Accelerated gate two queries process

Strategic solution(s)	Havant Thicket
Query number	HAV008
Date sent to company	24/12/2021
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Query

1. What are the proposed activities to Gate 3 to assess conjunctive use of the solution sub-options in the context of wider company and regional solutions?
2. Under a 1 in 200 drought resilience level, in addition to capacity, what is the dry year annual average and peak deployable output for all solution sub-options including the maximum sustainable yield of the source.
3. Please describe the methodologies/approaches used to calculate the utilisation and deployable output estimates for the scheme under a 1 in 200 and 1 in 500 drought resilience level.
4. Please include proposed activities to Gate 3 to calculate deployable output and utilisation under the 1 in 500 drought resilience level including incorporating outputs from regional modelling.
5. Please explain why '*Since Gate 1 the capacity of the WRP required for Option B.4 has been reduced from 61Ml/d to 15Ml/d.*'
6. Please provide evidence that wider resilience benefits of the solution sub-options (such as wider flood or drought resilience and catchment management approaches to improve water quality) have been considered.
7. a) What frameworks and guidance are being followed to reduce whole life carbon through the option choice, design and development of the solution?
   b) What innovative technologies and approaches have been considered to reduce the whole life carbon of the solution?
   c) To what extent have you explored mitigation vs offsetting as approaches to reducing carbon, including any specific mitigations that have been considered?

Solution owner response

1. What are the proposed activities to Gate 3 to assess conjunctive use of the solution sub-options in the context of wider company and regional solutions?

No further assessment is planned of the SRO conjunctive use as the capacity of the proposed system is fixed at 90 Ml/d of raw water to meet a future need of 87 Ml/d, as concluded at the end of Annex 12, Section 3.4. This fixed amount will be used to inform ongoing and future company and regional modelling. This is necessary to ensure timely delivery of the project and commence planning, design and procurement activities.

However, the system has been inclduded in both the Water Resources South East Model (WRSE Pywr model) and the National Modelling being completed by the Environment Agency. The SW team (incorporating the SW Water Resources group), support the development of both these models which will continue through to Gate 3 and beyond. A summary will be provided at the Gate 3 submission.

2. Under a 1 in 200 drought resilience level, in addition to capacity, what is the dry year annual average and peak deployable output for all solution sub-options including the maximum sustainable yield of the source.

A. Sub Option B4 Havant Thicket Reservoir + WRP 15 Ml/d

Operational Storage	8700 Ml
Inflow Bedhampton Springs	193 Ml
Inflow WRP	5475 ML
Annual water available	14368 ML
DYAA Deployable Output* (and maximum sustainable yield)	39.4 Ml/d
PDO Ml/d	104 Ml/d (83 + 21)

*DYAA would be reduced by 5% due to losses at the Water Supply Work

Dry Year Annual Average (DYAA) Deployable Output

Total water available for a dry year is calculated by adding the operational storage in the reservoir (i.e. storage available above the minimum level) to the total volume of water inflows over the year. It is assumed the reservoir is full at the beginning of the year. The water inflows include the flows from Bedhampton Springs (data taken from a representative 1 in 200-year drought model run) and the inflows from the 15 Ml/d Water Recycling Plant running constantly at capacity. DYAA is calculated by dividing the total water available in the year by 365 days to give the average (and maximum sustainable) yield.

Peak Deployable Output (PDO)

PDO is defined as the maximum yield from the source at the period of peak demand. The PDO is combined from the transfer to [redacted] WSW for treatment (83 Ml/d after process losses) and the 21 Ml/d transfer via Portsmouth Water, but note that this is not part of the sub-option that has been considered.

B. Sub Option D2 Havant Thicket Reservoir

Operational Storage	8700 Ml
Inflow Bedhampton Springs	193 Ml
Inflow WRP	n/a
Annual water available	8893 ML
DYAA Deployable Output* (and maximum sustainable yield)	24.4 Ml/d
PDO Ml/d	104 Ml/d (83 + 21)

*DYAA would be reduced by 5% due to losses at the Water Supply Work

DYAA Deployable Output

Total water available for a dry year is calculated by adding the operational storage in the reservoir (i.e. storage available above the minimum level) to the total volume of water inflows over the year. It is assumed the reservoir is full at the beginning of the year. The water inflows include the flows from Bedhampton Springs (data taken from a representative 1 in 200-year drought model run). DYAA is calculated by dividing the total water available in the year by 365 days to give the average (and maximum sustainable) yield.

