Strategic Solution Gate 2 Submission: Detailed Feasibility & Concept Design Report ii

Water Recycling

6 December 2021

RAPID

Environment Agency dwi Ofwat

Contents

1. Executive Summary

<table>
<tr><td>Strategic Challenge</td><td>This Detailed Feasibility and Concept Design Report (CDR) describes the stage of work completed to analyse the feasibility and viability of Water Recycling Options, in response to Southern Water's (SW) Water Resource Management Plan 2019 (WRMP19) and Section 20 agreement (s20) obligations, to deliver the Strategic Resource Option (SRO) by 2027. The SRO is part of the wider Water for Life Hampshire (WfLH) programme which, across a series of projects, aims to reduce SW's reliance on groundwater and drought orders increasing resilience of supply. In anticipation of potential increases in future drought resilience requirements, a high-level assessment of how these Options can be evolved to meet future needs (during a 1-in-500-year drought scenario) has been completed.</td></tr>
<tr><td>What SW has done to date</td><td>Since Gate 1, SW has progressed analysis into the feasibility and viability of the Water Recycling Options. While Options B.1 and B.3 have been removed from consideration, Option B.2 (61 Ml/d capacity Water Recycling Plant (WRP) with recycled water transferred to Environmental Buffer Lake (EBL), for abstraction and treatment at Otterbourne WSW) and Option B.5 (75 Ml/d capacity Water Recycling Plant (WRP) with recycled water transferred to EBL, for abstraction and treatment at Otterbourne WSW (with additional effluent flow from Peel Common)), have been considered as alternatives from the WRMP19 Base Case, as required by the Regulatory Alliance on Progressing Infrastructure Development (RAPID) Gate process. Both these Water Recycling Options have been considered in greater detail across multiple areas including technical engineering, environmental impact, procurement, customer and stakeholder engagement, schedule, regulatory compliance, costs and benefits to identify the most preferable Option at Gate 2.</td></tr>
<tr><td>Key findings</td><td>The key findings of the analysis are:
Water Recycling is understood and utilised internationally, however, the limited UK market for Water Recycling systems may present challenges for this solution from several perspectives;
The Water Recycling Options are medium cost (Capital Expenditure (CAPEX) and Operational Expenditure (OPEX)) Options, relative to the other Options considered at Gate 2. The use of new technologies to the UK market is expected to be a more expensive option than raw water transfers. The estimated CAPEX for Option B.2 is £480m, while the estimated CAPEX for Option B.5 is £562m;
Both Water Recycling Options are expected to cause adverse environmental impacts, such as biodiversity, flora and fauna, and air and climate impacts, although opportunities to mitigate and then offset these impacts exist and will be explored;
The supply capacity of Option B.2 is unable to be expanded to achieve the revised Supply/Demand Deficit due to the availability of effluent flow. Option B.5 is able to meet the revised residual deficit but would require an increase in the WRP capacity;
Stakeholders and customers have a negative perception of water recycling and creates a high-risk that will need to be managed as part of development as a viable Back-Up Option;
Both Havant Thicket-based Options would be expected to be completed and operational in Q4 2030.</td></tr>
<tr><td>Results of Options Appraisal Process</td><td>The results of the Options Appraisal Process (OAP), which included Economic Appraisal comprised of Cost Benefit Analysis (CBA) and Multi Criteria Decision Analysis (MCDA), consenting risk assessment and assessment of Options against the against programme Legal and Policy Obligations and Strategic Objectives are summarised below.
<table>
<tr><th></th><th></th><th colspan="4">Hierarchy Ranking</th><th rowspan="2">NPV (£m)</th></tr>
<tr><th>Option</th><th>Operating Scenario</th><th>Economic Appraisal</th><th>To meet 1-in-200-year needs</th><th>To meet greater than 1-in-200-year needs*</th><th>Capacity evolve and to meet 1-in-500-year needs*</th></tr>
<tr><td rowspan="2">B.2</td><td>'Business as usual' (BAU)</td><td>3rd of 6</td><td rowspan="2">3rd of 6</td><td rowspan="2">3rd of 4</td><td rowspan="2">3rd of 4</td><td>618</td></tr>
<tr><td>Drought</td><td>3rd of 6</td><td></td></tr>
<tr><td rowspan="2">B.5</td><td>BAU</td><td>4th of 6</td><td rowspan="2">4th of 6</td><td rowspan="2">2nd of 4</td><td rowspan="2">2nd of 4</td><td>703</td></tr>
<tr><td>Drought</td><td>4th of 6</td><td></td></tr>
</table>
These results compare all Options included at Gate 2. * Paused Options removed from this stage of OAP.</td></tr>
<tr><td>Key risks & assumptions</td><td>The key risks identified through the analysis completed are:
Customer and stakeholder perceptions and views surrounding the quality and acceptability of recycled water and ensuring that water quality meets Drinking Water Inspectorate (DWI) and customer wholesomeness requirements;
The SRO is unable to be delivered within the s20 obligation timescales, potentially leading to enforcement action if not sufficient managed with relevant stakeholders and regulators; and
Site selection assessment has not been completed for location of the EBL which may create a risk for attaining consent to build. This includes ensuring appropriate consideration of the EBL dimensions and operating regimes during emergency situations.</td></tr>
<tr><td>Recommendations</td><td>Based upon the robust OAP and supporting technical analysis completed to date, it is recommended that:
SW continue to develop Option B.5; as Option B.5 is the second-best ranked Option;
Option B.5 be treated as the 'Back-Up' Option to Option B.4 (which is the Selected Option); and
Development and progress of Option B.2 is stopped.</td></tr>
</table>

2. Background and objectives

This document provides a technical summary of the analysis completed to determine the feasibility and viability of two Water Recycling-based Options to provide a sufficient supply of water in an event of a severe (1-in-200-year[1]) drought in the Hampshire Water Resource West Zone (WRZ). Delivery of the Option selected by Southern Water (SW) aims to reduce reliance on drought orders and protect the rivers Itchen and Test, using All Best Endeavours (ABE), as required by SW's Section 20 (s20) agreement with the Environment Agency (EA).

Although current requirements are to provide sufficient supply to customers during severe drought scenarios, SW is anticipating future increases to this resilience requirement, so that customer demand can be met during an extreme (1-in-500-year[2]) drought, on a regional level.

While this document focuses on how the Water Recycling-based Options can meet the 1-in-200-year supply requirement, key factors considered on how these Options can been adapted and evolved to meet 1-in-500-year supply requirements have been highlighted in the respective sections of this document. Further detail of the anticipated future supply requirements during an extreme drought is detailed in Section 3.2.2.

3. Concept design

3.1 Solution and Options

3.1.1 Solution Context and Background

WRMP19 identified that a 75 Ml/d Strategic Resource Option (SRO), alongside the full and successful delivery of all other components of the WfLH programme, would provide 222 Ml/d, a 30 Ml/d surplus, in a severe drought. This modelling included conservative assumptions which continue to be tested and validated through the development of the SROs currently being considered. At Gate 1, a 14 Ml/d saving in the supply demand balance was identified, through the testing of previously made assumptions regarding the process and supply losses. Further detail on this is provided in Annex 2 of SW's Gate 1 submission. This led to the introduction of 61Ml/d capacity SRO Options.

Following Gate 1, further testing of the assumptions relating to wastewater treatment discharges to rivers led to a further 10Ml/d reduction in the remaining deficit, to 51Ml/d. More detail is included in Annex 4, Water Resources Modelling.

However, since the Interim Update, further modelling has been conducted on the Supply Demand Balance to determine the deficit against WRMP19 requirements, to account for the likely future needs. A boundary date of 2040 was agreed as elements becoming relevant beyond this date have a higher degree of uncertainty and therefore could not reliably inform infrastructure capacity specifications. The revised residual deficit is now calculated to be 83 Ml/d, as detailed in Section 3.7 of Annex 4 Water Resource Modelling, which has been carried through to the evolution plans included in Annex 12, Outline Option Evolution Plan and Annex 13, Selected Option Evolution Plan. However, to account for process losses at Otterbourne Water Supply Works (WSW) an additional allowance of +5% in deployable output (DO) is required from the SRO. Therefore, a revised DO required of the selected SRO is 87 Ml/d. The revised calculation now allows for future changes in requirements, such as supporting regional 1-in-500-year extreme drought resilience. At this stage, each of the Options considered at Gate 2 meets the supply/demand balance requirements of WRMP19 only (up to 61 Ml/d), factoring in the performance and progress of the non-SRO components of the WfLH programme. The potential for either Options B.2 or B.5 to meet future needs that differ from 1-in-200-year drought resilience has now been considered, with a particular focus on the potential of the Options to adapt to meet these needs. A summary of the re-calculation of the supply/demand balance and therefore informing the residual deficit, required to be supplied by the Selected Option is detailed in Table 1.

Table 1 - Supply Demand Balance update since Gate 1

		WRMP19	Gate 1	Gate 2 Re-calculation	Gate 2 Revision
Supply	Deployable Output	134	134	147	147

[1] The National Framework published by the Environment Agency in March 2020 sets out a higher level of drought resilience (1 in 500-years), following the publication of WRMP19. Our proposed solution was submitted to RAPID in accordance to our existing 1-in-200-year WRMP guidance.

		WRMP19	Gate 1	Gate 2 Re-calculation	Gate 2 Revision
	Sustainability Reductions & Climate Change	-61	-61	-61	-69
	Outage Allowance & Process Losses	-16	-5	-7	-8
	Inter-company Transfers	5	5	5	5
	Baseline Supply	62	73	84	75
Demand	Baseline Demand	218	218	218	218
Non-SRO Elements		**84**	**84**	**84**	**59**
Residual Deficit		**73**	**61**	**51**	**83**

For the purposes of this document, technical analysis and assessment has been completed on the assumption of resolving a deficit of 51 Ml/d as per 'Gate 2 Re-calculation'. For consideration of the ability of these Options to evolve to meet the revised residual deficit of 83 Ml/d, technical analysis is held within Annex 12, Outline Options Evolution Plan. Adaptability is one of three programme strategic objectives, which were used to identify the Preferred Option at Gate 2. Details regarding how the strategic objectives were applied are included in Annex 5, Options Appraisal Process. In addition, modelling of the required water volumes for any increased supply requirement is being led by Water Resources South East (WRSE) and is in its early stages. Further detail on modelling completed to date is provided in Section 3.2.1.

3.1.2 Solution Description

Water recycling converts final effluent from a wastewater treatment works (WTW) into clean water that can be used for applications such as agricultural, industrial, irrigation and public water supply. It is commonly used elsewhere in the world, but less so in the UK. For Hampshire, there are two potential candidate large WTWs from which the final effluent could be used, Budds Farm (BF) and Peel Common (PC). One of two alternative areas of land has been selected to locate the Water Recycling Plant (WRP), which is within close proximity of BF WTW, the larger of the two WTWs (basis for Site Selection held within Section 2.4 Water Recycling Technical Annex).

3.1.3 Options and configurations

From its five Water Recycling Options considered at Gate 1, SW now has two Options under consideration within this document, both indirect water recycling using an Environmental Buffer Lake (EBL) at Otterbourne Water Supply Works (WSW) as an environmental buffer.

Options B.1 and B.3 have both been removed from consideration between Gate 1 and Gate 2. This is detailed further in Section 3.1.6.

An additional Option, Option B.4 uses Havant Thicket Reservoir (HTR) as the environmental buffer for the treated recycled water. This Option is described in the separate feasibility document for the Havant Thicket Options. The Options considered here are:

- **Option B.2**: This considers a transfer of final effluent (FE) from BF WTW to a new 61 Ml/d capacity Water Recycling Plant (WRP) with recycled water transferred to a new, 75 ML capacity, lined EBL, for abstraction and treatment at Otterbourne WSW; and
- **Option B.5**: This Option consists of a transfer of the combined supply of FE from PC WTW and BF WTW to enable the WRP to produce up to 75 Ml/d. Recycled water will be transferred to a new, 75 ML capacity, lined EBL for re-abstraction and treatment at Otterbourne WSW.

The key difference between the two is that B.5 has the addition of a 25 km final effluent transfer from PC WTW to enable the WRP to treat up to its full capacity of 75 Ml/d, designed in order to be a direct substitute for the Base Case, Desalination. Both solutions include:

- A final effluent transfer from BF WTW via a 0.8 km tunnel to a new WRP;
- 35 km transfer pipeline from the WRP to a new 75 Ml EBL adjacent to Otterbourne WSW; and
- A Transfer from the EBL to a new 91 Ml/d pre-disinfection treatment plant at Otterbourne WSW.

The Options are illustrated in Figure 1.

Figure 1 - Schematic diagram of the transfer routes for Options B.2 / B.5

3.1.4 Asset Operation

Two operating regimes have been considered, maximum flow, where the Deployable Output (DO) from either Option is at maximum (61 Ml/d for Option B.2) and (75 Ml/d for Option B.5), and minimum flow, where both Options will operate at a deployable output of 15 Ml/d at all times. Due to the losses in water recycling processes, the required intake, or influent flow is 97 Ml/d at maximum flow for B.5, 78 Ml/d for B.2, and 19 Ml/d at minimum flow (for both Options), to provide the respective DO to meet demand. To illustrate, the required flow and respective losses at each stage of the water recycling process to meet maximum flow for Option B.5 are illustrated in Figure 2.

The operating regime of either Option will vary between minimum and maximum flow, depending on demand and the drought scenario at the time. Further detail of the operating regime is provided in Section 2.2.2 of Annex 2, Water Recycling Technical.

3.1.5 Assets to be constructed – Non-Infrastructure

3.1.5.1 Water Recycling Plant (WRP)

The FE will be transferred from the outlet channels at BF WTW via a short pipeline to a new WRP. The treatment of the FE needs to include Reverse Osmosis (RO) due to saline intrusion at the coastal BF WTW. SW proposes using the globally adopted approach for water recycling, i.e. Full Advanced Treatment comprising Microfiltration (MF), RO followed by Ultraviolet-Advanced Oxidation Process (UV-AOP) as illustrated in **Error! Reference source not found.**Figure 2 below.

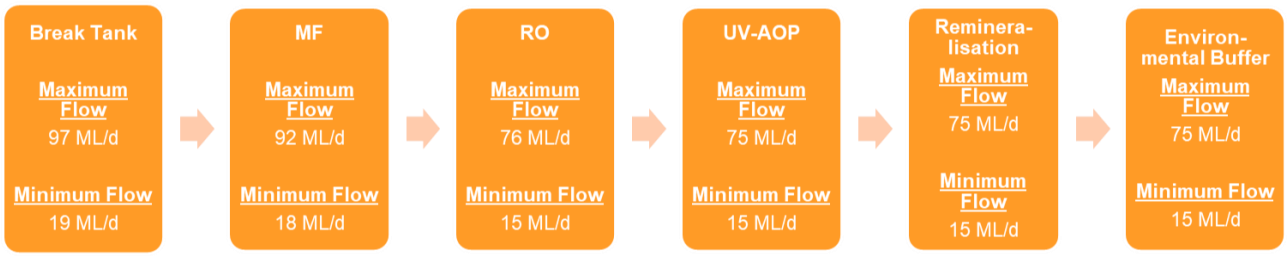

Figure 2 - Flow volumes at each stage of the water recycling process - maximum (75Ml/d) and minimum flow scenarios

WRP influent will be collected in feed tanks, which will blend water from BF and PC WTWs, if required by the Selected Option. From the WRP feed tank:

- MF feed pumps will send flow through the MF system to the MF Filtrate tank;
- RO feed pumps will transfer flow through RO membranes and gravitate into the UV-AOP using hydrogen peroxide as oxidant;

- UV-AOP treated water is remineralised using carbon dioxide and calcium carbonate prior to flowing by gravity to the high lift pump station wet well; and
- High lift pumps transfer treated recycled water from the wet well to the EBL at Otterbourne WSW.

These treatment processes in series provide a multi-barrier treatment process capable of meeting regulatory expectations. Due to the RO process reducing pH significantly and stripping the water of its mineral content, remineralisation is also proposed to stabilise the water prior to its transfer to the EBL. Assurance of treatment efficacy will be provided by real-time monitoring and periodic testing of membranes.

