



Dŵr Cymru
Welsh Water

Draft Water Resources Management Plan 2019 – Summary

March 2018



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A. Introduction

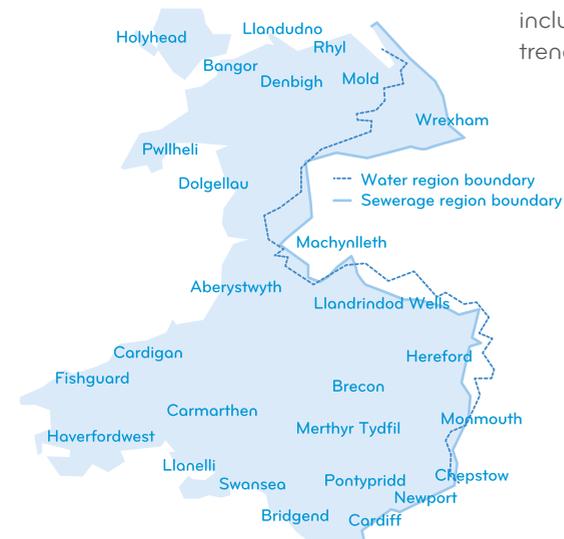
i. Our Water 2050 Vision

Dŵr Cymru Welsh Water provide an essential public service to over three million people across most of Wales, and adjoining parts of England. We are the sixth largest of the ten regulated water and sewerage companies in England and Wales and are unique in that we are a not-for-profit business with no shareholders. This means we can focus exclusively on what is in the best interest of our customers.

We have a clear vision in Welsh Water, which is to earn the trust of our customers every day. This will not be achieved by great customer service alone but by also

understanding our customers' needs and expectations and building future plans to meet these.

In May 2017 we presented our customers with our vision for the business and sought their views on our strategies to meet future challenges through our "Welsh Water 2050" consultation. One of our most important functions is to ensure that our customers will always have sufficient water supply to meet their needs now and into the future and so we have set out a strategy of 'Enough Water For All' to achieve this. It is clear that having a reliable supply of water is important to our customers and that we should fully understand the capability of our systems including how we will respond to future trends.



Welsh Water's operating area

The factors that will impact upon the levels of water resource required to meet customers' needs are:

- Demographic and economic changes that affect water demand. We need to use the best available information to predict our customer's water use;
- Climate change which is recognised by Welsh Government's Future Generations Act as a significant challenge facing Wales. We need to address the potential impact of this within our Plan;
- Our environmental obligations, in the way that we take water from the environment. This is controlled through legislation to ensure that the amount of water that we take from rivers and the use of reservoirs are not environmentally damaging particularly during the driest years when the impact of abstraction can be at its greatest.

This Plan looks out across 30 years from 2020 to 2050 to assess any risks in our ability to supply sufficient water to meet the demand from our customers, taking account of the above factors.

The investment needed to deliver improvements to meet these water resource risks will be presented in our Business Plan 2019 as part of the Office for Water's (Ofwat's) five yearly Price Review process. The outputs of the Business Plan will be delivered over the subsequent five year Asset Management Plan (AMP) period. For the 2019 Price Review (PR19)

new schemes will be delivered during the 2020 – 2025 period known as AMP7. Unlike previous Plan's we have also identified associated investment needs that are required to ensure that our strategic water resource objectives can be met.

ii. The Water Supply to our Customers

Over the last 25 years, the quantity of water we supply to our customers has reduced in a 'normal' year from an average of over 1000 million litres per day (Ml/d) to about 800 Ml/day today. About half of this is down to reduced leakage, the rest due to reduced demand from heavy industry and our customers increasing appreciation of the value of their water supply and subsequent reduction in their usage. Around 80% of this demand for water is from the major cities and towns of south Wales around Cardiff, Swansea, Newport, Bridgend, Carmarthen and the surrounding Valleys.

Wales has a significant amount of rain: we estimate that our infrastructure captures only some 3% of the effective rainfall, leaving some 97% for the environment, compared to the South East of England where up to 50% is used for public water supply. Most of our water is supplied from our impounding reservoirs although we abstract significant volumes from our lowland river sources such as those on the Rivers Wye and Usk in south east Wales, the Rivers Tywi and Cleddau in south west Wales and the River Dee in north Wales. Groundwater accounts for

less than five percent of our supplies at a Company level but at a local level, may be the whole supply.

On the face of it then, we should not have a water resources problem in Wales, however, for the reasons highlighted above, we need to look at the future pressures on our water supplies.

In the last 5 years we have worked towards meeting the requirements of a variety of new environmental obligations, such as the European Water Framework Directive and the Habitats Directive. These have driven new and much tighter standards which effectively require more water to be left in our rivers for the environment.

As a result, by 2020 improvements will have been made to over twenty of our sites to reduce their environmental impact. We continue to work closely with our environmental regulators to understand whether further changes to our operations are needed but we do not currently foresee anything significant over the next 5 years.

This Non-Technical Summary provides an overview of the draft Water Resources Management Plan technical report. The aim is to provide sufficient and accessible information for the majority of readers. For those that require more detailed information this is held in the full technical report.

Section B of this summary document sets out the process for understanding the

supply against demand balance results which Sections C and D outline how we will resolve any future shortfalls in supply. Section E provides details of our drought resilience work and the investment required to improve this. Section F details investment the Company will be making in other areas that help support our water resources position. Section G provides an overview of our approach to potential future water trading with Section H outlining the governance and engagement work that has been undertaken to ensure the robustness of our Plan. We have included an appendix to this report which briefly outlines the water resource position on a zone by zone basis across our region.



B. Objectives for the Plan

i. Zonal supply demand balances

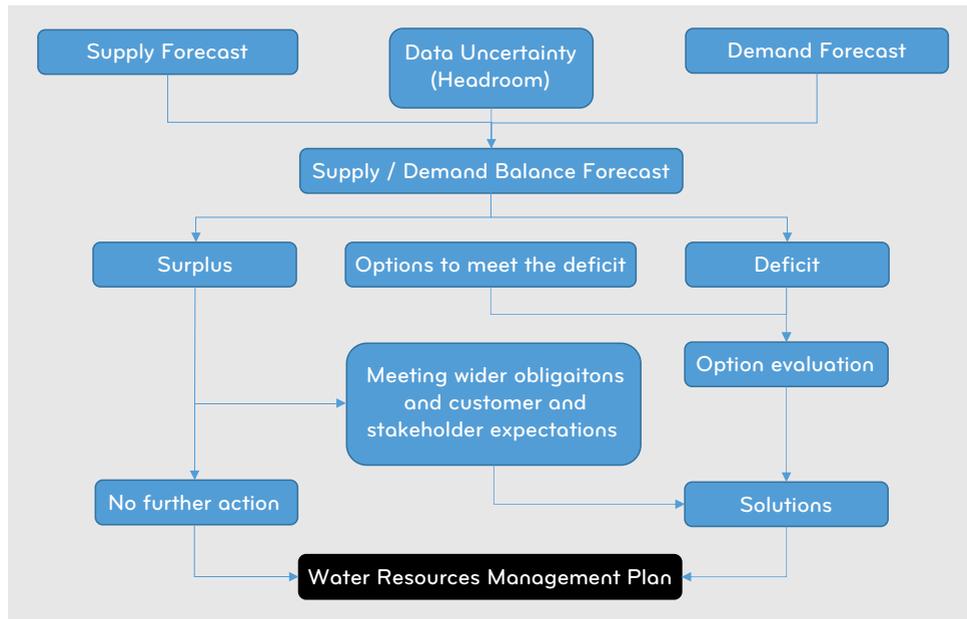
For operational purposes we divide our water supply area into three regions; North Wales, South West Wales and South East Wales. However, for water resource planning purposes we further subdivide our regions into Water Resource Zones (WRZ). A WRZ is defined as the largest area in which all resources can be shared, with some limitations.

The basic approach to the water resource planning process is shown in the diagram below. In order to develop the Plan, we project the future total demand for water from our domestic and business customers and leakage from our supply system. We then calculate how much water will be available from our current water sources in each zone to meet the demand. Long term water resource planning is a complex process involving the analysis of large amounts of data. We need to make an allowance for the uncertainties in our supply and future demand data and this risk allowance is known in the industry as "headroom".

We generate a supply against demand balance for each water resource zone which includes an uncertainty allowance. The figure below shows a graphical representation of this balance.

Where the zonal supply demand balance including uncertainty, shows a potential shortfall, the Plan identifies the options that either reduce demand or increase supplies to resolve the imbalance.

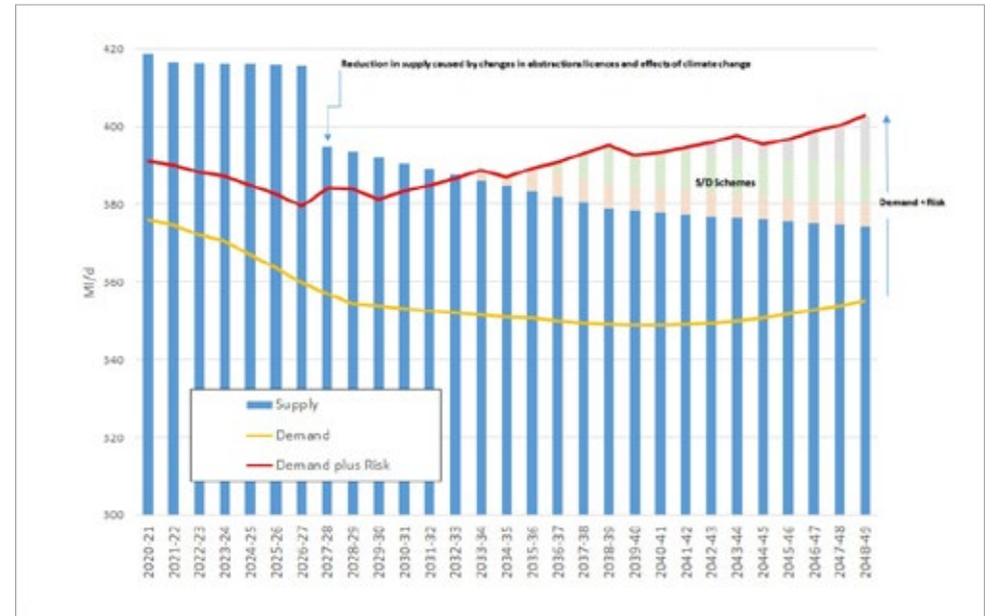
We initially look to find the least cost option to resolve the supply against demand shortfalls. These options would form the most economic plan but there are wider considerations that should be



The Water Resource Planning Process

taken into account when deciding upon the "best value" solution. These aspects include the views of our customers and stakeholders, synergies with other investment drivers, environmental aspects

and overriding government regulation and policy considerations. The Plan puts forward what we believe are the best value options available to us.



Example supply demand balance graph

The figure and the table overleaf show the Supply/Demand balance position for each of our water resource zones. There are two zones where we forecast a water resource deficit during the 30 year planning period, namely Tywyn Aberdyfi and Pembrokeshire. As important as understanding where we have a forecast shortfall, the Plan demonstrates that

for all other zones, with the exception of Vowchurch, the supply against demand position is robust and resilient to the most severe droughts that we can reasonably imagine occurring even when accounting for the potential impacts of climate change.



Water Resource Zone Supply Demand Position

WRZ	2025 Surplus MI/d	2050 Surplus MI/d	WRZ	2025 Surplus MI/d	2050 Surplus MI/d
NEYM	8.1	6.4	Hereford	8.8	9.9
Clwyd Coastal	1.3	2.5	Llyswen	1.5	1.5
Alwen Dee	2.1	2.1	Monmouth	0.6	0.7
Tywyn Aberdyfi	-0.8	-1.5	Pilleth	0.3	0.3
Bala	0.3	0.3	Brecon	0.6	0.7
Blaenau Ffestiniog	0.3	0.3	Vowchurch	0.0	0
Barmouth	0.0	0	Whitbourne	0.1	0.1
Llein Harlech	3.0	2.9	SEWCUS	16.0	18.6
Dyffryn Conwy	2.1	2.7	Tywi	22.7	24.5
South Meirionydd	0.4	0.4	Mid & South Ceredigion	2.7	2.5
Ross	3.3	3.6	North Ceredigion	1.8	2.0
Elan	0.4	0.5	Pembrokeshire	-3.6	-13.8

Our approach to resolving the forecast supply deficits in the Tywyn Aberdyfi and Pembrokeshire zones is set out in the next two sections.



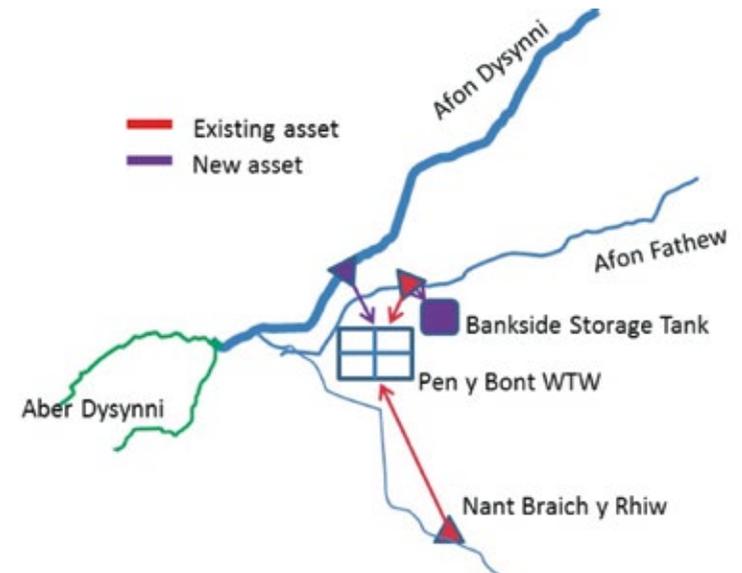
C. The Tywyn Aberdyfi Water Resource Zone

Our Tywyn Aberdyfi zone is small containing around 3000 properties with an average water demand during a dry year of around 1.3MI/d. We are planning to reduce this demand over the AMP7 period to 2025 to around 1.1MI/d through leakage reduction targeted through use of "Smart" water meters and enhanced water efficiency effort.

