Gate 2 Submission: Conceptual Design Report

Annex 1 Desalination

27 September 2021

from Southern Water

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.

Executive Summary

This Detailed Feasibility and Conceptual Design Report (CDR) describes the next stage of work completed to analyse the feasibility and viability of saline water Desalination-based Options, in response to Southern Water's Water Resource Management Plan 2019 (WRMP19) and Section 20 (s20) agreement 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 Southern Water's reliance on river abstraction and increase the resilience of supply sources during droughts.

This Detailed Feasibility and CDR does not include any overall recommendations and conclusions, please refer to the Concept Design Report - Desalination document and Submission Summary as part of this Interim Update for details on recommendations and conclusions.

Since Gate 1, Southern Water (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 for Progressing Infrastructure Development (RAPID) Gated process. Both desalination-based Options have been considered in greater detail across multiple technical areas including technical engineering, environmental impact, procurement, customer / stakeholder engagement, schedule, regulatory compliance and costs and benefits, to enable SW to select a Preferred Option at Gate 2.

Key Findings

- Internationally, desalination although complex, is a well-understood and is a viable source of water, however the limited UK market for desalination systems presents significant challenges for this Solution.
- Site selection investigations completed since Gate 1 confirmed that there was no consentable and viable alternative to the Base Case location in WRMP19, Ashlett's Creek. The site selection process has also investigated Options for intake and outfall locations in the marine environment and has considered pipeline corridors for the transfer of desalinated water to Testwood Water Supply Works. The site selection process confirmed that the Calshot marine intake / outfall Options should be taken forwards and the Lepe Options discounted as the former were deemed to have lower consenting risk from a Habitats Regulation Assessment (HRA) perspective. Regarding the pipeline route Options, pipeline corridors 1 and 2 were recommended to be included within the preferred configuration.
- Stage 4 of the site selection process concluded that there remained a number of consenting risks that needed to be considered further in Stage 5, including:
  - There remain significant HRA risks. There was significant residual uncertainty about the ability to mitigate the potential impacts associated with the marine intake and outfall, and the impact of the timescales on the scheme delivery programme that would be required to establish data on which acceptable proposals could be developed.
  - The impact of the terrestrial parcel on the New Forest National Park and the ability to mitigate the impacts.
  - The mitigation required to develop a deliverable pipeline connection to Testwood.
- Option D.1, ranked towards the bottom of the hierarchy at Gate 1 and after further work was considered unfeasible and undeliverable due to the inherent risks associated with this Option. Option D.1 did therefore not progress through the full Options Appraisal Process (OAP). See Appendix A for more details.
- Both desalination-based Options are expected to cause adverse environmental impacts to European designated sites, the national park, and marine designated conservation zones; such as, brine discharge, habitat degradation, air quality impacts and landscape impacts. Opportunities to avoid, mitigate and offset these impacts are limited.

- Stakeholder and customers expressed hesitancy of the suitability of the two desalination-based Options at this time, primarily due to the anticipated environmental impacts and the potential for offsetting these impacts, relative to the alternative Options being considered by SW at Gate 2.
- The preferred consenting strategy for Option A.1 and Option A.2 is via a Development Consent Order under the Planning Act 2008. However, the risk of not gaining consent is considered very high.
- We have used best practice and benchmarking to optimise delivery schedules. Notwithstanding both desalination-based Options are expected to be completed and operational in Q4 2030.
- The estimated Capital Expenditure (CAPEX) for the two desalination-based Options is £802 m for Option A.1, and £759 m for Option A.2.
- The estimated 60-year OPEX and 60-year Net Present Value (NPV) values for the two desalination-based Options is £1,319 m for Option A.1, and £1,239 m for Option A.2.

This document contains future commitments and deliverables that were made on the basis that the Base Case remains the Preferred 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.

1 Background and Objectives

This report details key technical information that underpins the analysis completed in assessing the feasibility and viability of desalination-based Options. This information substantiates recommendations and decisions made via the Option appraisal process, detailed in the Submission Summary and Detailed Feasibility & CDR.

This document focuses on the detailed technical information specifically related to RAPID's Gate 2 information requests. Key technical information included in this document was used to create the CDR of the Gate 2 submission hierarchy, illustrated in .

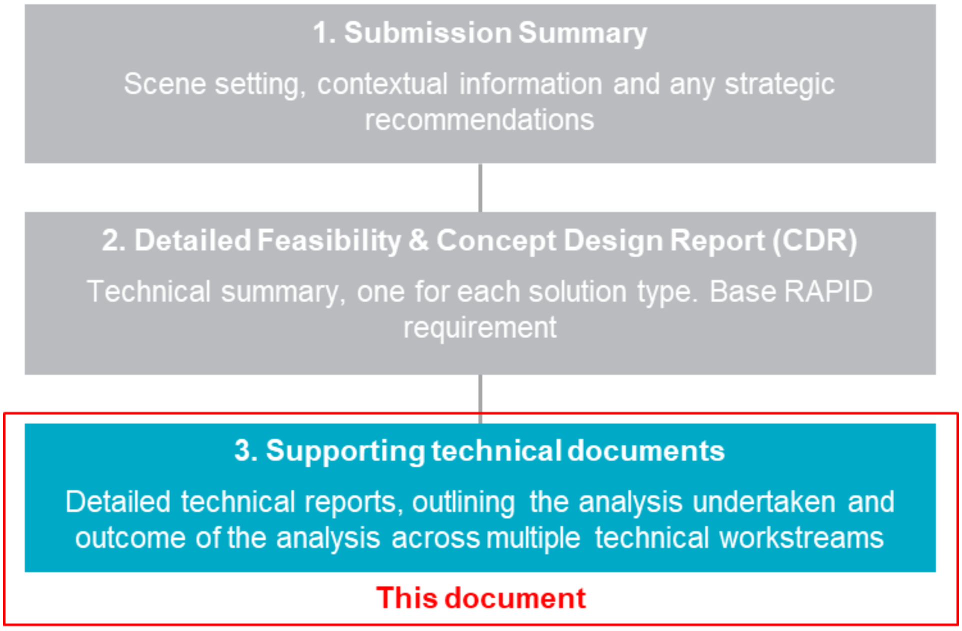

Figure 1 - Accelerated Gate 2 submission document structure

Throughout this Desalination report two Options, Options A.1 and A.2 have been considered and technical information for each of the Options have been detailed. The Options included within this report have been detailed Table 1.

Table 1 - Desalination-based Options

Option no.	Option Name
A.1	75 Ml/d Desalinated water direct to Testwood Water Supply Works (WSW)
A.2	61 Ml/d Desalinated water direct to Testwood WSW

Key objectives of this Desalination Report are:

- Detail technical information that underpins the assessment of Options A.1 and A.2
- Provide technical detail that is specifically aligned to RAPID information requests for the Gate 2 submission
- Provide technical detail that is specifically aligned to recommendations made by RAPID as part of the Gate 1 submission final determination
- Provide substantive detailed information that supports the Desalination Detailed Design & CDR

Document Structure

This report includes specific sections covering ten separate technical areas, all of which are specifically focused on the desalination-based Options considered at the Interim Update. Specific sections include:

- Engineering Design
- Network Infrastructure
- Site Selection
- Environmental
- Planning and Consenting
- Risk Management
- Stakeholder and Customer
- Schedule
- Cost Modelling
- Commercial and Procurement

In each of these areas, content is specifically aligned to the RAPID information requirements for the Gate 2 submission.

2 Conceptual Design

2.1 Overview of solution

SW's Water Resource Management Plan (WRMP), published in 2019, identified a substantial supply – demand deficit across its Western Area[1] during a 1-in-200-year drought event. The WRMP articulated a strategy to resolve this deficit, desalination being a key component of the Preferred Strategy, with 75 Ml/d of supply produced by a desalination plant in Fawley (the Base Case), which is directly transferred to existing assets in the Hampshire Southampton West Water Resource Zone (WRZ), then bringing wider benefits to the whole of the Western Area through existing and new interzonal transfers.

2.1.1 Desalination-based Options at Gate 2

A suite of strategic water resource Options as alternatives to the desalination Base Case were identified in the Gate 1 submission to the RAPID in September 2020, including alternative desalination scenarios. This report presents the progression of the two desalination-based Options carried forward to the Gate 2 submission illustrated in Figure 2; these two Options were presented in the Gate 1 submission as

- **Option A.1 – WRMP Desalination Scenario (Base Case):** A new desalination plant in the Fawley area capable of supplying 75 Ml/d of drinking water to Testwood WSW
- **Option A.2 – WfLH alternative scenario:** A new desalination plant in the Fawley area capable of supplying 61 Ml/d of drinking water to Testwood WSW

1 In 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.

Figure 2 - Schematic diagram of the transfer routes for Option A.1 AND A.2

The conceptual design presented in this report is based on meeting the drinking water production requirements of Option A.1, presenting the most conservative position for plant sizing, power supply, and environmental impact. With minimal economies of scale identified in the cost estimating at Gate 1, costing for Option A.2 was extrapolated from the A.1 estimates.

