ATKINS

AMP6 Reporter

Draft Water Resource Management Plan 2019 Assurance Report

Bristol Water

23 November 2017

Contains *sensitive* information

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Assurance Statement for Bristol Water's Draft Water Resource Management Plan

Based upon our audits of Bristol Water's Draft Water Resources Management Plan 2019 and the supporting information we saw over a programme of audits during August, September and October 2017 (See Appendix A.), we conclude that for the reporting of areas we covered, other than where indicated otherwise in our report:

- at a component level the various teams compiling the documents and information had a reasonable understanding of and were following industry best practice;
- the Company has applied sufficient processes and systems of control to meet its reporting obligations;
- the Company's explanations of where and why it is not following industry best practice are soundly based;
- the Company has sufficient processes and internal systems in place to identify, manage and review its reporting risks; and
- the Company's explanations of how it will manage and/or mitigate material or potentially material reporting risks are soundly based.

Our overall impression from the audit meetings was that the process of compiling Bristol Water's Draft Water Resources Management Plan 2019 and the supporting information was generally based upon the application of processes that are industry norms. The lack of investment identified in the Draft Water Resources Management Plan 2019 is such that any shortfalls against full application of industry best practice, as discussed in our report, will have no material impact upon the information reported. If the scale of investment changes significantly before the final Water Resources Management Plan 2019 there will need to be significantly more supporting evidence provided for key assumptions made and to underpin the costing of schemes.

Our assessment is based upon the Company implementing its process as explained to us at the time of the audits and providing appropriate text and appendices to its submission.

While we observed a number of issues for which we provide comment within the main report, we believe these do not impact materially upon the potential to sign-off the Company's draft Water Resources Management Plan 2019 submission. Each is an area we believe should be given further consideration as part of continuing improvement towards Bristol Water's final Water Resources Management Plan 2019.

During the assurance activities, we have had free access to the people responsible for preparing and reporting the draft Water Resources Management Plan 2019 submissions and the supporting information.

Jonathan P Archer
Regulation Director
Reporter providing Technical Assurance Services to Bristol Water

Executive summary

Introduction

This report summarises the external technical assurance (Reporter) services Atkins has provided in relation to aspects of Bristol Water's Draft Water Resource Management Plan (dWRMP) for the 2019 Periodic Review. This is our third year of providing assurance services to Bristol Water and the first time that we have provided assurance for the dWMRP. Our approach has been shaped by the expectations of the assurance to be provided for a "prescribed" water company. Throughout, we have received the cooperation of the Company and have had the freedom to express our opinions.

Approach

We carried out a series of structured audits, which we tailored to the different technical areas covered. Our methodology and data audits were combined due to the nature of the technical submission. The WRMP is a highly technical document and our approach to auditing reflected that. Our focus on particular areas was risk-based and derived through our own experience of developing WRMP guidance and submissions, plus our understanding of data management, quality assurance (QA) and associated risks and sensitivities gained as part of our general audit activities.

After detailed planning of an audit schedule to ensure the appropriate people (Company and technical auditors) are present, we formally notify all parties of the expectation of the audits. We provide immediate verbal feedback and document our audit findings in both a rapid feedback e-mail and a detailed audit summary. These provide the Company with the opportunity to correct errors of fact and respond with explanations or further information to our observations. The essence of the summaries is captured in an Action Log which is used to manage the progress on matters arising. The supporting documentation is available for inspection.

Summary of Findings

For this review we note that much of the data were not finalised at the time of audit, so our comments reflect the expected quality of the methods and data given our observations at audit.

Based upon our audits of aspects of Bristol Water's dWRMP we conclude that, for the reporting of areas we covered, and except where noted specifically below, the Company has collated its submission in accordance with the Water Resources Planning Guidelines and the associated UK Water Industry Research (UKWIR) guidance notes referred to in those guidelines. We also consider that the technical approaches that have been followed generally comply with standard water industry practice to a level that is appropriate to the relatively low level of investment that is proposed within the dWRMP. As shown in Table 0-1 below we did identify a number of areas for improvement or clarification, some of which could be considered to be significant and may attract regulatory questions or scrutiny. However, overall, we consider it is unlikely that these will materially affect the plan, as there is little investment proposed under the draft supply/demand forecasts and relatively little scope for movement from that position. At this draft stage we cannot reasonably comment on the likelihood that the WRMP will be ultimately acceptable to the Secretary of State, but we have not seen any issues that mean we consider the plan is at risk of being fundamentally flawed.

