Gate 1 queries process

Strategic solution(s)	SESRO
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Query

Please could you explain why the combined use of SESRO and STT does not provide a DO benefit and how this was determined. Is any further work to test this conclusion planned for Gate 2?

Solution owner response

Introduction

In past Water Resource Management Plans, it has been found that the Deployable Output benefits of SESRO and STT scheme options are largely additive when both options are included on the constrained feasible options list. The flow from the River Severn is often available when there is already sufficient flow available in the River Thames to support surface water abstraction hence limited benefit in physically combining the schemes. However, it has been noted that potentially some conjunctive use benefit between the two schemes could be found with more optimised operation.

In order for additional DO to be generated, larger overall discharges should be made from a SESRO scheme than would be made for individual SESRO and STT schemes, such that 'space' is made in SESRO that can be filled by water from an STT.

Modelling Approach

Using the WRSE Regional System Simulation (RSS) model, initial modelling has been carried out for two examples of the joint STT-SESRO scheme in which an STT option discharges directly into SESRO, in order to assess whether this should be investigated further. The joint SESRO-STT option was run for one size of the SESRO reservoir storage

and two pipeline scenarios: The 75 Mm3 reservoir was simulated in conjunction with a 300 Ml/d capacity STT pipeline, with both a 100 and a 300 Ml/d support flow at Deerhurst. Work to date has not investigated joint, large STT and SESRO variants, as an upper overall discharge limit of STT and SESRO schemes into the River Thames of 600Ml/d has been identified, on the basis of ecological protection. The 75 Mm3 SESRO option was felt to represent the variant that would show greatest sensitivity to additional refill benefits.

In this modelling, the STT is triggered whenever SESRO is below 95% full, rather than being triggered by the Lower Thames Control Diagram (LTCD).

Operating controls

- **STT inflows**: The STT option consists of various unsupported and supported transfers from Deerhurst on the River Severn. Unsupported flows are supplied as a timeseries input of flows calculated with the Kestrel-IHM hydrologicalmodel. A hands off flow(HOF) licence constraint has been implemented in accordance with the options proposed by the STT SRO. The Deerhurst supported flows are not subject to the HOF licences, and are used to supplement the Deerhurst unsupported flows (i.e. unsupported flows are 'cheaper' in the model and so are taken before the supported flows).

- **STT releases** are activated by the same trigger as the SESRO scheme, referred to as the 'Gateway trigger'. This is used in the model to trigger several of London's strategic supply schemes. Releases are triggered when flows are below the L1 HOF on the Lower Thames Control Diagram (LTCD) and the 10-day rolling Teddington naturalised flows are less than 3,000 Ml/d. As with the individual SESRO and STT DO modelling, an amendment to the existing trigger parameters was made to subtract the STT and SESRO releases from the subsequent 'Thames 3000' evaluations. This ensures that the Gateway trigger is not turned off just because SESRO and STT have been activated .Losses were applied to account for pipeline losses (2%) as well as losses from the River Thames (2%). Additionally,a delay of 4 days was applied to flows directly before releasing to Culham to represent the travel time between Culham and Teddington.

- **SESRO fill from STT**. Under the SESRO-STT joint scheme in addition to the primary SESRO refill from the Thames, releases from the STT can be used to refill the reservoir when SESRO storage is less than 95%. However, direct STT releases to the Thames are preferred over refill so if the 'gateway trigger' is activated then this will be satisfied before refilling SESRO. The 10 Ml/d sweetening flow for the STT is directed into SESRO

- **Option Deployable Output (DO).** Option DO was modelled by taking the difference between the London DO with the option in place and the London DO without the SESRO-STT option. DO values were calculated using the 'Scottish' DO method

whereby demands are increased in increments and the number of failures recorded to calculate a failure return period. Both the baseline and option DO were calculated from the London L4 1 in 500 year DO level. For this joint scheme the option DO was compared to the sum of the individual option DOs for the separate SESRO and STT schemes, as this indicates any additional potential value from combining the two schemes.

Model results

In both cases the modelling shows that the combined DO is slightly lower than the estimated DOs for the separate options, suggesting no additional benefit from combining the two schemes. The results are tabulated below.

Option	Combined SESRO-STT DO	Individual SESRO, STT DO's		
		SESRO	STT	SESRO + STT
SESRO-STT 75-300-100	350.12	154.97	197.02	351.99
SESRO-STT 75-300-300	436.35	154.97	284.43	439.40

This is not necessarily unexpected since the opportunity for STT to significantly support SESRO is likely to be small, as it relies on SESRO storage being low at the same time as there are surplus supplies from STT that are not required in London (aside from direct releases from STT into Thames). However, some limited benefit may be achieved through greater refinement of the operating controls of both the reservoir and pipeline. Also, it may be that additional DO benefits may be realised if the SESRO-STT joint option is combined with the Thames to Southern Transfer (T2ST), rather than supplying London only, although this variant has not been investigated further.

Therefore, to enable freedom of choice at a regional level, the joint STT-SESRO Joint Option was provided to WRSE as a feasible option for selection in the investment modelling, albeit that no DO benefit has yet been identified.

Proposed further work

The studies for Gate 2 will continue to investigate the optimisation of the operational parameters for SESRO and, if considered appropriate, the combined SESRO-STT modelling will be re-run to verify the Gate 1 conclusions. However, due to the limited circumstances when a SESRO re-fill from surplus resources within the STT would be available to deliver net benefit this is not expected to yield any significantly different results.

If the WRSE regional modelling confirms a preference for SESRO in combination with the T2ST then this may also be explored using the WRSE water resources model to verify any net DO benefit of directly re-filling SESRO from the STT.

Date of response to RAPID	23/07/21
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