Table 2 details SW's progress against the Gate 2 activities specified in the desalination technical report provided to RAPID as part of the Gate 1 submission; the planned activities should this solution be continued post Gate 2 are also recorded.

Table 2 - Summary of Gate 2 activities from Gate 1 and planned next steps post Gate 2

No.	Gate 2 Activities Defined in Gate 1 Report	Progress at Gate 2	Next Steps for Post Gate 2
1	Continuation of the sampling programme, providing source water quality data to support process design, and to identify suitable operational, risk and compliance monitoring parameters to be incorporated into the Water Safety Plan (WSP). Specific sampling locations will be determined from the site selection programme and the number of locations will be progressively reduced in alignment with this programme.	The sampling programme resumed in November 2020, with completion of phase 1 in January 2021 and phase 2 in July. Further detail is provided in section 2.2.1	Phase 3 sampling spans August 2021 to January 2022, with geographic scope reduced to Southampton Water & The Solent (near Fawley).

No.	Gate 2 Activities Defined in Gate 1 Report	Progress at Gate 2	Next Steps for Post Gate 2
2	Site selection and successful implementation of the source water sampling programme will enable the WSP structure to be defined prior to the Gate 2 submission, including a source-to-tap desalination water supply system and comprehensive desalination specific hazard list. A draft WSP will be presented with the Gate 2 submission including direct validation of the catchment and abstraction sub-system risks and indirect validation for the downstream sub-systems.	Draft WSPs have been prepared and submitted to the DWI for each new sub-system under the desalination-based Options. Further detail is provided in section 2.2.6.	The WSPs will be subject to ongoing review as additional sampling data is collected.
3	Coastal discharge modelling will be completed based on the discharge locations identified by the site selection exercise; this modelling will be used to assess the likely impact of the brine discharge. CORMIX modelling software will be used in the first instance, but a review of the modelling requirements for this scheme, and the capabilities of CORMIX, is currently underway to identify any additional requirements.	CORMIX and Mike2D modelling was completed for the short-listed discharge locations, assessing dispersion for a suite of key water quality parameters. Further detail is provided in section 2.2.1	Modelling to be refined as the design progresses to develop more estimates of discharge stream composition.
4	Continued consultation with Subject Matter Experts (SMEs), increased liaison with Engineering, Procurement and Construction (EPC) contractors, and engagement of Reverse Osmosis (RO) membrane suppliers are expected throughout this period to validate process design decisions and assumptions. In particular, membrane suppliers will be critical in validating the performance expectations for the RO membranes, with proprietary modelling platforms to determine the likely effluent quality produced by their products, based on a set of defined operating conditions.	SW's Procurement Team facilitated engagement with EPCs and RO membrane suppliers. Detailed in Section 2.11 Modelling software used for Gate 2 conceptual solution to support process sizing (2.2.1) and treated water quality projections (2.2.5.1).	Continued use of software where new information / data warrants revision of the mass balance / process design.
5	SW will continue its liaison with RAPID's constituent regulators, and other stakeholders in the WfLH programme, to ensure alignment of the solution with their expectations. It is expected that concerns relating to the Regulation 31 approval process and to the taste of desalinated water (and possible compliance implications) will be topics addressed in detail with the DWI. Progressing environmental discharge permit applications will be of critical importance to desalination solution development and regular engagement with the EA will be essential.	A number of consultation meetings with the DWI, the EA and NE have taken place since the start of Gate 2. SW's strategy for Regulation 31 approval are presented in the Section 2.11 Progress with environmental permitting applications is detailed in Section 2.5	Coagulant selection and dose will be confirmed through jar testing to refine the estimates for the composition of the blended discharge stream as an input for the permit application.

No.	Gate 2 Activities Defined in Gate 1 Report	Progress at Gate 2	Next Steps for Post Gate 2
6	The preliminary design proposed at Gate 1 will be refined / optimised based on the increased availability of key input data, provided from sampling and progression of the site selection exercise. Design changes will be communicated to the cost estimating team, in support of continued refinement of the estimating outputs. This design progression is expected to include optimisation of the pre-treatment, desalinated water conditioning and residuals treatment process configurations, mass balance construction and preparation of preliminary asset sizing, refined estimates of energy and chemical consumption, characterisation of residuals flow / composition for environmental permitting, and refined site footprint estimates. These outputs will be required to support a cost estimating exercise to a minimum class 3 standard, as defined by the Association for the Advancement of Cost Engineering (AACE).	A mass balance was constructed for the treatment process presented at Gate 1, configured using data from the Gate 2 sampling programme, and used as the basis for the process sizing underpinning the conceptual solution presented in Section 2.2	The mass balance will be revised to reflect the larger quantity of sampling data available at the end of Gate 2. The site layout will be refined following the development of high-level P&IDs to inform ancillary equipment and inter / intra-stage pipework requirements. Load and equipment schedules will be prepared.
7	The customer engagement team will be informed where risks are validated in relation to customer acceptability or agricultural impact, to support a pro-active approach to mitigating the risk of customer complaint based ODI penalties in periods of desalinated water supply. The engineering team will continue to liaise with the customer engagement team to ensure that the Gate 2 solution adapts to the preferences of SW's customers, where it is appropriate to do so.	The taste impact of desalinated water has been identified as a high-risk concern under drought operation but blending of the minimum production flow is expected to mitigate any taste concerns under normal conditions. Further detail is provided in Section 2.2.5.3	We will continue to engage with our customers to address concerns relating to water quality and associated perceived risks.
8	Operability considerations for desalination will be developed in detail on the basis of continued engagement with EPC contactors and following site visits to existing desalination installations, including engagement with operations personnel at these sites.	The conceptual design presented in section 2.2.3.1 is capable of 80 % turndown to support continuous operation of the desalination plant at a minimum treated water flow of 15 Ml/d, ramping up to 75 Ml/d during drought.	Continued development of strategies for commissioning and operation of the desalination plant.

2.1.2 Desalination Technology Overview

In this context, desalination refers to the broad-spectrum removal of dissolved salts from seawater, in combination with multiple additional treatment provisions, to achieve drinking water quality standards.

Seawater desalination is practiced internationally as a necessary means of drinking water production where freshwater resources are scarce. RO is the predominant technology globally, with conventional thermal processes, systems being the only practical alternative but typically requiring more than three times the energy input of an RO system. Distillation is of similar capacity, primarily being used where large supplies of low-cost thermal and / or electrical energy are available. RO is considered the more feasible technology

Option in the UK, recognising the energy scarcity and high energy costs of the UK relative to other regions where desalination is used. RO systems have proven reliability internationally, and the increasingly competitive and continually growing market for RO products is facilitating progressive improvements in energy efficiency, permeate water quality, and process recovery.

The largest example of a seawater RO system in the UK is the 10.8 Ml/d La Rosière, owned and operated by Jersey Water and subject to a different regulatory structure to that of the mainland. There are no large – scale examples in England & Wales, the closest UK specific case study being the Gateway brackish water RO plant at Beckton, owned and operated by Thames Water.

2.1.3 Proposed Desalination System Summary

The desalination drinking water supply system is defined as encompassing the marine intake and outfall assets, the desalination plant, the new Testwood Water Service Reservoir (WSR), and all interconnecting pipelines between these four new assets.

The site selection exercise has progressed through Gate 2, concluding with the identification of the Ashlett Creek site (the WRMP Base Case) as the best available location for the desalination plant. The locations of this site and Testwood WSW are illustrated in Figure 3 alongside the remaining Options for intake and outfall assets and interconnecting pipeline routes[2].

[2] It should be noted that Figure 3, whilst illustrating the locations of the Ashlett Creek site and the Testwood WSW, it also includes components that have now been discounted in previous stages of the Site Selection process.

[redacted]

The preferred operating strategy for the desalination system requires continuous *“minimum flow operation”* of the desalination plant, producing 15 Ml/d of desalinated drinking water for blending with flow from Testwood WSW, transitioning into *“drought operation”*, where desalinated water production ramps up to 75 Ml/d and treatment at Testwood WSW is suspended.

Figure 4 illustrates the process block diagram for the desalination process, identifying the maximum daily flows under drought operation (1) and the average daily flows under the minimum flow operating regime (2).

Figure 4 - Desalination process block diagram (excluding residuals handling).

2.2 Engineering Technical Design

RAPID's requirements for Gate 2 stipulate that solution development must have progressed to conceptual design for each of the proposed strategies; SW's desalination technical report, as part of the Gate 1 submission, identified the Gate 2 activities necessary to achieve this requirement for the engineering components of the system. This section presents the engineering conceptual design developed for Option A.1 and the findings of the Gate 2 activities which constitute the basis of design.

