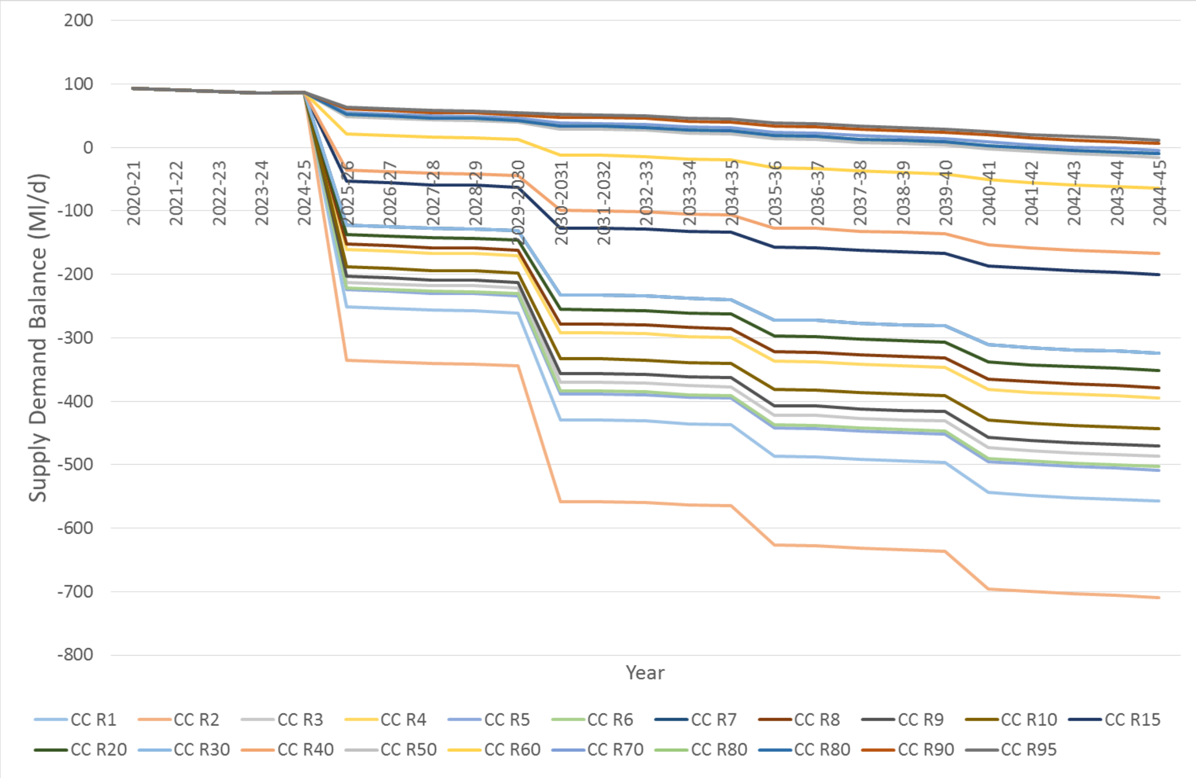
Using the upgrades to our Water Infrastructure and Supply Demand Model (WISDM) investment optimisation tool, known as the DMU (Decision Making Upgrade), we have been able to model a large number of alternative supply / demand scenarios to examine the sensitivity of our investment decisions to uncertainty around costs and benefits of options as well as different supply / demand planning assumptions including climate change uncertainty. Further information regarding WiSDM and the DMU upgrade is provided in Appendix E of our draft WRMP and in Section B3 of this document.

Within the DMU we considered each of the 2030s UKCP09 climate projections listed in Table B2.1 as individual 'Water Available For Use' (WAFU) scenarios, removing climate change uncertainty from target headroom to prevent double counting the potential impact. Our DMU tool enables us to consider the different climate change scenarios as individual supply / demand optimisations, each generating their own preferred programme and associated frequency analysis. Our analysis of specific scenarios or groups of scenarios allows us to examine 'least regret' decisions. These are investment options that feature in a range of possible optimised futures, thereby improving our confidence in the decision or programme being proposed.

The climate change projections produced a wide range of impacts on WAFU, particularly for the Strategic Grid. As the driest climate change scenarios caused large reductions in WAFU, we scaled the impacts using five year step changes instead of a year on year reduction. This helped the DMU model to better optimise the AMP by AMP balance of leakage reduction and supply enhancement options. Within each scenario we applied the same climate change projections to all water resource zones to ensure consistency and to allow the model to correctly balance transfers between zones.

Figure B2.6 shows the range of supply / demand balance surplus and deficits for each scenario used in the DMU modelling for the Strategic Grid, which used the climate change impacted WAFUs combined with a 'medium' demand profile. The DMU approach also allowed us to test the effects of completely removing the target headroom uncertainty around climate change scenarios from our decision making.

Figure B2.6: Range of supply demand balance surplus and deficits considered for the Strategic Grid WRZ based on 20 UKCP09 climate change projections



*Each line denotes a different climate change projection e.g. CC R5 is the Climate Change Rank 5 scenario (as described in Table E3.1 and Appendix A3 of our WRMP)

Figure B2.7 shows the example outputs from one investment scenario where we excluded climate change uncertainty from our target headroom requirement, and instead we optimised around just our baseline projections of changing supply and demand needs. The outputs from this scenario showed us that even when climate change uncertainty is completely excluded from the analysis, almost all of the new supply-side options in our draft WRMP preferred programme still provide an optimal long term supply / demand investment plan. This sensitivity analysis gives us confidence that these are low risk investment options that are not only driven by our assessment of increasing climate change uncertainty.

Figure B2.7: planning for climate change uncertainty - output from our optimisation model

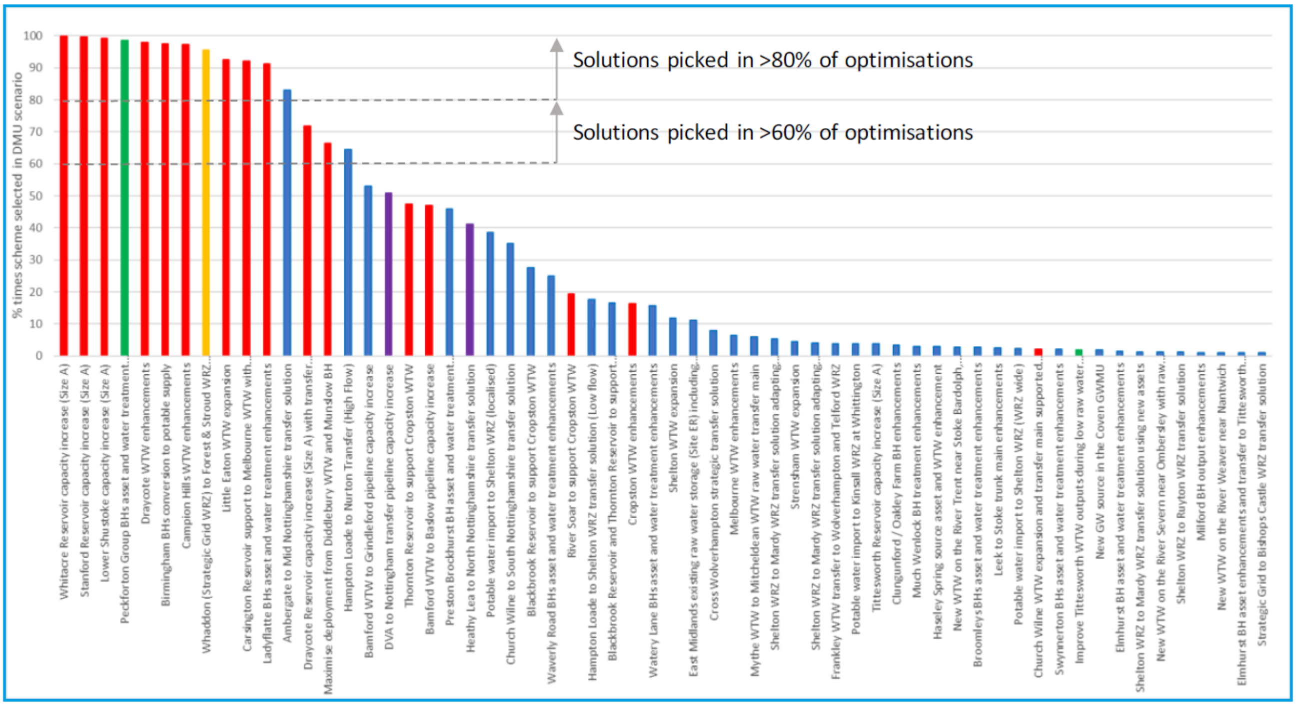


Figure B2.7 is colour coded to represent the WRZ that the options benefit. Red bars related to the Strategic Grid WRZ, purple is Nottinghamshire WRZ, green is North Staffordshire WRZ and yellow is Forest and Stroud WRZ. The blue bars denote options that were picked in some iterations by the DMU but did not form part of the preferred programme in our draft WRMP. The majority of the options selected for our draft WRMP preferred programme by our cost optimisation model, WiSDM, are in the top 25% most frequently selected by the DMU across all scenarios. This indicates that we have greater confidence in these options addressing our future needs. The DMU incorporates uncertainty around costs and benefits of the options so in some iterations uncertainty sampling assumes it is cheaper and/or provides more WAFU benefit than our baseline WiSDM run, which uses fixed assumptions for costs and benefits of the options. We have repeated the analysis taking into account comments received through the consultation of the draft WRMP. We will include details and outputs of this analysis in Appendix E of our final WRMP.

Llandinam and Llanwrin WRZ Vulnerability rating

Clarification has been requested by National Resource Wales regarding our classification of the Llandinam and Llanwrin WRZ as being of low vulnerability to drought and climate change. In preparing our draft WRMP we carried out an assessment of the vulnerability of each of our water resource zones to the potential impacts of climate change. Our assessment of the Llandinam and Llanwrin WRZ indicated that the Llandinam source could be sensitive to the impacts of climate change given the location adjacent to the River Severn and the boreholes being in hydraulic continuity with the river. Given this hydrogeological setting it was not appropriate to assess deployable output or climate change impacts using the standard GR2 method.

Clywedog Reservoir, the key regulation reservoir used to help maintain statutory flow requirements at Bewdley on the River Severn is in close proximity of Llandinam, approximately 11 km upstream. Compensation releases are made from Clywedog throughout the year. Regulation releases up to 500Ml/d are made during April to October when flows at Bewdley begin to drop. If appropriate flood drawdown releases are also made during the winter months. Given the scale of releases and the proximity to the reservoir it was expected that the river gravels would be well supported under potential climate change futures at this location. The Llandinam and Llanwrin zone was therefore given a classification of low vulnerability.

Our Aquator modelling has shown that water resource zones directly reliant on the River Severn such as the Shelton WRZ and Wolverhampton WRZ have a low vulnerability to the potential impacts of climate change. Under all 20 of our modelled climate change scenarios there was zero or minimal loss of DO predicted in these zones. Analysis of our model outputs has identified that greater and more frequent releases of water are predicted to be required from Clywedog reservoir under the climate change scenarios, as would be expected under a future with hotter, drier summers. The reservoir drawdown is more severe under the extreme climate change scenarios but recovers well during the warmer, wetter winter months.

The graphs in Figure B2.8 show the modelled drawdown of Clywedog reservoir under the rank 50 (central estimate) climate change scenario for a dry (or drought) period (1975-77), average period (1982-84) and a wet period (1978 to 1980). Figure B2.9 shows the same arrangement under the rank 10 ("dry") climate change scenario.

