

Appendix 3: Water stress assessment methodology

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1. Introduction

This appendix to the update to the determination of water stress areas in England sets out the approach we have taken to assess water stress. It provides detail on the modelling, data sources, the assumptions we have made as well as more detailed results.

2. Outline approach

Water stress applies both to the natural environment and to public water supplies. Both are affected by future pressure from climate change. In addition public water supplies are under pressure from: reductions in abstractions to make them more environmentally sustainable, a need to make public water supplies more resilient to droughts and increases in demand associated with population growth.

Future environment flow requirements were assessed as part of the National Framework to make sure that decisions on changes to water abstraction to protect the environment were future-proof. In this study we have used the values from the National Framework enhanced scenario that looked at the impact of climate change and greater environmental protection for Protected Areas and Sites of Special Scientific Interest (SSSI) rivers and wetlands, principal salmon and chalk rivers. The enhanced scenario sustainability changes are assumed to reduce the environmental stress to an acceptable level. More details around the enhanced scenario are given in Appendix 2.

The assessment of water stress on public water supplies involved adjusting the 2019 final water resources management plans (fWRMP19) supply demand balance (SDB). A number of small adjustments were made to make the SDB values more consistent. This included adjustments associated with resilience levels and planned leakage reductions.

The impact of the increase in sustainability changes associated with the enhanced scenario changes was added giving an updated SDB. To “normalise” the results between water company areas of different sizes, the updated SDB was divided by the target headroom for each water company area to give a % failure value. Where the supply demand balance deficit is more than half the target headroom the area is considered to be in serious water stress.

The scenario year was chosen as 2039/40 which is when water companies are expected to achieve the 1:500 level of resilience. It also reflects the timescales around the enhance sustainability scenarios.

3. Methodology

3.1. Data sources

The data from the tables within the water company fWRMP19 have been quality checked and collated into a consistent data format. The supply and demand data for each water resource zone (WRZ) in England was used for the analysis. Not all water companies have provided fWRMP19 table data out to 2050. Where this was the case the data was extended out to 2050 (i.e. five more years) using the methodology documented in Appendix 1 in the National Framework¹.

¹ Meeting our future water needs: a national framework for water resources - main report (EA, 2020)

As part of the National Framework modelling some initial assessments of the impact of future sustainable abstraction changes on water companies' water supply were developed. The National Framework study also modelled the future impact of climate change on river flows. The main aim of this work was to make sure that decisions on changes to water abstraction to protect the environment are future-proof from the impact of climate change.

The regional water resources groups looked at the impact on their water supply of these future flows as part of their interim resource position statements produced in May 2020. These interim resources position statements provided an assessment of the impact on their SDB of moving to a 0.2% (1 in 500) chance of needing level 4 drought measures such as standpipes.

3.2. Initial supply demand balance adjustments

The initial SDBs are taken from the fWRMP19. A number of water companies included drought measures and resilience adjustments in their fWRMP19. To make the assessment more consistent these were removed.

3.3. Public water supply resilience

By 2040 water companies in England are expected to have a resilience against the need for level 4 drought measures (e.g. standpipes) to 1 in 500 years (0.2% chance in any year). This will reduce the water available for supply as the fWRMP19 were generally based on a 1 in 200 year resilience (0.5% risk of level 4 drought restrictions in any year).

We have based our analysis on the resilience assessment that were provided by the water companies as part of the regional water resources groups interim resource position statements in May 2020. In a small number of cases it was necessary to estimate the impact using similar nearby resource systems.

3.4. Leakage adjustments

Water companies in England have committed to reducing leakage by 50% by 2050, using 2017-18 as the starting point. Not all water companies built this commitment in their fWRMP19. It was therefore necessary to adjust the SDB to ensure a 50% reduction by 2050. Where the fWRMP19 leakage was too high, reducing leakage levels to achieve the 50% commitment increased the SDB. Where water companies' fWRMP19 were ahead of a linear leakage profile (from 2024-25), the adjustment will decrease the SDB.

3.5. New supply options

To properly reflect water stress in the future it is necessary to remove future planned water supply options post the current water company business plan period, i.e. after 2024/25. The only exception was Havant Thicket Reservoir being developed by Portsmouth Water, which has planning permission and funding.

3.6. Climate change impact

The environment sustainability enhanced scenario includes the impact of climate change. The fWRMP19 also includes an allowance for climate change. The climate change impact in the fWRMP19 was removed to avoid the risk of double counting. Removing the fWRMP19 climate change impact will increase the SDB.

3.7. Sustainability reductions

The sustainability reduction enhanced scenario, was developed under the Environment Agency's National Framework. The scenario contains greater environmental protection for

Protected Areas, Sites of Special Scientific Interest (SSSI) rivers and wetlands, principal salmon and chalk rivers. More details of the development of the scenario are given in a separate technical document as Appendix 2 of this consultation.

The enhanced environmental scenario can be broken down in three components, 1) reductions in chalk related water bodies due to enhanced protection, 2) reductions in other water bodies due to enhanced protection and 3) adjustments in other water bodies, not due to enhanced protection, due to factors such as no deterioration. The impact of climate change is included in all these three components. An estimated breakdown of these components in the different water company areas are given in Table 1. We can see that overall the greatest overall change is needed to meet the requirements of chalk streams. This is followed by the adjustments for other needs and then non chalk water bodies.

The difference between the enhanced scenario and the sustainability reductions already in the fWRMP19 was used to adjust the SDB.

Table 1: Enhanced environmental scenario components by water company area in megalitres per day (MI/d) showing the different categories of environmental protection and the volumes used in the assessment.

