Draft Regional Plan

for consultation

Appendix 2: Data input assumptions & commentary

November 2022

WReN

Water Resources North

Appendix 2. Data input assumptions & commentary

This appendix provides a concise commentary on the Water Resources North data inputs, focussed on the following key aspects, as appropriate:

- Brief explanation of the data and methods used where relevant
- Context in terms of key assumptions, such as data profiling through the planning period, data sources, etc., as required.
- Explanation of alignment or key differences (as appropriate) between regional datasets across different resource zones.

The commentary is provided by major data components of the regional plan data table, in line with the guidance provided in the finalised regional plan template issued by the Environment Agency[1].

Data component	Nov-22 supporting data position	WReN commentary
Base year	Start year is 2019/20, but base not specified	The forecasted data is 2019/20 for Yorkshire Water and Anglian Water and 2020/21 for Northumbrian Water. If 2019/20 is the base year the demand data has been uplifted to reflect the impact of Covid on future demand or if forecasted from 2020/21 the outturn year has been normalised to remove the impact of weather and includes the impact of Covid and lockdown. Either way all water resource zones include the impact of Covid in the demand forecasts from 2020/21.
Planning period	2020 to 2080, with 2080 to 2100 optional	The core focus of the reconciliation is on the period 2025 to 2050, in line with the standard minimum 25-year planning horizon for the Statutory Water Resource Management Plans (WRMP24s). We have provided a forecast to 2085 (i.e., over a 60-year horizon) for Yorkshire Water and Northumbrian as presented in their draft WRMP24s and as is appropriate to the planning needs of the two strategic conjunctive-use water resource zones (Yorkshire Grid and Kielder).
Supply forecast and options	Implement supply options in baseline scenario that are either delivered by 2025, or and those planning for implementing after 2025 with PR19 funding.	The only WReN water resource zone (WRZ) with existing planned supply options is the Yorkshire Grid. The WRMP19 final planning solution for this zone included delivery of two supply side schemes by 2025. A 2 Ml/d deployable output benefit is currently included in the Yorkshire Grid to represent one of the schemes, which is currently being investigated ahead of a licence application being submitted. The benefit of the

[1] Regional Plan Tables Template – worked example v4, issued by Environment Agency by email from Lisa Winfield to regional group leads, 04 August 2022

Data component	Nov-22 supporting data position	WReN commentary
		scheme is based on the licence volume and will be updated once modelling is carried out to identify the true benefit in the Yorkshire Grid conjunctive system under the 1:500-year DO. A second borehole was planned for delivery by 2025 with a 6 Ml/d benefit from 2025/26 onwards, but this has been removed from the Yorkshire Water capital programme and therefore also removed from the relevant data input. This scheme would relocate an existing groundwater abstraction point for resilience purposes and was not essential for closing the WRMP19 deficit. The option has been selected as part of the Yorkshire Water WRMP24 WRMP solution to close the near-term deficit. The existing abstraction is listed on the Environment Agency's pre-WRMP licence information data and, although a sustainability reduction is not anticipated, we will review its status with the Environment Agency before proceeding with the relocation.
Drought resilience and measures	Deployable output under 1 in 500-year scenario without the use of level 4 restrictions	Since the publication of the PR19 tables, the Kielder WRZ and the Industrial WRZ have been merged. PR19 tables for the Kielder WRZ included the potable demand for Industrial customers and the Industrial WRZ was the non-potable water used in the various processes by these same customers. Merging the two zones does not change the DO of the Kielder WRZ as the non-potable and potable demand is separate. All water companies have followed the latest guidance to determine the drought resilience of their WRZs, with appropriate methods applied based on the complexity and nature of the zones. For the two strategic conjunctive-use WRZs (Yorkshire Grid and Kielder), system response modelling has been carried out using stochastic datasets for the first time. These are also the two WReN zones that could be most impacted by future water trading. For the Yorkshire East WRZ, the stochastic time series have been analysed using a simple threshold exceedance spreadsheet model. In the smaller groundwater dominated WRZs (Hartlepool and Berwick & Fowberry) a drought library approach has been used. In all cases the hydrological inputs to the models have been based on stochastic data sets for rainfall and PET (potential evapotranspiration), for the first time in the region.

