Method Statement – Resilience Framework

Title	Method Statement: Resilience Framework
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Author	Doug Hunt
Approved by	Trevor Bishop
WRSE Director Approval	Trevor Bishop

Email: contact@wrse.org.uk

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Executive summary

Water Resources South East (WRSE) is developing a multi-sector, regional resilience plan to secure water supplies for the South East until 2100.

We have prepared method statements setting out the processes and procedures we will follow when preparing all the technical elements for our regional resilience plan. We consulted on these early in the plan preparation process to ensure that our methods are transparent and, as far as possible, reflect the views and requirements of customers and stakeholders.

The WRSE approach puts resilience at the heart of its long-term planning. Having taken account of guidance and input from regulators and other stakeholders we have developed a resilience framework which will be used consistently through the planning process.

Section 3 provides an overview of the resilience framework and how it uses three characteristics of resilience (reliability, adaptability and evolvability) to assess options. It also outlines how the framework is applied to key systems. The systems we have chosen are the environment, public water supply and other water using sectors. For these systems we firstly assess the baseline position and then show the delta shift in resilience for the different planning portfolios.

Overall, the outcomes from this resilience framework will help customers and stakeholders in making informed choices on what plan they want and need for the future in terms of water security and the environment.

1. Introduction

This method statement outlines the final framework approach that Water Resources South East (WRSE) has implemented to allow us to incorporate the concept of 'resilience' into our regional planning process. This framework helps to move us from a focus on securing public water services and managing the risk of droughts, to securing wider resilience across a series of connected water systems.

We recognise that the water resource systems across the South East of England are complex, multi-sector and interlinked, and that risks associated with drought events cannot be viewed in isolation if we are able to address the challenges and identify the opportunities that exist within the domain of water resources within our region. We also understand that future shocks and stresses are uncertain, and the way in which we plan to invest in improvements to our water resource systems needs to reflect that in order to be resilient in themselves.

The framework described within this document is therefore intended to allow us to evaluate and quantify 'resilience' so that we can incorporate the concept into our wider best value planning of water resources for the south east. We consider this is an important step towards a wider, more integrated understanding of water resources planning.

For more information on WRSE and its members, the development and purpose of the regional plan and how it fits into the national picture, please visit wrse.org.uk.

2. Feedback on our approach

As laid out in our document: 'Securing resilient water resources for South East England – our response to feedback on our resilience framework', we collated responses on our initial draft framework and have reflected them where appropriate within this document. The key changes we have made as a result of that consultation can be summarised as follows:

- We have carried out a full, systems mapping exercise of the key systems associated with water resources in the south east[1] and ensured that the metrics we have used to measure resilience reflect the most important interactions between those systems.

- We have considered the south-east economic and social system as underlying the other three key systems and looked at how relevant feedback loops might affect our framework. That process specifically identified metrics relating to customer response during drought, and engagement with catchment management, which have been incorporated into the scoring metrics.
- We have clarified how the resilience framework fits in with and interacts with the rest of the best value decision making framework, particularly in relation to environmental value criteria, and we have enhanced the role of supporting catchment services in the resilience framework.
- Links to the national resilience assessment and Cabinet Office definitions of resilience have been made clearer and more explicit. The role of response and recovery is clearly identified, and the ability of investment programmes to evolve and incorporate innovation has been strengthened.
- The interactions with 'shortfalls' in the baseline system resilience, including parts of the public water supply system where there are known or suspected resilience issues, and catchment and soil health deficits for the water environment, have been made clearer.
- The water quality metric has been enhanced to include both the resilience of water resource options themselves, and the impact that changes might have on wider catchment water quality.
- We have implemented a carefully controlled process for managing subjective metric scoring to ensure, as far as is practical, that assessments are consistent and unbiased. This has been subject to an assurance review.
- We have avoided the need for metric or option weighting, with all benefits scaled according to an options contribution to a relevant regional deficit. Inputs relating to hazards and shock events other than drought have been clearly identified within the metrics.

