Water Resource Management Plan (WRMP24) Water Resource Zone Integrity Assessment

Wessex Water

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Document revisions

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1	Draft issued internally for comment	Chris Hutton	18/08/2021
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3	Final Draft Submission for dWRMP24	Chris Hutton	30/09/2022
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Contents

1. Introduction

According to the WRMP24 Water Resources Planning Guideline[1], the Water Resources Management Plan (WRMP) should be built up of assessments undertaken at a water resource zone level. A water resource zone describes an area within which the sources of water and distribution to meet demand is largely self-contained (with the exception of agreed bulk transfers). Since the completion of the new integrated supply grid in 2018, Wessex Water has operated at a single Water Resource Zone level, which was used for the last two Water Resources Management Plans, WRMP14 and WRMP19.

The overall WRMP24 guidance explains that:

- The water resource zone should be defined using the Environment Agency's supplementary guidance[2].
- Customers in a resource zone should face the same risk of supply failure and the same level of service for demand restrictions.
- There will be limitations to achieving this due to the specific characteristics of a distribution network.
- Water should be useable throughout your network and for your customers, in terms of water quality and hardness
- Companies should review whether future changes to the planned supply or demand would cause sub-zonal issues, and consider sub-dividing the resource sone or justify maintaining the current zonal area.
- The planned resource zone configuration and reasoning should be provided to the EA, Ofwat and the DWI during pre-consultation.

Figure 2 of the supplementary guidance summarises the key tasks for the WRZ assessment and review process (Figure 1-1). Following a description of the Water Resource Zone definition, Section 2 of this document fulfils Step 1 of assessment process by providing proportionate evidence to confirm Wessex Water's single resource zone.

1.1 Water Resource Zone Definition

A Water Resource Zone (WRZ) is defined as:

The largest possible zone in which all resources, including external transfers, can be shared and hence the zone in which all customers will experience the same risk of supply failure from a resource shortfall.

The WRZ describes an area within which, managing supply and demand for water is largely self-contained (apart from defined bulk transfers of water); where the resource units, supply infrastructure and demand centres are linked such that customers in the WRZ experience the same risk of supply failure.

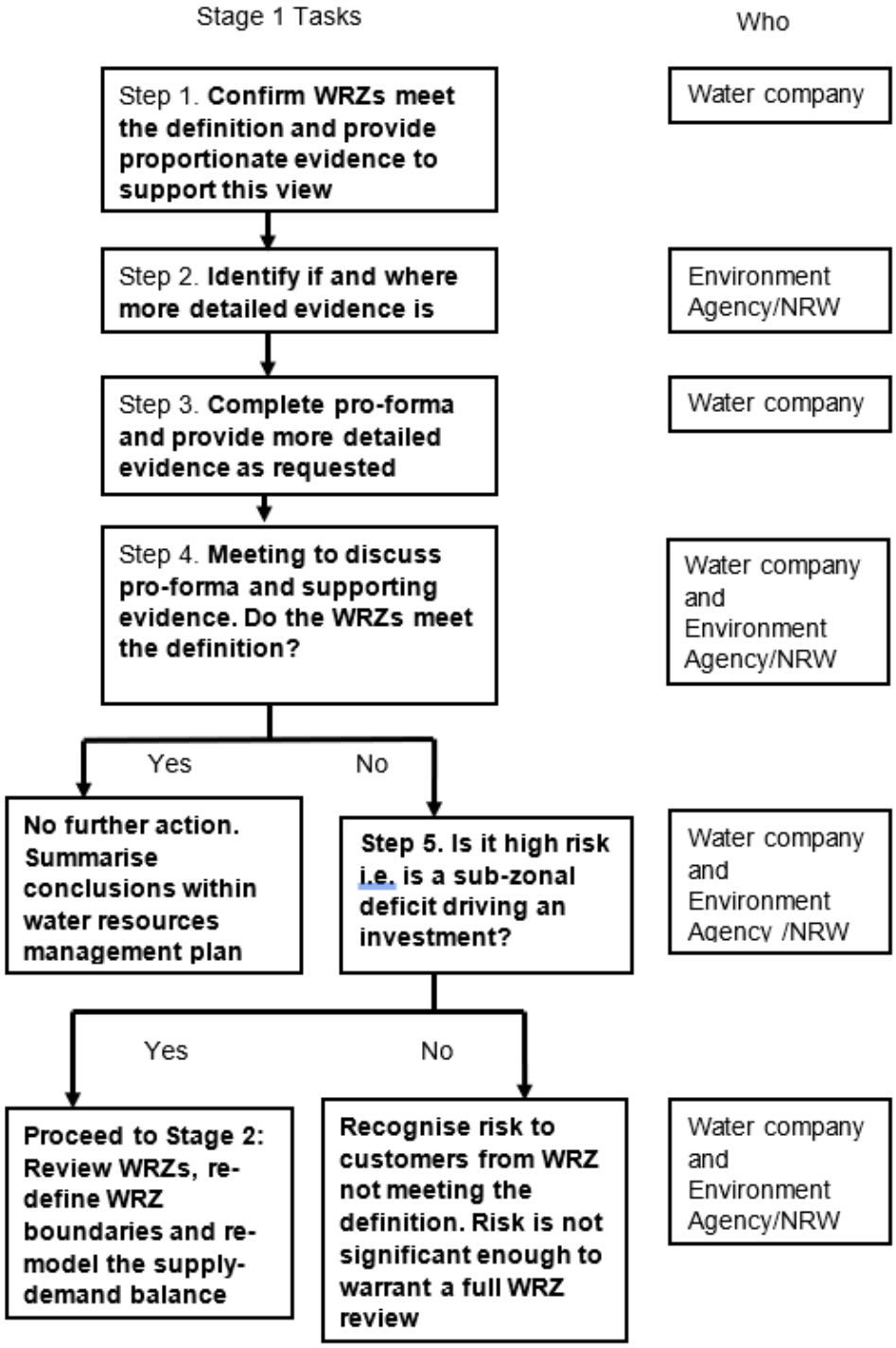
[1] Water resources planning guideline - GOV.UK (www.gov.uk)