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		Where system response modelling has been carried out, the 1 in 500 Deployable Output has been calculated based on the frequency of combined demand and storage trigger-based failures as defining Level 4 restrictions in the analysis. For the groundwater WRZs, analysis of the stochastic timeseries was carried out to select a sample of 1 in 500 hydrological events to model. We have included the benefit of customer use restrictions in the 'drought measures benefits' planning estimates. However, no benefit has been attributed to DO for drought permits and orders.
Climate change	Appropriate approach within each region, regarding use of UKCP18 products (use of RCM and/or probabilistic projections in line with guidance)	Results of the Regional Climate Models (RCMs), for the 2070's, from the latest UK Climate Projections 2018 (UKCP18) projections, have been used in our assessment of the potential impacts of climate change on water resources for public water supply. All water companies have used the RCP8.5 (high emissions) scenario as the basis for DO modelling, as data is spatially coherent and allows for consistent modelling to be carried out across the region (or between regions) in future. In the two strategic conjunctive-use WRZs (Yorkshire Grid and Kielder), and the Yorkshire East WRZ, all 12 RCM scenarios were applied to a sample of the stochastic data and run through rainfall-runoff models to produce inputs for resource modelling. In the remaining WRZs a sample of the 12 RCM scenarios were applied to the drought scenarios and re-run through the groundwater models. The RCP8.5 scenarios are based on a high climate emissions scenario, and as such the DO impacts produced are often significantly higher than the equivalent (non-regionally coherent) climate products used in WRMP19. As a result, we have scaled down the modelled DO impacts from the high (RCP8.5) to a medium (RCP6) emission scenario, using a method developed by Atkins which uses a temperature-based scaling equation (Atkins - WRSE Climate Data Tools Scaling Report v0.4). This is comparable with the approach taken by some other regions. Climate change impacts have been scaled back to 1990, which therefore assumes that the DO estimated in the start of the planning horizon already includes some climate change impacts.

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		Additionally we have also modelled the low emission (RCP2.6) scenario as part of the Ofwat common reference scenarios.
Confirmed sustainability changes	Total confirmed DO reductions to restore sustainable abstraction	We have included all confirmed sustainability reductions to restore sustainable abstraction including those for Hartlepool Water and Northumbrian Water's Berwick WRZ. See Appendix 6 for further details.
Environmental destination	Total additional DO reductions for Environmental Destination (excluding any confirmed reductions)	We have included DO reductions for our Business as Usual 'Plus' (BAU+) scenario, which represents the 'most likely' environmental destination. The only water company resource zone with estimated reductions for BAU+ is Yorkshire Grid. See Appendix 6 for further details.
Outage allowance and process losses	Outage allowance covering the risk of temporary or short-term losses of supply (both planned and unplanned) and raw water treatment losses	The outage allowances and raw water losses for all WRZs have been fully reassessed for WRMP24 and included in both the draft region plan and company WRMPs.
Population and property forecasts	Local authority population / property numbers as WRMP24 guidance	Updated population and property data sources have led to differences between WRMP19 population and property forecasts and the latest WReN view. Edge Analytics have provided population and property growth forecasts for all water resource zones in the WReN region to support a consistent approach. In alignment with WRMP24 Guidance, population and property forecasts have been designed to reflect Local Authority planned growth. For WReN this is the Housing Plan scenario used by all water companies for Baseline forecasts as well as the forecast used to calculate the DMO options. The Housing Plan scenario is a housing-led scenario, with population growth underpinned by each local authority's Local Plan housing growth trajectory. Following the final year of data, projected housing growth in non-London areas returns to the ONS-14 & ONS-16 long-term annual growth average by 2050.

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Household consumption	Policy assumption (e.g., 110 l/hd/d by 2050) with regional statement	The upward trend in household consumption seen generally across many companies since WRMP19 has resulted in higher forecasts in WRMP24 compared to WRMP19 projections. The current forecasts have been rebased to 2019 or 2020, and the "new normal" impact of covid and people working from home on demand has been applied to household consumption for all demand scenarios. The impact of Covid and the recovery of non-household demand has been factored into our plans utilising collaborative water industry studies. Household projections have been modified to reflect the impact of covid, which initially produced a significant increase to household demand. Using internal data and analysis from Artesia collaborative project these forecast assume a pathway to a new normal PCC which includes an assumption of households continuing to work from home. Where appropriate, water companies have updated their demand management options (metering and water efficiency) which have a direct impact on household consumption. Any adjustments to household consumption take account of behavioural changes and restrictions on movements working from home with the aim to meet the 110 l/h/d target by 2050. The baseline PCC reflects where companies assume no additional enhanced metering or water efficiency activity from AMP8. The final plan PCCs include demand management options to reduce consumption which aim to achieve a PCC of 110 l/h/d, these will include consumption savings as a result of metering and water efficiency strategies.
Non-household consumption	Large user forecasts and economic forecasts at a sector level in line with WRMP24 guidance	Non-household demands include the impact of covid. Taking account of the restriction of movements, and closure of schools and workplaces, adjustments have been calculated based on economic predictions where possible. New non-household demand has been included for any new known growth in the region. For some water resources zones including Kielder, the non-household consumption forecast has been modelled by characterising non-household customers by geographical area and industrial sector. For the Yorkshire Grid zone, the non-household consumption forecast is modelled by industrial sector. Historical regression modelling has been applied to consumption for each sector. Forecasts have then been based upon the appropriate selection of explanatory variables, such

