Strategic Solution Interim Update
CDR i Desalination

27 September 2021

Contents

Please refer to Strategic Solution Interim Update Submission Summary Appendix 1 - Submission Navigation and Glossary for the glossary of terms, definitions, and abbreviations for this document.

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 sea water Desalination-based 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.</td></tr>
<tr><td>What SW has done since Gate 1</td><td>Since Gate 1, SW has progressed analysis into the feasibility and viability of the Base Case from WRMP19 (75 Ml/d desalination from Fawley), Option A.1, as is required under SW's All Best Endeavours (ABE) obligations, and Option A.2 (61 Ml/d desalination at Fawley) as an alternative from the Base Case, as required by the Regulatory Alliance on Progressing Infrastructure Development (RAPID) Gate process. Both Desalination-based Options have been considered in greater detail across multiple areas including technical engineering, environmental impact, procurement, customer and stakeholder engagement, schedule, regulatory compliance and 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:
Internationally, desalination is a well-understood and viable source of water, despite being technically complex. However, the limited UK market for desalination systems presents significant challenges for this solution from multiple perspectives at this time.
Desalination is a high cost (Capital Expenditure (CAPEX) and Operational Expenditure (OPEX)) option, relative to the alternatives considered at Gate 2. The estimated CAPEX for the two Desalination-based Options is £802m for Option A.1, and £759 m for Option A.2.
Both Desalination-based Options are expected to cause adverse environmental impacts, such as brine discharge, habitat degradation, air quality and landscape impacts. Opportunities to offset these impacts are limited
Stakeholders and customers expressed hesitancy regarding the suitability of the two Desalination-based Options at this time, primarily due to the anticipated environmental impacts and the low potential for offsetting these, relative to the alternative options being considered by SW at Gate 2.
Site selection investigations completed since Gate 1 confirmed that the site initially proposed (in WRMP19) at Ashlett's Creek is the most suitable for the desalination plant. However, a consenting evaluation completed indicated that this site is not considered likely to be consentable at this location, at this time.
Both Desalination-based Options would be expected to be completed and operational in Q4 2030 if progressed.
A detailed Options Appraisal Process (OAP), including an Economic appraisal comprised of Cost Benefit Analysis (CBA) and Multi Criteria Decision Analysis (MCDA) has been completed to identify the option that, based upon the current information available, represents best value.</td></tr>
<tr><td>Results of Options Appraisal Process</td><td>The results of the OAP, which included Economic Appraisal, consenting risk assessment and screening against programme Legal and Policy Obligations and Strategic Objectives are summarised below.
<table>
<tr><th></th><th></th><th colspan="3">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></tr>
<tr><td rowspan="2">A.1</td><td>'Business as usual' (BAU)</td><td>5th= of 6</td><td rowspan="4">5th= of 6</td><td rowspan="4">5th= of 6</td><td>1,165</td></tr>
<tr><td>Drought</td><td>5th= of 6</td><td rowspan="2">964</td></tr>
<tr><td rowspan="2">A.2</td><td>BAU</td><td>5th= of 6</td></tr>
<tr><td>Drought</td><td>5th of 6</td></tr>
</table>
These results compare all options included at Gate 2.</td></tr>
<tr><td>Key risks & assumptions</td><td>The key risks identified through the analysis competed are:
It is highly unlikely that approvals from multiple stakeholders (such as Association of British Ports (ABP) Southampton, Marine Management Organization (MMO), Environment Agency (EA) and Natural England (NE)), will be granted in a timely manner to ensure SW can deliver either of the Desalination-based Options.
There is a risk of significant project delivery delays due to the requirement for membrane manufacturers needing to enter the UK market, which includes obtaining the necessary approvals from the Drinking Water Inspectorate (DWI).
There is a risk that SW is unable to utilise the Development Consent Order (DCO) planning and consenting route, as the required trigger thresholds related to the size and scale of the project (for either desalination-based) option is not met, leading to delivery schedule delays.</td></tr>
<tr><td>Recommendations</td><td>The development of both Desalination-based Options, Option A.1 and Option A.2, are paused at this stage and are not progressed post Gate 2 within the RAPID process. This is endorsed by SW's Board.
This document contains future commitments and deliverables that were made on the basis that the Base Case remains the selected option following Gate 2. As the Base Case and other Desalination-based options are no longer being progressed, these commitments and deliverables will also not be progressed.</td></tr>
</table>

2 Background and objectives

This document provides a technical summary for the feasibility and viability of two Desalination-based Options to provide a sufficient supply of water in the event of a severe drought in the Western Area[1]. The Desalination-based Options are aimed at meeting the Supply-Demand Balance (SDB) in Hampshire during a 1-in-200-year drought scenario[2], in line with requirements for SW's WRMP19. In its WRMP19, SW identified desalination (75 Ml/d capacity) at Fawley as part of the Preferred Strategy to meet water supply requirements in a severe drought scenario. The delivery of this strategy is subject to a Section 20 agreement (s20) with the Environment Agency (EA), for Southern Water (SW) to use All Best Endeavours (ABE) to implement the long-term scheme for alternative water resources set out in its final WRMP19 and reduce the need for drought permits and drought orders.

3 Concept design

3.1 Solution and Options

3.1.1 Solution Context and Background

WRMP19 identified that a 75 Ml/d capacity SRO, alongside 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 being considered. At Gate 1, a 14 Ml/d reduction in the SDB was identified through the testing of previously made assumptions regarding 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 61 Ml/d capacity SRO options. Since Gate 1, further testing of the assumptions relating to wastewater treatment discharges to rivers has led to a further 10 Ml/d reduction of the remaining deficit, to 51 Ml/d. Further detail is included in the Water Resources Modelling Technical Annex (to be provided at Gate 2).

Although the required SRO capacity has reduced, SW has not amended the WRMP19 SDB, maintaining the published deficit, and has not changed the Deployable Output (DO) of the options continued since Gate 1, as the minimum required SRO capacity is dependent upon the delivery of other WfLH programme components. SW recognises this results in what could appear to be an over-sized solution, however SW considers that it will provide an element of contingency to accommodate any future change in requirements, such as supporting regional 1-in-500-year extreme drought resilience requirements, as further explained herein.

At this stage, each of the options considered at Gate 2 meets the SDB requirements of WRMP19, when delivered alongside the non-SRO components of the WfLH programme. The potential for either options A.1 or A.2 to meet future needs that differ from 1-in-200-year drought resilience has been considered only at a high-level at this stage, via the Strategic Objectives as part of the OAP. This concluded that upscaling the desalination plant will be complex and require significant CAPEX investment, although there is source capacity (i.e., sea-water) for support the desalination process.

Water Resources South East (WRSE) is currently leading in supply demand modelling for future needs on a regional perspective. Final results are yet to be made available, but once available the extent of the future need will be able to be calculated with greater detail. The future potential for adapting to future needs was considered as part of the OAP through the application of the Adaptability Strategic Objective.

[1] SW's WRMP19 the 'Western Area' comprises seven interlinked WRZs: Hampshire Southampton East; Hampshire Southampton West; Hampshire Winchester; Hampshire Rural; Hampshire Andover; Hampshire Kingsclere; and, the Isle of Wight.
[2] The National Framework published by the Environment Agency in March 2020 sets out a higher level of drought resilience (1-in-500-years). Our proposed solution was submitted to RAPID prior to this policy steer, in line with the existing 1-in-200-year WRMP guidance.

3.1.2 Solution Description

Desalination is the physical removal of dissolved salt and minerals from seawater to produce a water that can be further treated for applications such as drinking, agricultural or industrial water. Internationally, desalination is widely used as a source of drinking water, however, domestically there are few comparable applications, with construction and operational experience limited to small plants on Scottish Islands and the Channel Islands. The only large-scale desalination (brackish water) scheme is Thames Water desalination plant at Beckton[3].

3.1.3 Options and Configurations

The Desalination-based Options, Option A.1 and A.2, involve the abstraction of seawater from the Solent, via a submerged offshore intake to a desalination plant at Fawley, before being transferred via a pipeline to Testwood Water Supply Works (WSW) via a blending tank. Options A.1 and A.2 are detailed below:

- Option A.1, also referred to as the Preferred Strategy, or Base Case, would provide 75 Ml/d desalinated drinking water direct to a blending tank Testwood, and
- A.2 would provide 61 Ml/d desalinated drinking water direct also to the blending tank.

The proposed locations of key infrastructure components and the transfer pipeline route for both Desalination-based Options are illustrated in

Figure 1. Assessments of key locations and other site selection processes are detailed in Section 0.

[3] Brackish water has more salinity than freshwater, but not as much as seawater, and therefore isn't a direct comparator to the solution proposed in this submission.

Figure 1 – Desalination-based Options key infrastructure components and locations

3.1.4 Asset Operation

Two operating scenarios have been considered by SW's technical team[4], as detailed below:

- Maximum flow (either 75 Ml/d or 61 Ml/d for options A.1 and A.2, respectively). This is where the plant operates consistently at its maximum capacity; and
- Minimum flow. This is where the desalination plant operates consistently at 15 Ml/d, with supply ramped up when required to meet demand during drought scenario.

The preferred operating strategy for the desalination plant requires a continuous "minimum flow operation", producing 15 Ml/d of desalinated drinking water for blending, in a service water reservoir constructed at Testwood Water Supply Works (WSW), with treated water from Testwood WSW. Transitioning into "drought operation", desalinated water production would ramp up to the required capacity to meet demand (up to a maximum of either 61 Ml/d or 75 Ml/d), depending on the option taken. In a maximum flow scenario, treatment at Testwood WSW would be suspended to prevent abstraction from the river Test under drought conditions, with supply to customers being water only from the desalination plant.

Analysis of mixing regimes identified that operating at approximately 15 Ml/d reduces the risk of a marked change in taste and odour associated with desalinated water as the sole source of drinking water in a drought situation, thus managing customer perception and acceptability. Furthermore, the 15 Ml/d minimum flow operating regime rate maintains the asset in a state of readiness, reducing response times to increasing demand, should this be required.

3.1.5 Assets to be Constructed – Non-Infrastructure

Key assets for both Desalination-based Options are consistent with variation between options A.1 and A.2 related to sizing and capacity of key components only.

[4] The on / off scenario, where the desalination plant only provides water when required to meet demand and when other sources are operating a maximum capacity, has been discounted since Gate 1.

3.1.5.1 Desalination Plant

The desalination plant is a multi-barrier treatment process, with the key stages in the desalination process illustrated in Figure 2, including the required flow at each stage in the treatment process, for the maximum flow (for Option A.1) and the minimum flow (for either options A.1 or A.2). Treatment losses equate to approximately 60% of water abstracted from the Solent.

Figure 2 – Desalination process block diagram (excluding residuals handling)

SW would construct the following transfer pipelines and structures to support both Desalination-based Options considered:

- Water intake structures including an underwater pipe located within the Solent that would transfer seawater to a terrestrial pumping station and a further pipeline to transfer the water from the pumping station to the Desalination Plant
- Outfall infrastructure within the Solent, and tunnel / pipelines to connect the Desalination Plant to the outfall and
- Underground pipeline to transfer water from the Desalination Plant at Fawley to a new blending tank at Testwood (WSW)

These principal elements of the development would require 'associated development', which could include (but is not limited to) receiving / blending tank infrastructure at Testwood WSW, permanent works to support operation / maintenance and utility connections for the site including electrical substation, telecoms, water and sewerage facilities.

Testwood WSW is subject to an enforcement notice from the DWI which requires upgrades to improve performance and reduce risk of customer outage. The desalination process produces drinking water quality water which would be blended with the output from Testwood WSW, which means there is no impact on or from the improvements required at Testwood WSW.