[2] Environment Agency (2021) Water resources planning guideline supplementary guidance – Water resource zone integrity

Perfect integration is not possible, as there will always be limitations to a supply network. The main factor is that significant numbers of customers should not be experiencing different risks of supply failure in a zone.

The WRZ definition should be based on the dry year annual average or critical period supply-demand balance

Figure 1-1 Water Resource Zone Integrity Assessment Process as presented in Figure 2 of the EA's supplementary guidance



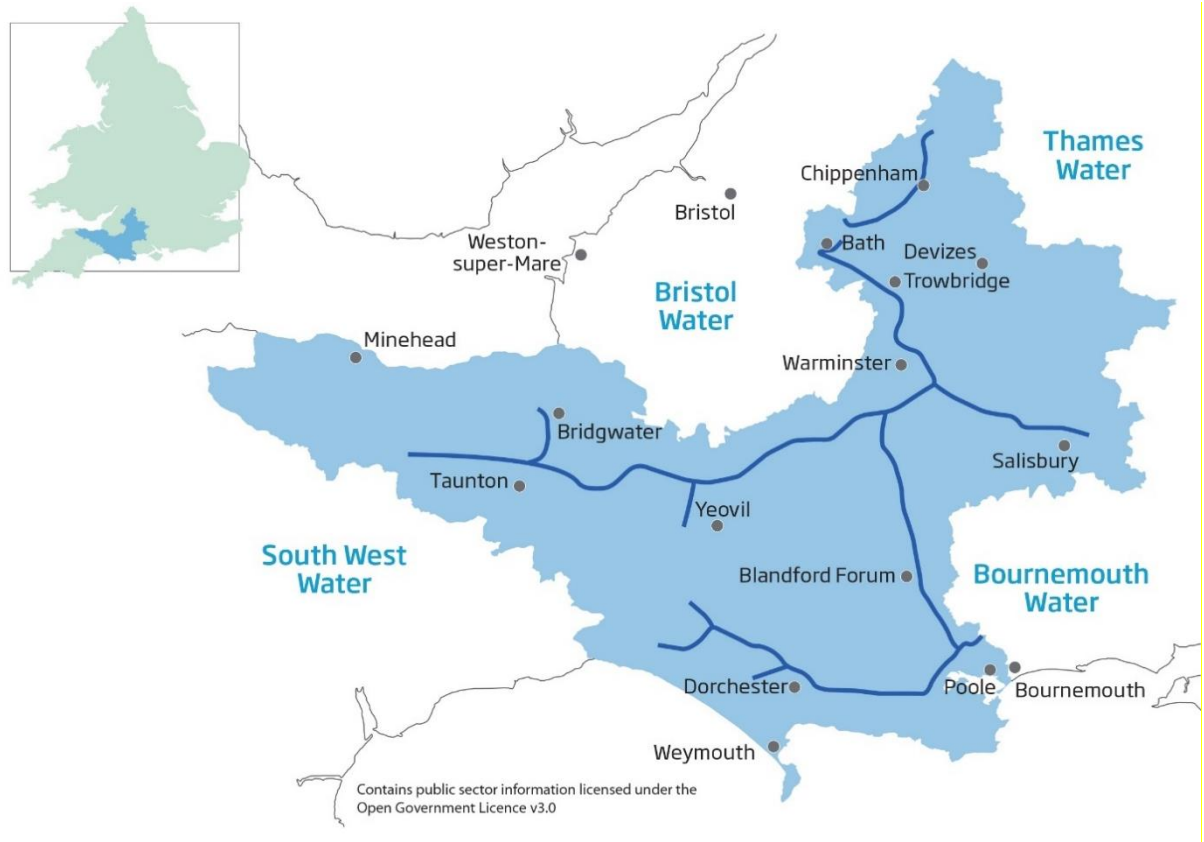
2. Wessex Water Supply Area Water Resource Zone