Data component	Nov-22 supporting data position	WReN commentary
		as numbers in employment or the level of economic activity (GVA), which most appropriately account for historical trends and variations in demand.
Leakage	Policy assumption (e.g., 50% reduction by 2050) with regional statement	For Northumbrian and Yorkshire, there is a commitment of a 15% reduction in leakage by 2024/25 and this will be achieved in the Kielder and Grid water resource zones. These levels remain static for the Baseline planning period until 2080. For the assumption adjustments to baseline scenario, the reduction in leakage to 50% by 2050 meets the national leakage target set by the National Framework for Water Resources, and as recommended by the NIC. For Hartlepool Water resources zone, leakage has been initially theoretically modelled to reduce by 30%, bearing in mind that the National Framework target of 50% applies nationally. For WRMP24 modelling Hartlepool records leakage in 2020 of 4.63Ml/d with DI at 27.06Ml/d, representing 17% of DI. As part of WRMP24 leakage is currently planned to reduce to 3.41Ml/d in 2050 a 14% reduction from 2025. DI is forecast to decrease to 23.72Ml/d in 2050 so leakage as a percentage of DI will be 14% in 2050.
Uncertainty	Target headroom - supply, demand, options uncertainty	All water companies are following the UKWIR 2002 methodology to calculate target headroom allowances for each Water Resource Zone (WRZ). This is based on the use of Monte Carlo simulation to combine probability distributions defining uncertainty ranges for key supply and demand components. A full review of all uncertainty factors has been undertaken, and the data and assumptions used to define the probability distribution parameters (minimum, most likely and maximum etc) have been updated to reflect the latest data and assessment of uncertainty for WRMP24. Updated WRMP24 input data for the target headroom models includes deployable output and demand forecasts, the latest assessments of climate change impacts on supply based on UKCP18 scenarios, and outputs from updated reviews of water quality risks to supply availability of individual sources. Probability distribution assumptions have been aligned between companies where possible; for example, all companies have now adopted triangular distributions to represent the uncertainty of climate change impacts on supply, with maximum and minimum values determined from the range of modelled impacts of UKCP18 climate change scenarios on deployable output.

Data component	Nov-22 supporting data position	WReN commentary
		Work to finalise the WRMP24 headroom components for both the WReN regional plan and individual company plans has included a review of headroom percentile glidepaths, to determine whether it may be feasible for the WReN companies to align to a set of benchmarked risk profiles (glidepaths). A standardised set of three risk profiles has been used based on the level of resilience of each WRZ to uncertainties within the supply-demand balance (referred to as the low resilience, medium resilience and high resilience risk profiles). In general, the WReN standardised risk profiles have been adopted across all companies' target headroom assessments. However, some flexibility has been retained to allow for adjustments, taking into account the circumstances of each WRZ and the views of individual companies and their customers and stakeholders on the balance between future risks and investment choices.
Regional plan supply options	As WRMP24 guidance	The cost / impacts and availability of the regional transfer options are dependent on WReN's in-region needs. The reconciliation processes did not result in a request from another region for a transfer from WReN. If another region was to request a transfer from WReN in the future, we would need to consider if there was an in-region need for the resource and assess the alternatives using our best value plan options appraisal process. The regional transfer options include exports to United Utilities (UU) from the Kielder Zone, although these options were not selected in either UU's or Water Resources West's (WRW's) best value plans and therefore they are not included in Norhumbrian Water's and WReN's best value plans. It should be noted that when planning for a 1 in 500 year level of drought resilience and the latest CP18 climate change projections, the supply surplus in the Kielder WRZ is significantly less than that published in Northumbrian Water's WRMP19. Additionally, modelled reservoir storage in Kielder reservoir has reduced from ~75% in a 1 in 200 year drought resilience scenario in its WRMP19 to ~40% in a 1 in 500 year drought resilience scenario in its latest draft WRMP24 forecasts. A 100Ml/d export from Kielder reservoir to UU would reduce storage in extreme droughts further. There are also significant cost and environmental implications surrounding the options, including an INNS risk that would need to be mitigated by significant treatment at source. If UU was to request a transfer in the future these risks would need to be considered