3. Summary of the framework

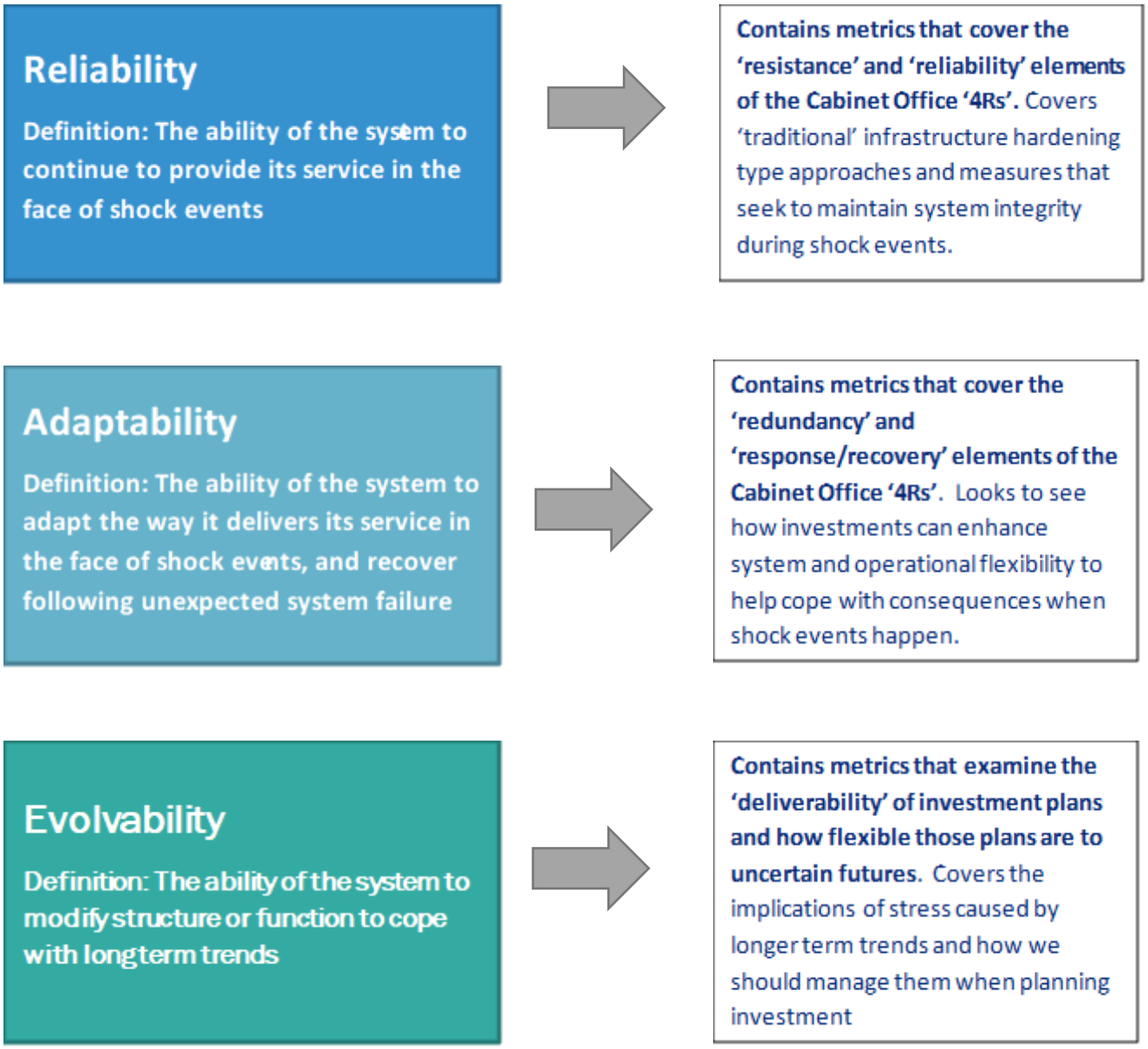
The first question that arises is 'what do we mean by *resilience* in this context'? There are a multitude of possible definitions and responses to this, and, in line with the National Infrastructure Commission, we have adopted this as a concept rather than a specific definition. In concept:

'Resilience is about the ability to continue to function effectively in the face of future challenges. The requirements to achieve it change over time, as challenges alter.'[2]

Whether or not a system can be considered to be functioning depends on whether or not it is able to provide the service that we desire from it. We explore the concept of service and how it relates to resilience later in this section.