Water is supplied from two small stream sources which feed water to the Penybont water treatment works (see figure below). Our analysis shows that the flow in these streams will not be able to meet demand

during severe drought periods and this will lead to a zonal supply demand deficit reaching 0.8 MI/d by 2025. This might be compounded by the risk of poor stream water quality during summer storm events which can cause water treatment issues.

Aligned with guidance, we have looked at all available options to resolve the future gap in the supply against demand balance for the zone. The amount of water that can be saved through further demand management activity is limited. We estimate that significant investment in further demand management activity



The Tywyn Aberdyfi Water Supply System

might save of the order of only 0.03MI/d, this through water mains renewal and further water efficiency work. This would be insufficient to meet the shortfall in supply.

We could transfer water from neighbouring zones where there is some spare water resource but due to the geography of the area and long distances between neighbouring sources of water this would be extremely expensive.

Our preferred solution is to construct a new river intake on the nearby Afon Dysynni which can provide the volumes of water required, and to transfer this water to the Penybont water treatment works. The Afon Dysynni is much larger than our existing sources and the amount of

water that we would abstract is a small fraction of the amount of water in the river even during drought periods. This is a sustainable and more resilient source of water to severe droughts and the effects of climate change. This solution is by far the lowest cost of all options, with the least environmental impact. It is proposed to support this solution with a raw water bankside storage reservoir to enable short term shut down of the existing stream sources. The overall scheme cost is estimated to be approximately £7.5 million.



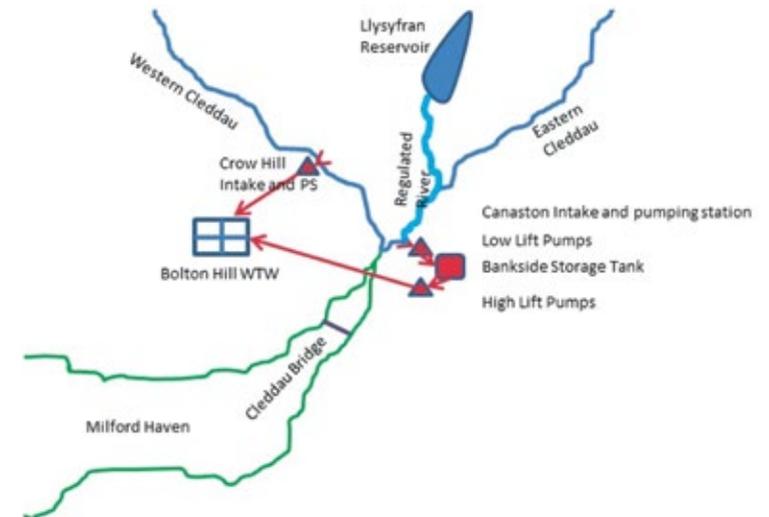
D. The Pembrokeshire Water Resource Zone

The Pembrokeshire zone covers the far south west corner of Wales, stretching from Pendine Sands in the east to the Pembrokeshire Coastal National Park in the west and from the villages of Manorbier in the south to Newport in the north.

The zone is primarily supplied from Bolton Hill water treatment works. The feed to the works is from the Western and Eastern Cleddau rivers through our intakes at Crowhill and Canaston. The majority of the abstraction is at Canaston as the flow in the Eastern Cleddau river

is supported through releases from our Llysyfran reservoir when required (see figure below). The supply demand surplus in Pembrokeshire will reduce significantly in 2019 as we will need to reduce the amount that we can take from the Cleddau rivers to meet environmental obligations. The zone is forecast to fall into supply deficit in 2021 with a shortfall of around 5MI/d by 2025.

This is a significant supply against demand deficit in the Pembrokeshire zone and we have looked at numerous supply and demand management options to



The Pembrokeshire Water Supply System

resolve the forecast shortfall in supply. Given the level of deficit, only demand management options such as complete mains renewal to reduce leakage would be sufficient as a solution but this would be at a cost of hundreds of millions of pounds. Alternatively, we could transfer water from the Tywi Gower zone where there is spare water resource but due to the distance is again an expensive option. A more obvious solution presents itself in the way in which we operate the 'Regulation' of the releases from the Llysyfran reservoir to be re-abstracted at Canaston.

The Canaston pumping station has fixed flow rate pumps and the operation of the station, within the terms of the abstraction licence, means that we currently need to over-release water into the Eastern Cleddau River while we are abstracting lower down the river. This means that we release too much water that could be saved during dry years in case of drought. The installation of variable speed pumps in the pumping station will enable more efficient river regulation to preserve Llysyfran reservoir storage during critical dry years. The change in operation will preserve sufficient water in Llysyfran to meet the supply against demand shortfall during severe droughts.

The Canaston abstraction licence has been subject to a review by Natural Resources Wales as part of the Habitats Directive Review of Consents and this has confirmed that the operation of the regulation scheme under new licence conditions meets environmental standards.

This scheme was identified as the best value solution as it was by far the lowest cost option of those available that resolved the forecast deficit and provided additional resilience against climate change and severe drought. The existing pumping station is relatively old and we will need to maintain the existing pumps in the near future and this scheme also meets the capital maintenance needs at the pumping station. The estimated cost of this option is around £13 million



E. Water Resource Resilience

i. Water Resource Level of Service

The long term supply demand balance for each zone is intrinsically linked to the level of service (LoS) supplied to our customers. If we anticipate that we might be unable to meet the demand for water during a drought we will put measures in place to limit demand. We have used measures such as hosepipe bans and non-essential use bans during the droughts of 1976, 1984 and 1989-90. How often we would put these in place is a measure of our water resource LoS and our customers accept that it is reasonable to impose such sanctions during a drought as long as this does not happen too frequently. Our current stated LoS is:

- Not to have a hosepipe ban (now called temporary water use bans) more than once in every 20 years (1-in-20), on average;
- Not to restrict water for commercial purposes (non-essential use bans limiting use of car washers, building cleaning, dust suppression etc) more than once in every 40 years (1-in-40), on average;
- To never impose more extreme measures such as standpipes and rota cuts.

We have sought the view of our customers who support this approach regarding the frequency at which we would impose

hosepipe and non-essential use bans. Government is understandably keen for the industry to be able to assess what 'never' means for the imposition of more extreme drought measures. The industry is currently considering how to measure this and has asked water companies to make an assessment of the resilience of their water supply systems to more extreme droughts than has been witnessed within their records.

To help answer this question, we have used some innovative statistical methods to examine whether our supply systems could cope with a drought that might occur 1 in every 200 years. The result of this analysis is that we have some confidence that all but 3 of our water resource zones are resilient to a 1:200 year type of drought without resorting to extreme drought management measures. These are our Pembrokeshire, Tywyn Aberdyfi and Vowchurch zones. The solutions put forward to resolve the supply demand balance for the Pembrokeshire and Tywyn Aberdyfi zones will dramatically improve water supply resilience. We are proposing to increase the resilience in our Vowchurch zone.

ii. The Vowchurch Water Resource Zone

We have assessed the susceptibility of the Vowchurch zone to severe droughts using new statistical analysis and this indicates that the zone is not likely to be resilient to

a drought event that might be seen only 1 in every 200 years. This is worse than we have witnessed in our historic record which includes the droughts of 1976, 1984, 1989/90 and 1995. In such an event, we estimate there is a possibility that we might need to resort to extreme demand management measures such as rota cuts but we would only undertake such actions in this relatively small zone if our tankering operations were found to be inadequate.

Although the risk is very low the impact to our customers in the area is unacceptable. We have asked for our customers views on the level of resilience that might be acceptable and they would be willing to pay for an improved level of resilience to droughts more severe than would be seen in 1 in 100 years.

There are limited options to resolve this issue in this area and demand management effort such as leakage reduction would not on its own resolve the situation. Our plan is therefore, to lay a main between our Hereford and Vowchurch zones too improve the situation. This would be at a cost of around £6 million.

In addition, the Vowchurch site has been subject to environmental investigations and we aware that the current abstraction licence is viewed at its limit of sustainability by the Environment Agency. The scheme would mean that we would never need to draw more water from the

underlying aquifer than our current licence allows, ensuring that we have a limited impact on the site under severe drought conditions through this improvement plan.



F. Supporting Strategies

The resilience of our water supply systems is of particular concern to us and this is reflected from government policy through to our duties as water undertakers and in our stakeholders' views. It is essential that the water resources plan is viewed within the wider context of the existing infrastructure that is needed to support the Plan. This section introduces these enabling initiatives and strategies that will be presented in our AMP7 business plan around Dam safety, maintaining the quality of water within the water catchments and our future demand management activity.

i. Dam Safety

Our dams are an essential component of the water resource system in the majority of our zones. These dams function to store water when readily available during the wetter part of the year, which is then used to meet water supplies during drier periods of the year. The full use of our dam assets is critical during the driest

years when we aim to maximise available storage.

Many of our dams and the pipework and valves within them, are over 100 years old. They require ongoing and significant investment to ensure they continue to satisfy modern safety standards and maintain water resource resilience.

All of our dams under the Reservoirs Act 1975 receive regular investment and work to maintain them. These are ongoing activities into AMP7 and beyond for as long as the dam remains under the scope of the Reservoirs Act. These activities include;

- Routine and regular inspection, monitoring and surveillance
- Studies and investigations
- Routine maintenance to fixed assets and surrounding grounds
- Small scale works e.g. fencing, signage and improvement to provide safe access and egress

In April 2016 Welsh Government introduced amendments to the Reservoirs Act. In response to the requirements of the amended legislation, plus continued advancements in new industry guidance and best practice, we anticipate the need for more significant dam safety works during the AMP7 period, above and beyond our regular activities.

Without these works we can expect regulatory notices requiring us to undertake works to meet our legal duties in the interest of dam safety and in many circumstances we need to lower the storage within our reservoirs prior to undertaking this work. Any reduction in reservoir storage within our WRZs has the impact of reducing our supply capability. Given the overriding importance of the water resource gained from our reservoirs we would either fall into a supply demand deficit in zones or have significantly reduced resilience to drought without this investment programme.

To both maintain and to meet future legislative needs we will be investing around £110m in our Dams during the AMP7 period.

ii. Water Quality

Welsh Water abstracts water for supply from 120 catchments covering an area of almost 11,000km². Land within these catchments is subject to a variety of land use types and management practices. We have limited land holding across the catchments and consequently we have little control of land activities. Modern land use with the use of chemicals presents an increasing risk to raw water quality and treatment challenges for our water treatment works. Our engagement with land owners is essential in understanding the risks we face but more importantly in the reduction of these risks through education and fostering of improved

land management. We believe that a 'catchment as a first line of defence' approach is crucial to the future safeguarding of drinking water quality.

Our strategy therefore is to maintain or improve the water quality in the catchments we rely on for our water supply so that our ability to supply water is not impacted. Our investment in this area will increase in AMP7 to around £18m.

As well as working to improve the water quality within the catchments from which we take water we need to ensure that our water treatment works are resilient in delivering wholesome water to our customers. These assets require significant ongoing maintenance and investment so they can continue to provide the quantity of water needed to meet customer demands, whilst achieving ever higher drinking water quality standards. Any reduction in the performance of these assets will directly affect the supply capability of our zones and leave us vulnerable during periods of high customer demand.

Of particular note within the South East Wales Conjunctive Use zone is our project to replace up to five of our existing treatment works with a new larger works in the Merthyr Tydfil area. The existing works were originally built in the early part of the 20th century, and these ageing assets have difficulty in providing a good service in the face of deteriorating raw

water quality. The current configuration also provides limited resilience to manage supply in the event of problems with poor raw water quality or drought.

We are therefore proposing to construct a new treatment works capable of supplying 350,000 households and businesses with water. The new works would consist of comprehensive and advanced treatment processes capable of treating water to current quality standards as well as being capable of meeting potential future regulatory changes and emerging new risks to drinking water quality. We will also reconfigure the existing pipeline network to feed the new treatment works from existing reservoirs and ensure treated water is supplied to the areas currently served by the existing works.

iii. Leakage

We know from our customer research that leakage is an emotive topic with views divided between those customers who recognise the significant financial aspects associated with finding and repairing our leaking pipes and those who feel strongly that leakage is unacceptable and we shouldn't be wasting any water at all.

Our findings are similar to those reported by CCWater¹ which confirmed that leakage is a key concern for customers, and where companies are not felt to be doing enough to reduce leakage, this can impact on customers' behaviours in respect of their own efficient use of water.

Welsh Government expects companies to forecast a reduction in leakage over the planning period and Ofwat have an expectation that water companies will reduce the overall leakage from their water supply systems by 15% during the AMP7 period.

Our current strategy is based upon achieving what is known in the water industry as a 'sustainable economic level of leakage'. This measure is based on the principle that the cost of reducing leakage rises significantly as the level of leakage reduces and that there comes a point at which the production of water is cheaper than the additional effort and cost needed to reduce leakage further. In other words, it becomes very much more costly to our customers to go beyond the sustainable economic leakage level.

