Large Scheme Gated Submission 1 – [redacted] Phase 4

FINAL Draft for Review

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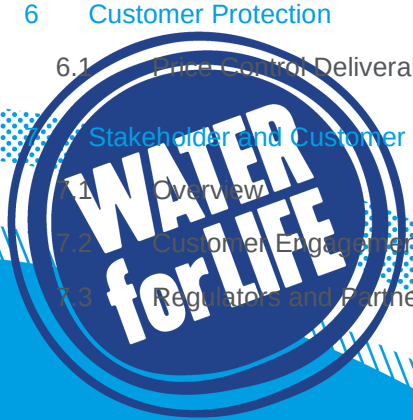
from Southern Water

Contents



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Glossary

Acronym	Full Term
AMP	Asset Management Period
BAU	Business As Usual
CAPEX	Capital Expenditure
CNI	Critical National Infrastructure
COD	Chemical Oxygen Demand
DWI	Drinking Water Inspectorate
EA	Environment Agency
EIA	Environmental Impact Assessment
FEO	Final Enforcement Order
GAC	Granular Activated Carbon
HazRev	Hazard Review
HTR	Havant Thicket Reservoir
KR	Key Risk
Ml/d	Megalitres per day
PACl	Poly Aluminium Chloride
PCD	Price Control Deliverable
PFAS	Per- and Polyfluoroalkyl Substances
PR24	Price Review 2024
G1SDP	Strategic Delivery Partner
SSE	Scottish & Southern Electricity
SWS	Southern Water Services
T&O	Taste and Odour
TSS	Total Suspended Solids
T2ST	Thames to Southern Transfer
WSW	Water Supply Works

1 Executive Summary

1.1 Overview

[redacted] AMP7 has focused on mitigating immediate water quality risks identified through our Hazard Review (HazRev) programme. Looking ahead, our strategic direction prioritises long-term asset resilience, enhanced treatment capabilities, and integration of a new mix of recycled and raw water from Havant Thicket reservoir.

1.2 Regulatory Drivers and Strategic Engagement

Our investment strategy at [redacted] has been shaped by the Final Enforcement Order (FEO) actions issued by the Drinking Water Inspectorate (DWI). In response, we have engaged extensively with the DWI to define a sequenced approach to strategic investment, ensuring that proposed solutions align with both regulatory expectations and customer needs. Key outcomes of this engagement include:

- Improved treatment process resilience across diverse operating conditions
- Enhanced treatment of variable raw water qualities at [redacted]
- Reduction in unplanned outages, improving operational reliability
- Secured long-term water supply under both normal and drought scenarios
- Improved taste, odour, and appearance of drinking water
- Reduced service interruptions through sustainable water use and protection of rivers and chalk streams

Design maturity will improve during the development phase, with levels of uncertainty in scope, cost and programme estimates to be reduced between Submission 1 and Submission 2, meaning we will have increased confidence in these by the time of Submission 2. In addition, we expect that our understanding of risks and issues will mature between September 2025 and March 2026 which will further improve confidence in our estimates.

Key risks and considerations identified include the power resilience of the [redacted] facility, which may impact operational continuity, and a notable increase in capital expenditure (CAPEX), as reflected in the Strategic Delivery Partner's initial cost estimates based on data provided for [redacted]. Risks are reflective of the lifecycle stage of the project, as the project moves through outline design and into full design, the risk position will change.

The details of our preliminary findings and recommendations are outlined in this report. As part of the initial optioneering, the viability of considered options are assessed and progressed into outline design. We seek approval and endorsement from Ofwat to continue our development phase of [redacted]. Table 1 illustrates key elements associated with this scheme.

Table 1 Key Facts

Category	[redacted] Resilience Scheme Details
WRZ	Hampshire
Population Impacted	[redacted]
Primary Assets	Carbon Treatment, Clarification and Filtration, Wash Water Recovery
Scope	• Provide Taste and Odour Treatment • Enhance Clarification process • Enhance Filtration process • Enhance Wash Water Recovery
Delivery Partners	Strategic Delivery Partner (CMDP JV)
Estimated Development costs	[redacted]
Regulatory Drivers	DWI Final Enforcement Order (FEO) actions
Programme Timeline	2025–2032
CAPEX Summary	Currently reporting against PR24 baseline, however, early indicative costs are shared for transparency

Multiple options have been investigated throughout the treatment process at [redacted]. Details of the options considered and the outputs of the Risk and Value (R&V) process are given in section 3 of this document. The key findings from the options appraisal work are:

- **Taste and Odour:** Install Granular Activated Carbon (GAC) process to remove Taste and Odour precursor compounds.
- C**larification and Filtration:** All existing clarification and filtration processes will be replaced with a new ceramic membrane filtration process.
- **Wash Water Recovery:** A new wash water recovery system is required at [redacted] to support the pre-disinfection treatment process.

The details of our preliminary findings and recommendations are outlined in this report. We seek approval and endorsement from Ofwat to continue our development phase of [redacted].

2 Background and Objectives

2.1 Introduction

This document provides a summary of historical investment at [redacted] and considers identification of current and future investment needs and how we have engaged with customers and regulators in developing these solutions. Scheme development, optioneering and design are outlined in section 3.
We provide a list of all supporting documentation which has been used to produce this report in Section 11.

2.2 Investment Need

We have invested significantly beyond our base allowance at [redacted] to maintain supply to [redacted] in Southampton, Winchester and the surrounding area. AMP7 focused on addressing immediate water quality risks identified through our HazRev programme, and the next phase of our strategy will focus on enhancing long-term asset resilience and delivering upgrades to meet evolving water quality demands, along with treating a new raw water import from Havant Thicket reservoir. These investments have largely been driven by Final Enforcement Order (FEO) actions issued by the DWI. We

engaged extensively with the DWI and identified the sequence of Strategic investment needs and appropriate solutions which address:

- Improved treatment process resilience under a range of operating conditions
- Enhanced treatment of variable raw water qualities experienced at the site
- Reducing levels of unplanned outage
- Securing long-term water supply under normal and drought conditions
- Improving water taste, odour, and appearance
- Reduced interruptions to customers and businesses through more sustainable use of water, protecting our critical rivers and chalk streams
- Reduced carbon footprint and greater protection against waste discharges

In addition:

- [redacted] is a key component of the Water for Life Hampshire Strategic Resource Option. Under drought conditions, from 2034 [redacted] will be required to treat up to 91Ml/d of water sourced from Havant Thicket Reservoir. This new source will have differing water chemistry to current sources
- [redacted] Significant spend above base Capex allowances, has been expended over the last 3 AMP periods [redacted] A holistic approach is required to address key issues and to upgrade key infrastructure including power resilience
- From 2040 investment is required to support future flows from Thames to Southern Transfer (T2ST) scheme
- The existing treatment processes are unable to remove algae derived taste and odour-causing compounds, and provide no barriers against pesticides
- [redacted]
- An unacceptable high level of compliance failures has led to a number of Final Enforcement Orders from the DWI. There are 87 FEO actions and a further 5 currently non-FEO actions which we are giving equal priority to, as failure to address these comes with a high risk of customer impact and further enforcement notices being issued

2.3 Objectives

The PR24 business case describes in detail how we assessed the needs at four of our WSW surface works, including [redacted], and assessed strategies to address these needs. Our priority is to enhance site resilience and mitigate vulnerabilities across the wider zones, ensuring long-term operational integrity and regulatory compliance.

The DWI have issued a number of FEO actions in February 2023 in relation to [redacted]. Addressing these long term problems and the vulnerability of sites throughout AMP8-9 within the context of their wider zones, in some cases low levels of mitigation against a complete loss of production, remains our utmost priority. We discuss how we address this issue within Section 3.

The scope of this Programme is the timely delivery of 96 outputs identified through detailed reviews of site risks and performance, alongside extensive engagement with the DWI.

87 of these are classed as FEO actions - of which 18 FEO actions relate to reporting and monitoring. A further 9 actions are currently not classed as FEO actions but are to receive equal priority by Southern Water due to their criticality to the future performance of the site, central to our strategic delivery plan for AMP8. Failure to address these non-FEO actions comes with a high risk of further enforcement notices being issued. (18 FEO actions relate to reporting and monitoring)

Table 2: Primary drivers

Scheme name	Reference (Final EP master - 2526 Price Base)	Driver	Date Requirement	Regulatory Notice
[redacted]	WRMP_20240626_000124	FEO	2032	SRN_2022_00008_[redacted]FEO
[redacted]	DWI_27	FEO	Various	SRN_2022_00008_[redacted]_FEO

2.4 PR24

As part of our PR24 business plan we submitted a series of Enhancement Cases for consideration. Our assessment for [redacted] was included within 'SRN25 Supply Resilience Enhancement Programme, Enhancement Business Case – Special Cost Claim'[1] [2]. This report was deemed a 'special cost claim' because it identified issues with four of our major WSW surface works and proposed that a single programme of strategic investment for each works to address needs would yield efficiencies rather than a series of smaller incremental projects.