Each area reviewed at audit was allocated an overall rating of Red, Amber or Green to reflect their priority, with separate ratings for the methodology and the data (see tables below). Descriptions for each category are given in the table below.

Category	Description
RED	High Priority: Failure to comply with reporting requirements, major failure of methodology or data errors that may lead to misreporting.
AMBER	Medium Priority: Shortfalls in methodology and/or methodology documentation. Methodology under development. Incomplete data set or minor errors identified that do not alter the performance reported relative to targets and threshold values.
GREEN	Low Priority: Minor revisions to methodology and/or methodology documentation needed. Issue(s) not judged to be material or no issues.

Table 0-1 Draft Water Resource Management Plan 2019 – Overall Assessment

Technical component	Methodology	Data
Target headroom	GREEN	GREEN
Outage	GREEN	GREEN
Climate change	GREEN	GREEN
Demand forecast	GREEN	GREEN
Decision-making model	AMBER	GREEN
SELL assessment	AMBER	GREEN
Options development and appraisal	GREEN	GREEN
Options costing	GREEN	GREEN
WRMP modelling and resilience analysis	AMBER	AMBER
WRMP tables	GREEN	AMBER
SEA / HRA	GREEN	GREEN
WFD	GREEN	GREEN

Our findings during audit and subsequent discussion with Bristol Water indicate that it should be feasible to address all of the 'amber' issues before the final WRMP submission.

1. Introduction

1.1. Background

Atkins Limited has been appointed by Bristol Water to provide external assurance on the regulatory submissions presented by Bristol Water (the Company) under the conditions set out in its Licence with the Secretary of State.

This report summarises the external technical assurance (Reporter) services Atkins has provided in relation to aspects of Bristol Water's Draft Water Resource Management Plan (dWRMP) for the 2019 Periodic Review. This is our third year of providing assurance services to Bristol Water and the first time that we have provided assurance for the dWMRP. Our approach has been shaped by the expectations of the assurance to be provided for a "prescribed" water company. Throughout, we have received the cooperation of the Company and have had the freedom to express our opinions.

The WRMP is a highly technical document so the purpose of our assurance is to comment on the compliance of the process and methods that Bristol Water has used with the relevant Environment Agency Water Resources Planning Guidance and good practice technical documents that are referred to by that guidance. Where we have identified potential issues, we have sought to gain an understanding of the materiality of those issues by evaluating the risk that they might have on the regulatory and stakeholder acceptance of the WRMP, and on the overall level of interventions and investments proposed within the plan.

1.2. Scope

The scope of the audit is shown in the table below.

Table 1-1 Draft Water Resource Management Plan 2019 Scope

Technical component	Methodology and Data Audit Completed
Target headroom	✓
Outage	✓
Climate change	✓
Demand forecast	✓
Decision-making model	✓
Short-run Sustainable Economic Level of Leakage (SELL) assessment	✓
Options development and appraisal	✓
Options costing	✓
WRMP modelling and resilience analysis	✓
WRMP tables	✓
SEA / environmental assessments	✓*

*Remote audit

This report is structured as follows:

- Assurance Statement
- Executive Summary
- Section 1 – Introduction
- Section 2 – Approach
- Section 3 – Summary of Findings

2. Approach

Our overall approach to assurance is based around a two-stage audit - methodology and data. For the provision of assurance of the Draft Water Resource Management Plan, the methodology and data audits were combined.

The purpose of each audit type is as follows:

Methodology Audits: To assess whether the Company's methodology aligns with appropriate guidance, reporting requirements, licence conditions or industry practice and whether appropriate checks, controls and explanatory documents exist.

Data Audits: To assess whether methodologies/procedures are applied as indicated including data trailing to source documents to ensure alignment/consistency with the reported number, checks and controls and appropriateness of confidence grades assigned to reported information (where applicable).

This approach is consistent with Ofgem's Data Assurance Guidance (DAG) which identifies external methodology audit and external data audit as potential 'assurance responses', described as follows:

External Methodology Audit: Not responsible for ensuring that returns are complete and accurate but to provide an independent challenge to the methodology to produce the submission. Review of the adequacy and effectiveness of the internal control systems to ensure returns are timely, complete and accurate. Formal report produced. Control gaps/areas for improvement identified and issues logged.