Figure B2.8 Predicted Clywedog reservoir drawdown under rank 50 (central estimate) climate change scenario

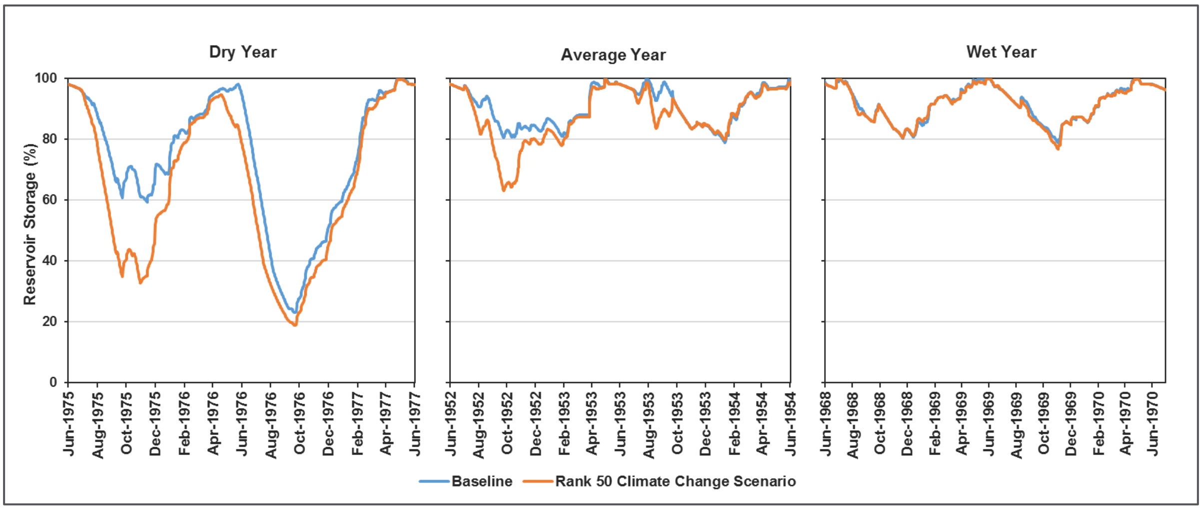
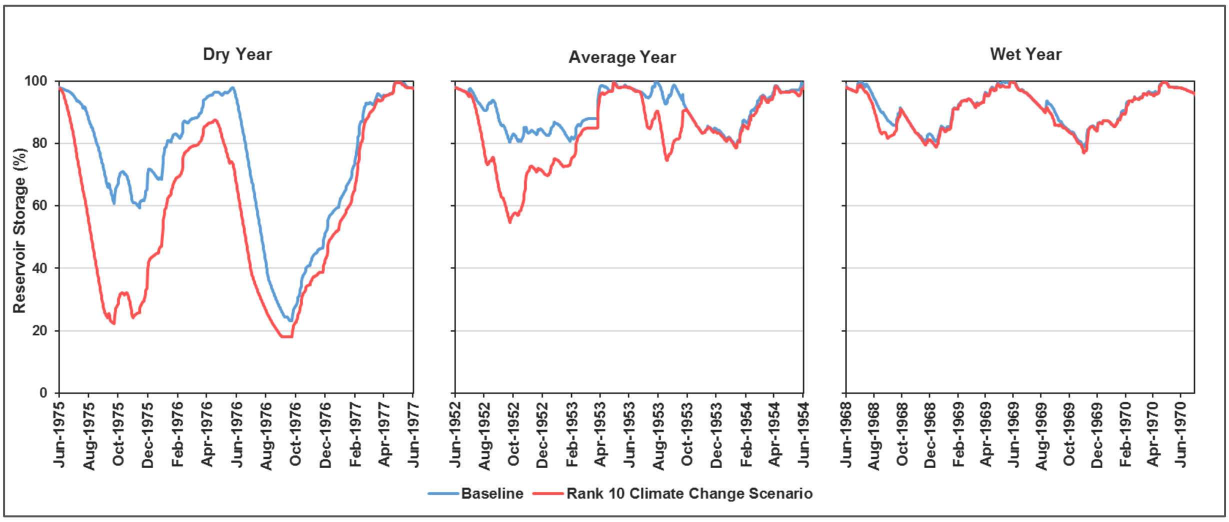


Figure B2.9 Predicted Clywedog reservoir drawdown under rank 10 (dry) climate change scenario



Our understanding of a changing risk

We acknowledge that there can be risks to conservation sites and the environment as a result of our activities and some of these risks are dynamic due to the uncertainty in the scale and timing of climate change impacts. In particular, environmental risk associated with our abstraction activities is particularly sensitive to climate change. These dynamic risks require further investigation and consideration at an industry level and we are committed to gaining an improved understanding and approach to address these challenges.

Our central location in the Midlands of England means that we have interfaces with other companies and have therefore been active participants in a number of regional groups; Water Resources East, Water Resources South East, Water Resources North and most recently West Country Water Resources. We have initiated two multi-sector working groups on the primary river transfer routes that run through our region; the River Severn Working Group (that we formed and now lead) and the River Trent Working Group. The purpose of these groups is to understand the potential in-combination impacts of transfer and new abstractors on the rivers. Environmental regulators, Natural Resources Wales, the Environment Agency and Natural England are members as well as abstractors.

In developing our WRMP we have worked extensively in partnership with other organisations across a number of different sectors via these regional groups and various Catchment Based Approach (CaBA) groups. We are committed to continuing to work with these groups and engage other organisations to help inform our future WRMPs. In AMP7 we will continue to reassess future risks arising from climate change and build impacts into our future WRMPs.

We are also working in partnership with other organisations within the Water Resources East group to consider future long term risks to water dependant conservation sites from abstraction and associated changes in flow patterns and groundwater levels as a result of climate change.

B3 Decision making & assurance

B3.1 Decision Making – Setting the planning horizon

Our draft WRMP focussed primarily on a planning horizon of 25 years. This horizon is the minimum required by the WRMP guidelines and we have selected this period due to the scale of the supply / demand challenge we face over the next ten years to achieve Water Framework Directive objectives and address the uncertainty around climate change impacts. Since our draft WRMP was published we have continued to explore the sensitivity of our investment planning decisions and we have extended our investment scenario modelling to cover an 80 year horizon. Our approach to the longer term planning and adaptation of our decision making approach is described in the following sections.

B3.2 Decision making - Developing a best value plan

A number of consultation responses requested further information regarding our approach to decision making. Our decision making approach in our WRMP has gone beyond a simple financial cost / benefit appraisal, and has explicitly considered customers' priorities, stakeholders' views, our environmental obligations and the environmental and social impacts of our supply and demand options. In addition, our Strategic Environmental Assessment has led us to make decisions that are not solely based on least cost appraisal and instead we consider wider environmental objectives.

Using our investment modelling tools we have developed a best value, least regrets plan, taking into account environmental legislation and the needs of our customers and other stakeholders. Our investment scenario modelling and sensitivity analysis has helped us to identify water supply options that give us high confidence under a wide range of different future supply / demand scenarios. Our plan is adaptable so that we can adjust as we go to ensure that all investment is targeted effectively and efficiently. We have already worked collaboratively with the EA, and will continue to do so, to shape our plan and the required outcomes to meet the needs of the environment in the least cost way for our customers.

As described in Appendix E of our draft WRMP, we have used our Water Infrastructure and Supply Demand Model (WiSDM) to assess the costs and benefits of different levels of mains renewal, leakage reduction, demand management and metering alongside options to increase supply capability. The WiSDM model allows us to predict the future performance of our water distribution assets, the investment needed to achieve different levels of performance, and the scale of investment needed to make sure we have sufficient water supply to meet future demand. As a result, we can be confident that we are able to generate a truly optimised package of demand and supply investment measures needed to meet different planning scenarios, and we can fully explore the economics of different leakage decisions. Our approach means that the supply and demand solutions included in our WRMP are fully integrated into the broader PR19 investment plans.

As well as exploring the overall supply / demand investment programme options, we have conducted option level cost optimisation and feasibility assessments to make sure that option scope and costs are efficient. We have followed an option screening process to help us capture a wide range of these potential options early on, and that has helped us to screen out options that we don't consider feasible for consideration in our current WRMP. The screening process and screening criteria, described in Appendix D of our WRMP were shared with Environment Agency, Natural Resource Wales and our wider stakeholders. The input of these parties helped us to refine our unconstrained list into a shorter list of feasible options. Using this approach, we were able to reduce the 200 possible options on our early unconstrained list, to 111 viable options that we developed further to a stage where we could prepare initial cost and benefit estimates for each option.

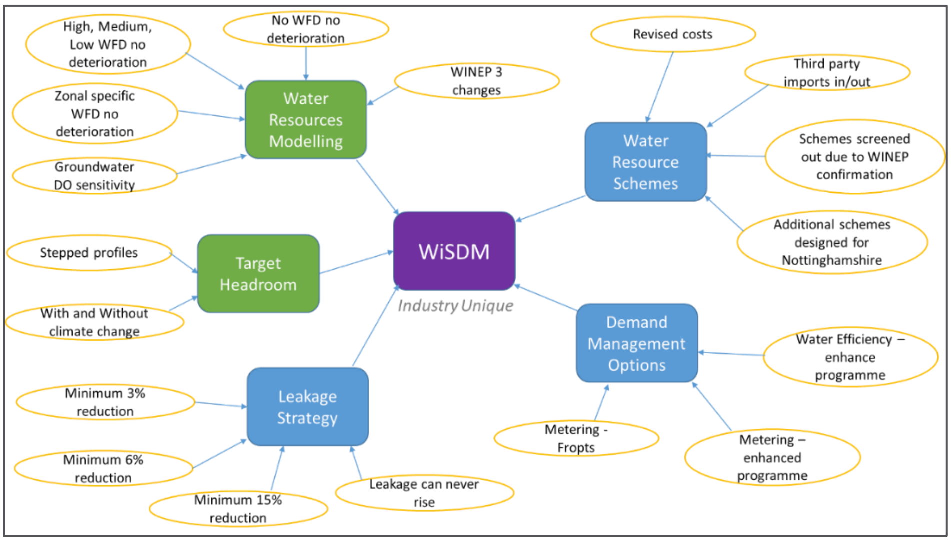
The feasible options were subsequently developed further in terms of engineering design, cost estimation and environmental appraisal to ensure a robust understanding of the options. For these feasible options we assessed deliverability, the likely construction and operating costs, the potential volume of supply or demand benefit they might deliver, the likely time it would take to plan, build and commission the option, and the environmental impacts. These cost and benefit values were then used in our investment modelling to give us an understanding of the optimised balance of leakage reduction, demand management and new supply investment needs.

Our approach to option-level and programme-level investment modelling has allowed us to generate a number of potential long term investment programmes which represent different ways of securing our long term supply and demand objectives. Additionally we have used our WiSDM model to understand variations to the optimum investment needs as a result of changes to our approach to our company-wide strategies. These strategies, such as leakage reduction, metering and the pace at which we adapt to abstraction licence changes needed to achieve Water Framework Directive objectives affect our approach to future investment and it is important to use that we establish the most cost and environmentally beneficial portfolio of investment for our customers.

We have explored how trading water with neighbouring water companies could impact on our long term investment needs, and what investment would be required to achieve the strategic objectives of Water UK's Water Resources Long Term Planning Framework. As a result, we have been able to generate a range of different feasible investment programmes and use these to assess the cost implications of maintaining our supply / demand balance whilst continuing to meet or exceed the expectations of our customers and other stakeholders. We have also used complex scenario and uncertainty modelling to understand the sensitivity of our investment decisions to the parameters we have used to estimate our projected future supply and demand data.

We considered numerous future supply / demand scenarios when developing our WRMP. From our water resources modelling we were able to create a number of different supply scenarios to help us understand the range of potential supply demand deficits we could face in the future, as a result of abstraction licence changes as part of WINEP3 and uncertainty around the potential impacts of climate change. Figure B3.1 shows an overview of the input variables that we include in our WiSDM modelling. As well as varying supply and demand data, we used WiSDM to test the cost implications of applying different strategies, such as enforcing a minimum leakage requirement and use of third party bulk imports.

Figure B3.1 WiSDM model inputs and scenario testing



We have carried out a large number of different assessments using our WiSDM model. These have included variations to the following parameters:

- Supply side options data:
    - Scheme benefits (deployable outputs)
    - Scheme costs (financial and monetised environmnetal costs)

- Future deployable output capability data:
    - Baseline deployable outputs and revisions during the course of developing our WRMP
    - Water Framework Directive impacts
    - Restoring Sustainable Abstraction impacts
    - Water trading impacts
    - Different level of Climate change impacts
    - WINEP Implications

- Customer Side and Distribution Side option data:
    - Varying leakage reduction levels
    - Varying meter optant uptake/profiles
    - Varying water efficiency implementation and benefit realisation

By assessing different permutations of the above data we were able to assess the implications of using, for example, enhanced leakage, metering and water efficiency programmes, in line with what our customers and other stakeholders told us they wanted.

Finally, the preferred programme of options output by our WiSDM model was subject to an expert engineering overview prior to inclusion in our draft WRMP. This final step and the resulting impact on our preferred programme are described in Appendix E1.6 of our draft WRMP. As noted by Ofwat's response to our consultation, this review resulted in a variation of the least cost plan. For example, in our North Staffs zone the WiSDM output for our draft WRMP selected options UNK01 (New WTW on River Weaver) and BHS04 (Swynnerton boreholes) based on the cost / benefit criteria given to the model. This demonstrated that the optimised supply / demand programme should include new option development of up to 27Ml/d. However, our review of the WRZ geographical supply/demand distribution and the reasons for zonal deployable output constraint demonstrated that these chosen solutions would not deliver water to the required locations. Instead we proposed options UNK07 (Changes to Site L WTW treatment capacity) and GRD18 (New treatment process at Peckforton boreholes) as these North Staffs WRZ options are more effective in delivering water to the location of model failure.

There have been updates to the preferred programme of options since our draft WRMP was prepared and following this consultation exercise. Further information is provided in Appendix A6.