The WRP will also produce the following waste streams:

- MF reject and RO concentrate from the membrane process will be blended with small volumes of neutralised clean-in place (CIP) chemical waste and discharged to the Solent, alongside remaining BF wastewater effluent via Long Sea Outfall (LSO);
- Following quenching of any residual chlorine with sodium bisulphite, the RO system brine will be blended with MF backwash waste and discharged to the Solent; and
- Minor waste flows such as compressor cooling water, sample drains, and trench / slab drains which will be discharged to the sanitary sewer.

3.1.5.2 EBL at Otterbourne WSW

SW proposes to construct a fully lined 75 Ml EBL, to allow it to blend recycled water with the River Itchen flows, when available, which provides additional re-mineralisation, and to provide c.24 hours of hydraulic residence time when the WRP is operating at full capacity for Option B.5 and around 29 hours retention for B.2 at 61 Ml/d. The size and retention time of the EBL has been assessed using QMRA (Quantitative Microbial Risk Assessment) and QCRA (Quantitative Chemical Risk Assessment) techniques to give an indication of the impact on the wholesomeness of water prior to treatment at Otterbourne WSW. The results of the QMRA study, across five pathogens and one indicator bacterium, demonstrated that the product water is wholesome for the two scenarios of operation with the EBL (75 Ml/d and 15 Ml/d) as the WRP treated water is significantly comparable or better, for given determinants, than water from the River Itchen.

In addition, the clear water tank at the end of the WRP treatment process is defined as a control point and if monitoring parameters, such as turbidity, indicate the treated water is out of specification it will be diverted and not fed to the EBL.

To allow for blending of all source waters, SW proposes to move the feed to the WSW to the EBL, with the existing river abstraction option acting as resilience for when the lake is cleaned and inspected. Further detail is provided in Section 2.2.8 of Annex 2, Water Recycling Technical.

3.1.5.3 Otterbourne WSW proposed pre-treatment process

Outside of the Havant Thicket-based Options being considered as part the WfLH programme, Otterbourne WSW is due to undergo refurbishment to reconfigure a new combined disinfection stream comprising of UV and chlorination of the surface water and ground water stream.

SW aims to launch a pilot of ceramic membrane technology starting in 2021 and currently assumes a full-scale membrane plant for concept design of the proposed pre-treatment process, detailed in Figure 3. It should be noted that, unless the pilot trial is successful, SW will consider other pre-disinfection technologies to meet the DWI notice requirements to identify a solution by December 2022. Further detail is available in Section 2.2.9 of the Water Recycling Technical Annex.

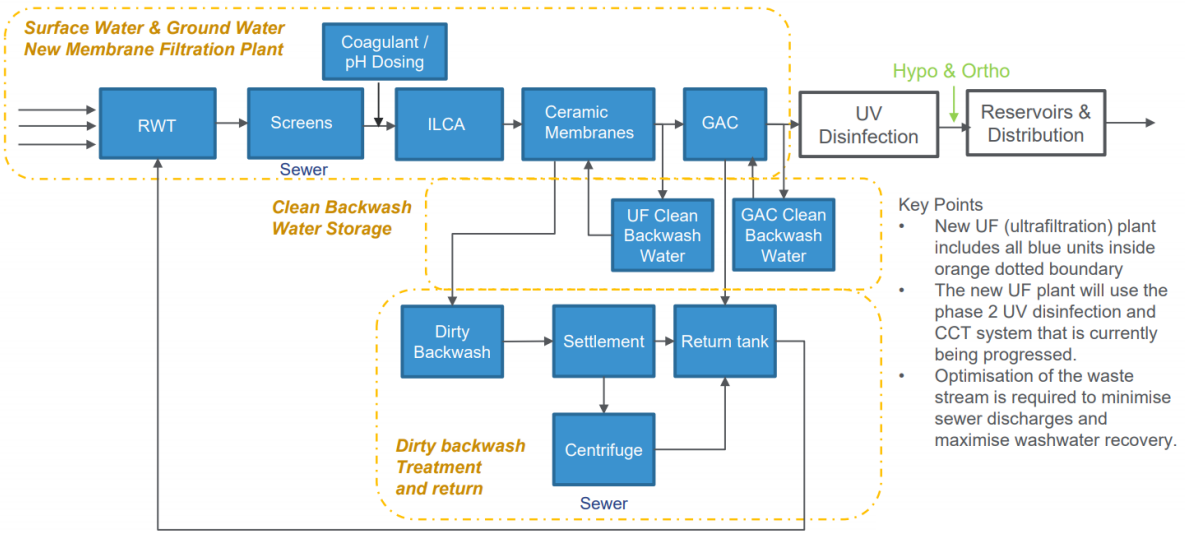

Figure 3 - Otterbourne WSW simplified process flow diagram

3.1.6 Assets to be constructed – infrastructure

SW will construct the following transfer pipelines:

- Transfer of pre-treated wastewater from BF WTW to the WRP;
- Transfer of return wastewater stream from the WRP to BF WTW;
- Transfer of treated and conditioned water from the WRP to the EBL;
- Transfer of water from the EBL to Otterbourne WSW; and
- Transfer of Transfer of pre-treated wastewater from PC WTW to the WRP (for Option B.5 only).

SW proposes dual stage pumping stations, with break tanks, along the longest of these pipelines, i.e. from the WRP to the EBL. Whole Life Cost (WLC) analysis of options for pumping arrangements and technical assessment will be used to confirm optimum design configuration. Current assumptions are for the same decision.

At Gate 1, SW recommended Option B.3 for continuation albeit with significant risks identified. It was understood that direct water recycling technology would likely be unacceptable due to the time required for DWI to give the required approvals within the context of the s20 agreement:

After Gate 1, further engagement with DWI confirmed their view that there is a high degree of risk surrounding direct water recycling risk and its technical acceptance. In order to enable easier introduction of direct water recycling at a local level, firstly there is a need for a national policy on recycling, then increased national awareness of, and confidence in, direct water recycling through stakeholders and customer engagement, which could be helpfully promoted by the regulators. To ensure views were taken into account, we carried out further work with the following findings:

- There are no examples of direct water recycling in the UK or in Europe;
- A minimum standard or guideline for water recycling is necessary through a clear policy framework and specific integrated regulatory framework that should be developed in partnership with Defra and all regulators;
- Environmental assessment identified better performing options at Gate 1;
- At Gate 1 the delivery timeline for this option was already later than the Base Case Option A.1
- Expert opinion from Brown & Caudwell (our technical advisors on water recycling technology) recommended a phased approach utilising indirect technology first. We are doing this via our Selected Option. Their report also identifies the need to allow considerable time to address policy and customer acceptance concerns, which would have a knock-on impact on the overall delivery schedule for Option B.3, if it was progressed.

In view of work carried out after Gate 1, it was concluded that there are too many uncertainties and risks associated with Option B.3 for it to be a genuine alternative to the Base Case in the context of the urgent need to deliver a long term water resources solution for Hampshire in the s20 Agreement

Further technical details regarding Options B.2 and B.5 are detailed throughout remaining sections of this document. Overall recommendations regarding the continuation of Options post Gate 2 are included in

Section 10.

3.2 Water Resource Assessment

3.2.1 Supply-demand balance delivery plan

In WRMP19, SW set out its preferred approach to provide a resilient water supply to customers during a 1-in-200-year drought event. The strategy included several interventions, which together formed the Water for Life Hampshire (WfLH) programme and combined will meet the projected supply/demand deficit during a severe drought. These interventions can be classified and include the following:

- Strategic Resource Option (SRO) project: desalination plant at Fawley as the base case[3];
- Non-SRO projects:
  - New supplies: Portsmouth Water bulk supply and a Bournemouth Water transfer
  - Management of existing resources: demand reductions from leakage prevention and per capita consumption

As detailed in Section 3.1.1, the supply/demand modelling has evolved since WRMP19, driven by testing and validation of modelling assumptions and updates in projected deployable output in the various projects of the WfLH programme.

Since the Interim Update, further Supply Demand Balance modelling has been conducted. From this modelling, the forecast residual supply deficit is 83Ml/d, as detailed in Section 3.1.1. This takes into account the most likely scenarios for bulk transfer and demand reduction performance. Further detail can be found within Annex 4, Water Resource Modelling.

3.2.2 Alignment with regional plans

Since the publication of WRMP19, modelling has been initiated by WRSE to consider possible options that could provide a resilient supply during an extreme (1-in-500-year) drought scenario, when considering supply options on a regional scale. SW is actively liaising with WRSE, including sharing modelling information and detailed technical options that supported SW's Gate 1 submission. It should be noted that, WRSE's draft modelling, has not yet concluded and outputs are not expected to be available until post Gate 2.

In lieu of final modelling results, SW has undertaken a preliminary modelling exercise, based on high-level information currently available. The primary purpose of this is to gain a high-level understanding of the possible order of magnitude for the supply demand balance during an extreme drought scenario. These calculations are indicative and based upon significant assumption, which will be tested and validated once WRSE draft modelling is complete. Initial SW modelling on further future requirements consider the 1-in-500-year extreme drought scenario and suggest that SW and PW needs can be met by an SRO which delivers a deployable output of 87Ml/d, which is in line with the revised Supply Demand Balance as per 3.3.1. Further detail can be found in Annex 12, Outline Option Evolution Plan.

3.2.3 Water resource benefit assessment

As detailed in Section 3.1 and Annex 4, Water Resources Modelling, the supply/demand balance, and required SRO capacity is 87 Ml/d (taking into account the 1-in-500-year requirements as well as future abstraction reductions).

Option B.2 is designed to deliver a DO of 61 Ml/d, and Option B.5 is designed to deliver a DO of 75 Ml/d. Both Options would therefore need to be evolved in order to achieve the required capacity. Opportunities for increasing the capacity of Option B.2 to respond to increased drought resilience requirements are limited by the capacity of BF WTW. As a result, there is negligible capacity for this Option to expand to further support regional water resource requirements on its own and as such is effectively defunct.

There is greater capacity for Option B.5 to be expanded for increased drought resilience requirements, and this is limited only by the combined FE flow from BF and PC WTWs. This flow could provide a maximum DO of 91 Ml/d, 16 Ml/d greater than the DO of Option B.2. A further constraint that limits the capacity of Options B.2 and B.5 to meet regional resilience needs is the capacity of the EBL which may need to be extended to ensure sufficient hydraulic resident time to meet DWI requirements. However, it should be noted that Option B.5 could be evolved to meet the increased requirements (91Ml/d capacity).

[3] For clarity, the desalination Base Case is essentially a 'placeholder' until the decision is made which of the three solutions is chosen (i.e. desalination/water recycling/Havant Thicket)

The EBL is limited to functional use only and has not been designed for alternative uses. Further detail on additional benefits provided by Options B.2 and B.5 are detailed in Section 3.6.

3.3 Drinking water quality considerations

3.3.1 Progress since Gate 1 and future Water Safety Plan developments

Since Gate 1 SW has made the following progress in its Water Safety Plans (WSP), steered by its water treatment and public health experts:

- A water recycling pilot system has been operated at PC WTW with four sampling events to gather extensive water quality data, to meet DWI's required data confidence levels;
- Hazards have been identified in the water supply system that impact microbial and chemical parameters which are important for compliance with water quality standards;
- Donor site selection has been conducted to confirm the source water for the WRP;
- WSPs have been developed with a committee of water treatment practitioners and experts with knowledge and experience in public health; and
- Several meetings with the DWI were undertaken to share findings and gather implications of findings from a regulatory standpoint.

3.3.2 Water safety plan development timeline

The development timeline proposed in Gate 1, identifying the key data gathering exercises for each Gate, is illustrated in Figure 4 Figure 4, which shows the stages of WSP development.

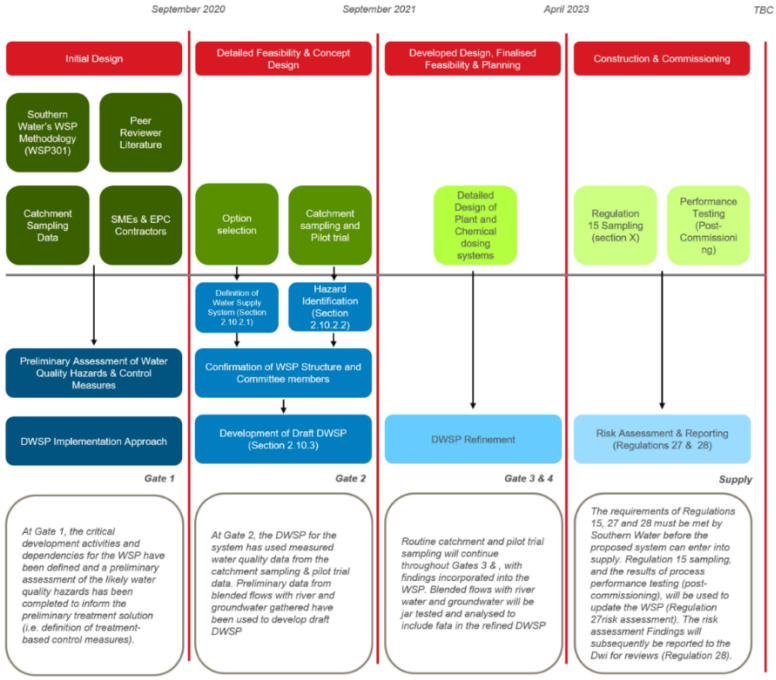

Figure 4 - Water Safety Plan Timeline – Water Recycling

Several consultation meetings have been held with the Drinking Water Inspectorate (DWI), the Environment Agency (EA) and Natural England (NE) since the start of Gate 2 and SW has provided updates and a draft of the WSPs for review to the DWI. The final WSPs are available for submission if required. Further detail is held in Section 2.2.9 Annex 3, Water Recycling Technical.

A specific consideration for the Water Recycling-based Options is the development of a WSP that considers multiple sources. As a result, the Water Recycling WSP brings separate components together, as illustrated in Figure 5.

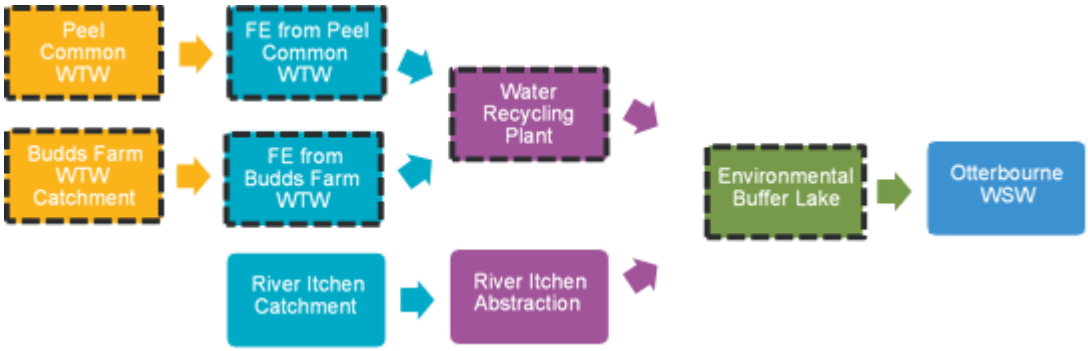

Figure 5 - Water supply sub-system used for WSP

3.3.3 Quality regulatory considerations

SW has engaged with multiple regulators, including DWI, and will continue to do so throughout the programme lifecycle. A key purpose of this engagement is to ensure that the Drinking Water Safety Plans (DWSP) meets DWI requirements and provides appropriate detail on how SW will manage and ensure water safety, once operational. This includes ensuring that water is acceptable to customers.

Engagement meetings with DWI were held in September 2020, December 2020 (two meetings) and April 2021 to share findings, understand the implications of those findings from a regulatory standpoint and to resolve issues and concerns arising from the findings. DWSPs were submitted to the DWI on 13 April 2021. They were developed using SW's WSP Risk Assessment & Monitoring Methodology (WSP301) which aligns with the specifications of British Standards document BS EN 15975-2:2013. SW has received no feedback from the DWI in respect of concerns about the DWSPs.