2.2.1 Source Water Characterisation

2.2.1.1 Sampling Programme Updates

The Gate 2 coastal sampling programme is a critical data gathering activity necessary to support water safety planning and to enable the process design to progress beyond the initial concepts presented at Gate 1. The site selection programme (completed in July 2021) has presented a significant challenge, requiring samples to be collected from locations dispersed along an extensive stretch of coastline, limiting the sampling frequency based on the availability of equipment and personnel to undertake the sampling activities.

This sampling programme is required to measure a broad suite of water quality parameters in the high salinity source water as a primary input for process design and water safety planning. In order to support this exercise, it was necessary for [redacted] (SW's appointed contractor) to subcontract other specialised laboratories for support or to develop new analytical methods where subcontractors could not support.

The Gate 1 submission proposed a four-phase sampling programme starting in September 2020. The Gate 1 sampling contractors, [redacted], were unable to offer continued support for the programme so the start of phase 1 was delayed from September to November 2020 as a new sampling contractor was identified. [redacted] were engaged to undertake the Gate 2 sampling and will continue to support this programme through Gate 3, with their personnel both crewing the vessel and taking the samples. [redacted] are not ISO 17025 accredited but received training from accredited [redacted] samplers before starting the phase 1 activities. Accreditation will become a priority for Gate 3 should desalination be selected as the preferred strategy.

Table 3 details the progress made with implementation and plans for continuation of the sampling programme.

Table 3 - Coastal sampling programme – overview of sampling phases

Phase	Frequency	Locations	Parameters	Start	End
1	Weekly	All	All	November 2020	January 2021
2	Fortnightly	Aligned with site selection programme	All	February 2021	July 2021
3	Monthly	At chosen intake location	All	August 2021	January 2022
4	To be confirmed for individual parameters	At chosen intake location	To be confirmed from phase 3 data	January 2022	Ongoing Sampling

Phase 4 sampling will be representative of the ongoing sampling regime at the seawater abstraction Pumping Station (PS).

with the suite of parameters having been refined, through continued development of the process design and the WSP, to focus on those analytes necessary to fulfil SW's obligations under Regulations 15, 27, and 28 of the Water Supply (Water Quality) Regulations and to support operational management of the treatment process.

Sample locations were proposed at Gate 1 based on the specific requirements of the seawater intake; these locations were further refined into clusters A to E, illustrated in Figure 5, based on the proposed land package sites and suitable intake locations identified by the site selection exercise. Sample point F1 was also included to capture the old Fawley power station intake, which is considered as an Option for the location of the seawater intake.

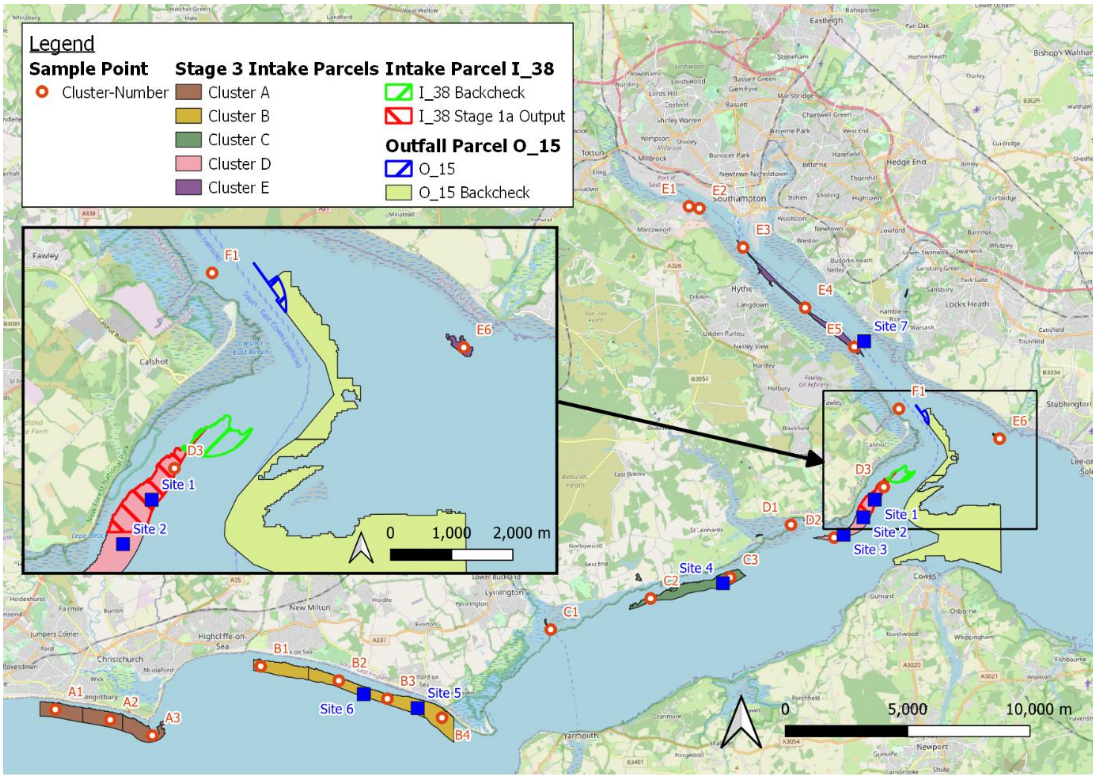

Figure 5 - Coastal sampling programme, sampling locations for November 2020 to July 2021

The site selection exercise determined that the Ashlett Creek site (near Fawley) was the preferred location for the desalination plant, allowing clusters A, B and C to be removed and additional sample points to be added to cluster D to coincide with possible intake locations; location F2 was also added to cover the tributary discharging into Southampton Water at this point. These updates took effect from the start of August 2021 and are illustrated in Figure 6.

Section 2.4 describes the site selection activities undertaken in Gate 2 which form the basis for these changes to the sampling programme, per the expectations for phase 2.

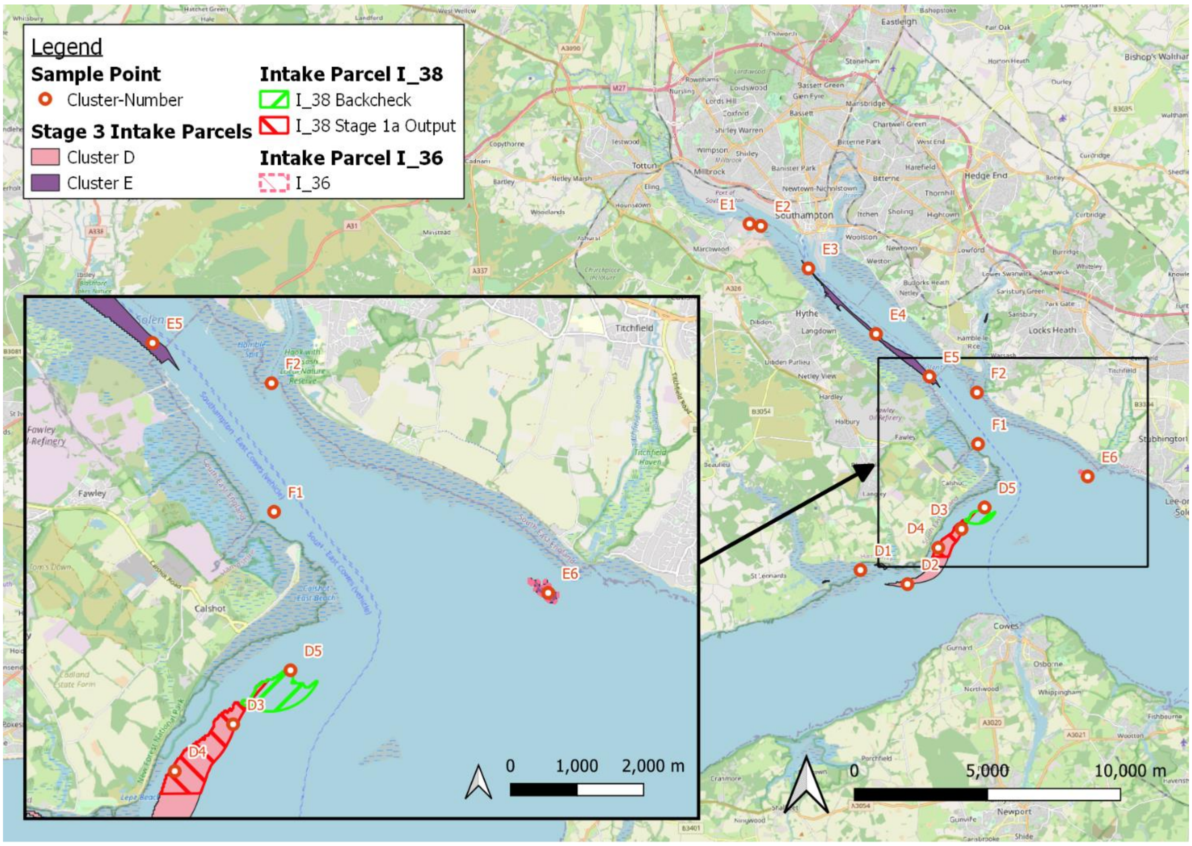

Figure 6 - Coastal sampling programme, sampling locations from August 2021

2.2.1.2 Quality Management System for Sampling Data

[redacted] have designed their Quality Management System to meet the requirements of BS EN ISO / IEC 17025. The majority of the tests being undertaken for the project by [redacted] are done so at the Coventry and Hawarden Laboratories where most of their tests are accredited for a wide range of matrix as specified in the documentation provided by UK Accreditation Service (UKAS). For some of the tests there are no UK accredited laboratories however the methods are fully documented and carried out by competent and trained staff who operate under the same management system requirements.