Water company area	Chalk water bodies with enhanced protection	Non-chalk water bodies enhanced protection	Other water bodies adjustments	Total
Affinity Water	430	27	7	463
AWS-East Anglia	189	19	135	343
AWS-Hartlepool	0	2	6	8
Bristol Water	0	0	15	15
Cambridge Water	22	0	0	22
DCWW (England)	0	0	0	0
Essex & Suffolk Water	0	33	19	52
Northumbrian Water	0	18	15	33
Portsmouth Water	23	12	11	46
Severn Trent Water	0	24	341	365
South East Water	67	6	61	134
South Staffordshire Water	0	0	74	74
SWW-Bournemouth	41	0	0	42
SWW-Devon & Cornwall	0	10	13	23
Southern Water	131	0	13	144
SES Water	9	2	1	12
Thames Water	204	222	25	450
United Utilities	0	25	57	82
Veolia Water Projects	5	0	0	5

Water company area	Chalk water bodies with enhanced protection	Non-chalk water bodies enhanced protection	Other water bodies adjustments	Total
Wessex Water	56	21	0	77
Yorkshire Water	50	55	11	116
England Total	1228	475	803	2507

The difference between the enhanced scenario and the sustainability reductions already in the fWRMP19 was used to adjust the SDB.

4. Water stress assessment results

Table 2 provides a summary of the SDB adjustments for England for each of the components described in section 3. Table 3 provides a summary of the SDB adjustments for each water company area for each of the components.

Table 2: Adjustment components of water stress assessment for England in 2039-40 (MI/d)

Water stress adjustment components	MI/d
fWRMP19 Supply demand balance (MI/d)	1578
Removal of resilience adjustments	167
Adjustment resilience to 1:500 (MI/d)	-493
Leakage adjustment	-41
Supply options after 2024-25	-643
Climate change adjustment	343
Enhanced sustainability changes	-2072
Predicted supply demand balance	-1161
SDB % Target headroom (MI/d)	-119%

The enhanced environmental scenario sustainability reductions had the largest impact upon the SDB. The scenario also included the impact of climate change as well and improved environmental protection.

Table 3: Water stress supply demand balance adjustments by water company area in 2039-40 (MI/d)

Water Company Area	fWRMP19 SDB	Initial	Resilience	Leakage	New Supply	Climate Change	Sustain-ability	Final SDB	% Target Headroom
Affinity Water	88	0	-10	9	-18	14	-429	-345	-412%
AWS-East Anglia	33	26	-83	4	-45	16	-264	-313	-388%
AWS-Hartlepool	10	0	0	1	0	0	-8	3	240%
Bristol Water	0	0	-3	6	0	2	-5	2	10%
Cambridge Water	4	0	-5	0	0	0	-16	-15	-554%
DCWW (England)	14	0	0	2	0	0	0	16	819%
Essex & Suffolk Water	104	0	-77	-2	0	-1	-50	-26	-87%
Northumbrian Water	185	0	0	-2	0	14	-33	164	380%
Portsmouth Water	17	-9	-11	2	0	1	-46	-45	-616%
Severn Trent Water	125	0	-26	-42	-184	69	-178	-236	-124%
South East Water	79	6	-34	0	-33	2	-88	-67	-123%
South Staffordshire Water	28	0	-2	1	-6	5	-68	-41	-506%
SWW-Bournemouth	26	0	0	5	0	0	-42	-11	-71%
SWW-Devon & Cornwall	35	0	-4	16	0	10	-23	34	90%
Southern Water	110	-7	-42	-9	-79	7	-144	-163	-359%
SES Water	30	0	-22	-3	0	1	-12	-5	-53%
Thames Water	351	151	-129	-35	-269	79	-407	-260	-162%
United Utilities	176	0	-20	11	0	36	-79	124	131%
Veolia Water Projects	0	0	0	0	0	0	-5	-4	-2346%
Wessex Water	31	0	-16	9	0	1	-61	-37	-122%
Yorkshire Water	130	0	-11	-16	-8	86	-114	67	104%

5. Limitations and assumptions

Water companies have produced water resources management plans that show how they will maintain public water supplies over at least the next twenty five years. The purpose of the determination is solely to inform whether water companies should be able to consider the option of charging by metred volume for all customers (compulsory metering), alongside other options to manage water supplies in their plans. The determination does not indicate that there will not be enough water for supplies or how individual water companies are performing in the management of their water resources, or a level of risk to public water supply.

We have used the final version of the 2019 water company water resources management plans. Where possible we have adjusted the individual water company data to make it more consistent. For example, ensuring leakage was reduced by 50% by 2050. There are still inconsistencies between individual water companies in how various data sets have been produced.

The impact of moving to a higher level of public water supply resilience has been derived from the interim resource position statements from the regional water resources groups. In a small number of cases the impact had to be estimated from assessment from nearby water company areas with a similar mix of supply sources. Further work is required on providing better estimate of the impact of moving to a higher level of supply resilience.

Climate change impacts have been included in the water company fWRMP19 plans and the enhanced sustainability reductions. To reduce the risk of double counting the climate change input in the water resources management plans was removed. Further work is require to fully understand the both the impact of climate change on the environment and public water supplies.

The limitations and assumptions around the development of the enhanced sustainability scenario are described in Appendix 2. The enhanced scenario should only be used for planning purposes, more detailed local and regional analysis is required to inform decision making.

6. List of abbreviations

AMP - Asset Management Programme

fWRMP19 - final water resources management plans produced in 2019

SDB - supply demand balance

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