This principle should not change, however, there have been significant innovations over recent years that help us to improve our understanding of leakage and methods of repair. In response to our customer and stakeholder views we have updated our leakage strategy for AMP7 and are proposing a series of initiatives which will provide a step change in our understanding and delivery of leakage reduction. Examples of some of the new and innovative ways in which we will look to reduce our leakage are given below:

- We are developing new techniques for modelling trunk mains water balances

and surveys have commenced on sections of trunk mains with innovative leak noise correlators. We also aim to develop methods to regularly survey our 10,000 km of trunk mains using new technology.

- New technology is available to detect a greater number of small external and internal leaks. A pilot study is proposed to survey properties in areas with apparent high leakage, and to follow up points of interest with a repair service.
- We will reduce our backlog of customer side leaks that have been detected and are awaiting repair as we believe that this water being lost may be significant. We will improve our processes and will undertake free repairs or replacements on a targeted proportion of customer supply pipe leaks.

In summary, we will continue to base our leakage targets on the economic level of leakage principle and plan to meet Ofwat's challenge of a 15% reduction in total leakage by the end of AMP7. We envisage that the majority of this additional leakage saving will be found from reducing customer side leaks and wastage supported by savings from trunk mains repairs. For Welsh Water this is approximately a reduction of 26 MI/d from our current leakage target of 169 MI/d at the end of AMP6 to a value of 143 MI/d by the end of the AMP7 period.

¹ Water, water everywhere? Delivering a resilient water system (2016-17). December 2017.

iv. Water Efficiency

In its Water Strategy for Wales (2015), Welsh Government sets out how it will look to work with water companies to drive action and engagement on water usage and to promote the benefits of water efficiency.

One of the key messages we received from our customers during the engagement work for this Plan is that we should be doing more for our customers with respect to promoting water efficiency. In response we plan to increase our effort in helping to improve our customer's water efficiency and will continue with and build upon the high quality 'Customer Focused' water efficiency service we currently undertake. Our plans for AMP7 are:

- To build water efficiency messaging and education into our 'Tap and Toilet' leakage initiative;
- Activity will ramp up significantly over the remainder of AMP6 and into AMP7. This is in line with the views of our customers through the WRMP customer engagement groups and stakeholder consultation where a proactive stance to water efficiency is welcomed. Activity is also targeted across the region;

- Increase our Domestic Audit Programme – supporting c.30,000 customers across AMP7 compared to c.5,500 across AMP6;
- To engage with and support our most vulnerable communities – during 2017/18 the company is looking to support c.10,000 customers within the Rhondda Fach Valley, an area of considerable water debt and vulnerable customer groups. This will set the basis for further 'community' support programmes going forward;
- Provide a targeted approach to Water Efficiency within our deficit zones.

The table below shows a summary of our proposed spend on water efficiency (excluding metering) in AMP7 in comparison to our previous spend (AMP5) and current spend (AMP6). A significant increase in spend is forecast as a direct result of much greater water efficiency activity we will undertake over the five years from 2020 – 2025.

Water Efficiency Budget	AMP5	AMP6	AMP7
	£2,200,000	£2,718,500	£4,548,000
		+ £518,500	+ £1,829,500



G. Water Trading

We believe water trading can play a part in supporting the economy, as long as it is done in a sustainable way. We support the position set out by the Welsh Government that water trading must benefit Wales and the people of Wales, and not jeopardise our own business and the customers we serve.

As part of the 2014 Price Review, Ofwat introduced water trading incentives to encourage water trading between water companies. Welsh Water have developed a Trading and Procurement Code which was approved by Ofwat in February 2016. The code is intended to provide reassurance that any trades we conduct will be in accordance with the code and that in contracting for the provision of water resources we will purchase from the most economical sources available, having regard to the quality, quantity and other relevant aspects.

Our Plan shows that we are open and transparent when considering supplies of water to us from 3rd parties and support the use of competitive processes. The majority of our supply region has water surpluses making water exports more likely. Any potential export would need to comply with the following conditions:

- No water resource zones placed into deficit as a result of the export

- No impact on our ability to supply water during periods of drought
- No impact on our company's level of service
- The environmental sustainability of supply (no deterioration of raw water source)

With the potential to benefit customers and the wider Welsh economy we have scrutinised the plans of neighbouring water companies and the potential for water exports. We discussed potential high level options for export to Severn Trent Water and Thames Water but we have not made any commitments or agreements as this will need further detailed work. Once this work is complete and if these are to be taken forward then we will discuss these options with Welsh Government and present these in our revised draft WRMPs. We will need to satisfy ourselves and our regulators that any scheme will meet the criteria above and be of benefit in reducing the bills of our customers.

We are also working with the Canal and Rivers Trust on a raw water export solution to support the Brecon & Monmouthshire canal during periods when their abstraction from the River Usk is restricted.



H. Plan Governance

We have developed our Plan in line with Welsh Government Guiding Principles for Water Resource Planning and have worked closely with our regulators to ensure that we have met the guidance for developing our draft Water Resources Management Plan 2019.

In developing our Plan, we have engaged with our customers and other stakeholders so that their views are taken into account.

We have pre-consulted our regulators, local authorities, neighbouring companies and some other key stakeholders such as the Consumer Council for Water to seek their views on what they saw as the important factors to consider within the Plan. The consultation ran for 6 weeks from the 23rd January 2017 to the 7th March 2017.

We have worked closely with our key environmental regulators, Natural Resources Wales and the Environment Agency who will report back to Welsh Government and the Department for Environment, Food and Rural Affairs (DEFRA) on the efficacy of our Plan. This engagement has been through regular technical meetings and the use of method statements so that there should be no surprises in either our approach in meeting guidance or in the results of analysis presented.

In addition to our environmental regulators we have also sought the views of environmental organisations across Wales through the Independent Environmental Advisory Panel (IEAP) which Welsh Water set up in 2012. We have consulted this Panel during the Plan preparation and have presented them with initial results for discussion and comment.

i. Environmental sustainability

We aim to provide water services in an equitable, sustainable and affordable way, based on regulatory control and environmental laws to ensure that environmental ecosystem's are preserved while at the same time ensuring customer wellbeing and economic development. The water resource planning process reflects this through a range of measures, including:

- The protection of environmental flows, via our environmental regulators', Catchment Abstraction Management Strategies process;
- The aim of achieving Good Ecological Status as required by the European Water Framework Directive;
- The protection of habitats and species of international importance via the enactment of the European Habitats and Birds Directives;

- The need to identify the least cost, most sustainable solution for maintaining a balance between supply and demand, taking account of carbon costs of schemes, and wider environmental issues via Strategic Environmental Assessment and Habitats Regulations Assessment; and subsequently to identify the best value option and,
- The statutory duty placed upon water companies to promote water efficiency and biodiversity.

ii. Assurance

Jacobs's consultants in their role as our Company auditors have undertaken a compliance audit of our Plan against regulatory guidance and have fed back

comments where our planning could be improved. This suggests that our processes are consistent with the WRMP guidelines, that the Plan adequately reflects the Welsh Government's guiding principles and Ofwat's key themes and that our processes incorporate appropriate levels of quality assurance.

The Plan has passed through internal Dŵr Cymru sign off processes to Board level.

iii. Next Steps

Over the next 12 months we will continue to engage through a wide consultation with our stakeholders and customers on the proposals in our draft plan. The process for undertaking this consultation is shown below.

Date	Stage
Dec 2017	Submit draft WRMP19 to Welsh Government
Jan – Feb 2018	Welsh Government security checking and direction to Welsh Water to consult on the draft WRMP19
Mar – June 2018	Public consultation on draft WRMP19
June – Sep 2018	Publish Statement of Response (SoR) and prepare a Revised Draft WRMP19 in light of the comments received
Oct – Nov 2018	Welsh Government Review of SoR and revised draft WRMP19
Feb 2019	Welsh Government direct Welsh Water to publish Final WRMP19

Timetable for WRMP



Appendix 1 – Welsh Water’s Water Supply Systems

North Wales

Our North Wales region (Figure 1) serves over half a million people living mainly in Chester and Deeside, Anglesey, the Bangor and Caernarfon area and the coastal strip from Llandudno to Prestatyn. We also supply several large non-potable customers in the area, most notably on Deeside and Anglesey.

Some parts of North Wales experience a significant tourism influx during the summer months, which has a direct impact on the quantity of water supplied during that time. As a consequence the resources and the associated infrastructure supplying these areas need to be able to meet the summer peaks whilst operating at lower levels throughout the remainder of the year.

The rainfall across North Wales varies from upwards of 3,000mm per year on the mountains of Snowdonia to 1,200mm per year around the coastline. However, evaporation throughout the region is also similarly high, reaching over 600mm per year (actual evaporation) across some parts of the area, which offsets the high rainfall to some degree.

Water resource planning in North Wales is based upon ten supply areas (WRZs) which vary from small areas supplied entirely from run-of-river abstractions to larger areas supplied from a combination of impounding reservoirs, run-of-river abstractions and groundwater sources. The following sections provide an overview of how each WRZ operates and their respective supply demand balance position.

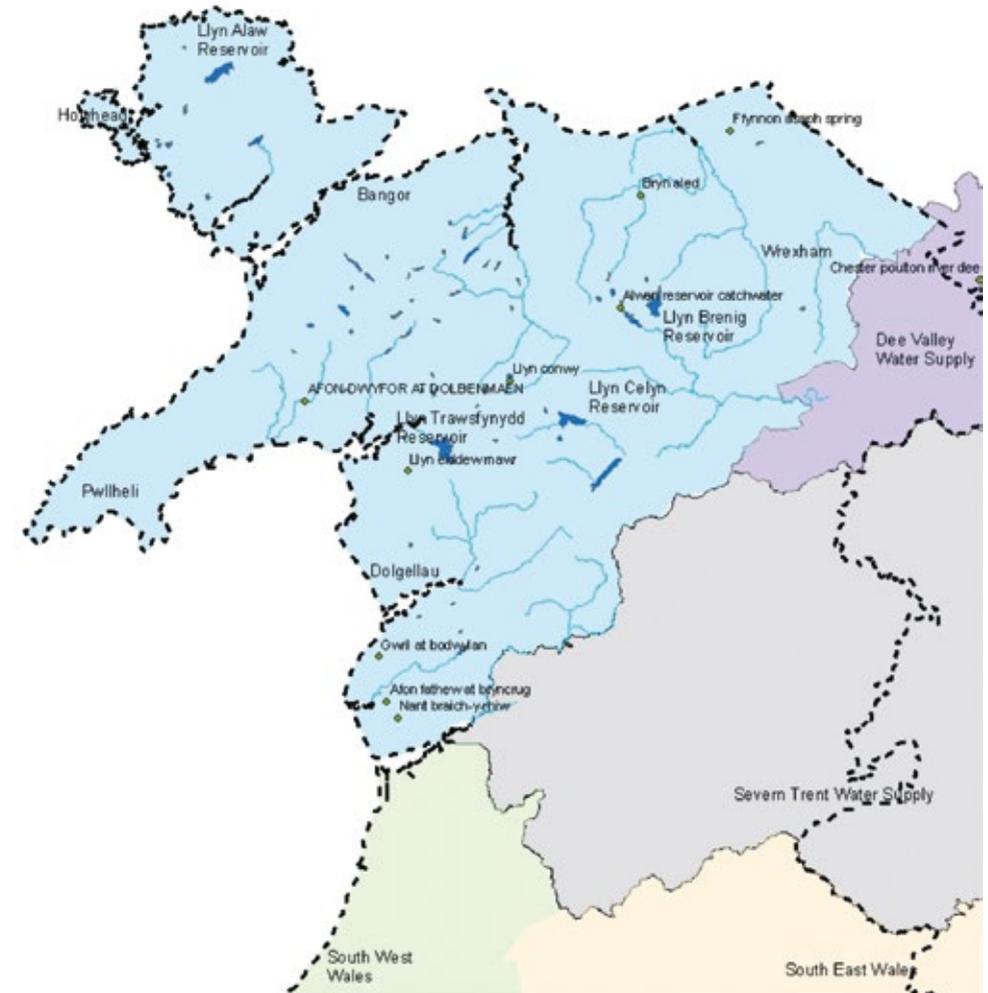
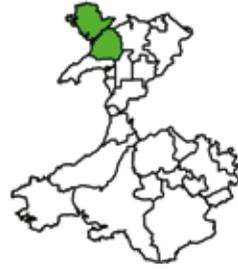


Figure 1 - Overview of our North Wales supply area



North Eryri Ynys Môn WRZ

This Water Resource Zone covers the mainland adjacent to the Menai Straits (North Eryri) and Anglesey (Ynys Môn), including the major towns of Bangor, Caernarfon and Holyhead.

Operation of the Water Resources

Water is supplied from five impounding reservoirs; Ffynnon Llugwy, Llyn Cwellyn and Llyn Marchlyn Bach on the mainland and Llyn Alaw and Llyn Cefni on Anglesey. The three reservoirs on the mainland feed into two water treatment works with the reservoirs on the island supporting two independent treatment works.

The resources and associated treatment works are operated conjunctively, with those

on the mainland being at much higher elevations and so they are able to gravitate supplies of water over to Anglesey. However, the works on Anglesey can only support the demand on the island. The objective when operating the reservoirs is to ensure that there is always sufficient water even during the driest years but, when water is plentiful, to make full use of the mainland sources. By operating in this way the operational costs for the system as a whole can be kept to a minimum.

