January 2019

Trust in water

RAG 4.08 – Appendix 2 (Water resources further guidance)

www.ofwat.gov.uk

Ofwat

Contents

1. Introduction

This appendix provides further guidance on two key elements for the implementation and measurement of the separate water resources control. A separate control for water resources enables better targeted regulation and will result in increased management focus on this key area of the value chain. The control will also facilitate the further development of markets for new water resources.

Building on the regulatory account guidelines (RAGs) we provide additional guidance on:

- The boundary of water resources (see section 2); and
- The calculation of water resources yield (see section 3)

2. The boundary of water resources

The boundary of water resources (the abstraction licences and raw water abstraction services) is defined for regulatory reporting purposes in Section 2: Disaggregation of wholesale activities – upstream services of RAG 4.08. In this section we provide additional supporting information on:

- The allocation of raw water reservoir assets (see section 2.1)
- The application of our guidelines through an example system with raw water storage (see section 2.2)
- The application of our guidelines through an example system with multiple water resource reservoirs (see section 2.3)

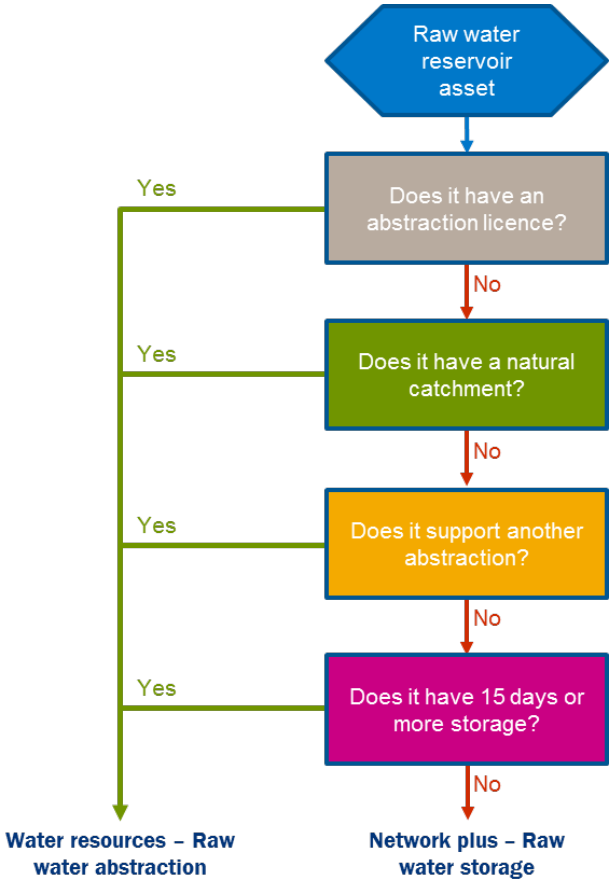
2.1 Allocation of raw water reservoir assets

In this guideline a distinction is made between balancing reservoirs and water resource storage reservoirs whereby:

- **Balancing reservoirs sit in Network plus - Raw water storage** - these reservoirs support the raw water transport network. Such balancing reservoirs only have a small amount of storage in relation to the demands placed on them (generally a few days) and provide enough temporary storage to support a constant rate to and from the water treatment works. They may allow some resilience in storage for very short amounts of time for pump outages or pollution events.
- **Water resource storage reservoirs sit in Water resources – Raw water abstraction** - these reservoirs are used to store the abstracted water for an average summer or even drought periods to provide storage to meet demand when the abstraction stops due to low river levels. In essence they are providing additional water resources by providing storage. These reservoirs may be large enough to supply very long periods of time (potentially years).

The decision tree shown in figure 1 should be applied to allocate raw water reservoir assets between these two categories. This decision tree is sequential and if any of the conditions are met the raw water reservoir asset will fall into Water resources – Raw water abstraction.