Our resilience framework is based on the three key attributes of *reliability, adaptability,* and *evolvability.* These describe how our systems are able to cope both in the face of 'shock' events (transient events such as drought or pandemic that can act to disrupt the function of the system) and future 'stresses' (trends that affect the functioning of the system). These attributes have been modified from the framework proposed by Boltz and Brown's 'Resilience by Design' approach[3], and one of the authors of that paper has been involved as an expert reviewer throughout the framework development.

We have chosen this method because it incorporates the required 'resilience in the round' approach recommended by Ofwat, and the 4R's recommended by the Cabinet Office to understand the resilience of existing systems and extends this to include an assessment of how resilient our investment plans themselves are to future uncertainties. A summary of the three attributes and how they relate to the best practice recommended by the Cabinet Office and Ofwat is provided in the figure below.



In our case it is important to note that the WRSE resilience framework sits within the wider 'Best Value' decision making framework. Within that framework, all of the value criteria described in the figure below are evaluated and considered when the decisions are being made about the preferred regional plan. That means value criteria such as carbon reduction, and the day-to-day condition of the environment are contained elsewhere within the best value decision making framework (the environment framework in that case). Similarly, societal resilience in the form of cost burden and economic considerations are evaluated elsewhere in the best value decision making framework.

The framework presented here concentrates on the ability of regional water resource systems to respond to shocks and manage long term stresses that might affect our ability to invest in and improve that response. Factors such as natural capital, biodiversity net gain, carbon emissions and affordability are not included in this resilience framework as that would mean they are double counted within the best value framework.

As well as the over-arching concept and definitions of the three resilience attributes, there are two further key concepts that inform our resilience framework.

Systems approach.

In accordance with accepted best practice, our approach to resilience is *systems based*. That is, we evaluate the resilience of the systems of interest as a whole, with a view as to understanding how well they can continue to provide the required service in the face of shock events and long-term stresses. In this case there are three primary systems of interest: the **public water supply (PWS) system,** the **water environment (environment) system** and the **non-public water supply (non-PWS) system** (i.e., other sectors that use water from sources other than the public utilities). We have undertaken a detailed process of **systems mapping** to identify how these systems interact with each other and how they

interact with the wider **south east regional socio economic system**, and used this understanding when developing our scoring metrics (see below) and the approach to implementation described in the next section.

Scoring metrics.

The three core attributes (reliability, adaptability and evolvability) of the resilience framework are not specific enough to allow us to measure them directly, so we apply a number of *metrics* that allow us to evaluate the resilience of the existing systems and proposed investment plans. These metrics have been identified through a process of *systems mapping* and are deigned to allow us to quantify the impact that potential options for regional investment might have on the resilience attributes for each system.
Our resilience framework therefore looks at the three systems and examines how well different water resource programmes that are being considered by WRSE might help those systems provide the resilient service that we want from them, as summarised in the figure below.

What is the SYSTEM?	What does it (typically) include?	What is the *service* we want?
Public water supply	Operation, infrastructure and supply chain associated with abstraction, treatment, and bulk network distribution, plus the nature of water demand on the system	Secure supplies that maintain availability to customers irrespective of hazards that might affect water resources
Non-Public Water Supply (other Sectors)	Management and infrastructure for abstraction and economic activities that rely on that water (crops, industrial processes etc)	Predictably available water resources that support relevant social and economic activities
Water environment	Catchments, including soils and hydrological processes, along with water bodies and their ecology	Catchments and water bodies that are able to help maintain water quality and ecology during and after shock events

We carried out *systems mapping* to understand how these three interact within the south east regional context ('system of systems') and make sure we are measuring all those metrics that describe the relevant interactions

We defined the service we want to understand how different options and investments help avoid failure of the service (i.e. promote resilience). We measure this through our option metrics

In summary, our resilience framework is designed to allow us to:

- Define the three systems that we need to consider, and understand how they interact within the wider south east context.

- Define the service that we desire from these three systems and the attributes of resilience that we consider will help to maintain this service over the long term.
- Understand how all of the water resource options that we have identified as being potential investments for the regional Plan can contribute to our three resilience attributes, in the context of the three systems that we have identified.
- Identify metrics through which we can score the resilience contribution of each option and potential investment portfolio, based on the systems mapping that we have undertaken in the context of the wider south-east region.
- Evaluate the benefits that the plan has on the baseline regional resilience (the 'resilience shift'), in terms of the number, type and extent of known pre-existing resilience issues that are addressed by the planned water resources enhancements.