The main DWI concerns related to the conditioning and blending of water and the impact these will have on drinking water quality and customer acceptance. It also required a comprehensive sampling programme, which is explained in Section 3.3.3.1 below. Outcomes of the sampling programme are key to managing regulator concerns and will guide the detailed treatment requirements to meet customer acceptability, that will be included in the WSP. The DWI required detailed evidence to confirm the equivalence of the source water for the pilot plant being operated at PC, which the sampling programme confirms. DWI concerns related to specific components for both Options B.2 and B.5 are detailed in the sections below.

3.3.3.1 Source Water Considerations

SW used a water recycling pilot plant at PC WTW to support and inform Water Safety Planning needs, which is derived from The World Health Organisation (WHO) approach, to identify the inherent risk to the source water. Further details of these are provided in Section 2.2.1 of Annex 2, Water Recycling Technical.

In addition, SW has initiated a six-stage source water sampling programme to determine detailed treatment requirements. Both the pilot plant operation and sampling will continue after Gate 2 to ensure seasonal changes are understood and that there is a sufficiently large dataset to demonstrate the data is statistically representative, as required by the DWI. Further detail of the sampling process is detailed in Section 2.2.1 of Annex 2, Water Recycling Technical.

3.3.3.2 Enforcement action at Otterbourne WSW

As detailed in Section 3.1.5.3, SW are planning of delivering a refurbishment of the Otterbourne WSW pre-treatment requirements, following DWI enforcement action.

The disinfection refurbishment is required irrespective of the Option selected and will be delivered by SW as a separate capital project, but the choice of a Water Recycling Option will change pre-treatment requirements. To allow for appropriate cost comparisons between Options, SW assumes that 50% of the costs of the membrane treatment plant relate to the water recycling SRO Options, as current assumptions include that 50% of the flows treated by the new treatment measures will be directly from the Havant Thicket-based Options. Further detail is available in Section 2.2.9 of the Water Recycling Technical Annex, with further detail regard cost implications of detailed within Section 3.73.7.1.

3.3.3.3 Environmental Buffer Lake (EBL)

The EBL will become the new source of water, for treatment at Otterbourne WSW. The EBL was included as a sub-system in the WSPs submitted to the DWI. The main purpose of the EBL is to blend recycled water with water from natural sources (when available). Further detail is provided in Section 2.2.5 of Annex 2, Water Recycling Technical.

Significant dilution of the recycled water with river water will reduce any water safety risk under most operational scenarios. When operating at 75 Ml/d with no dilution in the EBL, the quality of water from the WRP is cleaner than what is currently being abstracted and treated at Otterbourne WSW, therefore the risk of deterioration of the water within the EBL is low. Therefore, there is no increase in water safety risk across the EBL. Notwithstanding risks remain around customer acceptability of recycled water which need to be managed closely. Further detail is included within Section 7.

3.4 Environmental Assessment

Multiple assessments and appraisals have been completed prior to Gate 2 considering the environmental impact and any mitigation and off-setting opportunities that exist regarding Options B.2 and B.5. The factors influencing environmental impact are common to both Options, where the key difference between them is the DO of the water recycling schemes. Environmental assessments and appraisal completed have been considered by components. These components include; water recycling plant, transfer pipelines, and booster pumping stations.

3.4.1 Marine Conservation Zone (MCZ) Assessment

The proposed location of Options B.2 and B.5 is not within any MCZ, however, it is within close proximity of three MCZs – Yarmouth to Cowes, The Needles and Bembridge. Rejected water discharges, via the existing Eastney Long Sea Outfall (LSO), could impact the MCZs, in both minimum 15 Ml/d flow scenarios (refer to Section 5.2.1) and maximum flow of either 61 Ml/d or 75 Ml/d scenarios – for Options B.2 and B.5 respectively.

Modelling indicated that nitrogen concentrations in Portsmouth Harbour and Chichester Harbour were reduced compared to current operations, with negligible impacts from the discharge plume. This is caused by a reduction in wastewater discharges via the Eastney LSO (since some is used to feed the WRP), the associated increasing dilution and dispersion potential. It was concluded that the effects associated with Option B.2 will not result in an adverse impact on the conservation objectives of any of the three MCZs considered. Further details of these risks are included in Section 2.5.2.1 of Annex 2, Water Recycling Technical.

3.4.2 Environmental Surveys

The surveys completed can be categorised in three groups: Terrestrial Ecology, Aquatic Ecology and Marine Environment. The specific surveys within each are detailed in Section 2.5.2.2 of Annex 2, Water Recycling Technical. These survey groupings reflect the different environments that the Water Recycling-based Options would interact with and be cognisant of during construction and once in operation. Results from key surveys within these categories are summarised in the following sections.

3.4.3 Habitats Regulation Assessment (HRA)

A high-level HRA has been completed to test if either of the Water Recycling-based Options could significantly harm the designated features of a Habitats sites (SAC, Special Protection Area (SPA) or Ramsar sites). It should be noted that a statutory HRA assessment is not required further to the gated process, but a statutory HRA will be required in the context of the DCO application.

The high-level HRA process had two stages: Stage 1: Screening; and Stage 2: High-level Appropriate Assessment. Further detail on the process and the specific technical notes used to inform the assessment are provided in Section 2.5.2.2 of Annex 2, Water Recycling Technical. The potential effects caused by Options B.2 and B.5 are detailed in Table 2.

Table 2 - RA Screening: High-Level results - Water Recycling

Effect Category	Construction Effects	Operational Effects
Subtidal	• N/A	• Indirect effects - Changes to water quality
Terrestrial	• Direct habitat loss if located within a Habitats site • Indirect effects - Temporary disturbance due to noise, vibration, human activity and light; Temporary changes to air quality; Changes to ground water and surface water; Introduction of INNS; and Barrier to species migration	• Direct long-term habitat loss if located within a Habitats site • Indirect effects - Disturbance due to noise, vibration, human activity and light; and Changes to air quality
Ornithology	• Direct habitat loss if located within a Habitats site • Indirect effects - Temporary disturbance due to noise, vibration, human activity and light; Change in supporting habitat quality due to release in sediment during river crossing construction; Barrier to species migration/movement; Changes to prey resource; and Changes to air quality	• Direct habitat loss if located within a Habitats site • Indirect effects - Disturbance due to noise, vibration, human activity and light; and Barrier to species migration / movement
Freshwater	• Direct habitat loss if located within a Habitats site • Indirect effects - Temporary disturbance due to noise, vibration and human activity, Changes in water quality, Introduction of INNS, Barrier to species migration	• Connectivity with subtidal effects for migratory species • Changes to water quality due to potential emergency environmental buffer lake overflow

Following identification of the high-level risks, potential mitigations were explored, to understand what mitigations may be required, in the event that either Options B.2 or B.5 are selected for construction. At this stage, uncertainties regarding the extent of potential impacts remain. More detailed and comprehensive surveys are planned to comment in Q4 2021 and continue to 2023, which will provide a clearer understanding of potential HRA impacts.

3.4.4 Potential Mitigation Measures

Mitigation measures have been screened by habitat zone. An initial screening considered 18 habitat zones, of which eight were identified as potentially being impacted – either directly or indirectly – by construction activities associated with Options B.2 and B.5.

A summary of the construction requirements, potential environmental impacts and potential mitigation actions are detailed in Table 3. Further detail is in Section 2.5.2.2 of Annex 2, Water Recycling Technical.

Table 3 - Potential habitat impact mitigation measures - Water Recycling

Area / Zone	Construction impacts	Expected Environmental Effect	Potential mitigation requirements
Butser Hill Special Area of Conservation (SAC) and Woolmer Forest SAC	Indirect impacts – temporary, site access adjacent to major roads	Changes to air quality	• Construction Traffic Management Plan (CTMP) • Enforcing of a 'no idling' rule for construction traffic
River Itchen SAC, River Meon	Indirect impacts – temporary impacts during pipeline construction	Temporary Habitat loss	• Micro-siting of pipeline route and construction compounds to avoid sensitive features
		Temporary disturbance	• Identify birds during breeding season – protections during breeding seasons
		Changes to water quality	• Best practice construction methods may comprise of:

Area / Zone	Construction impacts	Expected Environmental Effect	Potential mitigation requirements
			– Bunding and appropriate storage of sediment – Onsite treatment / polishing of silted water – Use of sediment traps – Regular cleaning of haul roads to prevent runoff of construction waste dirt – Appropriate storage and application of both hazardous and non-hazardous waste and chemicals (e.g. diesel)
		Barrier to movement	• As per water quality
		Introduction of INNS	• Best practice biosecurity measures to ensure clothing, boots and machinery are free from propagules
Solent and Isle of Wight Lagoons SAC	Direct Impact – Pipeline construction	Changes to water quality	• Best practice construction methods may comprise of: – Bunding and appropriate storage of sediment – Onsite treatment / polishing of silted water – Use of sediment traps – Regular cleaning of haul roads to prevent runoff of construction waste dirt – Appropriate storage and application of both hazardous and non-hazardous waste and chemicals (e.g. diesel)
Solent and Dorset Coast SPA	Direct Impact – Pipeline construction	Temporary disturbance	• Seasonal restrictions on certain construction activities to avoid adverse effects on site integrity
		Changes to water quality; and changes to prey resource	• Best practice construction methods may comprise of: – Bunding and appropriate storage of sediment – Onsite treatment / polishing of silted water – Use of sediment traps – Regular cleaning of haul roads to prevent runoff of construction waste dirt • Appropriate storage and application of both hazardous and non-hazardous waste and chemicals (e.g. diesel)
Solent Maritime SAC	Direct Impact – Pipeline construction	Changes to water quality	• Best practice construction methods may comprise of: – Bunding and appropriate storage of sediment – Onsite treatment / polishing of silted water – Use of sediment traps – Regular cleaning of haul roads to prevent runoff of construction waste dirt. • Appropriate storage and application of both hazardous and non-hazardous waste and chemicals (e.g. diesel)
		Introduction of INNS	• Best practice biosecurity measures to ensure clothing, boots and machinery are free from propagules to avoid the spread of INNS
Chichester and Langstone Harbours SPA and Ramsar	Direct Impact – Pipeline construction	Temporary disturbance	• Seasonal restrictions on certain construction activities to avoid adverse effects on site integrity
		Changes to water quality	• Best practice construction methods may comprise of: – Bunding and appropriate storage of sediment – Onsite treatment / polishing of silted water – Use of sediment traps – Regular cleaning of haul roads to prevent runoff of construction waste dirt

Area / Zone	Construction impacts	Expected Environmental Effect	Potential mitigation requirements
			– Appropriate storage and application of both hazardous and non-hazardous waste and chemicals (e.g. diesel)

3.4.5 In-Combination Effects

High level assessments of potential in-combination environmental effects were identified across three of the zones considered in the HRA (Solent Maritime SAC, Solent and Dorset Coast, and Chichester and Langstone Harbours SPA and Ramsar). These effects include impacts on water quality driven by increase in suspended sediments, disturbances to habitat and associated prey resource impacts. More detailed analysis is required to determine the extent of these effects and identify any additional impacts, which cannot be ruled out at this stage. Additional required surveys will take place following selection of the Selected Option.

3.4.6 Water Framework Directive (WFD)

There is potential for minor impacts to the hydromorphology, biology, physico-chemistry and biology of the River Itchen. Proposed mitigations for these impacts align with industry guidance detailed in Section 2.5.2.6 of Annex 2, Water Recycling Technical. Further development of detailed mitigations will be prepared following identification of the Selected Option for construction.

3.4.7 Invasive Non-Native Species (INNS) Risk Assessment

Each of the core infrastructure components of Options B.2 and B.5 has been assessed individually, with results combined together to calculate the impact for each Option overall. The greatest INNS risk is associated with the transfer pipeline between the water recycling plant to Otterbourne WSW, primarily associated with the transfer between WFD Management Catchments and the long-term storage of water in a large reservoir at Otterbourne EBL. The emergency discharge represents the least risk of INNS transfer due to the very rare likelihood of occurrence. Summary of scoring is detailed in Table 4 and presentation of detailed results is demonstrated in Sections 2.5.2.4 and 2.5.4.4 of Annex 2, Water Recycling Technical, for Options B.2 and B.5 respectively. No proposed risk mitigation methods have been proposed at this stage.

Table 4 - INNS Risk Scores

INNS Risk Score Type	Score
Inherent	973
Adjusted	2483
Weighted	9672

3.4.8 Biodiversity Net Gain and Natural Capital

Biodiversity Net Gain (BNG) and Natural Capital evaluations completed for Options B.2 and B.5, have followed methodology guidance set by the All Company Working Group (ACWG), with the outputs of assessments being consistent with the requirements set by the WRSE Regional Plan Environmental Assessment Methodology Guidance, as well as the Water Resource Planning Guidance for WRMP24 and UKWIR Environmental Assessment Guidance.

The BNG assessment (summarised in Table 5) has been based upon the application of Defra 'Biodiversity tool, 'The Biodiversity Metric 2.0', which applies quantitative metric to scoring various biodiversity components and considerations. Further details of the assessment methodologies utilised are provided in Section 2.5.2.7 of Annex 2, Water Recycling Technical.

Table 5 - Detailed Quantified Biodiversity and Natural Capital Net Gain - Water Recycling

Metric	Assessment	Option B.2	Option B.5
Biodiversity		*Hectares (ha)*	*Hectares (ha)*
	Total temporary habitat	-87.40	-155.86
	Total permanent habitat loss	-16.77	-17.37
	Total on-site re-instatement / creation	104.00	189.31
	Total off-site habitat creation / BNG uplift	42.38	60.33
Climate regulation		*£2019/year*	*£2019/year*
	Change in non-traded carbon value – temporary	£-1719.46	-£3,267.92
	Change in non-traded carbon value – permanent	-£112.90	-£116.84

Metric	Assessment	Option B.2	Option B.5
Natural hazard regulation		*£2019/year*	*£2019/year*
	Change in natural hazard value – temporary	-£453.31	-£1,033.16
	Change in natural hazard value – permanent	-£182.44	-£200.53
Recreation & tourism		*£2019/year*	*£2019/year*
	Estimated Welfare Value	-£419,979	-£430,091
	Estimated visits	-122,450	-212,336
Agriculture		*£2019/year*	*£2019/year*
	Temporary loss estimated agriculture value	-£34,534.30	-£62,162.98
	Permanent loss estimated agriculture value	-£7,058.83	-£7,317.95

The BNG analysis detailed in Table 5 indicates that the Water Recycling-based Options are expected to have negative biodiversity impacts overall, with the increased capacity of Option B.5 meaning it has a greater impact than Option B.2. Further detail on the biodiversity net gain assessments for Options B.2 and B.5 are included within 2.5.2.5 and 2.5.4.5 of Annex 2, Water Recycling Technical.

3.4.9 Strategic Environmental Assessment (SEA)

As with the approach undertaken for the SEA level options assessment at Gate 1, the principles of SEA have been applied in analysing the Water Recycling-based Options at Gate 2. A SEA is not required for Gate 2 from a statutory perspective but will be required as part of any future consent applications. The SEA level options assessment from Gate 1 has been updated reflecting changes and revisions in the conceptual design of Options B.2 and B.5.

The SEA level option assessment has been completed in line with the WRSE Regional Plan Environmental Assessment Methodology Guidance (2020), ODPM A Practical Guide to the Strategic Environmental Assessment Directive (2005) and UKWIR (2020) Draft Environmental Assessment Guidance for Water Resource Management Plans and Drought Plans. The five-stage process utilised is detailed in Section 2.5.1.3 of Annex 2, Water Recycling Technical.

The key for this high-level screening is detailed in Table 6 with key results included in Table 7. The results included in Table 7 are presented by component. Further detail on the assessment process and the key results are included in Section 3.5.2.1 of Annex 2, Water Recycling Technical.

