

WRMP19 Peer review of  
decision making

Supporting Appendix 10D

15 August 2019

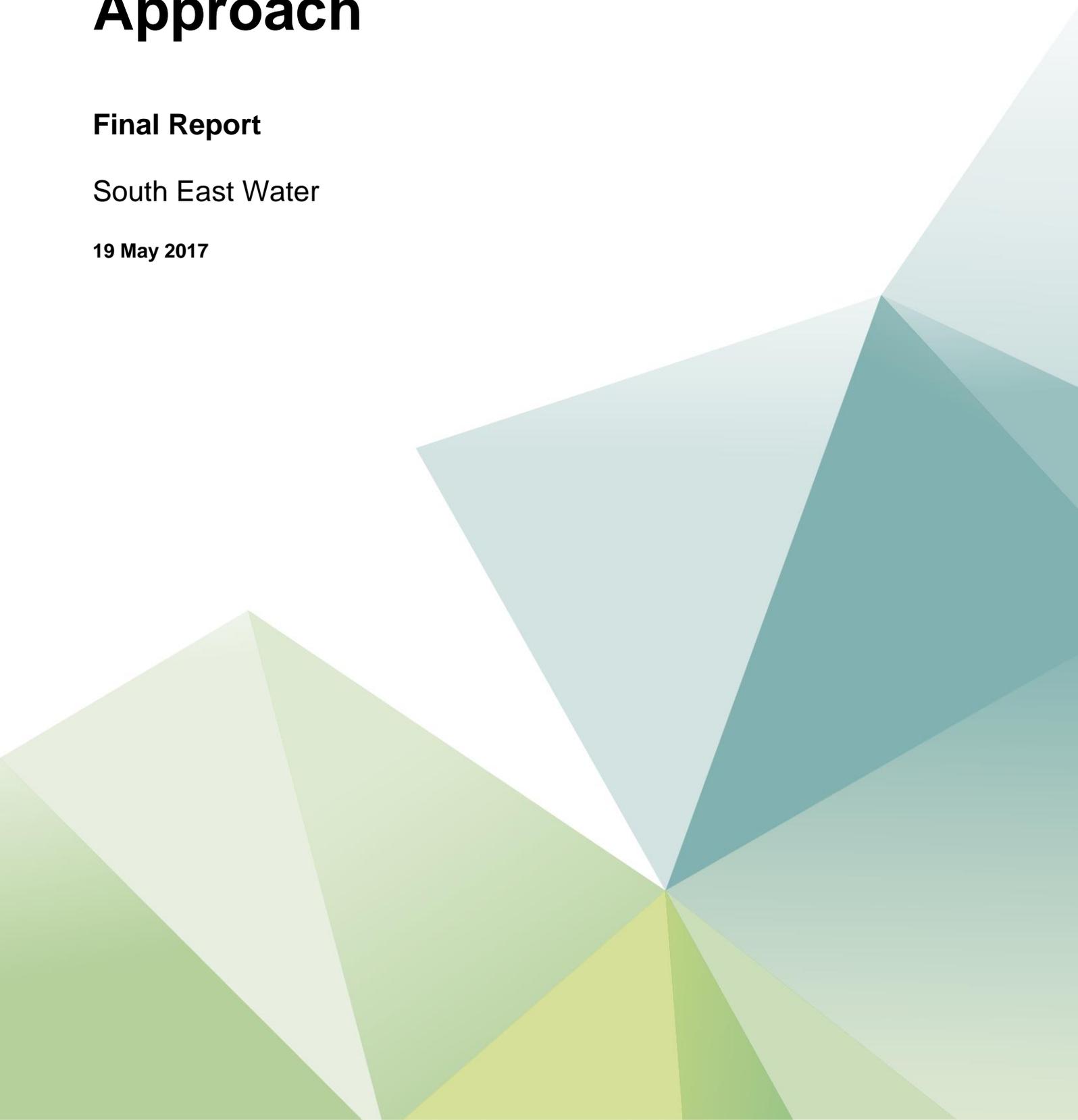
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# **Peer Review of SE Water's Approach**

**Final Report**

South East Water

19 May 2017



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This document has 13 pages including the cover.