2.1 Overview

For security reasons specific source names and descriptions have been redacted from this section and are not available in the version of this document published on our website.

Wessex Water operates as a single WRZ following investment in our integrated supply grid, which was completed and has been running operationally since 2018, and connected together previously disconnected Water Resource Zones with a new transfer connection from Poole in the South to Salisbury in the East (Figure 2-1). In the last two Water Resources Management Plans (WRMP14 and WRMP19) we planned on the basis of a single resource zone.

Figure 2-1 Water supply zone with new grid connections.



The grid integrates ~80 sources across the supply system. The majority of these sources are groundwater sources, supplying ~75% of water into supply mainly in the North, East and South of the supply system with impounding reservoirs located in the West of the supply system (Yeovil and West) providing ~25% of water into supply.

The new integrated grid consists mainly of two trunk mains moving water from the south near Poole north toward Warminster and west towards Salisbury to overcome licence reductions mainly in the upper Hampshire Avon catchment.

Whilst the main grid project delivered the major connections described above, it also included projects to eliminate stand-alone sources. Prior to the completion of our integrated grid we had 13 stand-alone sources – meaning the customers could only be supplied by a single source; in the event of an outage of that source it would not be possible to re-zone alternative supplies. One of the key drivers of our integrated supply network was to connect these isolated sources to the wider network to ensure customers are offered the same security of supply. On completion of the grid, nearly 94% of our customers are supplied by more than one source.

Now the grid is complete, 42,000 properties remain with a single source of supply. Whilst this is a single water treatment works, it is supplied by two independent sources.

2.2 Transfers and constraints

For security reasons this section has been edited, with source names and text redacted and not available in the version of this document published on our website.

We have many transfers of water within our region; the main transfers are shown in Figure 2-1. Significant transfers occur from:

- **SPINE main** – a transfer from reservoir sources towards Yeovil.
- **CALM main** – central area link main transfer west towards Yeovil, supported from groundwater sources in the east in Wiltshire, and from transfers north on the new grid.
- **East/West link** – Between Sources Near Poole and Purbeck west.
- **Malmesbury to Bath** - In the north of the WRZ from sources north of Chippenham towards Chippenham and onto Bath.
- **Grid transfers** – transfers north from sources in the River Stour to the centre of our supply system and onwards towards Salisbury
- **Centre to Bath** – Transfers of water to and from Bath from sources in the centre of the supply system balancing use of the import from Bristol Water in Bath.

Following the completion of our integrated grid in 2018 there will be two areas within our regional zone that could be considered ‘constrained’. These areas are not, however, expected to have a lower security of supply than other areas in the region, and are generally in more surplus than other areas.