The supply demand balance for this zone predicts a small surplus of water in a dry year over our 30 year planning period 2020 to 2050, as shown in Figure 2.

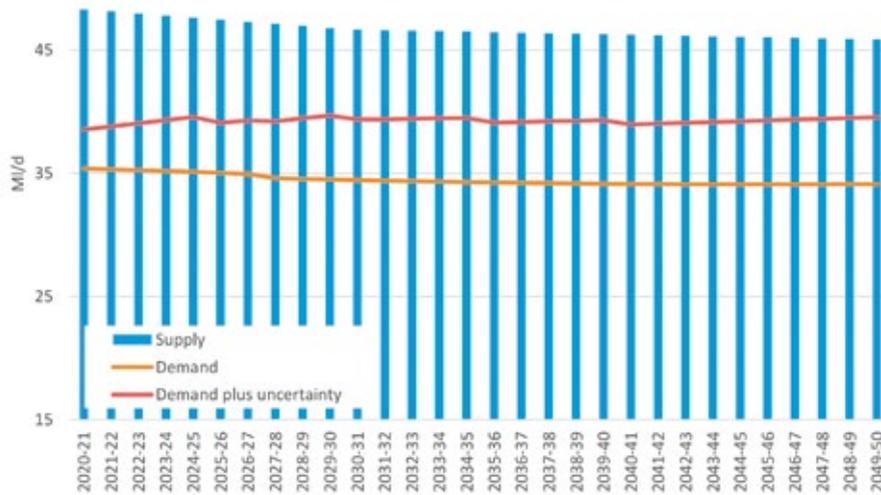


Figure 2 - North Eryri / Ynys Môn Annual Average Supply Demand Balance



Clwyd Coastal WRZ

This Water Resource Zone covers the coastal region from Prestatyn to Colwyn Bay and then further inland to St. Asaph.

Operation of the Water Resources

The zone is supplied by the three water treatment works; Glascoed, Llanerch and Trecastell.

The largest works in the zone is Glascoed. This is fed from Plas Uchaf reservoir which stores water abstracted from the Afon Aled via the Bryn Aled Pumping Station. The Bryn Aled abstraction is supported by river regulation releases from the Aled Isaf and Llyn Aled reservoirs.

Llanerch works is supplied by 3 boreholes which abstract from the sandstone aquifer in the Vale of Clwyd. As well as abstracting water from the sandstone, the boreholes

are known to affect flows in the nearby Afon Clwyd. To mitigate this, when flows in the river are naturally low, we release water from a set of boreholes further up the Vale to augment the flow. This is known as the Clwyd augmentation scheme and is covered under a S20 Operating Agreement between ourselves and Natural Resources Wales.

Trecastell works is supplied solely from a spring source at Ffynnon Asaph, however, during heavy rainfall the spring can suffer from poor raw water quality and the works is unable to treat the water. During such times the Prestatyn area is supplied from Glascoed works.

The supply demand balance for this zone predicts a small surplus of water in a dry year over our 30 year planning period 2020 to 2050, as shown in Figure 3.

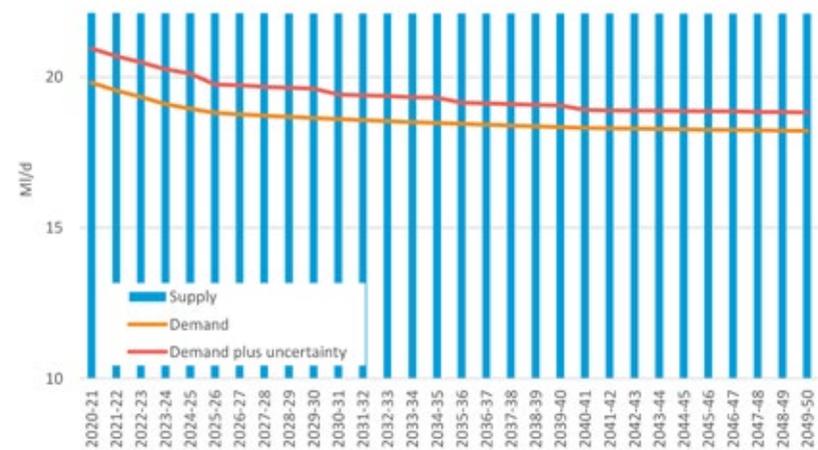
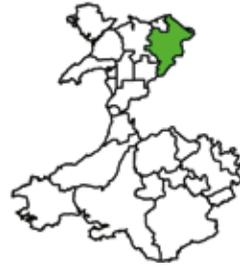


Figure 3 - Clwyd Coastal Annual Average Supply Demand Balance



Alwen Dee WRZ

This Water Resource Zone stretches from the floodplains of the River Dee at Llangollen to the coastal waters at Prestatyn and the industrial complexes on Deeside.

Operation of the Water Resources

There are two water treatment works within the zone; Alwen and Bretton. Alwen is supplied from Alwen reservoir and Bretton is supplied from the River Dee abstraction at Poulton and Bretton boreholes when they are needed to supplement the demand in dry summers.

The River Dee is a regulated river with releases made from Llyn Celyn and Llyn Brenig to support abstractions downstream.

The scheme is managed by Natural Resources Wales in accordance with the S20 Dee General Directions. Welsh Water, Dee Valley Water, United Utilities and the Canal & River Trust are the main abstractors from the River Dee. Flows in the River Dee are also managed to reduce flooding, enhance the biodiversity and fisheries and for recreational purposes.

There is a minor export of treated water from the WRZ to Dee Valley Water.

Over our 30 year planning period 2020 to 2050 the zone is forecast to have a surplus of water in a dry year, see Figure 4.

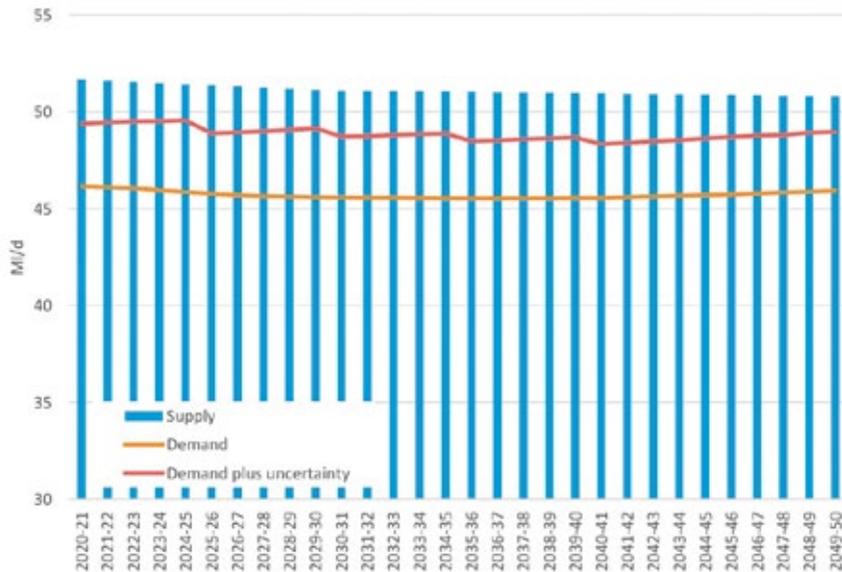


Figure 4 - Alwen Dee Annual Average Supply Demand Balance



Bala WRZ

This is the smallest of our water resource zones, serving a population of less than 4,000. It covers the town of Bala and the immediate surrounding area. In the summer the demand can increase significantly due to tourism.

Operation of the Water Resources

The zone is served from Bala water treatment works which receives its water from a single impounding reservoir, Llyn Arenig Fawr.

Over our 30 year planning period 2020 to 2050 the zone is forecast to have a healthy surplus of water in a dry year, see Figure 5.

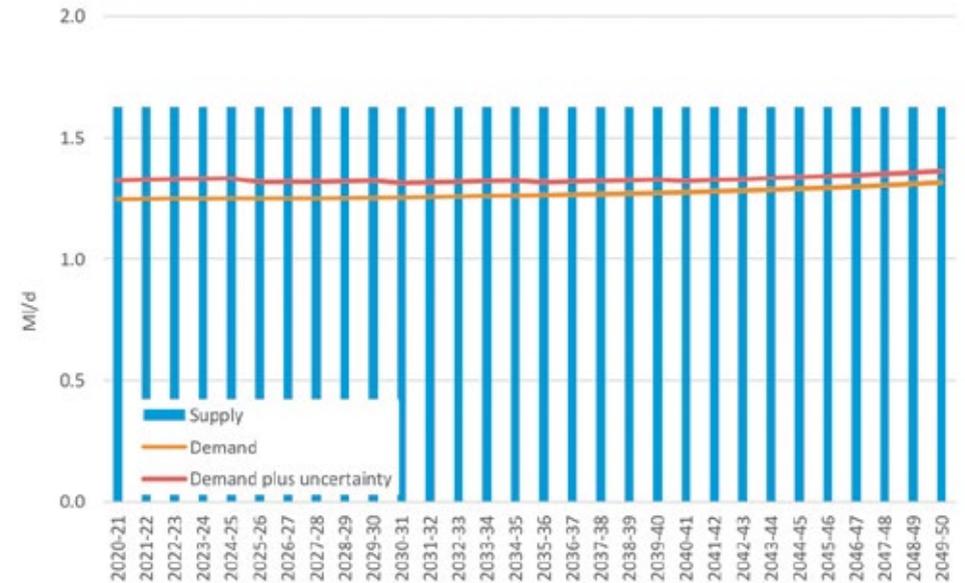


Figure 5 - Bala Annual Average Supply Demand Balance



Tywyn Aberdyfi WRZ

This water resource zone covers the small coastal area around the towns of Tywyn and Aberdyfi in Mid Wales. There are approximately 4,700 customers in this zone but the demand can increase significantly during the summer due to tourism.

Operation of the Water Resources

Penybont is the only water treatment works in the zone. It is fed from two small river abstractions; the Afon Fathew and the Nant Braich-y-Rhiw.

The Nant Braich-y-Rhiw abstraction licence has a condition which prevents us from using this source when the river levels are low. This comes into operation during most summer periods; we are then reliant upon the Afon Fathew.

The zone is forecast to have a significant shortfall in water in a dry year over the whole of our 30 year planning period 2020-2050, as shown in Figure 6.

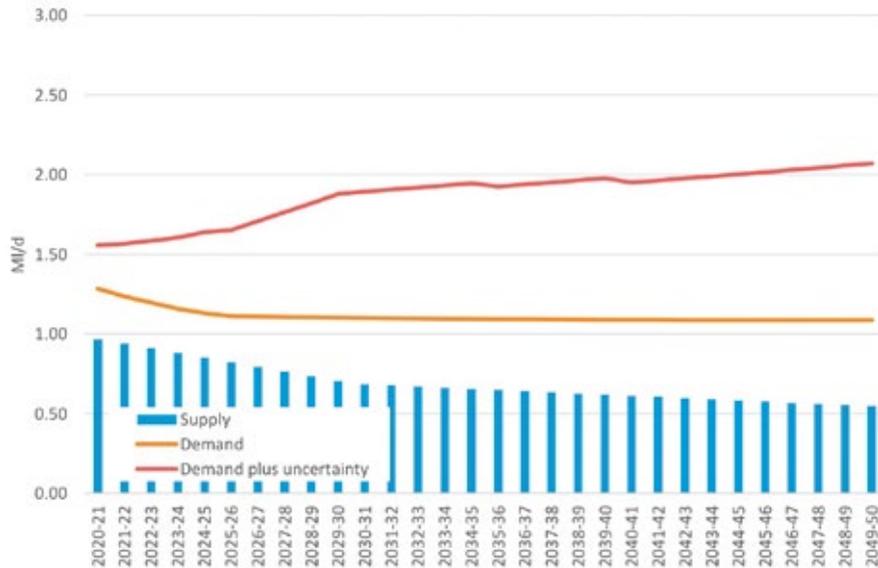


Figure 6 - Tywyn Aberdyfi Annual Average Supply Demand Balance

The deficit will be resolved through the development of the Afon Dysyni river intake scheme. The resulting balance is shown in Figure 7.

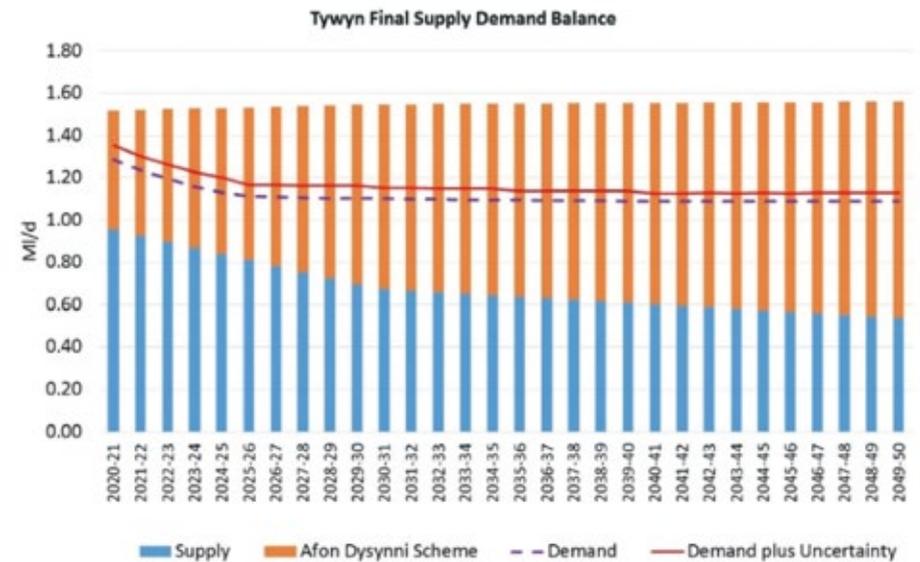


Figure 7 - Tywyn Aberdyfi Annual Average supply demand balance with the Afon Dysynni scheme in place



Blaenau Ffestiniog WRZ

This Water Resource Zone covers the town and surrounding area of Blaenau Ffestiniog.