External Data Audit: Responsible for providing evidence of verification of Data; Intends to determine the level of confidence that can be placed on the figures; Formal report produced.

The process flow followed for each audit is summarised as follows:

Figure 2-1 Audit meeting process

The deliverables for each stage of the process are summarised below in Table 2-1.

Table 2-1 Description of Deliverables

Deliverable	Description
Notification of Audit Form (NAF)	Issued in advance of audit. Details audit arrangements, scope and agenda.
Email summary	Initial feedback including detail of any material issues.
Summary of Audit Form (SAF)	Issued following the audit. Details findings and any actions for inclusion in the issues log.
Issues Log	Spreadsheet to track and report on responses to issues identified at audit. Includes Reference; Date Raised; Raised by; Line; Observation; Recommendation; Priority; Agreed (Y/N); Company response; Owner; By when; Status

Our assessment of the Company's reporting against each technical component has been assigned an overall rating of Red, Amber or Green to reflect their priority. Separate ratings have been given to the methodology and to the data.

Table 2-2 sets out the definitions for the different categories.

Table 2-2 Descriptions for RAG categories

Category	Description
RED	High Priority: Failure to comply with reporting requirements, major failure of methodology or data errors that may lead to misreporting.
AMBER	Medium Priority: Shortfalls in methodology and/or methodology documentation. Methodology under development. Incomplete data set or minor errors identified that do not alter the performance reported relative to targets and threshold values.
GREEN	Low Priority: Minor revisions to methodology and/or methodology documentation needed. Issue(s) not judged to be material or no issues.

Our focus on particular areas was risk-based as highlighted in Bristol Water's own analysis and supplemented by our experience in identifying and quantifying the elements of the journey from raw to published data that introduce material errors.

3. Summary of Findings

The table below summarises the assurance category assigned to each technical component of the dWRMP. Details of each technical component are provided within the sections that follow.

Table 3-1 Draft Water Resource Management Plan 2019 – Overall Assessment

Technical component	Methodology	Data
Target headroom	GREEN	GREEN
Outage	GREEN	GREEN
Climate change	GREEN	GREEN
Demand forecast	GREEN	GREEN
Decision-making model	AMBER	GREEN
SELL assessment	AMBER	GREEN
Options development and appraisal	GREEN	GREEN
Options costing	GREEN	GREEN
WRMP modelling and resilience analysis	AMBER	AMBER
WRMP tables	GREEN	AMBER
SEA / HRA	GREEN	GREEN
WFD	GREEN	GREEN

3.1. Target headroom

For dWRMP19 Bristol Water has opted to use the well-established UKWIR 2002 headroom methodology ("An Improved Methodology for Assessing Headroom, 2002"). This selection was based on the outcome of the Problem Characterisation assessment (a requirement of the UKWIR Decision Making Tools guidance), which identified the Company's single Water Resource Zone (WRZ) as low risk. The latest UKWIR (2016) Risk-Based Methods guidance advises that this is an appropriate method to use for low risk WRZs. This is the same methodology as was used for WRMP14, although the assumptions used under each of the headroom components have been reviewed and updated in most cases. Our review of the modelling process confirmed that the model itself works as intended and in accordance with the accepted methodology.

We discussed the main changes in the selection of relevant components for dWRMP19 as compared to WRMP14. Overall, we were satisfied by the Company's reasoning for the selection of headroom components for dWRMP19. We reviewed each headroom component used within the model; these are discussed in turn below.

3.1.1. S5-1: Gradual pollution of sources causing a reduction in abstraction

The assumption now being used is that there is a 5% chance that Egford could be polluted due to hydrocarbon contamination. If this occurs then 100% of DO is lost for that year and the remainder of the planning period. We confirmed from the 'Forecast' tab of the model that this function is working properly. We were also able to confirm that the DO value for Egford used is consistent with the value included in the draft version of the dWRMP tables we saw at audit.

3.1.2. S6: Accuracy of supply side data

Bristol Water is using S6-1 to represent the uncertainty around the HYSIM analysis used to determine the yield available from the Mendip Reservoirs. A default +/- 10% uncertainty on source yield was used throughout the planning period, based on the UKWIR (2002) guidance. This appeared to be reasonable in the absence of site-specific data. We were able to trail the source yield figure to the dWRMP tables. For the groundwater assessment our audits under Section 3.9 highlighted concerns that the lack of a 'unified methodology' between groundwater and surface water meant that groundwater risks could be higher than originally assigned. We understand that following the audit Bristol Water has increased its headroom allowance to +/- 10% to offset this risk.