3.1.6 Interaction of this Solution with Other Proposed Water Resource Solutions

New water resource models are being developed across the South East region by WRSE for inclusion in the Regional Plan. It was therefore desirable for SW's model to align as closely to the WRSE models. The project team liaised with WRSE regarding model configuration to ensure appropriate consistency. Further to longer term WRSE modelling requirements, SW is currently investigating the feasibility and viability of the Thames to Southern Transfer (TS2T), through the standard RAPID gate process. As a result, the options selected for delivery through the Accelerated RAPID gate process, would need to consider this project and its impact on the water supply and resource balance.

3.2 Feasibility Assessment

3.2.1 Identification of Mutually Exclusive Solutions

Both Desalination-based Options detailed throughout this document are mutually exclusive. These options are also part of a wider set of SROs being considered by SW at this stage, as part of the WfLH programme. The SRO selected for delivery, through a detailed and robust OAP (refer to Interim Update – Option Appraisal document), will be delivered as a single component of the WfLH programme, which includes other water supply and protection requirements, as detailed in WRMP19. Other projects within the WfLH programme include bulk transfers, source protection, demand reduction and other network infrastructure projects.

3.2.2 Indication of Suboptimal Solutions

At Gate 1, three Desalination-based Options were considered. Two of these (options A.1 and A.2) were continued and included in the OAP undertaken in advance of Gate 2. The third Desalination-based Option considered was Option D.1. This is a combination of 40 Ml/d desalinated water supplied to a large coastal industrial facility, with the existing 20 MI/d supplied by South West Water (SWW) via Knapp Mill Water Treatment Works to the industrial facility being diverted to SW, along with the existing 10 MI/d supplied by SW to the industrial facility. The remaining supply would be provided from a water recycling plant using treated effluent from Budds Farm. This option is no longer being progressed as, after further technical work, significant risks around the feasibility and deliverability of this option were identified. These risks make it too unreliable to be a genuine alternative to the Base Case in the context of the urgent need to meet the duty of supply through WfLH.

Key risks relating to the feasibility and deliverability of Option D.1 include, but are not limited to, the following:

- The 30 MI/d Knapp Mill supply that forms part of Option D1 abstracts from the River Avon, which is a chalk stream. As the EA has embarked on a programme to reduce reliance on chalk streams, there are significant security of supply risks around the future availability of this source and
- There are significant risks around the commercial viability of this option. Initial modelling work indicates that the unit cost of water for the industrial user from the proposed desalination plant would be five to seven times higher than its current rates. SW has no enforcement mechanism to make the industrial user accept this higher rate, meaning it may be required to supply this water at a significant financial loss.

3.3 Water Resource Assessment

3.3.1 Supply-Demand Balance Delivery Plan

In WRMP19, SW set out its Preferred Strategy to meet the supply-demand deficit across the Western Area in severe, 1-in-200-year, drought, combined with peak demand and minimum DO conditions. The strategy included several interventions to reduce the supply-demand deficit, including, but not limited to, the following:

- Major strategic supply schemes: desalination plant at Fawley as the Base Case[5]
- Bulk transfers from neighbouring water companies, including Portsmouth Water (PW) and SWW
- Demand reductions from lower leakage and per capita consumption and
- Network infrastructure upgrades.

As detailed in Section **Error! Reference source not found.**, there have been refinements in the supply d emand modelling since WRMP19 which have tested and validated the assumptions made in the original modelling undertaken by SW. For clarity, SW has not changed the SDB detailed in WRMP19 or the design capacities of the options being considered at Gate 2. This decision was made to be prudent in managing the inherent risks and uncertainties that exist in the delivering of some of the non-SRO projects within the WfLH programme, avoid re-work associated with adjusting the capacity of the SRO as continuing to develop the current sized options would provide suitable technical basis to assess the feasibility and viability of SROs at Gate 2.

As noted in Section **Error! Reference source not found.**, since the publication of WRMP19, policy r equirements have been updated to provide a resilient water supply during an extreme (1-in-500-year) drought scenario, although options to provide the required resilience are to be developed from a regional perspective. WRSE is responsible for determining the regional supply demand deficit for an extreme drought and identifying the preferred option(s) for bridging the deficit. SW is actively liaising with WRSE, including

[5] 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)

sharing modelling information and detailed technical options that supported SW's Gate 1 submission. These will start to reveal the regional 1-in-500-year drought resilience requirements.

In lieu of WRSE's modelling results, SW has undertaken a preliminary modelling exercise, based on high-level information currently available. The primary purpose of this was to gain a high-level understanding of the possible order of magnitude for the SDB during an extreme drought scenario. These calculations are highly caveated and based upon significant assumption, which will be tested and validated once WRSE modelling is completed and available for use. The future potential for adapting to future needs was considered as part of the OAP – through the application of the Adaptability Strategic Objective.

3.3.2 Water Resource Benefit Assessment

As detailed in Section **Error! Reference source not found.** and the Water Resources Modelling Annex (to b e provided at Gate 2), the SDB and minimum required SRO capacity is 51 Ml/d. This assumes that all other projects within the WfLH programme are delivered successfully and to full capacity. As detailed in Section 0, there are uncertainties in the delivery of the non-SRO areas of the programme which need to be managed and maintaining the original design capacity of 75 Ml/d would assist in mitigating these risks.

The preferred operating regime is a 'minimum flow' regime, as detailed in Section 0, where the asset will consistently provide a flow of 15 Ml/d. In drought situations, the output volume from the asset will increase, to a maximum of either 61 Ml/d or 75 Ml/d. An approximately 1-in-65-year drought is required for the asset output to increase above 15 Ml/d, with the asset expected to 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.

3.4 Drinking Water Quality Considerations

3.4.1 Progress since Gate 1 and Future Water Safety Plan Developments

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

- New sub-systems have been defined for the Desalination-based Options, with each assigned a separate WSP and
- An extensive sampling programme has been carried out, monitoring source water for a suite of microbial and chemical parameters, to inform the Gate 2 draft WSPs for the catchment and abstraction sub-systems

3.4.2 Water Safety Plan Development Timeline

The development timeline proposed in the Gate 1, identifying the key data gathering exercises for each Gate is illustrated in Figure 3.

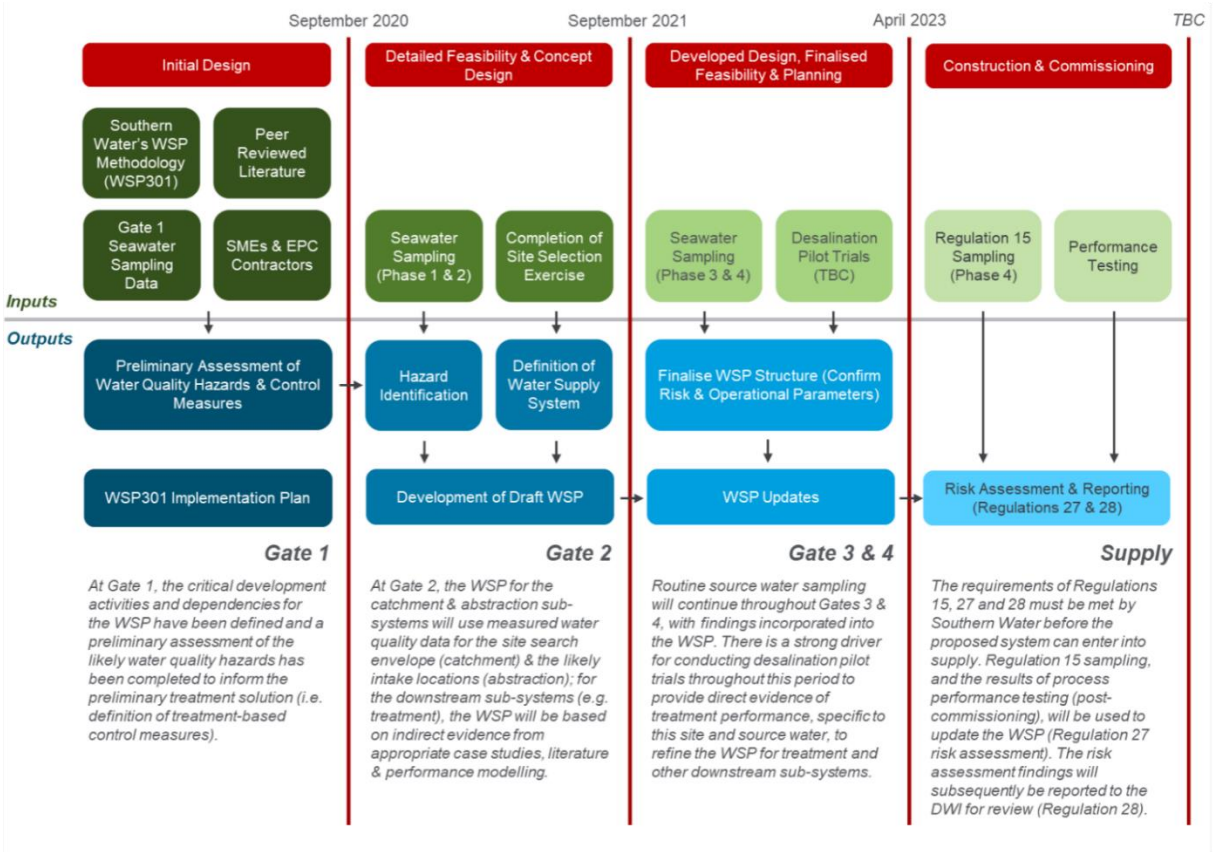

Figure 3 – Drinking Water Safety Plan (WSP) Timeline - Desalination

3.4.3 Quality Regulatory Considerations

SW has engaged with multiple regulators, including the DWI, and will continue to do so throughout the programme. A key purpose of this engagement is to ensure that the WSP 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. Further detail of the engagement with regulators completed during the Gate 2 stage is provided in Section 2.1.6 of Annex 1 Desalination.

Engagement meetings with the DWI were held in September 2020, December 2020 (two meetings) and April 2021 to share findings, understand the implications of findings from a regulatory standpoint and to resolve issues and concerns arising from said findings. Draft WSPs were submitted to the DWI on 13 April 2021 and approved WSPs will be submitted to the DWI through SW's water quality team. They were developed using SW's WSP Risk Assessment & Monitoring Methodology which aligns with the specifications of British Standards document BS EN 15975-2:2013.

The main DWI concerns, engaged on during the engagement sessions as outlined above, related to the conditioning, and blending of water and the impact these will have on drinking water quality and customer acceptance. The DWI also required a comprehensive source water sampling programme, which is explained in 3.4.3.1 below. DWI concerns related to specific components for both Desalination-based Options are detailed in the sections below.

3.4.3.1 Source Water Considerations

The Gate 2 sampling programme commenced in November 2020, monitoring for a suite of microbial and chemical parameters, with sample points distributed across the site search envelope, providing data to inform the Gate 2 draft WSPs for the catchment and abstraction sub-systems. Sampling is on-going to ensure seasonal changes particularly on algal counts are understood and that there is sufficiently large dataset to demonstrate the data is statistically representative, as required by the DWI. The DWI also noted the lack of laboratory capability for saline analysis. SW's analytical supplier is developing its methods to expand its capabilities and so for Gate 2 the WSPs are based on an understanding of the sources of each hazard and literature from the World Health Organisation. Source water quality sampling is a key input into the WSPs, with the high-level sampling schedule detailed in Table 1.