Figure 1: Decision tree for raw water reservoirs



The calculation of storage is only required if the answer is no to the first three questions in the decision tree. In calculating storage the following guidelines should be followed:

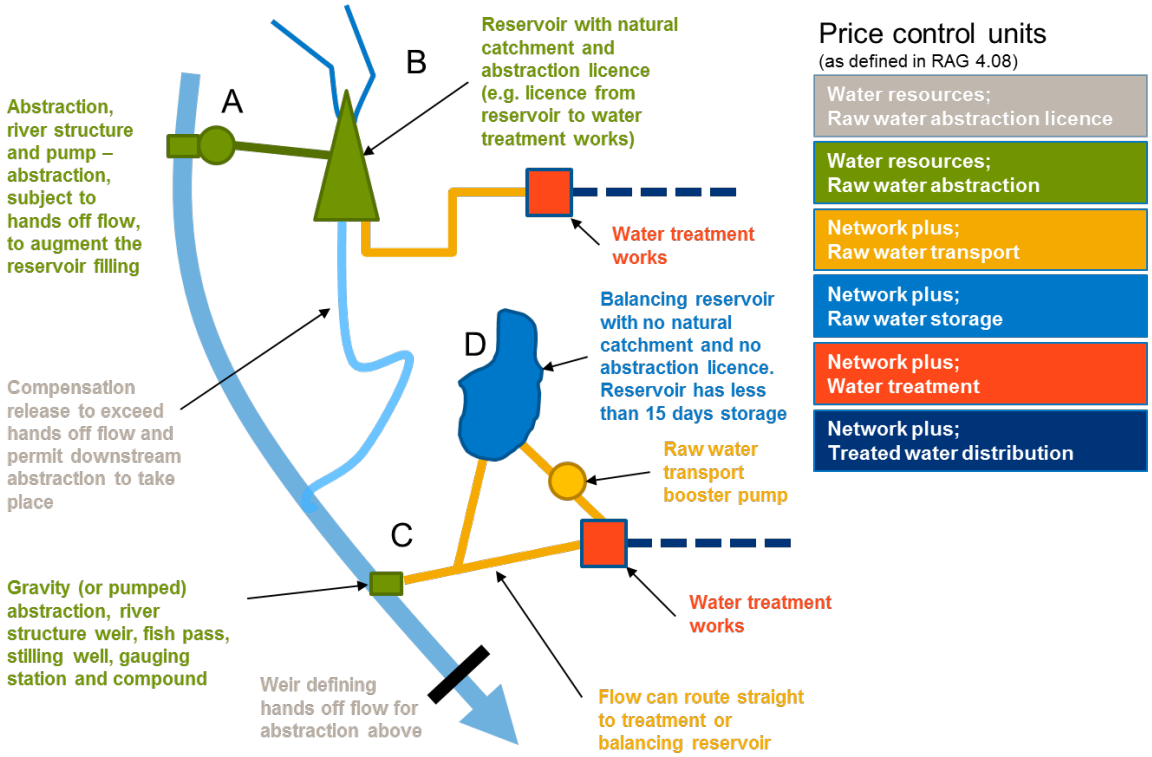
- **Demand** – The number of days of storage should be based on measured (where available) average usage (Ml/d) of the reservoir. If the flow from the reservoir to the works is not measured, the average demand placed on that reservoir by the treatment works should be used (where the treatment works is supplied by one reservoir this can be the average water into supply flow with an allowance for treatment process losses).
- **Usable storage** – Only the usable storage of the reservoir should be compared against the calculated 15 day storage. It is up to companies to determine this usable quantity (e.g. excluding storage below the lowest draw-off valve or where water quality inhibits its usage).

- **Multiple sources** – Where more than one reservoir supplies a treatment works (in series or parallel) and the individual demand placed on each reservoir is not measured, it is reasonable to assess the reservoirs as a group. The total usable reservoir storage across all contributing reservoirs should be used together with the treatment works total average demand.

2.2 Application of our guidelines – example system with raw water storage

Figure 2 shows the application of the water resource boundary guidelines in an example which has both a water resources reservoir and a raw water storage reservoir (balancing reservoir).

Figure 2: Example system identifying both water resources and network plus reservoir assets



In this example there are four key points:

- **Point A** – Raw water is abstracted from the river via pumping assets. Any operating costs for assets supporting abstraction are included within this activity
- **Point B** – A reservoir is supplied by its own natural catchment as well as the cross-catchment pumped abstraction via a pipeline. It releases water back to the river in order to maintain flow conditions

measured downstream. The reservoir has an abstraction licence.