Bristol Water is using S6-3 to represent the uncertainty around the yield of the Sharpness Canal during a dry year. A +/- 10% uncertainty has been adopted as an indicative figure. Bristol Water reported that this approach is considered to be acceptable by the Environment Agency, although it was suggested by the EA that a 10% loss of DO from this source could alternatively be incorporated as a scenario within the DO forecast rather than within baseline headroom.

3.1.3. S8: Uncertainty of impact of climate change on supply

The Company has calculated the difference in DO between the most likely UKCP09 climate change scenario and each of the other 99 scenarios, and incorporated these in a discrete distribution where each has an equal likelihood (1%) of occurrence, as this was felt to closely represent the guidance. We trailed the 'central estimate' climate change impact values and this was consistent with the values used in the dWRMP tables.

3.1.4. D1: Accuracy of sub-component data

Bristol Water has used a normal distribution with a standard deviation of 1.5% of DI to represent the accuracy of DI meters. However, it appeared that the value of 1.5 has been used as an absolute value rather than a percentage. Bristol Water agreed to check and amend the calculation used in the model.

3.1.5. D2: Demand forecast variation

We were able to confirm that the most likely, high and low household and non-household demand forecast figures included in the model were consistent with the latest version of the demand forecast at the time of the audit.

3.1.6. D3: Uncertainty of climate change impact on demand

We were able to confirm that the most likely, high and low climate change impact figures included in the model were consistent with the latest version of the demand forecast at the time of the audit.

3.1.7. Correlations

Bristol Water has not included any correlations in the model. The only components the Company believes may be correlated are S8 and D3; however, it was reported that it would be challenging to implement this due to the setup of S8. As the impact of D3 is relatively small, Bristol Water considered that adding this correlation wouldn't have a significant impact. We agree with this conclusion but suggested that this could be tested as a sensitivity run.

3.1.8. Risk percentiles selected

The Company has provisionally selected a standardised risk profile to use as a glidepath, starting with the 95th percentile in AMP6 and AMP7 and reducing to the 70th percentile in 2045. This approach appears reasonable, although it had not yet been signed-off by the Board at the time of the audit.

3.1.9. Sensitivity analysis

The model is set up to undertake a sensitivity analysis at the same time as calculating the standard headroom figures. We did not review the individual calculations, but were satisfied with the approach.

3.1.10. Model and data QA

Although we did not find any discrepancies in the figures included in the 'Assumptions' and 'Input Parameters' tabs of the model, we recommended that links be added between these tabs (and others where appropriate) to avoid any future copy-paste errors should the figures be updated. This was subsequently undertaken. We also recommended that a section is added to the 'Audit Trail' or a separate tab within the model to provide evidence that the model has been checked.

3.2. Outage

For dWRMP19 Bristol Water has opted to use the UKWIR (1995) outage methodology ("Outage allowances for water resources planning"). This selection was based on the outcome of the Problem Characterisation assessment carried out by Bristol Water, which identified the Company's single Water Resource Zone (WRZ) as low risk. The latest UKWIR (2016) Risk-Based Methods guidance advises that there are three potential

methods that can be used for outage. Following a review of these by Amec Foster Wheeler, who were contracted to undertake the assessment, and in combination with the outcome of the problem characterisation assessment, the UKWIR (1995) method was considered by Bristol Water to be the most suitable for dWRMP19. We were satisfied with the explanation provided for the choice of approach.

3.2.1. Data sources and data trailing

Bristol Water's analysis of historical outage was based on data for the previous five years only, which is in line with the UKWIR (1995) methodology, to avoid inclusion of older outage data that may no longer be relevant.

Bristol Water commenced a review and rationalisation of the Company's outage data early in 2017 to identify all outages occurring between 2011 and 2016 and to calculate the duration and magnitude of each event. The nature of the outage was assigned based on emails provided by Operations. The collated data and proposed assumptions for the assessment were then discussed in a meeting with Bristol Water's local Operations Managers. We trailed several outage events included in the assumptions database back to source spreadsheets. In all cases the data in the assumptions database matched the source spreadsheets and we were satisfied from what we saw that the outage data used for the assessment were sufficiently robust. Bristol Water advised that some of the treatment works Deployable Output (DO) figures will be updated following the yield assessments currently underway for dWRMP19; therefore, we did not review these in detail. We recommended that model and data checks are recorded on the model cover sheet to provide evidence that these have been undertaken. The model was subsequently updated with these details.