## Document history

Job number: 5143998			Document ref: 5143998_SEW_DG_006			
Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
Rev 1.0	Draft for Client	HG / DJH / BSP		DJH	BSP	28/04/17
Rev 2.0	Final for Client	HG / DJH / BSP	HG	HG	HG	19/05/17

## Client signoff

Client	South East Water
Project	Peer Review of SE Water's Approach
Document title	Peer Review of SE Water's Approach
Job no.	5143998
Copy no.	
Document reference	5143998_SEW_DG_007

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# 1. Introduction

- 1.1. The purpose of the Peer Review is to assess the approach to Decision-Making which South East Water is adopting for its Water Resource Management Plan 2019 (WRMP19) in the context of:
- The UKWIR WRMP 2019 Methods projects whose output are now enshrined in the latest Environment Agency WRMP19 Water Resource Planning Guideline; and
  - Work undertaken under the Water Resources in the South East (WRSE) programme.
- 1.2. The Decision Making Peer Review was undertaken by the following Atkins staff:
- Doug Hunt – Technical lead Water UK Water resources long-term planning framework (2015-2065), September 2016; Technical lead WRMP 2019 Decision Making Process: Guidance, Report Ref: 16/WR/02/10; and
  - Ben Piper – Atkins Technical Reviewer Water UK Water resources long-term planning framework (2015-2065), September 2016; Project Director UKWIR Decision Making Process: Guidance project.
- 1.3. The WRSE Peer Review was undertaken by:
- Helen Gavin – WRSE Programme Manager.
- 1.4. The audit was undertaken as follows:
- Conference calls: SEW and Atkins;
  - Review of SEW documentation; and
  - Face-to-face meeting with SEW and decisionLabs (Decision Making element only).
- 1.5. The Peer Review was focussed on the interpretation and application to SEW supply area of the current Water Resource Planning Guideline and UKWIR methodologies, and to assess the consistency of the approach with the approaches being taken for WRSE. Where the review of draft documentation has noticed inconsistencies and/or typographical errors these have been noted, but this should not be interpreted as an in-depth document review.
- 1.6. Section 2 of this report is the review of South East Water's interpretation and adoption of the UKWIR Report 'WRMP 2019 Methods –Decision Making Process: Guidance'.
- 1.7. Section 3 of this report is the review of South East Water's interpretation of WRSE. This Section also include editorial comments on the current draft of the report 'Decision Making Approach and Appendices', v1.3 and its associated Appendices.

## 2. Review of SEW's WRMP19 Decision Making Approach Methodology

### Introduction

- 2.1. This Section covers the review of SEW's interpretation of the 'UKWIR Report 'WRMP 2019 Methods – Decision Making Process: Guidance' through a review of SEW draft report and a working demonstration of the model and screenshots of typical outputs from model runs.

### Meetings, documentation and approach

- 2.2. The following meetings covered the Decision Making Approach:

- Start-up telecon: 23<sup>rd</sup> March;
- Progress telecon: 18<sup>th</sup> April; and
- Meeting with SEW/decisionLabs: 20<sup>th</sup> April

- 2.3. The Peer Review was based on the following documents:

- Problem characterisation spreadsheet, January 2017Ver0.3; and
- Decision Making Approach and Appendices, v1.3.

- 2.4. The telephone discussion and review of documentation provided informed the approach to the meeting with SEW/decisionLabs. The meeting had the following objectives:

- To clarify interpretation of written documentation to confirm where some modifications to the approach might improve interpretation of the work undertaken to date and communication of the outcomes of the model and the implications for WRMP19 decision making; and
- Review the workings of the model with reference to an example model run with a limited number of scenarios and with WRSE example data.

### Findings

- 2.5. **Overall.** The approach appears to be a valid interpretation of an aggregated version of an Info Gap Decision Theory (IGDT) method, which incorporates testing of droughts more severe than the historic record, as required by the Environment Agency Water Resource Planning Guideline (WRPG, Interim Update, April 2017). As discussed below, some adaptation of the presentation of outputs is recommended, along with the inclusion of the results of the MCA stage as a key IGDT output in their own right.

- 2.6. **Target headroom.** In response to the query of whether target headroom is being double counted (as scenarios are being used to explore supply and demand forecast uncertainties), SEW confirmed that target headroom had been included as a fixed value – set as the base year – throughout the planning period. There is therefore no double counting.