Table 6 - SEA level option High-level screening assessment criteria

High-level screening - RAG			
Risks of adverse effects grading		**Opportunity for beneficial effects grade**	
	Negligible		No beneficial effects / no applicable
	Minor adverse impacts likely, 'standard' best practice mitigation activities		Potential for beneficial effects
	Moderate adverse impacts likely, mitigation required to overcome		Potential or moderate beneficial effects
	Major adverse impacts likely, challenging to overcome		Potential or major beneficial effects
	Substantial adverse impacts, significant challenge to overcome		

Table 7 - High-level SEA results (per component) – Water recycling

Component	Adverse Effects		Beneficial Effects	
	Max. Rating	Commentary	Max. Rating	Commentary
BF to new WRP: Route 1		• One major adverse effect identified – biodiversity flora and fauna		• Five minor effects – water use efficiency, reduce pressure on other sources, minimise abstraction risks, minimise surface water risks and reduction in climate change risks
		• Three moderate adverse effects are identified – population and human health, material assets and resource use and archaeology and cultural heritage		
Water Recycling Plant		• Two major adverse effects are identified – biodiversity flora and fauna, air and climate		• Five minor beneficial effects to human health, materials assets and resources, air and climate
		• Four moderate adverse effects are identified – resource use, water quality, archaeology and cultural heritage and landscape / visual		

Component	Adverse Effects		Beneficial Effects	
	Max. Rating	Commentary	Max. Rating	Commentary
Changes to Eastney LSO from BF WTW		• One major adverse effect – biodiversity flora and fauna		• As per WRP
		• Five minor adverse effects – water quality and archaeology and cultural heritage		
Transfer Pipeline WRP to EBL WSW: Route 1		• Four major adverse effects – biodiversity, flora and fauna, material assets and resource use, archaeology and cultural heritage and landscape and visual amenity		• As per WRP
Transfer pipeline WRP to Lake Otterbourne WSW: Route 2		• Four major adverse effects – biodiversity, flora and fauna, material assets and resource use, archaeology and cultural heritage and landscape and visual amenity		• Five minor beneficial effects to human health, materials assets and resources, air and climate
Ceramic membrane plat at Otterbourne WSW		• Two major adverse effects –biodiversity, flora and fauna, and archaeology and cultural heritage		• Five minor beneficial effects to human health, materials assets and resources, air and climate
Lake Otterbourne environmental buffer		• Major adverse effects – biodiversity, flora and fauna, archaeology and cultural heritage and landscape / visual effects		• Five minor beneficial effects – human health, material assets and resources, water quality and air and climate
Water booster stations and Break Pressure Tanks (BPT)		• One major adverse effect – archaeology and cultural heritage		• Five minor beneficial effects – human health, material assets and resources, water quality, air and climate
		• Five moderate adverse effects – biodiversity, flora and fauna, human health, material assets and resource use and landscape and visual amenity		

3.4.10 Carbon Impact

SW is committed to meeting existing carbon commitments, such as the water industry's Public Interest Commitment of net zero, by 2030 for operational emissions and the UK government's target to bring all greenhouse emissions to net zero by 2050. Notwithstanding appropriate mitigation, the construction of any SRO considered at Gate 2 is expected to have a negative carbon impact that will need to be offset. Possible offsetting activities, such as tree planting, have the potential to also support BNG, although the extent of these benefits will be calculated in greater detail at a later stage of the design process, following Gate 2. Once the carbon impact can be calculated, required offsetting initiatives will be designed with greater confidence and in a manner which aligns with the requirements of current carbon net zero commitments. Further detail is provided throughout Section 2.5 of Annex 2, Water Recycling Technical.

Carbon modelling across the whole life of the asset, for both Water Recycling-based Options has been completed. Operational carbon emissions were calculated based on quantities for power use, chemical use, transport and operational maintenance requirements. The monetised cost of carbon was also calculated using the traded and non-traded carbon price forecasts from the Green Book Supplementary Guidance: Valuation of energy use and greenhouse gas emissions for appraisal (Table 8, Carbon prices and sensitivities 2010-2100 for appraisal, 2018 £/tCO_2, central price). The traded carbon price was applied to power related emissions only, with the non-traded carbon price applied to all other emissions.

The current estimate of emissions provides a view of how much the Options would add to SW's existing emissions once commissioned. Under SW's net zero operational emissions by 2030 commitment these operational emissions will need to be reduced and potentially offset by 2030. The potential costs of offsets have not been included, at this stage, as this would be considered as part of SW's overall net zero and offsetting strategy. The capital carbon, operational carbon (associated with chemical use, power and transport), whole life carbon and the non-discounted monetised cost of carbon for each Water Recycling-based Option is included in Table 8.

Table 8 - WLC carbon summary calculations for Water Recycling Options

Operating regime	Flow (Ml/d)	Capital carbon (tco2e)	Operational carbon (tco2e)	Whole life carbon (tco2e)	Monetised whole life carbon (£m)
MAX (DO)	61	68,000	11,200	872,000	230
MIN	15	68,000	3,400	357,000	87
AVERAGE	15.46	68,000	3,500	362,000	89

3.5 Site Selection, Option Configuration and Consenting Evaluation

3.5.1 Site Selection

A five-stage site and route selection process was applied to determine the most suitable sites and routes for key components of the Water Recycling-based Options. Further detail of the process utilised ins included in Section 3.1 of Annex 5 Options Appraisal. Site locations and option configurations were selected to cause the least environmental impact for each Option. The preferred site and pipeline routes selected are common for Options B.2 and B.5.

3.5.2 Option Configuration

The preferred site for the WRP requires environmental mitigations. The area of land is currently identified as having an outline application for business and commercial use, so a back-up area of land was identified. More assessment is required to confirm the preferred pipeline route. Either route would require small sections of pipeline to be laid in the South Downs National Park land.

Table 9 - Summary of Preferred Option Configuration

	Option B.2	Option B.5
Marine intake / outfall	Not applicable	Not applicable
Site	WRP 72 (parcel 71 held at Stage 4)	WRP 72 (parcel 71 held at Stage 4)
Pipeline Route	Route 1 Route 2 Budds Farm to WRP Pipeline	As per Option B.2, plus: • Pipeline from Peel Common to Budds Farm
Other Infrastructure / Components	EBL at Otterbourne Eastney LSO (Long Sea Outfall)	As per B.2

For Option B.5, Further feasibility assessment is also required to identify the preferred pipeline between PC WTW and the WRP, although the route would need go through potentially challenging urban locations, such as Portsdown Hill Road, where there is a highway, and various community and cultural heritage sites. Further details of the preferred site and route configuration are provided in Section 3.1.5.7 of Annex 5, Options Appraisal and Section 2.4 of Annex 2, Water Recycling Technical.

3.5.3 Consenting Evaluation

The Preferred Option configurations identified, as detailed in Section 3.5.2, were included within a detailed consenting evaluation – a component within the overall OAP. The two Water Recycling-based Options were ranked as 3rd and 4th (Option B.2, 3rd and Option B.5, 4th, out of six Options) within the Consenting Risk Assessment.

Further detail related to the consenting evaluation, including the approach and the results – overall and specifically for each option – is provided in Section 4 of Annex 5, Options Appraisal.

3.6 Wider Benefits Assessment

The Water Recycling Options provide some wider network resilience benefits in the Hampshire region. There are also opportunities for social and environmental benefits.

3.6.1 Resilience

A quantitative assessment of resilience for the options progressed at Gate 2 was completed, which built on the methodology presented at Gate 1 (Annex 17). The resilience assessment explored non-drought (BAU) resilience benefit provided by the SROs to Otterbourne WSW and Testwood WSW, and the benefit to Otterbourne and Testwood in a 1 in 200-year drought situation in comparison to a baseline in which no SRO is implemented. Testwood and Otterbourne WSWs account for half of the total zonal risk in the Hampshire region. Both sites currently have very poor redundancy and are critical to the supply of two-thirds of the customers within the zone

(298,654 properties served). There is not enough spare capacity in the network to make up the loss of either of these sites in the event of a full outage. Hence, the resilience assessment focusses on the loss and the resilience criticality of these sites. The shocks and stresses considered as part of the non-drought assessment included raw water loss, severe flooding, contamination, and critical asset failures, further details are provided in Section 2.2.10 of Annex 3, Havant Thicket Technical. Criteria utilised to conduct this assessment includes Integration with existing network strengthening solutions / plans; Adaptability of operation emergency response in a stressed situation (e.g. peak week demand); and Regional resilience.

The resilience assessment completed utilises key elements of SW's established resilience framework. This framework is based upon the Cabinet Office's '4Rs of Resilience' – resistance, reliability, redundancy and response and recovery. Further detail on the assessment criteria (which reflects RAPID resilience criteria and the WRSE guidance) is provided in Annex 4, Water Resource Modelling.

3.6.2 Value for Customers and Environment

As part of the Options Appraisal Process, all the SROs have been assessed under the MCDA framework to identity the best-value solution. Twenty-three criteria were used, covering customer aspects (customer acceptability of drinking water, security of supply), environment (biodiversity, air pollution), societal considerations (recreation and amenity), deliverability and affordability. Further detail on the MCDA, within the wider Options Appraisal Process is detailed in Section Comparison of solution costs and benefits3.7.5 and Annex 5, Option Appraisal.

3.6.3 Social and environmental benefits

Water Recycling-based Options provide some degree of social and environmental benefits. Conversely, Options B.2 and B.5 are expected to cause negative BNG impacts across multiple key metrics, as detailed in Section 3.4.8. Together this indicates that although there are impacts, there is potential for these impacts to be partially, not fully, off-set. Opportunities for amenity benefits are also limited. The environmental buffer at Otterbourne is planned to be constructed solely for functional use, with no additional amenity features being included.

3.7 Solution Costs

3.7.1 Overall costs of the solution, construction, and operation

Refined cost estimates for Options B.2 and B.5 are illustrated in Table 10 below. Detailed information is provided in Section 2.10 Water Recycling Technical Annex 2. OPEX, Net Present Value (NPV) and Average Incremental Cost (AIC) values are for the maximum DO flows and minimum flows. A third operating regime was also modelled, an average flow that assumes 1 year in the 100 operating years will be operating at maximum (DO) flow, with the remaining 99 years' operating at minimum flow.

NPV estimates have been calculated over a 108-year period, comprising 8 years for development and construction followed by 100 years of operation. The 100-year operation duration has been selected as this is the life of the longest lasting asset proposed in any Option; in accordance with latest HM Treasury Green Book recommendations. CAPEX (including maintenance and replacement costs) and OPEX forecasts (both fixed and variable costs) have been profiled over the 108-year analysis period. This longer period is more appropriate than the 60 years used in the Gate 1 cost estimates to meet All Company Working Group (ACWG) guidance by aligning to the longest expected useful lifespan of any component in the asset, plus the expected time from today to the asset being operational. This timeline is detailed further in Section 4.1.

Table 10 - Summary of costs: Water Recycling Options (2017-18 prices)

Option	Operating regime	Flow (Ml/d)	CAPEX (£m)	OPEX (£m/y)	NPV (£m) Gate 2=108yr; Gate 1=60yr	AIC (£/m3); Gate 2=108yr; Gate 1=60yr
B.2	Max (DO)	61	480	10.6	741	1.44
	Min	15	480	5.2	616	1.20
	Average	15.46	480	5.3	618	1.20
	Gate 1	*61*	*461*	*10.1*	*741*	*3.02*
B.5	Max (DO)	75	562	13.8	884	1.40
	Min	15	562	5.8	700	1.11
	Average	15.6	562	5.9	703	1.11
	Gate 1	*75*	*587*	*10.8*	*852*	*3.39*

AIC estimation has followed the process from the ACWG to ensure consistency in the calculation of NPVs and AICs across all SROs. The estimation method is consistent with that used in WRMP24.

B.2 and B.5 both include a ceramic membrane plant (CeraMac) at Otterbourne WSW as part of the design. The CeraMac plant asset will be shared between the SRO and other flows and will be constructed outside the B.2 / B.5 process. To enable comparison with the Desalination Options, it is assumed that the SRO option will drive half of the CeraMac flow. This would add £78.5 m to CAPEX stated above, with NPV of £107.5 m and AIC of £0.17/m3. For comparison purposes, the Multi Criteria Decision Analysis (MCDA) built these costs into the CAPEX assumptions (further detail can be found within Section 5 of the Options Appraisal Process Annex 5).

3.7.2 Detail of expenditure

Table 11 details an overview of CAPEX expenditure. Further breakdown and the process undertaken to prepare CAPEX estimates is set out in Section 2.10, Water Recycling Technical Annex 2.

Table 11 - CAPEX summary: Water Recycling Options without CeraMac

Cost item	Option B.2 (£m)	Option B.5 (£m)
Infra total	68.9	92.7
Non-infra total	100.3	105.8
Net direct costs (including uncertainty)	176.0	208.5
SWS Contractor Indirects	61.5	71.3
Contractor Total (Excluding Risk)	237.4	279.8
Additional Project Costs	39.2	40.9
SWS Client Indirects	27.4	31.7
CAPEX Sub total	**304.0**	**352.3**
Risk (from developed risk registers)	130.8	159.9
Optimism Bias	87.0	98.9
Option Project Cost (Subject to AACE class 4 accuracy range)	**521.8**	**611.1**
Indexation to 17/18 using RPI @ -8.804%	479.6	561.7

The process undertaken to prepare OPEX estimates is set out in Section 2.10.5, Water Recycling Technical Annex 2. As detailed in Table 11 above, OPEX estimates have been produced for three operating regimes. These operating regimes are consistent with those detailed in Section 3.1.4.

Annual operational maintenance costs have been estimated based on a percentage of the initial capital costs at the option level. These percentages are based on common assumptions used in the water sector for such infrastructure. Civil maintenance was calculated as 0.5% of the Infra and non-infra civil costs whilst Mechanical and Electrical (M&E) maintenance was calculated as 2.5% of Infra and Non-Infra M&E costs, which aligns to the approach taken within the WRMP24 exercise.

The methodology used to prepare the capital maintenance estimates is as follows:

- CAPEX estimates have been split by asset type and each asset type has been assigned an asset life from 4 to 100 years (detail in Section 2.10.3 Water Recycling Technical Annex 2);
- This allocation has then been used to allocate future capital maintenance/renewal costs for each asset type over the 100-year operation duration used in the NPV and AIC analysis. The capital maintenance cycles used in the NPV calculations follow the ACWG guidance and start in year 9 (first operating year).

3.7.3 Optimism Bias

In estimating the Optimism Bias (OB), SW followed the HM Treasury Green Book Supplementary Guidance: Optimism Bias as well as updated guidance from the ACWG. OB has been applied once to each Option, rather than being applied at a more granular level within each Option. Section 2.10.7 in Water Recycling Technical Annex 2 provides further detail on the Project Type and OB percentages selected. Table 12 details the changes in OB from Gate 1.

Table 12 - Optimism bias at Gate 1 (Q3 2020 values) versus Gate 2 (Q2 2021 values)

Option	Gate 1 OB Percentage	Gate 1 OB Value	Gate 2 Risk Adjusted OB Percentage (Stage 3)	Gate 2 Risk Adjusted OB Value
B 2	39.8%	£127m	28.6%	£87m
B 5	39.8%	£127m	28.1%	£99m

OB accounts for 18.4% of the total CAPEX cost for Option B.2 and 17.6% of the total CAPEX for Option B.5. This represents a reduction from the position at Gate 1. This is owing to a shift of value from OB into the quantified risk register, as well as increasing levels of information improving confidence in delivery.

While the Green Book recommends applying optimism bias to operating costs and benefits as well as to CAPEX, the Supplementary Guidance does not provide recommended upper and lower bound adjustment factors for OPEX as there was insufficient data to do so. In the absence of other data to inform what the OB adjustments for OPEX should be, the Supplementary Green Book Guidance recommends using sensitivity analysis to test the materiality of OPEX assumptions for investment decisions. Hence, the OPEX values presented in this report do not include OB.

3.7.4 Assumptions and exclusions

A detailed list of the assumptions and exclusions in deriving estimated costs is detailed in Section 2.10.8 Water Recycling Technical Annex 2. In summary:

- The estimates of cost, NPV and AIC were prepared in-line with relevant guidance requirements and methodologies, including WRSE guidance where appropriate;
- As the solution design underpinning the estimates remains at an early level of maturity, the estimates are deemed to be of Association for the Advancement of Cost Engineering (AACE) Class 4 accuracy (+30% / -5%). There is a risk that design development may identify alternative solutions and / or methodologies which may have significant cost impact both positively and negatively. As such the current accuracy envelope can only cater for fluctuations in cost of the current solution. Any changes to estimated solutions would require a reassessment of the estimate and confidence level;
- For consistency with the PR19 submission all costs have been indexed to average 2017/18 in line with the approach taken at Gateway 1. The price base is the average of 12 months of index, with a mid-point of end September. The factors for each year are April – March averages. Ofwat changed the basis of indexation in April 2020 to Consumer Prices Index Including Owner Occupiers' Housing Costs (UK) CPIH. Hence, the index up to and including March 2020 is based on monthly outturn Retail Price Index (RPI), converted to April to March annual averages, changing to CPIH in April 2020, using actuals until they run out then a forecast from a recognised source (OBR) This provides an indexation from current Q2'2021 back to 2017/18 of –8.084%; and
- Material prices are based on current 2021 market rates adjusted to PR19 17/18 utilising RPI data and CPIH data and while current price volitivity is included within risk allowances no allowance has been made for future fluctuations in supply costs.