B3.3 Decision making - Developing a best value plan: Updates for our final WRMP

Since we published our draft WRMP, we have carried out a number of additional WiSDM investment scenario assessments to inform our final WRMP. These additional assessments have included:

- Updates to supply and demand data.
- Updated option costs and benefit data.
- WINEP3 revisions – we modelled the potential WINEP3 licence changes and tested the implications on the plan of implementing the licence changes at 2025 and 2030.
- Water trading – we tested the implications of incorporating trades outlined by other water companies in their draft WRMPs.

We have also used complex scenario and uncertainty modelling to test how sensitive certain investment decisions are to our underlying supply and demand assumptions. For PR19, we enhanced our WiSDM investment optimisation model to go beyond the traditional approach to sensitivity analysis. These enhancements allow the investment optimisation to more explicitly account for uncertainty parameters around the supply and demand options, as well as considering a range of alternative future scenarios. This Decision Making Upgrade (DMU) to our WiSDM investment model has given us the ability to compute large amounts of supply / demand and options data and present it in a repeatable format. This has informed our decision making, and our ability to test the cost implications of meeting different supply / demand challenges and what our whole life cost investment plan might look like under a range of alternative futures. Since publishing our draft WRMP we have further developed the DMU to enable us to derive adaptive plans. We will include details of this work in our final WRMP.

B3.4 Decision Making - Using the DMU to inform our decisions

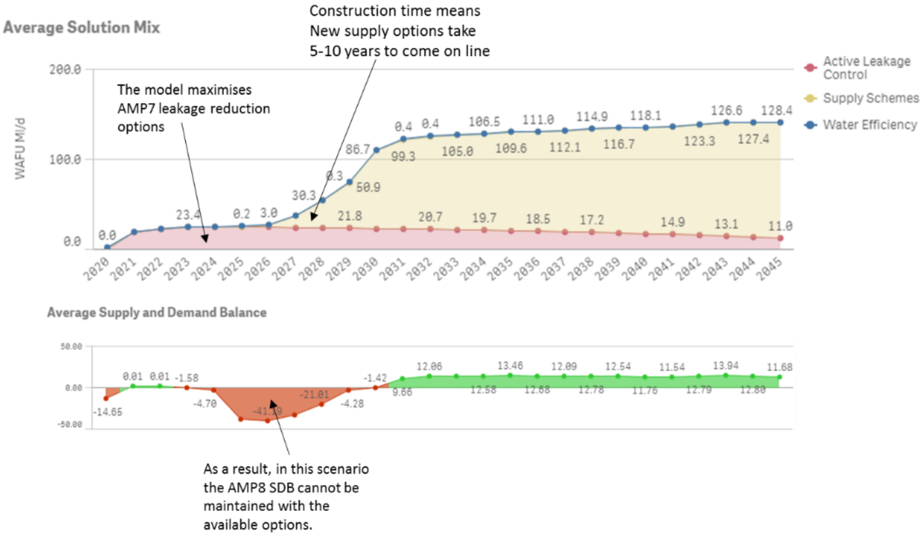
We have used the DMU to assess a large number of supply / demand scenarios to understand the sensitivity of our investment decisions to uncertainty around costs and benefits of options as well as different supply / demand planning assumptions. These scenarios represent different possible 'alternative futures' and examine the impact of different combinations of our potential supply / demand planning assumptions occurring at different times on our investment decisions. We generated these alternative futures by varying the supply / demand factors that have the greatest uncertainty, including the scale and pace of sustainability reductions (including the impacts of Water Framework Directive no deterioration), climate change and future demand for water. Each scenario used a bespoke 'Water Available For Use' (WAFU) profile reflecting the deployable output impacts of the factor being investigated and a 'high', 'medium' or 'low' demand profile.

We carried out a number of assessments using our DMU model, each using between 40 and 60 different supply / demand scenarios. Each scenario was optimised over 100 iterations. These scenarios tested the sensitivity of the plan to:

- Changes to abstraction licences due to Water Framework Directive no deterioration (captured within the WINEP programme) – we used high, mid and low impact scenarios based on WINEP data available at the time of preparing our draft WRMP to understand the implications of losing different quantities of licence and the significance of the timing of these licence changes.
- Demand – we used high, low and mid demand profiles to understand which options may or may not be required if demand increases or reduces from the baseline assumptions.
- Inclusion or exclusion of specific options (such as a potential new bulk imports).
- Climate change uncertainty in target headroom.
- Extreme Drought.

By varying the timing and scale of Water Framework Directive no deterioration impacts on our supply / demand balance (with impacts starting in 2025, 2030, 2035, 2040) we were able to determine the potential impact of adhering to the Environment Agency's timeframe and assess the least regrets options for overcoming any resultant supply demand balance deficits. Figure B3.2 shows an example DMU model output of one of the Water Framework Directive scenarios for Nottinghamshire WRZ, one of the zones with the greatest number of licences affected by potential WINEP3 licence changes. The figure shows that the deficit caused by the WINEP changes being implemented in 2025 was too large to resolve within the timeframe allowed by the Environment Agency even with the maximum practicable leakage reduction.

Figure B3.2: Nottinghamshire zone DMU scenario analysis



The outputs of our analysis informed our discussions with the Environment Agency regarding the pace of WINEP3 licence changes. The scenario testing demonstrated that it would be preferable for our investment strategy to stagger the abstraction changes needed to meet Water Framework Directive and sustainable abstraction (RSA) objectives in our Strategic Grid and Nottinghamshire water resource zones over a ten year period. Our DMU modelling showed that making these abstraction licence reductions in in just one AMP period, ready for 2025, would put security of supply at severe risk and would drive very high cost, short term investment decisions. Conversely, if these changes were to be made over a ten year period, ready for 2030, our DMU model demonstrated that this would incur a lower whole life cost investment programme and would mean much lower risk to security of supply. Assessments such as these made possible by our DMU model were integral to shaping the underlying supply / demand planning assumptions used in our draft WRMP.

Our DMU analysis also helped focus our efforts for option design development and highlighted where additional new resource or transfer options would be beneficial. Nottinghamshire WRZ in particular required a wider range of options, with varying time to benefit assumptions to help resolve the challenges posed by the expected deployable output losses as a result of Water Framework Directive no deterioration requirements. Consequently we developed additional options for inclusion in further DMU and WiSDM runs. Refinements to options as a result of the scenario modelling has helped to reduce the whole life cost of the 25 year plan.

B3.5 Decision making - Developing a best value plan: Extending the Planning Horizon Period

As described previously, our draft WRMP focussed primarily on a planning horizon of 25 years. Since the draft WRMP was published and as part of our PR19 strategic modelling programme, we have made significant updates to our cost optimisation Water Infrastructure Supply and Demand Model (WiSDM), improving model configuration, data inputs, model processing and building the Decision Making Upgrade (DMU), which has improved our decision making capabilities. Building on the long time horizon analysis we carried out for PR14, we have made a number of further adaptations to WiSDM to enable us to consider an 80 year analysis period to 2100.

In order for WiSDM to consider the water resources investment decisions holistically over this longer period, the pipe infrastructure planning component and supply options were reconfigured from 1 year (as in the baseline WiSDM model) to 5 year blocks to simplify the complex optimisation problem, reducing pipe replacement decision granularity and the sheer number of decision combinations. This ensured that the 80 year scenarios captured and optimised the benefit of pipe renewal to the long term leakage profile and hence overall headroom contribution.

We ran a number of scenarios using the adapted ‘80 year’ WiSDM model, with baseline supply and demand planning assumptions extrapolated to 2100. Two scenarios varied the climate change assumptions:

- Central estimate reduction in deployable output based on our rank 50 2030s climate change projections.
- 2080s climate change projections used to inform the reduction in deployable output.

Both of these scenarios used the same leakage assumptions as our final WRMP until 2030. The model was then allowed to find the economic level of leakage from 2030 onwards, with the key prerequisite that leakage can never rise. A further two scenarios were run using different leakage assumptions.

Our extended horizon modelling indicates that beyond the 25 year plan, increasing demand may mean we need to develop options to increase supply to some of our smaller water resource zones, including Whitchurch and Wem, Mardy, Ruyton and Kinsall. This could be done using interzone transfers, making these zones more resilient by connecting them to larger zones, or by enhancing treatment capacity at some of the existing sources within these zones.

In our larger water resource zones, including the Strategic Grid and Nottinghamshire, the combined impact of increasing demand and the impacts of climate change beyond 2045 may mean we need to consider developing a number of new water supply options, including:

- Final effluent reuse schemes.
- Exploit existing underground void dewatering activities for potable water supply with enhanced water treatment methodologies.
- Additional surface water storage.
- New river intakes with new water treatment works.
- Aquifer storage and recovery.

In the longer term, we may also need to consider increasing capacity at some of the larger reservoirs in our region.

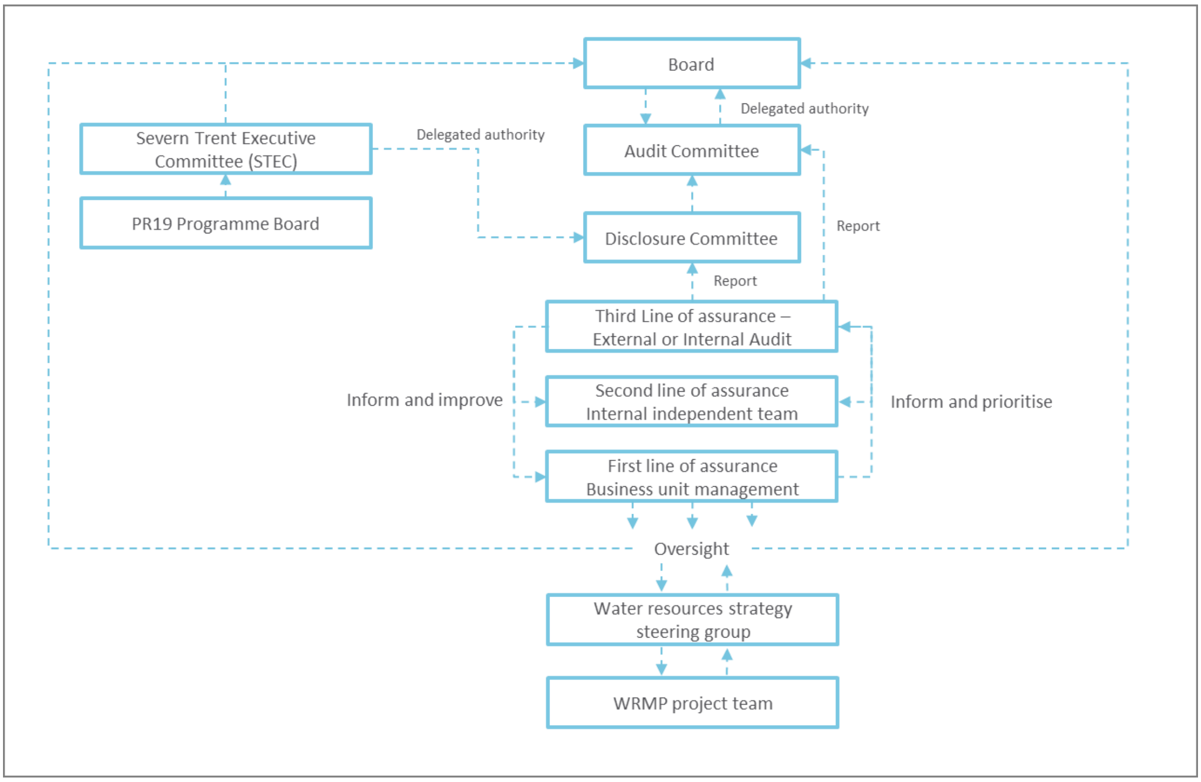
We will continue to refine our long term strategy, using our long horizon modelling in conjunction with our other modelling tools to inform the decision making process and help build a robust long term plan greater than 25 years for inclusion in our 2024 Water Resources Management Plan.

B3.6 Governance and assurance

Throughout the development of our draft WRMP we have used a rigorous approach to ensure appropriate governance and assurance around our decision making.

Our Board’s decision making and our public reporting to our customers and other stakeholders relies on sound information. We have established processes in place for ensuring risk-based assurance, using a three-lines of defence model with a clear delineation of accountabilities. Figure B3.3 illustrates the governance and assurance structure used in the decision making that informed our draft WRMP and our wider PR19 investment plan.

Figure B3.3 Our draft WRMP governance and assurance structure



We are pleased that OFWAT recognised our independent assurance of the draft WRMP and the engagement between the Severn Trent Water executive team and the Severn Trent plc Board during the plan development and its approval. We have continued this approach to assurance in production of the Statement of Response and will continue this through to the production of our final WRMP.