- 2.7. **Demand management (DM).** DM option sheets showed that DM options follow a deterioration profile (i.e. an initial value followed by a deteriorating benefit), and renewal is not an option within the modelling. This may not be acceptable to stakeholders, but it is acknowledged that modelling this 'properly' will be extremely difficult. Given the very small level of benefit involved, adopting a similar approach to that taken for leakage options was suggested, namely fix DM options on the baseline, and then allow the model to select options.

- 2.8. Benefits of Temporary Restrictions.** The method does incorporate allowances for temporary restrictions when severe droughts are being considered, but we had some concerns these were being over-estimated in some cases (and should not be included for those WRZs where the DO has been modelled through Kestrel-IHM). Consideration therefore needs to be given to the assumptions across WRZs of the percentage reductions in demand that arise from the imposition of restrictions (TUBs). In addition, some variability may need to be introduced in relation to the penetration of household metering, which could lead to different percentage reductions in demand associated with TUBs.
- 2.9. Ratcheting.** SEW explained that the concept of 'ratcheting' applied to DM options, in that once selected, the option then remains selected for the remainder of its asset life. This is reasonable and consistent with most approaches of this type.
- 2.10. Scenarios.** It was confirmed that all scenarios can be run, though to allow for shortened runtimes at the meeting, a reduced number of scenarios was used to illustrate the functionality of the model and to answer queries raised at the meeting by the reviewers.
- 2.11. Outage and Stress Testing.** A possible double counting issue was identified in discussion of Stress Testing. Any hazard contributing to outage and hence to WAFU should not be included in the assumptions used for Stress Testing of Extreme Events (as reported in Appendix E, Section 6.3, of the 'Decision Making Approach and Appendices' report). In addition, we noted that the combined probabilities of some of the events that are included in the stress testing occurring at the same time as a worst historic type event (or worse) are extremely small and it may not be appropriate to use the same deployable output (DO) in the stress tests as is used in the MCA analysis stage (e.g. 1 in 10 type drought events may be more appropriate to test at the same time as some of the stress test hazards).
- 2.12. Utilisation factors.** Appendix E Section 3.1.1.3 sets out the assumptions used for utilisation factors that apply to non-drought and drought conditions. The percentages shown in Table 4 need to be checked and additional explanatory text included, as currently they do not appear to be probability weighted. It may be that the values are constant across the drought severities, as the use of schemes will be triggered by the frequency and duration spent below control curves, which may not vary much across different drought severities; the recent Drought Plan analyses give some illustration of the interaction between return periods and expected duration, but this may be too complicated to include in the current WRMP.
- 2.13. Approach to MCA.** The model uses a '4-states of the world' approach for MCA. The criteria used have been the subject of stakeholder consultation. We note that MCA is not included in the solution objective, and it is not possible to examine how options chosen to meet certain MCA criteria might affect the cost of the preferred programme. However, it is unrealistic to include this in the timescales available, and the outputs from the modelling should support the WRMP19 decision making as they are.
- 2.14. Annuity.** In line with conventional best practice, the standard approach to annuity of Capex has been used.
- 2.15. InfoGap Decision Theory (IGDT) Application and Presentation.** The text, Tables and Figures of the report and Appendices needs more attention to draw on the detailed outputs of model runs into simpler tables and graphics to aid interpretation and communication. This would then be used for both the outputs from the initial model runs and from the stress testing runs. Specific comments on the individual elements are as follows:

- 2.15.1. For the initial MCA stage output, results could usefully be presented as a matrix, along with graphs of the total parameters (costs and benefit delivered) for each IGDT step: a draft of possible format was developed at the meeting. This is likely to form one of the key outputs for decision makers and should be understandable for stakeholders.
- 2.15.2. For the stress testing output, the metric (c.f Table 23 of Appendix E) 'resilience' is not particularly meaningful and makes no difference to customers, so should be dropped.
- 2.15.3. The remaining two IGDT metrics (c.f Table 23 of Appendix E) 'vulnerability' and 'reliability' should then be run under two conditions:
  - Without Drought Permits and Drought Orders (labelled O&P in model screens); and
  - With Drought Permits and Drought Orders.
- 2.15.4. Such runs could be based on an assessment of source output for a design condition between "normal year" and "dry year".