2.3.1.3 Sampling Results & Process Design Implications

Two Options for the seawater intake location have been developed for the Ashlett Creek site at Gate 2, detailed further in Section 2.2.2.1, the first is within the disused Fawley Power Station intake, planned for development by [redacted], and the second is situated off the coast of Calshot and utilises the disused power station outfall. The data detailed in Table 4 was collected from sample points D3, E6 and F1, in Table 4 these points being closest to the proposed intake locations; the cut-off date for this data was 21 April 2021. The data from clusters A, B and C is not reported following their exclusion by the site selection exercise.

Comparing the results from each individual location identifies no distinct water quality challenges that would warrant a change in the overall process design. The results for the three sample points are considered collectively in order provide one larger dataset for analysis. The water quality design envelope for the mass balance underpinning the process design was based on the data gathered for these three points before the cut-off date of 10 February 2021 where a Gate 2 design freeze was applied to the mass balance outputs.

Table 4 - Sampling data summary for sample points D3, E6 and F1

Parameter	Units	MDL	Maximum	95th Percentile	Average	5th Percentile	Minimum	Sample Count	Count < MDL	Process Impact
Turbidity	NTU	N/A	30.8	20.4	9.5	2.2	1.0	41	0	Pre-treatment recovery & solid waste disposal
Total Suspended Solids	mg/l	N/A	116.0	91.3	57.9	33.5	10.8	41	0	Pre-treatment recovery & solid waste disposal
Alkalinity (as $CaCO_3$)	mg/l	N/A	140.2	135.3	121.8	100.1	75.0	40	0	Determinant of chemical demand / pH impact
pH	-	N/A	8.2	8.1	8.0	7.8	7.7	40	0	A performance determinant for multiple processes
Total Dissolved Solids	mg/l	N/A	34,859	34,277	32,949	31,425	30,454	40	0	Critical design parameter for RO process
Sodium	mg/l	N/A	10,800	10,700	10,196	9,630	9,390	41	0	A primary component of seawater TDS
Magnesium	mg/l	N/A	1,210	1,200	1,141	1,070	1,010	41	0	A primary component of seawater TDS
Potassium	mg/l	8	409	405	390	366	361	41	0	A primary component of seawater TDS
Calcium	mg/l	N/A	425	407	390	376	365	41	0	A primary component of seawater TDS
Barium	µg/l	N/A	14.1	8.9	7.6	6.4	6.1	41	0	RO foulant (scaling)
Strontium	µg/l	40	8,080	8,050	7,708	7,330	7,160	41	0	RO foulant (scaling)
Silica	mg/l	0.5	1.1	0.8	0.6	< 0.5	< 0.5	41	10	RO foulant (scaling)
Chloride	mg/l	N/A	20,000	19,000	18,125	16,950	16,000	40	0	A primary component of seawater TDS
Sulphate	mg/l	N/A	2,620	2,610	2,482	2,380	2,310	41	0	A primary component of seawater TDS
Boron	µg/l	N/A	4,430	4,320	4,157	3,990	3,800	41	0	Persistent contaminant requiring second pass RO
Aluminium	µg/l	40	1,460	170	125	27	< 40	41	1	RO foulant (scaling)

Parameter	Units	MDL	Maximum	95th Percentile	Average	5th Percentile	Minimum	Sample Count	Count < MDL	Process Impact
Iron	µg/l	N/A	883	385	211	56	46	41	0	RO foulant (scaling)
Manganese	µg/l	N/A	35.0	12.9	7.5	3.4	2.6	41	0	RO foulant (scaling)
Total Organic Carbon	mg/l	2.5	7.0	< 2.5	< 2.5	< 2.5	< 2.5	39	38	RO foulant (surface deposition & biofouling)
Fats, Oils & Greases	mg/l	1	< 1	< 1	< 1	< 1	< 1	40	40	RO foulant (surface deposition & biofouling)
Total Extractable Petroleum Hydrocarbons	µg/l	100	< 100	< 100	< 100	< 100	< 100	40	40	RO membrane damage
Gasoline Range Organics, C5-C12	µg/l	50	< 50	< 50	< 50	< 50	< 50	40	40	RO membrane damage
Total Aliphatics & Aromatics, C5-C35	µg/l	10	< 10	< 10	< 10	< 10	< 10	39	39	RO membrane damage
Total Volatile Organic Carbon	µg/l	10	< 10	< 10	< 10	< 10	< 10	40	40	Low molecular weight taste & odour causing compounds
Total Semi-volatile Organic Carbon	µg/l	10	13.7	< 10	< 10	< 10	< 10	41	39	Low molecular weight taste & odour causing compounds
Total BTEX	µg/l	28	< 28	< 28	< 28	< 28	< 28	39	39	RO membrane damage
Total PAHs (6 substances)	µg/l	0.027	0.050	< 0.027	< 0.027	< 0.027	< 0.027	41	40	Specifically, regulated health-risk hydrocarbons

The Gate 1 report identified a selection of key risk parameters for the source water to be investigated through continuation of the sampling programme; these parameters can be classified as persistent contaminants, with limited removal anticipated for the Gate 1 design, or foulants, which increase cleaning requirements and/or reduce the service life of specific process components.

The Total Suspended Solids (TSS) concentration of the source water is a key determinant of pre-treatment recovery. Online turbidity measurements are used for process control and performance monitoring, accounting for both suspended and colloidal solids fractions. The suitability of the pre-treatment processes for the RO system for solids removal is typically assessed based on the Silt Density Index (SDI), a test indicating the particulate fouling potential of a specific feed water, and the turbidity; the required feed water quality conditions will vary by membrane supplier, but typically include a 15-minute SDI less than 3 or 4 and a maximum turbidity in the range of 0.1 to 1.0 NTU. The inclusion of Ultrafiltration (UF) upstream is expected to yield stable feed water quality with an SDI less than 3 and a turbidity less than 0.1 NTU.

The Total Organic Carbon (TOC) concentration can be used as an indicator of fouling potential, with the specific mechanism of fouling varying according to the constituent species; this is discussed in detail in the Gate 1 desalination technical report (Annex 4). Hydranautics' recommended maximum TOC concentration for RO feed water is 3 mg/l; a Minimum Detection Limit (MDL) of 2.5 mg/l was achieved from seawater analysis. The data shows 38 of 39 samples falling below the MDL with the single detection being significantly greater at 7 mg/l; this detection was almost entirely Dissolved Organic Carbon (DOC) but further characterisation was not completed to assess the likely removal rate by pre-treatment.

Algal cell counts and chlorophyll concentration are being measured to assess the risk associated with algae. Late summer is the peak risk period for algal blooms, with high nutrient loads increasing the propensity for accelerated growth; the sampling programme has not captured these conditions, so it is likely that further high detections will be made as the programme progresses. The total and DOC concentrations are also expected to peak in these conditions.

Fats, Oils & Greases (FOG) is a high molecular weight fraction of organic carbon consisting of various triglycerides, typically arising from wastewater and industrial food processing discharges; the hydrolysis of these compounds into free fatty acids is of particular concern for fouling for both UF and RO membranes. For UF membranes, feed water concentrations should be maintained below 2 mg/l to maintain a tolerable rate of fouling. RO systems have significantly lower tolerance for fouling given the much more limited cleaning procedures. Significant improvement in the analytical methods used at Gate 2 have supported a reduction in the MDL from 5 to 1 mg/l. The winter period covered is expected to be the highest risk for FOG, given increased storm discharges and surface run-off, and none of the 40 samples collected were found to exceed the 1 mg/l MDL.

Petroleum hydrocarbons are considered to be the primary catchment risk for the desalination plant based on the close proximity of the Fawley Refinery and the heavy shipping activity associated with the Port of Southampton (and the Refinery's marine terminal).

