SRN15 Cost and Option Methodology

Technical Annex

2nd October 2023

Version 1.0

from Southern Water

Contents

Part A: Optioneering

1. Introduction

The purpose of this Technical Annex is to summarise the approach that we have taken to develop and select the best solutions to address the future needs of customers and the environment, based around Ofwat's Best Option for Customers Guidance. These solutions form our PR24 plan. This document captures the standardised methodologies and evidence used to generate a long list of solution options, subsequent shortlisting and ultimately determination of the preferred option that provides a balance of cost, benefit, Risk, and other factors.

Optioneering is the process that Southern Water follows to identify a preferred solution from a series of potential options. We balance criteria of improved resilience, customer and stakeholder benefit, environmental impact, wider societal and economic benefit, and customer affordability in the short, medium, and long term. The project options in our PR24 plan have been selected following the process described within this document, seeking to find the correct balance of the needs described above.

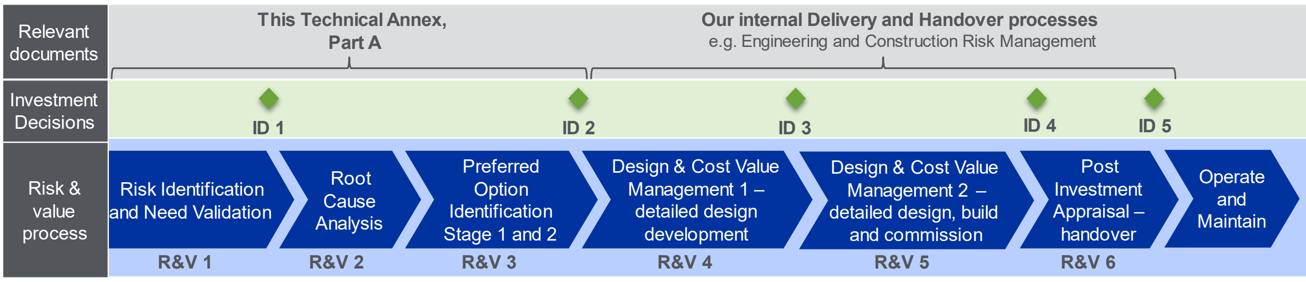
The business *need* for an intervention (making an investment to change our water or wastewater infrastructure's capability) is driven by quantifiable operational *Risks*, changing regulatory requirements, environmental protection and/or our customers' priorities.

2. Identifying Options

2.1. Summary of our approach

Southern Water's overall optioneering process is governed by our Decision-Making Framework, shown in **Figure 1** below, which allows Southern Water to develop, compare and prioritise options and projects across the PR24 wholesale programme under consistent and objective criteria. This enables us to manage the process of optioneering from an individual project perspective as well as from the viewpoint of the wholesale plan and how a programme of infrastructure solutions work together. We have deployed a standardised optioneering process across all projects for PR24 underpinned by common assessments across qualitative and quantitative metrics.

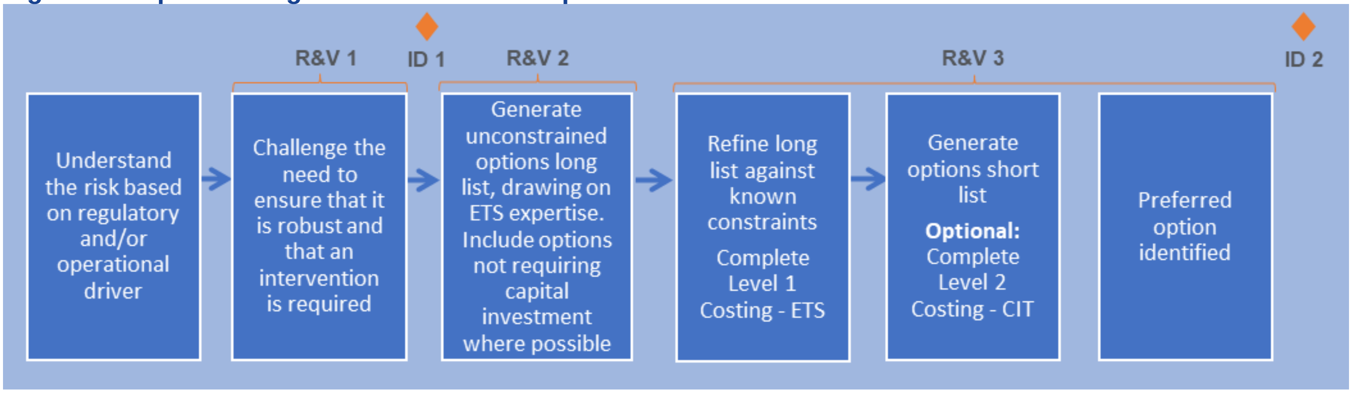
Figure 1 – Decision-Making Framework



As shown by **Figure 1**, our Decision-Making Framework is aligned to our Risk and Value (R&V) process which manages the full lifecycle delivery of a project. R&V stages 1-3 allow for a granular level of detailed optioneering, shown in more detail below in **Figure 2**. The Decision-Making Framework is tailored for business planning, to make decisions early in a project when there is greatest influence on achieving value, in line with established asset management principles. The choice of option selected influences the performance, Risks and maintenance requirements during the operational lifecycle and the methods and costs of decommissioning. The way it is operated and maintained influences its useful life and end of life complexities and costs. Our Decision-Making Framework, considers these variables in tandem to ensure that our optioneering decision making is holistic in approach.

Costing activities within the R&V process are supported by Southern Water's Engineering Technical Solutions (ETS) and Cost Intelligence Team (CIT) and the process is specifically used to determine the projects that are being included in our PR24 submission. The R&V investment planning and delivery process proceeds in a controlled fashion and has a series of fixed 'review sessions' where the multi-disciplinary team challenge, review and agree to progress on to the next 'gateway stage'. This allows the developing project to progress in a controlled manner with input from technical, operational and project delivery perspectives. Each R&V session and gateway stage has a clear and fixed criteria which ensures all options are reviewed on a consistent basis and against all relevant criteria/business objectives. Our optioneering process is described below:

Figure 2 – Optioneering and Risk and Value process



All stages of the R&V process include the capture and recording of lessons learned and these lessons help form part of the audit trail for each project, ensuring that future projects benefit from previous knowledge. The R&V workshops are supported by specific guidance documentation that defines the workshop's purpose, inputs, outputs, and necessary steps to progress to the next stage. These sessions are facilitated by a formal facilitator to ensure consistency in session practice and adherence to process as designed.

The R&V process includes several Investment Decision (ID) Points. These points are milestones in the process which a project must pass before it can progress, and they complete each prior phase of the process. The critical ID points for the optioneering process are ID1 and ID2.

ID1: Business Need Validation – Confirmation of alignment between the Risk, and corporate business objectives, and customer outcomes.
ID2: Preferred Solution Validation – Validation of root cause for Risks, preferred option, delivery route and Risk mitigation.

Southern Water's optioneering process is guided by an integrated team of Southern Water functional experts and third-party partners to deliver aligned optioneering with our supply chain, improved design innovation and constructability and overall greater business confidence in our selected solutions. The benefit of an integrated team over a more traditional small project team is that we are leveraging many forms of subject matter expertise and experience to support identifying the widest possible range of potential solutions.

The following sections detail the individual steps our optioneering process goes through to ensure our PR24 plan is built upon the strongest possible options.

2.2. Understanding the need and/or risk

Risks which may impact our services are regularly assessed. These Risks are driven through operation of aging assets, increasing clean and wastewater demand, population growth, climate change, changing legal or regulatory requirements and factors such as damage or resilience requirements. Risks are triaged and the root-cause is identified which allows for the needs to be fully identified and understood, then prioritised to allow for optioneering to begin development.

2.2.1. Ahead of R&V1: Project information gathering

This is an information gathering step that allows us to identify and analyse potential or emerging risks and start the evaluation process, gathering evidence such as historic trends, DWI audits, pollution/flooding history etc, to validate the project Risks, agree project information and identify gaps/uncertainties. Once a decision is made to progress a scheme for treatment then it is presented and 'validated' at the first R&V stage. Once a risk is approved to commit to developing a project to address then we decide on the most appropriate pathway with a Project Categorising Tool, this tool allows us to choose the most appropriate R&V process (for example a simple plant replacement will require significantly less engineering design and project management input than compared to a multi-million pound scheme).

The Project Categorisation Tool provides:

- The project's categorisation
- The Risk(s) score (criteria will vary depending on complexity)
- The most suitable R&V process and accompanying governance

2.2.2. R&V1: Risk identification and need validation

This initial workshop enables confirmation of the relevant validated Risks and uncertainties to be mitigated. The *Statement of Need* to invest is drafted and agreed by the integrated team. Risk needs are fully understood and prioritised ahead of project optioneering and supporting evidence is gathered.

The step concludes with Investment Decision 1 as detailed in **section 2.1**, the confirmation of alignment between risks, corporate business objectives and needs.

Once the need is sufficiently robust, we begin option development.

2.3. Creating a long list of options

It is critical to our optioneering process that we consider the widest range of possible solutions, to ensure that our thinking is constantly challenged by innovation, past learning and best practices to maximise outcomes. The R&V steps described below detail how we take the validated needs described previously and construct a long list of options that draws from the largest possible range of sources.

2.3.1. R&V2: Root cause analysis, gap analysis and unconstrained long-list generation

We conduct a series of broad reaching workshops, desk-top studies, and investigations to understand the root cause(s) of the validated need(s) established at R&V1. This allows us to understand what changes to our infrastructure system or management processes are required to proportionately mitigate/remove the Risk and meet the need. This step draws insights from a multitude of internal and external stakeholders and sources including:

- Operations and site staff
- Engineering and the engineering supply chain
- Southern Water subject matter experts, such as hydrogeologists
- Delivery Partners through early contractor involvement (ECI)
- Water and wastewater Risk teams
- Repair and maintenance contractors
- Customer feedback
- Academic input
- Consultancy reports

- Asset Management performance and health monitoring, via both system and on the ground reporting
- Contingency planning and resilience analysis
- Southern Water bid assessment frameworks
- Historic delivery performance reports

Additionally, in AMP7 we commenced new *Studies & Investigations Framework* with a dedicated supply chain to make our long list generation process more robust than in previous AMPs, where it was just part of the engineering process.

Building on our technical experience and incorporating both internal and external expertise generates an unconstrained long-list of project options built from traditional and non-traditional approaches to capture all potential solutions. For example, the use of nature-based solutions such as wetlands as an option for nutrient removal, and catchment flow separation solutions for spills reductions as alternatives to grey solutions that require storm storage capacity. We challenge ourselves to bring in a wide array of options using our engineering knowledge, delivery experience, operations team's local knowledge and our customer feedback to ensure that all potential options are considered.

2.3.2. R&V3.1: Constrained long-list generation

The first stage of constraining options (rationalising down unfeasible options) that can address the need statement is an assessment against immediate constraints that would make an option unfeasible for progression. This enables the creation of a constrained long-list of options that address the identified need or Risk, within context of what is practically achievable.

The appraisal is completed against all options to determine their feasibility, with these options progressing to the next stage. We consider feasible to mean that a project is constructable, deliverable, and affordable. This assessment is captured in the PR24 Options Scorecard, which we have used across the plan to support selection of preferred options. The purpose of this tool is to support the assessment of each project option against a standard set of criteria. Our criteria to determine feasibility are:

Business need – an assessment of how well the solution meets the need that we verified at R&V1 and minimises Environmental and Third-Party Impact Risks

Operation and maintenance – an assessment of whether the option supports operation and maintenance goals, such resilience targets

Deliverability – an assessment of whether the option can be delivered against scope, and on time

Affordability – an early rough order of magnitude assessment of budget requirements

These criteria are scored from 1 – 4 (low to high), however, a score of 1 against any criteria would define the option to not be feasible and it would not be considered any further. The aggregate scoring of the above is then considered at the end of the long-list assessment process, ensuring that the evaluation of these criteria contributes to the strength or weakness of the option when balanced against the rest of the wider assessment.

2.4. Option short-listing and preferred option selection

The long-list of feasible options are then assessed for the purposes of rationalising the long-list into a short-list of the most appropriate options.

When we generate the short-list, we begin by assessing a 'do nothing' option which establishes a baseline from which the benefits of any subsequent intervention are measured. The 'do nothing' option assesses the Risk of not intervening and captures the capital requirements of that Risk.

Our constrained long-list of options is then assessed against:

Natural and social capital criteria -

- Captures alignment with regulatory directives, where applicable (Water Framework Directives, Bathing Water Quality, etc). In instances with overlap, additional assessment is completed to determine overall impact against regulatory requirements.
- Land usage change – an assessment of the degree of change required on land use, i.e., does the intervention build new assets on to previously natural habitation and if so, to what degree. This assessment calculates an impact score of 1 – 4 on:
    - Carbon sequestration
    - Natural hazard regulation
    - Biodiversity impact
- Public trust – score based on how the option would affect the level of public trust / institutional support in Southern Water
- Engagements and networks – score based on how the option affects the level of engagement and networks between Southern Water and potential Delivery Partners

Carbon impact – An assessment of embedded (construction) and operational (post-build) carbon caused by the option. No build solutions score a maximum score of 4 during the construction phase.

Commercial considerations - A subjective assessment of both capex and opex on a scale of 1- 4.

A score is given against each of the criteria as described above, where a higher score represents a better outcome. Once complete the options with the highest overall score are those which are progressed to the short-list. Typically, the 3 – 4 strongest scoring options are progressed to the short-list but this can be higher or lower depending on how well various options have performed against assessment.