B4 Demand forecast

We provided a full description of the data and methods used for property projections, consumption trends and water efficiency assumptions in our draft WRMP Section B2.3 in 'Appendix B - How much water will we need?'. That Section of our WRMP describes:

- How our housing growth projections are based on the new property forecasts we generated in consultation with the local authorities across our region;
- The sources of data and assumptions used in our micro-component consumption forecasts;
  The baseline water efficiency and market transformation water using appliance assumptions used in the consumption forecasts.

Similarly, Section B5.2 from 'Appendix B - How much water will we need?' details the baseline water efficiency activity assumed in our WRMP.

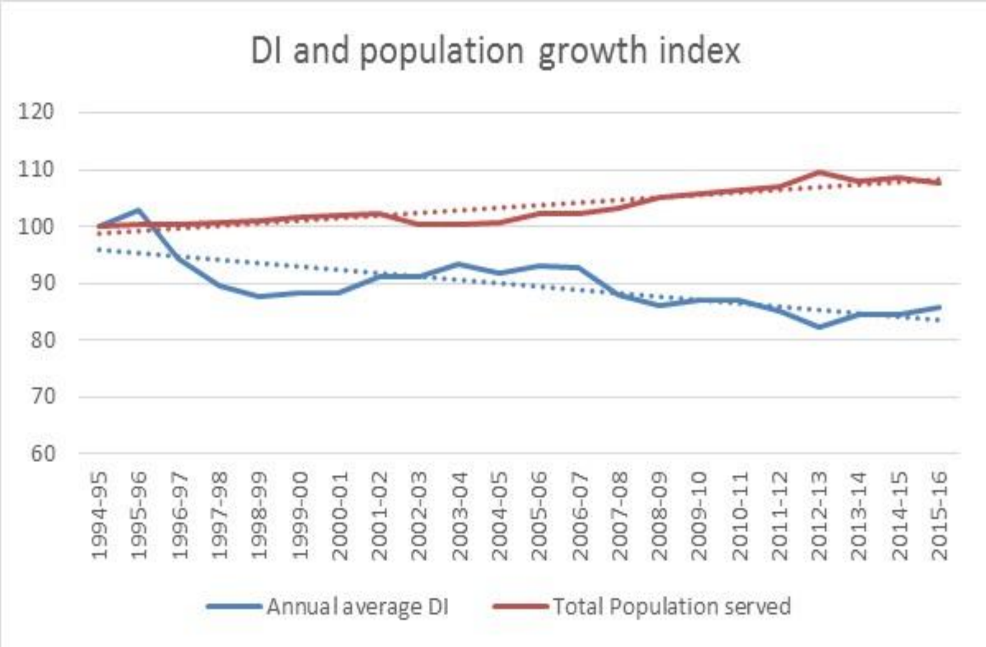
Planning for Growth
In developing our WRMP we have actively consulted with Local Authorities to gain an understanding of the projected future growth in our region. We have also followed the regulatory guidance that requires use of Local Authority growth forecasts and projections when planning for future demand.

Our liaison with Local Authorities is already an important and ongoing part of our ‘Growth Liaison’ approach and influences our water and waste infrastructure planning. The liaison ensures we have up to date insight on planned growth in the region allowing us to plan appropriate asset investment to ensure we have water and waste capacity to meet all growth needs. Any ongoing contact can be made by email, at any time, to growth.development@severntrent.co.uk.

During our development of our WRMP we also actively engaged with all non-household Retailers to gain an understanding of their forecasts for non-household demand and any demand management (water efficiency) activity they have carried out or are planning to implement in the future. Unfortunately, responses from Retailers were limited in detail, with no evidence of any significant demand reduction initiatives delivered to date. Retailers are mostly offering demand reduction initiatives as ‘added value’ services which customers have to pay for, significantly limiting uptake. No Retailers provided any evidence or forecasts of demand reduction, with demand predicted to be stable throughout the planning period. We have continued to seek opportunities to engage Retailers as we develop our final WRMP and have undertaken a research project to explore Retailers’ appetite for collaboration to develop incentives around non-household demand reduction initiatives. We are currently assessing the outputs from this work and we will update our non-household demand projections as and when new intelligence becomes available. We will include the results of our investigations in our final WRMP.

Demand Forecasting - Clarifications
Section 4 of our WRMP includes the chart (repeated in Figure B4.1), which illustrates that the long term downward trend in distribution input (DI), otherwise known as water into supply, has been achieved against a backdrop of steadily growing regional population. The success of our leakage and demand management initiatives have helped us achieve this long term trend. Within this timeframe and long term downward trend, there have been short periods of rising and falling water into supply linked to the economic cycle affecting commercial demand, and weather trends impacting leakage in the winter, and household consumption in the summer. For example, since 2012/13 we have seen an increase in commercial demand linked to economic recovery. As we continue to deliver our leakage and water efficiency targets, we expect this long term downward trend to continue.

Figure B4.1 Index of distribution input and population growth



Demand Forecasting - Adjustments

Household metering is part of our demand management strategy, through which we expect to realise benefits in the form of reduced consumption and reductions to Underground Supply Pipe Losses (USPL). Our draft WRMP detailed the consumption benefits of household metering but not the USPL reduction benefits. For the final WRMP tables we have adopted and implemented the recently published EA data tables that contain corrections for capturing USPL benefits in WRMP data table 6. USPL benefits will be displayed in the 'customer side management' category of table 6 and will include a forecast for options impacting measured USPL and options impacting unmeasured USPL.

The USPL benefits are calculated based on our preferred meter location policy under which the majority of new meters will be externally fitted. Consistent with our annual water balance reporting, we expect to achieve, on average, a lower per property USPL for external meters. Table B4.1 and Table B4.2 demonstrate our expected metering locations and average 'per property' USPL.

Table B4.1 Metering location assumption:

Metering location split	
Internal	10%
External – existing boundary box	23%
External – without boundary box	67%

Table B4.2 USPL per property:

Metering location split	
Externally Measured Household	24.09
Internally Measured Household	26.91
Unmeasured Household	26.91

Table B4.3 shows the reduction in household USPL from metering by water resource zone that will be included in the final WRMP data tables. The WRZ saving aligns with the number of meters fitted in the WRZ each year.

We have reviewed our WRMP data tables to ensure USPL benefits from our proposed metering program will be correctly reflected in the final WRMP data tables.

Table B4.3 Forecast USPL Reduction by WRZ

USPL REDUCTION Ml/d	2020 -2021	2021 -2022	2022 -2023	2023 -2024	2024 -2025	2025 -2026	2026 -2027	2027 -2028	2028 -2029	2029 -2030	2030 -2031	2031 -2032	2032 -2033	2033 -2034
Bishops Castle										-0.01				
Forest & Stroud						-0.06	-0.06	-0.03						
Kinsall										-0.01				
Llandinam & Llanwrin											-0.04			
Mardy										-0.01				
Newark					-0.05									
North Staffs			-0.09	-0.23	-0.23									
Nottingham	-0.23	-0.31	-0.26	-0.18	-0.16									
Rutland						-0.02								
Ruyton										-0.01				
Shelton								-0.09	-0.18	-0.16				
Stafford						-0.07								
Strategic grid					-0.06	-0.50	-0.50	-0.51	-0.51	-0.51	-0.79	-0.57	-0.36	-0.14
Whitchurch & Wem										-0.02				
Bishops Castle							-0.10	-0.10	-0.04					

Alongside our draft WRMP data tables we published our draft WRMP Appendix A which displayed, in table format, the adjustments necessary to aggregate micro-component PCC by property type to equate to the calculated PCC in WRMP data tables 3 and 8. We have now included the adjustments from Appendix A in data tables 3 and 8 for ease of understanding as demonstrated in Table B4.4 and B4.5 overleaf. This addresses the apparent 3% difference between calculated and micro-component aggregated PCC.

Our forecast of 'Water taken unbilled', has increased since previous WRMP and Periodic Reviews (PR). Our PR14 forecast for water taken unbilled was 25Ml/d for AMP6, set at the 2013 Ofwat Annual Return (OAR) reported volume. Following OAR13, we now include void property consumption in water taken unbilled, resulting in an increase in reported volumes as shown in Table B4.6. We estimate void property consumption each year using information gathered from responses to customer mailshots to void domestic properties to bring customers back into charge, void household inspections to identify further occupied properties and a study to identify occupied void commercial properties.

Void consumption is obtained by applying per property consumption from the annual water balance to the percentage of occupied voids (per property type – household, measured non-households and unmeasured non-households).

Changes in the percentage of occupied void households and occupied void non households results in annual variation. Our PR19 forecast and the forecast for our WRMP was set at the APR17 reported volume of 48Ml/d. A comparison of Reported water taken unbilled is provided in Table B4.6.

Table B4.6 Comparison of Water Taken Unbilled Values.

	OAR13	ARR14	ARR15	APR 16	APR 17
Reported Water Taken Unbilled (WRZ Sum Ml/d)	24	42	50	44	48