Operation of the Water Resources

Blaenau Ffestiniog is a single-source zone with Llyn Morwynion supplying Garreglwyd water treatment works. When the storage in Llyn Morwynion is low, water is transferred from the nearby Afon Gam.

The zone is forecast to have a surplus of water over the whole 30 year planning period 2020-2050, as shown in Figure 8.

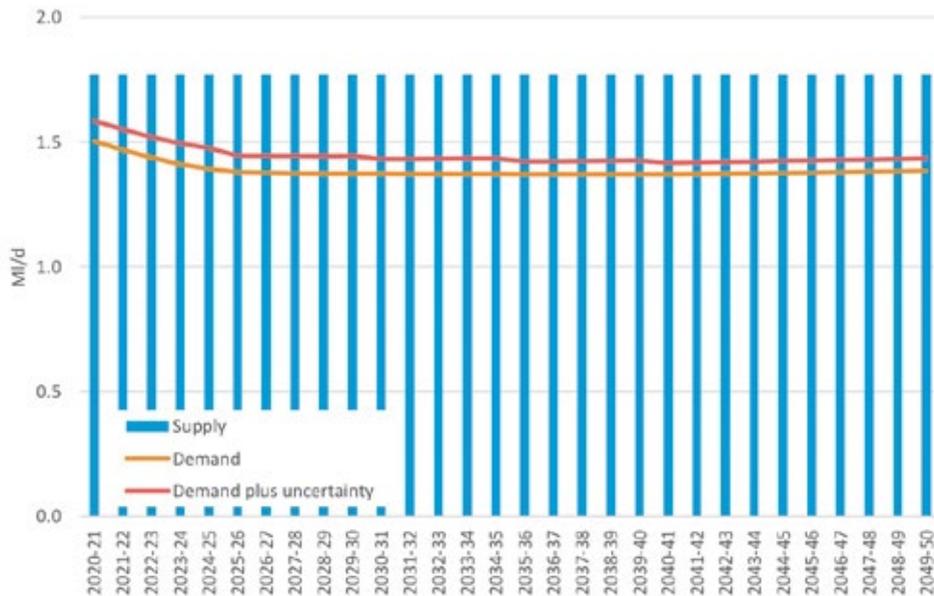


Figure 8 - Blaenau Ffestiniog Annual Average Supply Demand Balance



Barmouth WRZ

The Barmouth Water Resource Zone covers the coastal region from Harlech to Barmouth. Although it is only a relatively small area, the demand can increase significantly in the summer due to tourism.

Operation of the Water Resources

This small zone is served from a single impounding reservoir, Llyn Bodlyn, which feeds Eithinfynydd water treatment works. Peak demands (caused primarily by tourism) often approach the maximum

amount we can treat at Eithinfynydd. When this happens we can transfer treated water southwards from the neighbouring Lley Harlech zone to help meet the demand.

We do not generate a surplus of water in the zone as we only transfer the volumes needed from the Lley Harlech zone to meet the shortfall in existing supplies, meaning there is additional capacity available above that shown in Figure 9.



Figure 9 - Barmouth Annual Average Supply Demand Balance



Llyn Harlech WRZ

This Water Resource Zone covers the entire Llyn Peninsula and the coastal strip south to Harlech.

Operation of the Water Resources

Water is supplied from four impounding reservoirs; Llyn Cwmystradllyn and Llyn Cwm Dulyn to the east of the Llyn Peninsula and Llyn Eiddew Mawr and Llyn Tecwyn Uchaf to the south. There is also a river abstraction on the Afon Dwyfor downstream of Llyn Cwmystradllyn.

Dolbenmaen treatment works is fed by the Afon Dwyfor abstraction and Llyn Cwmystradllyn. Llyn Cwm Dulyn has its own associated treatment works whilst Llyn Tecwyn Uchaf and Llyn Eiddew Mawr are served by Cilfor and Rhiwgoch works respectively.

The Dwyfor abstraction is the subject of a Section 20 Operating Agreement with

Natural Resources Wales. When we abstract from this source, if river levels are low we have to release a specified volume of water from Llyn Cwmystradllyn to ensure we do not negatively impact the fisheries or ecology in the river.

There is also an inter-zonal transfer of treated water between this zone and the Barmouth WRZ. In a dry summer, treated water from Rhiw Goch is transferred southwards to the Barmouth zone to help meet peak demands in excess of the Eithinfynydd works capacity. In the winter however, water can be moved northwards to allow Rhiwgoch works to be mothballed, reducing our operating costs.

The zone is forecast to have a surplus of water over the whole 30 year planning period 2020-2050, as shown in Figure 10.

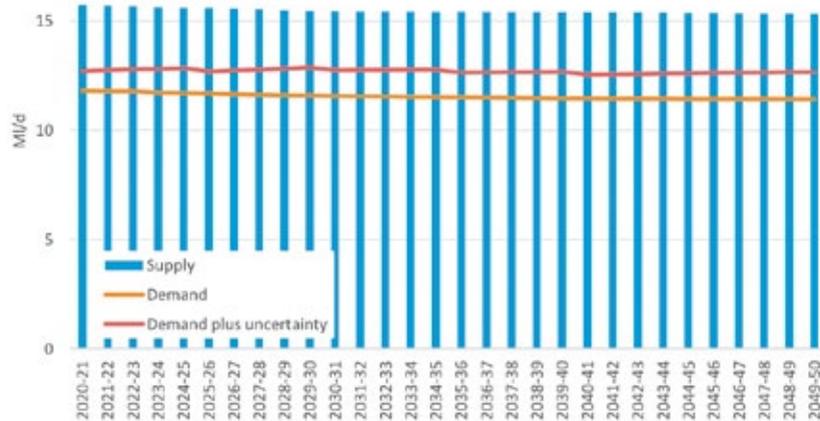
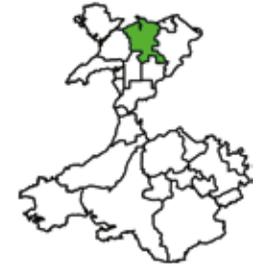


Figure 10 - Llyn Harlech Annual Average Supply Demand Balance



Dyffryn Conwy WRZ

This WRZ stretches from the coastal region of Llandudno, inland to the Snowdonia National Park close to Blaenau Ffestiniog.

Operation of the Water Resources

The area is supplied from two reservoirs; Llyn Cowlyd and Llyn Conwy.

The principal resource is Llyn Cowlyd which feeds Bryn Cowlyd water treatment works. The storage in Llyn Cowlyd is managed between ourselves and RWE Innogy, who operate a Hydro Electric Power scheme.

Llyn Conwy reservoir has its own dedicated treatment works which is able to gravitate supplies to parts of the Bryn Cowlyd supply area and help reduce our operating costs.

Figure 11 shows the zone is forecast to have a surplus of water in a dry year throughout the whole planning period.



Figure 11 - Dyffryn Conwy Annual Average Supply Demand Balance



South Meirionnydd WRZ

This WRZ stretches from the coastal town of Tywyn and the Dysynni estuary, north westwards to Dolgellau and the western fringes of Lake Vyrnwy.

Operation of the Water Resources

There is only one reservoir in the zone, Llyn Cynwch, which feeds Penycefn water treatment works. We can support storage levels in the reservoir by pumping water across from the Afon Wnion.

We have two river abstractions; Afon Gwrlid and Afon Calettwr which feed Garreglwyd water treatment works, and three small spring sources with their own associated

works supplying the local communities of Abergynolwyn, Llanymawddwy and Brynllys (Dinas Mawddwy). The Brynllys spring can run dry, so as part of our normal dry weather operation we will tanker from Penycefn to maintain supplies.

Water transfers include small imports and exports of water between ourselves and Severn Trent Water.

The zone is forecast to have a healthy surplus of water in a dry year over the whole 30 year planning period 2020-2050 as shown in Figure 12.

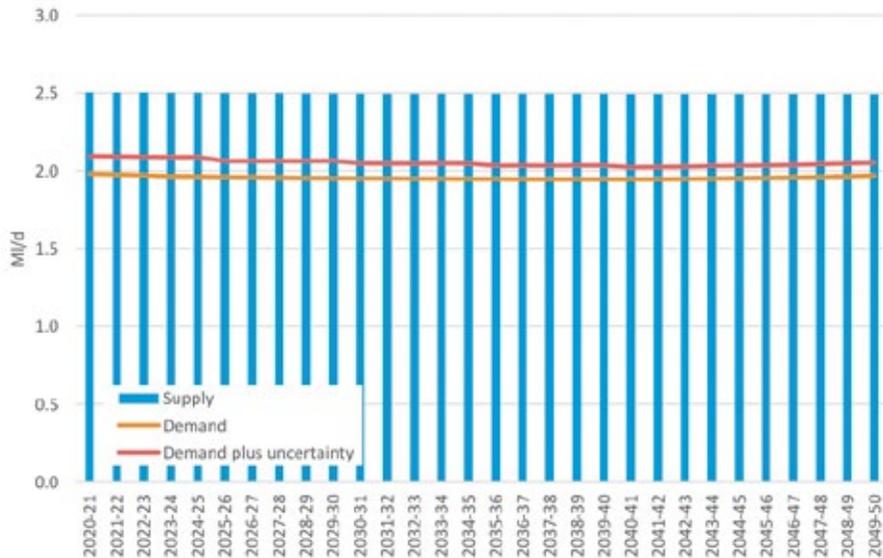


Figure 12 - South Meirionnydd Annual Average Supply Demand Balance



South West Wales

Our South West Wales region (Figure 13) serves over 900,000 people living mainly in and around Swansea, Bridgend, Llanelli, Carmarthen and the coastal towns and villages from Pembroke to Aberystwyth. We also supply several large non-potable customers in the Pembroke Dock / Milford Haven area and in the Swansea area. Much of South West Wales experiences a significant tourism influx during the summer months which has a direct impact on the quantity of water supplied.

The rainfall across South West Wales varies from a low of 1,047mm per year at Nevern on the north-west Pembrokeshire coast to a high of 2,220mm per year in the uplands of the Rheidol valley in Ceredigion. Rainfall in the main Tywi catchment averages around 1,600mm per year.

Water resource planning in South West Wales is based upon four supply areas (WRZs) which fall into two categories; the relatively simple systems in the north west of the area that serve Ceredigion and the complex and highly conjunctive systems in the southern part of the region that serve Pembrokeshire, Carmarthenshire, Swansea and Bridgend.

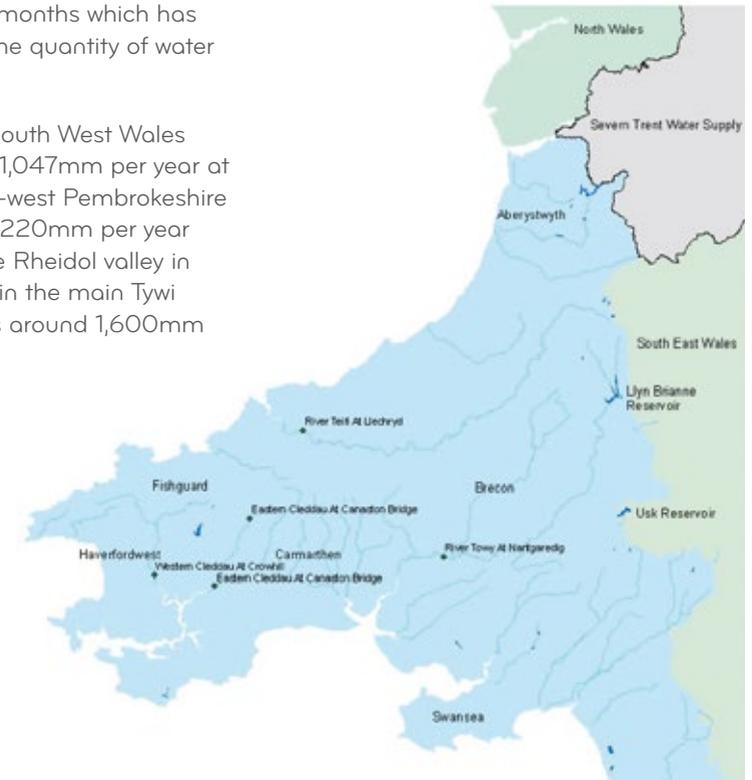
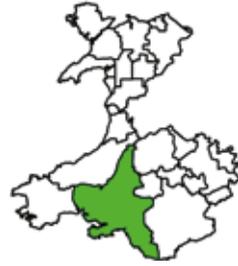


Figure 13 - Overview of our South West Wales supply area



Tywi Conjointive Use System WRZ

This is the largest WRZ in South West Wales, extending in the east from the Vale of Glamorgan to west of Carmarthen and stretching northwards past Llanwytrd Wells.

Operation of the Water Resources

The water resources within the zone consist of a number of impounding reservoirs and river abstractions which are operated together to make best use of the available water during years of average and below average rainfall.

Water is abstracted from the River Tywi at two locations - Nantgaredig and Manorafon. When levels are low in the River Tywi it is necessary to make releases of water from Llyn Brienne reservoir to enable us to abstract the required volumes of water at our intakes further downstream.