2.4.1. R&V3.2: Preferred option identification

Options that proceed to the short-list are subject to more detailed natural and social capital, capex, opex, embodied carbon and operational carbon assessments using the PR24 Scorecard and tools developed by the Southern Water Cost Intelligence Team (CIT). The cost approach, methodology and considerations are detailed in full in **Part B** of this technical annex.

Our costing tools provide an early estimate of capex and opex, which is captured in the scorecard providing a single **Whole Life Cost** value for the option, covering a 30-year lifespan in line with Ofwat's PR24 Final Methodology submission table guidance for wholesale water and wastewater.

We capture an estimate of carbon impact, derived by our opex calculation tool, or through an average ratio of carbon to opex derived from 43 completed AMP6 projects which provides option specific **embodied and operational carbon** estimates.

Finally, we calculate the **Natural and Social Capital Value,** a monetary value assigned to the benefits expected from the option itself. This calculation is captured on a separate section of the PR24 Scorecard and completes a significantly more extensive and detailed assessment of how the proposed solution impacts broad habitats, biodiversity, water supply and quality, food, recreation, and nature-based volunteering/education.

Driving the calculation of the Whole Life Cost, carbon estimates and Natural and Social Capital Values concludes the assessment of each option and provides the insight necessary for Southern Water to do an appraisal on cost and benefit and select a preferred option to proceed with.

3. Cost Benefit Appraisal

We have at this stage established an estimate of the Whole Life Cost and both Natural and Social Capital Value of the short list of options. We can now conduct an appraisal against these remaining short-listed options to identify two types for consideration prior to final selection.

Lowest Cost Option

Our process to this point has ensured that whilst we have considered how to meet the need from the widest range of sources, the options we are selecting between are all fundamentally able to meet the need as defined. The Lowest Cost option is therefore the option that delivers against this need, whilst having the lowest Whole Life Cost (based on capex & opex). We capture this option to ensure that our final option selection includes a solution that delivers the outcomes we seek at the lowest possible cost to the customer.

Best Value Option

Alongside our Lowest Cost Option, we also capture the option that delivers Best Value. The way we calculate Best Value is by taking the Whole Life Cost of an option (as above) and adjusting to account for the value of the Embodied Carbon, Operational Carbon and the Natural and Social Capital Value into the calculation. Effectively, the Best Value option is the one that totals the option cost & carbon impact and takes away the Natural and Social Capital Value to give an adjusted figure that demonstrates Best Value. Whichever shortlisted option has the lowest value after this adjustment is made is calculated to be Best Value.

Value of a Best Value option is expressed in monetary terms but is tracked against several natural and social capital impact measures. As an example, for WINEP[1] options, impact is assessed against:

- Water purification by habitats – The impact of options on the ability of wetlands to support the purification of waterbodies
- Water quality – The impact of options on the quality of waterbodies and how this affects recreation, biodiversity, aesthetic value, and existence value
- Water supply – impact on the benefit associated with the provision of public water supply

[1] Water Industry National Environment Programme. This programme aims to improve the environment in the UK by reducing the amount of pollution from water companies.

- Climate regulation – impact of changes in habitats on the volume of greenhouse gases they store or emit, such as carbon dioxide
- Recreation – impact on recreational access and opportunities (inclusive of angling)
- Food (shellfish) – impact of changes in the quality of shellfish waters on shellfish production
- Air quality - impact of changes in habitats on pollutants they absorb from the atmosphere, in terms of avoided damages to human health
- Hazard regulation wetland and woodland – impact of flood Risk protection
- Volunteering – the impact of on opportunities for nature-based volunteering
- Education – impact of opportunities for nature based educational visits for school children

Each of these components has a monetary value calculated using an appropriate method, for example, climate regulation takes a 'cost-based' approach.

The default solution that we progress is the least cost option, unless best value can be justified.

The calculations described above and the overall tool was developed in collaboration with third parties such as Exeter University and all the criteria are aligned with Environmental Agency expectations, with whom we consulted during the tool's development to ensure its value was fully maximised.

4. Best Value Analysis

Justifying that a Best Value solution is worth selecting over the Lowest Cost option necessitates further analysis to balance the value the option can deliver against the differential in Whole Life Cost (i.e., the cost to deliver the solution). In some scenarios, the Best Value option's Whole Life Cost may exceed the Lowest Cost by so much that the Lowest Cost option still has to be selected, due to financing or affordability in the shorter term. Alternatively, there are scenarios where selecting an option with a lower Best Value cost but marginally higher Whole Life Cost than the Lowest Cost option is preferable, due to better meeting preferred customer outcomes, plan-wide strategic objectives, long-term strategic objectives and environmental effects.

These impacts are cross referenced against plan specific outcomes, to ensure best value is materially linked to the specific commitments of each part of the PR24 plan. In the WINEP example, benefits would be tracked against wider environmental outcomes such as natural environment, net zero, catchment resilience and access, amenity, and engagement as these impacts are fundamentally at the centre of our WINEP plans' strategic objectives.

What determines the final selection between these options is determined on a case-by-case basis, decided by Southern Water stakeholders. For further details on how Best Value analysis has impacted options selected within specific components of the plan, please see the relevant business cases at the following link www.southernwater.co.uk/our-story/our-plans/our-plans-2025-30.

5. Quantifying Performance Improvements

The impact of investment on performance commitments is captured in a robust and consistent method via several tools described in further detail in the SRN18 Performance Commitment Methodologies Technical Annex. The tools quantify how the options that we have selected are helping us towards compliance with performance commitments, underpinned by the strength of the options we have selected to meet plan specific needs. The quantification is a variable in the data tables CW15-16 and CWW15-16.

6. Capturing Uncertainties

A key aspect of optioneering is to understand the uncertainty associated as we develop our options; uncertainties cover any number of aspects, such as longer-term insights and context, population trends, expected urbanisation, regional and local infrastructure plans that help to define the need and ensures our preferred option is appropriate given what we are unable to predict with increased certainty.

Uncertainty and margins of error are commonplace in Risk management, so we have taken objective steps to understand the confidence and room for error in our Risk, and therefore statements of need. If uncertainty is beyond a reasonable tolerance, then we will undertake more evidence gathering, such as commissioning a study or engaging a subject matter expert. Similarly, uncertainty also affects the designing and choosing of solutions, so we have a robust process of establishing design reviews that act to challenge and provide a fresh perspective on the integrated team's proposed solution to ensure that only technically feasible and affordable options are progressed to delivery. We incorporate non-traditional, lower Risk and modular solutions into our potential solution long-lists where we forecast that option utilisation will be low, giving us the flexibility to build solutions iteratively as future needs emerge and become more heavily evidenced (such as a Local Authority delivering their local plan).

Where an option has been selected, but has a higher degree of uncertainty, be it cost, deliverability or performance, then our cost estimation practices allow for a higher allocation of Risk (funding allocated to cover a project's Risk of overspending) as part of the expected cost of the solution. We cover this process in further detail in **Part B** of this technical annex.

7. Third-Party Funding

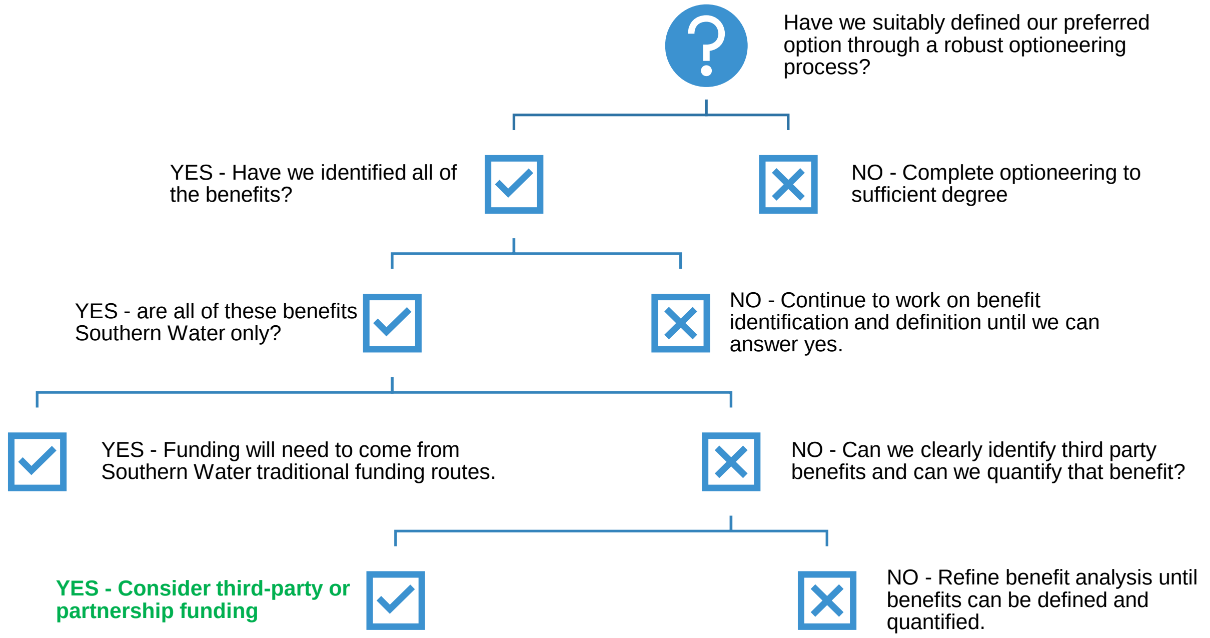
Overview

We have discussed in **section 3** how we make a broad consideration of environmental and social benefits. We seek to achieve the broadest possible societal and environmental benefit for each of our projects and in many cases this benefit extends beyond the water company and our customers so it is important to ensure a fair approach for our customers to protect them from any additional cost. The WINEP methodology explicitly states:

"Water companies should not use customer money to pay for work beyond their own functions. However, by working in partnership with third parties picking up a fair share of costs, there is the potential to deliver better outcomes overall. Solutions delivered in partnership allow companies to leverage input from third parties. Funding should be allocated such that each partner pays its fair and efficient share of the costs of solutions. This should consider the relative benefits of the solution and the incremental costs to water companies and third parties, compared to a solution the water company would implement to address only its requirements"

As such, we take a partnering approach with third parties such as developers to deliver projects earlier or Local Authorities where our assets interact.

Figure 3 – Decision tree to determine option for third-party funding



Third-party partnerships may take the form of co-design, co-delivery or co-funding depending on the particular requirements of the solution and benefits being realised.

An example of this would be the use of Highway Sustainable Urban Drainage (SUDs) to achieve surface water separation from our sewers. The benefits of this solution are obvious for our sewer network where we see a reduced storm response and demand for capacity, but there are also clear benefits for the Local Authority where there is a greening of the environment and people's residential areas.

Ensuring funding is reliable and appropriate

The use of third-party funding must be reliable and appropriate before we consider any partnership delivery of our projects. We consider the Risk of any funding being withdrawn before the project has been completed to ensure that it does not expose our customers to any additional burden via increases in bills. We also review the nature of the projects, the nature of the benefits and scale of funding required to determine whether a third-party funding or partnering approach is appropriate.

An example that we are currently exploring with a developer is for a project where we need to reduce nutrient levels at our wastewater treatment site by 2029/2030. This project is putting a restriction on our network which currently prevents the developer connecting new homes to our sewer network. We are exploring options with the developer whereby they provide the funding to get the project started now, and they pay the additional opex until 2029/2030 so that they can get an earlier connection to our network and can progress their development. This is still in the very early stages but is representative of our approach.

Full detail of third-party funding approaches we are taking is included within the respective Enhancement Business Cases.

8. Use of Direct Procurement for Customers and Alternative Funding

In some circumstances, projects or programmes will be funded using alternative funding methods, such as Direct Procurement for Customers (DPC) or other similar non-DPC routes. DPC involves competitively tendering for services in relation to the delivery of certain large infrastructure projects, resulting in the selection of a third-party competitively appointed provider (CAP). DPC means that we competitively procure more aspects of our infrastructure programme, including financing for projects. Outsourcing the delivery of our projects using DPC can help achieve significant benefits for customers such as innovation and lower whole life costs of a project. We conclude our optioneering process as described above to ensure we are considering the broadest possible long list of options, and we follow the robust short-listing and preferred option selection process that we use on all of our projects, before we assess whether the project or programme is suitable for an alternative funding approach.

We use Ofwat's guidance and mandatory criteria for DPC to assess the suitability of projects for alternative delivery routes. This process is discussed in more detail in SRN17 Direct Procurement for Customers and Alternative Delivery Model Technical Annex.

9. Customer Engagement and Protections

We engage with our customers regularly throughout business as usual, both in general terms and around specific targeted areas of our plans. There are several mechanisms that we use to capture the feedback we get including surveys, focus groups, workshops and one-to-one sessions to capture real time feedback, as well as monitoring social media and our incoming customer complaints to track the concerns of our customer base. We ensure that our approach is robust by using dedicated, independent research firms to support us in identifying and managing the customers we engage with.

For further detail about our customer approach refer to the SRN03 Customer Acceptability chapter.

We also keep our customers informed of our plans, and the ways in which we are addressing the concerns that they raise with us. Each communication method is targeted based on the issue being considered and the nature of the customer. For example, where we are talking about reducing the amount of water our customers use we undertake letter drops, include leaflets with bills and have pop-up stands around our region to talk to customers face-to-face. However, in the case of a burst causing a supply interruption then we communicate directly with the customers that have been affected.