Table 1 - Source coastal water sampling stages

Phase	Timing	Description
1	Until September 2020	Initial testing conducted along the Fawley coastline, with samples collected from seven locations on seven consecutive days, under various tidal conditions
2	October 2020 – March 2021	Continuation of Phase 1 sampling, with sampling areas extended to twenty locations across the Isle of Wight, West Sussex and Sandown Coast areas
3	March 2021 – September 2021	Further targeted sampling in terms of location and parameters sampled for as potential desalination plant sites become further refined
4	Post desalination site identification	Resumption of the 'BAU' monitoring regime at the preferred site selected for the Desalination-based Option

Comparing the results so far from each individual location identifies no distinct water quality challenges that would warrant a change in the overall process design. Further detail of source water quality is found in Section 2.1 of Annex 1 Desalination.

3.4.3.2 Certification of Desalination Membranes

Substances and products in contact with drinking water must be approved as set out in Regulation 31 of the Water Supply (Water Quality) Regulations 2018. SW intends to create a market for Regulation 31 certified Reverse Osmosis (RO) membrane suppliers who can provide the necessary membranes for the Desalination-based Options. To this end, SW has carried out market engagement with four suppliers (following a formal Prior Information Notice (PIN) without call for competition) to understand the level supplier appetite to achieve certification.

SW intends to go to market in early 2022 (once the Gate 2 decision has been received) to engage a competitive multi-supplier framework of RO membrane suppliers with the necessary certification (or a promise to obtain such). Until this time, SW will continue to engage with the membrane supplier market, gauging the level of appetite to incur the costs associated with getting onto the framework and with obtaining DWI Regulation 31 certification. This will continue to inform SW's procurement strategy and its view of the potential to create an RO membrane market.

3.4.3.3 Remineralisation and Blending

A key stage of the desalination process for preparing water for human consumption is remineralising (conditioning) the treated water. SW must conform to the requirements of Regulation 4 of the Water Supply (Water Quality) Regulations 2018 to demonstrate that desalinated water meets wholesomeness requirements. Further detail is provided in Section 2.1.5 of the Annex 1 Desalination, including detail on customer acceptance risk, corrosion risk, and blending impacts based on the forecast treated water quality from the desalination plant.

Under 'minimum flow' operation, any noticeable change in taste will arise on successful commissioning of the plant when the desalinated water is first introduced into supply, following which, a new normal water quality profile will have been established. Taste changes under normal operation, if any, are expected to be subtle given the marginal changes in blended water composition. SW expects to be able to provide advanced notification to affected customers and liaise with them throughout any transitionary period, which should not result in regulatory failure.

Under ‘maximum flow’ operation, desalinated water constitutes the sole source of supply for large populations across the Hampshire WRZs and noticeable changes in taste are inevitable. Maximum flow operation is a requirement under extreme drought conditions, which will be known about in advance as drought conditions progress. SW will enhance its drought communication plans to ensure widespread customer awareness of upcoming source changeover events and the subsequent taste impact, emphasizing the continued safety of the water despite the change in taste.

Network corrosion risk from desalinated water will be managed by dosing orthophosphoric acid during remineralisation and through dosing sodium hydroxide after disinfection.

3.5 Environmental Assessment

Since Gate 1, assessments and appraisals have been carried out which cover both options A.1 and A.2, due to the similarities in the options, as detailed in Section 0. Key factors that influence environmental impact, such as infrastructure components and their respective locations are common to both options.

The environmental impact has been assessed on a component-by-component basis (e.g., pipelines, desalination plant, pump stations etc), which is aligned to industry accepted practice.

3.5.1 Environmental Impact Assessment (EIA)

An EIA is not required for the Interim Update or Gate 2, however, SW is working on an outline EIA methodology which sets out a broad approach to EIA, following best practice, which can be applied to all the SROs currently being considered by WfLH. The outline EIA methodology continues to be developed with regulators, and in line with guidance, up to and post Gate 2, to support project consenting under the DCO regime, which is SW’s preferred consenting approach (see Section **Error! Reference source not found.**). S W will be engaging with key stakeholders including the EA and NE on the proposed methodology between now and Gate 2.

3.5.2 Marine Conservation Zone (MCZ) Assessment

Yarmouth to Cowes MCZ, The Needles MCZ and Bembridge MCZ were included in the Gate 2 MCZ Assessment for A.1 and A.2. All sites were screened into a Stage 1 assessment for A.1 and A.2 on a precautionary basis, due to the potential for impact on the designated features of the MCZs associated with operational discharge of reject water. Based on the data reviewed and the outcome of the Stage 1 MCZ assessment, which also incorporated results of modelling completed by SW, no adverse impact on the conservation objectives for any of the MCZs is predicted. Further details of these risks are included In Section 2.5.1.3 of the Annex 1 Desalination.

3.5.3 Environmental Surveys

To support the Strategic Environmental Assessment (SEA) and EIA process and supporting environmental assessments (e.g., Habitats Regulation Assessment (HRA) and Water Framework Directive (WFD)), a wide range of surveys and primary data collection will be required. To ensure that surveys are identified and scoped appropriately with regulators, a number of survey protocols have been developed, including for Terrestrial Ecology, Aquatic Ecology and Marine Ecology.

The purpose of the protocols is to ensure a consistent, transparent and standardised approach to the environmental survey methodologies used for WfLH SROs and the provision of a robust baseline to inform the relevant application documents. The collected baseline survey data will be used to inform the scheme development process, EIA process and the identification of appropriate mitigation measures.

As ecological surveys are seasonally constrained, priority has been given to developing the ecology protocols in the first instance, however protocols will also need to be developed for other environmental surveys (e.g., land quality, traffic, historic environment etc) beyond Gate 2.

3.5.4 Habitats Regulation Assessment (HRA)

A high-level HRA has been completed in evaluating the feasibility of all SRO options considered at Gate 2, however a statutory HRA assessment is not required until the final SRO 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 utilised and the specific technical notes used to inform the assessment are provided in Section 2.5.1.3 of Annex 1 Desalination. The potential effects caused by options A.1 and A.2 are detailed in Table 2. Additional detail is provided in Section 2.5.1.3 of Annex 1 Desalination.

Table 2 - HRA Screening: High-Level results - Desalination

Risk area	Direct Effects	Indirect Effects
Subtidal	• Direct temporary habitat disturbance if located within a Habitats site • Indirect effects – Temporary smothering following suspended sediment deposition – Temporary disturbance due to noise and vibration – Changes to water quality – Temporary increases in suspended sediment – Release of pollutants – Introduction of Invasive Non-Native Species (INNS) – Fish entrainment / entrapment – Barrier to species migration	• Direct long term habitat loss if located within a Habitats site • Indirect effects – Localised hydrodynamic changes (e.g., altering tidal flow, velocities, sediment transport) – Changes to water quality – Fish entrainment and impingement
Terrestrial	• Direct habitat loss if located within a Habitats site • Indirect effects – Temporary disturbance due to noise and vibration – Temporary changes to air quality – Changes to ground water and surface water – Introduction of INNS – Barrier to species migration / movement	• Direct long term habitat loss if located within a Habitats site • Indirect effects – Disturbance due to noise, vibration, human activity and light – Changes to air quality – Changes to ground water and surface water
Ornithology	• Direct habitat loss if located within a Habitats site • Indirect effects – Temporary disturbance due to noise and vibration – Change in supporting habitat quality due to release in sediment during river crossing construction – Barrier to species migration/movement – Changes to prey resource – Changes to air quality	• Direct habitat loss if located within a habitats site • Indirect effects – Disturbance due to noise, vibration, human activity and light – Barrier to species migration/movement
Freshwater	• Direct habitat loss if located within a Habitats site • Indirect effects – Temporary disturbance due to noise and vibration human activity – Hydrological effects – Release of pollutants – Introduction of INNS – Barrier to species migration	• Connectivity with subtidal effects for migratory species

High-level screening was completed across multiple locations of varying designations, either Special Area of Conservation (SAC), Special Protection Area (SPA) or Ramsar. A summary of the sites, their respective designation and potential of significant effects being identified is provided in Table 3.

Table 3 - Specific sites testing through environmental assessments

Designation	Site name	Likelihood of effects
SAC	New Forest, River Avon, River Itchen, River Meon Compensatory Habitat and Solent Maritime	Insufficient information to rule out Adverse Effect on Integrity (AEoI) on all features
SAC	Butser Hill, Woolmer Forest, River Test Compensatory Habitat, Solent and Isle of Wight Lagoons	No Likely Significant Effects (LSE)
SPA	Solent and Dorset Coast and Wealden Heath Phase II	No Likely Significant Effects (LSE)

Designation	Site name	Likelihood of effects
SPA and Ramsar	New Forest and Solent and Southampton Water	Insufficient information to rule out AEoI on all features

3.5.5 Potential Mitigation Measures

In line with the environmental assessments completed to date, potential mitigations have been considered on a 'site-by-site' basis, across the sites detailed in Table 3. Potential impact and mitigations have been identified across the sites where there is insufficient information to rule out AEoI, based upon the information available at this time. This is summarised in Table 4 - and detailed in Section 2.5.1.3.6 of Annex 1 Desalination. These potential impacts would need to be investigated further and validated through further analysis following Gate 2.

Table 4 - Potential impact mitigation measures – Desalination

EIA Impact	Example potential impact	Example potential embedded mitigation measures
Air Quality	• Impacts of dust, particulate matter and emissions	• Routing of infrastructure, pipelines and construction routes to avoid sensitive sites
Archaeology and Cultural Heritage	• Direct and indirect impacts	• Pipeline route to avoid direct impact to sites • Pre-construction surveys
Biodiversity	• Degradation or loss of habitats • Killing or injuring of fauna through the removal of resting or breeding sites	• Pipeline to avoid terrestrial and marine habitats • Sensitive selection of pipeline river crossings • Biodiversity enhancement measures
Land Quality and Ground Conditions	• Exposure to contaminated soils • Impacts on ground and surface water quality	• Avoidance of known areas of contaminated land through design of the SRO using good design principles
Land Use and Agriculture	• Loss of agricultural production and recreational land	• Routing of the pipeline to avoid land used for alternative sources
Landscape and Visual Impact	• Effects to visual amenity within landscape designations (including consideration of wildlife and natural beauty)	• Appropriate siting of above ground infrastructure to consider viewpoints
Noise and Vibration	• Noise and vibration impact to humans from construction plant, vehicles or vessels	• Construction methods selected to reduce noise and vibration
Traffic and Transport	• Reduction in road safety	• Select route to avoid heavily congested areas / roads
Water Resources and Flood Risk	• Changes to the geomorphology of surface watercourses and surface waters	• Sustainable drainage approaches
Benthic and Intertidal Ecology	• Habitat loss / physical disturbance • Re-mobilisation of contaminated sediments • Increased turbidity and smothering	• Route / outfall selection to avoid sensitive habitats
Coastal and Marine Processes	• Changes in sediment transport and morphology	• Design of outfalls / intakes to minimise permanent changes to coastal processes
Commercial Fisheries	• Changes in existing fishing patterns	• Construction activities will be confined to minimum areas required for the works
Fish and Shellfish Ecology	• Habitat loss / disturbance or entrainment of species	• Appropriate design of screens on intake pipes
Marine Mammals	• Changes in water quality	• Species and habitat surveys undertaken pre, during and post construction
Marine Water Quality	• Deterioration in water quality	• Design measures to mitigate the risk of adverse effects on aquatic flora and fauna

EIA Impact	Example potential impact	Example potential embedded mitigation measures
Ornithology	• Disturbance and displacement (e.g., noise, light and human activity)	• Surveys, sensitive location of infrastructure and construction compounds
Shipping and Navigation	• Increased risk to navigational safety due to the presence of construction vessels	• Navigational Risk Assessment completed to inform necessary mitigation
Carbon and GHG	• Embodied GHGs within construction materials	• Include the use of energy efficient materials

3.5.6 In-combination Effects

In-combination effects were only identified across two of the zones considered (Solent Maritime SAC and Solent and Southampton Water SPA and Ramsar), caused primarily due to run-off from pipeline construction and rejected water during asset operations. Further in-combination effects cannot be ruled out at this stage as there are further investigations planned following the Interim Update.