At Nantgaredig, a small portion of the water we take from the river supplies Capel Dewi water treatment works which serves Carmarthen. The majority of the abstracted water is pumped to Felindre works, the largest in the company which supplies the bulk of our customer demand in Swansea, Neath, Bridgend and the Vale of Glamorgan.

At Manorafon, water is only abstracted if storage in Usk reservoir is low. Under these conditions, water is pumped from Manorafon to Bryngwyn water treatment works. If storage in Usk is healthy, the reservoir provides the whole supply to Bryngwyn which feeds the upper Swansea Valley.

Ystradfellte and Crai reservoirs supply the upper parts of the Neath, Afan and Tawe Valleys. As storage in these reservoirs declines, the area served is gradually reduced in order to preserve supplies with this additional demand supported from Felindre.

There are no imports of water in to the zone but we export water to the neighbouring SEWCUS zone.

The supply demand balance for the zone, is shown in Figure 14 and this indicates a consistent surplus between 22 and 27 Ml/d across the 30 year planning period from 2020 to 2050.

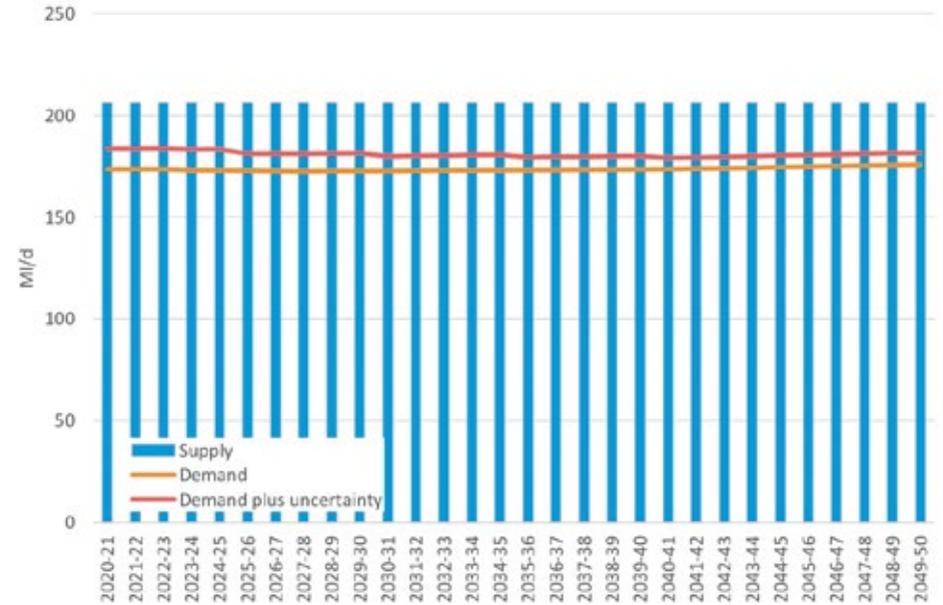


Figure 14 - Tywi CUS Annual Average Supply Demand Balance



Mid & South Ceredigion WRZ

This zone covers the Teifi Valley and the coastal area from south of Cardigan, northwards to just south of Aberystwyth.

Operation of the Water Resources

The zone is supplied from two sources:

Llechryd water treatment works, which is reliant on the abstraction from the River Teifi at Llechryd, and;

Strata Florida water treatment works which is supplied by three small reservoirs – Llyn Teifi, Llyn Egnant and Llyn Pondygaith, collectively known as Teifi Pools.

Strata Florida supplies customers along the catchment of the Afon Teifi as far as Llandysul. As storage in the Teifi Pools declines in dry weather, the area served is gradually reduced in order to preserve storage, with this additional demand supplied by Llechryd.

The supply demand balance for the zone is shown in Figure 15 and this indicates a surplus across the 30 year planning period from 2020 to 2050.

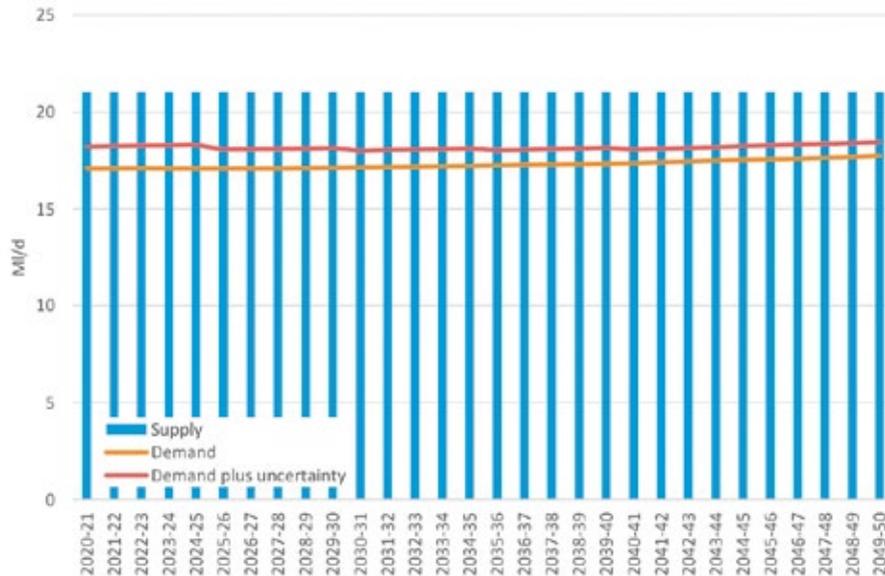


Figure 15 - Mid and South Ceredigion Annual Average Supply Demand Balance



North Ceredigion WRZ

This zone covers the land around the coastal and inland area surrounding Aberystwyth.

Operation of the Water Resources

The majority of the zone is supplied from the impounding reservoirs of Llyn Craig-y-Pistyll and Llyn Llygad Rheidol, which are supported by river abstractions from the Nant-y-Moch and Maesnant streams.

In the south west of the zone, groundwater abstractions from the two boreholes at Lovesgrove meet the demand in

Aberystwyth. As storage in the reservoirs decreases, water from the boreholes is pumped to serve the demand immediately north of Aberystwyth, in Clarach and Penglais.

The supply demand balance for the zone is shown in Figure 16 which indicates a surplus across the 30 year planning period from 2020 to 2050.

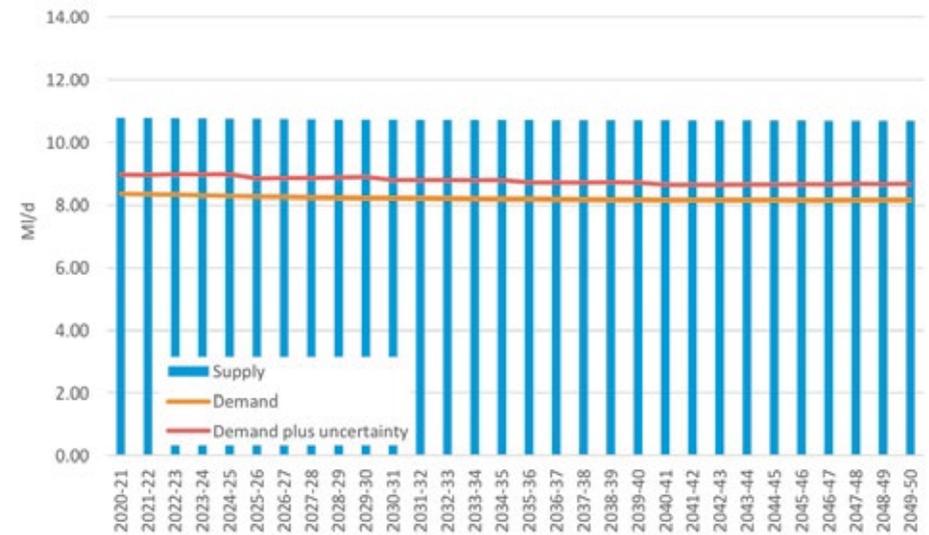
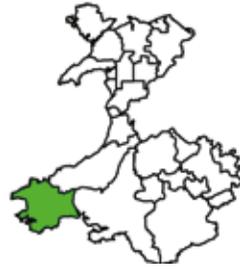


Figure 16 - North Ceredigion Annual Average Supply Demand Balance



Pembrokeshire WRZ

This zone covers the far south west corner of Wales, stretching from Pendine Sands in the east to the Pembrokeshire Coastal National Park in the west and from the villages of Manorbier in the south to Newport in the north.

Operation of the Water Resources

The largest treatment works in the zone is Bolton Hill, which is supplied by Canaston Bridge pumping station on the Eastern Cleddau and Crowhill pumping station on the Western Cleddau.

Canaston Bridge pumps water from two sources: a river intake on the Eastern Cleddau which is supported by releases of water from Llysyfran Reservoir, and a small piped supply from Valley Court springs. In addition to treated water for domestic customers, the Canaston Bridge – Bolton Hill arrangement supplies untreated water to the oil refineries south and north of Milford Haven.

The other major treatment works in the zone is Preseli, which is supplied from Rosebush reservoir. If storage in Rosebush is low, Preseli can be supported with water pumped from Llysyfran whilst Rosebush can be supported with water pumped from a river intake on the Eastern Cleddau at Pont Hywel.

Pendine borehole supplies the eastern part of the WRZ with support able to be provided from the Bolton Hill system.

The supply demand balances for the Annual Average scenario, Figure 17, shows a deficit starting in 2022/23 which increases to a maximum of 14 MI/d in 2049/50. Figure 18 shows the balance with the preferred Pembrokeshire scheme in place.

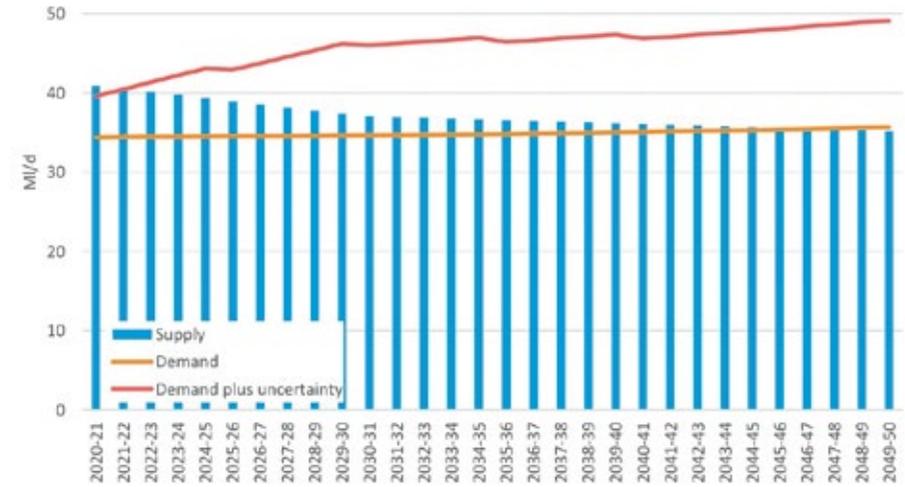


Figure 17 - Pembrokeshire Annual Average supply demand balance

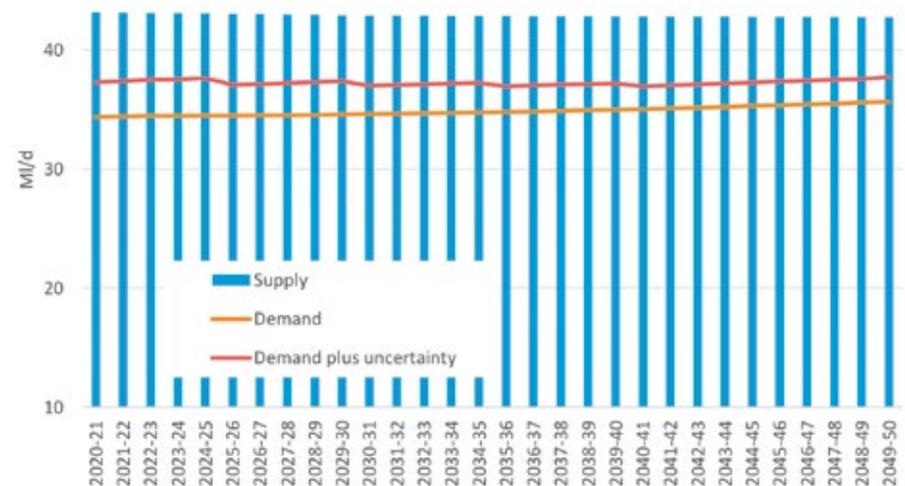


Figure 18 - Pembrokeshire Annual Average supply demand balance post scheme implementation



South East Wales Region

Our South East Wales region (Figure 19) serves nearly 1.6 million people living mainly in Cardiff, Newport and the South Wales valleys and parts of Herefordshire. We also supply a number of relatively large non-potable customers throughout the area.

The rainfall across the South East of our supply area varies greatly from as little as 700mm per year in the eastern parts around Hereford to some 2200mm in mid-Wales and uplands of the South Wales valleys. The

main lowland urban areas such as Cardiff receive around 1200mm per year, slightly under the average for Wales. Water resource planning in South East Wales is based upon ten supply areas (WRZs) which varies from simple, single sources of water to the extremely large, complex and fully conjunctive areas supplied from a combination of impounding reservoirs and river abstractions that have to be managed carefully to ensure sufficient resource is always available.

