Water Resources Forum, 18 July 2017

Developing our preferred programme

1. Introduction

We are currently developing our Water Resources Management Plan 2019 (WRMP19) which will set out how we will provide a sustainable, affordable and resilient supply of water for our customers to the end of the century[1]. For many years cost has been the primary factor in devising the WRMPs, and a least cost decision support tool, called Economics of Balancing Supply and Demand (EBSD), has been used to support the development of these plans. There is now wide support from regulators[2], stakeholders[3] and our customers[4], to develop *best value* plans which take account of a wider range of factors such as the environment, resilience, and customer preferences, in addition to cost. We have worked with other water companies and industry regulators to develop a more advanced decision making framework and we are applying this in developing our WRMP19. This note provides a summary of our approach and will be presented at the July Water Resources Forum. Detailed technical papers will be available in due course.

2. Understanding the planning problem

The starting point is to understand the severity and complexity of the water resource planning problem. Our supply area is made up of 6 Water Resource Zones (WRZ) and we have assessed the problem faced in each WRZ in accordance with industry guidance[5]. This is referred to as *problem characterisation*. The assessment helps us to decide on the appropriate planning horizon, and the approach and decision support tools to be used to develop the best value programme in each WRZ.

Planning horizon: The statutory minimum planning horizon for water resources is 25 years. In recognition of the longer term pressures, and the time it takes to develop some infrastructure, Government has encouraged water companies to adopt a longer planning horizon where this is considered to be appropriate[2]. We worked with independent consultants, NERA, to consider the planning horizon for WRMP19. NERA developed a framework[6] to assess the most appropriate planning horizon for each WRZ which considers the size and timing of the problem, the availability, lead time and lifespan of the solutions, and the level of confidence in forecasts. We presented results of this analysis at our Technical Stakeholder meeting in November 2016.

Decision support tools: There are a wide range of decision support tools which extend from simple to more advanced tools to support more thorough analysis of the planning problem and solutions.

The conclusions of the *problem characterisation* assessment and implications for planning for each WRZ are:

- London and the Swindon and Oxfordshire (SWOX) WRZs have significant and complex water resource challenges. Slough, Wycombe and Aylesbury (SWA) WRZ has moderate challenges. The solutions required in these WRZs will be high cost, with long lifespans. As such, we will plan over

[1] All water companies have a duty to prepare and maintain a WRMP as set out in Section 37A-37D of the Water Industry Act 1991
[2] Water Resources Planning Guideline, May 2016
[3] Technical Stakeholder Meetings, March 2016 & November 2016
[4] Customer research, Britain Thinks, September 2016
[5] UKWIR UK Water Industry Research WRMP 2019 Methods – Decision Making Process: Guidance Report Ref. No. 16/WR/02/10
[6] NERA study

an 80 year time horizon and use advanced decision support tools for thorough analysis of the planning problem and to develop multiple feasible programmes of investment.

- The remaining three WRZs (Kennet Valley, Guildford and Henley) have planning problems of lesser concern. Low-cost options are available and relatively quickly implemented. As such, we will plan over a 25 year time horizon and use less complex decision support tools.

3. The approach and use of decision support tools.

We have devised an enhanced approach to develop, appraise and test potential programmes to find the best value plan. This is presented in Figure 1 and each step described below.