## Conclusion

- 2.16. The methodologies set out in the UKWIR WRMP 2019 Methods projects programme are a major step forward in UK Water Resource Planning, however the application of the methodologies in practice is still at an early stage.
- 2.17. On the basis of the Peer Review as described above, the approach adopted by SEW is considered to be an appropriate application of the latest methodologies given the data and other information available at present.
- 2.18. Subject to refinements to the text, Tables and visual outputs, and the relatively minor technical points made above, the approach is considered to be 'fit for purpose' for the purposes of draft WRMP19.

## 3. Review of SEW's scenario generation, stress testing methods and input data

### Introduction

- 3.1. This section covers the review of the approach taken to the generation of possible futures, creating input data that accords to these futures to produce scenarios, running the scenarios through the EBSD model, and stress testing the arising portfolios.
- 3.2. SE Water aims to align its approach with the WRSE PR19 modelling work to build upon, benefit from, and remain consistent with, the regional perspective, but translate it to the local, company scale.

### Meetings, documentation and approach

- 3.3. The following meetings covered the Decision Making Approach:
- Start-up telecon: 23<sup>rd</sup> March; and
  - Progress telecon: 18<sup>th</sup> April.
- 3.4. The Peer Review was based on the following methodology report:
- "Decision Making Approach for WRMP19\_170316\_v1.3", and associated Appendices.

### Findings

- 3.5. Overall, the approach adopted by SE Water closes mirrors that of the WRSE, with some changes required in the translation of the regional approach to the company scale.
- 3.6. It is commendable that the Company is adopting the same extended and stretching planning horizon of 60 years, such that the planning period extends from 2020 to 2080. In accordance with its regional and strategic vision, the WRSE EBSD model used 5-yearly time steps, and used two time points along this period to examine the outputs: at 2040 and 2080. In contrast the SE Water approach is adopting the same period but using an annual time step and examining the outputs every year.
- 3.7. The methodology report and appendices are easy to read in some places but lacking in clarity in other places, particularly Appendix E which is the technical paper describing the approach to scenario generation. Parts of Appendix E which would benefit from further description and explanation.
- 3.8. Given the heavy reliance on the WRSE work, the methodology document should present a list of the key reference papers and spreadsheets used in the approach. Given the multitude of files arising from the WRSE EBSD and Info Gap work, and numerous revisions, it is not easy to check with confidence whether decisionLab have adopted the most up to date input data. It is recommended that the files with a WRSE register number are always cited in the text for traceability, rather than just use file names, to avoid any confusion.
- 3.9. In places, the methodology states that there are different sources of data or information but does not say which source has been used. For example, Appendix E, section 3.1.1.1 examines the effect of drought on zonal DO, stating that, "*South East Water can use in-house simulation modelling to provide the percentage change on zonal DO under "worst", "severe", and "extreme" drought impact (and climate change) and over the planning period. Alternatively data from the*

*national study... can be used.*" The report does not state what actually has been used: what data are being used? It is recommended that the text is reviewed and rewritten where necessary to present that approach that has been adopted.