The feedback we capture from our customers is incorporated at several levels across our company. 'The Customer' is a permanent agenda item at Executive Committee and Board level, championed by our Chief Customer Officer, [redacted], who drives the implementation of the information we receive across the business. Where sessions are held to cover specific areas of our plans the feedback is sent to the programme leads and technical teams for consideration in the optioneering process. This is captured in the PR24 Options Scorecard through the social capital considerations and links our customer engagement to our optioneering.

The detailed methodology that explains how we do this is captured in our SRN14 Customer Insight Technical Annex. We have additionally discussed customer protection through performance commitments in our SRN18 Performance Commitment Methodologies Technical Annex.

10. Conclusion

Our optioneering process is designed to identify the best value option to meet the identified need from the broadest possible list of potential options. We assess a wide array of benefits to also identify a best value option for customers, which can be taken forward if it meets the business need and wants from customers.

Once we have confirmed our short list and preferred option, we can progress into detailed cost estimation. This methodology is discussed further in **Part B**.

Part B: Cost Estimation for Enhancements

Introduction

What is Part B of this technical annex about?

Part B of this technical annex explains how we have ensured that our wholesale programme enhancements are based on robust cost evidence and represent efficient delivery. Our cost estimating methods are rooted in industry good practice, based on sound logic, and consistently applied. Our capital and operational costs are based on using the best available data from sources including supplier quotations, models derived from historical evidence, benchmarks, and estimates from subject matter experts. We have developed a standardised approach for assessing Risk in line with Green Book guidance that objectively considers complexity and maturity of each solution, and programme-specific uniform allowances for Indirect Costs and Corporate Overheads based on analysis of our historic costs.

In this annex we describe the standard costing processes we have used to generate our PR24 Business Plan and how we understand efficiency by undertaking benchmarking centrally on the cost data used to price the solutions. This standard approach supports the overwhelming majority of the enhancement costs. However, where the nature of specific work dictates that a bespoke approach to cost estimation would provide a more accurate result, we have done so. Where we have made exceptions to our standard processes we have described this, along with supporting rationale, in the respective enhancement business cases.

Our standard cost estimation process is well established. It is part of our business-as-usual practice forming part of our wholesale delivery project lifecycle. PR24 has incorporated this standard process, however, PR24 also provides a unique challenge – the scale and nature of our future plan means that we have had to adjust our costing approach to account for future complexity and efficiency where required. i.e., variations of our standard process have been adopted where necessary due to the size and scale of the PR24 plan.

What does this annex support?

Our costing methods underpin our proposals for investing in our operations to enhance them for customers and the environment. This annex therefore supports the enhancement business cases. It should be read in conjunction with all of our issued PR24 Documents.

Dependencies

The information presented in this technical annex is dependent on the other sections of our business plan in our PR24 Documents.

How is the information in this annex structured?

This annex steps-through each component of our capital and operating costs. It describes how we have formed accurate cost representing efficient delivery. This includes considering our historical performance, and benchmarking results against similar water and wastewater companies.

Within this **Part B**, we set out our approach to capture cost data and produce cost estimation tools in **Section 1**. Our approach to Cost Estimation is detailed in **Section 2.** This includes a description of our standard cost breakdown structure and our classification of costs. Our approach for calculating Direct Costs is outlined in **Section 3.** The calculation of the Indirect Cost multiplier is covered in **Section 4.** The methodology for capturing the add-ons for Risk and Corporate Overheads are detailed in **Sections 5 and 6** respectively. We explain our process for estimating operating costs in **Section 7** and benchmarking against other Water and Sewerage Companies (WaSCs) in **Section 8.**

How have we applied key learning from PR19?

Our PR24 costing approach is informed by regulatory feedback from PR19 and lessons learned from AMP7 Delivery. For PR24 this feedback has driven us to focus on: applying the highest standard of relevant and available evidence to develop our estimates, applying data and learnings from our past performance/ delivery and our ongoing commitment to cost efficiency. In this annex we are transparent with our customers and regulators over how we have estimated costs for PR24. Two key areas of changes in our approach from PR19 that illustrate how we have applied learnings are:

- Indirect costs – We have endeavoured to use a larger number of data points and the most recent, high quality and relevant datasets to calculate our indirect costs. For example, our non-infrastructure indirect costs are estimated using AMP7 performance data. Given non-infrastructure enhancements represent in the region of 60% of our plan value, this has a material impact in increasingly the overall quality and robustness of costs in our plan. We have also benchmarked our costs against our peers to confirm that we are efficient. See **Section 4** – Indirect Costs and **Section 8** – Benchmarking for further detail.
- Risk – Our PR24 approach to calculate Risk draws on a greater number of evidence points including historical AMP7 delivery performance, characteristics, and complexities of projects in our plan and industry good practice from the National Audit Office, HMT Green Book, and Infrastructure and Projects Authority. For our PR24 cost estimates our Risk approach addressed characteristics of each project. This enabled us to be more precise in our estimate. We have also benchmarked our costs against our peers to confirm that we are efficient. See **Section 5** – Risk and **Section 8** – Benchmarking for further detail.

We have used a process of continuous improvement to ensure that our programmes are efficient. Challenging ourselves to standardise solutions and deliver the optimal scope results in efficient costs being captured and used for our PR24 plan.

An example of this process is where we have challenged ourselves to be more efficient in the delivery of Phosphorous Removal (P Removal) projects between AMP6 and throughout AMP7. Delivery of a comparable project in AMP7 has involved us challenging our build-up of scope, reviewing in detail each item to ensure that it achieves our required output without compromising on quality, safety, or performance. This change in scope is represented as an adjustment to our PR24 scope build up taken forward for cost estimation. It is through this process of continuous improvement and cost curve adjustment that we can be confident in our efficiency of delivery, and therefore confident that our PR24 plan is efficient. Below we set out some of the key interventions we have made within AMP7 to deliver efficiencies in P removal:

- In AMP7, we have reduced the size of control panel we need to control our P removal process modifications. This means that we can reduce the sizes of our kiosks and the sizes of our concrete bases. We have made alterations to the design of chemical dosing units from a large kiosk enclosing both the storage tank and dosing pumps, to a separate storage tank and small kiosk for dosing pumps. On smaller sites, the dosing pump kiosk no longer needs to be a walk in, reducing construction time and cost.

- Early design process chemical dosing trials across several sites helped identify the level of P removal possible without providing unnecessary tertiary treatment. This early intervention helped us to avoid the need for new tertiary treatment on at least five medium to large sites that would have had this installed in AMP6.

- We have introduced sampling and jar-testing on sites where there is a Risk of alkalinity deficiency, enabling informed, Risk-based decision making on the installation of alkalinity dosing equipment, reducing the overall number of sites requiring alkalinity dosing.

- On sites with chemical dosing for an existing P permit, we have made efforts to optimise existing assets to meet the new permit requirements before a decision is made on installation of new assets, leading to several cost saving no-build solutions.

- The introduction of a Risk & Value process within the wider design process encouraged more discussion around what an acceptable level of residual Risk is, allowing scope reduction on several sites compared to the solution that would have been previously installed within AMP6.

- Our AMP7 delivery model features Southern Water keeping process design Risk for projects, making suppliers more open to solutions with less scope & higher degrees of design Risk.

- AMP6 saw significant requirement for tertiary treatment units for P removal. We leveraged the learnings from this process to push the design criteria on some types of units beyond the levels suppliers have historically been prepared to accept.

Whilst these are relatively small changes on a site-by-site basis, the cumulative effect over the whole P Removal programme is significant and impactful. We have used the reduced scope for P projects across all of our PR24 P removal programme. This demonstrates our commitment to implement efficiency opportunities where identified and scaling across our programmes.

On an ongoing basis we will continue to standardise our designs across programmes so that we can gain economies of scale across purchase of standard equipment (panels, pumps, manhole chambers, valves etc) and we will continue to pursue modular construction of our assets to increase the speed of construction and the simplicity of solutions.

1. Our Approach to Cost Capture and Modelling

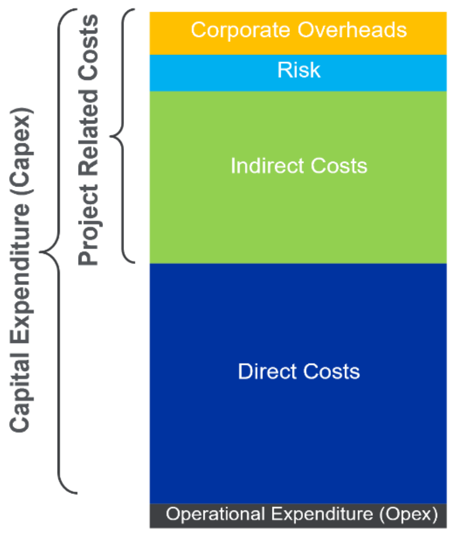
1.1. Introduction

Cost estimation for PR24 involves projecting what we know today and applying a series of rules and models to generate a predicted out-turn cost. This process relies on us capturing cost data from our Main Contractors (Delivery Partners) on real capital projects. We capture this data at three key points in time: upon agreement of the main construction contract award, completion of detailed design and again at completion. We use this data to form models for estimating the cost of investments through delivery cycles and Price Reviews. This cost capture and cost modelling process is 'business as usual' and has been in place since 2010 (brought in during AMP5). It is managed and maintained by a dedicated Cost Intelligence Team (CIT) formed of cost estimators and data modellers. They ensure our cost tools align with our historical experience of delivery. To challenge the efficiency of our costs we compare these cost models to benchmarks sourced by our CIT team and adjust where we deem necessary to ensure our models reflect efficient delivery.

Engineering and project development is completed by our internal Southern Water Engineering and Technical Solutions (ETS) team, with support from the Strategic Solutions Partner (SSP) engineering consultancy suppliers. Where beneficial Delivery Partners are also engaged prior to full construction contract agreement to support solution development.

1.2. Why we separate costs

Figure 4 - Our cost stack



As depicted in **Figure 4** we divide our capital expenditure into four categories: Direct Costs (or Net Direct Works) and Indirect Costs, Risk, and Corporate Overheads (collectively known as Project Related Costs). In aggregate, Project Related Costs (PRCs) are estimated as a multiplier to Direct Costs and in our approach, we have calculated a compound percentage for each individual element of the cost stack (i.e., the Indirect multiplier is applied to Direct Costs, the Risk multiplier is applied to the sum of the Direct and Indirect costs). This enables us to accurately forecast the total cost stack by evaluating each of its main components and their unique features. Additionally, we consider the net change in Opex resulting from additional capital investment which, in addition to Capex, formulates our comprehensive cost stack.

Note, this approach is broadly aligned to guidance from the UK Government Infrastructure and Projects Authority (IPA) Cost Estimating Guidance[2] which recommends adopting a cost breakdown structure that is in line with industry-recognised cost classifications.

Direct Costs refer to costs associated with the construction or modification of an asset, including materials and packaged plant, construction equipment, and labour. These are the foundation of our cost stack thus it is imperative that we accurately assess these as the rest of the cost stack is calculated as additional percentage add-ons to this. Our approach to calculate Direct Costs is outlined in **Section 3.**

Indirect Costs relate to the development and management of a project including, design, preliminaries, construction management, supplier overheads, and insurances. They are related to project delivery and are apportioned to direct asset cost. They are spread proportionally as a percentage across all Direct Costs. The scale of Indirect Costs differs for Infrastructure and Non-Infrastructure projects. This is due to material differences in the design process as well as construction site set-up and management. Our approach to calculate Indirect Costs is outlined in **Section 4.**

Risk refers to an adjustment that accounts for the impact of uncertainties and hazards applicable to each specific solution. Full certainty cannot be provided with the early-stage design and cost estimates produced for PR24. We perform an assessment of specific characteristics of each project and use these to derive an additional percentage for Risk. As this relates to Risks to project delivery, this is applied as an uplift to Direct and Indirect Costs. Our approach to calculate Risk is outlined in **Section 5.**

Corporate Overheads refer to the cost of corporate services that are critical to delivering our capital projects. Our capital programme is, in-part, made up of enhancements. Therefore, we have determined the appropriate level of overhead we need to implement our enhancement programme. Our approach to calculate Corporate Overheads is outlined in **Section 6.**

Separating costs in this manner aligns with the approach taken by other Water and Sewerage Companies (WaSCs) which enables us to obtain comparator benchmark information. This means we’ve been able to compare our current performance against the current performance of our peers and consider areas for improvement. Benchmarking is a crucial aspect of our ongoing performance monitoring, ensuring that we operate efficiently and deliver value to customers. Findings from benchmarking Indirect Costs, Risk and Corporate Overheads in our cost stack, against other WaSCs, are outlined in **Section 8**. Findings from benchmarking our Direct costs are included in the individual Enhancement Business Cases.

By separating costs into distinct categories, we achieve greater cost transparency, evaluate performance more effectively, facilitate enhanced benchmarking against industry, and uphold high standards of cost estimation and management.

[2] UK Government Infrastructure and Projects Authority Cost Estimating Guidance, Published in 2021. IPA_Cost_Estimating_Guidance.pdf (publishing.service.gov.uk)

1.3. Cost Capture

Cost capture is undertaken by CIT at the point a Level 3 estimate (described in **Section 2**) is produced by a Delivery Partner or Contractor, again when a project reaches Most Likely Out-turn Cost (MLOC), and finally once the project has been completed and the out-turn cost is known. In each case this is fed back to the relevant cost curves so that adjustments can be made to provide more relevant and up to date data, which informs our cost estimates. Where new data becomes available it is added to the cost curve data set and the regression analysis is re-run. We have used our most up to date cost curves to estimate our PR24 costs.