Our deployable output assessment takes into account all source capacity and network infrastructure constraints that exist within our supply system. We use the same Miser model, and therefore the same network constraint information, for our long-term water resources planning that we do for our day-to-day operational planning and optimisation. We believe this leads to robust assessments of deployable output.

At the time of undertaking the assessment, there are no pending investments to improve connectivity that are already funded but not yet implemented.

2.3 Water management zones

As we classify the Wessex Water system as a single resource zone the boundary is the extent of the supply area. Prior to the development of the grid we split the area into four

resource zones; the grid scheme effectively removed these boundaries by connecting the network and allowing greater movement of water around the region. The smallest water balance units we have are District Metered Areas (DMA) – we have over 650 of these. These are aggregated together into Water into Supply (WIS) zones of which we have 33. These are then aggregated into 6 water resources sub zones, which are formed at the boundaries of key transfers in the supply system.

2.4 System operation during drought and peak demand periods

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Wessex Water currently plans for both dry year annual average and dry year critical period scenarios reflecting the constraints on water supply in the system. As described in our draft drought plan[3] in development of drought triggers, these planning scenarios reflect the management of water during drought to avoid system failure, which may occur due to annual licence use exceedance, reservoir storage failure and hydro-geological constraints meaning instantaneous (peak) demand cannot be met.

2.4.1 Drought Scenario Modelling

To understand the vulnerability of the supply zone to supply failures, we have stress tested the performance of the system to drought events more extreme than those observed in the historical record under different scenarios, to understand the spatial variability of supply failure and whether deficits occur in some parts of the supply system earlier than others, and therefore whether different parts of the supply system receive different levels of service.

These simulations demonstrated that we start to see small demand deficits under a scenario with 87% of the rainfall observed during the 1975/76 event. On an annual average basis, deficits when they do occur are evenly distributed across the supply system as a result of integrated source management in the supply grid over the course of the event, reflecting annual licence and reservoir management.

On a critical period basis as drought severity increases, deficits tend to occur first in certain demand nodes of the model, typically reflecting the interaction of wider resource issues coupled with very localised constraints. These demand nodes, however, are not spatially localised, but are found in zones across the supply area. Failures occurring in these zones occur during the same peak summer timesteps. As well as reflecting conjunctive source use across the supply area to even out and minimise deficit, this correlation reflects the spatial correlation of hydro-geological constraints, which increases during extreme droughts – e.g. under drier and more severe drought events such as the 1 in 500 drought we are now planning for as part of WRMP24, low groundwater levels and the resultant source constraints are more likely to be spatially correlated. The correlation in deficits also reflects the timing of peak summer demands, which are typically ~20% higher than annual average demands, and strongly correlated across the supply area, responding quickly to daily/weekly changes in weather. With only small increases in drought severity from the initial severities

[3] Drought plan (wessexwater.co.uk)

that cause the first deficits, demand deficits start to become more widespread across the water resource zone. The conclusion from the modelling is that no area receives a significantly different level of risk of supply failure.

2.4.2 Recent peak demands in 2018

Peak demands that occurring during the hot, dry summer of 2018 occurred immediately after the new licences started in April 2018, and following commissioning of thew new grid system. The peak demands observed in the summer of 2018 were some of the highest and of the longest duration we have experienced at 420Ml/d, similar to our peak capacity forecast of 417.57Ml/d and within the range of headroom forecast. The event effectively provided a test of the new integrated supply grid, which was able to meet the peak demands with no significant supply difficulties.

The resilience of the supply network and importance of the new inter-connections was also demonstrated through the performance of the supply system during the Beast from the East event prior to the peak demand period in 2018[4].