Table B4.4 Summary of data Table 3. BL Demand

3. BL Demand	Row ref	Component	Derivation	Unit	2016-17	For info 2017-18	For info 2018-19	For info 2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45
Bishops Castle	29.7BL	Measured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.5	-1.0	-1.4	-1.9	-2.2	-2.6	-3.0	-3.4	-3.7	-4.0	-4.2	-4.5	-4.7	-5.0	-5.2	-5.3	-5.5	-5.7	-5.8	-5.7	-5.7	-5.7	-5.7	-5.8	-5.8	-5.8	-5.7	-5.7
	30.7BL	Unmeasured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.5	-0.9	-1.3	-1.9	-2.2	-2.6	-2.9	-3.2	-3.5	-3.9	-4.1	-4.4	-4.6	-4.9	-5.0	-5.2	-5.3	-5.6	-5.5	-5.6	-5.5	-5.6	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5
Forest & Stroud	29.7BL	Measured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.4	-0.9	-1.2	-1.7	-2.0	-2.4	-2.7	-3.0	-3.2	-3.4	-3.7	-3.9	-4.1	-4.3	-4.5	-4.7	-4.8	-5.0	-4.9	-4.9	-4.9	-4.9	-4.9	-4.9	-4.8	-4.9	-4.9	-4.8
	30.7BL	Unmeasured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.4	-0.8	-1.0	-1.4	-1.8	-2.1	-2.3	-2.6	-2.7	-3.0	-3.1	-3.4	-3.6	-3.7	-3.8	-3.9	-4.0	-4.1	-4.2	-4.2	-4.1	-4.1	-4.1	-4.0	-4.0	-4.0	-4.0	-4.0
Kinsall	29.7BL	Measured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.4	-0.9	-1.1	-1.6	-2.0	-2.3	-2.6	-2.9	-3.2	-3.5	-3.6	-3.9	-4.1	-4.3	-4.5	-4.6	-4.8	-4.9	-4.9	-5.0	-5.0	-5.0	-5.0	-5.0	-4.9	-5.0	-5.0	-5.0
	30.7BL	Unmeasured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.4	-0.8	-1.1	-1.6	-1.9	-2.3	-2.5	-2.8	-3.1	-3.4	-3.6	-3.8	-3.9	-4.2	-4.3	-4.5	-4.6	-4.8	-4.8	-4.7	-4.8	-4.8	-4.7	-4.8	-4.8	-4.8	-4.8	-4.7
Llandinam & Llanwrin	29.7BL	Measured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.5	-0.9	-1.2	-1.8	-2.2	-2.6	-2.9	-3.3	-3.6	-3.9	-4.2	-4.5	-4.8	-5.1	-5.3	-5.6	-5.8	-6.0	-6.0	-6.1	-6.2	-6.2	-6.3	-6.3	-6.4	-6.4	-6.5	-6.5
	30.7BL	Unmeasured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.5	-0.9	-1.3	-1.7	-2.1	-2.5	-2.9	-3.2	-3.6	-3.9	-4.1	-4.5	-4.7	-4.9	-5.2	-5.5	-5.6	-5.9	-5.9	-5.9	-6.0	-6.1	-6.1	-6.1	-6.2	-6.2	-6.3	-6.3
Mardy	29.7BL	Measured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.5	-0.9	-1.1	-1.6	-2.0	-2.3	-2.7	-2.9	-3.2	-3.5	-3.7	-3.9	-4.2	-4.3	-4.6	-4.7	-4.9	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0
	30.7BL	Unmeasured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.4	-0.7	-1.0	-1.5	-1.8	-2.1	-2.3	-2.6	-2.9	-3.1	-3.3	-3.5	-3.7	-3.8	-3.9	-4.1	-4.2	-4.3	-4.3	-4.3	-4.3	-4.3	-4.3	-4.3	-4.3	-4.3	-4.3	-4.3
Newark	29.7BL	Measured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.1	-0.1	-0.2	-0.3	-0.3	-0.4	-0.5	-0.5	-0.5	-0.6	-0.6	-0.7	-0.7	-0.7	-0.7	-0.7	-0.8	-0.8	-0.8	-0.8	-0.8	-0.9	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8
	30.7BL	Unmeasured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.1	-0.1	-0.2	-0.3	-0.3	-0.4	-0.4	-0.4	-0.5	-0.5	-0.5	-0.5	-0.6	-0.6	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.6	-0.7	-0.7	-0.6	-0.7	-0.7	-0.7	-0.6
North Staffs	29.7BL	Measured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.4	-0.9	-1.2	-1.6	-2.1	-2.4	-2.8	-3.0	-3.3	-3.6	-3.9	-4.0	-4.3	-4.5	-4.7	-4.9	-5.0	-5.2	-5.2	-5.2	-5.2	-5.2	-5.2	-5.2	-5.1	-5.2	-5.1	-5.1
	30.7BL	Unmeasured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.4	-0.7	-1.1	-1.5	-1.8	-2.1	-2.4	-2.6	-2.8	-3.1	-3.3	-3.5	-3.7	-3.8	-4.0	-4.2	-4.3	-4.4	-4.4	-4.4	-4.4	-4.3	-4.4	-4.3	-4.4	-4.3	-4.3	-4.3
Nottingham	29.7BL	Measured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.4	-0.9	-1.2	-1.7	-2.0	-2.4	-2.7	-3.0	-3.3	-3.5	-3.7	-4.0	-4.2	-4.4	-4.6	-4.6	-4.9	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-4.9	-4.9	-4.9	-4.8
	30.7BL	Unmeasured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.4	-0.7	-1.1	-1.5	-1.7	-2.0	-2.3	-2.5	-2.8	-3.0	-3.2	-3.4	-3.5	-3.7	-3.8	-3.9	-4.0	-4.2	-4.2	-4.2	-4.1	-4.0	-4.0	-4.0	-4.0	-4.0	-3.9	-4.0
Rutland	29.7BL	Measured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.4	-0.9	-1.2	-1.6	-2.1	-2.4	-2.7	-3.0	-3.3	-3.6	-3.8	-4.0	-4.3	-4.4	-4.5	-4.8	-5.0	-5.1	-5.0	-5.1	-5.1	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0
	30.7BL	Unmeasured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.4	-0.8	-1.1	-1.5	-1.9	-2.1	-2.4	-2.7	-2.9	-3.1	-3.4	-3.5	-3.7	-3.9	-4.0	-4.2	-4.2	-4.3	-4.4	-4.3	-4.3	-4.3	-4.3	-4.3	-4.3	-4.2	-4.2	-4.1
Ruyton	29.7BL	Measured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.4	-0.7	-1.0	-1.4	-1.7	-1.9	-2.2	-2.5	-2.7	-2.9	-3.1	-3.3	-3.5	-3.7	-3.8	-3.9	-4.1	-4.2	-4.3	-4.2	-4.3	-4.3	-4.2	-4.2	-4.2	-4.2	-4.2	-4.2
	30.7BL	Unmeasured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.4	-0.8	-1.0	-1.5	-1.9	-2.2	-2.5	-2.8	-3.1	-3.3	-3.6	-3.8	-4.0	-4.2	-4.4	-4.6	-4.8	-5.0	-5.0	-5.0	-5.1	-5.1	-5.2	-5.2	-5.2	-5.2	-5.2	-5.1
Shelton	29.7BL	Measured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.4	-0.9	-1.1	-1.6	-2.0	-2.3	-2.7	-2.9	-3.1	-3.5	-3.7	-3.9	-4.1	-4.3	-4.5	-4.6	-4.8	-5.0	-4.9	-4.9	-5.0	-5.0	-4.9	-4.9	-5.0	-4.9	-4.9	-4.8
	30.7BL	Unmeasured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.4	-0.8	-1.0	-1.4	-1.8	-2.0	-2.3	-2.6	-2.8	-3.0	-3.2	-3.4	-3.6	-3.7	-3.9	-4.0	-4.1	-4.2	-4.2	-4.2	-4.2	-4.2	-4.2	-4.1	-4.1	-4.1	-4.1	-4.1
Stafford	29.7BL	Measured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.4	-0.8	-1.1	-1.6	-2.0	-2.3	-2.6	-2.9	-3.2	-3.4	-3.6	-3.9	-4.1	-4.3	-4.5	-4.6	-4.8	-4.9	-4.9	-5.0	-5.0	-4.9	-4.9	-5.0	-4.9	-5.0	-4.9	-4.9
	30.7BL	Unmeasured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.3	-0.8	-1.0	-1.4	-1.7	-2.0	-2.3	-2.5	-2.7	-2.9	-3.1	-3.4	-3.6	-3.7	-3.8	-4.0	-4.1	-4.2	-4.2	-4.2	-4.2	-4.1	-4.1	-4.1	-4.1	-4.1	-4.1	-4.1
Strategic Grid	29.7BL	Measured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.4	-0.8	-1.2	-1.6	-1.9	-2.3	-2.6	-2.9	-3.1	-3.4	-3.6	-3.8	-4.0	-4.2	-4.4	-4.4	-4.6	-4.7	-4.8	-4.8	-4.8	-4.7	-4.7	-4.7	-4.7	-4.6	-4.6	-4.6
	30.7BL	Unmeasured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.4	-0.7	-1.0	-1.4	-1.7	-2.0	-2.2	-2.4	-2.7	-2.9	-3.0	-3.2	-3.3	-3.5	-3.6	-3.7	-3.9	-4.0	-3.9	-4.0	-3.9	-3.9	-3.9	-3.8	-3.9	-3.8	-3.8	-3.7
Whitchurch & Wem	29.7BL	Measured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.5	-0.9	-1.2	-1.7	-2.1	-2.5	-2.8	-3.1	-3.4	-3.7	-3.9	-4.1	-4.4	-4.5	-4.7	-4.9	-5.0	-5.2	-5.2	-5.3	-5.2	-5.2	-5.2	-5.2	-5.2	-5.2	-5.2	-5.2
	30.7BL	Unmeasured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.4	-0.8	-1.0	-1.5	-1.8	-2.1	-2.4	-2.7	-2.9	-3.2	-3.4	-3.6	-3.8	-3.9	-4.1	-4.2	-4.3	-4.4	-4.5	-4.5	-4.5	-4.5	-4.4	-4.4	-4.4	-4.4	-4.4	-4.4
Wolverhampton	29.7BL	Measured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.5	-0.9	-1.2	-1.7	-2.1	-2.5	-2.8	-3.0	-3.3	-3.6	-3.9	-4.1	-4.3	-4.4	-4.6	-4.8	-4.9	-5.1	-5.1	-5.1	-5.1	-5.1	-5.1	-5.1	-5.0	-4.9	-4.9	-4.9
	30.7BL	Unmeasured PCC - baseline water efficiency savings	Input	l/h/d	0.0	-0.3	-0.7	-1.0	-1.3	-1.7	-2.0	-2.2	-2.5	-2.7	-2.9	-3.0	-3.2	-3.3	-3.5	-3.6	-3.8	-3.9	-4.0	-4.0	-4.0	-3.9	-3.9	-3.9	-3.8	-3.8	-3.8	-3.7	-3.8

Table B4.5 Summary of data Table 8. FP Demand

8. FP Demand	Row Ref	Component	Derivation	Unit	2016-17	For info 2017-18	For info 2018-19	For info 2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45
Bishops Castle	29.7FP	Measured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.5	-0.9	-1.3	-1.8	-2.3	-2.6	-3.1	-3.4	-3.7	-3.9	-4.3	-4.5	-4.6	-4.9	-5.1	-5.3	-5.5	-5.7	-5.7	-5.6	-5.7	-5.7	-5.7	-5.7	-5.7	-5.7	-5.7	-5.6
	30.7FP	Unmeasured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.5	-0.9	-1.3	-1.9	-2.2	-2.6	-2.9	-3.2	-3.5	-3.9	-4.1	-4.4	-4.6	-4.9	-5.0	-5.2	-5.4	-5.6	-5.6	-5.6	-5.6	-5.6	-5.6	-5.6	-5.6	-5.6	-5.6	-5.5
Forest & Stroud	29.7FP	Measured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.4	-0.9	-1.1	-1.6	-2.0	-2.3	-2.7	-3.0	-3.1	-3.3	-3.4	-3.7	-3.9	-3.9	-4.2	-4.3	-4.5	-4.5	-4.6	-4.6	-4.5	-4.6	-4.6	-4.5	-4.6	-4.5	-4.5	-4.5
	30.7FP	Unmeasured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.4	-0.8	-1.0	-1.4	-1.8	-2.1	-2.3	-2.6	-2.7	-2.9	-3.2	-3.4	-3.5	-3.7	-3.8	-4.0	-4.1	-4.2	-4.3	-4.2	-4.2	-4.3	-4.2	-4.2	-4.3	-4.2	-4.3	-4.2
Kinsall	29.7FP	Measured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.5	-0.9	-1.2	-1.6	-1.9	-2.3	-2.6	-3.0	-3.1	-3.4	-3.7	-3.9	-4.1	-4.2	-4.5	-4.6	-4.7	-4.9	-4.9	-4.9	-4.9	-4.9	-4.9	-5.0	-4.9	-4.9	-4.9	-4.9
	30.7FP	Unmeasured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.4	-0.8	-1.1	-1.6	-1.9	-2.3	-2.5	-2.8	-3.1	-3.4	-3.6	-3.8	-4.0	-4.1	-4.3	-4.5	-4.6	-4.8	-4.8	-4.8	-4.8	-4.8	-4.8	-4.8	-4.8	-4.8	-4.8	-4.8
Llandinam & Llanwrin	29.7FP	Measured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.5	-0.9	-1.2	-1.8	-2.2	-2.5	-2.9	-3.3	-3.6	-4.0	-4.3	-4.5	-4.8	-5.0	-5.2	-5.4	-5.7	-5.9	-6.0	-6.1	-6.1	-6.1	-6.2	-6.3	-6.4	-6.4	-6.4	-6.4
	30.7FP	Unmeasured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.5	-0.9	-1.3	-1.7	-2.1	-2.5	-2.9	-3.2	-3.6	-3.9	-4.1	-4.5	-4.7	-5.0	-5.1	-5.4	-5.6	-5.9	-5.9	-6.0	-6.0	-6.1	-6.2	-6.2	-6.2	-6.3	-6.4	-6.4
Mardy	29.7FP	Measured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.5	-0.9	-1.2	-1.6	-2.0	-2.3	-2.6	-2.9	-3.2	-3.5	-3.7	-4.0	-4.0	-4.1	-4.3	-4.5	-4.6	-4.8	-4.8	-4.8	-4.8	-4.8	-4.8	-4.8	-4.8	-4.8	-4.7	-4.8
	30.7FP	Unmeasured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.4	-0.7	-1.0	-1.5	-1.8	-2.1	-2.3	-2.6	-2.9	-3.1	-3.3	-3.5	-3.6	-3.9	-4.0	-4.1	-4.2	-4.4	-4.4	-4.4	-4.4	-4.4	-4.4	-4.4	-4.4	-4.4	-4.4	-4.3
Newark	29.7FP	Measured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.1	-0.2	-0.2	-0.3	-0.3	-0.4	-0.4	-0.4	-0.5	-0.5	-0.6	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.8	-0.8	-0.8	-0.7	-0.8	-0.8	-0.8	-0.8	-0.7
	30.7FP	Unmeasured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.1	-0.1	-0.2	-0.3	-0.3	-0.4	-0.4	-0.5	-0.4	-0.5	-0.5	-0.6	-0.6	-0.6	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.8	-0.7	-0.8	-0.7	-0.7	-0.7	-0.7	-0.7
North Staffs	29.7FP	Measured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.5	-0.8	-1.1	-1.7	-2.1	-2.4	-2.6	-2.9	-3.1	-3.4	-3.6	-3.9	-4.0	-4.2	-4.4	-4.5	-4.7	-4.9	-4.9	-4.9	-4.9	-4.9	-4.9	-4.9	-4.9	-4.9	-4.9	-4.8
	30.7FP	Unmeasured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.4	-0.7	-1.1	-1.5	-1.8	-2.1	-2.4	-2.7	-2.9	-3.1	-3.3	-3.6	-3.8	-3.9	-4.1	-4.2	-4.4	-4.5	-4.6	-4.6	-4.6	-4.6	-4.5	-4.5	-4.6	-4.6	-4.5	-4.5
Nottingham	29.7FP	Measured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.5	-0.9	-1.2	-1.6	-1.9	-2.2	-2.5	-2.7	-3.0	-3.3	-3.5	-3.7	-3.9	-4.1	-4.2	-4.4	-4.5	-4.7	-4.6	-4.6	-4.7	-4.6	-4.7	-4.6	-4.6	-4.6	-4.5	-4.5
	30.7FP	Unmeasured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.4	-0.7	-1.1	-1.5	-1.8	-2.1	-2.3	-2.6	-2.9	-3.0	-3.2	-3.5	-3.6	-3.8	-3.9	-4.1	-4.2	-4.3	-4.3	-4.3	-4.3	-4.4	-4.3	-4.3	-4.3	-4.3	-4.3	-4.3
Rutland	29.7FP	Measured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.4	-0.8	-1.2	-1.7	-2.0	-2.4	-2.7	-3.0	-3.2	-3.3	-3.7	-3.8	-4.1	-4.3	-4.4	-4.6	-4.7	-4.8	-4.8	-4.9	-4.9	-4.8	-4.8	-4.8	-4.8	-4.8	-4.8	-4.8
	30.7FP	Unmeasured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.4	-0.8	-1.1	-1.5	-1.9	-2.1	-2.4	-2.7	-2.9	-3.1	-3.3	-3.5	-3.7	-3.9	-4.1	-4.2	-4.3	-4.5	-4.5	-4.5	-4.5	-4.5	-4.5	-4.5	-4.5	-4.5	-4.4	-4.5
Ruyton	29.7FP	Measured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.4	-0.8	-1.0	-1.3	-1.7	-1.9	-2.2	-2.5	-2.7	-3.0	-3.1	-3.4	-3.6	-3.8	-4.0	-4.1	-4.3	-4.4	-4.4	-4.4	-4.4	-4.4	-4.4	-4.4	-4.4	-4.4	-4.4	-4.4
	30.7FP	Unmeasured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.4	-0.8	-1.0	-1.5	-1.9	-2.2	-2.5	-2.8	-3.1	-3.3	-3.6	-3.8	-4.0	-4.2	-4.4	-4.6	-4.7	-4.8	-4.9	-4.9	-4.9	-4.8	-4.9	-4.9	-4.9	-4.9	-4.9	-4.8
Shelton	29.7FP	Measured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.4	-0.8	-1.2	-1.6	-1.9	-2.3	-2.6	-2.9	-3.2	-3.5	-3.6	-3.7	-3.9	-4.0	-4.2	-4.4	-4.5	-4.7	-4.7	-4.7	-4.7	-4.7	-4.7	-4.7	-4.7	-4.7	-4.7	-4.6
	30.7FP	Unmeasured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.4	-0.8	-1.0	-1.4	-1.8	-2.0	-2.3	-2.6	-2.8	-3.0	-3.2	-3.4	-3.6	-3.8	-3.9	-4.0	-4.1	-4.3	-4.4	-4.3	-4.3	-4.3	-4.3	-4.3	-4.3	-4.3	-4.3	-4.3
Stafford	29.7FP	Measured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.4	-0.9	-1.1	-1.6	-2.0	-2.3	-2.6	-2.9	-3.0	-3.2	-3.5	-3.8	-3.9	-4.1	-4.3	-4.5	-4.5	-4.8	-4.8	-4.7	-4.7	-4.7	-4.7	-4.8	-4.8	-4.7	-4.7	-4.7
	30.7FP	Unmeasured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.3	-0.8	-1.0	-1.4	-1.7	-2.0	-2.3	-2.5	-2.8	-3.0	-3.2	-3.4	-3.5	-3.7	-3.9	-4.1	-4.2	-4.3	-4.3	-4.4	-4.3	-4.4	-4.3	-4.3	-4.3	-4.4	-4.3	-4.3
Strategic Grid	29.7FP	Measured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.5	-0.9	-1.2	-1.6	-2.0	-2.3	-2.6	-2.9	-3.1	-3.3	-3.5	-3.7	-3.8	-4.0	-4.1	-4.2	-4.3	-4.5	-4.5	-4.4	-4.4	-4.4	-4.4	-4.4	-4.4	-4.4	-4.3	-4.3
	30.7FP	Unmeasured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.4	-0.7	-1.0	-1.4	-1.7	-2.0	-2.2	-2.4	-2.7	-2.9	-3.1	-3.3	-3.4	-3.5	-3.7	-3.8	-4.0	-4.0	-4.0	-4.1	-4.0	-4.0	-4.0	-4.0	-3.9	-4.0	-4.0	-4.0
Whitchurch & Wem	29.7FP	Measured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.5	-0.9	-1.3	-1.7	-2.1	-2.4	-2.8	-3.1	-3.4	-3.6	-3.9	-4.1	-4.2	-4.4	-4.6	-4.7	-4.9	-4.9	-5.0	-5.0	-5.0	-5.0	-5.1	-5.0	-5.1	-5.0	-5.0	-5.0
	30.7FP	Unmeasured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.4	-0.8	-1.0	-1.5	-1.8	-2.1	-2.4	-2.7	-2.9	-3.2	-3.4	-3.6	-3.8	-3.9	-4.1	-4.3	-4.4	-4.6	-4.6	-4.6	-4.5	-4.5	-4.5	-4.6	-4.6	-4.6	-4.5	-4.5
Wolverhampton	29.7FP	Measured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.5	-0.9	-1.2	-1.7	-2.1	-2.4	-2.7	-3.1	-3.3	-3.4	-3.5	-3.6	-3.8	-4.1	-4.2	-4.4	-4.5	-4.6	-4.6	-4.6	-4.6	-4.6	-4.6	-4.5	-4.6	-4.5	-4.5	-4.5
	30.7FP	Unmeasured PCC - baseline & enhanced water efficiency savings, additional metering	Input	l/h/d	0.0	-0.3	-0.7	-1.0	-1.3	-1.7	-2.0	-2.2	-2.5	-2.7	-2.9	-3.0	-3.3	-3.5	-3.5	-3.7	-3.8	-3.9	-4.0	-4.1	-4.1	-4.0	-4.1	-4.1	-4.0	-4.0	-4.1	-4.0	-4.0