- 3.10. The label 'worst' in the Tables and model screens is somewhat misleading for the reader that has not been directly involved in WRSE; the label 'worst historic' would be clearer.
- 3.11. There are some aspects of the WRSE approach where it would be prudent to check if the regional assumption made accord to the experience or situation of SE Water. For example, the WRSE approach has assumed a certain duration of time in which the four annual demand scenarios are experienced over a 10-year period. The SE Water approach adopts the same approach. However, it is recommended that checks are first made on the historic drought frequency and duration experienced in the SE Water region to verify if this is a reasonable approach to make.
- 3.12. In the main report, the Executive Summary states that the Problem Characterisation resulted in a score of 2, where... as in Section 2.3 it is reported as a score of 1. This needs to be clarified.
- 3.13. Section 2.6.2 is laid out to report on the WRSE results, however it is not necessary and this section can be removed. Such a section is better placed in the Company's Water Resource Management Plan.
- 3.14. Section 6 of the main body of the report is a clear and well written overview of the approach to Stress Testing approach. However, Table 6.1 is not helpful, and needs a better description and explanation to properly convey its meaning. Further, why does the chart extend to 2100 when the end of the planning horizon is 2080?
- 3.15. Appendix A is a clear process flowchart that greatly helps to clarify the approach that has been adopted. The Scenarios are numbered 1-6 however and should be renumbered to reflect the fact there are 127 scenarios under examination. The same is true for Table 4.1 in the main body of the report.
- 3.16. Appendix D is also a very valuable flow chart highlighting the changes from PR14 to PR19 and it highlights the much greater sophistication of the methodology being adopted for PR19.
- 3.17. Section 3.1.2 of Appendix E presents the approach to Sustainability Reductions and suggests the same approach as the WRSE in applying the 'Full', a 'Reduced' or zero volume. However, WRSE adopted this approach early in the planning cycle when only a rough draft of the SR volume was available. It is recommended that the Company uses the revised SR information that have since been issued by the Environment Agency.
- 3.18. Further, the WRSE applied these SR volumes in the year 2040 as there are only two points within the WRSE modelling approach by which to examine the outputs. For its own approach, SE Water should apply the SR volumes in the years they need to be achieved, to best model its situation.
- 3.19. Sustainability Reductions are expressed as being applied to the year 2040, and Table 5 states that these have been applied to the last year of the planning period. The same is true with water quality and Table 6. This contrasts with the statement in the methodology report that the planning horizon is 60 years long, so the text should be clarified to avoid confusion.
- 3.20. Section 4 of the Appendix E states that the EBSD model is run under each scenario to generate a "*set of alternative portfolios*" and that only "*diverse portfolios are carried forward for later stress testing*". In the WRSE approach, the least cost and ten 'runner-up' least cost portfolios were generated. What is the approach for SE Water? Similarly, how is 'diverse' defined in terms of selecting portfolios for stress testing? In WRSE, the portfolios were chosen based on the difference in scenarios. What is approach for SE Water?
- 3.21. Section 6.1 outlines the Info Gap stress testing approach which accords to the WRSE approach. There is confusing use of 'scenarios' to describe the Info Gap steps: using a different word than 'scenarios' would help make the distinction between the different parts of the modelling work.

There is reference to 5 levels of Info Gap incremental stresses but Steps 0, 2, 3, 4, and 5 mentioned. Should Step 0 be Step 1; if not what is Step 1? Or are there actually 6 levels of Info Gap stress testing?

- 3.22. Section 6.1 further states that “*the above reduces the number of SU scenarios from 135 to 5*”. Given the much large array of scenarios that are generated from the SE Water approach compared to the WRSE modelling work, do the Info Gap steps relate to the previous scenarios that have been examined? It would be helpful to understand how the Info Gap Step conditions mapped onto the modelled 127 scenarios. A table linking the stress testing scenarios “SU-C1 to SU-C5”, to the Info Gap Steps, and to the previous SU scenarios would be very helpful.
- 3.23. The approach taken for the uncertainty factor stress testing, and the event based stress testing is aligned to the WRSE methodology.
- 3.24. Section 6.5 of Appendix E details the output from stress testing in terms of three metrics: resilience, reliability and vulnerability. This is a great improvement on the WRSE EBSD approach which does not, to date, use such metrics to help explain the results and outputs.

## Queries/issues

- 3.25. Table 3.1 presents a list of the queries and issues that need a response and action from SE Water and/or decisionLab.

**Table 3-List of queries and issues that need action**

Report reference	Queries / issues
App. A	The scenarios are numbered 1-6 in Appendix A: it would be best if they were instead referred to as n, n+1 etc given there are 127 scenarios
Exec Summary and Section 2.3	These sections quote a different final score of the problem characterisation
Section 2.6.2	This can be removed as the information is better placed in the Company's Water Resource management plan
Table 6.1	The table need further explanation to convey its meaning, and should not show data being the planning horizon
App. E, Table 21	Appendix E would benefit from further description and explanation of the approach taken, the specific data or sources used and what checks have been made to ensure translation of the regional approach is suitable for the SE Water scale
n/a	To avoid confusion and ensure the most recent approach and data are being used from the WRSE approach, the methodology document should list the WRSE reference papers and spreadsheets used in the approach (with their WRSE File numbers), and have them available as part of the methodology library.
App. E, Section 3.1.1.1	What data are being used to determine the drought impact on zonal DO?
App. E, Section 3.1.1.1	If data from the national study are used, then the % change impact on zonal DO are calculated in years 2015, 2040 and 2065. What is the approach if the WaterUK work is not used?
App. E, Section 3.1.1.2	The report states that, “No drought impact is applied on existing and optional transfers and demand management schemes.” The reason for this should be given.
App. E, Table 3	Either it should be clearly stated that this table is just an example, or the table should be infilled to show the actual data
App. E, Section 3.7.1.1, and Table 4	In determining the apportionment of time for drought v no-drought conditions, the SE Water approach follows that of the WRSE on assuming a duration for each of the four annual demand scenarios over a 10-yearly duration. More information is needed however on how these 10-yearly averaged demand durations are modelled in the SE Water EBSD model which has a 1 yearly time step. Has there been any reflection of how the suggested WRSE