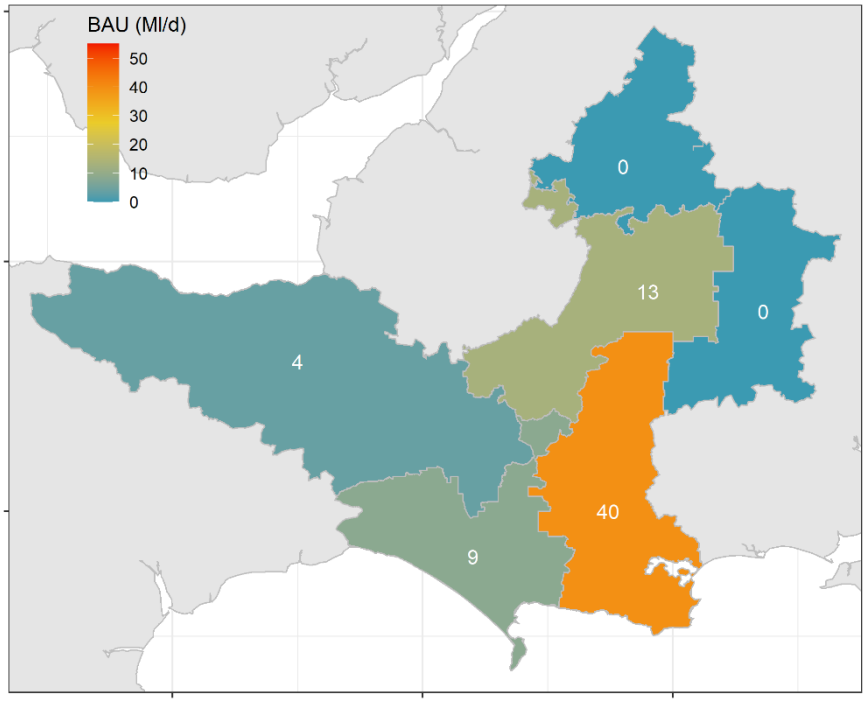
2.5 Environmental Destination Implications

The guidance requires us to consider whether future changes to supply and demand may cause and sub-zonal issues. The main driver for change in this round of planning is the potential licence losses associated with Environmental Destination, which based on current understanding could be between 60-80Ml/d, which represents around 20% of water into supply during drought periods. The location of Environmental Destination is mainly focussed on sources in the Chalk catchments of the Stour, Piddle and Frome, which are in the South of our supply system (Figure 2-2).

In relation to the supply grid (Figure 2-1) these licence losses are for sources that are well connected to the supply system and focussed on the main South-North grid transfer in the centre of the supply system. Whilst this represents a significant proportion of the abstraction in this area, during the peak summer of 2018 up to ~20Ml/d was exported from this area via the grid system. The scenario licence losses therefore primarily occur in parts of the supply system that are well connected to the rest of the water resource zone by the grid transfers, which will spread out the impact of licence reductions on deployable output and potential supply failure. No division of the Water Resource Zone for WRMP24 planning is therefore required.

Figure 2-2 location of potential licence losses by 2050 under the Environmental Destination Business as Usual Scenario at a Water Resources Sub Zone Level (WRSZ).

[4] The next 25 years in water, the Wessex Water Resource Plan



We apply a conjunctive use system simulation model in Miser of the entire supply system to derive our deployable output. The model includes all 80 sources and 132 demand nodes and is run on a weekly timestep. As part of our decision-making modelling for this round of planning we are to adopt a hybrid approach whereby we use the system simulation model both before aggregated investment modelling at the WRZ level (e.g. EBSD type modelling) to derive the Deployable Output and to test yield benefit of new potential schemes, and also after investment modelling, to test the performance of investment programmes/portfolios in the distributed model under different future scenarios.

It is possible that the environmental destination licence changes may result in small, localised issues within the supply system that may not be fully accounted for in a single water resource zone basis – there will always be small, localised issues that will cause some areas of the system to fail first, as no definition of a water resource zone can be fully satisfied. Whilst we do not anticipate that these local issues would justify a division of the Water Resource Zone, the proposed hybrid approach to investment decision-making above will manage this small risk by testing preferred investment programmes in the simulation model, thereby ensuring that preferred programmes for investment satisfy system deficits in a distributed manner across the supply area.

2.6 Drinking Water Quality

In the development of our WRMP24 we have accounted for sources of water where there are current or emerging water quality risks (i.e. pesticides) and this has been accounted for in the Deployable Output (DO) assessment which has informed our Water Resource Zone Integrity assessment. This ensures risks of customers are managed in the long term. Outside of the WRMP24 planning process, water quality risks are managed via our Drinking Water Safety Plans and operational monitoring, tracking and liaison with the Drinking Water Inspectorate. This will inform future WRMP planning processes.