Gate three query process

Strategic solution(s)	LWR
Query number	LWR017
Date sent to company	06/02/2025
Response due by	06/02/2025

Query

Following the response to LWR013, we note that:

a. Monte Carlo analysis was used to run simulations. Each simulation had 10000 iterations.

b. The methodology and how the input values were developed (min and max values as well as the probability distribution for the costs) is hard to follow/confusing.

Please provide:

- Enough details to understand how Monte Carlo analysis was conducted
- The methodology and how Thames derived the inputs including min and max values as well as the probability distribution for the costs

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Solution owner response

This response has been written in line with the requirements of the RAPID Gate 3 Guidance and to comply with the regulatory process pursuant to Thames Water's statutory duties. The information presented relates to material or data which is still in the course of completion. Should the solution presented be taken forward, Thames Water will be subject to the statutory duties pursuant to the necessary consenting *process, including environmental assessment and consultation as required. This response should be read with those duties in mind.*

Q1: Monte Carlo analysis methodology

R1: A Monte Carlo analysis is a recognised standard industry practice tool to derive a range of potential outcomes given a set of inputs. In the context of infrastructure projects, the computational method uses repeated random sampling of data to assess the potential range of outcomes and associated probabilities for a project, considering uncertainties in factors like construction costs, timelines, weather conditions, and material availability, essentially providing a comprehensive picture of project risks and their potential impact on the final outcome. The computation method considers the input (risk event likelihood and impact scenarios) and models all potential outcomes. To achieve a stable statistical output, 10,000 iterations were run.

The QCRA (Quantitative Cost Risk Analysis) was conducted in accordance with the ACWG Cost Consistency Methodology (*dated February 2022, Rev E – doc ref: 412624 | CC-400 | E*).

A derived range of risk exposure values were calculated and the P50 value was selected for inclusion within the cost estimate as per the ACWG methodology for Teddington DRA. The P50 value is the 50th percentile indicating there is a 50% probability the project's risk exposure should not exceed that value, given the stated scope, design solution and identified risks at the time of submission.

Q2: How min and max values are derived. How an appropriate distribution probability is selected for each risk item

R2: Risk events relevant to the project scope and design have been identified by the project team and captured in a risks, assumptions, issues, dependencies, opportunities log (RAIDO). These were identified during focussed facilitated workshops attended by subject matter experts from consultant and Thames Water teams and covered all workstreams, such as engineering and technical, environmental, procurement and supply chain, commercial, regulatory, land & property, project management and estimating and risk. This is explained in section 3.3 of Annex A2.

The risk events were discussed deliberating on the root cause and their potential cost and schedule impacts. This allowed an assessment of their likelihood of occurrence and of their possible impact scenario for a minimum, expected and worst-case impacts (triangular distribution). These cost impact scenario ranges were defined and estimated using group consensus during the focussed workshops and were reconciled against the base cost estimate to avoid duplication and/or gaps with input from the estimating team. Uniform distribution was also used to a lesser extent where a most-likely impact could not be confidently established. In addition, discrete distributions were used in risks where more than one impact scenario was to be considered with different likelihood of occurrence, or where extreme impact scenario had to be considered.

The identification and assessment process was undertaken for the three main components (Tertiary Treatment Plant, conveyance tunnel and outfall, and intake and TLT connection) of the project and considered project-wide items that would pertain to all three. This ensured a comprehensive list of discrete risks was identified and allowed a quantified risk analysis to be developed.

The description of the impact scenario obtained by consensus supported the selection of the most appropriate distribution to represent the risk's uncertainty, and was reflected in the risk model. Impact and probability consensus was reached based on a combination of data and professional judgement obtained from the subject matter experts.

Where risks were related to programme delays during the development phase and / or redesign activities, time delays and / or resource needs were considered based on professional judgement and project experience.

Cost impacts were derived by applying project running costs to the time impact period or tasks required as described in the impact scenario.

Risks associated with the proposed solution, such as ground conditions, environmental constraints, construction methodology, process selection, interaction with existing assets, or environmental impacts, minimum, most likely and maximum impact values were determined on a case-by-case basis.

It should be noted that the approach taken, risks identified and work completed to date is reflective of the stage the Project is at in the development process (Q4 2024) and that as we progress through statutory consultation, scheme procurement and development consent the risk profile will change and impact on cost and programme refined.

Date of response to RAPID	06/02/2025