- **Point C** – There is a gravity abstraction from the river. Any operating costs for assets supporting abstraction are included within this activity. If this was a pumped asset then operating costs should be proportionally allocated between raw water abstraction and raw water transport.
- **Point D** – There is a reservoir, with no natural catchment, with no abstraction licence but filled via the licensed river abstraction. The reservoir has less than 15 days usable storage based on the average demand of the treatment works. The reservoir is a balancing asset that is used to maintain continuation of supply to the treatment works (acting as a buffer against short term low river flow or poor river quality).

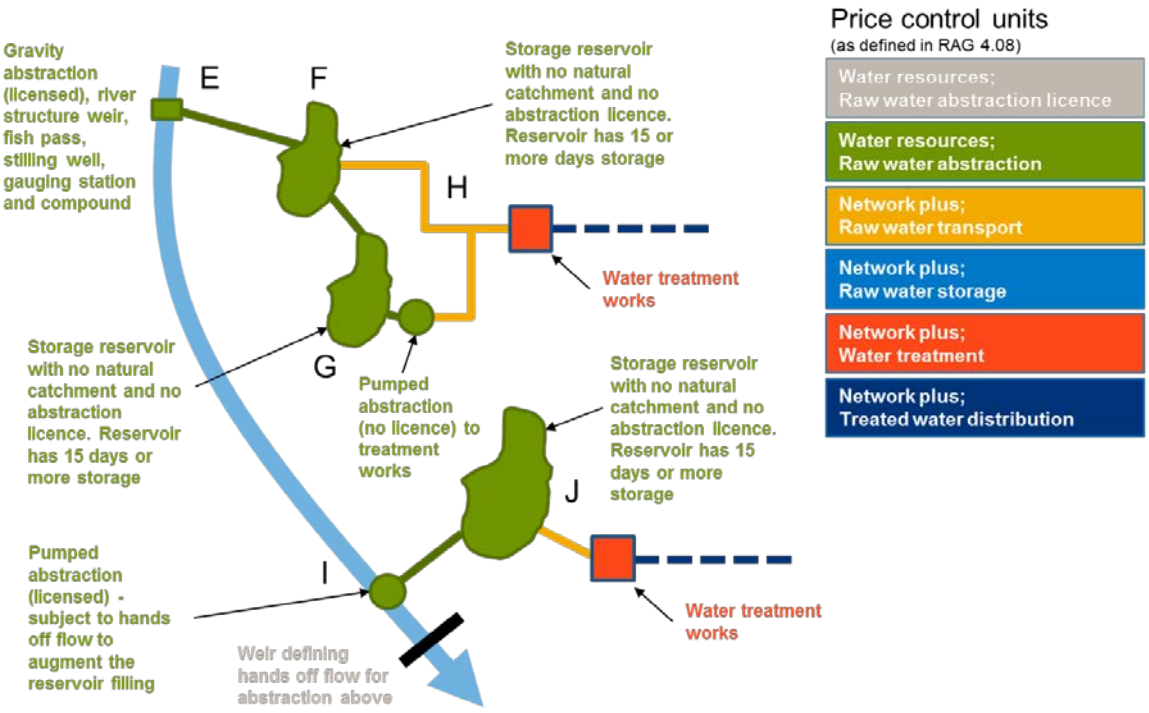
These points can be interpreted as follows:

- **Points A** and **B** are Water resources – Raw water abstraction activities. **Point A** contains river abstraction assets which are defined in the RAGs as being Water resources. This also includes the pipe transferring raw water from **Point A** to the reservoir at **Point B** (both being Water resources – Raw water abstraction). As the reservoir at **Point B** has an abstraction licence and natural catchment (see decision tree above) it is considered a Water resources – Raw water abstraction asset.
- For **Point C** only the assets supporting the abstraction process are classified Water resources – Raw water abstraction (in this case the weir, fish pass, stilling well, gauging station and compound).
- The reservoir at **Point D** has no natural catchment or abstraction licence and does not support abstraction downstream. Its function is to support the raw water transport network and the treatment process by balancing demands. It also has less than 15 days usable storage based on the average demands of the treatment works. It is therefore classified as Network plus - Raw water storage.
- The pipe connecting the abstraction assets (**Point C**) to the raw water storage (**Point D**) is classified as Network plus - Raw water transport. Only pipework transferring water between Water resources assets, or where Water resources and Water treatment assets are located on the same site are classified as Water resources – Raw water abstraction.
- Across the four points any activities related to negotiating with third parties to obtain abstraction rights and to agree charges, as well as the annual cost of the licence itself should be captured under Water resources – Abstraction licences.