Report reference	Queries / issues
	duration accord with the historic drought frequency and duration experienced in the SE Water region?
App. E, Section 3.1.2	The Company should use the more recent SR volumes that have been issued by the Environment Agency since the WRSE modelled commenced, and apply them in the years they need to be achieved to best model its situation.
App. E, Tables 5 and 6	Much more explanation is needed to understand what these tables depict.
App. E, Table 5 & 6 and text	A correction is required to the statement that 2040 is the last year of the planning period
App. E, Section 4	The EBSD model is run under each scenario to generate a “set of alternative portfolios” and that only “diverse portfolios are carried forward for later stress testing”. In the WRSE approach, the least cost and ten ‘runner-up’ least cost portfolio was generated. What is the approach for SE Water? How is ‘diverse’ defined in terms of selecting portfolios for stress testing? In WRSE, the portfolios were chosen based on the difference in scenarios. What is approach for SE Water?
App. E, Section 4	The sentence, “These reduces [sic] the number of portfolios from SU to a scalar m lower or equal to SU” should be rewritten to better express its meaning.
App. E, Table 21	Table 1 shows an example % reduction of zonal DO caused by contaminant spills– it should show the actual percentage to be applied and that this has not also been accounted for in WAFU (see Paragraph 2.11)
App. E, Table 23	The definition given for Resilience needs further explanation as the example given is not clear.
Glossary	A glossary would help explain the different terms used interchangeably: scenario, SU, SU-C1, programme, planning solutions / planning period / horizon, schedule of schemes etc.

## Conclusion

- 3.26. In conclusion, the SE Water approach does closely follow the WRSE methodology.
- 3.27. The proposed visualisation of the results and the presentation of stress testing results using the three metrics: resilience, reliability and vulnerability is a great improvement on the WRSE EBSD approach which does not adopt such useful tools.
- 3.28. There are aspects of the approach where the opportunity to update WRSE data with SE Water specific or revised data should be taken, such as the approach to Sustainability Reductions for example.
- 3.29. There are some places where it is not easy to completely understand the detailed approach to be adopted, and actions to increase clarity are presented in Table 3.1.

## 4. Conclusion

- 4.1. The review presents the findings of the Peer Review into the approach to Decision-Making which South East Water is adopting for its Water Resource Management Plan 2019 (WRMP19) in the context of:
- The UKWIR WRMP 2019 Methods projects whose output are now enshrined in the latest Environment Agency WRMP19 Water Resource Planning Guideline; and
  - Work undertaken under the Water Resources in the South East (WRSE) programme.
- 4.2. Section 2 of this report is the review of South East Water's interpretation and adoption of the UKWIR Report 'WRMP 2019 Methods –Decision Making Process: Guidance'. The approach adopted by SEW is considered to be an appropriate application of the latest methodologies given the data and other information available at present.
- 4.3. Section 3 of this report is the review of South East Water's interpretation of WRSE. This Section also include editorial comments on the current draft of the report 'Decision Making Approach and Appendices', v1.3 and its associated Appendices. It was concluded that the SE Water approach does closely follow the WRSE methodology and the proposed visualisation of the results and the presentation of stress testing results represents an improvement on the current WRSE EBSD approach. There are aspects of the approach where the opportunity to update WRSE data with SE Water specific or revised data should be taken, or where it is possible to increase clarity over the method follows (see Table 3.1).
- 4.4. Subject to refinements and recommendations made in this report, South East Water's approach is 'fit for purpose' for the purposes of draft WRMP19.

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