Through delivery, our Delivery Partners allocate costs to a standard work breakdown structure. This is a contracted obligation for them. The work breakdown structure aligns to the cost breakdown taxonomy used by our project delivery and finance functions. The cost breakdown structure separates costs that relate to the whole project (e.g., project management) from those to deliver a specific asset (e.g., a new pump).

Our AMP8 plan means we will be delivering work which we have not delivered at a similar scale before. It has therefore been necessary to collect and model wider industry (non-SWS) sources of data to form our cost models; either to blend with our existing data where it may be scarce or to form new models where we do not have any data. This process is managed by our CIT, supported by engineering consultancy [redacted]. [redacted] have access to a wide array of data from the wider UK water sector as well as other sectors and international projects. However, wherever possible, we have prioritised use of our own data in-line with recognised good practice and relied upon external data as benchmarks to assure costs represent efficient delivery.

1.4. Cost Modelling

Our standard cost capture and modelling approach has been used for PR24 cost estimation. We use our captured cost data to form models for estimating the cost of investments through delivery cycles and Price Reviews. Cost models enable us to capture the relationship between various factors which influence the Direct Cost of our PR24 projects (e.g., asset size). Our models rely on regression analysis, which involves analysing historical data to identify patterns and trends. We use these models to estimate Direct Costs for different elements of PR24 projects. For example, we can estimate the cost of a future pipeline of a given diameter and length using a cost curve (see **Section 3.2.3** for a worked example). Cost modelling in this way ensures a consistent data-driven and systematic evaluation of Direct Costs can be carried out, allowing for accurate estimation. It also provides the foundation of informed decision making and continuous efficiency improvement through monitoring asset-level cost changes.

2. Cost Estimation

2.1. Approach

Our approach to estimating costs forms part of a wider PR24 planning process we follow to develop options to address regulatory requirements. Our optioneering process through to preferred option identification is described in **Part A** of this annex. We use one of three different levels of estimating for our Direct Costs depending on the stage of project development. We describe these three levels of costing below.

Level 1

For the purposes of options short-listing and cost estimation we use the Southern Water Level 1 cost tools which are based on industry data, captured from completed projects. For programmes consisting of lots of projects, such as storm overflows, mains renewals or metering, this approach is robust as it is based on the average delivery cost for all of the projects. The data captured from the delivery of real projects across the industry to develop these models ensures that the costs represent efficient delivery at the programme level. The benefits of this approach are that it reduces the Risk of any elements of scope being missed at an early stage, and it is quicker to cost up project options as we model data a process level. The disadvantages are that it assumes future projects have the same complexity as historical projects when this may not always be the case. Any discrepancies are picked up in the level 2 review when more granular costing is undertaken at a subsequent stage (compared to the higher level of aggregation at Level 1 as a result of there being less detail available).

As project development continues and more specific and granular information about the solution becomes known, we generate the next level of costing. We consider whether Level 2 costing is appropriate on a solution-by-solution basis. It can be used to improve cost confidence in a specific project or can be for a sample of projects in a programme to support a Level 1 cost, or to help justify particularly complex or novel projects.

Level 2

Level 2 cost estimating relies on the scope being defined sufficiently by ETS to generate a Level 2 scope sheet, which itemises the quantity and scale of each type of new or refurbished asset, lengths of pipework and other ancillaries, as well as any other project specifics such as power upgrades. In contrast, the Level 1 cost tools take a generalised allowance for these more granular items. Therefore Level 2 costing requires additional engineering design, but results in an estimate of higher definition and confidence. Both Level 1 and Level 2 pricing use our cost model library, based on collection of real historical project data. Level 1 curves are process level and Level 2 use a combination of both process level and asset level curves. In addition, where the volume or quality of data may be relatively weaker, our models are supported by import of selected external data.

Level 3

Level 3 cost estimating is typically undertaken in collaboration with our construction Delivery Partners. Level 3 cost estimation requires accurate scheduling of all project elements, assets, and quantities. It typically also involves engagement with suppliers to provide specialist input, including quotations. With this information a more detailed cost estimate is produced, and the solution can be implemented. This is the most robust level of costing and it ultimately forms the value of the agreed construction contract. We have utilised Level 3 cost estimation in a small number of cases where more detailed cost estimation was required to make appropriate decisions. This has been concentrated around the Four Sites Resilience projects and Smart Metering.

How have we applied these levels of costing for PR24?

A summary of the levels of cost estimation across the enhancements in the plan are contained in the following table.

Figure 5 - Summary of programme value based on Level 1, 2 and 3 costing across enhancements

Enhancement Business Case	Total Enhancement Capex	Value of Level 1 costing	Value of Level 2 costing	Value of Level 3 costing
WTW Growth	7.9%	7.9%		
First Time Sewerage (s101a)	0.2%	0.2%		
IED	3.7%	3.7%		
Resilience - power	0.9%	0.9%		
Resilience - Infiltration	1.0%	1.0%		
Resilience - heat	0.2%	0.2%		
Resilience - flooding	0.1%	0.1%		
Resilience - coastal	0.5%	0.5%		
WINEP - Bioresources cake storage/sludge treatment (Anaerobic digestion)	1.4%		1.4%	
WINEP - Enhancing Waste treatment	16.4%	14.4%	2.0%	
WINEP - Storm Overflows	10.8%	10.8%		
WINEP - monitoring	3.8%	3.8%		
WINEP - wider environmental enhancement	1.8%	1.8%		
Supply Resilience Enhancement Programme (4-sites)	8.6%			8.6%
Tightening Water Quality Standards and Raw Water Deterioration	2.7%	2.7%		
Lead	0.1%	0.1%		
Water Resources - Supply	21.6%	21.6%		
Water Resources - Demand	7.0%	7.0%		
Water Resources - Smart metering	1.7%			1.7%
Water resources – SROs	6.3%	6.3%		
WINEP – Supporting water abstraction	2.0%	2.0%		
Reservoir Drawdown Capacity Increase	0.7%	0.7%		
SEMD	0.3%			0.3%
NIS	0.6%			0.6%
Total:	**100.0%**	**85.4%**	**3.4%**	**11.2%**

We have taken a Level 1 approach across the majority of our PR24 plan programme to support the optioneering that we have undertaken and based on our experience of delivery. Southern Water have prior experience of delivering the types of projects included in approximately 47% of the plan. Our prior experience is particularly robust in the areas of Leakage, Meter Replacement, Nutrient and P Removal, and Lead Pipe Replacement. This experience increases the confidence we have in our Level 1 estimates for these areas. We have matched the effort put into generating estimates to the complexity/repeatability/past experience of the programme/assets. So, for programmes of low-cost volatility which we have previously delivered a high volume of, we are confident about the scope and cost. Thus Level 1 is appropriate as it requires a lower effort than Level 2 costing but is still a high confidence estimate. It would not have been efficient to progress all areas of the plan where solutions might be repetitive or where we have significant experience to Level 2 costing.

However, we have used targeted Level 2 costing in areas where we needed to improve confidence in our Level 1 estimates. We have used Level 3 contractor costing in areas where our programme is sufficiently developed, as shown by the table above.

In some discrete cases we have additionally developed some bespoke costing approaches where the scope of a particular programme warranted it. This is where we have used supplier pricing or trial projects to support our PR24 costs. Examples include Storm Overflows where we are running trial projects through our Pathfinder programme, Smart Metering infrastructure where we have reached out to our suppliers for quotes and the SRO programme where we are engaging with suppliers, investors and contractors to develop our plans.

Further detail on the costing approach adopted (Level 1, Level 2, Level 3 or bespoke costing) is detailed within each enhancement business case.

3. Our Approach to Estimating Direct Costs

3.1. Introduction

Direct Costs are those associated with the construction or modification of an asset. These include the costs of construction labour, materials, operational plant, and construction equipment. When we estimate Direct Costs, we create a cost baseline for each project or programme based on the details and type of solution to be deployed. As we develop the project further, we track the costs enabling us to measure cost efficiencies against this baseline.

The Direct Costs also form the basis for the whole project Capex estimation approach, with Indirect Costs, Risk and Corporate Overheads applied as a multiplier of these Direct Costs. Obtaining a robust understanding of the PR24 Direct Costs therefore has a material impact on the plan for enhancement cases.

Our approach follows good practice cost estimation. We have challenged our cost models and cost estimates against cost benchmarks. These benchmarks are generated by our Cost Intelligence Team and they use them to review our cost curves each time new cost data is imported. New data imports to cost models mean cost curves are re-drawn. The regression method is also checked and amended where necessary to ensure highest possible and logical r^2 value. This process is discussed in more detail in **section 3.2.1**. We follow the principles of evidence-based costing as set out in the Infrastructure and Projects Authority's Cost Estimating Guidance[3] which sets out eight steps in the estimation process. These are:

Step 1: Establish brief and engage the team

Step 2: Gather data and evidence

Step 3: Select cost estimating methodology

Step 4: Calculate base estimate, uncertainty, and Risk

Step 5: Produce cost estimate report

Step 6: Review and assure

Step 7: Project leadership sign-off

Step 8: Use the cost estimate to support decision-making

For PR24 we have assessed the robustness of our Direct Costs and made improvements in focused areas, discussed in **section 8.3.2**. We have additionally benchmarked these costs to identify any delta against industry median costs.

[3] UK Government Infrastructure and Projects Authority Cost Estimating Guidance, Published in 2021. IPA_Cost_Estimating_Guidance.pdf (publishing.service.gov.uk)

3.2. Approach

Direct Costs have been estimated for all parts of the enhancement programme using our standard probabilistic costing methodology. The standard methodology is based on the use of our data, infilled with some wider industry data, developed over previous AMP periods by our Cost Intelligence Team (CIT) indexed/adjusted for inflation to generate estimates for each project's Direct Costs.

3.2.1. Data and evidence

The data and evidence we use is in the form of more than 970 cost curves, covering 66 different overall operational process level and 907 specific asset level costs. These cost curves allow us to estimate a project's Direct Cost based on a specified unit of measurement. In the case of a pump, this unit of measure would be power (kilowatts), which is a function of flow (litres per second) and head (meters). Our cost curves are underpinned by data we capture from our Delivery Partners, described in **Section 1.3**.

The curves use ordinary least squares regression – a statistical method used to find the line of best fit, or curve, that minimizes the sum of the squared differences between the observed data points and the predicted values. It is commonly used to model the relationship between a dependent variable and one or more independent variables, which is usually measured by R-squared (r^2). r^2 ranges from 0 to 1, with a value of 1 indicating that the regression model perfectly predicts the dependent variable based on the independent variables. Conversely, a value of 0 indicates that the regression model does not explain the variability in the dependent variable. Note, multiple regression models (linear, quadratic, cubic etc.) can be derived from the same dataset. Regression models are selected based on the r^2 values and logical engineering expectations on the curve shape.

Note that cost models used for Level 2 estimates have a more defined parameter of inclusions than those used for Level 1. This is due to the increased granularity of detail a Level 2 cost estimate includes. Level 2 requires a larger number of specifically identified and priced items.

3.2.2. Adjustments for inflation

Our cost capture process generates the data for our cost curves and takes data points from historical AMP delivery. The cost curves are adjusted for inflation using CPIH so that all data within a cost model has the same price time basis.

For PR24 we have used the 22/23 price base. The inflation adjustments applied are based on CPIH data to align with the approach that Ofwat have taken previously.

In the instance where the price base of the datasets we examined was the same, the models were run, and their determinations were subsequently adjusted for inflation. In the instance there were different price bases in the dataset, the data was adjusted prior to the inflation model being run. This means that we apply the inflation approach consistently across all curves and data sets. The regulator has identified a number of areas where applying inflation in line with CPIH may not be representative. These include wages, materials, and energy costs. For further details of how we have considered these areas, refer to SRN16 Real Price Effects / Frontier Shift Technical Annex.

3.2.3. Illustrative example of our regression process

To produce a Direct Cost model for a given asset, we use a regression process facilitated by our Cost Curve tool. This tool generates r^2 values for different regression models, which play a crucial role in determining the most suitable curve for accurate cost estimation. To illustrate our approach, we have shown our process for the Pump Set (Water) – MM588 curve. This has a unit of measure (i.e., the independent variable) of Power (kW).

To support robust cost estimation we use our historical data, supplemented with external cost data where required to build robust cost models. We have outlined the current model used for PR24 costing below.

Note, analysing the r^2 value is a prima-facie selection criterion, it is not entirely mechanistic as our CIT team also make other considerations in their analysis and visual corroboration of the curves, e.g., they will consider any unexpected dips, the nature of the curve including its profile at the extremities of the range. Thus, the highest r^2 value does not necessarily represent best the cost variable relationship.

PR24 model

We adopt an iterative approach to our cost modelling and have incorporated new historical data points through AMPs 6 and 7. This has led us to develop a robust cost estimation curve, which now serves as a reliable foundation for projecting PR24 costs.