3.7.5 Comparison of solution costs and benefits

A detailed economic analysis, comprising of MCDA and Cost Benefit Analysis (CBA), where criteria could be valued quantitatively, was undertaken to determine and assess the costs and benefits of each Option. This analysis considered 23 criteria across Net Social Impact and Cost categories. The criteria structure utilised is detailed in Table 13.

Table 13 - Economic appraisal criteria categorisation

Category	Sub-category	No. of criteria
Net Social Impact	Customer	2
	Environment	15
	Society	3
	Deliverability	1
Cost	Affordability	2

Each of these criteria were assessed on a normalised score basis, scoring each Option against each criteria from 100 – best performing, to 0 – worst performing, during both 'business as usual' (BAU) (i.e. non-stressed) and drought (i.e. stressed) scenarios.

The average score for each Option, from a Net Social Impact and Cost perspective for both operating scenarios was calculated and compared against each of the other Options considered at Gate 2. The scopes for the two Water Recycling-based Options are detailed in Table 14, with further detail on the approach utilised, criteria assessed, and the results of the Economic Appraisal included throughout the Options Appraisal Annex.

Table 14 - Economic Appraisal - costs and benefits results

Operating Scenario	Economic Appraisal Category	Average Economic Appraisal – Normalised Score (for each option)					
		A.1	A.2	B.2	B.4	B.5	D.2
BAU	Net Social Impact	40	40	45	48	54	61
	Cost	0	0	45	55	38	100
Drought	Net Social Impact	40	38	44	46	53	61
	Cost	0	0	45	55	38	100

The Economic Appraisal undertaken was a key technical input to the overall Options Appraisal and Decision-Making process. This process and the overall outcomes are detailed in the Options Appraisal Annex and have informed the overall recommendation regarding steps of further Option development post Gate 2, detailed in Section 10.

The interaction of this solution with other proposed water resources solutions would be considered through WRSE and WRMP24 modelling. However, as this solution is being considered through the RAPID accelerated Gate process, and the other solutions are not, there is limited information on the interactions between alternative solutions at this stage. WRSE are currently developing their model and have provided some initial results. SW will continue to engage with WRSE throughout the design development process. Analysis was completed in-line with industry accepted practice, as detailed in Annex 5, Options Appraisal Process, although have not been reported in profiles consistent with WRMP24 requirements.

4. Programme and Planning

4.1 Project Plan

4.1.1 Delivery Schedule and Milestones

The s20 agreement with the EA requires that SW uses ABE to deliver the Preferred SRO to support the WfLH programme, providing sufficient water supplies during a severe drought event by 2027. For the Water Recycling-based Options, the overview delivery schedule is illustrated in Figure 6, which includes the phasing of key activities (both pre-construction and construction) and decision points, high-level dependencies and a summary of the activities to be completed in delivering the project. A more detailed schedule is included in Section 2.9 of the Water Recycling Technical Annex.

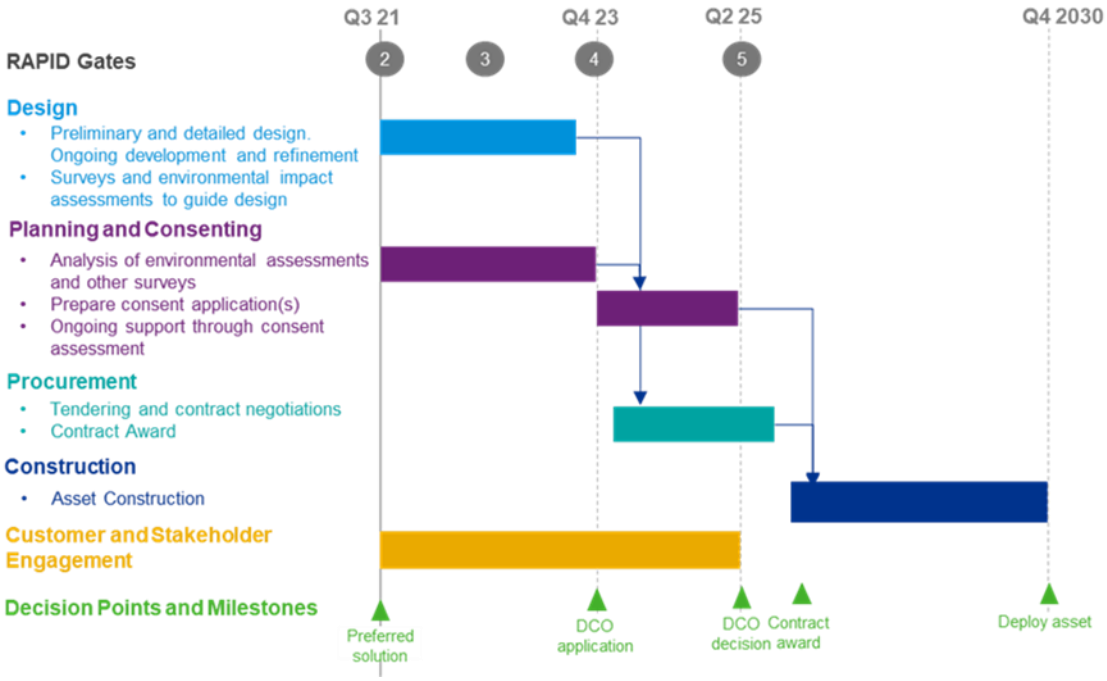

Figure 6 - High-level delivery schedule - Water Recycling

Key milestones of the project, for Options B.2 and B.5 are detailed in Table 15, with key regulatory milestones, including Ofwat's DPC control points and upcoming RAPID gates in Table 16.

Table 15 - Delivery milestones

Indicative Key Milestones	A.1 & A.2	B.2 & B.5	B.4	D.2
Design completion	Q3 2023	Q3 2023	Q3 2023	Q3 2023
Consent application submission	Q4 2023	Q4 2023	Q4 2023	Q4 2023
Expected consent decision	Q2 2025	Q2 2025	Q2 2025	Q2 2025
Procurement (tender) commencement	Q1 2024	Q1 2024	Q1 2024	Q1 2024
Contract award	Q4 2025	Q3 2025	Q3 2025	Q3 2025
Construction start	Q4 2026	Q4 2025	Q1 2026	Q4 2025
Construction completion	Q2 2029	Q2 2030	Q2 2029	Q2 2029
Asset operational	Q4 2030	Q4 2030	Q1 2030	Q1 2030

Table 16 - Indicative Regulatory Milestones

Ofwat Control Points	Submission	Decision	RAPID Gates	Submission	Determination
A	Q1 22	With control point B	Gate 1	Complete	Complete
B	Q1 22	Q1 22	Gate 2	6 Dec 21	Q1 22
C	Q4 22	Q4 22	Gate 3	Q4 22	Q1 23
D	Q1 23	Q1 23	Gate 4	Q4 23	Q1 24
E	Q3 23	Q3 23	Gate 5	Q2 25	Q3 25
F	Q2 25	Q2 25			

Although the timeline is on ABE basis, completion and asset operation will commence after the 2027 s20 deadline, in 2030. As previously communicated to RAPID in the Strategic Solution Gate 1 Submission: Remediation Action Plan, dated 31 March 2021 and the Gate 1 submission, the timeline for delivery set out in WRMP19 is challenging and current estimates forecast project completion to be post the deadline. SW is actively looking at measures to limit the delay in project delivery post the s20 deadline. These include, investigating the use of Project Speed, procurement delivery models (refer to Section 5) and detailed review of regulatory timeframes and construction and commissioning schedules to identify opportunities for earlier delivery, so that SW is meeting its ABE obligation. Following Gate 2, SW will continue to explore possibilities to bring the anticipated project completion date closer to the s20 deadline of 2027.

SW will work with the EA and NE on the s20 agreement commitment, and the consequences of the Selected Option and Selected Back Up Option being unable to meet the 2027 deadline. This will include discussion of changes in the s20 agreement regarding timelines as well as active engagement on operational and environmental mitigation measures to be undertaken for the period between 2027 and the anticipated date the asset will be operational (Q4 2030 for Options B.2 and B.5). This will be progressed in alignment with the RAPID gated process. Analysis was completed in-line with industry accepted practice, as detailed in Annex 5, Options Appraisal Process, although have not been reported in profiles consistent with WRMP24 requirements.

4.1.2 Assumptions and dependencies

The key assumptions underpinning the schedule are summarised below, with a more comprehensive list of assumptions included and a description of their impact on delivery in Section 2.9 of the Water Recycling Technical Annex. The key assumptions and dependencies are:

- Any necessary revision to SW's WRMP to account for new Options B.2 and B.5 can run in parallel to project delivery;
- SW can submit a S35 request for direction without revising its WRMP19;
- Water Recycling Options are delivered through the Development Consent Order (DCO) consenting route;
- DCO consent is provided before Contract award;
- DPC is the preferred procurement route and one DPC contract is issued containing all elements of work;
- Landowners give SW timely access for surveys; and
- Feasibility design for non-statutory consultation is of sufficient quality and depth to meet Ofwat's Control Point E requirements.

4.1.3 Missing Information

At this stage, project schedule development has concentrated on pre-construction, such as design, site and environmental surveys, consenting, procurement and stakeholder engagement. The construction schedule will be developed with the CAP, once further detail on project delivery is available, considering terms such as cost, design and consent conditions. To the best of SW's knowledge, there is no outstanding information that is expected to be included in the Gate 2 submission.

4.2 Planning route

4.2.1 Preferred planning route

A DCO, under the Planning Act 2008, or planning consent under the Town and Country Planning Act 1990 (TCPA) are the consent and planning regime options available.

A DCO is the preferred consenting strategy for all Water Recycling-based Options, based on multiple factors, including the greater certainty of timescales for consenting the Selected Option (in line with SW's s20 obligation to utilise ABE in project delivery), the scale and significance of the scheme, the ability to include multiple consents and powers required for delivery, and because of the likely significant impacts across a 'larger than local' area. Only projects within section 14 of the Planning Act 2008 automatically qualify as a National Significant Infrastructure Projects (NSIP) that must be consented under the DCO regime. The water recycling options do not meet the NSIP threshold criteria so do not automatically qualify as a NSIP under the Planning Act 2008. Therefore, to be consented under the DCO regime, a s35 direction from the Secretary of State is required. The key steps in the DCO planning approach process, including the request for a s35 Direction, are set out in Section 2.6 within Annex 3, Water Recycling Technical.

The use of TCPA consenting is expected to increase the time required to obtain the necessary consents (the exact time implication is not known at this time), as although a 'simple TCPA application' may be quicker, there is a significant risk that this may take longer than a DCO due to the need to coordinate multiple TCPA applications, plus other applications for consents, licences and possibly a separate Compulsory Purchase Order. Using the DCO consenting route is expected to support more timely delivery of the consenting process and the project overall in-line with SW's s20 obligation, as highlighted in Section 5.1.

SW has engaged with Defra on the scope of a s35 request and anticipates making an application to Defra as soon as practicable on confirmation of the Selected Option.

4.2.2 Pre-planning activity plan

If a s35 Direction is given, SW proposes two additional stages of pre-application consultations, both statutory and non-statutory, prior to submitting its application for a DCO.

Land referencing and surveys - SW has referenced all potential main sites and pipeline routes so that landowners can be identified and, in some cases, they have already been contacted. Where land is unregistered, site notices are being posted requesting those with land interests to make contact and Crown land and 'special' categories of land under the Planning Act 2008 are being identified. In the period to Gate 3, SW will continue land referencing as the pipeline route selection process continues and continue engaging with landowners to secure access and interests in land, where required.

Environment - As part of the DCO process, SW will undertake an Environmental Impact Assessment (EIA) and submit an Environment Statement. The EIA will be supported by other environmental assessments (e.g. Habitats Regulations Assessment, Water Framework Directive compliance assessment). Further detail is provided in the Section 2.5 of Annex 2, Water Recycling Technical.

SW will also obtain the relevant environmental permits for the activities relating to the water recycling solutions, for example any new water discharges or for treatment or storage of waste. Annex 2, Water Recycling Technical, section 2.6.7 lists the possible secondary licences and consents, with associated timescales and consenting bodies to ensure timely application.

Stakeholder and consultee engagement – SW will continue to engage with planning consultees on the scheme development and information from its various assessments and appraisal undertaken as part of the as part of preparing its application for consent. This will include future public consultation event.

4.2.3 Key planning steps and risks

The key planning steps to be managed and mitigated in delivering either of the Water Recycling-based Options following Gate 2 include:

- Ongoing refinement of high-level consenting schedule, aligned with other regulatory and procurement processes, and incorporation of detailed activities to achieve key consenting milestones into P6 schedule;
- Submission of request for a s35 Direction to Defra;
- Progressing pipeline route selection and commencement of early environmental assessment work to inform public consultation;
- Refinement of the approach, planning for and preparation of the deliverables required for next stage of public consultation;
- Submission of a Scoping Request to PINS (if a Section 35 Direction is given);
- Ongoing resource planning and procurement of resource necessary to progress through the planning process; and
- Increased levels of consultee (including stakeholder, community and landowner) engagement in accordance with SW's approach to stakeholder engagement.

Further detail of the consenting risks identified, associated mitigations and management processes proposed are detailed in Section 2.6.11 of Annex 2, Water Recycling. SW has also prepared a contingency programme for a Town & Country Planning Application consenting route should the DCO consenting regime not be available.

4.3 Key risks and mitigations measures

SW has used a consistent approach for identifying and managing assumptions, risks and opportunities across all Options[4], as detailed in Annex 14 of SW's Gate 1 submission. The WfLH Programme Risk Management Strategy has been designed to incorporate all aspects of risk management, and demonstrates a commitment to managing assumptions, risks and issues proactively and comprehensively throughout the lifecycle of

[4] Approach and outputs consistent with quarterly dashboards.

the WfLH Programme. WfLH programme assumption, risk and opportunity registers initially developed prior to Gate 1 have been continued into Gate 2 and provide the underpinning information for risk and assumption information included within SW's Gate 2 submission. Further detail of the risk, assumption and opportunities are included in Section 2.7 of Annex 2, Water Recycling.

A summary of the risks rated as either 'Very High' (VH) or 'High' (H), based upon the risk scoring classification is illustrated in Figure 7.

These have been scored to have a residual risk (post mitigation) score either equal to, or greater than, 19 (out of a maximum score of 25). No assumptions were rated in this area. As a result, no assumptions have been included specifically in this document, although assumptions are included in Section 2.7 of Annex 2, Water Recycling.

It should be noted that the proposed mitigation actions at this stage primarily relate to the near-term tangible and practical so a realistic approach that can be taken (rather than a long-term aspirational approach to managing risk). As a result, there are some cases where the current and residual risk scores are consistent.