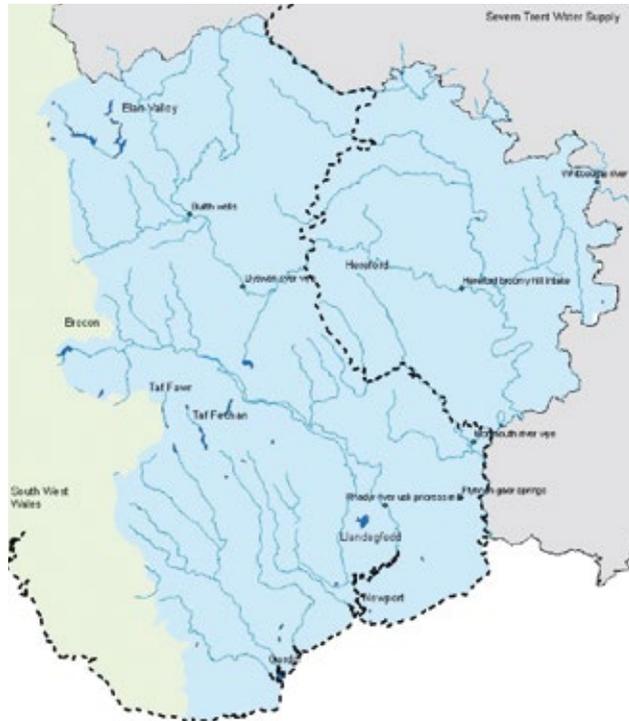


Figure 19 - Overview of our South East Wales supply area



Ross-on-Wye WRZ

As the name suggests, this zone covers the small area and hamlets surrounding the market town of Ross-on-Wye.

Operation of the Water Resources

The zone is supplied in its entirety by the Bulk Supply of potable water from Severn Trent Water's Mitcheldean water treatment works. There is a small import of water from the neighbouring Hereford zone.



Figure 20 shows that there is a relatively large surplus in the supply demand balance for the zone across the 30 year planning period from 2020 to 2050.

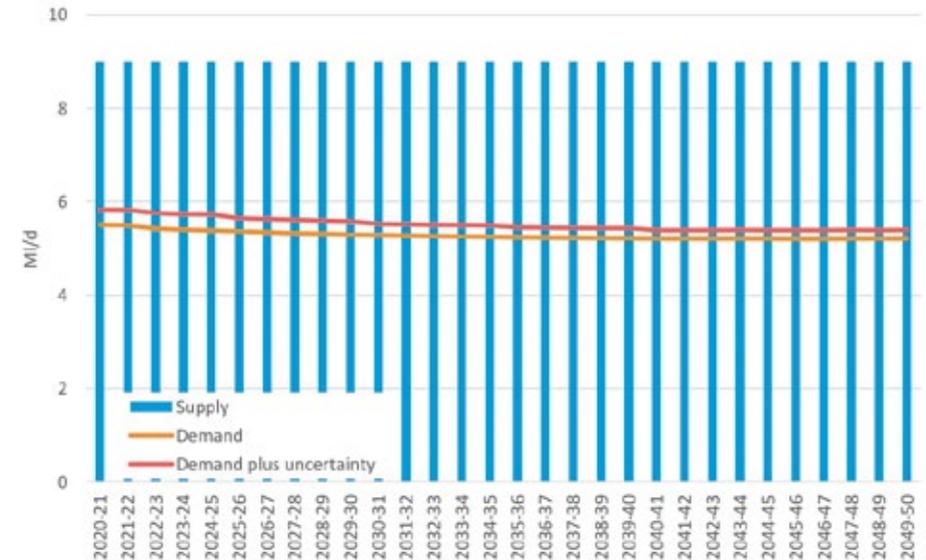


Figure 20 - Ross on Wye Annual average supply demand balance



Elan – Builth WRZ

This zone covers a large area of Powys, centred on the Elan Valley reservoirs and the town of Builth Wells.

Operation of the Water Resources

The zone is supplied from two sources, the Elan Valley Reservoirs and an abstraction from the River Wye at Builth Wells. These sources supply local water treatment works with the greater proportion of water coming from the Elan Valley works.

The Elan Valley reservoirs hold a significant volume of water that is predominantly used to supply Severn Trent Water. In addition, the Elan Reservoirs provide regulation releases

to support abstractions from the lower part of the River Wye by Severn Trent Water at Lydbrook (see the above Ross on Wye WRZ section) and by ourselves at Monmouth (see the sections on Monmouth WRZ and SEWCUS WRZ).

This zone is heavily influenced by the additional demand for water that is placed on Builth Wells WTW during the Royal Welsh Show week.

The Critical Period supply demand balance is shown in Figure 21 and this indicates a surplus across the 30 year planning period from 2020 to 2050.

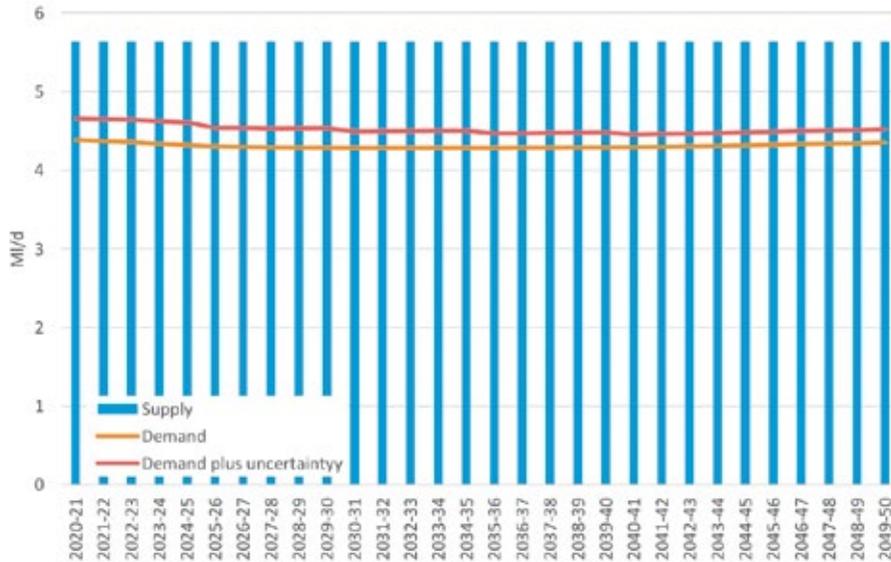
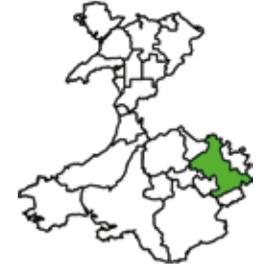


Figure 21 - Elan Builth Dry Year Critical period supply demand balance



Hereford Conjunctive Use System WRZ

As the name suggests, this WRZ covers the city of Hereford, the surrounding area and rural villages as far north as Leintwardine.

Operation of the Water Resources

The main supply of water for this zone is an abstraction from the River Wye at Hereford which is treated at the nearby Broomy Hill water treatment works. In addition we abstract water from two separate borehole sources at Dunfield and Leintwardine which are treated on site and supply their local areas. We are able to provide a limited

transfer of water from Broomy Hill to support the areas supplied from the much smaller boreholes.

There are small exports of water from the Hereford WRZ into the adjacent Ross-On-Wye, Whitbourne and Vowchurch WRZ's.

Figure 22 shows that there is a surplus in the supply demand balance for the zone across the 30 year planning period from 2020 to 2050.

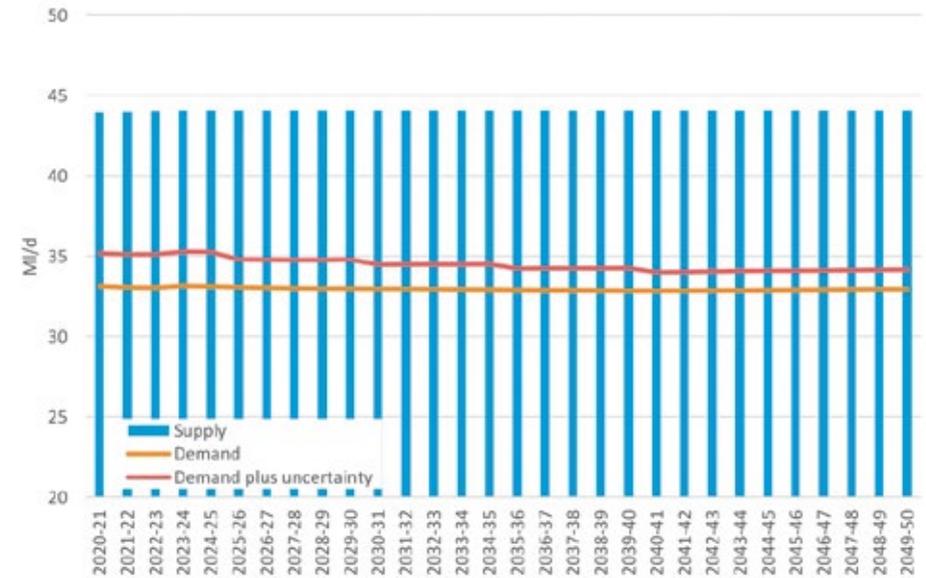


Figure 22 - Hereford Annual Average Supply Demand Balance



Llyswen WRZ

This zone covers the small rural communities in and around Hay-on-Wye.

Operation of the Water Resources

Water is abstracted from the River Wye at Llyswen where it is treated at the associated water treatment works before it enters the supply network.

There are no imports of water to Llyswen from neighbouring WRZ's however a small export to the Vowchurch zone is available for use when required.

Figure 23 shows that there is a healthy surplus in the supply demand balance for the zone across the 30 year planning period from 2020 to 2050.

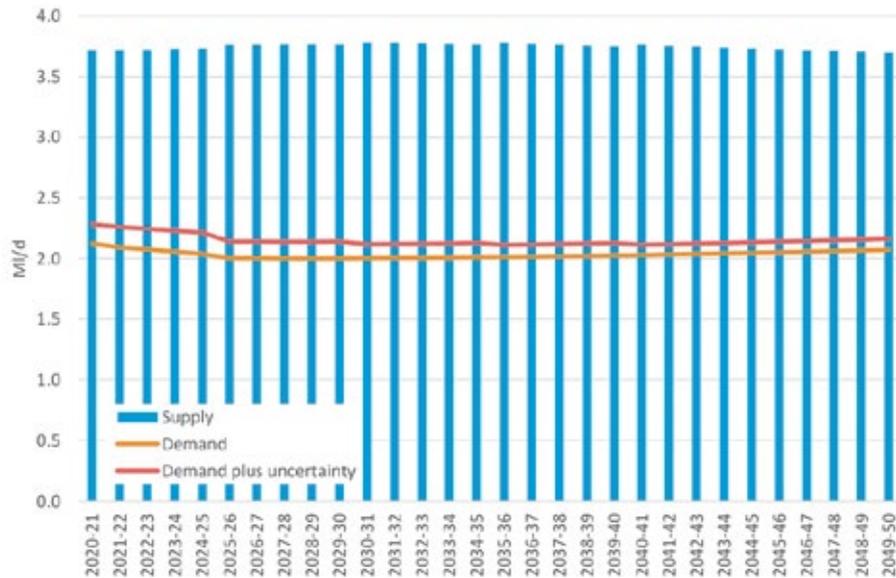


Figure 23 - Llyswen Annual Average Supply Demand Balance



Monmouth WRZ

This zone supplies the market town of Monmouth and the surrounding villages.

Operation of the Water Resources

The zone is heavily dependent on the Mayhill abstraction from the River Wye at Monmouth. There is also a spring abstraction at Ffynnon Gaer which supplies a small localised area south of Monmouth.

The supply demand balance for the zone is shown in Figure 24 and this indicates a surplus across the 30 year planning period from 2020 to 2050.

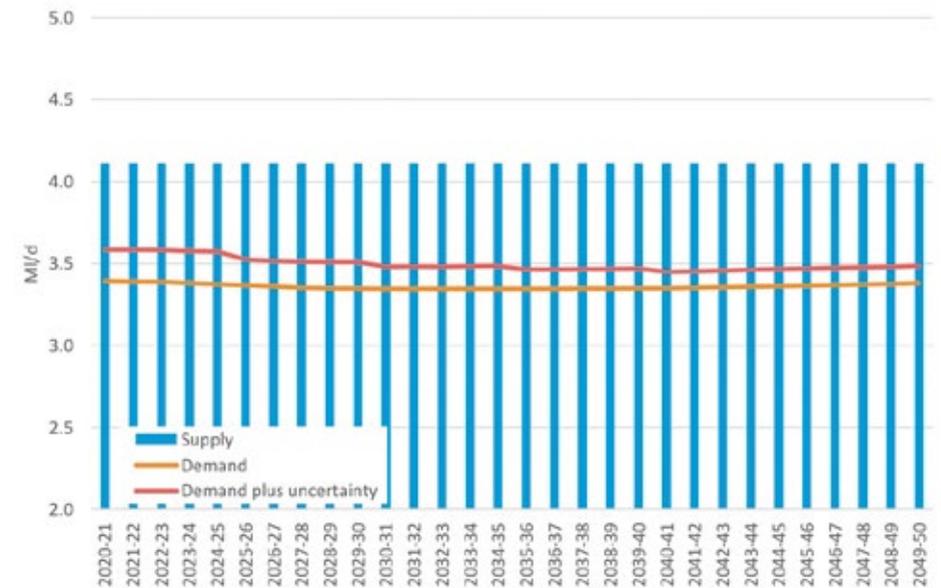


Figure 24 - Monmouth Annual Average Supply Demand Balance



Pilleth WRZ

This zone supplies the small rural area surrounding Presteigne and extends into the adjacent catchment of the River Teme and serves Knighton.