WTW Process Losses

During the consultation OFWAT requested that we clearly set out the reasons for our water treatment works (WTW) process losses apparently doubling since our previous WRMP in 2014. The apparent increase is because the Environment Agency's WRMP data tables have changed since the 2014 WRMP. The current data Table 2 (baseline) includes row 9BL 'Raw water losses, treatment works losses and operational use'. This is different from the 2014 WRMP data Table 2 row 9BL which required us to state 'treatment works losses and operational use'. In our draft WRMP we included our compensation flows as 'raw water operational use' to ensure that they were captured within the planning assumptions. These compensation flows are also included in row 1BL 'raw water abstracted'. This gives a better overview of our total raw water abstracted than in previous plans. The current WTW losses and operational use contribution (32.18Ml/d) to WRMP data Table 2 row 9BL is broadly consistent with our previous WRMP in 2014 (32.61Ml/d).

Table B4.7 demonstrates the split between the compensation flows and WTW losses in WRMP data Table 2 row 9BL for each of our WRZs. As can be seen from the above table WTW losses have not increased, but the compensation flows combined with WTW losses does increase the line total to 61Ml/d.

Table B4.7 Comparison of WTW Process Losses between dWRMP18 and fWRMP14 by WRZ

	Our draft WRMP: dWRMP18			Our previous final WRMP: fWRMP14
WRZ	Compensation flows (Ml/d)	WTW process losses (Ml/d)	9BL Total = Compensation flows + WTW process losses (Ml/d)	WTW process losses (Ml/d)
Bishops Castle	0.00	0.00	0.00	0.00
Forest and Stroud	0.00	0.36	0.36	0.35
Kinsall	0.00	0.00	0.00	0.00
Llandinam and Llanwrin	0.00	0.00	0.00	0.00
Mardy	0.00	0.00	0.00	0.00
Newark	0.00	0.00	0.00	0.00
North Staffordshire	1.10	1.21	2.30	1.35
Nottinghamshire	12.73	0.00	12.73	0.00
Rutland	0.00	0.00	0.00	0.00
Ruyton	0.00	0.00	0.00	0.00
Shelton	6.31	1.93	8.24	2.12
Staffordshire	0.00	0.00	0.00	0.00
Strategic Grid	8.74	28.68	37.43	28.79
Whitchurch and Wem	0.00	0.00	0.00	0.00
Wolverhampton	0.00	0.00	0.00	0.00
Company	**28.88**	**32.18**	**61.06**	**32.61**

We will include Table B4.7 and supporting commentary in our final WRMP narrative.

B5 Drought risk

Drought Risk

In our draft WRMP we included a table in Appendix A8 to demonstrate the percentage annual risk of various levels of drought restrictions. However, we did not tabulate the risk over time. In our final WRMP narrative a further table and commentary will be included to clarify this information and conform to the listed directives. Table B5.1 shows the risk granularity table to be included in the final WRMP.

Table B5.1 Annual Average Risk of Drought Restrictions for each AMP from 2020 to 2045

Drought Restriction	Our levels of services	2020-25	2025-30	2030-35	2035-40	2040-45
Temporary Water Use Ban	3 in 100 years (3% annual risk)	3%	3%	3%	3%	3%
Ordinary Drought Orders (Non-Essential Use Restrictions)	3 in 100 years (3% annual risk)	3%	3%	3%	3%	3%
Emergency Drought Orders	We consider these unacceptable	-	-	-	-	-

Based on the analyses carried for our supply forecast and drought resilience we consider that our current annual average risk of drought restrictions of 3% for both temporary use bans and ordinary drought orders will not change across the planning period. This annual average risk value has been calculated based on the frequency of Temporary Use Bans (TUBs) and Non-Essential Use Bans (NEUBs) water use restriction that we used in our calculation of deployable output in our Aquator water resources model. NEUBs are also known as Ordinary Drought Orders.

All water resources modelling to predict baseline deployable output, sustainability reductions, climate change, drought resilience and supply option DO benefits have been carried out using a 3 in 100-year frequency of TUBs and NEUBs. In our final planning scenario we show how any supply-demand deficits forecast will be resolved through our preferred supply and demand options. Therefore, we assume that with the implementation of these options, the actual level of service will match the planned level of service over the 2020 to 2045 planning horizon. Over the 25-year planning period this equates to a 75% risk of implementing these water use restrictions.

We consider the use of emergency drought orders unacceptable and, therefore, we do not provide an annual average risk value for this type of drought restriction. Our drought resilience analysis demonstrates that we are able to meet DEFRA's reference level of service (a 1 in 200-year drought) without the use of emergency drought orders. This highlights our resilience to extreme droughts and provides further context for our decision to consider the use of emergency drought orders unacceptable. Further information on our drought resilience work is found in Section A9 of our WRMP.

We have also ensured alignment of these figures with our current Drought Plan 2014 and our draft Drought Plan 2018.

Drought Resilience – Llandinam & Llanwrin WRZ
In preparing our draft WRMP we carried out an assessment of the vulnerability of each of our water resource zones to the potential impacts of drought. As discussed in Section A9 of the draft WRMP all of our groundwater only zones have been classed as low vulnerability to drought and therefore have not been tested against extreme droughts outside of the normal groundwater deployable output calculations. This is why we have not completed WRMP data table 10 (drought plan links) for any of our groundwater source only WRZs.

As described in Appendix B2, our assessment of the Llandinam and Llanwrin WRZ indicates that due to the location of the Llandinam source adjacent to the River Severn, it could be sensitive to the impacts of climate change and therefore potentially also drought as the boreholes are in hydraulic continuity with the river. However, given the scale of releases from Clywedog reservoir and the proximity to the reservoir it is expected that the river gravels would be well supported under drought and extreme drought events.

In response to the draft WRMP consultation we have completed WRMP data Table 10 for the Llandinam and Llanwrin WRZ. Our Aquator modelling has shown that WRZs directly reliant on the River Severn, such as the Shelton and Wolverhampton WRZs, have a very low vulnerability to the impacts of drought. Under all of our modelled historic and extreme drought scenarios; these zones showed zero change in DO. We can therefore assume that the Llandinam and Llanwrin WRZ, which is higher up the reaches of the River Severn and close to Clywedog reservoir, will also have no change in DO for the same droughts. We have therefore completed WRMP data table 10 for the Llandinam and Llanwrin WRZ.

Groundwater Drought
One consultee provided responses to our draft WRMP associated with the resilience of our Sherwood sandstone sources to long term droughts. Concerns were raised regarding the level of investigation we had carried out to assess the impacts of multiple year droughts on the groundwater sources abstracting from this resource.

As part of our climate change investigation, we investigated the impacts of multiple year droughts on the deployable output from our groundwater source water production sites. This study concluded that 6 borehole sources would be impacted by a prolonged multiple year drought, however only peak deployable output would be affected.

Drought Resilience and our changing boundaries
As stated in our draft WRMP, in 2017 we welcomed Dee Valley Water as part of Severn Trent Plc with the shared purpose of serving our communities and building a lasting water legacy.

This Statement of Response relates to the area previously served by Severn Trent Water. A separate draft WRMP was prepared for the previous Dee Valley Water area. We made an application to Ofwat for a new licence appointment / variation (NAV) for these two licensed undertakings and this came into effect on 1st April 2018.