A number of external factors combined with the WSWs being near the end of their useful lives required a significant investment at these sites across 2025-2030 to maintain a reliable supply [redacted].

Our PR24 Draft Determination Response (DDR) submission included the interventions to improve the resilience of water supplies from [redacted] Since the DDR submission (and subsequently the Final Determination), we have continued to work on these interventions to improve resilience and find efficiencies, to meet the regulatory comments set out in the FEO, and any changes will be reported in the subsequent submission.

3 Optioneering and Solution Design

3.1 Optioneering Activities post final Determination

Optioneering has informed the selection of the PR24 preferred option. We have enhanced the PR24 preferred option analysis by back-checking to identify potential options and refreshing both the scope elements and associated costs to inform this document. Our optioneering process is summarised in this section.

Whilst acknowledging the need to progress [redacted] (also known as [redacted]) through the Ofwat gated process, we also recognise the need to progress the project to maintain compliance as well as achieve regulatory and enforcement dates. Therefore, we have carried out detailed briefings with our teams responsible for delivering capital investment projects with key information on the requirements, deliverable benefits and time, cost and quality expectations for a project.

[1] SRN25 Supply Resilience Enhancement Programme, Enhancement Business Case – Special Cost Claim'
https://www.southernwater.co.uk/media/2m5bxeka/srn-ddr-028-water-resources-supply-enhancement-cost-evidence-case.pdf
[2] https://www.southernwater.co.uk/media/0zjhinmq/srn25-supply-resilience-enhancement-programme-redacted-1.pdf

The key elements making up the [redacted] investment are shown in Figure 1 below.

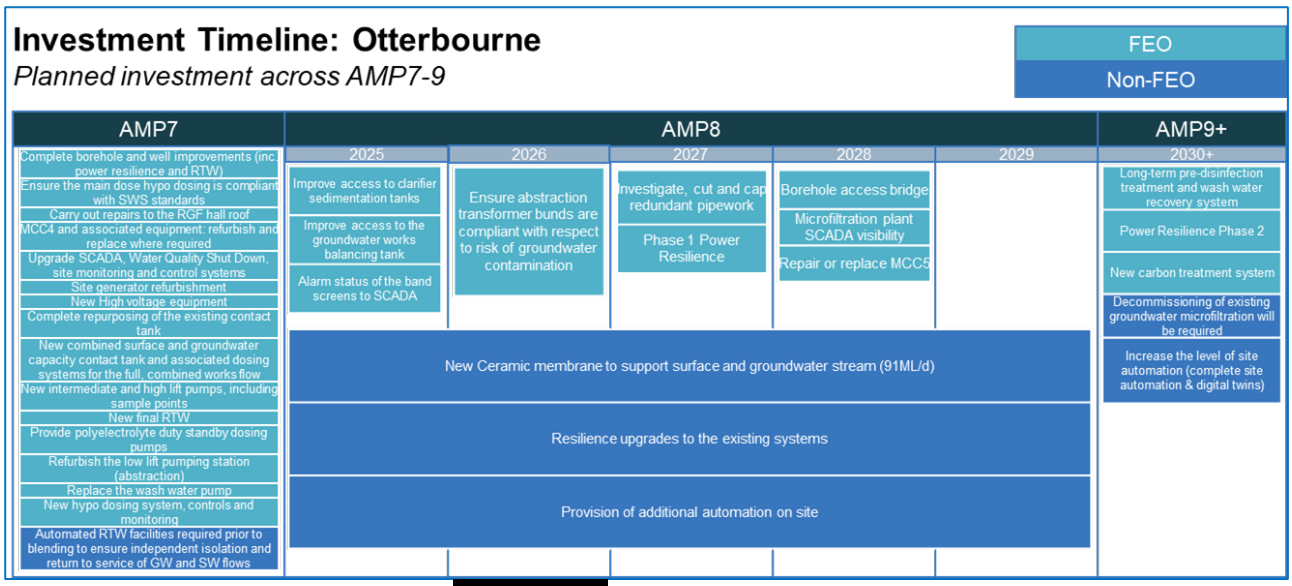

Figure 1: High level Scope items at [redacted]

3.1.1 Final Enforcement Order

Under the terms of the FEO, Southern Water Services (SWS) is required to construct and commission a new pre-disinfection treatment process in AMP8 [redacted] to treat both the existing surface and groundwater sources and the alternative drought source (via the Havant Thicket reservoir transfer). This new process is required to address existing water quality risks at the site and support the company's long term Water Resource Management Plan (WRMP24). [redacted] The scope detailed in this section is to address the DWI FEO items detailed in Table 3. The full version of the DWI FEO with reference number SRN-2022-00008, Version 1 and dated 28 February 2023, is online[3]. The planned mitigation of the actions set out in the DWI notice is detailed in Section 3.3 to 3.6.

3 [redacted]

Table 3: Summary of FEO requirement for the Phase 4 Projects

FEO Step	Activity Description	Regulatory date
44	**Taste and Odour**: Complete the programme of works to mitigate risks associated with Taste and odour, to include: d) Construct and commission new carbon treatment system.	**30 June 2031**
50	**Power and Resilience**: Complete the programme of works to mitigate risks associated with Power and Resilience to include: d) Confirm completion of Phase 2 programme of works in step 50(a) e) Commissioning of Phase 2 programme of works in step 50(a)	**30 Sept 2032** **30** June **2032**
57	Construction and installation of the long-term pre-disinfection treatment and wash water recovery system as agreed in writing with DWI following the submission of the final strategy document dated 30 April 2023.	30 June 2030
58	Commission of the long-term pre-disinfection treatment and wash water recovery system as agreed in writing with DWI following the submission of the final strategy document dated 30 April 2023.	31 June 2031

3.2 New pre-disinfection options (long to short list)

The preferred option selection followed our Asset Lifecycle Process (ALP) which details how to plan, design, build, operate, maintain, and decommission assets. This process involves using a multi-stage Risk and Value (R&V) based decision-making process to identify, select and install the most optimum and viable option. The [redacted] Project has progressed through the R&V process, where 9 options were appraised as shown in Figure 2.

Options			Scores	Commercial		Final Score	Level of Risk Reduction	Progress Option to Short-list?
No.	Option	Description	Total Score (on criteria)	CAPEX	OPEX	Overall Score (TOTEX)		
1	Do Nothing		16	4	1	21	L	No
2	Do Minimum	Refurbish existing works and add another 45Mld plant of same process	16	3	2	21	L	No
3	Restructure existing	Repurpose existing structures to create new process stream	16	3	2	21	L	No
4	Low-Rate Clarification	FLAT Bottom Clarifier + Filtration + GAC	19	1	4	24	H	No
5	Moderate-Rate Clarification	Conventional Lamellas + filtration + GAC	19	1	4	24	H	No
6	High Rate Clarification	Actiflo + Filtration + Granular Activated Carbon	21	3	2	26	H	Yes
7	Floatation	DAF + Filtration + GAC	21	3	2	26	H	Yes
8	Polymeric Membranes*	Polymeric Membranes + GAC	20	3	2	25	H	Yes
9	Ceramic Membranes	Ceramic Membranes + GAC	22	2	3	27	H	Yes

Commercial Consideration Key					
	1	High cost	3	Medium cost
	2	Medium-high cost	4	Low cost

Figure 2: Long list of option identified and appraised

For Options 1–3, the reuse or refurbishment of existing assets, [redacted] only minimal risk reduction and resilience benefits and are deemed unsuitable for

addressing future (early AMP9) raw water treatment requirements. Options 4–9 involve the replacement of current clarification and filtration systems with low - to high-rate clarification–filtration processes, Dissolved Air Flotation (DAF) followed by filtration and polymeric or ceramic membrane systems. Four options which offer a higher risk reduction were shortlisted for further investigation (highlighted green in Figure 2), these included Dissolved Air Flotation (DAF) or Actiflo with Rapid Gravity Filters (RGF), polymeric membranes and ceramic membranes.

Additionally, the requirement for taste and odour (T&O) removal at [redacted] has been reviewed. The preferred solution is the Granular Activated Carbon (GAC) process, which offers reliable removal of T&O precursor compounds and is deemed suitable for addressing the T&O potential risk associated with wastewater reuse. GAC also provides a more reliable treatment against PFAS, which has been detected at Level 2 in the groundwater sources and approaching Level 2 in the river source. An alternative solution for T&O precursor removal is to use Powder Activated Carbon, but this is not favourable due to handling issues, achieving reliable dosing and the required retention time in the system to achieve removal. The future raw water is expected to include recycled water sourced from an existing wastewater treatment plant via the Havant Thicket Reservoir. In addition to abstracted flows from the River Itchen and existing Boreholes, the typical flow from Havant Thicket reservoir will be about 30Ml/d but can be increased to 90Ml/d under drought conditions.