Figure 1 - Pump Set (Water) – MM588 curve

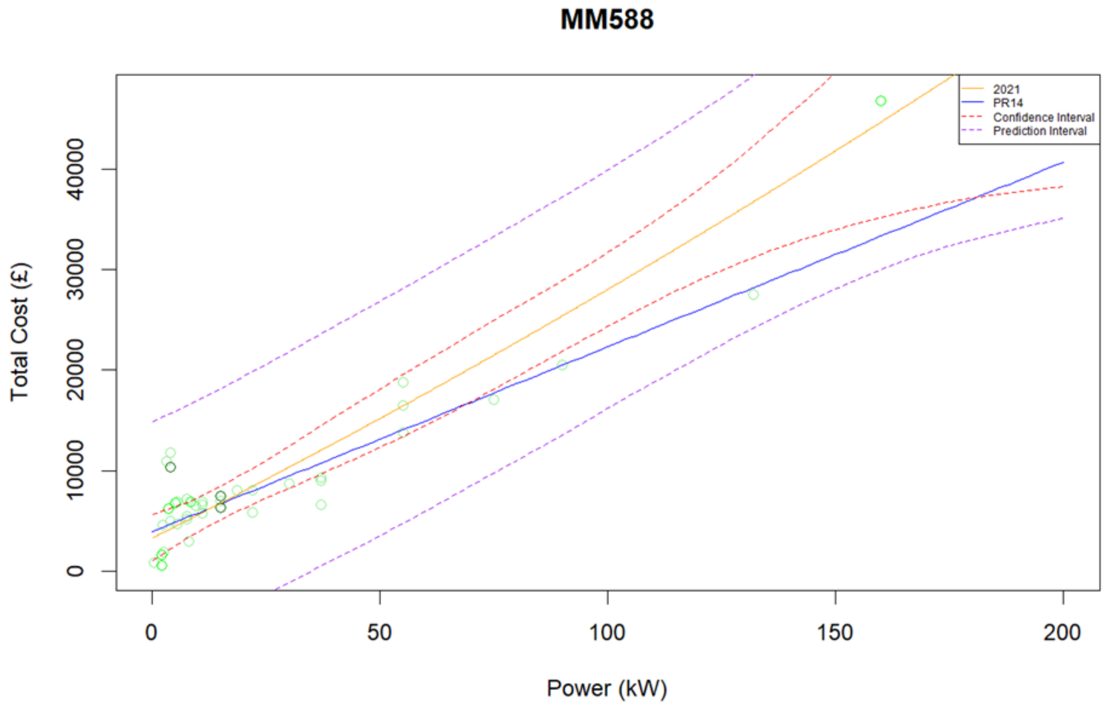


Figure 2 - Pump Set (Water) – MM588 curve r^2 values

```
R Squared Values
Linear: 0.719486229449219
Quadratic: 0.720308743867313
Cubic: 0.722105073709183
Power: 0.680213358423775
Exponential: 0.466610340230872
```

The expected position from the uplifted PR14 curve is represented by the dark blue line in **Figure 6**. Our tool allows us to also examine any outliers and/or out-of-range values. The confidence and prediction intervals have been set to 95%. We can change the confidence level as desired, typically this is used when exploring confidence in the model, e.g. if the expected cost curve (PR14 uplifted) falls within the confidence range of the new cost curve being generated through regression modelling. A quadratic equation has been considered in this instance as this has the highest r^2 value that does not return a negative gradient over the applicable range.

Key benefits of this approach

Analysing multiple regression models and selecting a cost curve based on r^2 value and visual corroboration to expectations provides a robust approach to estimating asset costs. The statistical measure indicates the strength of the relationship between the variables and the accuracy of the model at predicting the datapoints used within it. By prioritising the model with the higher r^2 values, we ensure that the selected curve provides a robust fit to the data, enhancing our confidence in the cost estimation. However, it is also essential to obtain the highest volume of relevant and reliable data to form cost models, and so r^2 alone cannot be a singular measure of cost model quality. The ability to swiftly compare and assess various regression models through the tool's output of r^2 values and graphs allows for efficient decision-making in choosing the most appropriate curve.

3.2.4. Internal cost review and assurance

Our PR24 cost estimation process has been reinforced through additional assessment of a portion of the enhancement cases, identified by their material impact on the plan. In the first instance we completed an assessment of our completed Direct Cost estimates to determine the robustness of the data. Our assessment was based on the criteria in **Figure 8** below, which is aligned to our Risk assessment criteria discussed later in this document.

Figure 8 – Cost robustness assessment criteria

Criteria	Indicator			
		Low confidence	**Medium confidence**	**High confidence**
Complexity of project	1. Implementation complexity 2. Interdependency Risk	Southern Water have little experience of delivery & Risk profile is currently unknown **AND/OR** There is a large gap between Southern Water Costs & benchmarks with no clear justification	Southern Water have some experience of delivery, but solution still has large areas requiring refinement **AND/OR** Delivery is of historical projects, not within AMP7	Southern Water have extensive experience of delivery & Risk profile well understood **AND/OR** Southern Water have compiled evidence or benchmarking from across the supply chain to generate high confidence in solution
Quality of cost data	1. Volume of available cost data 2. Availability of contemporary cost data	Small sample of appropriate cost data available **AND/OR**	Moderate sample of appropriate cost data available **AND/OR**	Large pool of cost data available to support cost model **AND/OR**

	3. Range of cost data	No available industry benchmarks or SWS costs look at or above the range of industry benchmarks **AND/OR** Cost data is sourced from historical cost models **AND/OR** Large gaps within cost data relating to the full scope of the project	Limited/insufficient industry benchmark data or SWS costs look within range **AND/OR** Cost data sourced from historical cost models with some recent supporting delivery data **AND/OR** Cost data to represent all known scope within the project	Sufficient industry benchmarks OR SWS costs are close to the upper quartile of performance **AND/OR** Cost data is based on recent delivery (AMP7) **AND/OR** Costs data consists of delivery partner/supplier quotations **AND/OR** Third party assurance of costs

4. Our Approach to Estimating Indirect Costs

4.1. Introduction

We incur Indirect Costs during the development and management of a project. Indirect Costs are project related costs which include design, preliminaries, construction management, contractor's overheads, and insurances that occur across the project's full lifecycle. These items cover the total project function irrespective of whether it is a direct Southern Water resource or provided by a supplier.

Indirect Costs are applied as a percentage mark-up to the total Direct Cost of the project. This means the value of Indirect Costs is directly proportionate to the overall value of the work to build each project. Estimating Indirect Cost in this manner, as a percentage of Direct Cost, is a widespread industry practice for pre-construction cost estimates. This parametric approach is suitable for the early-stage cost estimates used in the formation of our plan. It is in-line with the Infrastructure and Project Authority's published Guidance on Cost Estimating[4]. The efficiency of our estimated Indirect Costs is informed via industry benchmarking of our Indirect Cost multiplier values against comparable Water and Sewerage Companies (WaSCs) (see **Section 8**).

4.2. Approach

To calculate appropriate Indirect Cost multiplier values, we used cost data from our AMP7 delivery programme to calculate a multiplier that can be applied to enhancement project Direct Costs.

[4] UK Government Infrastructure and Projects Authority Cost Estimating Guidance, Published in 2021. IPA_Cost_Estimating_Guidance.pdf (publishing.service.gov.uk)

Historically, non-infrastructure and infrastructure projects have had significant material differences in design and construction site management requirements. To ensure this is reflected in the costings, the Indirect Cost multipliers are broken into two, separate values. We have opted for keeping a consistent multiplier value for Water & Wastewater projects due to available project cost data.

The PR24 project related Indirect Cost multipliers are shown in the table below:

Figure 9 – Indirect cost multiplier

Project Type	Calculated Indirect Cost Multiplier
Non-infrastructure	0.765
Infrastructure	0.331

Non-infrastructure

Our non-infrastructure multiplier has been calculated using data from a selection of Southern Water's AMP7 projects. We collated a sample of the best available quality project data, comprised of 32 projects of varying sizes. These projects represent £127m of Direct and Indirect project costs. This data set is taken from late design stage estimates in AMP7 developed in conjunction with agreed construction contracts.

Our non-infrastructure multiplier is calculated by summing these costs and presenting them as a percentage of the total Direct Costs. These Indirect Costs break down as follows:

Figure 10 - Indirect cost build up non-infrastructure

Indirect Cost Component	Proportion of Direct Cost (%)
Preliminary costs	10.92
Construction management	25.99
Main Contractor's overhead and profit	13.47
Design	17.81
Insurance and bonds	0.06
Southern Water Client Indirect Costs	8.25
Total	**76.50**

This Indirect Cost is applicable in the majority of cases. However, it will not be applicable in all instances. For example, it may be appropriate for major scale complex projects to perform a distinct assessment. Where deviation from this standard approach has been applied, an explanation has been provided in the corresponding enhancement business case.

Infrastructure

To calculate a robust multiplier value for infrastructure projects, we have taken a different approach. The manner in which our infrastructure projects are developed and contracted meant data sources were not as easily obtained.

The PR24 infrastructure multiplier has been established by adjusting our historical infrastructure Indirect multiplier (as used in PR19) to reflect the realities of the PR24 programme. The initial multiplier value was based on Indirect costs that formed part of agreed rates with construction contractors taken from our construction framework agreements. This was blended with an estimation to account for Southern Water client cost resources and consultant support. By benchmarking this sum against actual performance and WaSC peers, manual adjustments to account for a more realistic blend of complex and non-complex projects was made. This has resulted in our final indirect uplift for Infrastructure projects of 33.1%

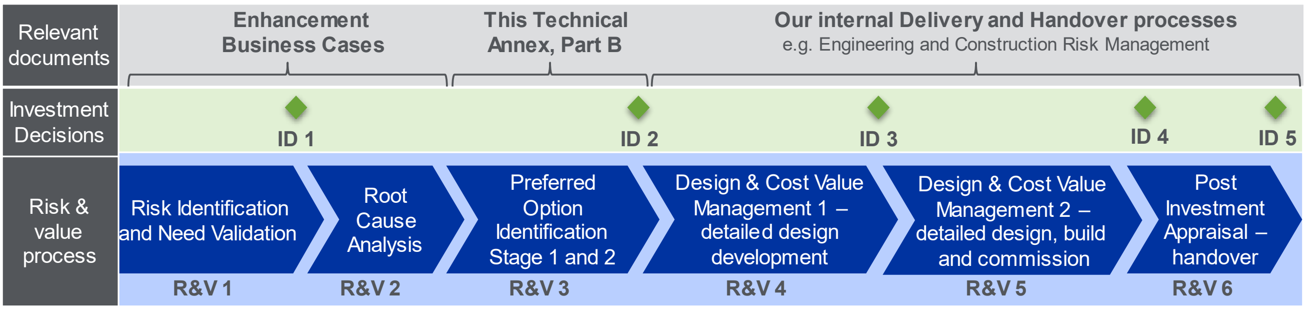
5. Our Approach to Estimating Risk

5.1. Introduction

Our cost estimating approach includes an allowance for Risk. This is in-line with good industry practice such as the Infrastructure and Projects Authority's (IPA) Cost Estimating Guidance[5] and HM Treasury Green Book[6]. We apply this adjustment as a percentage uplift (a multiplier) to the total of Direct and Indirect capital costs. It provides an adjustment in relation to uncertainties and hazards that could not be reflected with certainty in cost estimates which may or may not arise. Illustratively, as a new pipeline project nears the start of construction, detailed site investigations might reveal that the anticipated trenchless method would not be possible, and a more expensive method adopted. The opposite may also be true; we may realise future savings against our initial cost estimates. Our adjustment for Risk covers the potential for material cost increases. Our cost estimates are based on an anticipated scope, which may not be realised exactly as planned. Given Risk covers things that might change on a project, it includes situations that can impact Indirect Costs. For example, if hazards are detected during the construction phase of a pipeline that were not picked up in the surveys, this will change Direct Costs due to the additional pipe needed to navigate around the hazards. It will also require a change to the design which will need to be project managed, thus increasing Indirect Costs.

Given the size and scale of our plan and the level of design work undertaken at this early stage of planning, it is not possible to undertake a full, detailed Risk assessment for individual projects. We have estimated Risk for the PR24 investment portfolio, prior to detailed delivery planning (Risk and Value process stages 1 to 3 – see **Figure 11**).

Figure 11 - Overview of our Risk and Value process – our framework for decision making and investing in enhancements



[5]UK Government Infrastructure and Projects Authority Cost Estimating Guidance, Published in 2021.
IPA_Cost_Estimating_Guidance.pdf (publishing.service.gov.uk)
[6] Supplementary Green Book Guidance – Optimism Bias:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/191507/Optimism_bias.pdf

To ensure our costing is appropriately robust and evidence based for the purpose of our PR24 plan we have followed a consistent approach which draws on a range of evidence points including:

- Our historical AMP7 delivery performance
- The characteristics and complexities of projects in our plan
- Industry good practice from the National Audit Office, HMT Green Book, and Infrastructure and Projects Authority

We have reviewed the efficiency and appropriateness of our Risk adjustment through benchmarking – see **Section 8**.

5.2. Approach

Our approach to determine a Risk adjustment is shown in three stages below. We set a Risk multiplier for a medium Risk project based on our standard Engineering and Construction (E&C) Risk management approach. We used this as a central reference point and increase or decrease this depending on the Risk characteristics of the projects forming our plan. This means we reduced our Risk multiplier to create a lower allowance for lower Risk projects and increased it to create a higher allowance for higher Risk projects, following a consistent methodology. This enables us to be more precise in our estimate for each project. In-turn this also supports more accurate options analysis. Our aggregate Risk multiplier for our PR24 plan is the aggregated impact of our project Risk multipliers, it is not a top-down blanket Risk adjustment.