3.5.7 Water Framework Directive (WFD)

Assessment of WFD impacts has continued since Gate 1. The outline WFD compliance assessment concluded that the proposed activities will not result in changes to the hydromorphology, biology, physico-chemistry and chemistry of surface waters or the quantity and quality of groundwaters that are sufficient to result in deterioration in the status of any quality elements.

Furthermore, the proposals would not prevent the implementation, or counteract the effects of, any mitigation measures identified in the River Basins Management Plan (RBMP) or adversely affect water-related Protected Areas. This means that these activities are unlikely to result in deterioration of the water body status or prevent WFD objectives being achieved in relevant water body in the future. Further detail related to the WFD is included in Section 2.5.4.4 of Annex 1 Desalination.

3.5.8 Biodiversity Net Gain and Natural Capital

Biodiversity Net Gain (BNG) and Natural Capital evaluations completed for options A.1 and A.2 have followed methodology guidance set by the All Company Working Group (ACWG), with the outputs of assessments being consistent with the requirements set by WRSE Regional Plan Environmental Assessment Methodology Guidance, as well as the Water Resource Planning Guidance (WRPG) for Water Resources Management Plan 2024 (WRMP24) and UK Water Industry Research (UKWIR) Environmental Assessment Guidance.

The BNG assessment 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. A summary of these results is included in Table 5, further details of the assessment methodologies utilised are provided in Section 2.5.1.3.5 of Annex 1 Desalination.

Table 5 – Detailed Quantified Biodiversity and Natural Capital Net Gain – Desalination

Assessment	Metric	Desalination Plant and pipeline to Testwood WSW
Biodiversity	Temporary habitat loss	[redacted]
	Total permanent habitat loss	[redacted]
	Total Offset habitat BNG / uplift	[redacted]
Climate Regulation	Total non-traded carbon	[redacted]
Natural Hazard Regulation	Change in Natural Hazard regulation	[redacted]
Recreation and tourism	Estimated Welfare Value	[redacted]
	Estimate Visitor Investment	[redacted]

Assessment	Metric	Desalination Plant and pipeline to Testwood WSW
Agriculture	Temporary loss estimated agricultural value	[redacted]
	Permanent loss estimated agricultural value	[redacted]

Analysis completed in the lead up to Gate 2 has indicated that the Desalination-based Options are expected to cause environmental impact across all key assessment areas. This is primarily driven from the desalination plant and pipeline to Testwood WSW, with there being limited impact from the marine intake and outfall component of the option. There appears limited opportunity for environmental net gain on site and opportunities to offset impacts expected over the project lifespan of the desalination component on site. Further detail of the BNG analysis is provided in Section 2.5.1.3.4 of Annex 1 Desalination.

3.5.9 Strategic Environmental Assessment (SEA)

The SEA Screening Assessment undertaken for Option A.1 at Gate 1 has been updated to reflect changes in the conceptual design and potential pipeline routes.

The SEA 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 2.5.1.3.7 of Annex 1 Desalination, with the key steps illustrated in Figure 4.

Figure 4 – SEA stages

Further detail on the assessment process and results is included in Section 2.5.1.3.7 of Annex 1 Desalination.

3.5.9.1 Summary of Effects

Adverse effects

The abstraction and discharge have the potential for major adverse effects from direct and indirect changes in habitat condition for qualifying features of Solent Maritime SAC, Solent and Dorset SPA and Ramsar and Solent and Southampton Water SPA and Ramsar. Both pipeline options have the potential for major adverse effects to the qualifying features of the New Forest SAC, SPA and Ramsar due to habitat loss, air quality and noise.

The desalination plant and both pipeline options have the potential for major adverse effects from the use of resources and due to the long-term energy requirement and associated emissions for the desalination plant.

The desalination plant has the potential for major adverse landscape and visual impacts to the to the New Forest National Park. The pipeline options will have short term major adverse impacts until vegetation / screening has established as they are partially located within and will be visible from the New Forest National Park. The potential for the infrastructure associated with the waste stream to have major adverse effects on landscape and visual cannot be ruled out at this stage.

Beneficial effects

This SRO would have beneficial effects to population and human heath, material assets and resources, water and air and climate relating to the provision of a large potable water supply which would lessen the pressure on other sources during severe drought conditions, the minimisation of the

risks associated with unsustainable abstraction of groundwater and fresh surface waters and reducing the vulnerability to risks (drought) associated with climate change effects.

Cumulative effects

The intake and offtake structures have the potential for adverse cumulative effects to migratory salmon features of the River Avon SAC, River Itchen SAC and River Meon (Compensatory habitat) and changes in water quality and prey resource to Solent and Dorset Coast SPA, Solent Maritime SAC and Solent and Southampton water SPA and Ramsar in combination with the AQUIND Interconnector project.

Cumulative adverse effects could occur to population and human health (recreation) if this SRO is constructed after [redacted] is constructed.

Cumulative adverse effects could occur to landscape (from the combined presence of new development and the desalination plant), recreation and land use and from the presence of both Fawley Waterside and this SRO.

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.

To support the Gate 2 submission, carbon costs have been estimated, and are summarised in Table 6. The table summarises the capital carbon, operational carbon (associated with chemical use, power and transport), whole life carbon (includes capital maintenance in addition to operational carbon over 100 years) and the non-discounted monetised cost of carbon for A.1 and A.2.

Table 6 – Carbon calculation summary

Operating regime	Flow (Ml/d)	Capital carbon (tco^2e)	Operational carbon (tco^2e)	Whole life carbon (tco^2e)	Monetised whole life carbon (£m)
A1					
MAX (DO)	75	165,000	26,800	2,115,000	558
MIN	15	165,000	5,200	733,000	177
AVERAGE	15.6	165,000	5,400	746,000	181
A2					
MAX (DO)	61	118,000	21,800	1,679,000	445
MIN	15	118,000	5,200	612,000	151
AVERAGE	15.46	118,000	5,300	623,000	154

Based on the above, 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 biodiversity net gain, 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 can be designed with greater confidence. Further detail is provided throughout Section 2.5 of Annex 1 Desalination.

3.6 Site Selection, Option Configuration and Consenting Evaluation

3.6.1 Site Selection

Drawing on the results of the environmental surveys described above, and following the methodology set out at Gate 1 (subject to modifications in light of new information and stakeholder feedback), the site locations and option configurations were selected, representing the most appropriate available location for the desalination plant and its marine and terrestrial components.

3.6.2 Option Configuration

As detailed in Section 0, Option A.1 is the Base Case identified in WRMP19 and Option A.2 is a consistent option with the key differentiator being the varied DO.

Since Gate 1, a structured site selection and transfer pipe route selection process has been undertaken, to determine if there are suitable alternative sites, as explained in Section 2.4 of Annex 1 Desalination. This analysis validated that the Ashlett's Creek site is the most suitable relative to the alternatives considered. Further detail is provided in Section 2.1.3 of Annex 1 Desalination.

3.6.3 Consenting Evaluation

SW has included the Base Case in a detailed consenting evaluation, as part of the overall OAP. This evaluation concluded that the proposed desalination plant site at Ashlett's Creek, or any other location nearby is not considered likely to be consentable at this time. Due to Ashlett's Creek being identified as the site expected to cause the least environmental impact relative to the alternative sites considered, it is also expected that the alternative sites considered would not be expected to achieve the necessary consents. This is a key driver for pausing the development of the Desalination-based Options, at this time, as outlined in Section 0.

3.7 Wider Benefits Assessment

The Desalination-based Options provide significant wider network resilience benefits in the Hampshire region. The opportunity for social and environmental benefits under the Desalination-based Options is limited. The wider benefits assessment, along with the results from the various environmental assessments completed, detailed in Section 0, are key inputs into identifying the option that provides the best value. The key inputs of benefits are detailed in this section, while how these lead into the options appraisal, to inform best value is detailed in Section 3.8.5.

3.7.1 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 (Stressed) 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.

The assessment has been completed using the documented Resilience Assessment Procedure and a Resilience Assessment tool. SW's approach uses the key elements of SW's established resilience framework as a basis for applying a systems-based methodology to assess against the Cabinet Office's '4Rs of Resilience' – resistance, reliability, redundancy and response / recovery. A summary of the resilience impact assessment is provided in Table 7, with further detail on the assessment criteria (which reflects RAPID resilience criteria and the WRSE guidance) is provided in Section 4 of Annex 1 Desalination.

Table 7 – Desalination-based Options A.1 and A.2 resilience impact

Resilience Criteria	Assessment
Integration with existing network strengthening solutions / plans	The addition of the SROs reduces the risk of service loss by over 100,000 properties. This means over 100,000 fewer properties are at risk of losing supply in a BAU situation due to the resilience benefit provided by the SROs. This increase in resilience is generated by the increase capacity to treat water from new sources. This means there is sufficient headroom to maintain supply in the event of failure at Otterbourne or Testwood regardless of which Desalination-based Option is chosen.
Adaptability of operation / emergency response in a stressed situation (e.g., peak week demand)	Approximately 4,000 more properties are at risk of supply loss in a stressed (drought) scenario compared to BAU conditions where there is a desalination plant in operation. This is because the desalination plant can supply up to 75 Ml/d of water, whilst Otterbourne produces the 21 Ml/d expected in peak drought conditions. As the desalination plant operates agnostically to Testwood or Otterbourne any headroom in processing ability can also be utilised at these WSW in the event of raw water loss not caused by drought. The operating flow envisioned for the desalination is for the plant to always operate with a minimum flow of 15 Ml/d, increasing as required to meet demand needs. A key driver for this is giving the plant greater ability to ramp up supply relatively quickly and avoid substantial delays in meeting supply demands in the event of an emergency reducing supply from another part of the network.
Regional resilience	The resilience score is increased significantly by the addition of a desalination plant in both stressed and BAU conditions. The reliability of the network is greatly improved as fewer properties would be vulnerable to supply loss in both a 1-in-200-year drought, or the failure of Testwood or Otterbourne.

It is important to note that the SW approach to resilience is developed and evaluated on the basis of assessing the resilience of the overall system, rather than simply the resilience of each individual asset or SRO. Resilience of each individual asset or SRO is done via analysing the resilience contribution of each asset or SRO to the overall system. The full results of the assessment are provided in Section 4 of Annex 1 Desalination.

3.7.2 Value for Customers and Environment

As part of the OAP, all the SROs have been assessed under the Multi-Criteria Decision Analysis (MCDA) framework to identity the most preferrable option. 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 OAP is detailed in Section 3.8.5 and Interim Update – Options Appraisal.

3.7.3 Social and Environmental Benefits

Desalination-based Options provide limited opportunity for social and environmental benefits. As indicated as part of the environmental assessments in Section 0, Desalination-based Options are expected to cause negative BNG and high-level SEA results where beneficial impacts are largely restricted to resilience benefits (detailed further in Section 3.7.1). Opportunities for amenity benefit are also limited and not expected to be delivered by ether of the two Desalination-based Options considered.