2.3 Application of our guidelines – example system with multiple water resource reservoirs

Figure 3 shows the application of the water resource boundary guidelines in an example which has multiple water resources reservoirs.

Figure 3: Example system identifying different types of water resources reservoir assets



In this example there are five key points:

- **Point E –** Raw water is abstracted from the river via gravity. Any operating costs for assets supporting abstraction are included within the Water resources activity.
- **Point F –** The upper reservoir is supplied from the river abstraction. The reservoir does not have its own catchment or abstraction licence. It does have 15 days or more usable storage (based on the average supply sent to the treatment works measured on the gravity pipeline).
- **Point G -** The lower reservoir in the cascade receives some water from the upstream reservoir. It also supplies the treatment works via a pump and pipeline. The lower reservoir also doesn't have natural catchment or an abstraction licence but does have 15 days or more usable storage (based on the average supply sent to the treatment works measured on the pumped pipeline). If the individual contribution from each reservoir to the

treatment works were not directly measured, the total usable storage (of the two) could be combined, and compared with the treatment works average demand to calculate the number of storage for the reservoir system. The reservoir assets would be classified in the same category depending on the result of the calculation.

- **Point H –** There is a gravity pipeline to the treatment works from the upper reservoir and a pumped pipeline from the lower reservoir. They are not on the same site.
- **Point I –** There is a pumped abstraction from the river with a pipeline to the reservoir.
- **Point J –** The reservoir is supplied from the pumped river abstraction. The reservoir does not have its own catchment or abstraction licence. It does have 15 days or more usable storage.

These five points can be interpreted as follows:

- **Points E**, **F and G** - are Water resource – Raw water abstraction activities. Both sets of reservoirs require the 15 day storage test (as they do not have abstraction licences a natural catchment or support downstream abstraction). Based on the calculation they do have 15 days or more storage and all assets from the abstraction from the river down to the pumped abstraction from the lower reservoir are considered Water resources – Raw water abstraction assets. This is because essentially all assets are working in combination to provide a yield availability at the last Water resource asset in the chain to enter raw water distribution/treatment
- For **Point H,** all pipework assets from **Point F** (the upper reservoir) and after the abstraction pump at **Point G** (the lower reservoir) are Network plus - Raw water transport assets.
- The reservoir at **Point J** is supplied from the pumped river abstraction. The reservoir does not have its own catchment or abstraction licence. It does have 15 days or more usable storage. It is therefore a Water resource – Raw water abstraction asset, as is the pipeline from the river abstraction. The pipe connecting the reservoir to treatment works is a Network plus - Raw water transport asset.
- Across the five points any activities related to negotiating with third parties to obtain abstraction rights and to agree charges, as well as the annual cost of the licence itself should be captured under Water resources – Abstraction licence.

3. The calculation of water resources yield

In the PR19 final methodology we confirmed the use of water resources yield as the capacity measure for the water resources control. Further information regarding this decision can be found in section 4.2.2 of Appendix 5: Water resources control.

Water resources yield is a sub-component of existing supply-demand balance calculations, however there is no pre-defined methodology that companies can follow to calculate it. This section addresses this issue through providing additional guidance for water resource yields calculation and reporting. We consulted on a draft version of this guidance as part of the draft methodology for PR19 and this final version reflects the comments and queries we have received.

We provide an overview of the:

- definition of water resources yield (see section 3.1)
- calculation of pre-2020 capacity in a simple WRZ (see section 3.2)
- calculation of post-2020 capacity in a simple WRZ (see section 3.3)
- forecasting and tracking of water resources yield over time (see section 3.4)
- approach to more complex capacity issues (see section 3.5)

3.1 The definition of water resources yield

Water resources yield will capture the average volume of water available from the environment (dependent on the level of service and planning period) and constrained by water resources control assets. These will be the assets which provide water for raw water transport and/or treatment and will typically include boreholes, reservoirs and river abstraction assets (as defined by the example assets and activities envelope in RAG 4.08). Assets that sit outside of the water resources control assets boundary like, for example, the water treatment capacity of the water resource zone (WRZ), will not influence the reporting of water resources yield.