Each of the investigated options above include the provision of a new wash water recovery system to support the pre-disinfection treatment process. This includes:

- A buffer volume to stabilise wash water recovery plant, feed flow and solids loading:
- A system to incorporate sufficient buffering to limit return flows to <10% of total works inlet flow (across all production scenarios)
- Wash water returns to comply with Badenoch and Bouchier guidance
- Compliance with trade effluent discharge permit conditions (TSS, COD, volume and instantaneous flow).
- Dewatering, with liquors discharged to sewer, and sludge cake exported offsite by road for disposal.

3.3 New pre-disinfection options (preferred Option)

Following detailed assessment under our Risk and Value (R&V) process, Option 9, which comprises of ceramic membranes with GAC has been identified as the optimal solution for [redacted]. Figure 3 shows the optioneering scorecard covering this process selection. Although Capex for the ceramic membrane option was slightly higher, the difference with polymeric membranes was minimal (~4%) and within margins of error given the maturity of scoping at the time.

The ceramic membranes provide a reliable removal of suspended solids and pathogens and will provide a more consistent filtrate quality than conventional treatment. Ceramic membranes are more resilient to more vigorous chemical cleaning than polymeric membranes, which improves performance (lower trans-membrane pressure and greater throughput) and asset life. This allows greater ability to deal with greater raw water challenges, which is particularly advantageous given the unknown future water quality from Havant Thicket reservoir. Ceramic membranes is a new technology for SWS, therefore pilot trials have been completed to assess how well the solution responds to the current raw water challenges at [redacted] (See Annex A1). The pilot trial result shows a very good filtrate quality, with flow recovery greater than 97%. Two reference ceramic membrane plants, using the PWNT technology, are currently operational in the UK, these include the 90 Ml/d Mayflower WSW and 4.5 Ml/d at Bonnycraig in Scotland. An additional five PWNT installations are currently either under construction or in the commissioning phase in the UK.

A further benefit of this technology is that the ceramic system has a smaller footprint when compared with alternative options. [redacted] is a very congested site with space at a premium, and the selected option will have to be installed and commissioned whist the existing process plant is kept operational and maintaining supply. The smaller footprint of the ceramic membranes makes the solution more deliverable and

therefore cheaper. Its selection brings reduced impact on the environment and our neighbours as we would have to encroach less onto land outside the current operational works boundary.

			Option 1 - Ceramic UF > GAC		Option 2 - Polymeric UF > GAC		Option 3 - Actiflo > RGF > GAC		Option 4 - DAF > RGF > GAC	
Section	**Criteria**	**Considerations**	*Rating comments*	*Rating*	*Rating comments*	***Rating***	*Rating comments*	***Rating***	*Rating comments*	***Rating***
Strategic	Business Needs	How well does the option meeting the needs defined in R&V1?	The option satisfies the project needs as defined in the Needs Statement.	5	The option satisfies the project needs as defined in the Needs Statement.	5	The option satisfies the project needs as defined in the Needs Statement.	5	The option satisfies the project needs as defined in the Needs Statement.	5
	Maintenance and Operability	How well does the option meet the operational and maintenance goals? (wholesome/resilience/reliability)	Maintenance, is unkown at the moment due to lack of internal knowledge within the industry Operationally, ceramic membranes appear to be more resistant than polymeric membranes and process should be similar	4	Maintenance (from current MF plant) difficult due to cost and parts lead times Operationally, the challenge is with the amount of moving parts, but as long as a MSTs are in place it should operate smoothly.	3	Maintenance wise, this should be easier as Ops/MEICA are familiar with clarifiers Operationally, clarifiers will be hard to optimise due low incoming turbidity	2	Maintenance wise, this should be easier as Ops/MEICA are familiar with clarifiers Operationally, DAFs will be hard to optimise due to low incoming turbidity	2
	Water Quality & Resilience	How well does the option treat the varyining raw water quality?	There are no differentiating water quality factors identified at the current stage of design development.	4	There are no differentiating water quality factors identified at the current stage of design development.	3	There are no differentiating water quality factors identified at the current stage of design development.	3	There are no differentiating water quality factors identified at the current stage of design development.	3
	Achievability	Can the whole solution be delivered and commissioned on time?	Preliminary delivery programmes suggest that Option 1 can be commissioned by the 31/12/26 with a provision of circa 6 month float/process support (assuming 20 week commissioning & handover)	5	Preliminary delivery programmes suggest that Option 2 can be commissioned by the 31/12/26 with a provision of circa 6 month float/process support (assuming 20 week commissioning & handover)	5	Preliminary delivery programmes suggest that Option 3 can be commissioned by the 31/12/26 with a provision of circa 6 month float/process support (assuming 20 week commissioning & handover)	5	Preliminary delivery programmes suggest that Option 4 can be commissioned by the 31/12/26 with a provision of circa 6 month float/process support (assuming 20 week commissioning & handover)	5
	Affordability	How well does the option fit within the budget? Budget as at 30/08/2022 = **£92M**. High-level cost estimation of the various options assuming full delivery in the Hybrid location.	The option exceeds the budget by circa 60% Potenial Upper Cost = £202,223,024 Potential Lower Cost = £119,835,866	1	The option exceeds the budget by circa 50% Potenial Upper Cost = £187,671,254 Potential Lower Cost = £111,212,595	2	The option exceeds the budget by circa 45% Potenial Upper Cost = £180,192,014 Potential Lower Cost = £106,780,453	2	The option exceeds the budget by circa 45% Potenial Upper Cost = £178,141,915 Potential Lower Cost = £105,565,579	2
Social	Public trust / institutional support (e.g. trust and reputation)	How does the option affect the level of public trust / institutional support in Southern Water? This relates to the level of confidence that stakeholders including customers, regulators and others have in Southern Water given our reputation and operating environment	There are no differentiators between the different options for this criteria.	3	There are no differentiators between the different options for this criteria.	3	There are no differentiators between the different options for this criteria.	3	There are no differentiators between the different options for this criteria.	3
Carbon	Embodied Carbon	Construction Phase	The option supports employing lean design and the use of DfMA. However, the option still requires the construction of traditionally carbon intensive activities.	3	The option supports employing lean design and the use of DfMA. However, the option still requires the construction of traditionally carbon intensive activities.	3	This will primarily employ large amounts of insitu civil construction (concrete & steel) and has limited opportunity for DfMA.	2	This will primarily employ large amounts of insitu civil construction (concrete & steel) and has limited opportunity for DfMA.	2
	Operational Carbon	What is the expected operational carbon output?	This option has the largest peak power consumption based on the preliminary power estimates. Therefore, this option rtes as moderatly disadvantageous.	2	Based on the maximum demand, this option is expected to have the joint lowest power demand, but requires periodic replacement of membranes.	2	Based on the maximum demand, this option is expected to have the joint lowest power demand .	3	This option has the largest peak power consumption based on the preliminary power estimates. Therefore, this option rtes as moderatly disadvantageous.	2
Commercial	CAPEX	This criteria was removed from the scoring as agreed at the Options Workshop 01/09/22								
	OPEX		Based on the maximum demand, this option is expected to have the highest power demand and chemical usage.	2	Based on the maximum demand, this option is expected to have the joint lowest power demand, but requires periodic replacement of membranes.	2	Based on the maximum demand, this option is expected to have the joint lowest power demand .	3	Based on the maximum demand, this option is expected to have the second highest power demand.	2
				29		**28**		**28**		**26**

Figure 3: Shortlisted Options Scorecard (see also Annex D1)

3.4 Final Configuration

The proposed final site process is shown below. The existing pre-disinfection processes are aged and are not capable of treating the future raw water from Havant Thicket reservoir nor will they provide taste and odour removal against the future water source, therefore a new pre-disinfection process, comprising ceramic filtration and GAC absorbers, will be installed as a replacement of the surface and ground water processes to treat up to 91 Ml/d of distribution input. This will initially treat only the existing surface and groundwater inflows until the new Havant Thicket reservoir raw water stream is available in early AMP9, when it will treat a combination of inflows. A new sludge management process is also required to support upgraded pre-disinfection system to lack of capacity in the existing sludge plant.