3.8 Solution Costs

3.8.1 Overall Costs of the Solution - Construction and Operation

Refined cost estimates for options A.1 and A.2 are detailed in Table 8. Detailed information is provided in Section 2.10 of Annex 1 Desalination. 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 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 0.

Table 8 – Summary of costs: Desalination-based Options (2017-18 prices)

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
Gate 2: Option A.1					
Max (DO)	75	745	22.5	1,319	2.09
Min	15	745	7.7	979	1.55
Average	15.6	745	7.9	983	1.56
Gate 1	75	802	10.1	1,165	3.89
Gate 2: Option A.2					
Max (DO)	61	745	19.0	1,239	2.41
Min	15	745	7.7	979	1.91
Average	15.46	745	7.9	982	1.91
Gate 1	61	759	10.0	964	3.84

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.

3.8.2 Detail of Expenditure

CAPEX expenditure is summarised in Table 9. Given minimal economies of scale identified in the SROs, CAPEX costing for Option A.2 was extrapolated from the A.1 estimates. Further breakdown and the process undertaken to prepare CAPEX estimates is set out in Section 2.10.4 of Annex 1 Desalination.

Table 9 – CAPEX summary: Desalination-based Options

Cost item	Options A.1 and A.2 (£m)
Infra total	101.6
Non-infra total	190.1
Net direct costs (including uncertainty)	306.3
SW Contractor Indirects	107.2
Contractor Total (Excluding Risk)	413.6
Additional Project Costs	41.2
SW Client Indirects	42.3
CAPEX Sub total	**497.0**
Risk (from developed risk registers)	152.1
Optimism Bias	161.0
Option Project Cost (Subject to ACCE range)	**810.0**
Indexation to 17/18 using RPI @ -8.804%	744.5

As detailed in Table 9, OPEX estimated have been produce for three operating regimes. These operating regimes are consistent with those detailed in Section 2.2 of Annex 1 Desalination.

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 cost 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.

- 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).

3.8.3 Optimism Bias (OB)

In estimating the 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. Project Type and OB percentages selected are detailed further in Section 2.10.6 of Annex 1 Desalination, with the changes in Optimism Bias from Gate 1 outlined Table 10 – Optimism bias at Gate 1 (Q3 2020 values) versus Gate 2 (Q2 2021 values)

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Table 10 – 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 Combined Upper Bound OB Percentage	Gate 2 Adjusted OB Percentage	Gate 2 Risk Adjusted OB Percentage	Gate 2 Risk Adjusted OB Value
A.1	40.3%	£203 m	66%	42.7%	32.4%	£160 m
A.2	40.3%	£203 m	66%	42.7%	32.4%	£160 m

OB accounts for 24% of the total CAPEX cost for both options A.1 and A.2. 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.

Whilst the Greenbrook recommends applying OB 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.

3.8.4 Assumptions and Exclusions

A detailed list of the assumptions and exclusions in deriving estimated costs is included in Section 2.10.7 of Annex 1 Desalination. In summary, the assumptions are as detailed below:

- The estimates of cost, NPV and AIC were prepared in line with relevant guidance requirements and methodologies, including WRSE guidance where appropriate.
- As the option 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 alternatives options 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 options. Any changes to estimated options would require a reassessment of the estimate and confidence level.
- For consistency with the Price Review 2019 (PR19) submission all costs have been indexed to average 2017 / 18 in line with the approach taken at Gate 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 (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 (Office for Budget Responsibility (OBR)). This provides an indexation from current Q2'2021 back to 2017 / 18 of –8.084%.

- Material prices are based on current 2021 market rates adjusted to PR19 17 / 18 utilising RPI data and CPIH data and while current price volatility is included within risk allowances no allowance has been made for future fluctuations in supply costs.

3.8.5 Comparison of Solution Costs and Benefits

A detailed economic analysis, comprising of MCDA and CBA, where criteria could be valued quantitatively, was undertaken to determine and assess the costs and benefits of each option, and support in identifying the most preferable option. This analysis considered 23 criteria across Net Social Impact and Cost categories. The criteria structure utilised is detailed in Table 11.

Table 11 – 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 criterion from 100 – most preferable, to 0 – lowest ranking, during both '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 Desalination-based Options are detailed in Table 12Table 12, with further detail on the approach utilised, criteria, and the results of the Economic Appraisal included throughout the Interim Update – Option Appraisal.

Table 12 – 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

Based upon the Economic Appraisal outcome, detailed in Table 12, the Desalination-based Options provide less value than the other four options considered.

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 Interim Update – Option Appraisal and have informed the overall recommendation regarding steps of further option development post Gate 2, detailed in Section **Error! Reference source not found.**. The OAP considered the Economic A ppraisal, Consenting Evaluation, alignment to Legal and Policy Obligations and Strategic Objectives, in a structured process aligned to industry accepted practice and government guidance, such as HM treasury Greenbook. This process identified that desalination is least preferable of the options considered based upon the information available at this time.

The interaction of this option with other proposed water resources solutions would be considered through WRSE and WRMP24 modelling. However, as this solution is operating through the RAPID accelerated gated process, and the other solutions are not, there is limited information on the interactions between solutions at this stage. WRSE is currently developing its all model and have provided some initial results. SW will continue to engage with WRSE throughout the process.

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 option to support the WfLH programme providing sufficient water supplies during a severe drought event by 2027. For the Desalination-based Options, the overview delivery schedule is illustrated in Figure 5, 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 Annex 1 Desalination.

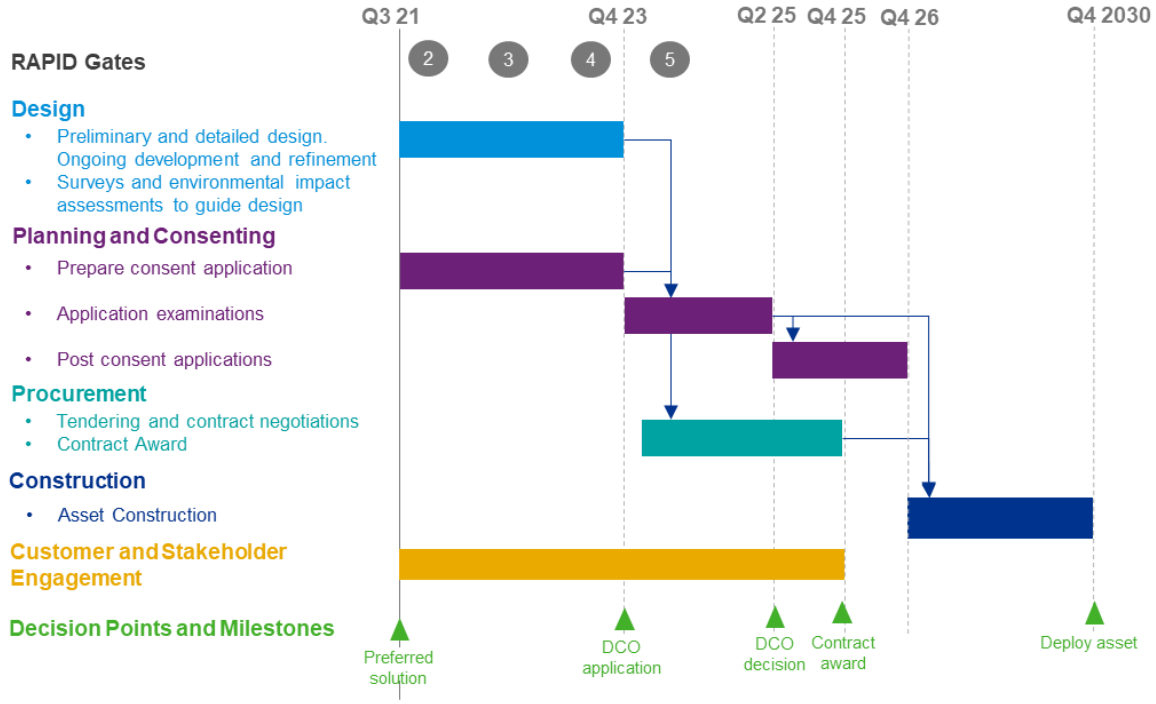

Figure 5 – High-level delivery schedule – Desalination

Key milestones of the project, for options A.1 and A.2, are detailed in Table 13 with key regulatory milestones, including Ofwat Direct Procurement for Customers (DPC) control points and upcoming RAPID gates in Table 14. The two Desalination-based Options have the same timeline for delivery.

Table 13 – Delivery milestones

Milestone	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 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 14 – Regulatory Milestones

Ofwat Control Points	Submission	Decision	RAPID Gates	Submission	Decision
A	26-Nov-21	09-Dec-21	Gate 1	Complete	Complete
B	31-Jan-22	28-Mar-22	Gate 2	27-Sep-21	27-Jan-22
C	29-Jan-24	25-Mar-24	Gate 3	17-Jun-22	12-Sep-22
D	29-Apr-24	29-May-24	Gate 4	17-Apr-23	12-Jul-23
E	16-Oct-24	11-Dec-24	Gate 5	10-Sep-24	03-Dec-24
F	22-Jan-27	19-Mar-27			

Although the timeline has been developed an ABE basis, completion and asset operation would 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 our work indicates that project completion would be post the s20 date.

4.1.2 Assumptions and Dependencies

The key assumptions underpinning the schedule are summarised below, with a more comprehensive list of included, with a description of their impact on delivery, in Section 2.9 of Annex 1 Desalination. The key assumptions and dependencies include, but are not limited to, the following:

- Both A.1 and A.2 are delivered through a DCO consenting route rather than Town and Country Planning. The critical path mostly comprises activities required for the DCO submission.
- DCO consent is provided before contract award.
- DPC is the preferred procurement route with one DPC contract issued containing all elements of work.
- Landowners give SW timely access for surveys.
- DWI approves use of recommended RO membranes via approved laboratory testing.
- Feasibility design for non-statutory consultation is of sufficient quality and depth to meet Ofwat control point E requirements.

4.1.3 Missing Information

At this stage, project schedule development has concentrated on pre-construction activities, such as design, site and environmental surveys, consenting, procurement and stakeholder engagement. The construction schedule would be developed in consultation with the Competitively Appointed Provider (CAP), once further detail on project delivery is available, considering items such as costs, design and consent conditions. There is no outstanding information that would be expected at the strategic outline case of a major project's development.

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 both Desalination-based Options[6], based on factors including the need for the scheme and benefit of timely delivery, the scale and significance of the scheme, its complex terrestrial and marine interfaces and various consents required, and likely significant impacts across a 'larger than local' area.

[6] Works in the marine environment can be included (on a 'deemed' basis) within a DCO.

The use of the DCO planning process is limited to projects that are defined as National Significant Infrastructure Projects (NSIP) under section 14 of the Planning Act 2008. The Desalination-based Options do not automatically qualify as NSIP because their DO falls short of the 80 Ml/d qualifying threshold. Therefore, to proceed under the DCO consenting route, a Section 35 (s35) direction from Secretary of State for Environment, Food and Rural Affairs is required. The key steps in the DCO process, including the request for a s35 Direction, are set out in Section 2.6 of Annex 1 Desalination.

SW has engaged with Department for Environment Food & Rural Affairs (Defra) on the scope of a s.35 request and the programme for these options anticipate that it would be necessary to make an application to Defra shortly after the Gate 2 submission, should desalination be confirmed as the preferred option.

If a request for a s.35 Direction were made and were to be unsuccessful, the TCPA planning route would be used. SW have identified a range of secondary consents that would be required if the TCPA route is used.