The water resources yield from an asset will be defined by both the planning assumptions of the incumbent and the capabilities of the asset itself. The water resources planning assumptions (level of service and planning period) are usually defined first which then influence the source yield and licenced availability. The abstraction asset capacities are fixed values regardless of the assumptions made. Therefore, water resources yield is constrained by:

- the company's agreed level of service (the return period of drought

resilience and frequency of restriction implementation)

- the company's agreed planning period (the period over which the amount of water available is measured e.g. dry year annual average)
- the baseline hydrological/hydrogeological (source) yield
- the abstraction licence availability
- the raw water abstraction asset capacities (e.g. abstraction pumps)

For a very simple WRZ (few assets, own sources and no transfers) where there is one raw water source, one abstraction licence, and one abstraction asset – the water resources yield, and therefore capacity, will be the lowest of the flow rates (volume per unit time) that can be achieved across each of those three components using the company's level of service and planning period scenario(s) (i.e. the lower of, source yield - the amount available from the natural environment, the limit set in the abstraction licence or the physical capacity of the asset used for abstraction).

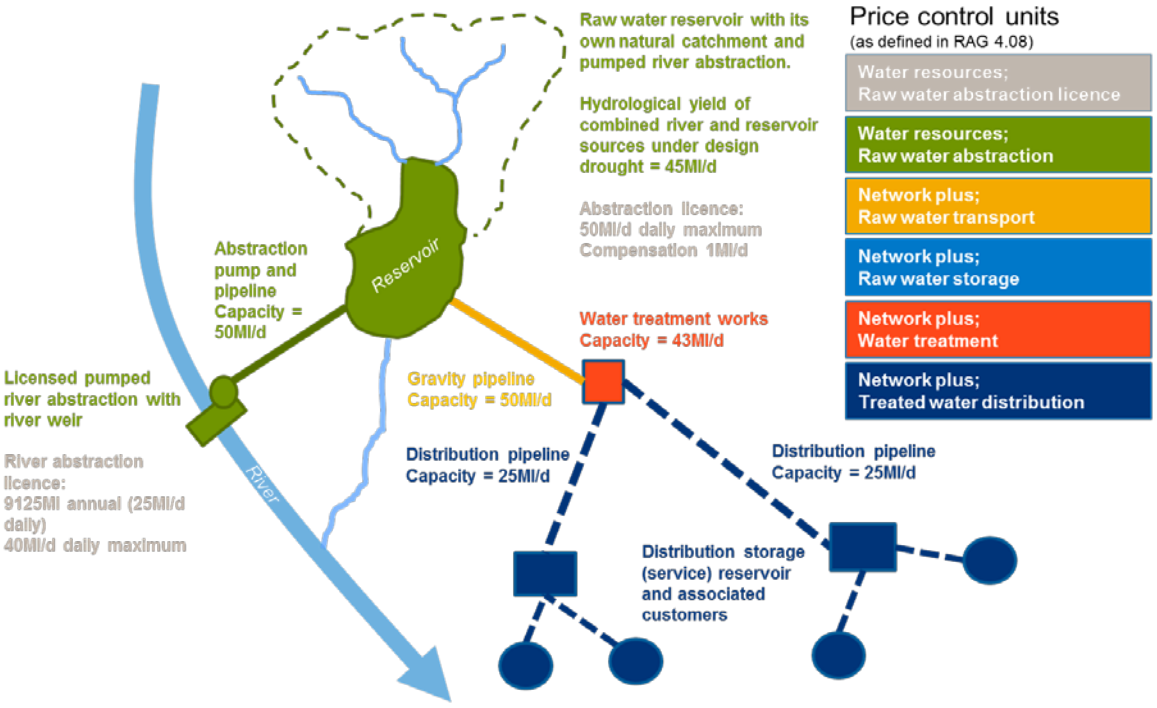
Where multiple sources, licences and abstraction assets contribute to the water resources yield of a WRZ, companies have various methods to calculate the capacity. This could range from a simple summation of individual water resource yields to a complex water resources optimisation model (ensuring that the resulting capacity is not influenced by network plus water constraints).