Peak Deployable Output

PDO is defined as the maximum yield from the source at the period of peak demand. The PDO is combined from the transfer to [redacted] WSW for treatment (83 Ml/d after process losses) and the 21 Ml/d transfer via Portsmouth Water, but note that this is not part of the sub-option that has been considered.

3. Please describe the methodologies/approaches used to calculate the utilisation and deployable output estimates for the scheme under a 1 in 200 and 1 in 500 drought resilience level.

Results from the 2000-year Aquator water resources model run are tabulated in a spreadsheet to show volumes transferred as a daily timestep in Ml/d. Results captured include

- Portsmouth Water Worlds End bulk transfer
- Sandown Water Recycling Plant output
- Portsmouth Water [redacted] existing bulk transfer
- Havant Thicket potable water bulk transfer via [redacted]
- Havant Thicket to [redacted] WSW transfer
- Havant Thicket transfer to Portsmouth Water's Farlington demand zone
- Water Recycling Plant output to Havant Thicket Reservoir.

Results for a specific transfer (such as Havant Thicket to [redacted] WSW) are then calculated for each year in the 2000-year run to show

- the maximum daily transfer volume
- the sum of the volume transferred over the year
- the number of days the transfer operated above its minimum (i.e. sweetening) flow.

These results are then sorted by value (lowest to highest) and assigned a return period based on their relative ranking in value. For example, the 1 in 200-year return period for maximum daily transfer volume will be the tenth-highest value of maximum daily transfer volumes, as 2000 years divided by 200 equals 10. Similarly, a 1 in 50-year return period is defined as the fortieth-highest value as 2000 years divided by 50 equals 40.

The results are then tabulated in the Gate 2 submission document according to their relevant return period.

The 2000-year Aquator model run gives results suitable up to a 1 in 200-year drought, however, for a 1 in 500-year drought the large WRSE Pywr 20,000-year model is required. Initial results from this model were considered in the Future Needs assessment presented in Annex 12 however, the level of detail / accuracy we have been able to assess at this return period is less mature.

4. Please include proposed activities to Gate 3 to calculate deployable output and utilisation under the 1 in 500 drought resilience level including incorporating outputs from regional modelling.

As outlined in Annex 10, Section 3.3: the 1 in 500 drought resilience assessment will be carried out by and in conjunction with the Water Resources South East (WRSE) Team in their development of the Regional Plan. The SRO Team is working closely with WRSE to ensure that the proposed programme of options is correctly considered within the modelling and provides appropriate utilisation results for the SRO.

Whilst important to understand the SRO in the future context SW need to ensure that the requirement for the selected option is “fixed” rather than “dynamic” to ensure appropriate focus on design, consenting, delivery, customer and stakeholder management.

5. Please explain why '*Since Gate 1 the capacity of the WRP required for Option B.4 has been reduced from 61Ml/d to 15Ml/d.*'

Southern Water's submission for Gate 1 stated that the water recycling plant WRP capacity required for Option B.4 was 61 Ml/d, however, this figure was to ensure a direct like for like comparison of the proposed WRP plant to a similarly sized Desalination plant, based solely on the magnitude of the residual supply-demand balance deficit i.e. no further direct usage benefit being derived from Havant Thicket reservoir, as we had limited time to assess the benefit within the water resources model prior to the Gate one design freeze.

Since Gate 1, we have undertaken the second phase of resource modelling, which assessed the benefit of water storage in Havant Thicket (our preferred option). This has shown that a water recycling plant at this capacity (61Ml/d) is not necessary to support the demand within a 1 in 200 year drought. This is because the WRP and reservoir act in combination, to provide a system response. The volume of water stored creates the buffer to supply peak flows in response to a drought and the WRP ensures that the volume required (resilience duration) for the 1 in 200-year drought is met. Modelling was undertaken to determine the size of WRP required to deliver this resilience and this has been assessed as 15 Ml/d.

6. Please provide evidence that wider resilience benefits of the solution sub-options (such as wider flood or drought resilience and catchment management approaches to improve water quality) have been considered.

As part of Southern Water's ongoing review, studies have been carried out to assess resilience through several lenses. This was summarised in Annex 3 Havant Thicket, Section 2.2.10.

The results of the resilience studies were included as part of the Multi-Criteria Decision Analysis (MCDA), a best practice approach for economic appraisal defined by HMT Green Book, which tested the rankings of the SROs under different assumed weightings to the National Significant Infrastructure criteria.