3.2.2. Model function

Data from the outage assumptions database appeared to have been transferred correctly into the outage model. We reviewed the distributions used within the model; Bristol Water demonstrated that triangular and custom distributions had been used appropriately. Bristol Water confirmed that should any of the current data change in this respect, the distribution selection has to be manually changed and that this is covered in the user guide.

Bristol Water is planning to use the provisional outage percentile currently selected (95th) in the decision-making model and WRMP tables, as this already gives a low outage figure compared to other companies so taking a lower percentile would result in an even lower figure being taken. We were satisfied with this explanation.

3.2.3. Outage results

The current outage figure produced by the model (5.28 Ml/d based on the 95th percentile) is significantly lower than the WRMP14 figure of 17 Ml/d. For WRMP14 a five-year rolling average was taken and outage events over this period were not broken down by category, so this could have included some one-off events or those which would be unlikely to occur in a dry year. It also appears that outage levels were genuinely lower over 2011-2016 compared to 2008-2012 as the five-year rolling average over 2011-2016 was 2.6 Ml/d (compared to 17 Ml/d).

3.3. Climate change

3.3.1. Methodology

Although the Basic Vulnerability Assessment (BVA) carried out by HR Wallingford (HRW) for dWRMP19 found that the vulnerability of Bristol Water's single water resource zone (WRZ) had reduced from "high" in WRMP14 to "medium", the Problem Characterisation process highlighted sensitivities in the system that caused Bristol Water to carry out a level of assessment suitable for a zone of "high" vulnerability. HR Wallingford (HRW) were employed to select a representative sample (n = 100) of the 10,000 UKCP09 climate projections for the 2080s, and to generate flow and groundwater perturbation factors for Bristol Water's sources. These outputs were used in Bristol Water's mass balance model. We consider that this is a reasonable technical approach to take.

The climate change factor projections were selected for the correct geographical area (grid square 1582), based upon the reasoning that this area covered the majority of Bristol Water's WRZ and sources - other than the River Severn. We understand that this approach is consistent with WRMP14.

The application of climate change factors to hydrological models, groundwater and the water resource system model was found to be appropriate with the following exceptions and comments:

- The approach to perturbing groundwater yields did not split groundwater sources into “spring” and “deep” sources, unlike WRMP14. Although the “spring” sources were appropriately perturbed using factors derived by HRW using a “baseflow” separation method on the perturbed flow sequences, this was not done for the “deep” groundwater sources, mainly because it was felt that the lack of hydrogeological modelling or hindcasting that is available means that such an exercise would not produce reasonable results. This issue of the age and quality of groundwater DOs was discussed in the WRMP modelling and resilience audit (see Section 3.9), where it was agreed that this would be reviewed following WRMP19 and a greater headroom allowance used to cover the risk in WRMP19. Therefore, although technically this is of concern, because of that agreement, and because the impact of climate change on deep groundwater is unlikely to represent a risk of more than 1% to the overall WRZ level DO figure, we concluded that this is not a material risk to the plan.

- In assessing the DO of the system no account was taken of compliance with the current levels of service (LoS) other than the basic risk of breaching emergency storage. This was justified by the company based on the fact that control curves are likely to change anyway under future climates, so current LoS curves may not be appropriate. Commentary to this effect has now been included by Bristol Water in the dWRMP text.

We initially raised concerns over the lack of Emergency Storage allowance in the original calculations, but this issue was addressed prior to submission, as discussed under Section 3.9 of this report

3.3.2. Data

QA processes applied by the consultant that generated the data were reviewed and found to be acceptable. We noted that the inflows sequences used in this assessment end in 2009 and have not been updated since the previous WRMP. The auditee had discussed this with the EA, and was committing to update the flow records following WRMP19, but as there have not been any significant drought events then this does not represent a significant risk to WRMP19.

3.3.3. Models, Results and Reporting

All of the hydrological and mass balance models that were used for climate change are the same as those used for the baseline DO and resilience assessment, as described under Section 3.9

3.4. Demand forecast

This audit focused on the baseline demand forecast within Bristol Water’s baseline supply-demand balance. This included a review of the population, property and occupancy forecasting, household consumption forecasting and non-household consumption forecasting elements of the dWRMP19. We reviewed both the methodology and assumptions used for each of these elements and were satisfied with the overall approach taken and models used.