5.2.1. Step 1: Initial Risk multiplier

When we estimate costs for PR24 we use tools that are also used routinely by E&C for estimate production outside of the PR24 process. It therefore follows that we also draw on our standard E&C approach for estimating Risk. For PR24, we set an initial Risk multiplier of 7% based on our past experience (set out in our E&C Risk Management approach – see **Figure 12**). It corresponds to projects with Level 2 cost estimates, which is a mid-point in our three-stage estimating process (see **Section 2**).

Figure 12 - Upper and lower bounds of the Risk allowance in our Engineering and Construction Risk Principles

	Lower bound	Upper bound
Nature of project	Low complexity Low value	High complexity High value
Risk performance measurement baseline	4%	10%

Our medium Risk percentage is efficient when compared to benchmarks (see **Section 8**). This is because, a large proportion of our AMP8 enhancements require relatively standardised solutions (see **Figure 5** in **Section 2.1**), which are in-line with our past delivery experience. For example, work to enhance our distribution network to improve supply-demand balance is repeatable, high volume and lower Risk – we have substantial experience of delivering these in AMP7. Whereas major large-scale upgrades to water treatment works are more complex (but still consistent with our prior experience).

Given the size and scale of our AMP 8 programme and the early stage of our design and delivery planning (Risk & Value stages 1 to 3 – **Figure 11**), our PR24 programme may carry greater delivery Risk but also potential for savings opportunities against our initial estimates. It is therefore not appropriate for our PR24 estimate to apply the upper and lower bounds that we use to calculate Risk for projects in delivery. At this early stage of planning, we anticipate a wider range of outcomes and therefore a wider range between the upper and lower bounds of Risk adjustments. In Steps 2 and 3 we set out how we have conducted appropriate Risk assessments and calculated the upper and lower bounds for Risk in our PR24 plan.

5.2.2. Step 2: Project Risk assessments

In this step we assessed the Risk level of individual projects in the PR24 plan using a common set of criteria and a grading system of low, medium, and high. These assessments were carried out by our engineering team (ETS) when they prepared project designs and costs. This approach enabled a more precise estimation of the adjustment in our plan because we assessed Risk on an individual project by project basis in a consistent way. Our assessment criteria are as follows:

Figure 13 – Risk overview

Criteria	Overview
Maturity of design	Considers how detailed and developed the solution design is; the projects with lower design maturity are less certain and therefore more likely to require changes to delivery plans and cost projections, so they have a higher Risk profile.
Project complexity	Considers the ease or difficulty with which a given project can be delivered. Complex projects have a higher chance of change with more numerous hazards in delivery and more challenges in estimating costs accurately. Our complexity assessment draws on industry good practice from Infrastructure and Projects Authority's Routemap[7] and the National Audit Offices' Delivery Environment Complexity Analytic tool (DECA)[8].

We have also reviewed the relative strength of the cost data used to estimate the Direct Costs. High quality cost information gives us greater confidence in the accuracy of the cost estimate for those and therefore a lower Risk profile. We note that in broad terms, data quality is aligned to the complexity assessment as this considers our prior experience. The experience we have completing an activity determines the volume of relevant and reliable data for cost estimation.

When we conduct the assessment, we considered the following factors to determine a low, medium, or high-Risk rating to a project against each criterion. Please refer to **Appendix 1** for the Assessment Scorecard.

Figure 14 – Risk indicators

Criteria	Indicators considered
Maturity of design	**1. Stage in design lifecycle:** whether the design has been cost estimated at Level 1, 2 or 3 (described in **Section 2** of this annex).

[7]IPA Project Development Routemap for Infrastructure Projects
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/953076/PDR-Handbook.pdf
[8]Good practice guide: Delivery Environment Complexity Analytic (DECA), understanding challenges in delivering project objectives (nao.org.uk)

Project complexity	**1. Implementation complexity**: whether this type of project been delivered by us before and to what degree of success **2. Interdependency Risk**: how much reliance there is on other projects for successful delivery of outcomes **3. External stakeholder interest**: how vulnerable the project is to external stakeholder influence These criteria consolidate the 12 complexity factors in the NAO's Delivery Environment Complexity Analytic tool (DECA) guidance meaning they can be practically applied in our assessment.

5.2.3. Step 3: Project Risk multipliers

In this step we determined a Risk multiplier specific to each project, considering the nature of our future delivery portfolio. We calculated a weighting to tailor the unadjusted Risk multiplier (Step 1) to reflect our Risk assessment of each project (Step 2). This means we reduced our Risk multiplier to create a lower allowance for lower Risk projects and increased it to create a higher allowance for higher Risk projects. There are two key areas of assumption driving our weightings approach:

Our weightings are based on good practice principles from HMT Green Book guidance[9].

Figure 15 - Optimism bias recommended adjustment ranges from HMT Green Book

Project Type	Optimism Bias (%)			
	Works Duration		Capital Expenditure	
	Upper	Lower	Upper	Lower
Standard Buildings	4	1	24	2
Non-standard Buildings	39	2	51	4
Standard Civil Engineering	20	1	44	3
Non standard engineering	25	3	66	6

As shown in **Figure 15** the Green Book optimism bias guidance for non-standard Civil Engineering Capital Expenditure recommends a circa tenfold difference between the upper and lower bound Risk adjustment. We applied this relationship to our weightings, resulting in a lower bound (high confidence score) that is ten times lower than the upper bound (see **Figure 14**). While many of our projects were relatively standardised, a significant proportion were not, comprising solutions that were less established. As such we deemed this an appropriate reference point. In reality, the standard civil engineering provided a similar overall range by percentage than non-complex.

[9] Supplementary Green Book Guidance – Optimism Bias: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/191507/Optimism_bias.pdf

In addition, we included a medium confidence weighting, which served as the mid-point between the high and low confidence weightings. This enabled us to be more specific and tailored to the unique characteristics of each project, enabling a more precise cost estimation of Risk.

The weightings for our Risks assessment criteria are shown in **Figure 16**. In the next **section** we provide a worked example to show how these are applied.

Figure 16 – Weightings

Criteria	Indicator	Weightings		
		Low confidence (Upper Bound)	Medium confidence (mid-point)	High confidence (Lower Bound)
Maturity of design	1. Stage in design lifecycle	50%	27.5%	5%
Complexity of project	1. Implementation complexity 2. Interdependency Risk 3. External stakeholder interest	50%	27.5%	5%
	Total weighting	100%	55%	10%

5.2.4. Aggregate multiplier

Our Risk approach, informed from best practice methodologies such as HMT Green Book guidance, the DECA tool and the IPA Project Development Routemap was developed to ensure a precise and not overstated estimation of the Risk multiplier. Applying this approach to PR24 projects resulted in an aggregate Risk multiplier of 9.8%. Given that our historical analysis established that 7% is appropriate for our AMP7 plan with estimating Level 2 (**see section 5.2.1** – Step 1), our overall Risk adjustment of 9.8% for PR24 reflects the fact that a majority of projects are estimated at Level 1, which is early in the design lifecycle and other project-specific complexities. This aggregate multiplier is based on a bottom-up assessment of Risk associated with the nature and complexity of projects in our plan, drawing on good practice industry guidance and our historical delivery experience. It is not applied as a blanket figure across the whole programme, therefore it is not reliable to compare Risk percentages being used individual SW programmes, such as SROs. We therefore consider this a fair and sufficiently precise adjustment for Risk to include in our plan.

5.2.5. Worked example

As described in Step 1 (**section 5.2.1**), our historical data supported a medium Risk adjustment of **7%**. In this worked example we show how we adjust this for a specific project, following the approach described above.

In Step 2 we used the total weightings drawing on the HMT Green Book (**see section 5.2.3**) and our medium Risk assessment to calculate a low confidence multiplier (**7%** / 55% = **12.73%**) (**Figure 17)**. This 12.73% is the starting figure that we used to calculate the weighted Risk multiplier for each project.

Figure 17 - Derivation of Risk Multipliers

		Low confidence (Upper Bound)	Medium Confidence	High Confidence (Lower Bound)
Step 1	Medium Risk adjustment	-	**7%**	-
Step 2	Total weighting (from Figure 16)	100%	55%	10%
	Risk multiplier	**12.73%**	**7%**	**1.27%**
	Calculation used to derive the Risk multiplier	7 / 55 *100	-	7 / 55 * 10

These low and high confidence Risk multipliers give a wider percentage range than multipliers we apply on projects in delivery. This means in our cost estimates we are recognising potential for a greater range of outcomes – greater delivery Risk for complex projects and potential for savings opportunities against our initial estimates. This also means we avoid overstating our cost estimate for Risk at this early planning stage for simpler or lower complexity projects.

In Step 2 we also conducted the project Risk assessment against our criteria and determined our level of confidence in each criterion (results shown in **Figure 18**). In Step 3 we then applied the corresponding weightings for each criteria (drawing on **Figure 16**) and calculated the overall weighted multiplier of 7% for this project (calculation shown in **Figure 18**).

Figure 18 - Risk assessment and weighted Risk multiplier calculation

Step 2: Project Risk Assessment		**Step 3: Project Risk Multiplier Calculation**	
Assessment criteria	**Level of confidence**	**Weighting**	**Calculation steps**
Design maturity	Low	50%	A
Complexity	High	5%	B
Combined weighting		55%	C = A+B
Weighted Risk multiplier		**7%**	D =C * **12.73%**

6. Our Approach to Estimating Corporate Overheads

6.1. Introduction

The final cost we add as an uplift to total enhancement expenditure of our capital programme is for our Corporate Overheads. This recognises the cost of corporate services critical to delivering our capital projects. These costs include the costs of individuals within other directorate teams including Asset Strategy & Planning, IT, Water, Waste, Commercial, Finance, HR and Legal for support that is directly attributable to the delivery of the capital programme. Our Corporate Overhead is comprised of costs that vary with the size of our capital programme (*variable costs*) and costs that do not (*fixed costs*). This overhead is a capital cost only – it does not include operational costs.

We understand the historical relationship between our Corporate Overheads and the size and our AMP7 capital programme. In previous Price Reviews our plans have been relatively consistent in scale – it was therefore reliable to use the ratio of annual capital cost to capital overheads in our model to determine the Corporate Overheads. However, for our larger PR24 plan we have started with a model based on a programme of similar scale to AMP7 and then modelled additional overhead required for the scope of the AMP8 plan that is greater than the AMP7 capital programme. We refer to our AMP7 capital programme as our **baseline programme** in this section. This results in a lower ratio of annual capital cost to capital overheads, as we are spreading our fixed overheads over a larger base, i.e., we are incorporating efficiency due to economies of scale. In combination with our previous AMP7 model output, this provided our estimate for all fixed and variable overheads.

In this section we explain how we calculated our enhancement Corporate Overhead for PR24 and the assumptions we have made to adjust our historical baseline to the significantly larger scale of the PR24 plan. We describe our robust and evidence-based approach, including why we are confident in the data underpinning this analysis. This section is supported by **Section 8** – Benchmarking, where we describe how our Corporate Overhead reflects efficient delivery through comparison to our peers.

6.2. Approach

We have calculated the appropriate level of Corporate Overheads for our Business Plan by creating a model based on actual and forecast AMP7 cost data and applying logical assumptions. We summarise our approach in three steps below:

6.2.1. Step 1 – Confirming the total Corporate Overheads used within our AMP7 data

The starting point was our baseline data set, which provided the level of Corporate Overhead supporting our AMP7 plan that is currently in delivery:

Figure 19 - AMP7 baseline data (5-year period; FY22/23 prices)

AMP7 baseline data	£m
Capital expenditure (excluding Overhead)	2,831
Enhancement Capex (excluding Overhead)	1,103
Corporate Overhead (across Base and Enhancements)	392.9

As shown in Figure 19, we have assumed that for an AMP8 plan that is in line with the AMP7 size (£2.8bn capital expenditure (excluding Overhead) and £1.1bn enhancement capex (excluding Overhead)), the level of Corporate Overhead will be consistent (£392.9m across base and enhancements). A breakdown of this Corporate Overhead AMP7 baseline is included in **Appendix 2**.

Our baseline data was derived from our full AMP7 outturn forecast figures used by our Finance team to develop our Business Plan forecast (converted to FY 22/23 prices). We used the most recent actual and forecast data available to ensure our estimates were as accurate as possible – this included almost 3 full years of actual costs (the first 2 years of AMP7 and the majority of Year 3). We consider this approach to be more robust because it combines both actual and forecast data, unlike alternatives such as extrapolating our Year 5 forecast. We used the full AMP7 outturn figure as our baseline – this allowed us to normalise the data across years with different year-on-year variability.

6.2.2. Step 2 – Calculating the overhead cost related to incremental enhancement Capex

Our next step was to model the overhead cost related to our 'incremental' AMP8 enhancement Capex – the enhancement capex in excess of the £1.1bn in our AMP7 baseline (shown in Step 1). This calculation and costs components are shown below in **Figure 20.**

Figure 20 – Calculation of the incremental Corporate Overhead

Element	£m	Calculation steps	Note
AMP8 enhancement capex (excluding overhead)	2,103	A	Excludes enhancement capex that will be alternatively funded
AMP7 enhancement capex (excluding overhead)	1,103	B	As per 6.2.1 – Step 1
Incremental enhancement capex	1,000	C = A - B	
Incremental Corporate Overhead % increase required	4.9%	D	Further detail provided below
Incremental Corporate Overhead	**49.2**	E = C * D	

We assumed that only variable costs will increase to account for an increase in capex compared to previous programmes. Fixed overheads are sufficiently recovered against the value of £392.9m equivalent to the scale of our AMP7 plan. This variable overhead assumption is supported by the fact that fixed elements, such as office leasehold costs, are not expected to be impacted by any incremental enhancement expenditure. We have confidence in this assumption as our Finance team have analysed our costs and determined that majority of this enhancement work will be performed by contractors, thus increasing our variable costs. Furthermore, due to increased opportunities for remote working for traditionally office-based work, a rise in investment is not expected to have the same impact on fixed costs as it has in the past. While it seems logical that we fix 'fixed' costs and only vary 'variable' costs, we recognise that no costs are truly fixed. There is always a scaling point. However, the assessment of our Finance team is that there will only be a small element of 'fixed costs' increasing, which should be offset by any AMP7 vs AMP8 fixed overhead efficiency savings.