The resilience Model considers a number of 'shocks and stresses' as part of the assessment, which include:

a. **Raw Water Loss**: This assesses the non-availability of raw water delivered to the treatment works through the source water being untreatable (either due to quality or quantity issues). Typically this will include aspects such as river contamination, impounding reservoir algal blooms and elevated nitrates in groundwater.
b. **Severe Flood**: This assesses the sites in flood risk locations where they are exposed to fluvial, coastal, or surface water flood risks. The effects of climate change are expected to increase the risk to SW's sites from environmental flooding.
c. **Contamination**: This assesses the risk of contamination of clean water caused by infiltration of contaminants into the water process or network

(downstream from the source). This will include events such as service reservoir infiltration from pollutants.

d. **Critical Asset Failures**: This assesses how the option supports the wider resilience on the system in the event of a single point of failure of a critical asset which could lead to the loss of supply.

The model uses two sets of deployable output figures, based on either:

- [redacted] Dependant – BAU, or
- [redacted] Dependant – Stressed (with a Transfer from Havant Thicket Reservoir of 75Ml/d or 61Ml/d peak output flows)

The objective of the BAU options is to test the SRO for resilience against normal operating conditions and the objectives of the stressed options are to test for resilience against a 1 in 200-year drought situation. Both Havant Thicket Sub-Options rely on the treatment at [redacted] hence in the model they are considered as '[redacted] WSW Dependant', as the model is based on Water Supply Works (WSW) output.

Our resilience reports are available for review if required.

7. a) What frameworks and guidance are being followed to reduce whole life carbon through the option choice, design and development of the solution?

Southern Water will be looking to adopt the All Company Working Group guidance on Carbon.

The process undertaken to prepare the capital carbon emissions estimates for each of the options is based on PAS2080. The monetised cost of carbon was calculated using the traded and non-traded carbon price forecasts from the Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal.
Carbon from the perspective of natural capital is related to climate regulation Environmental and Social Safeguards (ESS). A key element of most safeguard systems is the use of a categorisation system for identifying environmental and social risk, applied at an early stage in a project cycle. Assessing carbon in this context involves calculating the change in carbon sequestration as a result of land use change, and calculating its value, so that the risk associated with the project can be calculated. The assessment carried out to date has been high level, consistent with the stage of scheme design, and suitable to enable like for life comparison of the options. The level of detail in the assessment will be developed so as to influence the development of the solution as the design matures, with the aim of reducing whole life carbon in the selected option.

Under Southern Water's commitment to net zero operational emissions by 2030, the operational emissions will need to be treated in accordance with our committed net zero carbon hierarchy (avoid and reduce, replace, remove and offset). In addition, Southern Water will also be considering embedded carbon within this SRO Project and will again apply the carbon hierarchy (avoid and reduce, replace, remove and offset).

As part of the option choice, a Multi-Criteria Decision Analysis (MCDA) tool was used as a best practice approach for economic appraisal defined by HMT Green Book. The MCDA incorporates capital carbon, operational carbon and whole life carbon (referred to in the MCDA as embodied carbon and operational carbon) as well as the high level assessment of carbon sequestration after impacts of construction and biodiversity net gain are considered (referred to in the MCDA as the climate regulation (NC)) as key 'Environmental' sub criteria that affect the overall National Significant Infrastructure of the scheme. The MCDA also tested the rankings of the SROs under different assumed weightings to the NSI criteria.

b) What innovative technologies and approaches have been considered to reduce the whole life carbon of the solution?

The carbon assessments carried out for the feasiblity design have set the initial carbon estimates for the sub-options. As the design develops, we will apply the carbon hierarchy (avoid and reduce, replace, remove and offset) to reduce the whole life carbon associated with the selected option.

Examples of areas where we are consideing ways to reduce carbon are:

- The Water Recycling Plant's Reverse Osmosis Membranes, by recovering energy from the flow pressure, and
- The Transfer Pumping Station (from [redacted] to the Water Recyling Plant) could potentially be powered by the [redacted] Combined Heat and Power Plant (CHP).
- The pipeline routing to reduce the over static pumping head

Southern Water is bringing specialist carbon manager into the team to help challenge the design to further reduce the whole life carbon impact.

c) To what extent have you explored mitigation vs offsetting as approaches to reducing carbon, including any specific mitigations that have been considered?

Given the current level of maturity within the SRO project, carbon is a consideration, however, formalisation of mitigation vs offsetting as a means to manage the carbon impact of the scheme over the duration of the asset life has yet to be completed. Southern Water will be considering embedded, operational and whole life carbon within this SRO Project and will again apply the carbon hierarchy of: avoid and reduce, replace, remove and offset.

Date of response to RAPID	10/01/2022
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