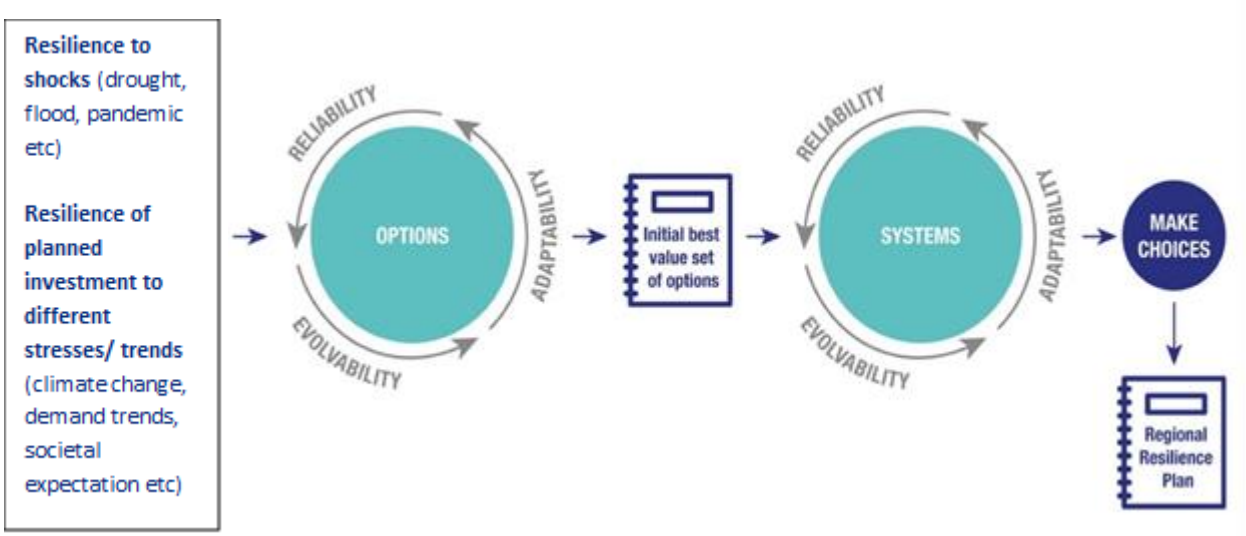
4. How we have applied the framework

Concept and purpose of the framework application

The resilience framework as designed to allow WRSE to consider how all the options, schemes and strategies that have been identified as potentially contributing to water resources in the region might affect the resilience of the PWS, non-PWS and water environment systems. Not all options/schemes will affect all aspects, but the metrics have been designed to ensure that all reasonable benefits have been captured, and the scoring system is designed to allow different options, strategics and schemes to be compared on a reasonably consistent basis. It is meant to be comparative, not absolute, and we recognise that there will be more variability for some metrics. That is an expected outcome of the framework, i.e., it helps us understand how and where the regional plan can affect the resilience of water resources in the region.

Because the framework is designed to score resilience in a consistent, comparable way, we can use it to compare the overall resilience of potential water resource programmes that we identify during the best value decision making process. The framework is essentially applied in two stages:

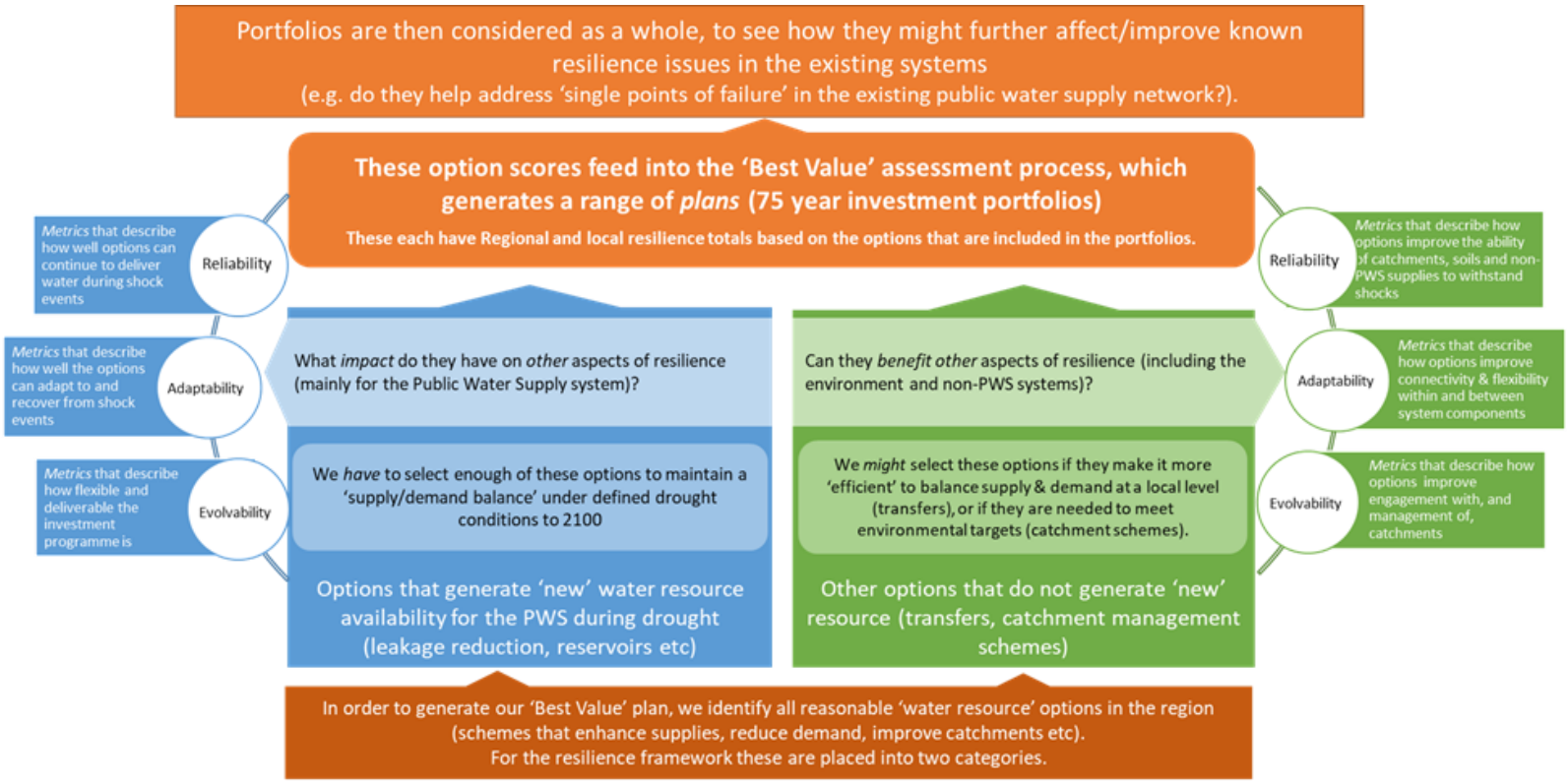
1. as a scoring method for individual options that the regional plan could consider to address its identified water resource needs
2. at a 'portfolio' level (i.e. as a whole across the proposed investments within a water resource programme and the existing systems) once a range of potential plans have been identified. This is summarised in the figure below.



One of the main points that we had to account for in the framework was that the majority of options have been designed to address a specific requirement, primarily related to drought resistance (supply/demand benefit) or environment (enhancing natural capital, biodiversity net gain etc), but those options also have a potential impact on our resilience metrics, and this could occur across more than one system. We also had to account for options that either directly, or as a result of their nature, helped to address existing resilience deficits within the *existing* PWS, non-PWS and environment systems. For example, a catchment management scheme may be designed to enhance water quality specifically for PWS supply capability, but in doing so it might also help to improve known soil health issues in the catchment and help promote public involvement in the catchment, which, in turn, enhances customer co-operation during drought events.

The framework addresses this by compartmentalising and scoring individual options prior to the generation of candidate best value water resource programmes, and then by evaluating those programmes against existing known system issues, as shown in the Figure overleaf.