We provided queries regarding the impact of climate change on demand and inclusion of growth scenarios in headroom. We suggested that calculations and data sources were clarified within the models to reduce the risk of error in future iterations and to aid Bristol Water in their future use of the models, and recommended that clearer source data logs and evidence of model checks are included throughout.

The review of the methodology and assumptions behind each of the demand forecasting elements are discussed in turn below.

3.4.1. Population, property and occupancy (POPROC) forecasting

The methodologies used to assess and forecast population and property for the area were in accordance with the UKWIR 15/WR/02/81 guidance, and the population, property and occupancy forecasts were calculated using the Official National Statistics (ONS) data: “trend”, and local authority information: “plan” using an appropriate methodology. Our recommendations were therefore focused on QA and model logs, as discussed above.

3.4.2. Household consumption forecasting

We were satisfied that household consumption methodology document outlines how the methodology aligns with best practice guidelines for household demand forecasting. Our recommendations around clarifying some of the methodological steps in the report and formatting spreadsheets, including input data filename logs for QA purposes and version control, were addressed post-audit. We noted that the Dry Year Uplift (DYU) factor is now half the size of the DYU factor applied in WRMP14, and understand that this is primarily a result of the changing best practice guidance, and more reflective of recent Distribution Input experience. Although the calculations appear to be in line with current good practice, we recommend that Bristol Water consider this change more fully, as it is important to explain this difference in the Final WRMP submission.

3.4.3. Non-household consumption forecasting

Overall, absolute growth in non-household demand is about the same across the planning period, when comparing the WRMP14 and WRMP19 forecasts, so, there is no significant change in growth, but a higher base year figure for 2016/17 is now being used (based on actual demand). We recommend that Bristol Water include text within the dWRMP to explain why the new approach is considered more robust than the previous NERA method and why this has now been adopted. The audit revealed a small discrepancy between a few of figures presented in the report which have since been addressed.

3.5. Decision-making model

Currently Bristol Water does not have to make use of its decision-making tool for the dWRMP, as there is very little investment required beyond the 15% leakage reduction recommended by the short-run Sustainable Economic Level of Leakage (SELL) assessment described in Section 3.6. This fact is reflected in the evaluation of risks and issues described below.

The decision-making model that has been developed is similar to WRMP14, as it incorporates a Genetic Algorithm to provide a non-linear form of EBSD model, although it does not currently incorporate the interactions between mains renewals and leakage that were contained in the previous tool. Overall, we consider that the approach is appropriate to the level of risk, as defined by the Problem Characterisation. The inputs to the tool were still being finalised at the time of audit, but we found that the methods and QA that were available were generally adequate, with the notable exception of a model log, which we recommend is developed before the tool is used for decision making purposes.

We did find two technical issues with the model and inputs that would be of potentially significant concern if it was being used to justify large scale investment. These were:

- The model is currently unable to reflect utilisation factors, either due to frequency of use or capacity need (i.e. partial use of a scheme). It will therefore tend to unrealistically favour interventions such as leakage/demand management in its current set-up.

- The leakage schemes as they were configured did not account for transitional and ongoing costs.

Although technically significant, these issues should be reasonably straightforward to address through changes to option input matrices. Given the current status of the model inputs, it is unlikely they could be

[1] WRMP19 Methods: population, household property and occupancy forecasting guidance manual (Report ref. no. 15/WR/02/8).

addressed prior to the dWRMP submission. As they are unlikely to change the overall plan they have only resulted in an 'amber' risk rating on the methodology side for this report.

3.6. SELL assessment

The SELL assessment was not yet complete at the time of the audit, so the audit focussed on the expected approach and modelling carried out to date.

The derivation of the ALC cost curves and pressure management demonstrate good industry practice. However, we consider that it would be prudent to confirm the representativeness of the weather conditions in the years used as the basis of the analysis. We have been advised that this has been confirmed post-audit, though at the time of writing we had not yet seen an accompanying reported or updated analysis spreadsheet.