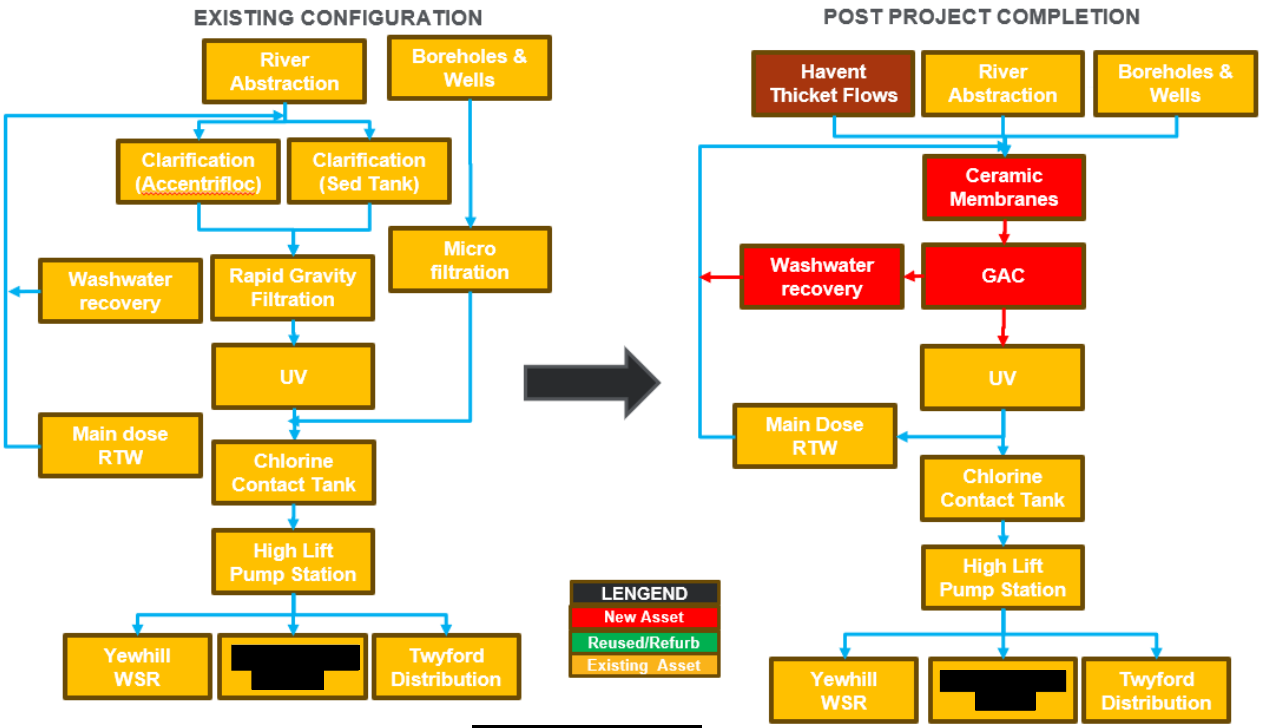

Figure 4: Existing and proposed [redacted] final process configuration (simplified)

We have been informing Ofwat of the progression of the design as part of the quarterly reporting on projects, in particular highlighting issues regarding:

- The overall system resilience within the site now being lower with no storage (12-18 hours) [redacted] The inclusion of reservoir extension, new reservoir or onsite storage as part of the site improvement is now needed. This was not previously included in the PR24 costing
- A critical task is an end to end review of the entire site. This is required to ensure appropriate redundancy is available for all assets on completion of the overall scheme.

[redacted] Phase 5 is being designed to further strengthen resilience through targeted improvements in redundancy and reliability. As part of this initiative, we are evaluating the implementation of parallel disinfection treatment streams and the construction of additional water storage. These enhancements are intended to ensure continuity of service, reduce operational risk, and align with WRMP, as well as our long-term asset health strategy.

The proposed measures are currently under detailed review and development by our Asset Management team, with the intention of inclusion in the PR29 regulatory submission.

The opportunity of efficiencies and value for money will be explored to include concurrent Phase 4 and Phase 5 works to maximise value for money, benefits and outcomes. A list of opportunities will be provided within Submission 2 should any be identified.

The implications of these items are being assessed in the design of the whole scheme and will be reported in due course and in scope items detailed in Submission 2.

4 Solution Costs and Benefits

4.1 Introduction

This section provides updated costs for the feasible options and the costing methodology that has been used to derive the costs. No best value appraisal has been undertaken to date; this activity will be undertaken prior to Submission 2. This section identifies the approach that will be used and examples of potential solution benefits.

All scope information was produced in June 2022 as part of our PR24 submission development and the cost build-up is in-line with SWS' PR24 Methodology entitled "SRN15 Cost and Option Methodology". [4]

We have undertaken reviews on the scope items to ensure that relevant yardstick and sizing information is available and correctly presented. During this review, scope item costs were compared with the relevant cost curves and models and we have addressed any areas of mismatch and/or gaps.

The cost models and generated costs were validated and a sense check was applied to the outputs to address any further anomalies. Any further gaps were raised and doubled checked, as well as addressed. The cost information was benchmarked and the methodology is provided below.

Table 4: Summary Cost Breakdown (Class 4 estimate)

Blended Total Project Estimated Cost (Inc Corp OH for Price Review (PR) Only)	[redacted]
Corporate OH	[redacted]
Blended Total Project Estimated Cost (Exc Corp OH)	[redacted]
Total Indirect Costs	[redacted]
Contractor & Client Indirects	[redacted]
Sites Specifics and TtOR (Risks)	[redacted]
Net Direct Works Costs	[redacted]

Net Direct Works

The base cost of the project includes all direct construction and delivery activities, such as:

- Civil, mechanical, and electrical works
- Installation of pipelines, treatment facilities, or infrastructure
- Materials, labour, and subcontractor costs
- Site preparation and enabling works

These components collectively form the Total Net Direct Works, which represents the base cost of the project.

- Cost Models: circa 46%.

[4] Southern Water. SRM15 Cost and Option Methodology: Technical Annex (October 2023). Available at: https://www.southernwater.co.uk/media/mjyp0of4/srn15-cost-and-option-methodology_redacted.pdf

- Bottom-Up Estimates and Quotations (inflated to 2022/23) undertaken by SWS CIT: circa 54%.

Contractor and Client Indirect Costs

Indirect Costs are applied to the Net Direct Works to account for:

- Site management and supervision
- Temporary works and facilities
- Design and engineering support
- Project controls and administration

These have been applied as a percentage uplift of 76.50% to the Net Direct Works.

Blended Project Total

This is the sum of Net Direct Works and Indirect Costs, representing the full cost of delivering the physical scope of the project.

Risk Allowance

A contingency or risk allowance is added to cover estimating and scope uncertainty. This has been calculated as 20.0% (Generic Percentage Similar to Sandown LSG project).

Total (Excluding Corporate Overheads)

This subtotal includes all costs required to deliver the project, excluding corporate-level costs.

- Net Direct Works
- Contractor & Client Indirect Costs
- Risk Allowance

Corporate Overheads

Corporate overheads are applied to cover:

- Head office support
- Governance and assurance
- Legal, finance, and HR functions
- Strategic management

These have been applied as a percentage uplift.

Total Project Cost

The Total Project Cost includes all components:

- Net Direct Works
- Contractor & Client Indirect Costs
- Risk Allowance
- Corporate Overheads

This figure represents the full financial commitment required to deliver the project.

This estimate has been classified as being at Class 4. The percentage level of current cost confidence is based upon the current scope / design maturity which underpins the estimate.

4.2 Change Log - Post PR24 FD

There have been no material changes to the scope, benefits, site location, route, programme or costs on this project since the PR24 Final Determination in December 2024 (based on Ofwat's PR24 criteria of change). Therefore, no change log is included in this submission.

4.3 Solution cost estimates

Solution cost estimates have been produced for the feasible options. The costing methodology is described in Southern Water's corporate value framework for Cost Benefit Appraisal [5], which is consistent with the approach taken for PR24. The cost estimates are summarised below and reported, alongside the benchmarking.

4.4 Early CAPEX estimate

The Stage 1 Strategic Delivery Partner (SDP) Contract has provided an indicative cost estimate for information purposes related to [redacted], which reflects a substantial increase compared to the PR24 baseline. This variance underscores the need for a thorough validation of the SDP's underlying logic, particularly in relation to programme assumptions and procurement strategy.

Early during Submission 2 we will carry out a formal review of these indicative costs, complete our internal governance and update Ofwat through a revised Change log as part of the Delivery Plan requirements.

To address this, Submission 2 will focus on key activities aimed at scrutinising areas where efficiencies may be realised. Central to this effort will be the development of a fully costed high-level design, offering a transparent and comprehensive representation of the proposed solution.

This design will be subject to rigorous benchmarking and assurance processes to test its feasibility, performance, and alignment with strategic objectives. These measures are intended to build confidence in the accuracy and reliability of the design and its associated costs, thereby supporting informed decision-making and mitigating delivery risk as the project advances.