4.2.2 Pre-planning Application Activity Plan

4.2.2.1 Land referencing and surveys

SW has carried out land referencing for the selected preferred desalination plant site and has begun work on land referencing pipeline routes (although routes are subject to further refinement). Landowners with registered interests in the land have been identified and contacted. Where land is unregistered, site notices have been posted requesting those with land interests to make contact. Crown land and 'special' interests in or categories of land under s127 to s132 of the Planning Act 2008 have been identified.

4.2.2.2 Environment

As part of the DCO process, SW would need to submit an EIA. The EIA would be supported by further assessments (e.g., HRA, WFD compliance assessment). Further detail is provided in Section 2.5 of Annex 1 Desalination.

SW would also obtain the relevant environmental permits for the activities relating to the marine environments for example for new water discharges or for treatment or storage of waste. Section 2.6.9 of Annex 1 Desalination lists the possible secondary licences and consents, with associated timescales and consenting bodies to ensure timely application.

4.2.2.3 Stakeholder engagement

SW's overall approach to pre-application engagement for the Base Case and alternative options comprises different 'Stages' of engagement, including specific public consultation exercises, which SW will follow to submission of a future application for consent.

In accordance with this approach, a non-statutory consultation exercise was undertaken between February and April 2021. Beyond Gate 2, engagement will continue with key stakeholders as SW progresses the pre-application activities for the preferred option.

4.2.2.4 Key Planning Steps and Risks

The key planning steps after Gate 2 are listed below and detailed further through the schedule, included in Section 0 and Section 2.9 of Annex 1 Desalination:

- Submitting s.35 request to Defra
- Submitting a Scoping Request to the Planning Inspectorate following any s.35 Direction from the Secretary of State
- Commencing early environmental and other impact assessment activities
- Preparing for further public consultation
- Stakeholder, community and landowner engagement

Although DCO has been identified as the preferred planning route, SW is considering the potential of the TCPA consenting route should the DCO consenting regime be deemed to not be viable at a later stage. The main planning risks are summarised in Table 15.

Table 15 – Main planning risks and mitigations

Risk	Risk Description	Risk Mitigation
s35 Direction (aligned to risk ID Prog-R22. See Section 4.3)	SW's preference to utilise the DCO consenting regime cannot be realised because the SRO is below the NSIP thresholds, and a s 35 direction is not given to bring the SRO into the DCO regime.	Continue close engagement with Defra, RAPID, legal and consenting advisors to understand if level of risk requires contingency planning for a TCPA consenting process.
s35 Delay (aligned to risk ID Prog-R22. See Section 4.3)	Progress of the SRO through the DCO consenting route is frustrated because there is delay in obtaining a timely s 35 Direction.	As above. Ensure stakeholder awareness of consenting activities that affect critical path.
TCPA route (aligned to risk ID Prog-R22. See Section 4.3)	Using the TCPA consenting route (if required) unacceptably extends the consenting period compared to a DCO route, particularly if a planning appeal and compulsory land purchase is required, as well as the multiple other consents required in addition to planning.	Ongoing review of consenting route and risks, including contingency planning for a TCPA consenting process. Ensure stakeholder awareness of consenting timescales.
DCO non-acceptance	Any DCO application for the SRO is not accepted by PINS due to inadequate consultation & engagement.	Adopt robust consultation and engagement strategies to meet DCO requirements & expectations.
DCO refused	The DCO application is refused because the site and scheme selection process is not sufficiently robust.	Undertake rigorous planning evaluation to determine consentability of Base Case and alternatives taking into account key legislative and policy requirements.
Resourcing (aligned to risk ID Prog-83. See Section 4.3)	SRO delivery is delayed because the consenting schedule cannot be achieved due to an unrealistic programme and/or resourcing constraints (e.g., external bodies delay handling of consenting requirements or assurances)	Ongoing review of consenting schedule and resourcing requirements to achieve schedule
Alternatives (aligned to risk ID 710059-089. See Section 4.3)	Desalination is not considered to be consentable if other less environmentally damaging alternative solutions are available to meet the WRMP19 need.	Apply a rigorous planning evaluation as part of site/scheme selection to test the consentability of both Base Case and alternatives.
Desalination technology (aligned to risk ID 710059-008 and 710059-009. Section 4.3)	The planning process and delivery of the Base Case is subject to delay and challenge given the significant level of opposition to desalination technology at this location.	Continue to engage stakeholders on the programme and need case. Undertake rigorous planning evaluation to determine consentability of Base Case and alternatives.
Water Resources NPS	National Policy Cover for the Base Case SRO is weakened because the draft NPS is not progressed to adoption.	Engage with Defra to understand timescales for NPS adoption.

4.3 Key Risks and Mitigations Measures

SW has used a consistent approach to identifying and managing assumptions, risks and opportunities across all solutions. This was set out in SW's Gate 1 submission, "Annex 14.0 Risk Report Guidance".[7] 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 the WfLH Programme. At Gate 2 the registers for assumptions, risks and opportunities have been updated for each option. The key assumptions, risks and opportunities are detailed in Section 2.7 of Annex 1 Desalination, with risks rated as 'high' presented in Table 16. There were no 'high' scoring assumptions, therefore these have not been included in this section.

[7] Approach and outputs consistent with quarterly dashboards.

Risks are scored on a range from 1-25. All threats scored as high have a residual risk score of 19 or more, with the scoring system summaries in

Figure 6.

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 6 – WfLH Programme Probability Impact System

In order that consideration is given to the effect of each action on the Residual Risk Score (the score associated with the risk following the assumed completion of the listed actions), the following approach is undertaken. Following the identification of each action, discussion takes place between the Programme Risk Manager, Risk Owner and Action Owner to understand whether the identified action:

- Influences the current probability of the risk (proactive action)
- Influences one or more of the current risk impacts (reactive action)
- Influences both the current probability and one or more of the current risk impacts (combined action)
- Is a necessary step in developing an action aimed at tackling one of the above

Once the outcome of this discussion has been determined, the extent of the influence on either the probability or impact is agreed and this extent is applied to the appropriate Residual Risk Score input(s), thus updating the Residual Risk Score. This approach is applied to all actions upon their identification in order to ensure an ongoing link between the identified actions and the Residual Risk Score.

It is important to note that the mitigation actions identified at this stage primarily relate to the near-term realistic approach that can be taken (rather than a long-term aspirational approach) in order to commence and develop mitigation of the risk. This reinforces the reason why, in some cases, there is currently no difference between the Current and Residual Risk Score recorded.

Table 16 – Key risks

Risk ID	Risk Description	Risk Category	Current Score	Mitigation Strategy	Residual Score
Costs and benefits					
710059-004	There is a risk that compensatory habitats are however required in relation to the Desalination Scheme, resulting in additional costs and potential delays depending on the habitat required.	Environment	24	Continue to develop HRA Assessments with a specialist consultant to understand the extent to which habitat compensation will be required and factor into cost estimate and delivery schedule.	19
710059-049	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. Therefore, there is a risk that the costs associated with these items are significantly higher than assumed within the cost estimate rates, leading to an increase in the cost of the non-Infrastructure element of the cost estimate (cost increases around pipe materials previously accounted for).	Budget	23	Continue to monitor material volatility as the estimate is revised throughout the lifecycle. Adjust the base estimate and risk profile accordingly as further information is received. Explore alternative procurement approaches to procure materials in advance of contract award and free issue to mitigate against rising costs.	21
Potential regulatory barriers					
710059-008	Owing to the need to gain approval from a number of stakeholders (ABP Southampton, MMO, EA and NE) and therefore the limitations on the number of viable locations, there is a risk that SW are unable to agree on a suitable location of the Intake structure (incorporating all construction and operation approvals) within The Solent within the required timescales, leading to programme delays as the necessary permits and approvals are obtained.	Stakeholders	25	Prepare collaborative mitigation plans with ABP Southampton, MMO, EA and NE to address their concerns following the site selection process and further design development. Issue technical notes to the regulator relating to HRA consenting risks including a detailed assessment of the Intake structure and how it could affect the marine park. Await feedback from the EA on the survey protocol issued. Schedule in surveys once agreement has been reached on survey protocol.	24
710059-009	Owing to the need to gain approval from a number of stakeholders (ABP Southampton, MMO, EA and NE) and therefore the limitations on the number of viable locations, there is a risk that SW are unable to agree on a suitable location of the Outfall structure (incorporating all construction and operation approvals) within The Solent within the required timescales, leading to programme delays as the necessary permits and approvals are obtained.	Stakeholders	24	Prepare collaborative mitigation plans with ABP Southampton, MMO, EA and NE to address their concerns following the site selection process and further design development. Continue talks with [redacted] over the potential reuse of an existing outfall structure. Await feedback from EA, NE and MMO on dispersal modelling undertaken and arrange for further hydrodynamic modelling with EA but awaiting their agreement on the scope. Issue technical notes to the regulator relating to HRA consenting risks including a detailed assessment of the Outfall structure and how it could affect the marine park. Await feedback from the EA on the survey protocol issued. Schedule in surveys once agreement has been reached on survey protocol.	22
Programmes of work					

Risk ID	Risk Description	Risk Category	Current Score	Mitigation Strategy	Residual Score
710059-089	Owing to the conditions as detailed within the Habitats Directive, there is a risk that Desalination proves not consentable as it is deemed that other less environmentally damaging alternative solutions are available to meeting the need as contained within WRMP19, leading to an alternative SRO being taken forward.	Planning	24	Work closely with NE and EA as the scheme is developed in order to identify and then mitigate any environmental concerns raised. Ensure that HRA development is undertaken at each Gate which takes consideration of the Habitats Directive.	22
710059-091	Owing to the benefits of being able to apply for a number of consents through a DCO application, this is viewed as the preferred planning route by SW. However, owing to the current uncertainty around the size of the preferred solution, there is a risk that a direction under s35 of the Planning Act 2008 might not be made to enable the preferred solution to progress via the DCO consenting process, leading to SW having to utilise the Town and Country Planning process instead.	Planning	24	Prepare and submit a robust and well-reasoned request for s35 direction to the Secretary of State, taking into account any comments resulting from any Defra engagement. Owing to Defra stating that they will not provide review of any draft Section 35 documentation prior to Gate 2, ensure Pinsent Masons provide all necessary advice and support around the s35 process prior to submittal in November 2021. Agree on final size for Base Case / Strategic Alternative to take through Gate 2 and into design.	22
Prog-R56	Owing to a number of currently identified risk events, there is a risk that delivery of the chosen SRO is not achieved in accordance with the obligations under the s20 agreement, including timescales, leading to potential legal enforcement and significant reputational damage. Drivers include outfall construction and wet commissioning timescales, environmental survey timescales, durations associated with the DCO application preparation and determination, stakeholder consultation timescales, and timescales around the DPC procurement strategy.	Timetable	25	Following finalisation of the P6 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 s20 date.	24

5 Procurement, Ownership and Operation

5.1 Procurement Strategy

SW continues to refine the procurement and commercial strategy to support the delivery of the desalination solution. For clarity, consistent procurement strategy has been developed for the Desalination-based Options. Since Gate 1 submission, SW further developed the following areas:

- DPC eligibility assessment
- Tender model
- Commercial model

The outline DPC procurement timeline is illustrated in Figure 7.