Incremental Corporate Overhead percentage increase required (Step D)

We have analysed the variable overhead using 5-year forecasted AMP7 Corporate Overheads spend data disaggregated by business department as follows:

1. For each department, calculated the proportion of these costs that is attributable to enhancement expenditure. Our Finance team determined average percentage allocated to enhancements across the programme is 42.1% from their analysis of actual data and professional experience.
2. We determined the proportion of these costs that will increase with a bigger plan (variable costs), and which will not (fixed costs). Our estimate is that 33.0% of AMP7 enhancement overhead costs were variable. This was calculated by taking an average across the departments, based on our Finance team's understanding of each department and the nature of their costs. For example, we assume that only 20% of Finance costs are variable, as there will be some extra processing due to the increased expenditure; we assume 60% of commercial costs are variable as an increased number of contracts will require a significant increase in people to prepare and manage them.

3. We divided the overheads associated with the variable elements of the enhancement Capex in the baseline plan (obtained in 2, above) by the total enhancement Capex for the same period (£1,103m as per calculation step B in **Figure 20**). This gave us the incremental Corporate Overhead percentage increase required of 4.9%. Given that this percentage is derived from our latest available data, we are confident that this is a reliable basis to estimate the Corporate Overheads of our additional enhancement expenditure at AMP8.

The approach we have taken is firmly rooted in historical data, which provides a solid foundation for our calculations. By determining our overheads at a departmental level, we have increased the precision and accuracy of our results. This approach is preferable to making broad assumptions at a programmatic level because it considers the specific characteristics and costs associated with each department. It is based on our extensive experience and understanding of these departments, allowing us to make more informed and targeted estimations. This more granular approach enables us to improve confidence in the reliability and validity of our results.

6.2.3. Step 3 – Calculating the total overheads for the PR24 plan

In this final step we calculated the total overheads by combining the AMP7 baseline Corporate Overheads from **6.2.1** – Step 1 with the Corporate Overheads related to the incremental enhancement Capex outlined in **6.2.2** – Step 2. The calculation steps are shown see **Figure 21.**

Figure 21 - Corporate Overhead multiplier

Element	£m	Calculation steps	Note
AMP8 Base Capex	1,679	A	
AMP8 Enhancements Capex	2,103	B	This is the total of Direct Cost, Indirect Cost, and Risk. Excludes enhancement capex that will be alternatively funded.
Total AMP8 Capex	3,782	C = A + B	
Baseline Corporate Overhead	392.9	D	Derived in 6.2.1 – Step 1
Incremental Corporate Overhead	49.2	E	Derived in 6.2.2 – Step 2
Total Corporate Overhead	442.1	F = D + E	
Overheads as % of Total Capex (excl. overheads)	11.7%	G = F / C	
Corporate Overhead allocated to Base	196.3	H = G * A	
Corporate Overhead allocated to Enhancements	245.8	I = G * B	

The enhancement overheads multiplier derived in **Step G** is applied to the total of Direct Cost, Indirect Cost, and Risk. In **Section 8** we described the external benchmarking we have performed to evidence that our Corporate Overheads costs are efficient with respect to our industry peers.

6.2.4. Third party financed investments

The Corporate Overhead calculation described in **Section 6.2.1 to Section 6.2.3** has been applied to AMP8 enhancement Capex. It has not been applied to parts of our plan for which we plan to seek third party financing, such as DPC. For the purposes of our data model, we are treating these investments separately. However, the methodology for calculating Corporate Overhead associated with third party financed investments is the same (as we will still incur administrative costs to manage this Capex sourced through external funding). So, to calculate the Corporate Overhead associated with this level of circa. £2bn alternative funding, we apply the 4.9% incremental enhancement multiplier identified in **6.2.2** - Step 2. This results in circa £94m of Corporate Overhead.

7. Our Approach to Estimating Enhancement Operational Expenditure (Opex)

7.1. Introduction

Enhancement investments may be categorised as either capital or operational expenditure. All capital investments must include an assessment of their net impact on Opex, i.e., whether developing our assets to meet an enhancement needs results in a net increase or decrease in Opex. Opex includes such things as energy and chemicals, contracted services, staff costs related to operations and maintenance, and other necessary expenses required to provide our water and wastewater services on a day-to-day basis. This section only relates to Opex relating to enhancement investment. If a specific enhancement solution itself is Opex, an explanation has been provided in the relevant enhancement business case.

Our approach to estimating Opex arising from Capex is aligned to the detailed costing approach outlined in **Section 2** of this annex. We have used two estimating levels that we describe below, including how our approach ensures that our estimates provide a precise and accurate representation of projected Opex.

7.2. Level 1 Opex estimation process

Our engineers applied a systematic approach to estimate Opex for Level 1 cost estimates. They input the necessary scope of the enhancement required, such as the size of land or equipment needed. Opex was then calculated using models similar to those used for Capex estimation (see **Section 2**). Each asset intervention (scope element) was aligned to both Capex and Opex models which generated their estimated cost. For Level 1 estimates the cost model 'driver' variables were the same for both Capex and Opex estimation models. Opex is profiled annually from the point of forecast Capex delivery completion.

Our Opex cost models have been developed using data from pre-AMP7 data from wider industry, provided by [redacted]. We validated this data against a sample of projects from our Level 2 Opex tool, which is based on our Southern Water data (current and forecast cost rates – **section 7.3** below). Given recent market increases in some types of Opex costs (e.g., chemicals and power), we focused our sample on 20 wastewater projects where significant increases in chemical usage or power consumption were planned. We adjusted our Level 1 Opex costs to align to a more accurate and up to date reflection of chemical and power pricing. We also analysed the cost drivers of these increases and applied it to projects outside of the sample with the same features, again ensuring that the assumptions underpinning our Level 1 costing model were more reflective of real and future costs, enhancing the accuracy of our estimate.

Note, our Level 1 costing tool is only used for Wastewater projects, Water projects (and some Wastewater projects) have been cost estimated using our Level 2 tool, see below.

We have confidence in the accuracy and reliability of the underlying data used for these estimates, as they are underpinned by normalised water sector data which has been adjusted to mitigate any Risk of under-estimation of Opex costs as a result of subsequent power and chemical cost increases.

7.3. Level 2 Opex estimation process

In line with our Capex estimation methodology (**Section 2**) there are instances where we have determined Level 2 costing is appropriate. The Opex modelling process outlined below is business as usual and was brought in during PR14. It is managed by our ETS team who use our [redacted] tool to capture and manage the costs of each project selected for Level 2 costing. The cost rates that underpin the estimates produced by this model have been updated for PR24 by our Finance team and relevant department heads.

To calculate Opex for a given project, our engineers built up the costs by inputting raw data relating to the additional equipment/materials needed because of enhancement investment in that programme. Our model then automatically calculated the additional cost using unit rates set up in [redacted]. These costs were built-up for each of the elements listed below. The total of these elements gave us the net impact on Opex from enhancement investment for a given project. Summing this up across all projects gave us our total Opex arising from enhancement Capex.

Our model ensures a robust build-up of the Opex because it uses a granular approach to develop the estimate. Opex estimates are produced for each key category as follows:

- Staff (operational and maintenance)
- Hired / Contractor
- Materials / Equipment
- Power Used
- Business Rates
- EA Discharge Charges
- Screening and Grit disposal
- Generated Power
- Chemicals
- Additional Costs
- Cost of Sludge, Transport, Treatment and Disposal

We assumed that a like for like replacement of assets does not attract any additional Opex. If those replacement assets were larger or smaller in size (e.g., Power) due to a change in the duty the difference in operational expenditure was calculated as a positive or negative Opex impact.

7.3.1. Illustrative example

An example of how these Opex costs were estimated for staff costs is described below.

The model calculated the operational and maintenance elements separately. The elements for operational labour are split between waste and water. For each element, the tool lists a set of predefined standard routines that are carried out by human labour across our asset base, such as maintenance activities for pumps or general site maintenance requirements. These lists have defined durations and frequencies that are based on our historical experience.

The engineers input the number of each particular asset to be installed against the maintenance and operation routines listed, e.g., for a storm tank cleaning routine, the engineer inputted the number of additional storm tanks required by the project. The tool uses the predefined standard routines frequency and duration and multiplies this by the number of additional equipment to calculate total labour hours required for this routine. It is then multiplied by the hourly cost rate to give the additional Opex resulting from this routine.

So, the formula for estimating the staff cost for a given routine in our model is:

Staff cost = asset number (n) x frequency of operation/maintenance activity (n/year) x duration (hours) x unit rate (£/hour)

This approach is replicated across the different categories of operating expenses.

8. Benchmarking and Efficiency

8.1. Embedding efficiency throughout end-to-end delivery

8.1.1. Optioneering and Business Planning

We ensure efficiency is achieved by undertaking various activities throughout our solution development and delivery. In **Part A** we described how we ensure we are optioneering the solutions of greatest benefit to our stakeholders. In the preceding sections of **Part B**, we have detailed how we capture and use our historical data to create robust estimates for those solutions and understand our internal efficiency. In the subsequent parts of this section we detail our approach and the results of external benchmarking against peers. Within the individual enhancement business cases further efficiency and value engineering activities are described.

8.1.2. Procurement and delivery

During delivery, we follow a competitive tender process for all of our Engineering & Construction frameworks. This process follows an industry standard prequalification process before a formal tender with commercial offer stage. Doing this supports the efficiency of our programme because it ensures that we are building the best available market skills, at the most competitive market prices into our supply chain.

We also prequalify and set up frameworks with materials and component suppliers that get added to our approved suppliers list. This process allows us to negotiate the best rates for items, and to take account of scale purchasing to improve our unit costs. This protects our customers by preventing us over-paying during the development and delivery of our projects.

8.2. Approach to industry benchmarking

To assess the efficiency of our cost estimates within the PR24 plan, our Cost Intelligence Team (CIT) and their supplier [redacted], have conducted benchmarking to compare elements of our cost stack (Indirect Costs, Risk, Corporate Overheads) and our aggregated multiplier (the whole stack) to our peers. CIT have collated data from 4 peer Water and Sewerage Companies (WaSCs) comparable in scale, structure, and operating delivery model to us.

This benchmarking enables us to assess the efficiency our approach to applying multiplier uplifts to account for Indirect Costs, Risk & Corporate Overheads in context of other WaSCs. For Direct Costs, we challenged efficiency of our estimates on a project-by-project basis and have described these findings in the respective enhancement business cases.

CIT have taken the seven-step good practice approach as laid out within the Infrastructure and Project Authority's (IPA) Best Practice in Benchmarking publication[10]. We adopted this approach for our PR24 plan:

Step 1: Confirm objectives and set metrics

The objective of this benchmarking is to assess the Southern Water Cost Stack multiplier uplifts compared to other WaSCs within the industry to provide evidence of the efficiency of the Southern Water approach taken for PR24.

Step 2: Break cost stack into key components for benchmarking

Our benchmarking exercise breaks the full cost stack into components consistent with our cost methodology. Meaning we are benchmarking the following components against others within industry:

- Indirect Cost
- Risk
- Corporate Overhead
- Full Cost Stack (Indirect, Risk & Corporate Overhead)

Step 3: Develop templates for data gathering

The existing Southern Water Cost Data Capture process, and associated Cost Information Template, has been used to capture the data relating to Southern Water Indirect Costs.

Step 4: Scope sources and gather data

[redacted] identified suitable comparator companies to enable benchmarking and selected four WaSCs deemed to be similar enough in size and profile to allow for comparison. The benchmark data was collated in January of 2023 and represents draft PR24 multiplier uplifts of these comparator companies against Direct Cost.

Step 5: Validate and re-base data

Southern Water data has been pre-validated through Southern Water's cost data capture and assurance process. As the data points are based on percentages applied to a common £, there has been no need to re-base the data for location or inflation. **Figure 22** is a table of PR24 Southern Water multiplier values that we have used for benchmarking. These data points are taken from each of the previous sections of this Annex, where they are each described in more detail – see final column for references.

[10] IPA Best Practice in Benchmarking, Government Project Delivery Framework, Published in 2021 Best Practice in Benchmarking (publishing.service.gov.uk)

Figure 22 – Summary table of Southern Water PR24 cost multipliers

Cost Component	Non-Infrastructure	Infrastructure	Calculation steps	Source of data in this annex
Direct Cost	1	1		
Indirect Cost	0.765	0.331	A	Section 4 – Figure 9
Risk	0.098	0.098	B	Section 5 – 5.2.4
Corporate Overheads	0.117	0.117	C	Section 6 – Figure 21
Full Stack – aggregate multiplier	2.16	1.63	1*(1+A)*(1+B)*(1+C)	

For this reason, we concluded that the benchmarking of Non-Infrastructure indirect multiplier (and the corresponding full cost stack) is a more reliable comparison.