Probability						
	VH (5)	11	16	20	23	25
	H (4)	7	12	17	21	24
	M (3)	4	8	13	19	22
	L (2)	2	5	9	14	18
	VL (1)	1	3	6	10	15
		VL (1)	**L** (2)	**M** (3)	**H** (4)	**VH** (5)
		Impact				

Figure 7 - WfLH Programme Probability Impact Diagram

Table 17 - Key Risks

Risk ID	Risk Description	Risk Category	Current Score	Mitigation Strategy	Residual Score
Costs and benefits					
710060-040	Owing to the spatial constraints observed in the [redacted] area, risk that the pipe route construction needs to be converted from a micro tunnel to a 3m diameter segmental tunnel, leading to an increase in cost, over and above that assumed in the cost estimate.	Other	21	Undertake a feasibility study on this route and the alternative options, in conjunction with the Planning & Consents team, prepare an appropriate methodology to enable the route to be correctly defined. Use Early Contract Involvement (ECI) to gather more information along route. Look at topics such as traffic, air quality, etc. to help determine the most appropriate route. Focus discussions with the key stakeholders impacted by the route to enable input into the design.	21
710060-039	Owing to a number of global factors including shipping costs, import tariffs, the coronavirus pandemic, and other supply/demand volatility, projections are indicating significant increases in costs associated with Steel and Timber.	Budget	23	Continue to monitor material volatility as the estimate is revised throughout the lifecycle. Adjust the base estimate and risk profile accordingly. Ensure that contractors have started to look at scalability testing and raw water/treated water profiles. Explore alternative procurement approaches to procure materials	21
710060-025	Turbidity issues observed at PC and BF. Solids pre-treatment design for the WRP has been increased. Risk of having to install further pre-treatment infrastructure to ensure FE quality does not impact on the operation of the WRP, leading to additional assets being required at additional cost.	Water Quality	21	Ongoing assessment of the Pilot to understand how it is reacting to final effluent peaks and troughs and assess these against data from around the world. Risk to be discussed as part of a wider asset strategy to resolve issues at source, rather than resolve using new assets if possible. Undertake assessment to provide detail of potential scope involved in fixing problem using the WRP, versus resolving problem at source.	19
710060-068	Owing to environmental and spatial constraints adjacent to environmental crossings, risk that significant amendments required to location and extent of reception and launch pits, leading to additional requirements and increased costs.	Environment	20	Undertake a feasibility study on this route and the alternative options. With the Planning & Consents team, prepare an appropriate methodology to enable the route to be correctly defined. Focus discussions with key stakeholders (local authority) impacted by route to enable input into design to refine the technique that SW is proposing.	20
Dependencies					
710060-010	Owing to the fact that Water Recycling technology requires key stakeholder (DWI, NE, EA) approval, there is a risk that the required approval is not achieved within the required timescales, which could result in programme delay.	Stakeholders	21	Drinking Water Safety Plan needs to be developed further for sign off by the DWI having now shared the initial document with them for comment. Monitor government guidelines on Covid-19 to understand if sampling can still be undertaken as this impacts the DWSP (Drinking Water Safety Plan) content.	19
Planned progress					
Prog-R56	Owing to number of identified risk events, risk that delivery of Strategic Alternative is not achieved in accordance with s20 agreement obligations, including timescales, leading to potential legal enforcement and significant reputational damage.	Timetable	25	Following finalisation of the schedule, continue to look at opportunities within the logic and mitigations to schedule pressures to improve the forecast completion date where possible. Undertake risk-based approach to examining the assumptions throughout the schedule in order to understand risk assessed timescales. Utilise formal governance routes to keep the regulator informed of the latest position. Develop mitigation schemes to enable provision of water in the event that the SRO is not available as per the Section 20 date.	24

Risk ID	Risk Description	Risk Category	Current Score	Mitigation Strategy	Residual Score
710060-007	Owing to need for significant power infrastructure and capacity to operate the WRP and associated Pumping Stations, risk that estimated upgrade scope as provided by DNO is not sufficient for final Scheme design, leading to additional costs and a programme extension	Stakeholders	21	Undertake further revision to Plant design to revise the loading assumptions and compare to latest DNO scope. Continue dialogue with DNO to update assumptions about the scope of their works, including timescales. Feedback to DNO in the event that our loading requirements change through the design.	19
710060-027	There will be a need to discharge water from the EBL in times of emergency. The obvious point for discharge is the River Itchen, but Natural England (NE) / EA have already stated they will not allow discharge direct from the WRP into the River Itchen. Therefore, there is a risk that NE / EA do not approve even emergency discharge into the River Itchen, leading to an alternative discharge solution requiring development or the EBL not being able to be located at Otterbourne.	Stakeholders	24	Obtain feedback from NE in relation to the survey strategy, implement feedback into revised survey strategy and then commence relevant surveys. Appoint EIA consultant in order to start baselining and scoping processes to support survey information. Utilise the survey information to develop a design solution with feedback from the relevant regulators, to be presented as part of the non-stat consultation process.	22
Other					
710060-001	Owing to the Pilot being a complex and time critical process, and in light of the extraordinary circumstances around COVID-19, there is a risk that there is insufficient data generated to support further assessments in relation to water recycling, which could lead to delays in finalising a suitable design.	Water Quality	24	Obtain agreement with [redacted] over [redacted] Ongoing monitoring of the Pilot Plant operation to understand any data gaps that may occur. Ensure that investigation is undertaken into reasons for Pilot Plant being offline in order that any corrective measures can be incorporated as part of the Pilot trial. Communicate with the DWI to discuss the current data gaps and SW proposals for utilising the Pilot to develop future mitigations.	22
710060-014	Owing to the relatively novel technique of Water Recycling, there is a risk that public perception is negatively skewed against Water Recycling, leading to delays to during the planning process as concerns are addressed. (Perception driven by taste, odour, source, etc.).	Water Quality	21	Continue to undertake purposeful customer consultation to build an informed picture of current perception. Details to include Customer Action Group (CAG), the young person's group (Water Futures 2050), Surveys, Analysis, etc. Undertake necessary activities and obtain necessary approvals / funding in order to relocate the Pilot Plant from Peel Common to Budds Farm in order to provide an end-to-end stakeholder experience for recycled water. Utilise the regulators to assist in promoting a consistent, collaborative message around the use of recycled water.	19
Prog-R98	Owing to the Selected Option at Gate 2 being shift away from the 'Base Case' included within WRMP19 (desalination at Fawley), in order to support our future planning application, this needs to be reflected in an update of WRMP19 and consultation on our Selected Option is also required	Regulatory	24	Prepare a letter to the EA expressing SW concerns over the expedited WRMP24 timeline and the impact that this may have on submission quality. Within the letter to the EA, seek support in the form of additional resource in order to assist in the preparation of WRMP24.	22
Prog-R99	Owing to the Selected Option at Gate 2 being shift away from the 'Base Case' included within WRMP19 (desalination at Fawley), in order to support our future planning application, this needs to be reflected in an update of WRMP19 and consultation on our Selected Option is also required.	Regulatory	24	Prepare a letter to the EA expressing SW concerns over the expedited WRMP24 timeline and the impact that this may have on SW ability to align WRMP24 with the final outputs of the WRSE modelling and regional planning process.	22

5. Procurement, ownership and operation

5.1 Procurement strategy

Since Gate 1, SW has continued to refine the procurement and commercial strategy for the delivery of the SRO, including both Water Recycling Options, Options B.2 and B.5. Due to the close similarities between Options B.2 and B.5, Option B.5 has been utilised as representative for both Water Recycling-based Options, when considering the procurement activities and implications. Since Gate 1 submission, SW further developed the following areas:

1. DPC eligibility assessment
2. Tender model
3. Commercial model

The outline DPC procurement timeline is detailed in Figure 8.

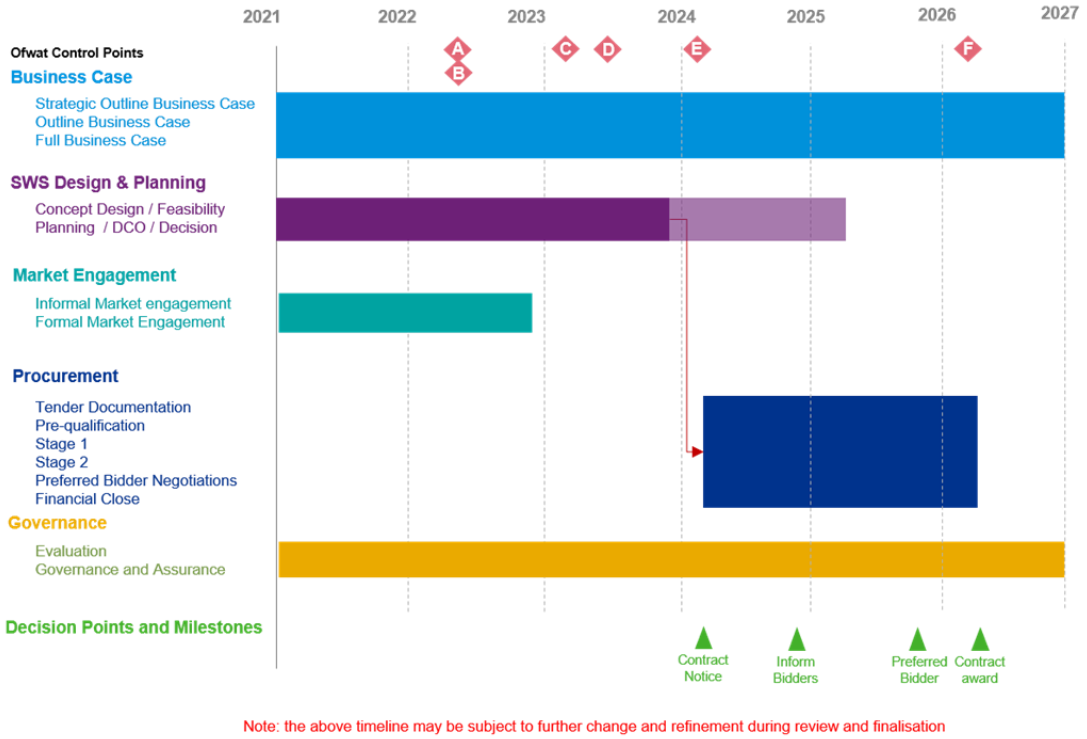

Figure 8 - Outline DPC timeline

5.1.1 DPC eligibility assessment

The latest assessment is that the solution is somewhat suitable for delivery under a DPC model. This is consistent with the findings from Gate 1. SW followed Ofwat's three-step DPC process guidance[5], which considers project scope developments and feedback from market engagement earlier this year. The full findings from the size test, discreteness test, Value for money (VfM) analysis and a summary of market engagement are provided in Section 2.11 from the Water Recycling Technical Annex.

SW will continue to test and validate the assumptions that underlie this submission following further development of the project specification, updated risk mitigation plans as feasibility information matures and additional market engagement. As such the analysis should be considered indicative rather than an endorsement of the DPC approach for these Options. SW will confirm the solution's suitability for DPC as part of the Gate 3 submission.

[5] Ofwat (February 2020) Appendix 2: Direct Procurement for Customers; Briefing Note on the Procurement Process for 2020-2025.

SW has identified a range of project-specific considerations which may present constraints to delivery via the DPC route, which will continue to be explored beyond Gate 2. These include:

- **Discreetness** criteria. Gate 2 assessment considers four areas regarding DPC eligibility for Option B.5. Two areas, specifically, stakeholder interactions and statutory obligations (e.g. DWI's 'water wholesomeness' concern), and output type and stability (e.g. the large variation in how much and when the water source will need to be accounted for in commercial arrangements with the CAP).
- **Value for money.** The current VfM assessment is based on Ofwat's *standard* assumptions set out in the 2017 guidance. The cost to customers in net present value (NPV) terms of B.5 under the factual scenario (DPC) is £399m compared with £481m under the counterfactual of in-house delivery. The difference in the costs to customers is £82.6m which is equivalent to c.20.7% of the SW PR19 revenues. The key value drivers under the DPC model are the benefits from cheaper financing costs (£42m) and the benefits from CAPEX efficiency (£46m). The VfM may change once the solution is developed further, and ***project-specific*** inputs are used including, but not limited to, market views on key financing issues such as debt terms and gearing, and a more detailed commercial model and risk allocation.
- **Licencing and DCO uncertainty.** The DCO process will run in tandem with the procurement and is subject to a degree of uncertainty and delays (as discussed in section 4.2). While SW aims to achieve DCO approval prior to contract award, this may adversely affect investor appetite and push up financing costs, with a potential knock-on effect on the VfM assessment. More market testing is needed to better understand this risk.
- **Treatment technology.** SW recognises that water recycling is not an established treatment process within the UK at this scale. It is important for SW to be able to provide confidence in the viability of such an option to the market and on successful implementation for customers. It is important to be able to convey confidence to the market that such an option will progress successfully.

5.1.2 Tender model

Four DPC tender models were identified for further progression at Gate 1: a) late with early design, b) late with early market engagement, c) late with novation of early designer or d) late with split design and build (D&B) from finance.

The *late tender model with early market engagement* has been selected as the preferred model, based on a combination of internal assessment and informal market engagement[6]. Further detail on tender selection and proposed tender process is included within Section 2.11.2.5 of Annex 2, Water Recycling Technical. Key reasons for selecting the late model with early market engagement are:

- Simplicity, which helps with timeline constraints
- Likelihood of keen design and build competition from international contractors
- Transparency of risk allocation between CAP and SW with fewer interfaces between them
- Preference expressed by potential bidders in the early market engagement

5.1.3 Assessment of alternative procurement routes

Further consideration has been given to procurement routes beyond DPC. Major infrastructure schemes such as this are predominantly delivered through Design and Build (D&B) contracting. D&B contracting is utilised extensively to deliver infrastructure projects of various sizes, ranging from small and regularly delivered projects to major 'one-off' type projects across numerous infrastructure sectors, including the water sector.

A high-level consideration of D&B delivery model, as an alternative to DPC, the preferred route (identified in Section 5.1.1) was conducted based upon the information currently available at this time. D&B was utilised as a test as it aligns with SW's previous experience and regularly used industry methods. Considering the project scope, size, use of novel technology, plus SW's previous experience with delivering projects like Options B.2 and B.5. SW's current framework agreements are not designed for this scale of capital expenditure. Alongside the specialist technical nature of this scheme, it dictates that a new published procurement would be required. It is also the case that large-scale design and build procurement models predominantly include ECI to safeguard solution design, as well as optimise risk balance, providing more cost efficient and predictable contract values and delivery timescales. The nature of risks identified for this scheme further assert the benefit of ECI. However, the nature of ECI means it can compromise competitive tension.

[6] Internal assessment narrowed down the choice to two Options - the late tender model with early market engagement, and the late tender model with split D&B from finance – which were presented at market engagement.

Following research in recent major capital schemes, infrastructure clients have deployed competitive ECI successfully whereby two design and build contractors are engaged with capped reimbursement for both.

This procurement would follow a pre-qualification process followed by a tender period to award contracts to two design and build suppliers. These contracts would be divided into initial ECI phase and construction phase. The ECI phase would involve suppliers working in parallel, competing for a single award for the construction period. A set contribution would be provided for the ECI phase with SW specifying the maximum price, ensuring market interest while also stimulating competition leading to successful award. Contracting with two suppliers for the ECI phase safeguards against either supplier withdrawing before final construction price agreement, in addition to maintaining competitive tension. During the ECI period, SW would engage with both contractors to understand progress, provide constructive challenge, source information and provide feedback on innovation. A desired benefit from the ECI phase is that collaborative team culture can be fostered. Given this option would be directly funded, the construction contract could be agreed prior to securing DCO planning approval and RO membrane licencing.

The suitability of DPC procurement, and other possible alternatives, will continue to be considered through the Ofwat Control Point process. Proposed dates for each Control Point are detailed in Section 2.9 of the Water Recycling Technical Annex. Confirmation of the procurement method to be utilised will to be confirmed with Ofwat at the relevant stage in the overall project lifecycle, where there is sufficient knowledge and confidence in technical information that underpins procurement method decision making.

5.2 Ownership and operation

5.2.1 Asset utilisation

During normal daily operation the asset will operate on a minimum flow of 15 Ml/d at all times. The purpose of this is to assist the SRO to be more flexible and able to react to sudden increases changes in need, such as in the event of emergency, where other water sources have temporarily failed, and also to reduce energy requirements in increasing throughput to meet increased supply needs during droughts. As drought severity increases the asset will be called upon to output increased volumes, with the WRP starting to operate above its minimum flow during a drought with an approximate return period of 65 years. During a drought with a return period of 100 years the asset will operate above minimum flow for 16 days in a 365-day period, and in a 1-in-200-year drought the asset will be operating at or near its full capacity for 49 days in a 365-day period. The forecasted flow and supply requirements in various drought scenarios are detailed in Table 18.