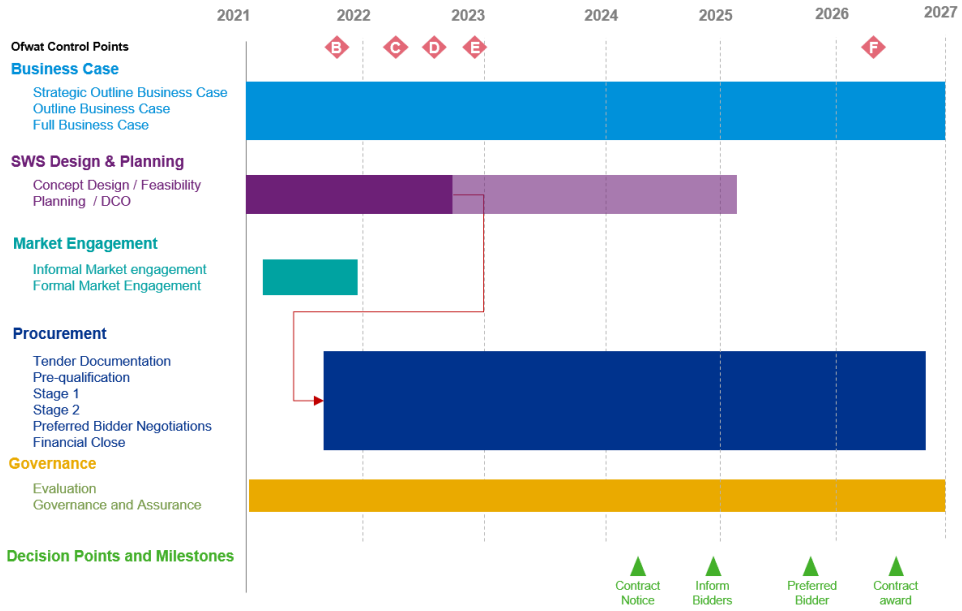

Figure 7 – Outline DPC timetable

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[8], taking into account project scope developments and feedback from market engagement earlier in 2021. 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 of Annex 1 Desalination.

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

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, but are not limited to, the following:

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

- **Discreetness** criteria. Gate 2 assessment flagged that the solution did not meet some aspects of this criteria. Specifically, stakeholder interactions and statutory obligations (e.g., DWI's 'water wholesomeness' concerns and the need for EA discharge licences for the desalination brine by-product cannot be considered solely the responsibility of the CAP). Considerations where the Gate 2 assessment was somewhat more suitable for DPC included Interoperability considerations; output type and stability; and asset and operational service issues.
- **VfM.** The current VfM assessment is based on Ofwat's *standard* assumptions set out in the 2017 guidance. The cost to customers in NPV terms of A.1 under the factual scenario (DPC) is £504m compared with £609m under the counterfactual. The difference in the costs to customers is £104m 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 (£52m) and the benefits from CAPEX efficiency (£58m). 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.
- **VfM.** The current VfM assessment is based on Ofwat's *standard* assumptions set out in the 2017 guidance. The cost to customers in NPV terms of A.1 under the factual scenario (DPC) is £504 m compared with £609 m under the counterfactual. The difference in the costs to customers is £104.4 m 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 (£52 m) and the benefits from CAPEX efficiency (£58 m). 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.

Key dependencies

- **Licencing and DCO uncertainty.** The desalination *membrane technology* is not currently licenced by the DWI. While SW does not anticipate licencing to be problematic from a technical perspective, the potential timescales and associated costs could pose a difficulty in relation to CAP procurement. The *DCO process* will run in tandem with the procurement and is subject to a degree of uncertainty and delays, as outlined in the delivery schedules, included in Section 2.9 of Annex 1 Desalination. While SW aims to conclude the licencing and achieve DCO approval prior to contract award, the combination of these factors 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.

5.1.2 Tender Model

Four tender DPC 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 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[9]. Further detail on tender selection and proposed tender process is in Section 2.11 of Annex 1 Desalination".

Key justifications for the selection of late model with early market engagement are:

- Time savings, supporting early asset delivery
- Likelihood of keen design and build competition from international contractors
- Transparency of risk allocation between CAP and SW with fewer interfaces between them and
- Preference expressed by potential bidders in the early market engagement

[9] 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.

5.1.3 Assessment of Alternative Procurement Routes

Further consideration has been given to procurement routes other than 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.

SW considered the applicability of four other procurement routes from with the current SW delivery model, as detailed below:

- AMP7 frameworks with SW's three delivery partners, with a specific focus on larger projects and programmes.
- A Low Complexity Delivery Route (LCDR) which sits outside of the more complex delivery partner contract route, providing additional supply chain capability and capacity to complement the existing supply chain partners and reducing the overheads on smaller-value infrastructure and non-infrastructure projects whilst also creating resilience and commercial competition.
- The S&I framework (see the Key pre-DPC activities to implement the preferred tender model and commercial model sub-section later in this section for more information).
- The AMP7 Strategic Solutions Partner (SSP) framework, which provides project management and Project Management Office (PMO) support, in addition to engineering and technical solutions.

These frameworks are reliant on the D&B delivery model. Through the high-level consideration it was identified that SW's framework agreement may not be suitable for a project of this scale and complexity. Due to this, if SW were to progress with an 'in-house' delivery model, then SW would most likely need to conduct a new published procurement process to appoint a provider for the design and construction of the works.

SW's analysis of procurement routes has shown that large-scale design and build procurement models typically include ECI to provide safeguards, optimising the risk balance and provide SW with a more cost efficiency, predictable contract values and delivery timescales. The nature of risks identified for this project further assert the benefit of ECI.

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 Annex 1 Desalination. Confirmation of the procurement method to be utilised will 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 Operational Model

5.2.1 Asset Utilisation

During normal daily operation the asset will operate on a minimum flow of 15 Ml/d. As drought severity increases the asset will be called upon to output increased volumes, with the desalination plant 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 plant will operate above minimum flow for 16 days in a 365-day period, and in a 1-in-200-year drought the plant will be operating at or near its full capacity for 49 days in a 365-day period. The plant will need to be available with reasonable response time in the event of an incident or if required for emergency use.

Table 17The forecast production requirements of the desalination plant, in terms of days and total water volume expected to be transferred in various drought scenarios, is detailed in Table 17.

Table 17 – Asset utilisation, Option A.1

Drought Return Period (years)	Maximum Daily Supply (Ml/d)	Annual Days Operation (above sweetening 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**[10]	**49**	**6275**

5.2.2 Commercial Model

The commercial model builds on the work carried out as part of the Gate 1 submission.

It covers key contractual principles and main categories of risk allocation, both of which have been tested with potential DPC market participants. They were engaged on the nature of the solutions under consideration, the indicative tender timeline and tender model, in addition to 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. The DPC model, at this stage, based upon the information available and will be regularly updated and refined as more detailed information becomes available during project delivery.

At this stage it is assumed that the asset will be owned and operated by the CAP. This is typically ownership and operation arrangement for the projects delivered by DPC procurement. Ownership and operation models will be considered in greater detail at a later stage of the project once there is sufficient technical detail of design and other regimes, which will be developed further through more detail stages of the design process. This underpinning information is required before the ownership and operating models for the asset can be confirmed.

SW's proposed high-level commercial model is summarised in Table 18. More detail is provided in Section 2.11 of Annex 1 Desalination, including the allocation of key risks within the DPC model, as allocated between customers, CAP and SW.

Table 18 – 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 in parallel to the tender period, plus a 4-year construction period
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 Regulatory Capital Value (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

[10] 48 Ml/d rather than 51 Ml/d deficit otherwise quoted due to technical modelling outputs vs. static projections.

Area	Proposed approach
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

Since Gate 1, SW has spent close to (c. 2% above) the regulator allowance delivering activities supporting the feasibility and viability analysis of all options considered at Gate 2. The key basis for this spend is the complexity of the options considered – requiring technical expertise to support determine feasibility and viability, the accelerated Gate 2 allowance and the ABE (s20) obligations that require activities to be expedited where possible. A breakdown of the costs incurred so far in delivering the activities to Gate 2 is detailed in Table 19.

Table 19 - Gate 2 costs (17 / 18 price base, £m)

	Remediation Action Plan Response	Final determination cost allowance	Actual, accrued and forecast costs to 27 Sept 2021	Variance
Total costs	12.0	12.1	12.3	0.2 (2%)

The costs outline in Table 19 are total across the programme, i.e., consider non-Desalination-based Options, such as water recycling and Havant Thicket based options. Of these costs, some a specific to desalination, while other are common activities, across all SROs, such as programme and project management, commercial analysis and legal advice. A breakdown of the costs incurred delivering Gate 2 activities will be provided at Gate 2, for options considered at that stage – including option specific and common costs, allocating these to the individual options, where possible.

6.2 Evidence of Efficient Expenditure

Further to the spend incurred to date delivering Gate 2 activities and in line with the programme's legal obligations, some activities originally intended to be completed between gates 2 and 3 have been brought forward so that they are delivered ahead of Gate 2. These early-start Gate 3 activities have been delivered under the Gate 3 allowance, and activity costs are to be netted from the Gate 3 allowance of £27.5 m. A breakdown of the costs incurred delivering early-start Gate 3 activities will be provided as part of the Gate 3 submission, alongside the costs incurred across other options considered by SW at that stage.

In addition to this, SW have engaged [redacted] to assess the scope for benchmarking at Gate 2. [redacted] found no representative benchmarking data for water projects at this early and specific project stage. We have also not found any suitable comparator data in the public domain for projects that are in the sector, or in the same jurisdiction with the same consenting and regulatory requirements. This involved looking to other regulated sectors such as energy development and airport development consent order projects with complexity and scale. This was also found to be the case at Gate 1, where appropriate benchmarking information limited.

6.3 Forecast of Expenditure to Gate 3

SW is not forecasting further spend on the Desalination-based Options because these options are not being taking forward to Gate 3. Refer to Section 0 for further detail on the overall recommendation and key supporting evidence.

7 Stakeholder Engagement

7.1 Overview of Engagement and Key Findings

Engaging proactively and openly with regulators, stakeholders and customers is essential to the successful consenting, delivery and operation of the WfLH programme. SW is engaging with a broad range of groups across the WfLH programme, such as communities, environmental organisations and customer groups, including harder to reach customers. This is to ensure to 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 20. More information on specific engagement activities undertaken since Gate 1 is provided in the Stakeholder and Customer section of Annex 1 Desalination.

Table 20 - Overview of Engagement Undertaken, Key Findings and Resulting Action

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. As a result, there is more feedback and insights from customers and stakeholders about the Base Case, meaning there is a more developed understanding of the potential issues and impacts. Throughout all of the engagement undertaken, stakeholders, customers and consultees have noted their potential concerns and issues with desalination as a solution for SW at this location.

The most comprehensive engagement activity was the non-statutory consultation from February 8 to April 16 2021, where planning consultees for the Base Case, 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. 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 the potential impacts of the Base Case and on the different infrastructure components.

The key issues raised in response to the question at the consultation on the potential impacts of the proposed Base Case related to the environment, carbon emissions and energy, and the marine environment. The impacts of both construction and operation of traffic and transport was also a key concern raised by some respondents. The main concerns related to the potential environmental impacts, and in particular, the potential impact of releasing the brine back into the Solent, which was raised by more than one-third (35%) of respondents, including both individual responses and statutory and non-statutory group responses.

As well as the non-statutory consultation, 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, as detailed in the Interim Update documents - Options Appraisal Process and the Regulator and Other Statutory Bodies Engagement Plan.

As part of progressing the Base Case, SW is identifying and engaging with landowners who would likely be impacted by the proposals. There has also been general engagement and briefings during the non-statutory consultation with the Parish Councils in the communities likely to be impacted. 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.

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 is provided in Section 2.8 of Annex 1 Desalination, specifically at Section 2.8.3.5, regarding Primary Actions to Mitigate Customer Concerns.

Table 21 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 is provided in Section 2.8 of Annex 1 Desalination, specifically at Section 2.8.3.5, regarding Primary Actions to Mitigate Customer Concerns.