Data component	Nov-22 supporting data position	WReN commentary
		further. WReN and NWL will continue to work with WRW and UU on this option and will decide whether to further investigate as a Strategic Resource Option through the RAPID gated process. A raw water export from the River Tees to Yorkshire Water, supported by Kielder reservoir via the Tyne Tees Transfer system, of 140Ml/d is included in Yorkshire Waters Best Value Plan. In the preferred plan it is not required until 2049, however it could be triggered earlier if Yorkshire Water diverts to the low demand scenario. Northumbrian Water has carried out initial stochastic modelling that showed that a raw water transfer of 140Ml/d from the River Tees to Yorkshire Water is possible as long as the pumping capacity of Riding Mill RWPS is upgraded. We have provided more detail on options in Appendix 5
Regional Plan strategic options		The inter-regional reconciliation process resulted in strategic cross regional options being selected by some regions. None of the WReN cross regional export options are included as they were not selected by the other regions. Water Resources West (WRW) has an option to reduce or stop an existing import to Yorkshire Water from the Derwent valley reservoirs. The reconciliation outputs from WRW indicated that this option is frequently selected in its optimisation runs and the most likely scenario is that the transfer will cease. The transfer could be retained if WRW is following a lower ED scenario and if a strategic regional option to increase the Derwent valley reservoirs could be implemented. The Derwent Valley reservoir increase requires further development through the gated process before it can be considered feasible. As the future of the transfer is uncertain both options have been listed.
Non-public water supply (non-PWS) regional demand	Baseline and future abstraction demands of non-PWS sectors across the WReN region.	The data input for non-PWS regional abstraction is for information only to help us work together with representatives of other sectors in our region, to better understand environmental needs and how they may impact on abstraction in order that our plan can adequately reflect likely future water needs across all sectors.

Data component	Nov-22 supporting data position	WReN commentary
		Non-PWS abstraction is summarised by WRZ, where possible, to be consistent with other components and broken down by primary sectors (agriculture, industry, private water supply, power and 'other' non-PWS sectors) and then by secondary sectors where this is applicable. The split by WRZ omits some outlier abstractions that are included in the National Frameworks 'North' dataset but do not fall within the particular WRZ applicable to the WReN region. The majority of the data are sourced from the work undertaken for the WRNF[2], however figures have been reviewed and updated to reflect engagement with stakeholders and where better data have been made available by non-PWS representatives. For data sourced from the WRNF, the recent actual abstraction data is reflective of the period 2010 to 2015. The future abstraction data provides a forecast for 2050 and is based on 2050 growth factors for each sector (from the WRNF). Water still needs to be available for abstraction regardless of whether it is then returned back to the environment. For this reason, recent actual and future abstraction data is given for both 'consumptive only'' and for 'consumptive plus non-consumptive'. In addition to the WRNF data, the Canal and River Trust (CRT) provided WReN with data for their navigational abstractions. This was analysed by WReN and added to consumptive baseline figures as agreed with CRT (the baseline for these figures differs from the WRNF and is based on 2011-2017). In addition, the power sector has provided WReN with updated water demand projections for their sector through work undertaken for the Joint Environmental Programme (JEP). WReN used the JEP forecasts to update the future abstraction figures for the power sector. The updated navigational and power figures are not available at a WRZ level at this stage and are applicable across the region as a whole. There is considerable uncertainty with the data, therefore certain assumptions are made:

[2] Meeting our future water needs: a national framework for water resources, Environment Agency (March 2020)

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		• All abstractions are assumed to take place in same location (e.g., does not represent new / emerging abstraction in locations where it does not already take place) • Does not account for some abstractions which have been/are exempt from licensing and not included in the WRNF data (with the exception of navigation where data have been provided by CRT). • Industry and trickle irrigation are not included, therefore non-PWS demand is likely to increase • Growth factors have been applied consistently at a national scale based on the licence point-purpose category – however variation between regions, catchments and individual users are probable but won't be reflected in dataset The limitations with future growth data make it difficult to see trends in abstraction from recent actual up to 2050.
Environmental destination	Proposed abstraction reduction through environmental destination	We have included our proposed 'most likely' environmental destination scenario in this tab at water company resource zone scale, consistent with row 7.3BL in the planning table (YW grid only). Only Proposed public water supply abstraction reductions have been included as no non-public water supply abstraction reductions have been identified at this stage.

How to find out more

More information about Water Resources North, including our publications and how you can contact us, is available on our website, www.waterresourcesnorth.org.

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