5 Programme and Planning

5.1 Project Delivery Plan

We have developed a project delivery plan for the PR24 preferred option, progressing from Submission 1 through to full commissioning. The scheme is designed to deliver additional capacity by 2031, with final completion anticipated between 2031 and 2035. However, the assessment of hydraulic capacity within the existing network is ongoing. This analysis will determine whether a phased delivery approach is required, potentially enabling partial capacity enhancements ahead of the full scheme rollout.

[5] Southern Water. SRM15 Cost and Option Methodology: Technical Annex (October 2023). Available at: https://www.southernwater.co.uk/media/mjyp0of4/srn15-cost-and-option-methodology_redacted.pdf

We have ensured that this submission is fully aligned with our DPW4 delivery plan table, including all key milestones and expenditure details. The relevant table is provided in the Annex C1. This replaces our August delivery plan submission as the most up to date baseline, there is likely to be limited change as part of our November 7th delivery plan update to the delivery plan. As part of submission 2 there may be further changes to the delivery plan baseline.

The delivery plan is structured to accommodate flexibility, ensuring responsiveness to emerging insights and operational constraints. Figure 5 provides a visual summary of the proposed draft delivery programme. This has been produced in partnership with our SDP and has been produced to meet the SWS target delivery dates with sufficient contingency in the event that risks materialise.

The delivery plan has been developed through a structured process against the SWS scope, objectives, and success criteria. The SDP in partnership with SWS and key stakeholders have undertaken optioneering and feasibility assessments that have created a baseline on the project's complexity and risk profile.

The delivery plan itself includes detailed programming and scheduling, resource allocation, cost planning, risk management, quality assurance, health and safety compliance, and stakeholder communication strategies. Increasingly, digital tools such as Building Information Modelling (BIM) are integrated to enhance coordination and visibility. Assurance of these plans is achieved through internal peer reviews, formal governance gate reviews, and independent audits. Compliance with industry standards and regulations is verified, and risk and change control mechanisms are maintained throughout delivery. Performance is monitored using key metrics and regular reporting to ensure the project remains aligned with its objectives and expectations.

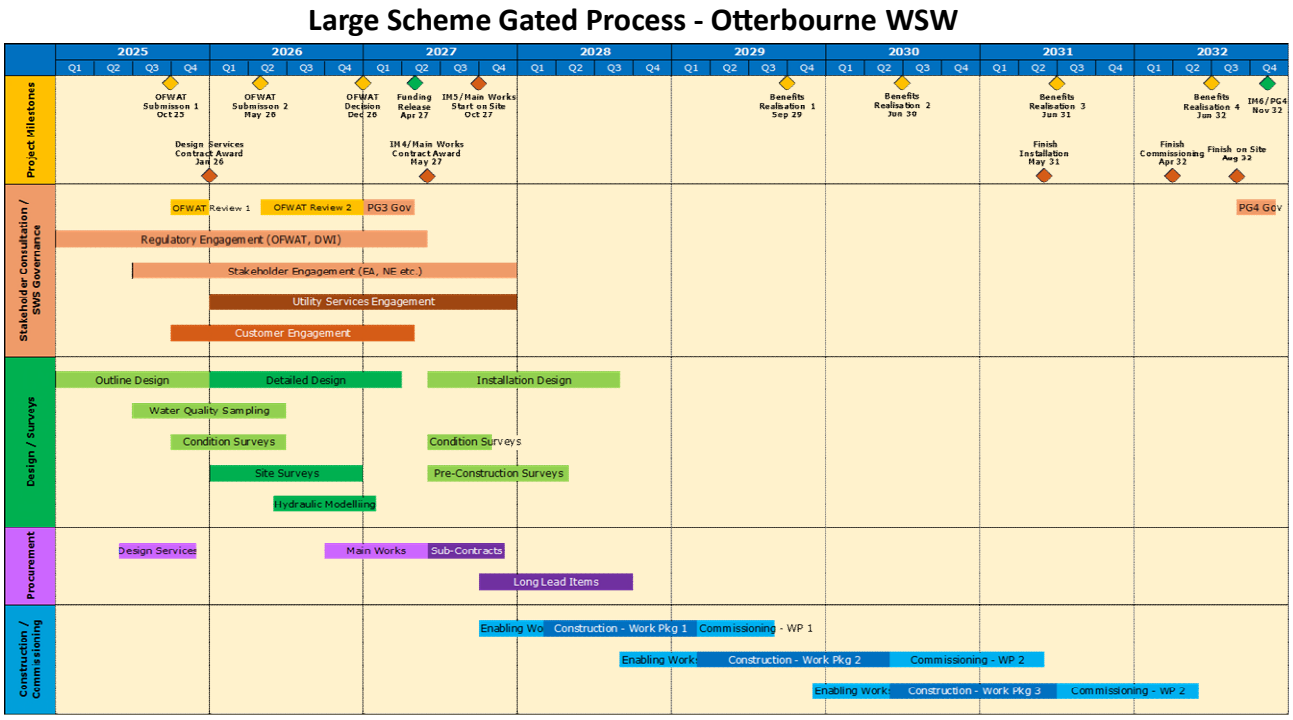

Figure 5: proposed delivery program

5.1.1 Submission 2 Timeline and Activities

Given the current scope and programme constraints, our target date for Submission 2 is May 2026. Should significant risks arise that impact this timeline, we will engage with Ofwat through our established quarterly reporting framework to discuss potential adjustments.

By Submission 2, the high-level design will be further developed and costed to reflect maturity, providing a clear and comprehensive overview of the proposed solution. This costed design will undergo benchmarking and assurance processes to validate its feasibility, performance, and alignment with project objectives. These measures will ensure a high degree of confidence in the design's accuracy, reliability, and cost-effectiveness, enabling informed decision-making and reducing risk as the project progresses.

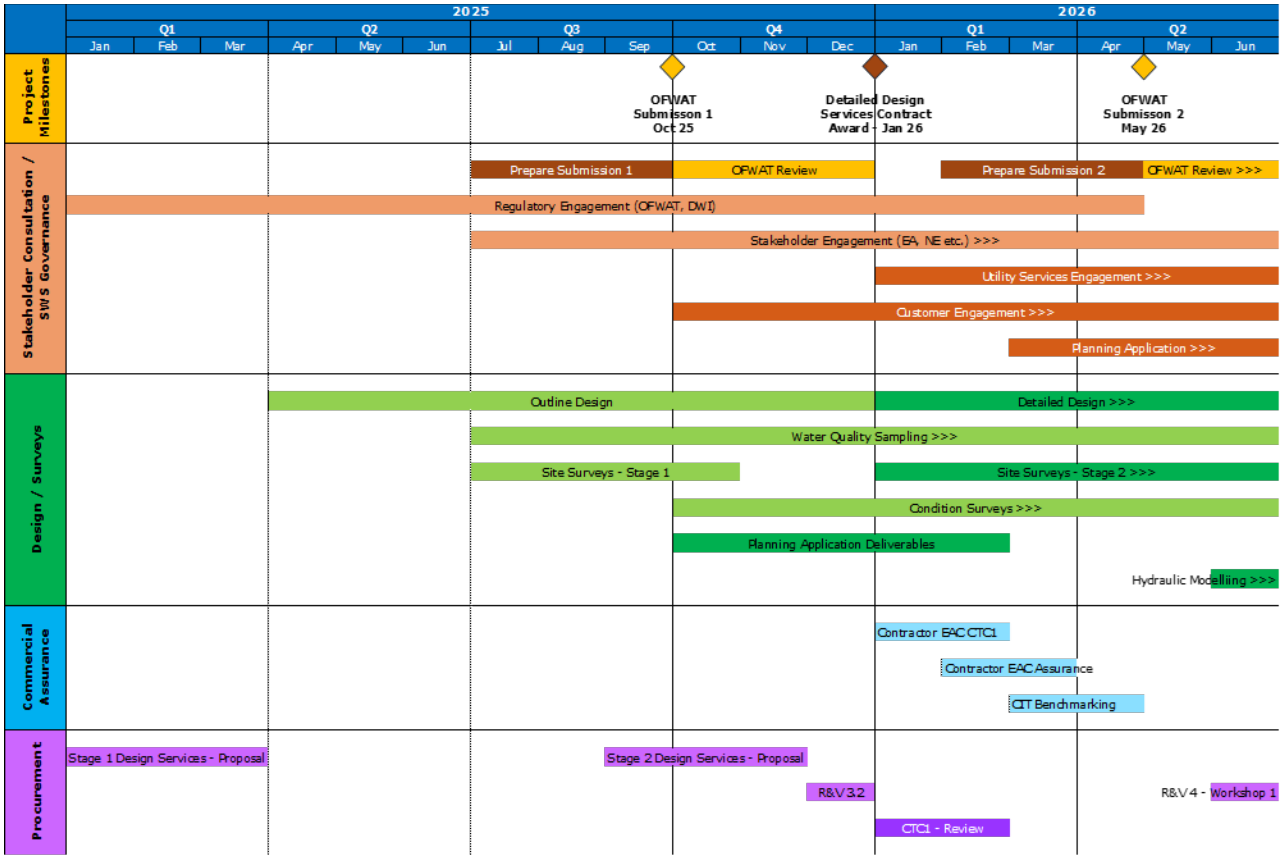

Figure 6 Activities prior to Submission 2

It is worth noting that by Submission 2, the SDP will have submitted a CTC 1, which is the first of three submission stages. At CTC 1, the SDP is required to submit the following:

- Design Proposals including sufficient Process Solution and Process Solution Parameters
- An initial programme for each project (schedule) in P6 showing the critical path activity
- Any revisions to the access date(s), key date(s) (where applicable) for each project and the completion date(s) and/or sectional completion dates
- Notional Design Deliverables Schedule(s)
- Notional Procurement Schedule(s) & the Framework procurement strategy
- Monetised risk register(s), unless agreed as an exceptional risk, for each project
- If available, subcontractor and/or supplier quotes for each package of work
- Where available/applicable, tender analysis of each subcontractor or supplier formal package(s), or assurance that S/C Framework and/or Bulk procurement arrangements prices have been assured in-line with SDP suppliers Framework rates
- Cost build sheets (including PRCs and backing sheets) for each project in accordance with SWS WBS where possible
- Copies of any reports and/or ECI outputs referenced and/or used in the Contractor's formation of the CTC(s), for each project, e.g. site/ground investigation reports, environmental reports

The Project team, CIT and wider internal stakeholders will review and assure the CTC submissions to ensure that the project is developing sustainably and inline with the project brief/design criteria.

5.2 Key risks and mitigation measures

Risk identification and evaluation activities are in line with SWS's risk management framework. This framework defines a process that all capital projects must follow for risk identification, evaluation, mitigation, and review, and is fully aligned with ISO31000 requirements. Following this process, the key risks to achieving the project objectives have been identified, scored, and mitigation actions defined.

Risks are identified, evaluated and managed using our Programme Insights Manager (PIM) system. Key delivery risks (and issues) are set out in Table 5 below.

Table 5 Key Risks

Risk Category (and ID)	Risk Description	Pre-mitigation Score	Mitigation Action	Residual Score
Power Supply Upgrade KR001	[redacted]		Escalated within SW & SSE with Director level intervention.	
Sewer capacity KR002	The new plant provided by Phase 4 will need to discharge wash water to the sewer. [redacted]		The project is seeking to incorporate solutions that will alleviate this issue but this is likely to increase the costs.	
Access KR003	Change in security classification on site reduces construction traffic through the site and requires alternative routes.		This involves moving existing Solar Farm and acquisition of 3rd party land	
River Interface KR004	Risk that the rising main from River Itchen Intake to main works requires upgrade as part of the proposed new pumping station upgrade		Close working between project teams to understand scope requirements between packages	
Interface KR005	Southampton Link Main Interface delays delivery / commissioning of the Phase 4 works. Havant Thicket Res - rising main delays the delivery / commissioning of the phase 4 works.		Close working between interface teams to align requirements.	
Supply chain KR006	There is a risk that due to the highly technical complexities of the works and use of new technology / sub-contractors to deliver the works that scope shortfalls between packages is not fully understood at the time of the CTC resulting in design/scope changes		Close working between project teams to understand scope requirements between packages	

6 Customer Protection

6.1 Price Control Deliverables

As part of this scheme, we recognise the importance of ensuring our customers are protected and so we have proposed a price control deliverable (PCD), this is in addition to our current PCDW16a on the water resilience and the upgrade of our water supply works.
Although, specifically for [redacted] we note that part of this project has a PCD already. This is the [redacted] part of the project and is covered by the PCDW11a, the details of this are provided in PR24-FD-CA29-Water-Supply-enhancement-expenditure-model_redacted-v2.xlsm and as stated in "large projects adjustment and DPC" it should not have been included as a PCD at the time. Although, it can stay in the PCDW11a as long as the benefits are still equivalent and Ofwat progress this submission and provide the full funding.

This PCD follows the same conditions as set out in section 8.1.2 of PR24-final-determinations-Price-control-deliverables-appendix-REDACTED.pdf

The unit rate is currently derived from the total value of the project at the PR24 Final Determination, this will be updated for Submission 2 once we have final values of the project.

Table 6 PCD information

Company	SRN
Enhancement area	Resilience
PCD No.	PCDW16d

Common requirements	See Section 8.1.2 of Price control deliverable appendix

Additional company specific requirements	
Description	Upgrade works at SRN water treatment works [redacted] Hastings and upgrade to Isle of Sheppey resilience
Output measurement and reporting	The company should report the % earned value (EV) delivered against the scope of works specified within each of the Submission 2s. The company must annually report delivery progress of all interventions and must deliver all of these interventions by 31st March 2030 or non-delivery payments apply.
Assurance	Companies should provide assurance on the reported data as per the common requirements.
Conditions on scheme	No further conditions

Non-delivery PCD rate	Unit	Under-performance
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
Hastings	£m per 1% of earned value of project not delivered	0.35
Isle of Sheppey	£m per 1% of earned value of project not delivered	0.15

PCD outputs (cumulative)	Unit	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]					
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]					

Hastings	%	0	0	0	0	0	0	100%	100%	100%	100%	100%	100%
Isle of Sheppey	%	0	0	0	0	0	0	100%	100%	100%	100%	100%	100%

7 Stakeholder and Customer Engagement

7.1 Overview

Southern Water has engaged proactively with key stakeholders throughout the development of the [redacted] Resilience Scheme. A stakeholder engagement plan has been created to guide activities up to Submission 2. Key Stakeholders include.

- **Drinking Water Inspectorate (DWI):** Engagement has been ongoing following notices and Final Enforcement Order (FEO) actions. The scheme directly addresses DWI concerns around asset condition, treatment performance, and operational resilience.
- **Environment Agency (EA):** Coordination has focused on environmental constraints and planning considerations, particularly around raw water infrastructure and aqueduct refurbishment. Early-stage environmental impact assessments (EIAs) and planning reviews are underway.
- **Ofwat:** SWS continues to maintain regular engagement with Ofwat through quarterly meetings and structured reporting. The scheme has been formally introduced, outlining its core aims, objectives, and key challenges. To support transparency and deepen understanding, onsite visits are being planned to showcase the complexity of operational activities.
- A site visit is currently being arranged for November 2025.This visit will provide an opportunity to demonstrate firsthand the intricacies of delivery and foster constructive dialogue around progress and regulatory expectations.
- **Local Authorities:** Hampshire County Council, Winchester Council and Parish Councils

7.2 Customer Engagement

Customer engagement has been extensive, and we have engaged with them as we developed our proposals for PR24 (refer to SRN25 Supply Resilience Enhancement Programme Sect 2.3 for full details). To make sure that we are addressing those problems and securing the opportunities for our customers in the most value-for-money (VFM) manner, we need to ensure that the scope of our proposed solutions is right for customers now and in the future, and that our expenditure proposals are as cost efficient as possible. To do that we have conducted a detailed optioneering process to ensure that we are providing the best outcome for our customers based on the routes available to us, and that we have robustly benchmarked our unit costs with appropriate comparators to confirm that they are deemed efficient. We continue to engage with customers to ensure we provide the best options.

For example, the qualitative Water Futures online panel is a key source of insight and a valuable resource to inform our PR24 planning. It comprises 40+ customers that represent a wide variety of demographics. A quantitative element was also added to the workstream to explore issues raised from the panel and provide insights from more ‘uninformed’ customers (over 1,000) via an online survey, across our area of operation.

In June 2023 we held five additional online sessions as our part of Water Futures 2030 engagement with customers across all counties in the SWS region to explore overall reactions to the planned four sites enhancement programme. This feedback told us that:

- Customers were largely supportive of the plans we have in place and understood the long-term risks of inaction.
- Customers positively see benefits to both themselves, and to the local economy of the proposed investment programme, feeling that their previous views have been represented.
- Customers understand the need for work to be prioritised and are happy to see that our current thinking matches their own.

- References to sustainable solutions, use of technology and improving resilience for future generations increases confidence and support.
- The current plan feels proactive and innovative and matches well with customers desire for more modern and innovative methods of delivery.