Aprotic solvents have been identified as a subset of petroleum derived hydrocarbons which can cause irreversible structural damage to membranes as a result of swelling of the polysulfone support layer underlying the active thin-film polyamide membrane or dissolution of the membrane glue lines. The standard warranty conditions for Hydranautics' membrane products apply a 100 µg/l limit for total hydrocarbons; however, Technical Application Bulletin (TAB) 116 also identifies a 50 µg/l risk threshold for aprotic solvents, gasoline and diesel, and a suite of other organic contaminants of concern. Testing was conducted for total Extractable Petroleum Hydrocarbons (EPH) as well as fractionation into various sizes and classes; a condensed summary of these tests is detailed in Table 4, with no results exceeding their respective MDLs, all of which are equal to or less than the feed water limits.

Volatile Organic Carbon (VOC) and Semi-Volatile Organic Carbon (SVOC) fractions are composed of low molecular weight compounds, largely falling below the molecular weight cut-off for RO membranes, meaning their rejection is more variable and dependent on molecular weight, shape, and charge. Many of these compounds have low taste and / or odour thresholds, often of the order of nanograms per litre, raising concerns for customer acceptance given the 1-3 µg/l saline water MDLs for the 140 VOCs / SVOCs measured indicates the risk is considered minimal given the precedent set globally by a multitude of operational seawater RO plants, particularly in regions such as the Middle East with extensive petrochemical processing, where no issues are reported in the literature.

Boron was flagged as a persistent contaminant at Gate 1, present in seawater in concentrations more than four times that of the 1 mg/l Prescribed Concentration Value (PCV) for drinking water; in the average case, the concentrations measured from the Gate 2 samples are consistent with those from Gate 1. The RO process has been configured as a split-partial two-pass system, as described in Section 2.3.1.3, to achieve treated water boron concentrations of 0.5 mg/l or less.

Dissolved iron is a concern in aerated feed waters as precipitation of the dissolved metal, occurring as a result of oxidation, can result in membrane scaling. The feed water concentration for these two metals is typically limited to 50 µg/l; data as detailed Table 4 shows iron concentrations significantly exceeding this limit in most samples. The majority of the iron in the samples is expected to be particulate, most likely colloidal iron, composed of insoluble ferric oxides and hydroxides, which is still a concern for particulate fouling, but the upstream UF process is expected to minimise the risk to the RO process.

Aluminium is also commonly identified as a scaling risk species in RO membrane warranties, with maximum feed water concentrations varying from 100 to 1,000 µg/l; Table 4 details the average and maximum sampled concentrations (respectively) exceeding the lower and upper limits of this range. The solubility of aluminium is typically lowest in the range of pH 5.5-7.5 and the proposed pre-treatment process will operate in the range of pH 6.5-7.0. Aluminium is therefore expected to be colloidal in nature and readily removed by ultrafiltration.

2.2.2 Marine Intake & Discharge

2.2.2.1 Design - Options & Constructability

The purpose of the intake PS is to abstract seawater from the marine environment and transfer it to the desalination plant. The intake PS consists of a deep caisson shaft wet-well PS, situated as close as possible to the shoreline, with a tunnelled intake main extending offshore to an array of passive wedge wire screens, with a 1 mm aperture mesh, situated such that they remain permanently submerged. As illustrated by the Process Flow Diagram (PFD) in **Error! Reference source not found.**, the PS includes an air-burst cleaning system, used to clear accumulated debris from the screens at regular intervals, and an On-Site Electrolytic Chlorination (OSEC) system, used to produce a dilute hypochlorite solution from seawater for dosing during intermittent shock chlorination. Not shown is the diesel generator and fuel store which will also be located at this site, providing an emergency power supply.

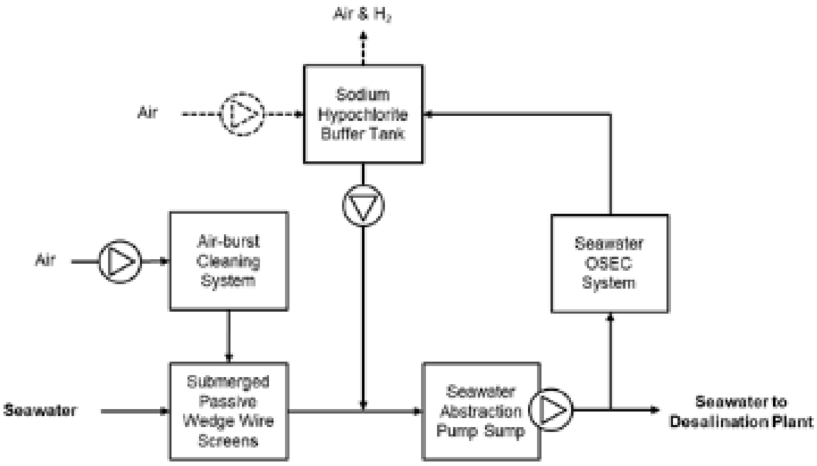

Figure 7 - Intake PS PFD

An oil-in-water monitor will be installed at the seawater intake, representing a critical control point which automatically initiates a system shutdown in the event that Total Petroleum Hydrocarbons (TPH) and / or VOC concentrations deviate above the acceptable limits, protecting the treatment assets and the wholesomeness of the downstream supply system.

The outfall structure is the discharge point, required to disperse the combined treatment residuals stream back into the marine environment, this being primarily composed of a hypersaline brine stream from the RO process. The configuration of this outfall structure is illustrated in Figure 8; this arrangement is considered across all Options for the outfall location.

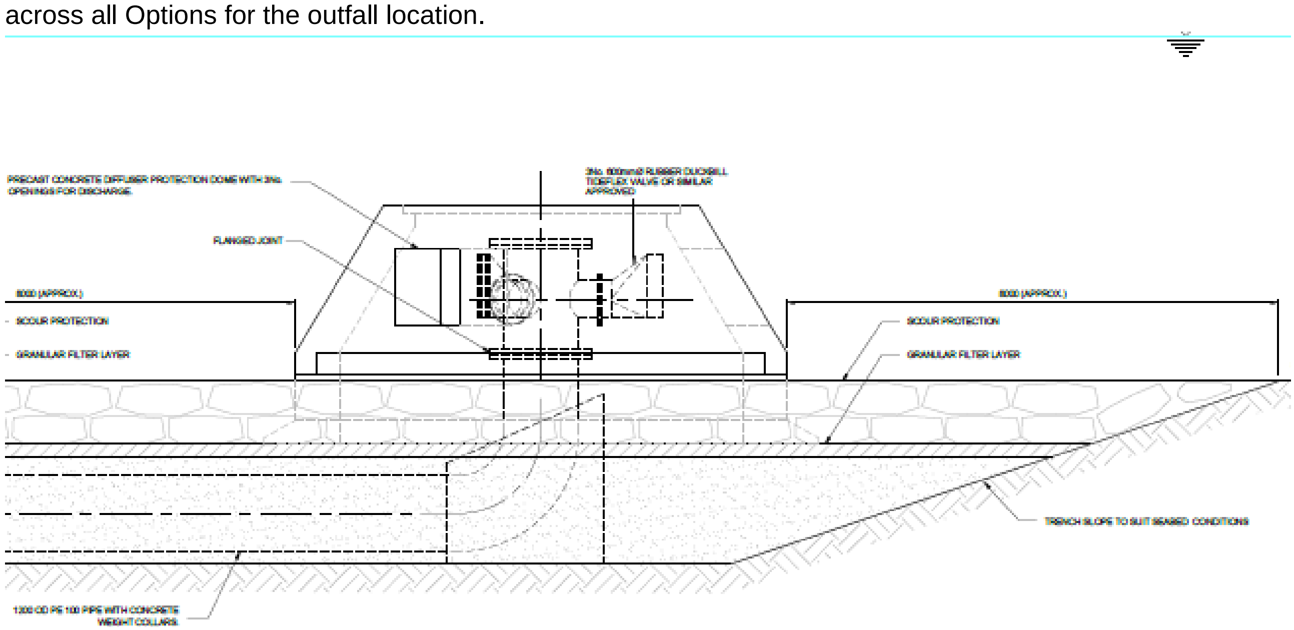

Figure 8 - Side drawing of the outfall diffuser and protection dome

Two Options have been developed at Gate 2 for the location of the seawater intake assets, using site screening criteria identified in the Gate 1 report with specialist support from [redacted], and for the outfall, based on hydrodynamic modelling to assess mixing and dispersion of the discharge at these points.

Planning approval submission for the Fawley Waterside development includes filling of the Power Station cooling water surge shaft and 300 m of the existing tunnel with concrete to minimise settlement following future works. As part of the design, it has been assumed that the structures up to the infilled tunnel section shall be excluded from any proposed works for the intake and outfall pipelines. The proposed pipeline routes for the two Options are illustrated in Figure 8.