Following the licence variation, we intend to publish the final WRMPs based on the geographies of the new areas of appointment, so far as reasonably practicable given the integrated nature of the supply systems and underlying models. This will be in the form of a separate English WRMP and Welsh WRMP, and will be in keeping with our customer and stakeholder engagement to date in England and Wales. The customer and consultee feedback collected through our draft WRMP consultation process will be used to inform those final WRMP publications.

One consultee requested clarification regarding the level of drought resilience that is achieved in the former Dee Valley Water area that was transferred into our Severn Trent Water area. In particular, the consultee requested confidence that we are testing and ensuring resilience to a 1/200 year drought in the transferred area.

In the Dee Valley Water draft WRMP we described how the problem characterisation exercise identified that there is a low level of concern regarding the future water resources situation for Wrexham and Chester. Consequently, our approach to drought resilience in the Dee Valley draft WRMP was proportional to this problem characterisation- following a ‘Risk Composition 1- conventionally tested plan’ approach as defined in the UKWIR (2016) WRMP 2019 Methods – Risk Based Planning document. This means that the drought scenarios we used to test our plan included only those observed in the historic record which are included in our baseline deployable output calculations. This baseline modelling period (1927 to 2015) captured a number of drought events including 1933-34, 1995-96 and 2010-2011 droughts.

The key area that will be transferred into our Severn Trent Water region and hence our final WRMP is Chester. Further work is still needed to enable us to demonstrate that we are resilient to a 1 /200 year drought in this zone, and we will need to carry out the following steps:

- Step 1: Derive a synthetically generated series of river flow data for the Dee Valley catchment.
- Step 2: Estimate the river flow volume of a 1 in 200-year drought event using the inflow data used in the Dee Valley Water Aquator model and the River Dee Natural Resources Wales Aquator model – this known as the ‘target flow’.
- Step 3: Search the synthetic flow series derived in Step 1 for the ‘target flow’.
- Step 4: Input the ‘target flow’ data into the old Dee Valley Water Aquator model and the River Dee Natural Resources Wales (NRW) Aquator model.
- Step 5: Run the River Dee Natural Resources Wales Aquator model with the ‘target flow’ data to define what river abstraction ‘cutbacks’ would be imposed on the Dee Valley Chester WRZ.
- Step 6: Input the cutbacks information derived in Step 5 into the Dee Valley Water Aquator model.
- Step 7: Run the Dee Valley Water Aquator model for the Wrexham and Chester WRZs using the “target flow” data and cutbacks data to define the deployable output of a 1 in 200-year drought.

Due to the nature of this work requiring input from multiple stakeholders including Natural Resources Wales and United Utilities, this may not be available in time for our final WRMP. If the work has not been completed in time for our final WRMP, we will provide this information during the WRMP annual review process.

B6 Outage

At the time of writing our draft WRMP, our wider PR19 investment plans were not fully formed. Since we published our draft WRMP, we now have a more robust assessment of future capital maintenance and investment for our water treatment works. We have therefore updated our assessment of future outage allowance to account for the effects of this future planned investment.

We have also reviewed the deployable output values used in the outage model for all sources in the Strategic Grid WRZ and we have re-run the outage model using these updated values. As a result, a new baseline outage allowance of 124.06 Ml/d has been derived for the Strategic Grid WRZ. This new baseline outage allowance value was used in the work carried out to review future WRMP outage allowances based on PR19 investment plans.

The PR19 capital maintenance programme will prevent future asset deterioration, while our planned asset enhancements should increase the reliability of treatment processes and reduce the risk of asset failures. As a result, some of the unplanned outages included in the draft WRMP probability distribution based outage model are likely to be resolved through these investments across future AMPs. We have accordingly updated outage allowances over the next five AMPs based on investment plans in each AMP. This has enabled us to account for the reduction in outage allowance due to the improved asset conditions. The changes are outlined below.

- As a first step we reviewed the modelled outage assumptions against the significant treatment works investments planned to be completed by the end of AMP6 for all sources in the Strategic Grid WRZ. We identified and removed some unplanned surface water outages the cause of which are likely to be resolved through the improved asset conditions as a result of these investments. For example, significant investment in AMP6 on filtration process at Site F water treatment works is expected to remove causes for the following historical outages (Table B6.1) and hence these are removed from the dataset before estimating AMP7 outage allowance using the model.

Table B6.1 Extract of outage data table for Site F WTW

Start	End	Design Flow Ml/d	Outage Min | Av. | Max	Type	Reason	Comment
19/01/12	23/05/12	90	0% | 19% | 50%	Restriction	Process Maintenance	Scraper & Filter Restrictions
25/05/12	17/06/12	90	17% | 21% | 60%	Restriction	Process Maintenance	Scraper & Filter Restrictions
19/06/12	03/07/12	90	17% | 17% | 25%	Restriction	Process Maintenance	Scraper & Filter Restrictions
05/07/12	09/08/12	90	17% | 17% | 25%	Restriction	Process Maintenance	Scraper & Filter Restrictions
30/08/12	20/09/12	90	17% | 19% | 44%	Restriction	Process Maintenance	Scraper & Filter Restrictions
22/09/12	06/10/12	90	17% | 17% | 17%	Restriction	Process Maintenance	Scraper & Filter Restrictions
08/11/12	31/12/12	90	17% | 24% | 100%	Restriction	Process Maintenance	Scraper & Filter Restrictions

- Significant planned investments for AMP7 at each surface water sources in the Strategic Grid WRZ were acquired from the latest PR19 capital improvement and maintenance plan and were also used to identify and remove outages risks from the model. For example, significant investment in AMP7 on disinfection process at Site A WTW is expected to remove causes for the following historical outages (Table B6.2) and hence these are removed from the dataset before estimating AMP8 outage allowance using the model.

Table B6.2 Extract of outage data table for Site A WTW

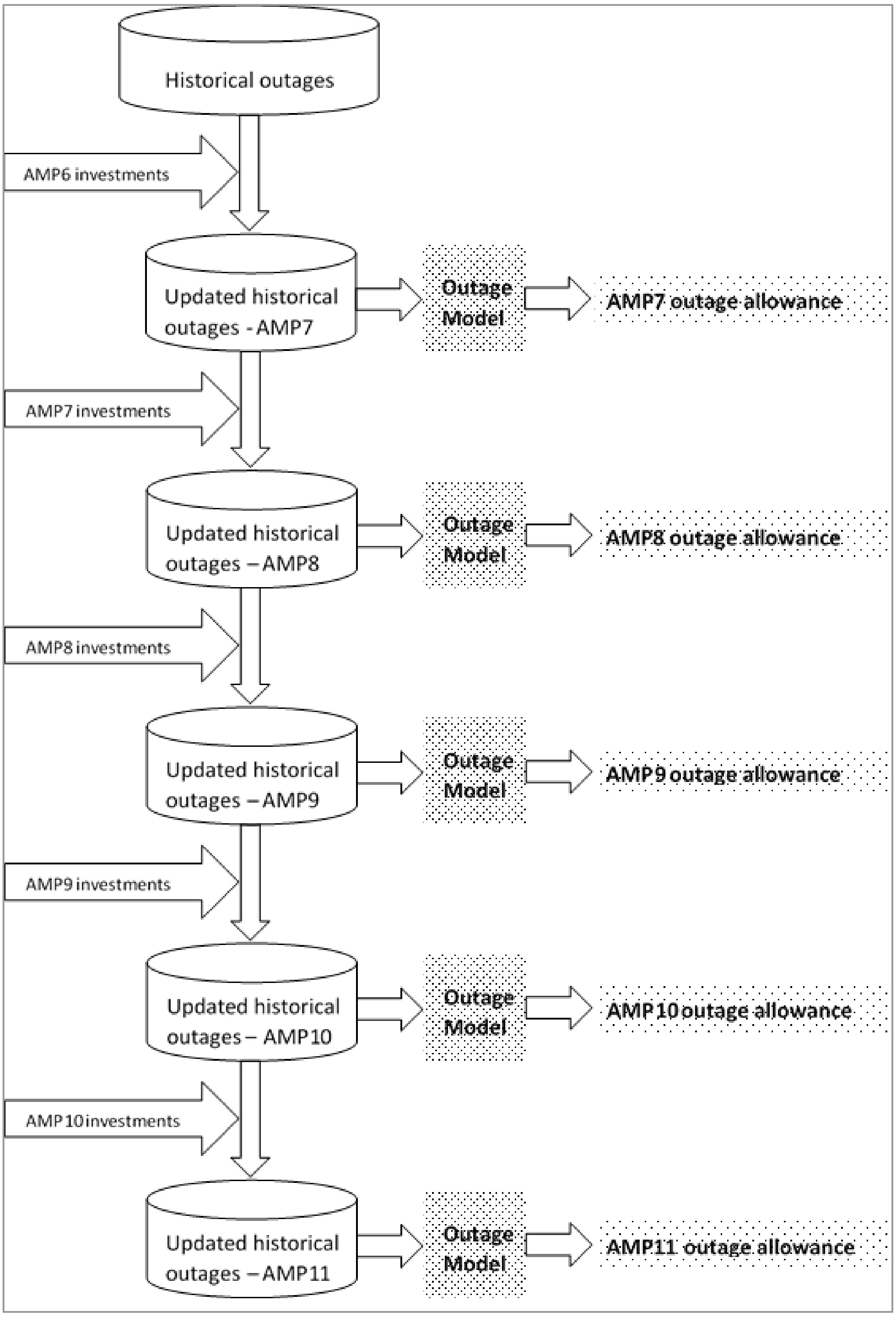
Start	End	Design Flow Ml/d	Outage Min | Av. | Max	Type	Reason	Comment
28/02/08	28/02/08	43	53% | 53% | 53%	Shutdown	Quality	Problem with Cl2
24/03/11	24/03/11	43	10% | 10% | 10%	Shutdown	Chlorine dosing problems	*None*
14/05/12	14/05/12	43	16% | 16% | 16%	Shutdown	Quality	Chlorine dosing failure
23/09/13	23/09/13	43	30% | 30% | 30%	Shutdown	Quality	Chlorine dosing issues
16/01/14	16/01/14	43	23% | 23% | 23%	Shutdown	Quality	Low Cl2 residuals, follows by power dips.

- Similarly, AMP8 to AMP10 investments were used to update the list of unplanned surface water outages in the respective periods.

- The outage model was then used to predict outage allowances in the Strategic Grid WRZ for five year interval periods (2021-2025, 2026-2030, 2031-2035, 2036-2040, 2041-2045) based on the updated list of outages for each period and updated DO values.

Most of the outages removed based on AMP9 and AMP10 investments have relatively smaller magnitude and durations. This has caused positive skewness in the probability distributions of the overall outage magnitude and durations, resulting in very small increases in the outage allowances during these periods. In these cases, investments during these AMPs were considered to have caused insignificant reductions in risk of failures and thus, outage values for AMP 9 and AMP10 have been held constant in our supply / demand assessment. Figure B6.1 illustrates the stages of our outage risk review for our final WRMP.

Figure B6.1 Outage allowance review process based on capital improvement and maintenance plans



The results of our outage allowance review are shown in Table B6.3. The results show that in our final WRMP we are projecting that there will be a reduction in future outage risk as a result of our ongoing capital maintenance and asset investment programmes.

Table B6.3 Reductions in Outage Allowance in the Strategic Grid zone following investment

AMP Years	7 2020-2025	8 2025-2030	9 2030-2035	10 2035-2040	11 2040-2045
Outage Allowance (Ml/d)	124.06	119.23	119.23	119.23	116.58
% of Deployable Output	8.68	8.34	8.34	8.34	8.15

Planned outage associated with maintenance plans

Our Monte Carlo based statistical outage modelling includes records of historical planned outage from which we are able to estimate the ongoing occurrences of planned outages across the future planning horizon. For planning purposes we assume that planned outages associated with delivering maintenance and investment plans in future AMPs are likely to be statistically similar to historical planned outages in current and previous AMPs. Thus, the statistical method we have used to estimate planned outages due to maintenance works in future AMPs based on historical (observed) planned outages is a reasonable approach using auditable data and assumptions. This will be included in our final WRMP.

Outage and new supply-side options

Most of the new supply-side options that are in our preferred programme described in our WRMP are enhancements to existing sources, meaning outages associated with these existing sources have already been accounted for through the outage modelling. The new options are not considered to cause significant changes to the supply system and no additional or increased supply failure risks are expected. Moreover, a review of historical outage data has shown that a significantly low amount of unplanned outage has been observed in supply sources where new options have been implemented in previous AMPs. The development stages of new options will be planned to cause minimal interruption in daily operations, thus planned outages estimated using the statistical model for these sources is considered to account for the likely occurrence of outage during the development stages of new supply options.

The unconstrained list of options prepared for the WRMP included proposals to remove treatment constraints at eleven of Severn Trent Water's surface water treatment works. Removing these constraints will allow these water treatment works to operate at a higher capacity.