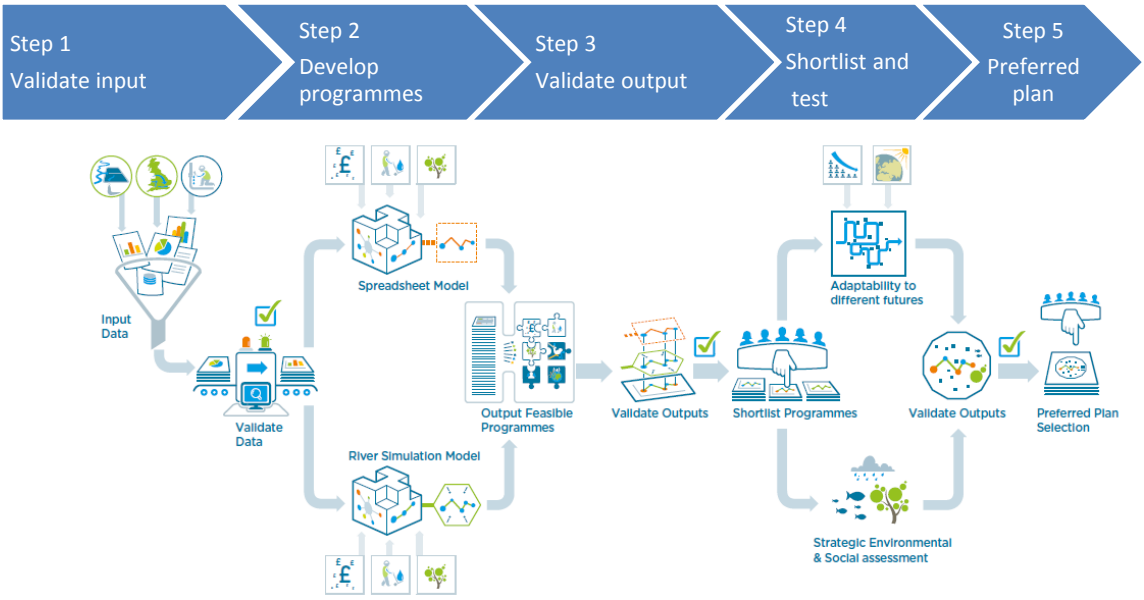

Figure 1: Approach to programme appraisal

Step 1 - Collation and validation of input data: We have undertaken detailed work to identify and assess feasible demand management and resource options, in terms of cost, impacts, lead times etc. This information is the main input data to the decision support tools.

Step 2 - Develop programmes: The approach combines methods for evaluating programme performance with methods for searching for the best programme. The decision support tools, ranging from simple to complex, are shown in Figure 2. There are 2 main types of model used for water resource planning, firstly aggregate or spreadsheet models; these are less complex and established tools, such as EBSD. Secondly, system simulation models; these are more complex tools and are set up based on simulating the resilience of the current operating system to drought and other hazards.

In Henley, Guildford and Kennet Valley WRZs we will use an enhanced EBSD model which includes assessment against a series of performance metrics, combined with optimisation against each metric.

In London, SWOX and SWA WRZs, we will use both aggregated methods (enhanced EBSD) searching for optimal and near optimal solutions with a variety of criteria (Table 1), and system simulation methods which enable assessment of many parameters with multiple criteria search (MCS).

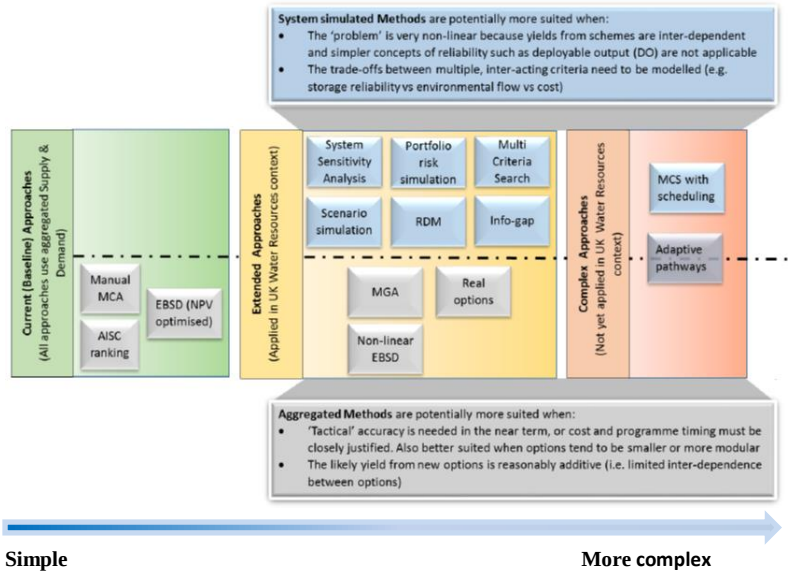

Figure 2: Planning methods for problems of different complexity (UKWIR, 2016)

Step 3 – Validate output: Several hundred feasible solutions will be generated by the models. We will consolidate the output provided by the different models to assess differences and similarities.

Step 4 – Shortlist and test: We will assess the solutions in respect of their performance against a range of metrics, presented in Table 1.