This limitation does not impact benchmarking of Risk and Corporate Overheads multipliers, which are compared at an aggregated level.

Step 6: Produce and test the benchmark figure

In this final step, we compared our Southern Water data with that of our peers. Our key findings are described in **Section 8.3** below.

8.3. Summary of findings

8.3.1. Key limitations

The comparator benchmark data has been aggregated and shared with Southern Water via a report from [redacted], concluded in January 2023. This data represents the best available evidence and is one of a number of evidence points we have used to assess our PR24 costs.

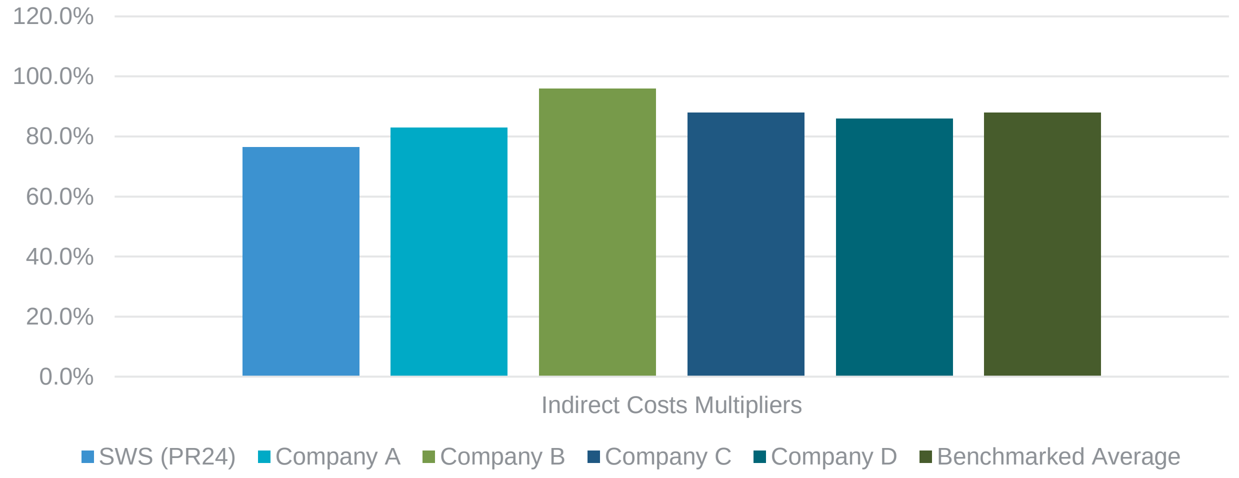
8.3.2. Direct costs

Since PR19 we have introduced industry wide programme level benchmarking of our costs against our peers. CIT have undertaken a broad industry benchmarking exercise to compare all aspects of our Direct Costs and each element of our wider cost stack. This includes a focus on specific Direct Costs forming large areas of our enhancement plan, equalling 26% of our Direct Costs. Wherever our programme level benchmarking highlighted that our costs were higher or lower than benchmarks we sought to understand why. We challenged Engineering to revisit the projects and review scope, ensuring that additional items were not being included and that we were not building in unnecessary additional Risk.

8.3.3. Indirect costs

Benchmarking indicates that our Indirect Costs for non-infrastructure are efficient because our multiplier of 76.5% is the lowest of 4 comparator companies.

Figure 23 - Non-infrastructure Indirect Cost industry comparison

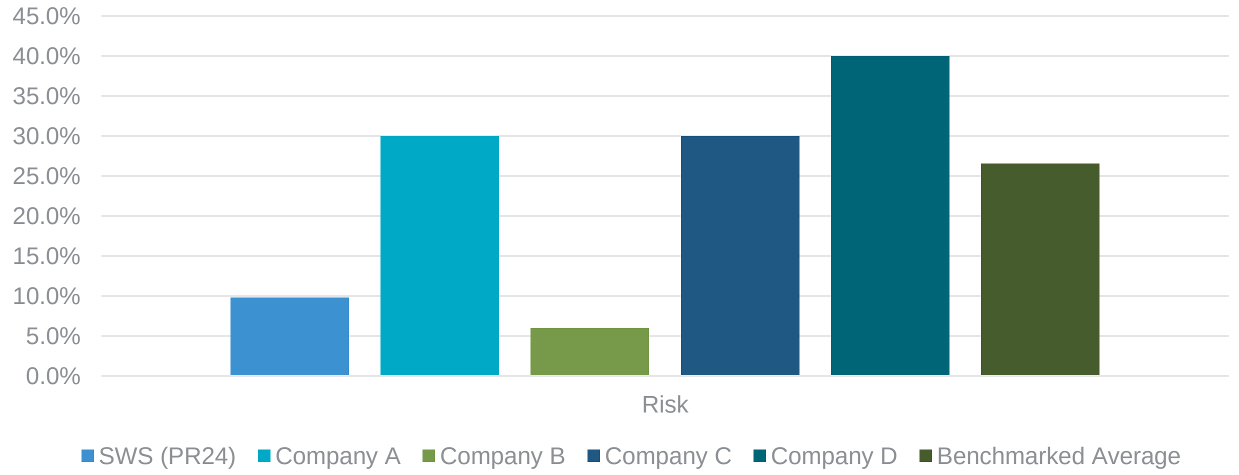


8.3.4. Risk

Benchmarking indicates that our Risk estimate is efficient because our aggregate Risk multiplier of 9.8% is the second lowest of the 4 comparators. Please see **Section 5.2.4** for an explanation of how our aggregate multiplier was derived.

Noting the limitations described in **8.2.1**, as PR24 planning progresses and comparators understand their projects in further detail, comparator's Risk estimates may be reduced.

Figure 24 - Risk industry comparison

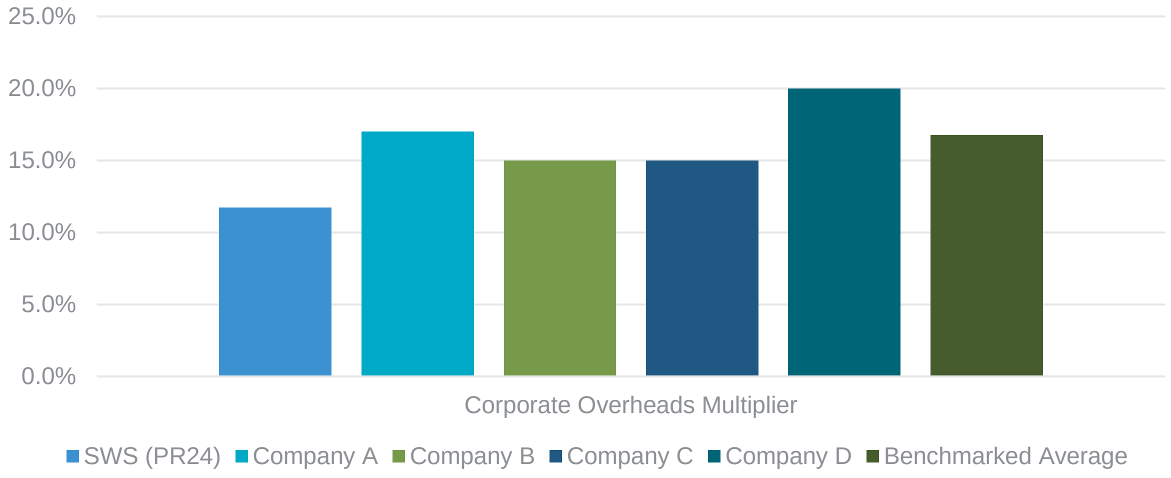


8.3.5. Corporate Overheads

Benchmarking indicates that our Corporate Overhead costs are efficient because our multiplier of 11.7% (see Section 6.2.3) is the lowest of the 4 comparators.

Noting the limitations described in **Section 8.2.1**, as PR24 planning progresses and comparators understand their projects in further detail, comparator's Corporate Overhead estimates may be reduced.

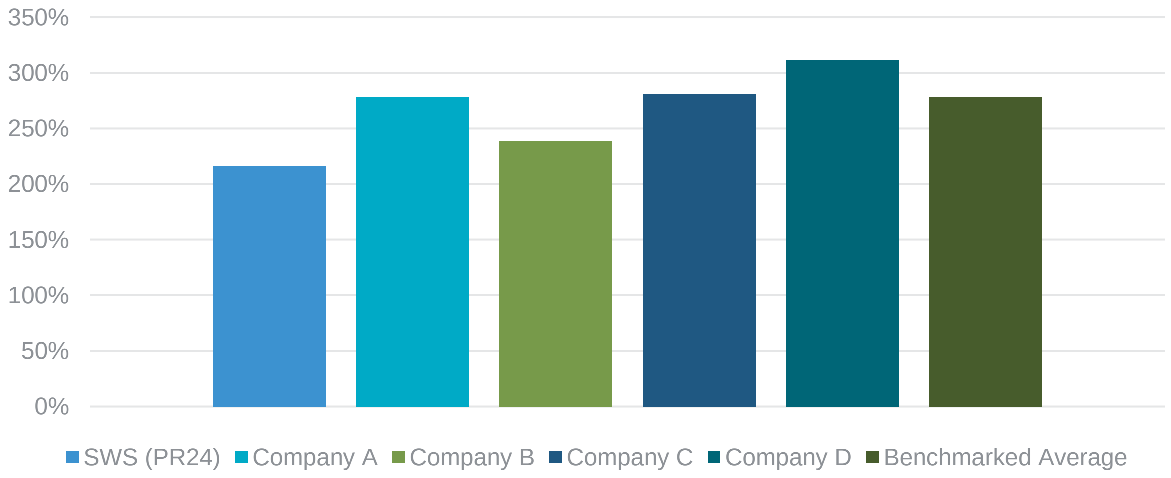
Figure 25 – Corporate Overheads industry comparison



8.3.6. Aggregate multiplier

Benchmarking our non-infrastructure aggregate multiplier of 216% indicates that our enhancement costs are efficient because it is the lowest of the 4 comparators. The aggregate multiplier compounds non-infrastructure Indirect Costs, Risk and Corporate Overhead multipliers to provide one value that is indicative of the entire uplift that has been applied to Direct Costs within the full plan.

Figure 26 – Non-infrastructure aggregate multipliers industry comparison



Appendix 1 – Project Risk Assessment Scorecard

	Indicator	Assessment of criterion indicators		
		Low confidence	**Medium confidence**	**High confidence**
Maturity of design	**1. Stage in design lifecycle**	• Project at early design stage: 'conceptual' or 'needs valuation' stage • Level 1 stage in design lifecycle	• *Projects which fall between Low and High assessment should be scored as 'M'*	• Detailed design completed • Level 3 stage in design lifecycle
Complexity of project	**1. Implementation complexity**	• Project has never been delivered before by Southern Water • Lack of appropriate skills and resources on hand to deliver	• *Projects which fall between Low and High assessment should be scored as 'M'*	• Similar project delivered before with considerable success with appropriate range of skills and resources on hand to deliver
	2. Interdependency Risk	• Project's success is highly dependent on that of other projects		• Project's success is independent to that of other projects
	3. External stakeholder interest	• Project is highly vulnerable to external stakeholder influence		• Project is not at all vulnerable to external stakeholder influence

Appendix 2 – AMP7 Corporate Overheads

KPI	BP23					
Overheads	2020/21	2021/22	2022/23	2023/24	2024/25	AMP7
(Overheads = Total Opex - Net Opex)	£m	£m	£m	£m	£m	£m
Water Operations	7.0	7.2	8.0	11.6	12.0	**45.8**
Wastewater & Asset Management	8.2	9.2	10.0	17.8	17.1	**62.3**
Chief Operating Officer	0.0	0.6	1.0	1.2	1.2	**3.9**
Engineering & Construction	5.3	6.4	5.8	2.9	2.8	**23.2**
Water For Life Hampshire	(0.0)	0.3	0.6	0.3	0.3	**1.4**
Customer	1.7	2.2	1.8	2.8	2.7	**11.2**
IT	16.2	17.6	24.3	27.5	24.2	**109.8**
Directors	2.0	2.0	2.5	2.5	2.6	**11.6**
Transformation	0.4	0.2	0.0	0.0	0.0	**0.6**
Asset Strategy & Planning	4.1	3.9	4.0	4.3	4.3	**20.5**
Business Channels	2.2	2.1	2.9	2.7	2.5	**12.3**
Central	0.0	0.0	0.0	0.0	0.0	**0.0**
Commercial	4.5	6.2	7.7	8.2	8.6	**35.1**
Compliance	1.8	1.5	1.5	2.0	2.0	**8.9**
Environmental & Corporate Affairs	0.7	1.6	1.3	3.5	2.4	**9.5**
Finance	1.6	2.3	2.1	2.3	2.1	**10.5**
General Counsel	0.3	0.4	0.4	0.5	0.4	**2.0**
Health And Safety	0.4	0.4	0.6	0.5	0.6	**2.5**
HR	1.5	1.9	2.0	2.4	2.3	**10.1**
Pension	1.1	0.9	0.8	1.5	1.1	**5.5**
Strategy & Regulation	0.5	0.9	0.7	0.5	0.5	**3.1**
Total Overhead	**59.5**	**67.7**	**77.8**	**95.0**	**89.8**	**389.7**

Note, the above **figures** are in nominal price base and thus differs to the £393m total used in **Section 6** which is in 22/23 prices. The purpose of the above is to model the variable enhancement capex % and thus will not be impacted by a proportionate inflationary uplift.