Summary of the process used to generate resilience scores for candidate water resource programmes

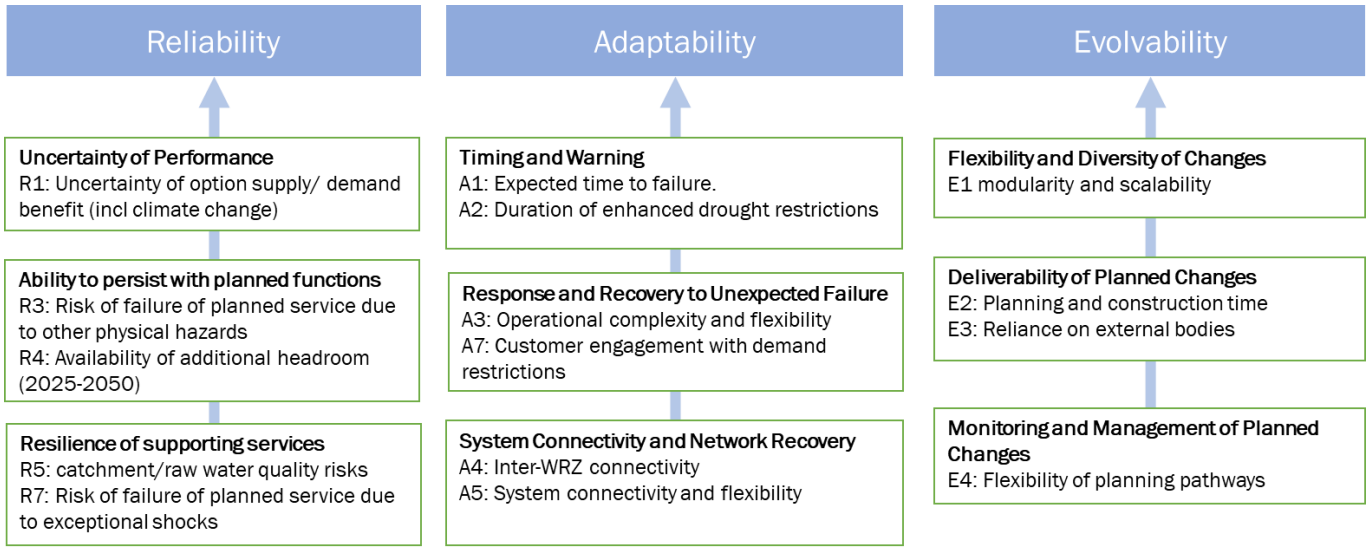


5. How we have measured resilience for options and programmes

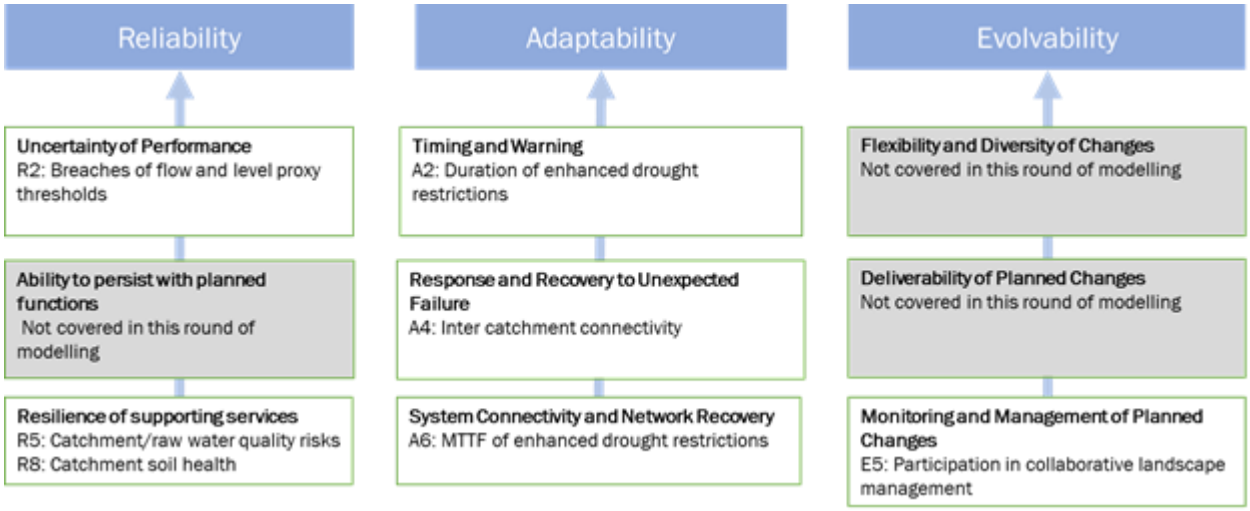
As indicated above, the performance of options (covering demand management strategies, supply options, transfers and catchment schemes) in relation to resilience is scored through the use of metrics. Further metrics are then scored once candidate investment programmes have been identified. Details of the scoring process and guidance are provided in the Technical Appendix to this method statement.