To be able to demonstrate integration of the SELL and WRMP it will be important to offer a full range of leakage options to the EBSD model if a long run marginal cost analysis has to be carried out. In particular, we consider that supply pipe options should be integrated into the SR-SELL and EBSD options set. The decision-making tool model structure should be able to incorporate such options, but these had not been formulated as part of the SELL work at the time of the audit. We have been advised supply pipe options have now been incorporated post-audit, though at the time of writing we had not yet seen an accompanying reported or updated analysis spreadsheet.

Given the history of leakage reduction nationally and at Bristol Water, we note that it unusual that the SR-SELL assessment indicates that ~4 Ml/d (15%) of ALC leakage reduction is justified on the basis of savings in marginal production costs from existing sources. Bristol Water consider that it is realistic, as the ALC savings are readily deliverable and that the marginal cost of their existing sources is relatively high. A reduction of 15% in leakage is also in line with Ofwat's stated expectations. However, we note that the current uncertainties over reported leakage figure, as identified during the APR audit process, and the uncertainties caused by the Leakage Convergence Method, mean that this finding should be carefully reviewed prior to submission of the final WRMP. We would expect to see some analysis of why the SELL has dropped in comparison to WRMP14 as part of the dWRMP text. We also note that there are uncertainties with the current level of leakage as a result of Ofwat queries around non-household night use allowances following APR17, and the results of the Water UK Leakage Convergence assessment that Bristol Water carried out in parallel with the APR17 submission.

Although we are generally confident in the methods and procedures used to evaluate leakage economics, the large proposed reduction in leakage (15%) under SELL, the uncertainties in the current level of reported leakage and the lack of formulation of different strategies mean that we consider an 'amber' classification needs to be applied to the overall methodology.

3.7. Options development and appraisal

We can confirm that, based on the information provided, the Company has undertaken an options development and appraisal process that is consistent with statutory guidance and UKWIR developed methodologies.

The Company has considered a wide range of options covering all elements of the supply process including catchment management, metering, demand management, water resources, production, and water trading (bulk supplies and licence opportunities). The Company has developed a detailed approach to excluding options from the unconstrained list and subsequently from the feasible options list for options to be taken through to the constrained list for inclusion in the investment modelling. The risk criteria and scoring mechanism appear appropriate.

We note that all distribution options were subsequently taken on board within three distinct programmes following the outcome of the SELL modelling; this approach appears reasonable to maintain consistency with SELL.

The options sheets have good version control with check and review and links have been provided, where appropriate, to evidence to support options development and assessment.

3.8. Options costing

The cost estimates for the projects to be included in the WRMP have not yet been developed using the proposed methodology from Ofwat for the Price Review 2019, as this is currently only at the consultation stage. Currently Bristol Water has not gathered evidence of benchmarking of the projects against other Bristol Water or other water companies' costs and so we found no demonstration that the cost estimates represent an efficient level of cost. The Project Definition of the projects were at an early stage and had at best only a high level attached scope for the Projects, the more defined projects being based upon scopes that were developed during PR14.

The cost estimates therefore provide for an order of magnitude cost only with an assessed accuracy of +/- 30%. We consider that this reasonable for a preliminary outline designed, and given the lack of supply side investment we have therefore categorised the risk as 'green'. Confidence in supply side costs would need to be improved if significant investment becomes necessary due to updates of the supply/demand balance between the draft and final plans.

3.9. Deployable Output modelling and resilience analysis

There have only been three changes made to the 'base' DO calculated from an analysis of the historic record since WRMP14. These all affect the assessment of the Mendips sources and are as follows:

- The 1933/34 worst historic drought year has been included within the Level of Service requirement, so the DO is effectively defined by the level of demand that can be met without breaching emergency storage (ES) in that year. Originally this was set so that a dead storage breach was required before levels of service were compromised, but this was updated following our challenges at audit, as this did not represent good practice in accordance with the Manual of Source Yields.

- The ES allowance has been appropriately re-calculated in light of the northern and southern resilience schemes.

- The benefits from Temporary Use Bans (TUBs) have been updated in accordance with the Drought Plan.