Whatever approach is chosen the calculation of water resources yield should be consistent with guidance used to calculate deployable output and the assumptions made in those calculations for the company's latest water resources management plan (WRMP). The UKWIR Handbook of source yield methodologies 2014, and latest water resources planning guidance should be referred to where relevant. However, the key difference is that the constraints included in the deployable output calculation which are influenced by network plus water assets (e.g. treatment capacity) need to be excluded.

3.2 Calculation of pre-2020 capacity in a simple WRZ

The example in figure 4 below shows a simple WRZ as of 31 March 2020. This shows the current situation before any planned investment. The capacity levels provided are for the company's given level of service and its planning period which in this instance is dry year annual average. The estimates are consistent with the company's WRMP19 assumptions. The assets have been mapped to our price control units defined in RAG 4.08

Figure 4 - Applying water resources yield to a simple WRZ



The capacity for the simple WRZ above would be based on the lowest component of the building blocks of water resources yield; hydrological yield (combined yield of river and reservoir sources = 45Ml/d), abstraction availability (combined river and reservoir licence quantity = 75Ml/d), and abstraction asset capacity (abstraction pump and pipeline = 50Ml/d).

In this scenario the water resources yield would be 45Ml/d and constrained by the environmental availability of water from the sources (river and reservoir combined, contributing approximately 20 Ml/d and 25 Ml/d respectively) within the water resources control. This pre-2020 capacity would be reported separately to any post-2020 capacity.

If for example the river abstraction assets (pump and pipes) were 10 Ml/d rather than the 50Ml/d for example, then 35 Ml/d (10 Ml/d from river, 25 Ml/d from reservoir) would be the water resources yield of the system.

By way of comparison, if treatment capacity was included in the capacity measure definition, as it would be for deployable output, then the resulting capacity for the simple example zone would be 43Ml/d, equal to the maximum water treatment works capacity. The treatment works capacity and asset outage do not however affect water resources yield as these assets are accounted for in the network plus water control and not the separate water resources control.

3.3 Calculation of post-2020 capacity in a simple WRZ

Post-2020 capacity captures the incremental water resources yield funded through the water resources control after 1 April 2020. For example this could be the construction of a new borehole, a new river offtake or a reservoir expansion.

When an asset is proposed and constructed, its water resources yield will need to be calculated just as it would for water resource planning and reporting. In the simple WRZ example above, the planning period deficit for the zone is to be resolved with leakage reduction and demand management (both network plus) but also the construction of two borehole sources in the 2020-25 period (not shown in figure 4).

The capacity from this post-2020 investment is based on the water resources yield of each borehole using the same assumptions as the pre-2020 capacity. Both boreholes are funded and fully commissioned within the 2020-25 period therefore reported in post-2020 capacity. In this instance borehole A provides 2 Ml/d in 2022, and borehole B provides 1 Ml/d in 2023. The reporting of post-2020 capacity should be an aggregate of all schemes available at that point and is reported separately to the pre-2020 capacity (in the example this would be 0Ml/d in 2020 and 2021, 2Ml/d in 2022, and 3Ml/d in 2023 and 2024).

Post-2020 capacity will not capture scenarios where pre-2020 capacity has been maintained through investment in current sources and assets. For example, were the river pumps to deteriorate or fail meaning that their capacity was reduced to 10Ml/d they will become a constraining factor of overall capacity. Any investment to get them back up to the original pre-2020 level of 50Ml/d is considered maintenance and not associated with post-2020 capacity.

However, post-2020 capacity will include situations where sources/assets have been upgraded to increase capacity beyond that reported at 31 March 2020. Post-2020 investment on a pre-existing reservoir (as of 31 March 2020) to improve its source yield, such as raising the dam, would be considered as investment to increase the pre-2020 capacity.

3.4 Forecasting and tracking of water resources yield over time

Both pre- and post-2020 capacity will change through time and are not fixed. In the above example the WRZs water resources yield as of 31 March 2020 is 45Ml/d, however, as this is constrained by the amount available in the environment (source yield) this may reduce over time due to environmental factors such as climate change and changes to licensing of water resource abstraction.

The forecast impact of climate change on capacity should be consistent with the approach taken for deployable output reductions for WRMP19. Most companies' WRMP climate change reductions make use of factors and scalars from the latest climate change projections (UK Climate Projections 2009 - UKCP09) and the water resources planning guidance which are then applied to the deployable output. Therefore, for this example, climatic reductions to the water resources yield means that by 2025 the capacity for the WRZ will have reduced by 3Ml/d and therefore the reported pre-2020 capacity for that year would be 42Ml/d.