An overview of recently conducted customer research relevant has told us that the areas of focus are:

- Resilience – Customers recognise the need for and importance of urgent investment in basic infrastructure in the face of climate change
- Drinking water quality – Customers believe that safe drinking water is their number one priority as they need huge trust in the quality of water coming out their tap
- Carbon and Net Zero – Does not feel like a core priority for acceleration, though customers acknowledge wider importance of less carbon

Customer Priorities are therefore:

- Addressing ageing infrastructure, population growth, climate change
- Long-term, sustainable solutions, not short-term fixes
- Nature-based and partnership approaches, balanced with traditional infrastructure
- Affordable solutions that support future growth
- Concern about overdevelopment, loss of green space, and infrastructure strain

Overall, there were mixed reactions to the scheme: some support a new WSW as sustainable, others worry about odour and noise and prefer the idea of using existing infrastructure.

7.3 Regulators and Partner Organisations

In developing our WRMP, we worked with a wide range of partners, including the DWI, Local Planning Authorities and organisations with responsibilities for protecting and enhancing the environment such as Natural England, Catchment Partnerships and River and Wildlife Trusts. We engaged with over 180 individuals from 75 organisations.

We last met with Ofwat in September 2025 as part of the regular Quarterly Review meetings with EA, DWI and Ofwat. These are regular meetings which discuss progress, risk and planning. Output from these sessions influences solution development and risk mitigation planning. The purpose is to provide an update on the scheme progress, issues, risks and timeline. Quarterly meetings will continue through Submission 1 and Submission 2.

Drinking Water Inspectorate – Our proposals have been developed to meet FEO actions and we have the support of the DWI regarding our proposals at [redacted].

The FEO list is set out below in following link:

[redacted]

We liaise with the Inspectorate on a regular basis. Throughout the year, we have quarterly meetings on our sites where they track our progress. Furthermore, we send them detailed reports every six months with updates and evidence of the ongoing work. We also have monthly meetings to discuss our overall progress and governance of our programme.

Environment Agency - SWS has provided a written update outlining the current status and forward strategy for the [redacted] Resilience scheme. As the project progresses, SWS recognises the critical importance of proactive engagement with key environmental stakeholders, particularly the Environment Agency (EA) and

Natural England, due to anticipated changes in abstraction volumes and potential modifications to environmental discharge parameters.

To date, initial contact has been made with the EA, and key representatives have been identified to support collaborative forward planning. This early engagement is intended to ensure regulatory alignment and facilitate a smooth progression through future planning stages.

Natural England - SWS has also reached an agreement with Natural England to initiate formal engagement once the scheme's options have been sufficiently refined. This phased approach will allow for more targeted and meaningful discussions, ensuring that environmental considerations are fully integrated into the decision-making process.

As the project moves toward Submission 2, stakeholder engagement will intensify in parallel with the maturation of design options. The final solution will be underpinned by robust environmental assessments and regulatory input, ensuring that it is both technically viable and environmentally sustainable. This collaborative approach is expected to enhance confidence in the scheme's deliverability and compliance, while reducing risk and supporting informed investment decisions.

7.4 Stakeholder engagement plan

We have developed a Stakeholder engagement plan which is owned by both the Project Team and our Customer Engagement team to ensure effective, transparent, and inclusive engagement with stakeholders and customers throughout the lifecycle of the [redacted] Scheme, supporting regulatory compliance, community trust, and successful delivery.

Table 7: Stakeholder Identification

Stakeholder Group	Role/Interest	Engagement Priority
Drinking Water Inspectorate (DWI)	Regulatory oversight; FEO actions issued	High
Environment Agency (EA)	Environmental compliance and planning	High
Winchester Council	Local governance and planning	High
Local MPs and elected officials	Political advocacy and community representation	Medium
Community organisations & charities	Support for vulnerable groups	Medium
Southern Water customers	Service recipients and impacted residents	High

Engagement Objectives

- Address regulatory concerns and align with FEO timelines
- Build trust with customers following repeated service disruptions
- Ensure vulnerable customers (PSR) are prioritised in planning and delivery
- Incorporate local authority and community feedback into scheme design
- Communicate clearly and frequently about progress, risks, and benefits

Table 8: Engagement Activities

Activity	Audience	Frequency	Purpose
Regulatory briefings and updates	DWI, EA	Quarterly or as required	Compliance and alignment
Local authority workshops	Councils, MPs	Bi-annually	Planning input and coordination
Incident debrief and planning sessions	Hampshire Resilience Forum, Emergency Services	Post-incident and annually	Emergency preparedness
Community forums and listening events	Residents, charities	Quarterly	Feedback and co-design
PSR customer outreach	Vulnerable customers	Monthly	Needs assessment and service assurance
Multi-channel communications (SMS, website, social media)	All customers	Ongoing	Updates, education, and transparency

Key engagement activities with these groups in the period to Submission 2 are:

- Regular contact with Ofwat and the Environment Agency to report solution progress and risk management
- Targeted meetings with the Local Planning Authority, Natural England, Historic England to discuss initial development ideas and constraints, which can inform design development
- Contacting Statutory Undertakers to identify technical and programme constraints in the location of the solution and ways of working to mitigate constraints
- Providing updates to neighbouring local authorities and parish councils to share
- In addition, consulting environmental, community groups and residents through steps in the planning process, e.g. non-statutory consultation exercise

Customer engagement will continue through our established channels, including seeking feedback from our customer panel as the development of solution continues.

Stakeholder mapping has been undertaken which has confirmed the following key groups:

- Regulators: Ofwat, Environment Agency, Drinking Water Inspectorate, Marine Management Organisation, Natural England, Historic England
- Local Planning Authority: Hampshire County Council
- Local Authorities and Parish Councils: Winchester Council and Parish Councils
- Statutory Undertakers: Network Rail, National Highways, Crown Estate, electricity, gas, telecoms and water providers Environmental, community and business groups: Hampshire Wildlife Trust, National Trust, Recreational users of the coast / sea, Residents, Hampshire Chamber of Commerce

8 Assurance

8.1 Our approach to assurance

As described in our statement Data Assurance Summary, we take full responsibility for our performance information and seek to take a transparent approach to data assurance. We follow the ‘three lines of defence’ framework for our reporting governance and assurance activity. This framework helps to assure performance information by applying multiple levels of control.
Ultimately, all assurance activity has oversight from the Board and Audit Committee; the Board maintains oversight of material risks and issues and our timelines for improvement, while the Audit Committee monitors the assurance over the integrity of information reported by us in fulfilment of our regulatory, legal and environmental obligations as well as overseeing and challenging the effectiveness of our approach.

Our Risk, Audit and Assurance team ensures compliant reporting to our regulators by ensuring all our reporting is subject to internal review and appropriate external assurance.

We engaged [redacted] to undertake limited assurance (under ISAE (UK) 3000) over our Large Schemes (Gated) Submission 1, focusing on completeness, accuracy and validity of the data in the areas detailed by Ofwat in their Final Determination and subsequent guidance. [redacted] reports for each scheme are appended to this submission and describe their scope, approach and findings in greater detail.

8.2 Managing Risks and improvements

Through an extensive execution planning process, Southern Water has developed our PR24 Business Plan into AMP8 delivery and investment Plans. We continue to refine our plans for the AMP and are collaborating with our internal and supply chain stakeholders to improve maturity. During the development of our plans we are identifying, mitigating and managing deliverability risks.

We have established a Strategic Programme Operating Model, with each Strategic Programme Leadership Team responsible for mitigating and managing identified risks. This is an active and ongoing process and will be used to support future reporting submissions.

8.3 External Assurance findings ([redacted])

Annexes F1 and F2 contain the external assurance findings from our independent advisors (both technical and commercial). The findings relevant to this submission have been reviewed by our Assurance teams, our Water MD and our CFO as part of our signoff governance process.

All findings will be incorporated into our preparations for Submission 2 and reviewed as part of Submission 2 assurance.

9 Efficiency of Expenditure to Date

9.1 Expenditure to Submission 1

Our costs and activities associated with Submission 1 and 2 are provided in Annex G1 with summaries below.

It is important to note that no costs have been incurred in relation to Submission 2 at this stage, as no early activities or preparatory expenses have been undertaken for that phase. All financial commitments to date are exclusively associated to Submission 1.

Table 9 Costs to Submission 1

Expenditure Summary	Submission 1 Costs
SWS Indirect Costs	[redacted]
Strategic Delivery Partner Stage 1 forecast	[redacted]
Risk 10%	[redacted]
SWS Overheads	[redacted]
Total	[redacted]
Total deflated to 22/23	[redacted]

9.1 Forecast expenditure to Submission 2 (Oct to May 2026)

Our costs and activities associated with Submission 1 and 2 are provided in Annex G1 with summaries below.

A summarised version of the Submission 2 forecast is presented below for quick reference. These projections are directly linked to the detailed activities scheduled to be undertaken as part of the Submission 2 phase, and reflect anticipated operational, logistical, and strategic commitments necessary for its successful execution.