We therefore consider that the changes are appropriate and represent an improvement over WRMP14. In terms of Bristol Water's other sources, we note that the groundwater DOs still use 1976 data. This is not consistent with the Mendips surface water design scenario and hence good practice methods for conjunctive use assessment, particularly as calculations based on the 1933/34 drought would likely result in a lower DO for groundwater. Whilst this is a concern, it would have to be addressed as a wider package of re-assessment to update groundwater DO, so cannot be realistically carried out for WRMP19. As a result of our audit Bristol Water has therefore increased the headroom allowance for groundwater to cover this risk as an interim measure, and intends to update the groundwater assessment following WRMP19. The Sharpness yield calculations also continue to rely on 1976, but that represents a conservative view and it is unlikely that average yield would reduce significantly if the analysis were updated for 1933/34, so we are not concerned on that point.

For the Table 10 resilience assessment we reviewed the draft text and table data on risks and return periods, and have concerns that the severity of the 1933/34 event has been over-stated and the risk during a 1 in 200 event is likely to be higher than the analysis provided in the dWRMP. The technical details surrounding this were discussed at audit and generally agreed, and some further analysis will be undertaken prior to submission, although a more detailed evaluation is likely to be required for the final WRMP. Although this introduces some uncertainty, we note that Bristol Water's Level of Service commitments mean that they would be able to utilise emergency storage under 1 in 200 year type events, so there is mitigation against the resilience risk that these events pose. This, plus other mitigating factors relating to extended timescales for the use of drought permits and TUBs means that it is unlikely the revisions to resilience risk would fundamentally alter the nature of the WRMP.

Based on the above review we consider that the issues identified warrant an 'amber' classification on both methodology and data, but they are not a fundamental risk to the integrity of the plan.

3.10. WRMP tables

The tables have been completed according to reporting requirements, but we note that the very low incremental costs that have been entered for leakage control are likely to attract regulatory attention. These are not material in the overall context of the Business Plan totex, but are likely to be regarded as significant by the EA.

3.11. Environmental assessments

3.11.1. Strategic Environmental Assessment and Habitats Regulations Assessment

We reviewed the SEA and HRA methodology and outputs, and environmental inputs to Bristol Water's options development process and were satisfied with the overall approaches taken and the outputs that were available for review. Minor comments were made regarding the treatment of uncertainty in the option fine screening process, references to the SEA of the 2014 WRMP (and its implementation), and clarity of influence of the SEA for the testing of alternative plan scenarios.

3.11.2. Water Framework Directive assessment

We reviewed the WFD screening spreadsheet, WFD assessment methodology and WFD inputs to Bristol Water's options development process and were satisfied with the overall approaches taken and the outputs that were available for review. Comments were made regarding i) the consistency across and between the documents, ii) how the Resource options have been chosen for Level 1 screening iii) the methodology relating to the lack of detail for Level 2 assessment to inform the preferred options. However, these all represent ongoing improvements rather than significant issues with the submission, and the lack of supply side investment means we have categorised these as 'green' risks.

Appendix A.

A.1. Meeting Record

Table A-1 Draft Water Resource Management Plan 2019 Audits Meeting Record

Performance Measure/ Purpose	Owner/Auditee	Auditor	Audit Date
Assurance scope delineation	Keith Hutton/James Holman/Edward Barnes	Jonathan Archer	11/05/17
Assurance WRMP scoping	Patric Bulmer/Liz Cornwell	Jonathan Archer	29/06/17
Target headroom	Liz Cornwell / Tom Roach (Atkins)	Monica Barker	31/08/17
Outage	Krystian Taylor / Liz Cornwell / Katy James (Amec), Paul Davison (Amec)	Monica Barker	05/09/17
Climate change	Liz Cornwell / Ralph Ledbetter	Rob Tothill	18/09/17
Demand forecast	Rob Lawson / Sarah Rogerson / Liz Cornwell	Joanne Parker	11/09/17
Decision-making model	Damian Staszek / Liz Cornwell	Doug Hunt	27/09/17
SELL assessment	Michelle Ashford / Georgina Cope / Bill Brydon / Mike Butler / Mathias Pacalin (part) / Damian Staszek (part)	Graydon Jeal	20/09/17
Options development and appraisal	Krystian Taylor / John Sanders / Shawn Beatson	John Sutherland	29/09/17
Options costing	Andrew Ware / Patric Bulmer / Krystian Taylor	Nic Hillier / Chong Diong	25/09/17
WRMP modelling and resilience analysis	Liz Cornwell	Rob Tothill / Doug Hunt	11/10/17
WRMP tables	Shawn Beatson; Damian Staszek	Doug Hunt	13/11/17
SEA / environmental assessments	Pete Davis	Heather Coutts / Suzie Maas	N/A – remote audit

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