Alongside climate change, water resources yield can also change due to:

- water quality impacts on source yield
- abstraction licence changes (under the current framework)
- future abstraction reform impacts
- changes to the actual asset/source base providing the supplies

Any changes in pre-2020 capacity (e.g. due to climate change impacts) will be calculated and forecast beyond 1 March 2020 over 25 years (consistent with the minimum planning period used for water resources planning). The changes to post-2020 capacity over time should also be forecast from the point in time that the capacity is commissioned as it is likely to be impacted by the same factors as the pre-2020 capacity. These forecast lengths reflect the long term nature of water resource schemes which ensures that the measure looks beyond 2020-25.

3.5 Approach to more complex capacity issues

The additional issues covered in this section include:

- Allocation of capacity between pre- and post-2020 (see section 3.5.1)
- Capacity and water trading (see section 3.5.2)
- Raw water trades with other incumbent companies (see section 3.5.3)
- Raw water trades with other third parties (see section 3.5.4)
- Abstraction licence changes (see section 3.5.5)
- Reporting planning scenarios (see section 3.5.6)
- Capacity re-assessment frequency (see section 3.5.7)

3.5.1. Allocation of capacity between pre- and post-2020

Pre-2020 capacity will include all existing commissioned assets (consistent with those assets included in the deployable output calculation for WRMP19) and any assets that are fully funded but yet to be commissioned as of 31 March 2020. This should include previously commissioned but now mothballed sites that only require network plus (e.g. connecting pipework) expenditure to make use of existing yield. Mothballed sites that would require water resources spend in order to make use of the yield would be excluded from capacity.

To avoid additional complexity in allocating capacity, we are only allowing transition expenditure (i.e. spending in the last year of PR14 for PR19 deliverables) in water resources in exceptional circumstances. Post-2020 capacity only includes new or upgraded capacity commissioned and available after 1 April 2020. This post-2020 capacity can include situations where sources/assets have been upgraded to provide more capacity than their original design capacity (as of 31 March 2020) but does not include maintenance of existing capacity.

3.5.2. Capacity and water trading

Water trading will be reported consistently with the RAG 4.08 activity envelope, meaning that trades that affect water resources yield volumes and therefore capacity will be for raw water only. Treated water trades where a company provides treated water to another incumbent company, whether this is to another company's treatment works, distribution system or directly to their customers, are not included in capacity. These are network plus related activities. The water resources yield (raw water) associated with the treated water trade will be part of the exporter's total capacity.

3.5.3. Raw water trades with other incumbent companies

A raw water trade is where another incumbent company still owns the assets and/or the rights to the raw water which is providing the additional capacity. If assets or water rights are purchased by one company from another, then this is not considered a trade but rather represents additional own source capacity.

Pre-2020 raw water traded capacity (from other incumbent companies) should be included in the capacity assessment and forecast for the company benefitting from the capacity (importer). An example of a current raw water trade between incumbent companies is the transfer of raw water to Severn Trent Water from Welsh Water. In this instance Welsh Water (exporter) would not include the water resources yield provided to Severn Trent Water in their own capacity. Severn Trent Water (importer) would include the traded raw water in their calculation of capacity. There should be

no double counting of traded capacity. This is similar to the deployable output assessment as used for WRMP where imports and exports are used to generate the supply-demand balance. The calculation of traded capacity should mirror the method used for own source capacity as discussed above.

A renewal of a raw water trade agreement would be equivalent to maintenance of pre-2020 capacity and therefore not represent new capacity. Where a renewed trade is for an additional volume of raw water and therefore increases the capacity, the incremental capacity component only would be considered as post-2020 capacity.

Capacity provided by raw water trades with other incumbent companies should be reported as part of the total capacity (own source added to traded capacity) – for both pre- and post-2020 capacity.

3.5.4. Raw water trades with other third parties

A water trade can also be with other third parties (who are not incumbent companies) that have their own access and rights to raw water. As with trades with other incumbents, a water trade is only considered where the third party retains ownership of the assets/water rights and agrees to trade water via a contract with the incumbent company.