Option 1 – Intake at Fawley Waterside Development & Outfall at Calshot

The intake PS for Option 1 will be located to the West of the existing power station access road; this will become a public road as part of the Fawley Waterside development. The outfall will be situated approximately 1,400 m off the Calshot coast.

The intake will consist of a submerged array of Passive Wedge Wire Screen (PWWS) positioned within the dock area of the Fawley Waterside development; from here the water will be conveyed along a 1,200 mm internal diameter pipe to a 12 m deep shaft approximately 150 m away within the intake PS boundary. It is envisaged that this section of pipeline will be pipe jacked to the dockside using the proposed PS shaft as the launch site. The seawater will be pumped from the PS shaft to the desalinisation plant via a 1,200 mm steel pipeline, which is expected to be open cut.

The power supply for this site will be obtained from the main desalination plant site with dual transformer substation containing 3,000 kVA-11 kV to 690 V step down transformers for the intake pumps and single transformer 315 kVA-11 kV to 415 V step down transformer for the auxiliary. There will be a separate High Voltage (HV) ring provided from the main site HV switchboard to supply the intake area.

The terrestrial pipework between the desalination plant and the outfall is to be laid using the open cut method; the pipe material is to be steel or ductile iron with an internal diameter of 1,200 mm. The marine part of the outfall is estimated to be 1,410 m of 1,200 mm internal diameter solid wall polyethylene pipe connecting the terrestrial pipeline onshore at Calshot to the offshore diffuser structure.

The outfall would be buried in a dredged trench, backfilled, and will not be exposed above the seabed. The proposed trench would be excavated using a combination of land-based plant working on the beach during low tide conditions and marine plant working through the high tide conditions mainly in the locations close or beyond low water. A temporary sheet pile cofferdam may be required in the inter tidal area to assist with the trench and pipe installation.

For installation of the terrestrial pipeline, planning and land ownership issues may hinder the development of the design. If this is the case an alternative construction method of tunnelling a new 1,200 mm internal diameter tunnel, approximately 2,041 m long, using a Tunnel Boring Machine (TBM) to reach the outfall location. For installation of the terrestrial pipeline, planning and land ownership issues may hinder the development of the design. If this is the case an alternative construction method of tunnelling a new 1,200 mm internal diameter tunnel, approximately 2,041 m long, using a TBM to reach the outfall location.

Option 2 – Intake and Outfall using Disused Fawley Power Station Outfall Tunnel

Option two includes the partial use of the existing infrastructure left redundant from the closure of Fawley Power Station, with both the intake and outfall being situated off the Calshot coast.

The existing intake caisson in the marine parcel will provide the shaft from which a new tunnel can be bored approximately 395 m to the marine parcel identified, where the PWWS can be mounted on the seabed. The air burst screen cleaning system would need to be mounted on the existing caisson structure, requiring a boat for operations to access the assets for routine inspection and maintenance.

The existing caisson will need to be checked structurally and a new lining will need to be provided. The existing tunnel will be used to convey the 1,200 mm pipeline back to the new terrestrial PS. The outfall structure will be modified to remove the existing screens and replace the shaft capping, finished above ground to accommodate the air burst system (as a minimum); moorings will also be provided to allow access for operation and maintenance. A new marine shaft will be constructed using a jacked caisson method to support the new intake screen and provide the launch site for a pipe to be jacked back to the existing power station outfall structure. All marine shafts and modification works will be undertaken behind temporary double skin sheet piled cofferdams.

The power supply for this Option will consist of a single Distribution Network Operator (DNO) supply at 11 kV at 3,000 kVA and a separate standby containerised generator rated at 2,500 kVA. There will be a HV switchboard with mains and generator incomers with 3 outgoing feeders for stepdown transformers. Dual transformer substation containing 3000 kVA-11 kV to 690 V step down transformers for the intake pumps and single transformer 315 kVA-11 kV to 415 V step down transformer for the auxiliary.

The intake pipeline reuses one of the two existing Fawley Power Station outfall tunnels; these are approximately 20 m below ground level with 4 m internal diameter. A landside shaft will be sunk over the existing tunnel, and it is anticipated at this stage it would be installed using a jacked caisson technique. The shaft will form the sump for the new intake PS. The transfer main feeding the desalination plant from the terrestrial PS will be open cut. The existing Fawley Power Station tunnel upstream of the new landside shaft will be fully backfilled by the Fawley Waterside site developer. The existing tunnel downstream is to be relined to the extent of the current outfall structure.

The outfall follows a similar approach to the intake using the other existing Fawley Power Station outfall tunnel. From the existing marine caisson there will be a new tunnel bored 720 m long into the marine parcel.

There is significant engineering risk associated with uncertainty at Gate 2 relating to the condition of the existing tunnels to the outfall structure and the existing shaft, and as to whether the shaft is of sufficient diameter for receiving the tunnelling machinery. These risks, whilst not explicitly highlighted in risk management Section 2.7 have been considered as part of the costed risk values reported in the cost modelling Section 2.10.

2.2.2.2 Coastal Discharge Modelling

The impact of substances released into the coastal environment was assessed in different length scale contexts, termed “near field” and “mid / far field”.

The near field region, close to the discharge point, is characterised by high initial mixing, depending on the discharge structure’s design and the properties of the discharged brine and the receiving seawater; mixing in the near field is relatively small scale and completed within minutes. The negative buoyancy of the brine is a critical consideration for discharge modelling, and the associated effects predominate in the near field region.

In the mid / far field, tidal influences predominate, with advection and dispersion being the primary mechanisms. In this context, advection is transport arising from the tidal movements of water; this is an oscillating movement, initially carrying a substance away from the discharge location and returning with the reversal of the tide. Dispersion is the spreading out of a substance, as indicated by a fall in concentration, occurring as a result of diffusion and small-scale changes in hydrodynamic conditions along the tidal flow path.

The water quality impact of the proposed desalination coastal effluent discharge was investigated for multiple proposed discharge locations in the near field using the results of a previous CORMIX assessment and in the mid / far field using a calibrated and validated Mike21 hydrodynamic and water quality model.

Eight discharge locations were considered in this modelling, illustrated in Figure 9; locations 1, 2, 3 and 8 are considered in the commentary for this report following the selection of the Ashlett Creek site as the preferred location for the desalination plant.

Figure 9 - Coastal discharge modelling locations

This discharge modelling exercise investigates the dispersion of five key water quality parameters, listed with justification for their inclusion as follows:

- **Total Dissolved Solids (TDS):** The hypersaline brine stream generated by the RO process constitutes the majority of the total discharge flow (> 85%); in this investigation, the TDS concentration is considered relative to ambient seawater conditions in terms of an “excess salinity”. Excess salinity can cause detriment to marine fauna and flora.
- **TSS:** Waste handling processes included recovering water from the pre-treatment waste streams further concentrating the captured solids; it is expected that a fraction of the suspended solids will still be returned to the environment in the recovered water. The TSS concentration in environmental discharges is controlled under various regulations making it a critical consideration for this exercise.
- **pH:** The pH of the abstracted seawater will be suppressed significantly below ambient conditions to support enhanced coagulation and to reduce first-pass RO scaling; the waste streams are not subject to pH correction therefore this pH suppression carries through to the discharge.
- **Total Iron:** It is assumed that an iron-based coagulant will be dosed during pre-treatment, and it is expected that a residual will be present in the combined discharge stream; it is normal for an environmental discharge permit to specify a maximum total iron concentration where iron-based coagulants are used in water / wastewater treatment.
- **Phosphate:** It is assumed that an antiscalant product will be dosed in the RO feed; these antiscalant products typically incorporate phosphorous compounds, yielding orthophosphate in the brine stream as a product of hydrolysis. Phosphate is a key nutrient for algal growth and elevated concentrations increase the risk of eutrophication in the receiving water.

Two scenarios were defined for the purpose of this investigation, an average, and a worst-case discharge quality scenario, detailed in Table 5.

Table 5 - Modelled discharge composition scenarios

Parameter	Units	Average	Worst-case
Excess Salinity*	psu	18	26
TSS	mg/l	30	150
pH	-	6.85	
Total iron	mg/l as Fe	2.0	1.0
Phosphate	mg/l as P	0.5	0.3

**Excess salinity is the difference between salinity of ambient seawater and that of the combined treatment residuals stream.*

Table 6 details the referenced water quality targets applied for the dispersed discharge stream forming the basis for all subsequent commentary on the modelling results.