Table 18 - Asset utilisation, Option B.2 & B.5 – developed to a maximum of 1-in-200-year drought scenario only

Drought Return Period (years)	Maximum Daily Supply (Ml/d)	Annual Days Operation (above minimum flow)	Annual Volume Transferred (ML)
1	15	**0**	**5475**
2	15	**0**	**5475**
5	**15**	**0**	**5490**
10	**15**	**0**	**5490**
20	**15**	**0**	**5490**
50	**15**	**0**	**5490**
100	**24**	**16**	**5537**
200	**48**[7]	**49**	**6275**

5.2.2 Commercial model

The commercial model builds on the work carried out as part of the Gate 1 submission. Key items included in the current model include contractual principles and main categories of risk allocation, both of which have been tested with potential DPC market participants, through a market engagement process. Possible market participants were engaged on multiple items that influence the commercial model, including the nature of the Options under consideration, the indicative tender

[7] 48 Ml/d rather than 51 Ml/d deficit otherwise quoted due to technical modelling outputs vs. static projections

timeline, indicative tender model and key contractual terms within the commercial model. The results of this informal engagement indicate that there is significant appetite within the market to compete for a solution of this nature.

At this stage it is assumed that the asset will be owned and operated by the CAP. This is typically an ownership and operation arrangement for the projects delivered by DPC procurement. Ownership and operation models will be considered in greater detail following Gate 2, once further technical detail, related to design and operating regimes is available. This underpinning information is required before the ownership and operating models for the asset can be confirmed.

A high-level overview of the proposed commercial approach, based upon the analysis completed to date, including outcomes from the market engagement exercise has been included in Table 19, with further detail provided in Section 2.11 of the Water Recycling Technical Annex 2.

Table 19 - Overview of proposed commercial model

Area	Proposed approach
Contract length	• The recommended contract length is 20 years for operation. • The contract will also cover a design period of 1 year and the construction period of 4 years.
End of contract asset treatment	• A bullet payment will be made to the CAP based on the end of contract asset value. • At the end of the contract, the asset will either be retendered by SW or transferred to SW's control and an amount equivalent to the end of contract asset value added to SW's RCV.
Termination and termination payments	• Contract terms should include termination rights, allowing SW or CAP to terminate the contact based on pre-defined scenarios or targets, such as default scenarios, force majeure, or non-payment by SW.
Payment mechanism	• Payment to CAP will start post commissioning • Hybrid model primarily based on availability charge combined with a volumetric element to cover variable OPEX linked to asset utilisation • Fixed price contract • Refinancing gains to be shared 50:50 between the CAP and the customers • Performance targets with associated incentives / penalties
Acceptance and late service commencement	• Liquidated damages for late service commencement • Financial incentive for timely asset delivery • Clearly defined criteria and process for acceptance
Operational performance	• Most risks are expected to be transferred to the CAP, e.g. EA water quality risk, process risk, leakage, response time and critical spares • Some will be shared between the parties (e.g. DWI water quality risk, volume uncertainty)

6. Costs to Gate 2 and forecast

6.1 Breakdown of Gate 2 costs

Costs incurred during Gate 2 to further progress and develop the Water Recycling-based Options include those related to be completed in Gate 2, plus "early-start Gate 3" activities. "Early-start Gate 3 activities" are activities which were initially expected to be completed during the period between Gates 2 and 3, as included in PR19, yet in order to progress the project in line with SW's s20 obligation, ABE are being utilised to deliver the project. Commencing these activities ahead of Gate 2 was previously agreed with RAPID, which included that any costs incurred delivering "early-start Gate 3 activities" be netted from the Gate 3 funding allocation.

A breakdown of the costs incurred between Gates 1 and 2 to progress and develop the Water Recycling-based Options is detailed in Table 20.

Further detail of the costs incurred delivering activities specifically focused to the Water Recycling-based Options is provided in Section 1.2 of Annex 6, Efficiency of Expenditure.

Further to the activities and cost incurred listed in Table 20, series of common activities which cannot be directly attributable to a specific solution-type or option. These activities include programme and project management, legal advice, stakeholder and customer engagement and commercial analysis. For illustrative purposes, we have allocated our common costs to SROs using an even proportioning between the solution types, summarised in Table 21 and detailed further in Section 1.2 of Annex 6, Efficiency of Expenditure.

Table 20 - Gate 2 and accelerated Gate 3 costs – Water recycling, 17/18 prices

Activity	Description	Gate 2 (£k)	Gate 3 accelerated (£k)	Total (£k)	Total (£k 17/18 prices)
Engineering Studies and Surveys	UV/AOP Pilot trial - PC WTW. Proving the concept and application of the process design. Collecting data to evidence the process efficacy of water design. Being undertaken in Gate 2 period to enable SW to collect sufficient data to support DWI approval of water recycling in the UK.	766	643	1,409	1,329
Ceramic membrane Pilot trial - Otterbourne WSW	The ceramic membrane pilot trial is designed to inform the design and delivery of the pre-disinfection plant at Otterbourne to receive the water transferred from the source under this SRO.	0	646	646	609
Engineering Studies and Surveys	Design Consultancy undertaken by Internationally recognised specialist in water recycling design. Input includes engineering, construction best practice, analysis of the sampling data. Being undertaken in Gate 2 period to enable SW to collect sufficient data to support DWI approval of water recycling in the UK.	838	817	1,655	1,561
Design Development	Activities for G2 largely centre around the development of concept design to inform the CAPEX estimate and environmental assessments. This data then informed the MCDA. Design detail was enhanced through route refinement to main connection points in overall design.	643	508	1,151	1,086
Planning and Environmental works	The principal focus for the planning activities in G2 was the first non-statutory engagement and refining the activities to support a DCO process. As part of the route corridor refinement and down-selection process the environmental and ecology teams performed desk-based assessments to feed into the HRA staged review.	125	36	161	152
Site surveys	Environmental, Ecological, Terrestrial only at this stage	38	0	38	35
Project management	Project Management to lead and manage the projects.	98	0	98	92
Sub-total		2,508	2,649	5,157	4,865

Table 21 - Gate 2 and accelerated Gate 3 costs – total summary (using multiple proportioning methods for common activities)

Description	Gate 2 (£k)	Early Gate 3 (£k)	Total (£k)
Desalination	5,566	1,248	6,814
Water recycling	5,052	3,228	8,281
Havant Thicket alternatives	2,894	1,791	4,685

6.2 Evidence of efficient expenditure

An overall summary of the programme wide spend in the Gate 1 to Gate 2 period, relative to the Gate 2 allowance is detailed in Table 22. Further detail on the total spend and the contributing activities to this spend is detailed throughout Annex 6, Efficiency of Expenditure.

Table 22 - Gate 2 and accelerated Gate 3 costs (17/18 price base, £k)

Solution Type	Final determination cost allowance (as of 2019), (£k)		Actual, accrued and forecast costs to 6 December 2021 (£k, today prices)			Actual, accrued and forecast costs to 6 December 2021 (£k, 2017/18) prices			
	Gate 2	Gate 3	Gate 2	Gate 3	Total	Total (2017/18 prices)	Gate 2	Gate 3	Variance (£k)
Desalination	Total allowance below	Total allowance below	3,022	668	3,690		n/a on a 'per solution' basis	n/a on a 'per solution' basis	n/a on a 'per solution' basis
Water Recycling			2,508	2,649	5,157				
Havant Thicket			350	1,212	1,561				
Common Costs			7,633	1,739	9,372				
Total	**12,108**	**27,500**	**13,515**	**6,268**	**19,780**	**18,661**	**12,748**	**5,913**	**640**

The main reason for the overspend against the Gate 2 allowance is that the SROs SW is developing are technically complex and SW is progressing at pace to enable construction to start as soon as possible, in

order to meet the urgent need for water resources. As a result, the amount of technical and legal guidance and risk analysis significantly increases. As pathfinders of the accelerated RAPID process, SW is moving at a faster rate than other companies, as well as delivering against the backdrop of an ABE obligation, which the Ofwat allowance has in part been based on.

Following our Gate 1 submission, Ofwat challenged aspects of our costs, including the lack of benchmarking that had been included. In terms of project costs management, there are a number of benchmarking, knowledge-based elements and cost control mechanisms which are used. These include:

- A framework process, built on competitive tendering and benchmarking;
- An approval and sign-off process to the point of commitment of expenditure, controlled by defined delegations of authority. The levels are set by value and challenge is applied at each level of seniority before approval. This authority runs from project manager to executive management; and
- A full tender process.

There is extremely limited opportunity to externally benchmark steps in the project development process for highly idiosyncratic water infrastructure projects – with severely limited benchmarking information available. In response the programme team contacted [redacted] requesting support on benchmarking the Options considered, using relevant comparable projects, which indicated there were no suitably comparable projects which could be used as benchmarks. Following this, the programme team commissioned [redacted] to assess the scope for benchmarking at Gates 1 and 2. [redacted] found no representative benchmarking data for water projects at this early and specific project stage.

As a result, SW has focused on ensuring robust processes are in place to ensure efficient costs. Details of the procurement and management approaches are detailed in Annex 6, Efficiency of Expenditure. We will keep this under review for future gates and will continue to reach out to our supply chain to determine whether any useful benchmarks become available in the future.

For context, it should be noted that the programme cost allowances capped development costs at 6% of total solutions costs. At the time, this was based on a limited number of comparisons, with at least one benchmark (the Thames Tideway Tunnel) having a much higher proportion of development costs (10%). In its determination, Ofwat stated that the '6% also assumes that costs for some components of complex solutions requiring development consent orders are more likely to happen beyond 2025'.[8] This assumption does not appear appropriate for SW, as it needs to apply for development consent before 2025.

6.3 Forecast of expenditure to Gate 3

Option B.5 has been identified as the Back Up Option. As a result, activities in the period from Gate 2 to Gate 3 will focused on the development of the Selected Option, with some activities completed associated specifically to the progression of the Selected Back Up Option. A breakdown of the expected expenditure to Gate 3 for progressing both the Selected Option and the Back-Up Option is detailed in Table 23.

Table 23 - Gate 3 expenditure forecast for Option B.5, the Selected Back Up Option (17/18 price base, £k)

Description	Early Gate 3 expenditure	Gate 3 expenditure post Gate 2 submission	Total Gate 3 expenditure	Gate 3 funding allowance	Delta to allowance	Forecast costs to November 2022
Water recycling / Havant Thicket	3,213	15,611	19,022	14,389	+6,630 (+46%)	10,017
Water recycling back up	1,523	613	2,185			498
Desalination	1,177	-	1,177	13,090	-11,883 (-91%)	-
Total	5,913	16,225	22,284	27,479	-5,253 (-19%)	10,516

Further detail on the cost forecast to Gate 3 is detailed in Section 9.1 of this document and Section 1.3 of Annex 6, Efficiency of Expenditure.

[8] Ofwat (2019) 'PR19 draft determinations: Strategic regional water resource solutions', page 13

7. Stakeholder engagement

7.1 Overview of engagement and key findings

Engaging proactively and openly with regulators, stakeholders and customers and stakeholders is essential to the successful consenting, delivery and operation the WfLH programme. SW is engaging with a broad range of groups across the WfLH programme, including harder to reach customers. This is to ensure a wide range of stakeholder and customer views are understood and had regard to as Options are developed. A snapshot of some of these groups is shown in Table 24. More information on the specific engagement activities undertaken since Gate 1 is provided in Annex 9, Stakeholder and Customer Methodology and Section 2.8 of Annex 2, Water Recycling Technical.

Table 24 - Overview of customer, stakeholder, regulator and consultee engagement

Customers	Stakeholders	Regulators	Planning Consultees
Non-statutory consultation			
Customer Action Group	Water for Life – Hampshire Stakeholder Group meetings	1-1 briefings and discussions	Briefing and engagement with Local Planning Authorities
Ongoing Customer Insight	1-1 briefings and discussions	Senior Stakeholder Group meetings	Briefing and engagement with statutory bodies
Industry-wide engagement		Practitioner Workshops	Communications with landowners for the Base Case

7.1.1 Overview of engagement undertaken, key findings and resulting action

As the 75 Ml/d desalination plant at Fawley is the Base Case, SW has carried out more detailed engagement and consultation on this Option; however, there has been engagement on the Water Recycling-based Options. Regulators and other statutory bodies have been engaged on an ongoing basis, including on the development of the different stages of the OAP, namely the site and route selection methodology, the Consenting Evaluation and the MCDA appraisal methodology, and also on the emerging results.

The most comprehensive engagement activity was the non-statutory consultation from February 8 to April 16, 2021, where planning consultees, including regulators, local communities and landowners and stakeholder groups were consulted. This was run as a virtual consultation due to Covid-19 restrictions and it consulted on elements of the desalination Base Case and introduced the back-up alternatives, including Option B.2 and Option B.5. Whilst the non-statutory consultation did not ask consultees to rank their preference for each of the Options presented, as it was not a general 'Options' consultation where consultees were asked to choose an Option, it did ask for consultees' views on whether the water recycling alternatives would be acceptable solutions to meet the need should the Base Case be undeliverable.

A significant proportion of respondents agreed that water recycling alternatives would be an acceptable alternative solution to address potential water resource challenges in Hampshire should the Base Case not be delivered, with only 12% indicating disagreement, and 28% in total responding, 'don't know' or 'neither agree or disagree'. However, it is important to note that when considered the responses to the consultation that a total of 67% of respondents stated that they lived within the local area of the Programme, whilst 38% stated that they lived close to the proposed Base Case Option. As a result, we can expect the issues and preferences of those local to the Base Case to be better represented in the consultation feedback. We have published a report on this feedback and are in the process of analysing and having regard to it as part of the ongoing Option scheme development process.

As well as the non-statutory consultation, we have carried out in-depth engagement with customers through the Customer Action Group, and other customer forums, as well as conducting targeted customer surveys – this included engaging more than 240 Informed Customers through deliberative approaches and more than 1,950 in quantitative surveys.

Table 25 provides some insights from the customer and stakeholder engagement. We have already had regard to some of this feedback in the work undertaken to Gate 2 and will continue to as we progress into the consenting process. Further detail on this is provided in Annex 2.8 Stakeholder and Customer, Section 2.8.3.6 Primary Actions to Mitigate Customer Concerns.

Table 25 - Key customer insights and associated actions

Stakeholder group	Key insights and feedback	Associated actions completed prior to Gate 2
Customers	Customers would need reassurance on the quality and specifically any health risks when drinking recycled water. The process of water recycling should be explained in a way that demonstrates the natural components so as not to alarm customers that the water would be artificial	Customers would need reassurance on the quality and specifically any health risks when drinking recycled water. Using data from pilot trials can help evidence these assurances. Fairly simple reassurances around the purity and high standard of treated water can be an effective way of mitigating some concerns.
Regulators	DWI broadly content with how SW is progressing their concerns regarding the enforcement action at Otterbourne water treatment works and the environmental buffer water quality.	Since Gate 1, the programme team has had ongoing engagement with regulators and also other statutory bodies. This includes over twenty engagement sessions with organisations including Ofwat, Defra, EA, DWI and CCW. The environmental buffer has been included as a sub-system in the WSPs submitted to the DWI, with no further comments from the regulator. SW held several meetings with DWI since Gate 1, and will continue to engage closely
Planning authorities	Ongoing engagement required with relevant local planning authorities who have been briefed on Option B.2 and B.5.	SW has briefed Historic England and all of the local planning authorities likely to be affected by the various options on the methodology and results of the OAP. Relevant planning authorities were also engaged as part of the non-statutory consultation and this engagement will continue on an ongoing basis as we progress into the consenting process for the Selected Option.
Environmental Groups	Concerns related to the environmental impact from construction, WRP location and pipeline routes Further information and detail required to provide a full and comprehensive view on the potential environmental impact of the options	Options were assessed against environmental criteria as part of the Options Appraisal, including the Consenting Evaluation and MCDA appraisal. Environmental regulators, the EA and NE, have been engaged throughout the process and their feedback has been considered as we designed the options appraisal process and also prepared the Gate 2 submission. As we progress into the consenting process, there will be a full assessment of environmental impacts for the Selected Option and information will be shared for consultees' views at the upcoming consultations. Proposals for avoiding, reducing and mitigating environmental impacts will be developed as the scheme development process progresses.
Landowners	There has been some very early initial landowner engagement on survey access for some sites, but as these options have been back up alternatives to the Base Case this has been limited.	Landowners have been identified and contact made in some cases. Engagement on survey access and potential property negotiations will continue after Gate 2 for the Selected Option and Back-up Option, where appropriate.