Operation of the Water Resources

The zone is supplied from a single group of four individual boreholes located in the gravel aquifer adjacent to the upper River Lugg at Pilleth. Industrial usage in Presteigne is a disproportionately large component of demand.

The supply demand balance for the zone is shown in Figure 25 and this indicates a surplus across the 30 year planning period from 2020 to 2050.

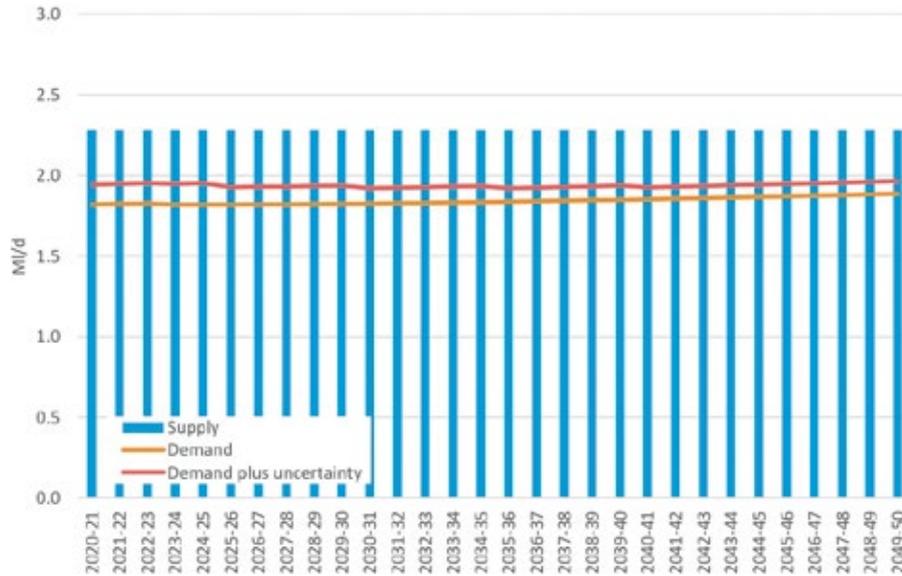


Figure 25 - Pilleth Annual Average Supply Demand Balance



Brecon – Portis WRZ

This zone is situated in the headwaters of the River Usk, in the immediate vicinity of the towns of Brecon and Sennybridge and the Usk Reservoir.

Operation of the Water Resources

The Usk Reservoir has two main direct supply uses:

- to supply Bryngwyn water treatment works that serves the upper area of the Tywi CUS;
- to supply Portis water treatment works that serves the Sennybridge area of this zone.

Usk reservoir is also able to provide regulation releases to support our lower River Usk abstractions in the SEWCUS zone during drought periods.

In addition to Portis supplying the zone there are three boreholes at Brecon which meet the larger proportion of the town's demand.

The supply demand balance for the zone, is shown in Figure 26 and this indicates a surplus across the 30 year planning period from 2020 to 2050.

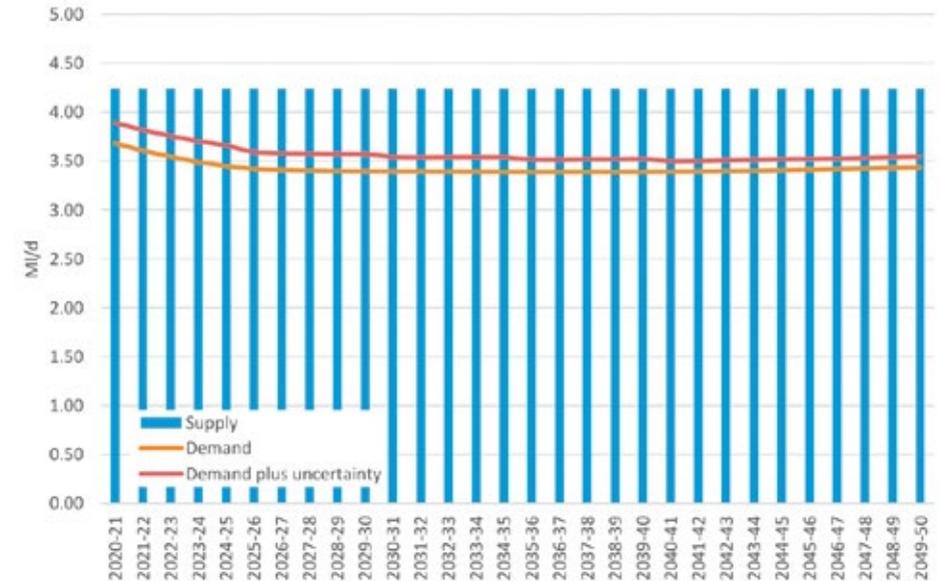


Figure 26 - Brecon Portis Annual Average Supply Demand Balance



Vowchurch WRZ

This zone covers the small rural area south of Hay-on-Wye.

Operation of the Water Resources

The zone is supplied from boreholes that are located adjacent to the River Dore at Vowchurch.

There is a small import of water from the Hereford and Llyswen zones which have the capacity to match any additional customer water needs over the planning period. There are no exports of water.

The supply demand balance for the zone is shown in Figure 27 and this indicates that supply matches demand across the whole planning period due to an import of water from Hereford and Llyswen that is sized to just ensure the zone is in balance. We plan to improve the resilience on the zone in AMP7 through increasing the capacity of the link between the Vowchurch and Herefordshire zones.

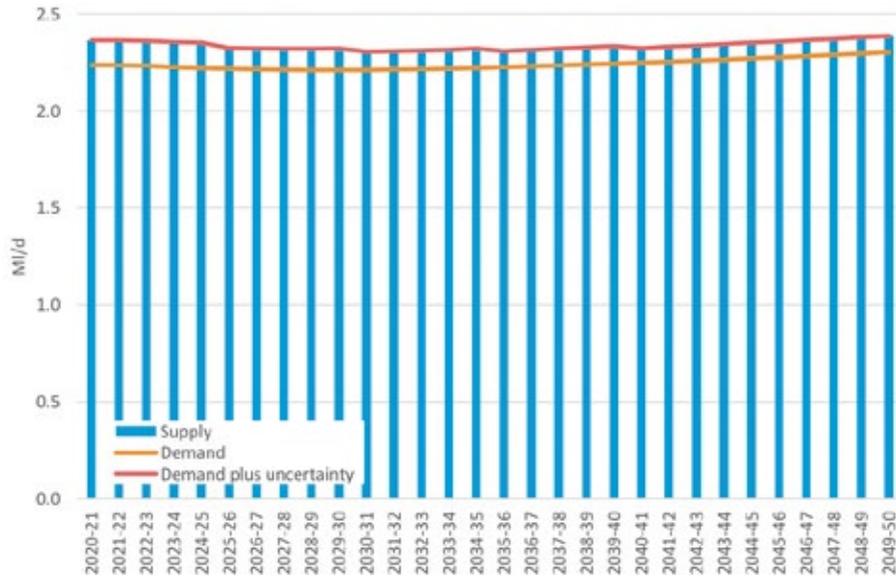


Figure 27 - Vowchurch Annual Average Supply Demand Balance



Whitbourne WRZ

The zone is located in east Herefordshire adjacent to the Worcestershire border and supplies the rural towns and villages in the area surrounding Bromyard.

Operation of the Water Resources

The supply is from a single abstraction from the River Teme at Whitbourne some 20 km upstream of its confluence with the River Severn.

There is a small internal import of water from the Hereford zone which has the capacity to match any additional demands placed on the zone over the planning period. There are no exports of water.

The supply demand balance for the zone is shown in Figure 28 and this indicates a surplus across the 30 year planning period from 2020 to 2050.

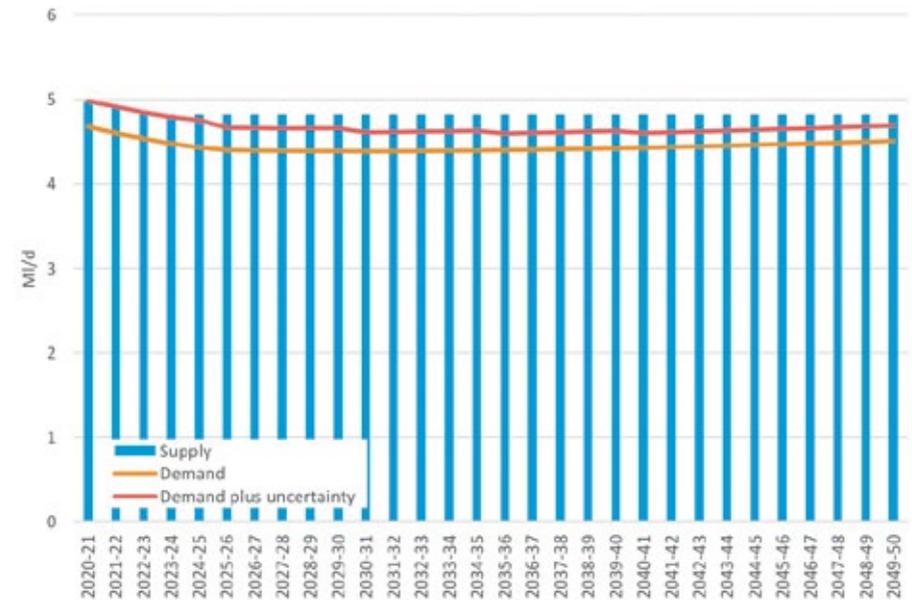


Figure 28 - Whitbourne Annual Average Supply Demand Balance



SEWCUS WRZ

This is the largest of all our 24 water resource zones and serves some 1.3 million domestic customers. It covers the large conurbations of Cardiff and Newport as well as the towns and villages of the South Wales valleys as far west as the Rhondda Valley and as far east as Chepstow.

Operation of the Water Resources

In total, there are over 40 resources that are used for supply which range from upland reservoirs to large river abstractions from the bigger rivers in the east of the zone.

Of the 40 sources that supply SEWCUS, there are five major reservoir systems (the 'Big 5'), which provide the bulk of the water going into supply. These are: Usk Reservoir; Talybont Reservoir; Llandegfedd Reservoir; Taf Fawr Reservoirs (Llwynon, Cantref & Beacons Reservoirs); and Pontsticill Reservoir.

Llandegfedd Reservoir utilises a refill strategy which relies on our ability to abstract the majority of the water we require from the River Usk at Prioress Mill during winter periods when there is a lot of water in the river in order to reduce our impact on the environment.

There is an import of water from the Tywi CUS WRZ, which supplies the area north-west of Cardiff around Talbot Green and Llantrisant. There are no exports of water.

The SEWCUS zone is connected by a series of large water mains to allow water from the lowland river sources in the east to be transferred further west and north as needed. The objective when operating the reservoirs and associated works is to ensure that there is always sufficient water across the zone even during the driest years but when water is plentiful to make best use of the cheaper upland reservoir sources.

Under normal operation we aim to maximise the use of the upland reservoirs from which we can gravitate water to the conurbations of SE Wales. However, during dry periods, the output from some of these sources are restricted to service local demands with an increased use of the lowland river sources.

During low river flow conditions the abstractions from the Wye at Monmouth are maintained by regulation releases from the Elan Valley Reservoirs in the headwaters of the River Wye. Similarly in prolonged dry periods water can be released into the River Usk from Usk reservoir to allow us to take it out of the river upstream of Usk town at our Prioress Mill pumping station.

The supply demand balance for the zone, as shown in Figure 29, indicates a surplus across the 30 year planning period from 2020 to 2050.

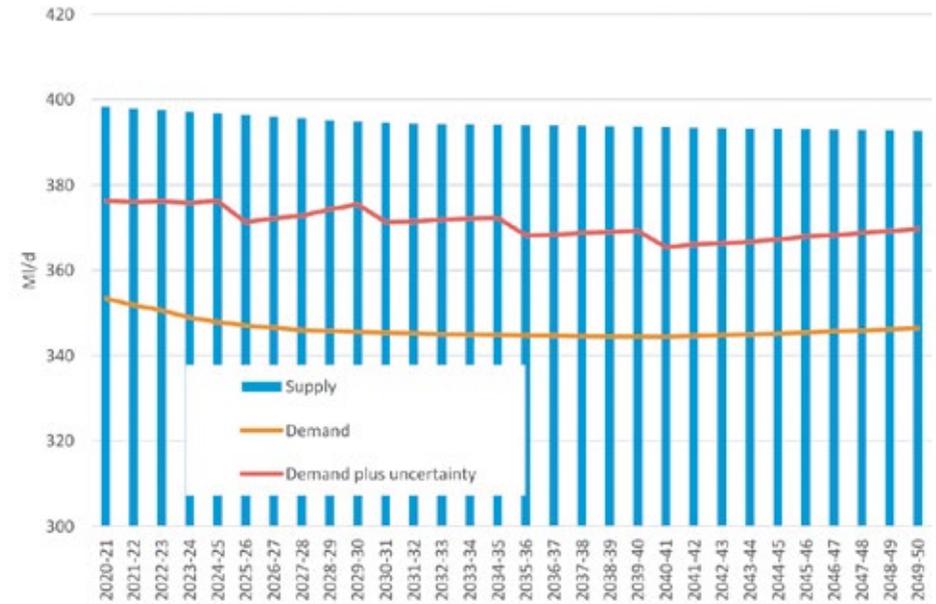


Figure 29 - SEWCUS Annual Average Supply Demand Balance