Table 6 - Coastal discharge dispersion targets

Parameter	Units	Target Value	Reference
Excess salinity	psu	< 1.7	No regulatory standard for salinity. Maximum excess of 5% applied for this study based on an average salinity of 33.8 psu from EA near East Lepe.
TSS	mg/l	25 (mean)	Freshwater Fish Directive guideline standard.
		100 (max)	EA default permit standard.
pH	-	6.0 - 8.5	"Surface water pollution risk assessment for your environmental permit" EA Guidance Document.
Total iron	µg/l as Fe	< 1,000	"Surface water pollution risk assessment for your environmental permit" EA Guidance Document.
Phosphate	µg/l as P	< 114	No standards for phosphorus in the marine environment. The river water standard for moderate quality low alkalinity lowland was applied.

The near-field modelling assessment was carried out using the results of the CORMIX model prepared by Royal HaskoningDHV for a continuous discharge under the drought operating scenario. The results of this CORMIX assessment were analysed and the concentrations of the water quality parameters were calculated at the previously reported distances from the discharge site. The results show that:

- Excess salinity concentrations are reduced to around 3 psu, within 200 metres of the discharge point for Sites 1 to 3 even in the case of the maximum discharge concentration. Excess salinity concentrations are projected to meet the 1.7 psu limit at around 250 metres from the discharge point for all modelled scenarios.
- Excess TSS concentrations are reduced to less than 20 mg/l, within 20 metres of the discharge point for Sites 1 to 3 even in the case of the maximum discharge concentration.
- Excess phosphorus concentrations are reduced to less than 60 µg/l, within 200 metres of the discharge point for Sites 1 to 3 even in the case of the maximum discharge concentration. This excess phosphorus concentration is approximately equivalent to the good standard for river quality.
- Excess Fe^{3+} concentrations are reduced to around 120 µg/l, within 200 metres of the discharge point for Sites 1 to 3 even in the case of the maximum discharge concentration.
- The pH deficit is reduced to around 0.02, within 200 metres of the discharge point for Sites 1 to 3.

The mid and far-field modelling was conducted using a calibrated and validated Mike21 with a resolution of 125 m; this model replicates the unique tidal regime found in the Solent and Southampton Water. Simulations were conducted for present and future scenarios encompassing a period of more than 30 days to encompass two spring / neap tidal cycles to provide an understanding of:

- Changes in water depth at each discharge location
- Changes in current velocity at each discharge location
- The point at which accumulation of the identified parameters reaches a state of dynamic equilibrium, allowing the impact to be fully assessed
- The change in ambient water quality, for the identified parameters, across the model area as a result of the discharge

The results of the model simulations have been analysed to understand the maximum and mean concentration at each location in the model domain across the model simulation period after dynamic equilibrium has been achieved. The findings are summarised as follows:

- The impact on water quality standards is low with respect to the standards considered for all locations
- Site 2 and Site 3 have a reduced impact on the concentration of water quality parameters and these sites show improved transport and dispersion when compared to Site 1 and Site 8

The results of this modelling study are reported in full in the document titled "Coastal Modelling – Desalination Reject Water Assessment"; details of the CORMIX assessment completed previously by Royal HaskoningDHV are reported in the document titled "Water for Life Hampshire: Hydraulic Modelling Study for Site Selection Assessment". Both documents can be made available upon request.

2.2.3 Desalination Plant

2.2.3.1 Desalination Process Overview

Figure 10 is the PFD for the proposed treatment process at the desalination plant, excluding the treatment residuals handling processes which are presented separately in the subsequent throughout the remainder of this section.

Conventional Pre-treatment

The conventional pre-treatment processes are enhanced coagulation, Dissolved Air Flotation (DAF), and Rapid Gravity Filters (RGFs). These treatment stages are included as a barrier for foulants present in the seawater (e.g., suspended solids and organic carbon), yielding suitable feed water quality for economic operation of the downstream membrane processes.

Sulphuric acid dosing is included before coagulation to reduce pH from ambient seawater conditions towards the optimal range for the ferric chloride coagulant which has been assumed for this plant.

The DAF plant consists of six parallel streams sized to an N+1 design, providing redundancy in the event of asset failure at peak demand. Each DAF stream includes a flocculation tank, flotation basin, and dedicated recycle system. Each flocculator contains alternating over / underflow baffles to create two compartments in series, each of which contains a pair of vertically mounted impellers. The recycle system includes a recycle pump, strainer, air saturator, and compressor; the recycle feed is drawn from the individual DAF outlet. Each DAF basin contains a pair of dispersion headers, assumed to support 50% turndown for each stream. A hydraulic desludge mechanism is proposed for these basins.

The RGF plant consists of 12 dual-media (sand & anthracite) filters, sized to N+1 and structured as a split bed. The clean washwater tank is filled from the combined RGF filtrate and is sized on two backwash volumes plus 10% ullage. A “collapsed pulse” combined air / water backwash regime will be employed but a filter to waste period post-backwash will not normally be required given the provision of UF downstream.

Both the DAF and RGF processes will operate with all units in service in the drought operating regime; three DAF streams and eight RGFs will be taken out of service under the normal minimum flow operating regime, with duty rotated at suitable intervals to verify their continued operational readiness and control wear.

Ultrafiltration (Advanced Pre-treatment)

The UF plant is a two-stage system achieving upwards of 98% recovery by feeding the backwash waste from the primary membranes (the first stage) through an array of secondary membranes (the second stage) with the secondary UF filtrate being recycled to the primary UF feed tank; the process losses from this configuration are associated with backwashing of the secondary membranes and chemical cleaning for both stages. This arrangement is a deviation from the concept solution presented at Gate 1 which employed a single stage system where recovery could be as low as 90%.

Both UF stages will adopt a constant filtrate production control strategy, with feed buffer tanks provided for each stage to compensate for upstream flow fluctuations and maintain a stable feed to the RO plant.

The primary UF system includes nine skids of 258 membranes, with spare capacity for a further 30 membranes in each skid; the secondary system includes five skids of 60 membranes and 12 spare housings. Under minimum flow operation, three of nine primary skids and two of five secondary skids will remain in service, translating to a normal operating flux 65% that of the full flow operating regime (i.e., 35% turndown).

Reverse Osmosis (RO)

Hydranautics’ IMS Design RO projection software was used to support membrane selection and process sizing, with energy consumption, permeate quality, and the total number of membranes required being primary design concerns. Using the SWC5-LD seawater membrane in the first pass and the CPA5-LD brackish water membrane across the three stages of the second pass yields a suitable blended permeate quality across the expected range of operating conditions and an intermediate energy consumption relative to Hydranautics’ alternative products. Hydranautics is understood to be commencing a Regulation 31 application for these two products to supply Thames Water’s Gateway Desalination Plant; aligning membrane selection with that of the Gateway plant is prudent at this stage with the Regulation 31 approval process being a major programme risk going forward.

The “partial” indicates that a proportion of the first pass permeate bypasses the second pass membranes and is blended with the second pass permeate to achieve an intermediate water quality between permeate from the first and second passes. The “split” leverages the declining permeate quality, preferentially withdrawing the highest quality permeate from the front-end of the module to bypass the second pass, achieving a higher quality blended permeate at minimal energy cost.

The first Pass RO has a target recovery of 45% with a maximum projected feed pressure of 75 bar. The second pass RO has a target recovery of 85% with a maximum projected feed pressure of 28 bar.

Turbine-type Energy Recovery Devices (ERDs) will be installed on the first pass brine discharge. The feed side of this type of ERD is similar to a pump and is not expected to require new Regulation 31 approvals provided materials of construction are consistent with those of the high-pressure feed pumps.

Pressure-exchangers offer a significant energy benefit above that of turbine ERDs, saving an excess of up to 0.45 kWh/m^3 of permeate produced, and are the Preferred Option for minimising the energy footprint of the plant. The pressure-exchanger mechanism is assumed to require Regulation 31 approval, with potentially novel materials of construction (specifically ceramic internals). Pressure-exchangers have been excluded from the design pending supplier engagement, recognising that due to the large international demand for these devices and the small number of suppliers offering them; the perceived risk associated with the Regulation 31 approval process is currently expected to deter suppliers.

RO processes must be operated at constant flow and recovery to achieve consistent permeate quality and energy efficiency. This plant comprises six parallel streams, with five duty and one standby at the maximum design flow, allowing the plant to operate in 20% increments. Each stream includes first and second pass membrane racks and high pressure first pass feed and inter-pass booster pumps.

An antiscalant solution will be dosed in the feed for both passes and the pH of the second pass will be increased to pH 10.5 to achieve high boron rejection.

During minimum flow operation, where the plant is turned down to 20% of its design capacity, the plant will operate with duty rotation whereby each stream operates at full flow for a period of six days before entering a 30-day standby period in short-term storage. At the end of its operational period, the stream will be flushed with permeate at low pressure to equalize the salinity on both sides of the membrane. To maintain the stability of the offline membranes, flushing must be carried out at least weekly throughout the short-term storage period; timing this flushing to coincide with during duty rotation would minimise the required frequency of operator intervention.