Pre-2020 traded capacity (from other third parties) should be included in the capacity assessment and forecast of the company benefitting from the capacity (importer). An example of a current raw water trade between a water company and other third party is the water trade from the Canal & River Trust to Bristol Water. This capacity would be reported by Bristol Water in its pre-2020 capacity and its future contribution to the forecast. As above, a renewal of a water trade agreement would be equivalent to maintenance of pre-2020 capacity and therefore not new capacity.

Capacity provided by raw water trades with other third parties should be reported as part of the total capacity – for both pre- and post-2020 capacity.

3.5.5. Abstraction licence changes

Confirmed and likely abstraction licence changes should be included in the capacity forecast as per the final WRMP. A reduction in licence is one that impacts on the pre-2020 capacity.

Licence changes which are not forecast but agreed in period can form part of the limited re-assessment where necessary (see discussion in 3.5.7 below). It is not unexpected that a significant licence reduction would occur during a five year planning period, without exceptional circumstances.

3.5.6. Planning scenario reporting

The planning scenario is the length of time over which the quantity of water available (supply) and quantity of water required (demand) is measured and will be a key driver of water resources yield. There are two common planning periods that are used for WRMPs, these are:

- Average supply available in a dry year period (dry year annual average)
- Average supply available during a dry year peak demand critical period (dry year critical period)

For each WRZ, companies will have decided what planning period scenario(s) to use for the latest WRMP based on what the system is critical to. For the purposes of capacity, all the planning period scenarios as presented in the WRMP19 data tables should be reported. Consistent with water resource planning this may be just the one scenario (dry year annual average is compulsory) or both. This will reflect what the WRZ is sensitive to and should not create any additional work to develop scenarios that are unnecessary for that zone. For consistency between pre-and post-2020 capacity, the incremental capacity that a company proposes to develop during any price control period will also be defined using the same planning scenarios.

If there is a change in planning scenario for WRMP24 for which the pre-2020 capacity and its forecast was not calculated, then if this is material, the company will be required to back-calculate the pre-2020 capacity as it would have been for that planning scenario.

3.5.7. Capacity re-assessment frequency

The capacity as defined by water resources yield can change over time due to forecast changes (as would have been known as of 31 March 2020). However, as is the case with water resource planning, assumptions can change and new data become available.

There are also components which could affect capacity as reported for 31 March 2020 which are not forecast assumptions (e.g. change in level of service, baseline source yields, abstraction asset capabilities). These will only become known from a re-assessment of those elements. Under water resource planning, these components are fully assessed every five years with the submission of new WRMPs. There is also an option to publish updated data and forecasts as part of the WRMP annual review to reflect changes. A significant change in circumstances (resulting in changes to investment or impacts on the environment) would result in the re-submission of the WRMP within the five year period.

The following components of capacity could be updated as part of a re-assessment of assumptions and available data:

- change in agreed level of service (a system in a worse drought will yield less water)
- change in agreed planning period
- re-assessment of climate change impacts on source yield
- re-assessment of water quality impacts on source yield
- re-assessment of abstraction licence changes (under current framework)
- re-assessment of future abstraction reform impacts (including new unforeseen requirements)
- re-assessment of source yields
- re-assessment of raw water abstraction asset capacities
- re-assessment of WRZ integrity

The re-assessment of pre-2020 capacity will be considered on the same basis as for WRMPs, which will be every five years unless there is material change and a WRMP re-submission. This can be considered as a limited re-assessment approach. Therefore the baseline assumption for post-2020 capacity should be the same as pre-2020, namely a five yearly re-assessment frequency in line with WRMP reporting.

However, post-2020 capacity will be small and uncertain in nature and there is greater importance of ensuring that what is reported is accurate. Linked to this point we expect post-2020 capacity to be updated more frequently (with justification) so that updated forecasts and actual post-2020 capacity is reliable. This means the reporting of post-2020 is closer to asset specific contributions than the more aggregate pre-2020 capacity approach.

The post-2020 capacity assessment should also match the bilateral entry reporting whereby forecasts and actual capacity from bilateral entrants can be updated more frequently to ensure they accurately reflect market development. Companies should report year on year forecasts per WRZ per planning period scenario for pre-2020 capacity, post-2020 capacity, and post-2020 bilateral entry capacity.