Insights from the customer engagement work were used to inform parts of the MCDA appraisal section of the OAP, as set out below. Further information is detailed in Section 5 of the Options Appraisal Process Annex 5:

1. The views of members of the SW customer panel informed the weighting scenario applied to the MCDA appraisal ranking and
2. The criteria for the MCDA appraisal were originally informed by customer insight work, undertaken by SW and WRSE, so that the factors that were of most interest to customers could be considered when designing the assessment

As detailed in sections 3.6.2 and 3.7.5, two customer specific criteria were considered – tap water quality and resilience of supply. Due to the importance of considering customer views, these two criteria equated to 13% weighting across all 23 MCDA criteria. Multiple sensitivity analysis scenarios were considered, each of which further increased the weighting towards customer related criteria in the MCDA, relative to other criteria which include environment, society, deliverability and cost. Further details in the sensitivities considered are included in Annex 5, Options Appraisal Process. The normalised customer criteria scores for each of the Options considered in the Options Appraisal Process are detailed in Table 26.

The customer specific MCDA scores, detailed in Table 26 broadly align with the full MCDA and overall options appraisal results. which are detailed in Section 3.7.5. This supports ensuring that customer views are reflected in the work undertaken as they both informed the recommendations and conclusions detailed in Section 10. Further detail on the Options Appraisal Process and outcomes is detailed in Annex 5, Options Appraisal Process.

Table 26 - MCDA scores per Option: Customer criteria only

Scenario	MCDA Customer Criteria scores – Normalised					
	A.1	A.2	B.2	B.4	B.5	D.2

BAU Scenario	50	38	25	75	38	75
Drought Scenario	50	38	25	75	25	75

7.2 Future engagement activities planned

Customers and stakeholders will continue to be engaged and consulted on the Selected Option and Selected Back-Up Option, including activities that relate specifically to the SROs and the wider WfLH programme:

- **Water Futures 2030** – is SW's continuous consumer group which will take over from the W4LH CAG to provide a central hub for insight. SW will invite a number of members of the CAG to join and continue to use the group to drive relevant decisions, develop engagement materials and test options within the WfLH programme;
- **Water Futures 2050** – is SW's young person's group which has provided insight for WfLH from future customers. The group will continue to support the programme through its next stages;
  - Water Recycling acceptability – joint work with WRSE and PW building on the insights of water recycling and developing further to ensure consistent approach to building public acceptability. This runs from Jan 2022 to June 2022 to support the standard RAPID gates and WRSE programme.
- **Sharing of key insight** – as SW is progressing through an accelerated process it has been at the forefront with much of our insight. All the key insight is being shared across the industry and SW is developing a range of materials (e.g. reports, videos, recorded podcast debriefs and infographics) to make this information accessible;
- **Stakeholder groups** - continuation of strategic engagement at various levels within organisations, such as regulators and other statutory bodies, and the WfLH Stakeholder Group meetings; and
- **Wider stakeholder engagement activities** - continue to progress ongoing engagement with stakeholders and consultees, and also undertake consultation at the appropriate points of the pre-application schedule, with associated structure and resource to deliver the consultations activities.

8. Board Statement and Assurance

The Board has reviewed and discussed the overall strategy for the approach to the accelerated Gate 2 RAPID submission and is satisfied that both the submission and data assurance are appropriate.

SW confirms that:

- All the elements add up to an accelerated Gate 2 submission that is high quality and meets the requirements as set out in the Price Review (2019) PR19 Final Determination and subsequent guidance from RAPID;
- SW has put in place an assurance process to support improvement of the accuracy and robustness of the data and estimates used to develop the Gate 2 submission;
- Expenditure has been incurred on activities that are appropriate for accelerated Gate 2 and activities brought forward for accelerated Gate 3 (as discussed with RAPID) and is efficient;
- SW endorses Option B.4 as Selected Option and Option B.5 as Back-Up Option being put forward at Gate 2, for continuation to the next stage of the RAPID process;
- SW is satisfied that progress on the solution(s) is in line with the solution being in place and operable by 2030; and
- SW is committed to transparent reporting of high-quality data that can be trusted

The Board supports the continued joint working groups with PW on the Havant Thicket SRO and continues to work closely with PW Board to satisfy both parties that an appropriate strategy has been implemented to assure the submission approach and data verification. PW supported the creation of the Havant Thicket SRO documentation and co-reviewed the documents during the assurance process prior to submission approval from the PW Board on the 3rd December 2021.

How the Board has reached its conclusion:

- The SW Audit committee is responsible for the WfLH assurance approach and responded to external assurance findings;
- [redacted] provided technical assurance, focussing on reliability, consistency and quality of data, and efficient cost expenditure;
- SW established a Board working group which met regularly to discuss progress, approve key decisions to meet programme milestones and reviewed key areas of the submission;
- The joint executive team working group with PW has confirmed it is satisfied with the Havant Thicket element of the submission; and

- Final assurance reports were provided to the WfLH Executive Programme Board and the SW Board working group for consideration in approving the submission.

Further evidence:

- Active Board engagement with the submission team through the Board working group;
- The WfLH Executive Programme Board challenged key areas of the plan, advising the Board working group.

Future Plans for Board Engagement

Both the SW Board and PW Board will continue to be actively engaged on the RAPID solution(s) as the solutions progresses towards accelerated Gate 3.

The current governance process, driven up from the WfLH Steering Group, WfLH Executive Programme Board into the Board working group and full SW Board, will continue to meet on a regular basis to share progress and make key decisions to manage or mitigate risks identified by the delivery of the solution to meet the 2030 delivery date.

The Board will oversee the obtaining of the agreed amendment in writing from the EA to the s20 delivery dates from 2027 to 2030 and a workstream ensuring sufficient interim supply for the period.

SW and PW are in discussion with Ofwat and RAPID on Direct Procurement for Customers (DPC) and Gated Process timings. These timings will drive the schedule of activity and determine the Board level engagement topics to support decision making and regulatory engagement.

Annex 10 Gate 3 activity plan contains milestones from Gate 2 to Gate 3. Board engagement for SW and PW on key topics leading up to accelerated Gate 3 should include:

- Network interface between PW and SW;
- Potential regulatory barriers, guidance or changes required;
- Accelerated Gate 2 determination feedback;
- DPC (DPC and Control Point timetable with Ofwat);
- Review of efficient cost expenditure;
- Interface between the Gated Process and WRMP, and Water Resource South East (WRSE) plans; and
- Assurance findings and Board statement for accelerated Gate 3.

9. Proposed Gate 3 activities and outcomes

9.1 Proposed Gate 3 activities

As detailed in Sections 2 and 4, SW is committed to delivering the Selected Option using ABE, in-line with the s20 obligations. As result, the WfLH programme team has commenced the delivery of Gate 3 activities prior to Gate 2, as part of the 'early-start' Gate 3 activities, detailed further in Section 6, anticipating delivering the remaining Gate 3 activities, plus commence delivery of activities initially expected to be delivered in the period between Gates 3 and 4, as part of the "early-start Gate 4" activities. Proposed Gate 3 activities to progress the Selected Back Up Option will be constrained relative to proposed Gate 3 activities for progressing the Selected Option and look to utilise the outcomes of work completed associated with the Selected Option, where possible. A summary of activities to be completed to Gate 3 progressing the Back Up Option is outlined below, with further detail of these activities provided in Annex 10, Activity Plan to Gate 3.

The development of the Back-Up Option will be more limited than the development of the Selected Option. SW will look to progress the Back-Up Option as far as possible through 'piggy backing' on the primary solution development activities given the underlying asset types are very similar. SW will not however be progressing items such as works information development or anything that is designed to directly inform the consenting process as this could be an abortive effort at this stage. The Back-Up Option will be included in the non-statutory consultation as a back-up to the Selected Option so that if SW needs to switch options it will have already been through a consultation event. Key activities specific to the development of the Back-Up Option will be:

- Investigating and developing pipeline routes associated with the Back-Up Option;
- Investigating the potential locations for an appropriate environmental buffer for increased recycled water output.

9.2 Proposed Gate 3 outcomes, penalty assessment criteria and incentives

The proposed outcomes for Gate 3 are detailed in the Gate 3 Activity Plan, with an overview of the activities and the key steps to be completed by Gate 3 detailed in Section 9.1. Ahead of Gate 2, SW has brought forward activities, intended for delivery between Gates 2 and 3, into the Gate 2 Activity schedule, in line with SW's obligation to deliver the SRO asset by 2027, using all best endeavours.

SW is proposing an alternative delivery incentive mechanism for Gate 3 that will move the focus to incentivising delivery of the Preferred Option, rather than as now on the SRO gate submission. A proportion of the incentive would be based around key project milestones rather than Gate 23 itself. A summary of the proposal is contained in Annex 6 and more detail will be provided.

10. Conclusion and recommendations

Based upon the technical analysis completed regarding the feasibility and viability of the water recycling-based Options, Options B.2 and B.5, up to Gate 2, it is recommended that Option B.5 is progressed up to Gate 3 as the Selected Back Up Option. Prior to Gate 3, SW will consider if there is sufficient evidence discontinue further development of this Selected Back-Up Option in future. For clarity, the Selected Back-Up Option will continue to be developed within the WfLH programme and RAPID process, while development of Option B.2 will be stopped and not continued post Gate 2. Further detail of the OAP utilised and the outcome of this process is included throughout Annex 5, Options Appraisal Process. Option B.5 will need to be evolved as set out in Annex 13 to achieve the revised residual deficit (87-95 Ml/d) as per Annex 12, which will be developed post-Gate 2.

11. Supporting documentation

Responses to the actions and recommendations made in the Gate 1 final determination are included throughout SW's Gate 2 submission. References to the location of where technical detail is provided in response to the Gate 1 final determination actions and recommendations are provided below. For further information on Gate 2 submission structure and annex descriptions, refer to the 'Gate 2 Navigation and Glossary' (Appendix 1, Submission Summary).

Table 27 - Gate 1 Final determination action and recommendation references

No	Action – From Gate 1 Final Determination	Location
1	Provide a 'conceptual design report developed in consultation with all regulators, to meet gate two requirements and timescales. Include a recommendation for which solution should progress beyond Gate two, based on the outcome of the assessments completed by that stage.	Full Annex 2, Water Recycling Technical
2	Undertake site selection process as detailed in Annex 9.2 in consultation with the EA and NE, to meet gate two requirements and timescales.	Water Recycling Concept Design Report, Section 2.4
3	Provide a clear summary of the water resource benefit (DO) of each Option including the conjunctive use benefits. The operational and utilisation assumptions for each benefit should be clear. The assumed drought scenario used to calculate the benefits should be made clear including why you present these for a 1-in-200-year scenario whilst your emergency drought order level of service is 1-in-500 year. The output of a solution for a 1-in-500-year scenario will need to be calculated to support achieving the 1-in-500-year emergency drought order level of service.	Annex 4 Water Resource Modelling, Section 3.6 of this document and Submission Summary
4	Provide summaries of the further development of SEA, Habitats Regulations Assessment, Water Framework Directive assessment, Natural Capital Assessment, Environmental Social and Economic Valuation and Environmental Net Gain, that have been discussed and agreed with the EA and NE, to meet gate two requirements and timescales.	Water Recycling Concept Design Report, Section 2.5
5	Provide more information about risks related to water quality. We expect to see substantial progress made towards an approved membrane for the direct re-use sub-option.	Water Recycling Concept Design Report, Section 2.1.5
6	Provide a summary of the potential impact that the Water Recycling Options could have on the supply-demand balance. This should also include the impact on any current options or programmes within the WRMP19 or AMP7.	Annex 4 Water Resource Modelling
7	Whilst use of historical sample data in this and other locations may serve to enable a continued planning progress, DWI would require evidence of the representativeness of these samples for the current project at gate two. We expect further development of the risks associated with differing effluent quality based on evidence gathered from future sampling surveys, particularly seasonal, as part of the gate two submission which should include information on viral and pathogen loading especially in light of well documented effluent sampling for CoVid-19.	Water Recycling Concept Design Report Section 2.2.1

No	Action – From Gate 1 Final Determination	Location
8	Otterbourne WSW site is currently the subject of a legal instrument to carry out significant refurbishment works. The DWI has already amended the legal instrument, delaying some of the work, to take account of the Strategic Resource Options at this site. Implications of this solution on the ongoing refurbishment at Otterbourne WSW should be identified and discussed with the Inspectorate.	Water Recycling Concept Design Report Section 2.2.6
9	Provide details of a monitoring programme for the effluent to ensure that a baseline is available to inform treatment requirements.	Water Recycling Concept Design Report Section 2.2.1
10	Undertake a procurement strategy assessment including DPC eligibility assessment and value for money analysis. Include in this assumption with respect to who would operate the solution under both the DPC and traditional delivery model.	Water Recycling Concept Design Report, Section 2.11
11	Provide more information about stakeholder engagement and the understanding of customer acceptability including: -for individual options and sub-options; -on issues that could cause delay; and -how the views of vulnerable or harder to reach stakeholders and customers will be sought.	Water Recycling Concept Design Report, Section 2.8
12	Develop a fuller risk assessment that explores the areas of uncertainty associated with this solution. This should include: -a clearer relationship between mitigation measures and residual risks -greater clarity on the scoring criteria applied -more direct read-across to the dashboard risk Full assessment of the upstream catchment, the effluent flow and mitigation, including emergency response, should the wastewater site be adversely affected in any way and should be reflected in the DWSP.	Water Recycling Concept Design Report, Section 2.7
13	Future plans for board engagement must provide for effective oversight of SW's obligations under the section 20 agreement and to ensure that one or more solutions are in place and operating by the end of 2027. We expect Board assurance for gate two to include a statement that the Board is satisfied that progress on solutions is commensurate with solutions being in place and operating by the end of 2027.	Water Recycling Concept Design Report, Section 2.8
14	Provide total gate expenditure and activity breakdown costs in a common cost base. These costs should be presented in 2017-18 prices.	Gate 2 Efficiency of Expenditure Annex 6
No	**Recommendation – From Gate 1 Final Determination**	**Location**
1	Please clarify what factors are included in the final out-turn cost adjustment included in the indirect CAPEX estimates and whether there is any double counting of allowance for cost uncertainty included under the risk assessment and optimism bias assessment.	Water Recycling Concept Design Report, Section 2.10.3
2	Correct the inconsistency confirmed in clarification response (SRN020 Western Grid Minimum Flows) to demonstrate that option operating costs are calculated correctly for different operating scenarios and therefore options are being compared consistently.	Water Recycling Concept Design Report, Section 2.10.5
3	To aid comparison with other WRMP options provide the Average Incremental Costs (AIC). Please clarify why 60 years has been used for OPEX and whole life cost calculations. It is noted that the Water Resources Planning Guideline (WRPG) recommends that costs are profiled over at least the next 80 years.	Water Recycling Concept Design Report, Section 2.10.6
4	The estimated CAPEX for recycling options has increased since WRMP19. Please clarify which cost components have increased and the reasons for the change.	Water Recycling Concept Design Report, Section 2.10.4
5	Provide both operational carbon emissions and carbon intensity using the same throughputs as used for the OPEX and whole life cost per m3 presented in Annex 12 (i.e. as a whole life carbon per m3 or Ml using the expected flows over 60 years). However, the expected flows used in both cost and carbon analysis should be consistent with the flows stated in Annex 7. Include a clarification of whether operational carbon emissions calculations take into account the future decarbonisation of the power grid.	Water Recycling Concept Design Report, Section 2.10.6
6	Provide further detail on the planning risks and the planned mitigation measures.	Water Recycling Concept Design Report, Section 2.6.9
7	Provide information on future plans for board engagement and a compiled summary/log of assurance findings with actions taken.	Gate 2 Assurance Annex 7
8	Provide information on future plans for board engagement to improve future submissions.	
9	Provide a breakdown of the costs to Gate 2 that is consistent with the scheduled activities for Gate 2.	Gate 2 Efficiency of Expenditure Annex 6

Data tables including cost and benefit profiles consistent with WRMP24 reporting requirements have not been included within this submission due to availability. We are expecting our submission date for WRMP24 to be brought forward to 13 June 2022, with a direction confirmed in January. We will therefore be populating these tables closer to the deadline.