Table 21 – A snapshot of customer and stakeholder views and insights and associated actions

Stakeholder group	Key insights and feedback	Associated actions completed prior to Gate 2
Customers	Significant customer concerns on the quality of desalinated water	The chemicals used are all part of the normal treatment process for drinking water. They have all been approved for drinking water, so the action taken here will relate to future engagement planning once the solution is agreed, drawing on work with the DWI in relation to the Water Safety Plan to reassure customers of the safety of desalinated water. This will require tailored approaches to key customer groups - such as businesses reliant on water for their end product / service.
	Concerns about the environmental impacts	SW has a commitment to Net Zero through its operations by 2030. From April 2021 it is using low carbon energy to power its sites. Options were assessed against environmental criteria as part of the Options Appraisal, including the Consenting Evaluation and MCDA appraisal. Proposals for avoiding, reducing and mitigating environmental impacts will be developed as the scheme development process progresses.
Regulators	DWI broadly content with how SW is progressing the water quality concerns, including Regulation 31, operating strategy and raw 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. SW has considered a plan to ensure that Regulation 31 compliance can be maintained, ensuring that water provided to customers is considered 'wholesome' and acceptable to customers.
	More detail required in the potential environmental impact from the options	We are undertaking ongoing scheme development and assessment work to identifying and assess potential environmental impacts. So far, this work as informed the OAP and it will continue as we progress into the consenting process. The outputs of this assessment work will be shared with environmental regulators as part of the ongoing engagement.
Planning authorities	Ongoing engagement required with relevant local planning authorities	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.
Environmental Groups	Concerns relating to the environmental impact from desalination, including discharges to Solent, construction impacts, pipeline routes and visual / landscape impacts	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 – land referencing only in progress for the Base Case	Discussions around what land and property rights are required and how these will be acquired, plus potential impacts of the Base Case	Land referencing for the Base Case is in progress for the main sites and pipeline routes. As part of this, initial contact has been made with landowners to introduce the Base Case scheme, confirm their details and interests in the land and start discussions about potential property and land rights that are required. This would be ongoing on an iterative basis as the scheme development process progresses and landowners are identified.
Other water companies	Not applicable	SW engages with other water companies and keeps them up to date on its proposals as part of industry groups, such as WRSE.

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 3 of the Options Appraisal Process Annex of this Interim Update:

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 3.7.20 and 3.8.5, two specific customer focused criteria were part of the assessment – tap water quality and resilience of supply. Due to the importance of considering critical impacts on customers, 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 the Interim Update – Option Appraisal. The normalised customer criteria scores for each of the options considered in the Options Appraisal Process are detailed in Table 22.

Table 22 – 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

The alignment between the customer only MCDA scores and overall recommendations aligns with our position of ensuring that customer's views and requirements are reflected in the work undertaken and that customer preferences are reflected in the recommendations and proposed steps forward following Gate 2.

7.2 Future engagement activities planned

As detailed in sections **Error! Reference source not found.**, 0 and 0, SW is not anticipating delivering any a ctivities related to Desalination-based Options prior to Gate 2. Although no activities are expected to be completed ahead of Gate 2 within the RAPID gated process, desalination remains a potential water resource option to be considered as part of SW's long term water resources planning in the region. As a result, SW will continue to engage more generally on potential desalination-based solutions as part of its wide water resources planning obligations. We will continue to engage and consult on the remaining options, and the Selected Option following Gate 2, plus any Back-up Option. For example, the following programme wide activities will be undertaken, and these relate to both the programme as a whole and each of the options:

- **Water Futures 2030** – is our ongoing consumer group which will take over from the WfLH CAG to provide a central hub for insight. We will invite a number of members of the CAG to join and continue to use the group to inform decisions, develop engagement materials and test options within the Water for Life – Hampshire programme.
- **Water Futures 2050** – is our 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.
- **Sharing of key insight** – as we are progressing through an accelerated process, we have been at the forefront with much of our insight. All the key insight is being shared across the industry and we are developing a range of summaries materials (e.g., reports, videos, recorded podcast debriefs and infographics) to aid accessibility.
- **Stakeholder groups** - continuation of strategic regulatory engagement at various levels within organisations and the WfLH Stakeholder Group meetings.
- **Wider stakeholder engagement activities** - delineation between ongoing engagement and consultation, with associated structure and resource to deliver consultation activities as the programme progresses.
- **Planning engagement and consultation** – ongoing engagement with consultees and further consultation on the updated proposals in preparation for submitting an application for consent.
- **Recruitment** – permanent roles of Media officer and Stakeholder officer now in place to support delivery of wider engagement as we move forwards.

8 Board Statement and Assurance

This document is being provided as part of the SW Interim Update following WfLH governance process prior to approval by SW Board.

WfLH governance has approved the Interim Update as follows:

- WfLH Steering Group
- WfLH Executive Programme Board
- SW Audit and Risk Committee
- SW Board

External assurance has taken place on the following documents:

- Annex 1 Desalination
- Interim Update – Options Appraisal
- CDR i Desalination

External reviews have taken place on the Interim Update documents, as follows:

- Interim Update – Submission Summary
- Interim Update – Option Appraisal
- Interim Update – Efficiency of Expenditure
- Interim Update – Regulator and other statutory bodies engagement Plan
- Interim Update – Activity Plan to Gate 2
- Interim Update – Customer and Stakeholder Engagement

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 of the Interim Update.

9 Proposed Gate 3 activities and outcomes

9.1 Proposed Gate 3 activities

As detailed in Section **Error! Reference source not found.**, SW are not anticipating spending any of the G ate 3 allowance on the further developing the Desalination-based Options. As a result, there are no proposed Gate 3 activities for the Desalination-based Options.

A summary of the recommendations and key evidence supporting the recommendations is detailed in Section 0.

9.2 Proposed Gate 3 outcomes, penalty assessment criteria and incentives

As detailed in Section 0, SW is not anticipating delivering any activities to Gate 3 related to the Desalination-based Options. The key recommendations and key evidence supporting the recommendations is detailed in Section 0.

SW proposes using penalty and incentive structure that is aligned to that utilised by RAPID across all accelerated and standard Gate 1 submissions. SW proposes that specific penalty and incentives regimes are developed with RAPID so that they are proportionate with previous regulatory submissions, including Gate 1 and Price Review 2019 (PR19) amongst others.

Penalty incentive rates and delay impacts are to be applied upon the Gate 2 final decision, with rates applied to be specific categories of spend (as detailed in the Section **Error! Reference source not found.**) where t he penalty is incurred, rather than being applied to the total Gate 2 expenditure. This structure will help to ensure that incentives are focused and proportionate.

10 Conclusions and recommendations

Based upon the technical analysis completed up to the Interim Update into the feasibility and viability of options A.1 and A.2, desalination to Testwood WSW at 75 Ml/d or 61 Ml/d respectively, it is recommended that both options are not to be progressed post Gate 2, and that development of these options is paused. Further detail on the Options Appraisal Process, technical inputs and outcome are detailed in the Interim Update – Options Appraisal. Key drivers that informed this recommendation include:

- Potential of the preferred sites to achieve the necessary consents – Section 3.6
- Environmental impacts, relative to the potential benefits offsetting impacts – Section 0
- Forecast costs, relative to benefits expected to be delivered, and compared to other options considered – Section 3.8

Stakeholder and customer views and feedback compared to those provided by stakeholders and customers relative to other options considered – Section 0.

11 Supporting documentation

Responses to the actions and recommendations made in the Gate 1 final determination are included throughout supporting documentation of this submission. Specific locations of the action and recommendation responses are listed in Tables 23 and 24.

Table 23 – Gate 1 Final Determination: Action Navigation – Desalination

No.	Action – From Gate 1 Final Determination	Location
1	Provide a 'conceptual design report developed in consultation with all regulators, to meet Gate 2 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 1 Desalination
2	Conclude site selection process as detailed in Annex 9.1 in consultation with the Environment Agency and Natural England, to meet Gate 2 requirements and timescales. This should include the associated environmental, water resource and drinking water assessments, including consideration of a dedicated desalination facility on the industrial customer's site.	Annex 1 Desalination, 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 appear to 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.	Water Resource Management Technical Annex, Section 3.6 of this document and Submission Summary
4	Provide summaries of the further development of Strategic Environmental Assessment, 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 Environment Agency, Natural England and any other relevant regulators, to meet Gate 2 requirements and timescales.	Annex 1 Desalination, 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 non-industrial site related options.	Annex 1 Desalination, Section 2.1.5
6	Provide a summary of the potential impact that the Desalination-based 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	Water Resource Management Technical Annex
7	Testwood WSW site is currently the subject of a statutory legal instrument to carry out significant refurbishment works. Implications of this solution on the ongoing refurbishment at Testwood WSW should be identified and discussed with the Inspectorate.	Annex 1 Desalination, Sections 2.1.4 & 2.1.5

No.	Action – From Gate 1 Final Determination	Location
8	Remineralisation and blending of desalinated supplies is necessary prior to distribution to reduce aggressivity and address customer concerns regarding taste and odour. We would expect that these issues are well understood and require suitable solution design to be addressed to mitigate these risks at the Gate 2 two submission.	Annex 1 Desalination, Section 2.1.3
9	Provide a programme of raw water sampling throughout the period, to enable appropriate siting and design of the plant.	Annex 1 Desalination, Section 2.1.1
10	Provide details of an 'Evidence Planning Strategy, which has been discussed and agreed with the Environment Agency and Natural England, to meet Gate 2 requirements and timescales. Baseline methodologies and scopes to inform survey work needs to be agreed as a priority.	Annex 1 Desalination, Section 2.5.1
11	Undertake a procurement strategy assessment including DPC eligibility assessment and value for money analysis. Including consideration of operation in both a DPC and traditional delivery model.	Annex 1 Desalination, Section 2.11
12	Provide more information about stakeholder engagement and the understanding of customer acceptability including a) for individual options and sub-options; b) on issues that could cause delay; and c) how the views of vulnerable or harder to reach stakeholders and customers will be sought.	Annex 1 Desalination, Section 2.8
13	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 risks Clarity on the status of risks that are mentioned elsewhere in the submission but not in the risk register such as the risk of a negative impact on agricultural productivity introduced in Annex 4.	Annex 1 Desalination, Section 2.7
14	Future plans for board engagement must provide for effective oversight of SW's obligations under the s20 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 2 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.	Annex 1 Desalination, Section 2.8
15	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 (to be provided at Gate 2)

Table 24 – Gate 1 Final Determination: Recommendation Navigation – Desalination

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.	Annex 1 Desalination, 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.	Annex 1 Desalination, Section 2.10.5
3	The estimated CAPEX for Desalination-based Options has increased since WRMP19. Please clarify which cost components have increased and the reasons for the change	Annex 1 Desalination, Section 2.10.4
4	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.	Annex 1 Desalination, Section 2.10.6
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 Strategic Modelling, from Gate 1. Include a clarification of whether operational carbon emissions calculations take into account the future decarbonisation of the power grid.	Annex 1 Desalination, Section 2.10.6
6	Provide further detail on the planning risks and the planned mitigation measures.	Annex 1 Desalination, Section 2.6.9
7	Provide information on future plans for board engagement to improve future submissions.	Gate 2 Assurance Annex (to be provided at Gate 2)
8	Provide information on future plans for board engagement and a compiled summary/log of assurance findings with actions taken.	
9	Provide a breakdown of costs to Gate 2 that is consistent with the scheduled activities for Gate 2.	Gate 2 Efficiency of Expenditure Annex