Performance metric	Description
Cost	Net present value (NPV) of the total cost of a proposed programme across the planning horizon.
Adverse Environmental Impact	Numerical grading of SEA significance
Environmental Benefit	Numerical grading of SEA significance
Deliverability	Probability that a proposed investment programme will deliver the volume of water
Resilience	The resilience of the proposed investment programme against a variety of hazards e.g. more severe droughts than in the historical record
Intergenerational Equity	Evaluation of the impact of a proposed investment programme on current and future generations
Customer Preference	Evaluation of the programme in relation to customers preferences and priorities

Table 1 WRMP19 Metrics to develop a best value plan

To aid evaluation, we have developed a web-based visualisation tool, called Polyvis, which shows how each solution performs against each metric. An illustrative output of Polyvis is shown in Figure 3. Each line represents an investment portfolio, and so comparison and filtering of different portfolios across the metrics can be carried out to shortlist solutions. Internal assessment will then be carried out, and ten to twenty solutions shortlisted for further testing and analysis. The shortlist will then be passed to an expert panel for critique and challenge.

We recognise how important it is that we are able to clearly present the decision making process to stakeholders hence have tried to provide transparency and assurance of the process.

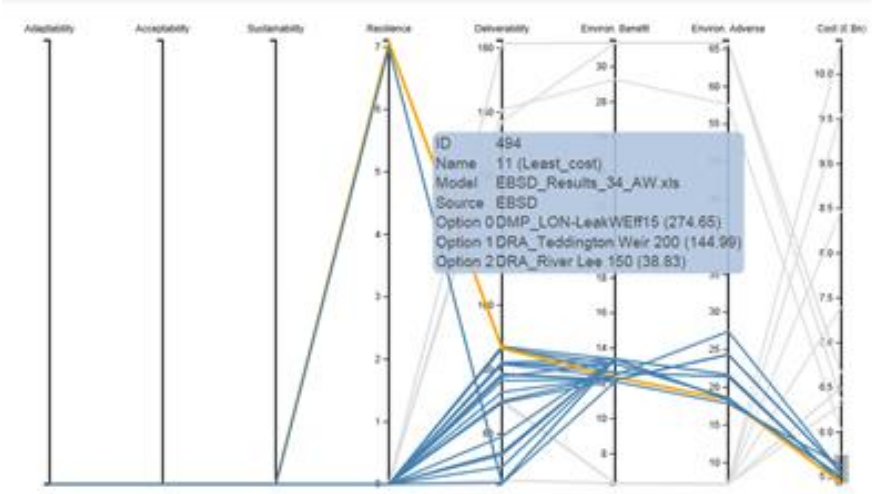

Figure 3: Illustrative output from Polyvis.

All shortlisted solutions will then be assessed in respect of adaptability and programme level Strategic Environmental Assessment (SEA).

Adaptability: In developing a long-term plan, either over 25 years or 80 years, there are uncertainties. It is important to test the effect that these could have on the plan and ensure the plan is flexible and robust in the face of an uncertain future. We are using a similar approach to the 'adaptive pathways' method, first used by the Environment Agency to manage tidal flood risk in the Thames Estuary. We have identified 4 key drivers: regulatory change; growth forecasts; climate change and regional water requirements, and plan to test which combination of options performs best against key future scenarios. As the WRMP and its associated investment plan are reviewed every 5 years, we can assess whether the investment plan could adapt to different futures and where potential future decision points may lie.

Environment: A programme-level SEA for each shortlisted programme will be completed to ensure that neither the quantification of effects for the environmental metric, nor the combination of impacts from multiple options, has skewed the environmental impact of the overall programmes.

Step 5 – Preferred plan: The step-wise approach will lead to selection of the best value plan which will be promoted in draft WRMP19 for wider comment as part of the public consultation. There will be a central audit trail of all the decisions taken.

4. Summary

We have developed methods of programme appraisal and decision support tools that are commensurate with the water resource challenge in each of WRZ. WRZs of lower concern (Kennet Valley, Guildford and Henley) will be assessed using less complex modelling tools over a 25-year horizon and WRZs of moderate (SWA) and high (London and SWOX) concern will be assessed using enhanced programme appraisal. A tool, Polyvis, will be used to help visualise the alternative solutions, aid the internal and external expert review and provide transparency in decision making.