These metrics were identified and then refined through an extensive process of systems mapping, which identified the key contributors to water resource resilience, and the interactions between the systems. This systems mapping is described in the WRSE report 'WRSE Resilience Phase 2: Multi-Sector and Systems Approaches'. A summary of all of the resulting metrics that were identified, separated according to the benefitting system and the type of resilience effect that they have, is provided below. To clarify, the metrics themselves are indicated by the 'R1, R2, R3..' type descriptors below. The sub-headings (e.g. 'uncertainty of performance') have been included purely to give a high level conceptual description of the nature of the metrics contained in that sub-heading

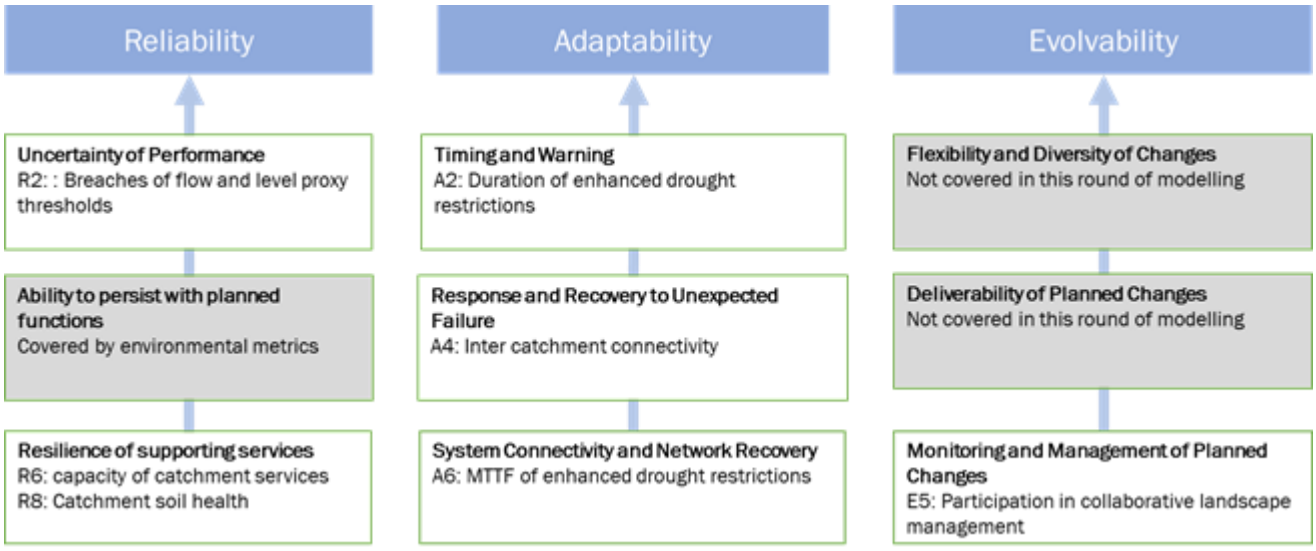
Option and programme metrics relevant to the public water supply system



Option and programme metrics relevant to the non-public water supply system



Option and programme metrics relevant to the water environment system



In accordance with the overall concept, the approach to scoring has been carefully designed to allow the resilience impacts of options to be simply added together without any need for subjective weighting to generate an overall score for each investment portfolio. At the same time, it is important that the resilience scores generated for different portfolios can be compared on a consistent basis. These

objectives have been achieved through the application of two over-arching principles to the scoring process:

1. All metrics are described according to the same 5-point scale approach, ranging from 'notably less resilient (2 points below an average), through to 'notably more resilient' (2 points above average). There is a variety of ways in which metrics have been scored, from quantitative to semi-qualitative, as detailed in the technical appendix, but the key point is that impacts are all scored on a comparable basis.
2. The *impact* that individual options have on the overall metric scoring across the region is scaled according to the size of benefit they provide to the relevant key regional need. For example, if a water supply option can contribute 100Ml/d to an overall regional supply/demand deficit of 1,000Ml/d, then its *impact* value for a given metric (e.g. R1) is equal to its metric score * 100/1000. Using this 'scaling approach' means that all option impacts can be added in a consistent way to generate overall resilience scores for regional investment programmes.