B7 Resilience

Our WRMP specifically considers our resilience to drought events, and sets out our long term proposals to manage this risk. Our WRMP has been developed in parallel to our wider PR19 investment plans that improve operational resilience by enabling us to provide a continuous supply of water under a wide range of shocks and stresses. Our PR19 plans – the development of which will be completed in the latter half of 2018 – set out investment we need to make across the whole of our water supply and distribution system

For submission of our final WRMP, the text in Section 5 of the draft WRMP is to be modified to provide an improved understanding of our approach to incorporating resilience into the decision making process. Where we have identified that new supply capacity is needed to maintain the supply / demand balance, we have prioritised solutions that make the best use of our sustainable sources of supply. We have focussed on solutions that:

- Increase the flexibility and resilience of our supply system, such as the new strategic supply links from our Strategic Grid zone into the groundwater supplied Nottinghamshire zone;

- Increase or optimise deployable output from existing, sustainable sources where possible, such as increasing the treatment capacity of our existing Site E, Site F and Site J water treatment works;

- Make use of potential trades into and out of our region to optimise national use of resources. We have met all neighbouring companies and other sector organisations to identify potential transfer options. These discussions are ongoing and the final WRMP will include an updated narrative to make this position clearer.

In addition, the preferred programme of options and the appraisal of different investment choices, has been developed in parallel with our wider water distribution and supply resilience strategy. We have ensured that we understand the holistic total expenditure (Totex) implications of our investment choices, and we can derive a fully integrated, optimised supply/demand, infrastructure and leakage investment plan.

Our supply / demand decisions are underpinned by our broader capital maintenance and water quality investment programme. At the same time, the options and activities included in our plan not only contribute to addressing future supply / demand challenges, but also deliver broader benefits to our customers by creating more resilient supplies.

We have presented a preferred programme of options in our WRMP that we are confident is achievable, will provide the stated benefits and meet the challenge of providing a cost effective and sustainable water supply to our customers into the future.

B8 Working with retailers

Organisations representing agricultural non-household customers commented on our draft WRMP, asking for more clarity on how the opening of non-household retail competition will affect water supply planning.

In April 2017 the non-household water market was opened to competition, this means business customers can now choose their water retailer. The retailer in essence provides billing and meter reading services, wholesale services are still provided by us (Severn Trent Water). We (Severn Trent Water) made a decision that we did not want to be in the retail market and formed a Joint Venture with United Utilities called Water Plus. On 1st April 2017 we transferred our business customers over to Water Plus. This means that business customers now have to contact their retailer for any billing or metering issues but can still contact us directly for network related issues.

Within our wholesale region there are now a number of retailers operating (25 have signed contracts with us). Our relationship with Water Plus is the same as the relationship with any of the other retailers such as Wave, Castle Water or the self-supply retailers. We have a separate team who manages the relationship with retailers. Where a retailer needs to ask us for information or to do something for one of their customers there are established processes which we all follow to ensure we are treating all retailers in exactly the same way. This change does alter our relationship and the service we can provide to non-household customers.

During an incident affecting water supply

In an incident affecting water supply, our first priority is to look after our most vulnerable customers and priority sites (like hospitals) - and to provide alternative supply to our customers. This can be in the form of tankers - where we typically inject the water directly into the water network so that customers can continue to get water from their taps.

With the exception of hospitals, prisons and care-homes our support for non-household customers through alternative supplies will very much depend on the nature of the incidents and the capacity we have available in terms of resources (both human and physical). Where we do have capacity available (tankers, bowsers and bottled water) any support we provide must be done in a fair and equitable way. We have developed a hierarchy of types of business customers (based on the nature of their business) to work out the priority order in which we would offer support where have the capacity available. We are currently reviewing this again especially around businesses caring for livestock (farms, vets, rescue centres etc) but there is no guarantee that we will be able to provide bowsers or tankers during an incident.

We have a standard for bottled water of providing 10 litres per person per day. Using census data, there are typically 2.4 people per property so initial estimates of volumes are based on 2.4x10 litres i.e. 24litres per household per day, which works with typical bottled water pack sizes. Non-sensitive businesses are not included in this and therefore need to have their own plans in place for what they would do in such an event. The only exception is where someone lives at the business address e.g. a farm, where water is provided in line with the domestic property allowance above. As a wholesaler we have no legal obligation to provide a certain amount of water to livestock in a certain amount of time, but we will provide support if the circumstances allow.

Businesses must therefore look at what contingency they can put in place, many already have storage tanks and we know there are some who have private contracts for alternative supplies such as tankering etc. Some Retailers are starting to offer contingency supplies support but this is not a requirement on Retailers and is therefore a business decision for them and any support is likely to come at a cost to the customer.
DEFRA's advice on their website is that any person that is responsible for any animal welfare must have their own 24 hour contingency plan.

Low water pressure
Regarding low water pressure, we are responsible for providing 1.5 bar of pressure at the customer's property boundary. If farmers or fruit growers or rural businesses struggle with supply due to long service pipes or local topography, then it is their responsibility to rectify it by using pumps and boosters. Our standards guarantee 1.5 bar pressure at their property boundary, but if a non-household customer's private set up isn't capable of getting sufficient water to where it's needed then it is a private issue. We will offer advice on this matter where possible.

Temporary Use Bans
If extended drought conditions mean that reservoir storage or other drought indicators exceed our drought triggers, we may need to temporarily restrict certain uses of water. Prior to the Water Use (Temporary Bans) Order 2010, water companies were only allowed to restrict the use of a hosepipe if it was to water a garden or wash a private car. Since 2010 water companies have had wider and more far reaching powers to restrict water use.

In June 2018 we published an update to our statutory Drought Plan, which describes our drought escalation triggers and explains the actions we will take as a drought situation develops. Chapter 3 of the Drought Plan explains the uses of water that are covered by a temporary use ban, and also explains that many business uses, including the watering of plants that are grown or kept for sale or commercial use by horticultural businesses (e.g. plant nurseries etc), would be exempt from such a ban. These exemptions are in line with the 2013 UKWIR Code of practice and guidance on water use restrictions (CoP), and are used to delay the economic impacts of restrictions on business customers for as long as we can.

B9 Data changes since WRMP14

Appendix A2.3 of our draft WRMP provides a detailed description of the updates and improvements we made to our Aquator model and deployable output assessment between our final WRMP in 2014 and our current draft WRMP. The model changes included:

- Incorporating new abstraction licences and any changes to existing abstraction licences which have been varied since WRMP14.
- Updating strategic linkages using current hydraulic modelling and operational knowledge to establish the maximum potential flow along the pipelines.
- Modelling the potential impacts of water quality issues such as metaldehyde which may prevent abstraction for short periods each year.
- Updating our reservoir control curves including the Level 2 (Temporary Use Bans) and 3 (Non Essential Use Ban) thresholds.
- Extending our river inflow series by 4 years to cover 1920 to 2014 and recalibrating against a longer time period. We also extended the verification period and used more calibration statistics to improve confidence in the inflow series.
- Improving the granularity of a number of supply areas in the model, building a more detailed representation of the demand centres and the complex supply network in these areas.

The updates made minor changes to the deployable output assessment for each water resource zone, with differences attributed to one or more of the following:

- Our groundwater deployable output was reviewed and updated for the dWRMP18.
- Improved granularity of the WRZ, including a more detailed representation of the demand centres and the complex supply network in the zone.
- New strategic links or transfers being established during AMP6.
- Recalibration of river inflow series.
- Updates to our WTW capacities across individual zones has resulted in some capacities increasing (e.g. due to capital work on the site) and other decreasing (e.g. due to regulatory water quality limits).
- Revisions to the capacities of some of our strategic linkages have also contributed to the overall reduction in zonal DO.

Whilst preparing our draft WRMP we briefed the Environment Agency and Natural Resources Wales in detail at a number of meetings about the updates we made to our water resources model and the revised deployable output assessment. We also discussed our approach to modelling climate change, extreme drought and the techniques we used to model the effect of meeting the requirements of the Water Framework Directive and Restoring Sustainable Abstraction (RSA) objectives.

B10 WRMP data table corrections

Following the consultation responses and our development of the WRMP since the draft WRMP was submitted, we have made a number of changes to the WRMP data tables. These changes can broadly be surmised as follows:

- Update the WRMP data tables to the Environment Agency's Template V15 standard.
- Update Table 2 & 7 to incorporate our revised approach to representing sustainability reductions
- Update Table 4 to demonstrate the climate change component
- Update Table 5 data with revised option data and following consultation comments
- Update Table 6 with the revised preferred programme of options
- Update Table 8 to resolve a property count formula error
- Update Table 10 (Llandinam & Llanwrin WRZ only)

Update the data Tables to the Environment Agency's Template V15 standard
Our WRMP data tables submitted with our draft WRMP was prepared on the Environment Agency's table template Version 14. Since the submission of our draft WRMP, the Environment Agency issued an updated Table template (Version 15) on 21st June 2018 which included modifications to the table calculations. We have ensure the data tables representing our final WRMP aligns with Version 15 of the template.

Through the consultation process it was identified that the WRMP data tables that we prepared for the Llandinam & Llanwrin WRZ and Rutland WRZ included calculations from template Version 12 of the tables. The data tables for these WRZs have now been updated to template Version 15

Update Table 2 & 7 to incorporate our revised approach to representing sustainability reductions
As described in Appendix A4.10, when preparing our draft WRMP we used Table 7 to demonstrate how we proposed to implement sustainability reductions. Table 2 (baseline) showed the baseline sustainability reductions, as outlined in WINEP2, with licence reduction implementation dates commencing in AMP7. We added a new row to Table 7 to show how in the final plan scenario we would use 'up front permitting' to delay the impact of these sustainability reductions until AMP8. This formula change in Table 7 was only made in our Strategic Grid WRZ.

In response to the consultation feedback we received from the Environment Agency, in our final planning tables we have removed this change to the calculation in Table 7 and have shown the reductions we are planning, based on WINEP 3, in Table 2 row 8.2BL for all zones. This ensures consistency with other water companies.

Update Table 4 to demonstrate the climate change component
As described in Appendix B2, the WRMP data tables have been updated for submission with the final WRMP to demonstrate the contribution of the climate change component for each water resource zone.

Update Table 5 with revised option data and following consultation comments
Since the preparation of our draft WRMP we have further developed our Supply side, Customer Side and Distribution Side options which has given us an improved understanding of the deployable outputs and option costs. Consequently the WRMP data Tables accompanying our final WRMP will be updated with this revised option information.

Our WRMP data tables submitted with our draft WRMP did not show the correct 'Option Type' field for the Distribution Side and Customer side options. This has now been resolved and will be reflected in the WRMP data tables accompanying our final WRMP.

There was an inconsistency in the ordering of the Table 5 data in Section 61a Customer Side options for some between different WRZs. The order some WRZ Table 5 datasets was aligned to a previous template version. This has now been resolved and will be reflected in the WRMP data tables accompanying our final WRMP.

Update Table 6 with the revised preferred programme of options
There has been a minor variation in the preferred programme of options being progress. This has resulted in an updated Table 6 for the Forest & Stroud, Strategic Grid and Nottinghamshire WRZ.

As described in Appendix B4, household metering is part of our demand management strategy, through which we expect to realise benefits in the form of reduced consumption and reductions to Underground Supply Pipe Losses (USPL). Our draft WRMP detailed the consumption benefits of household metering but not the USPL reduction benefits. For the final WRMP tables we have adopted and implemented the recently published EA data tables that contain corrections for capturing USPL benefits in Table 6.

Update Table 8 to resolve a property count formula error
We have reviewed the draft WRMP data tables to understand the source of a total property count error in Table 8 (row 45FP) which displays a higher total property count compared to the baseline projection in Table 3 (row 45BL). We have found this is due to Table 8 displaying the free meter optant (fropt) profile from the baseline scenario instead of a revised free meter optant profile from the year 1 of proactive metering. We have corrected this error in our final WRMP tables.

Update Table 10 (Llandinam & Llanwrin WRZ only)
As described in Appendix B5, we have completed Table 10 for the Llandinam and Llanwrin WRZ.

General Notes
A consultee raised concerns early in the process that in the data Tables for some WRZs there were options listed in Table 6 (Preferred Options) that were not present in Table 5 (Feasible Options). Upon inspection we established this referred to our inter-WRZ transfer options which act to increase potable water export from the Strategic Grid WRZ into the Nottinghamshire WRZ.

The function of these options means that we included them in Table 6 for both WRZs, albeit with a positive deployable output in Nottinghamshire WRZ and a negative deployable output in the Strategic Grid WRZ to maintain the resource balance. However, the Table 5 information regarding costs of the option are only provided in the data tabled for the WRZ with a positive benefit from the option (Nottinghamshire WRZ). We have maintained this approach in the tables accompanying our final WRMP. We have added commentary into the description field in the Strategic Grid WRZ Table 6 for these options to clarify this matter.