Table 10 Forecast to Submission 2

Expenditure Summary	Submission 2 EAC
SWS Indirect Costs	[redacted]
Strategic Delivery Partner Stage 1 forecast	[redacted]
Risk 10%	[redacted]
SWS Overheads	[redacted]
Total	[redacted]
Total deflated to 22/23	[redacted]

9.2 Comparison against the development allowance

The current financial forecast for SWS indicates a projected underspend relative to the allocated development allowance. This suggests that, based on current planning and expenditure trends, SWS is expected to operate within budget and may not require the full extent of the funds originally earmarked for development activities.

To ensure continued accuracy and responsiveness to changing conditions, the forecast will be reviewed and updated on a monthly basis. These updates will incorporate:

- Emerging risks that could influence cost trajectories
- Cost pressures arising from market fluctuations
- Resource constraints
- Scope adjustments
- Operational changes that may affect timelines or deliverables

Forecast monitoring will help maintain transparency, support effective decision-making, and ensure that any deviations from the original forecast are identified.

Table 11 Comparison of development allowance (£ deflated to 22/23 price base)

Development Funding Allowance	Submission 1 Costs	Submission 2 Forecast	Total EAC	Variance
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

10 Conclusions and Recommendations

10.1 Overview

[redacted] is a key strategic site that is fundamental to maintaining a resilient supply of high quality water [redacted]. Its importance has been further underscored through stakeholder and customer engagement, which has validated the necessity of continued investment, particularly in resilience enhancements aligned with PR24 objectives.

The solution design will be matured during the development phase; the option definitions and preferred solution development has provided sufficient evidence to justify the progressing to Submission 2. Stakeholder and customer engagement has validated the need for this investment, with strong support for resilience improvements. However, key risks remain from increasing demand and abstraction.

10.2 Development Phase and Justification

The development phase has yielded mature option definitions and a preferred solution that collectively provide a robust foundation for advancing to Submission 2. These proposals address key vulnerabilities in the current system and reflect a proactive approach to futureproofing Otterbourne WSW infrastructure.

Key outcomes from the development phase include:

- Evidence-based justification for progressing to the next submission stage
- Strong stakeholder and customer support for resilience improvements
- Alignment with PR24 strategic goals and regulatory expectations

Continued development will:

- Improve confidence in delivery outcomes
- Strengthen cost certainty and programme reliability
- Ensure resilience objectives are met in a sustainable and efficient manner
- Otterbourne WSW remains a cornerstone of our strategic infrastructure, and this investment represents a vital step toward securing long-term water quality and supply resilience for our customers.

10.3 Risks and Considerations

Despite the progress made, several risks remain that could impact long-term delivery and performance:

Power Resilience at [redacted]

- Identified as a critical risk due to potential capacity in energy supply
- May impact operational continuity and reliability of service delivery
- Requires further assessment and potential mitigation strategies during design development

Increased Capital Expenditure (CAPEX)

- Initial cost estimates from the SDP indicate a significant uplift compared to earlier projections
- Data provided for [redacted] highlights the scale of cost escalation.
- Necessitates detailed cost validation and value engineering to ensure affordability

Lifecycle Stage Risk

- Current risks are reflective of the early project lifecycle, particularly during outline design
- As the project transitions into full design, risk profiles are expected to evolve
- Enhanced clarity on scope, design, and delivery approach will enable more accurate risk quantification and mitigation

Forward Risk Management Considerations

- Continuous risk monitoring and reassessment will be essential
- Integration of resilience planning and cost control measures into design and procurement phases
- Stakeholder engagement and assurance processes will support informed decision-making and risk reduction

These risks are being actively monitored and will be incorporated into the next phase of planning and design refinement.

10.4 Recommendation

Our project plan in Section 5 confirms a full scheme completion (based on PR24 scope) is possible, provided currently identified risks and issues can be mitigated with continued key stakeholder support. Our activities to Submission 2 will confirm our preferred solution and updated forward plan for completion. Any significant changes will be notified to Ofwat.

We propose that sufficient evidence has been provided in this submission to enable the progression to Submission 2, where greater confidence in cost estimates, programme timelines, and delivery feasibility will be demonstrated. The confirmed preferred solution will undergo further design development, enabling more accurate forecasting and value-for-money assessments.

11 Supporting Documentation

Annex A1 Optioneering & solution Design

Figure A-1 below outlines the future PCV position following the interventions discussed in this report.

Figure A-1: Future Water Quality PCV position

Ceramic Membrane Pilot Trial

There are currently two ceramic membrane providers: PWNT and Nanostone. Pilot trials of both suppliers commenced at Otterbourne in March 2022 and finished in March 2023 having captured Spring, Summer, Autumn and Winter seasonal raw water variations.

The trial operated under different water source scenarios including a blend of 44% surface water and 56% ground water, 100% surface water, and 100% ground water. This allowed both pilot providers the chance to understand the individual sources for providing their full-scale design. Indications are that the ceramic membrane technology can treat river water at a flux rate of at least 200 lmh, with coagulant doses below those needed for the existing surface treatment plant. Acid dosing may be required as well, which in cost terms will offset the coagulant savings, however the lower coagulant dose requirement will reduce the unit sludge production rates and pH correction will contribute towards more stable and consistent water chemistry into distribution. The process selection is based on the key assumption that the quality of the future raw water provided from Havant Thicket reservoir, which is in turn sourced from a blend of Spring water and reclaimed water, will be at least as treatable by ceramic membranes as the current Itchen raw water in terms of algal and organics loading.

Each pilot plant had one operator who attended the pilot site regularly to carry out any optimisation needed as well as bench top water quality analysis. Laboratory water quality analysis was carried out by SWS to gather data for both pilots as well as the surface and ground water site currently operational at [redacted].

PWNT Pilot

The PWNT pilot uses the company's "Ceramac" ceramic membrane system; this consists of raw water chemical dosing through coagulation and pH correction, proprietary coagulation mixing (ILCA), a ceramic membrane, and permeate tank. There are also facilities to backwash, chemically backwash and clean in place (CIP) the membrane. The PWNT full scale design has a set number of membranes encased within one containerised unit.

PWNT completed multiple tests runs to understand optimal operating conditions of the membrane with differing source water quality. These tests included:

- understanding the maximum flux (and flow) the membrane can achieve,
- Use of different coagulants to determine what gives the best water quality results.
- altering the coagulant dose to determine the optimal range,
- increasing the time between backwashes and enhanced backwashes
- altering the chemicals using in the CIP to determine the best cleaning regime.

Nanostone Pilot

The Nanostone pilot plant consisted of an inline strainer, raw water chemical dosing through coagulation and pH correction, coagulation tanks, ceramic membrane and permeate tank. There were also facilities to backwash, chemically backwash and clean in place (CIP) the membrane. The Nanostone full scale design is very similar to the conventional encased polymeric membrane, where the system contains racks of membranes.

Nanostone completed multiple tests runs to understand optimal operating conditions of the membrane with differing source water quality. These tests included:

- Understanding the maximum flux the membrane can achieve through increasing the feed flow of water to the membrane.
- Use of different coagulants to determine what gives the best water quality results.
- Altering the coagulant dose to determine the optimal range.
- Increasing the time between backwashes and enhanced backwashes.
- Altering the chemical used in the CIP to determine the best cleaning regime.

Summary of Tests

Both companies have completed different sets of tests in to develop full scale designs for [redacted], as shown in Table 11-1: Initial Ceramic supplier test results below:

Table 11-1: Initial Ceramic supplier test results

Test	PWNT	Nanostone
Coagulant	Dose optimisation of: - Ferric Chloride Coagulant - Poly Aluminium Chloride pH correction with Sulphuric Acid for PACl	Dose Optimisation of: - Poly Aluminium Chloride - Ferric Chloride - Alum - High basicity PACl - No coagulant

Test	PWNT	Nanostone
		pH correction completed with Sulphuric Acid.
Flux (Raw Water Blend)	150 – 300lmh Operating flux: 200lmh	200 – 400lmh Operating flux: 250lmh
Backwash Frequency	30-90 minutes	30 – 120 minutes
Enhanced Backwash	Every 9-11 backwashes	Every 8 -19 backwashes
Enhanced Backwash Chemicals	- Sodium Hypochlorite - Sodium Hydroxide - Hydrogen Peroxide - Sulphuric Acid - Citric Acid	- Sodium Hypochlorite - Sodium Hydroxide - Hydrogen Peroxide - Sulphuric Acid
Recovery	>97%	97.9-98.9%

Annex C1: Delivery Plan Table (DPW4)

(See attached)

Annex D1: Shortlisted Options Scorecard

(See attached)

Annex F1: Technical Assurance Report

(See attached)

Annex F2: Commercial Assurance Report

(See attached)

Annex G1: Cost Forecast

(See attached)