These two principles mean that any potential investment programme that is being considered within the best value decision making process can be compared on a meaningful basis, against any other programme according to a single overall attribute score, which is equal to the sum of the impact values from options and strategies in that programme. Each of the resilience attributes (reliability, adaptability and evolvability) has this single overall attribute score for each programme, and the contribution of any individual scheme/option is visible based on the impact value it has for each metric.

The actual process for scoring resource options, demand management strategies and catchment schemes has been carefully managed and assured to address the risk of bias or misinterpretation when scoring has been carried out. This process is described in the relevant assurance report. The key elements can be summarised as follows:

- For water company supply schemes, relevant metrics were all initially evaluated by the WRSE team on a generic basis according to type (e.g. desalination plant feeding a system with limited/no storage). The generic scores were then challenged in an open workshop format across all companies and amended where appropriate logical/conceptual cases were made and accepted. The WRSE team then met with water companies on an individual basis to define 'bespoke' scores for individual schemes, mainly for larger options. Again, this was carried out on a challenge/accept basis, where

changes to the generic scoring were only accepted by the WRSE team where appropriate logical and conceptual representations were made.

- For demand management strategies, relevant metrics were scored centrally by the WRSE team, based on the type of demand management initiatives contained within that strategy.
- Catchment and soils enhancement schemes (metrics R6, R8, E5) were evaluated according to the amount of movement that they provided towards the desired standard, according to the 5-point scale described above. This was done by the WRSE team using the baseline assessment as described in the next section.
- Additional programme level benefits (metrics R2, R4, A1, A2, E4) were evaluated using the economic best value modelling tool, or the regional spatial simulator tool, by the WRSE team as appropriate.

6. Evaluating impacts on baseline resilience issues

The resilience framework was not only designed to allow an evaluation of the level of resilience associated with the 'new' water resource that is provided by water resource options and demand management strategies. The existing PWS, non-PWS and environment systems were evaluated to understand where there may be deficiencies in the existing systems in relation to the metrics covered by the framework. This is important because the investments proposed by the regional plan can affect these pre-existing issues, and the assessment of how proposed regional investment programmes might affect these existing issues is an important part of the programme level scoring process. Baseline assessments were therefore carried out on the following aspects of the existing systems:

- For the PWS systems, interviews were held with all water companies to understand where there are likely to be concerns in the base year (2025) within their existing networks relating to metrics R3 (vulnerability to physical shocks), R5 (water quality risks), R7 (vulnerability to other exceptional events), A3 (system flexibility and complexity) and A5 (system connectivity). These interviews were

used to generate a geographically based 'hotspot' assessment, similar in nature to the approach used in long term wastewater management planning. The initial regional 'candidate' portfolios were then reviewed to determine which schemes and combinations of schemes have the potential to feature in the final Regional Plan. These were then reviewed against the 'hotspot' assessment to understand where scheme combinations might benefit the existing supply system and enhance the overall resilience score for those portfolios that contain such beneficial scheme combinations.

- For the environment system the work carried out on catchment strategies for the environmental framework was used to determine where those strategies might benefit existing catchment resilience issues. This generated the scores for metric R6. Similarly, a regional assessment was carried out to determine the soil quality for all major catchments, and the potential benefits that catchment management schemes could have on areas of degraded soils. This generated the scores for metric R8.
- Although discussions were held with non-PWS system (multi-sector) representatives and important qualitative understanding was taken from those discussions, the outputs were not sufficiently detailed to allow a quantitative baseline impact assessment in the same way as the PWS and environment systems.

Summary

Water Resources South East (WRSE) is developing a multi-sector, regional resilience plan to secure water supplies for the South East until 2100. We are taking a long-term view and considering the water we need to use at home and at work, as well as that required by agriculture, to generate electricity, for industry, recreation, the environment and to support the well-being of society.

The resilience of water supplies and the environment which underpins them has been highlighted by government, regulators, stakeholders and customers as important, particularly as we face increased uncertainty in the future and the risk of more shocks to the system. The approach to resilience sets out in this method statement shows how WRSE has developed an overarching framework which provides a technically robust, consistent and transparent approach which can be applied across multiple systems.

Appendix