When brought back into service, feed water will be initially recirculated at low pressure for a few minutes to displace the permeate and then the high-pressure pumps will be engaged, ramping up to the full operational pressure in two minutes. The RO streams can be brought back into service in less than 15 minutes.

Online monitoring is included upstream of the RO system for the anticipated suite of warranty parameters; this is a critical control point shutting down the works in the event of feed water quality deviations. A run-to-waste location is included upstream of the RO process for flushing non-compliant water from the system.

Online conductivity monitoring is included for first pass, second pass and blended permeate on each stream for performance monitoring and an indirect indicator of membrane integrity. The blended conductivity for each stream is a critical control point, triggering duty rotation to another stream following a deviation in permeate conductivity and signalling operational personnel to investigate the root cause of deviation. Second pass feed pH is also a critical control point associated with each stream, recognising its importance for boron removal; deviations will trigger the same duty rotation response as for blended conductivity.

Remineralisation

The remineralisation plant employs a side-stream limewater process for the reintroduction of calcium hardness to the RO permeate and carbon dioxide as a source of inorganic carbon to restore alkalinity. Magnesium sulphate dosing was discounted from the system, with magnesium typically constituting less than 5% of total hardness in the existing supply from Testwood WSW, and the high supply-side risk arising from the availability of just one Regulation 31 approved imported product.

Matching the calcium hardness of the existing supply is not feasible given the excessive cost, embodied carbon, and logistical complexity that would be entailed. Limewater dosing will instead be controlled to achieve a calcium concentration of 60 mg/l in the remineralised water, approximately 60% that of the treated water from Testwood WSW, aligned with the targets at the existing Thames Water Gateway Desalination Plant.

There are five lime saturators sized to an N+1 design, resulting in 20% turndown when all units are available at the maximum production flow. The baseline operating strategy assumes that turndown on the lime saturators is limited such that four of five lime saturators must be taken offline during minimum flow operation, leaving them empty until the plant is instructed increase production.

Two lime silos are included for storage, each fitted with bin activators, to prevent blockage, and augers for transfer to the duty / standby lime slurry tanks, each containing a vertically mounted rapid-mixing impeller, and generating a slurry of hydrated lime and RO permeate for dosing upstream of the saturators. A limewater buffer tank, sized for a four-hour minimum residence time, provides a buffer between the saturators and the process stream, providing additional lime for dissolution to minimise the dosed turbidity.

Carbon dioxide will be stored as a liquid, evaporated as required for injection into an RO permeate carrier water side-stream at elevated pressure (approximately 3 bar) to maximise the dissolution, and minimise carrier water demand, before combining with the main process flow upstream of the limewater dosing point. The carbon dioxide addition will be controlled to keep the remineralised water below pH 7 to minimise any residual risk of undissolved lime carrying forward to disinfection, which could compromise the pre-disinfection turbidity requirement is present in sufficient quantities.

Sodium hydroxide dosing post-disinfection will be used to raise the treated water pH such that the Langelier Saturation Index (LSI) and Calcium Carbonate Precipitation Potential (CCPP) are slightly positive. This approach has been demonstrated to effectively control the corrosion risk associated with desalinated water supplies however orthophosphoric acid will also be dosed during remineralisation as an added corrosion mitigation.

Disinfection

The configuration of the disinfection process has been revised from the Gate 1 concept solution to use ordinary chlorination downstream of remineralisation to control for possible recontamination during this process.

Contact tank sizing is based on the product of the minimum effective contact time and the estimated minimum free chlorine concentration at the tank outlet, denoted as “Ct”. A minimum Ct of 5 mg.min/l was adopted for this plant to yield a 4 log-reduction in active viruses. The biocidal effectiveness of free chlorine depends on the temperature and pH of the water undergoing disinfection, primarily due to their effect on the equilibrium position between hypochlorous acid and its dissociated hypochlorite form, the former being the more effective biocide. The Ct calculation was modified to consider only the hypochlorous acid fraction of the free chlorine such that the working volume of the disinfection process could compensate for the worst-case temperature and pH effects.

Turbidity is monitored online upstream of the contact tank inlet. This is a critical control point for ensuring Regulation 26 compliance, shutting down the works in the event of turbidity deviations to maintain the integrity of the disinfection process. The free chlorine concentration will be monitored continuously at the contact tank outlet and again on the outgoing distribution main; these are both critical control points associated with full plant shutdowns, the former for ensuring compliance with the site-specific disinfection policy and the latter for controlling outgoing treated water quality.

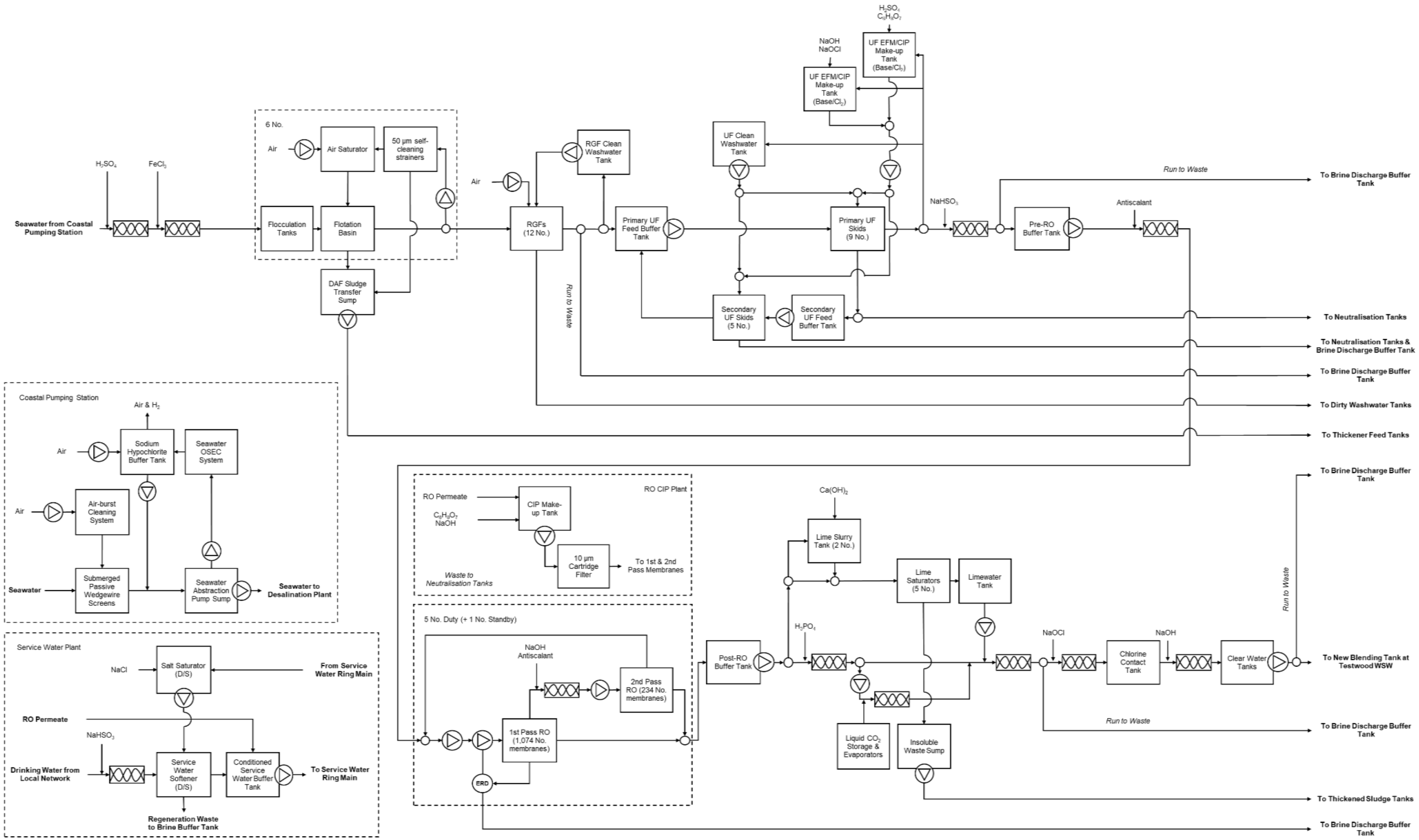

Figure 10 - Desalination plant PFD

2.2.3.2 Treatment Residuals Handling

Consistent with the Gate 1 solution, a conservative worst-case residual handling process has been included to ensure maximum recovery of the captured suspended solids and coagulant residuals from the pre-treatment process, consolidating this solid waste into a wet cake for export. The liquid fraction of the pre-treatment residuals is clarified and blended with the reject streams from the membrane systems and discharged back into the marine environment via an offshore submerged diffuser. The connectivity of the residuals handling systems is illustrated by the PFD in Figure 11.

Figure 11 - Treatment residuals handling system PFD

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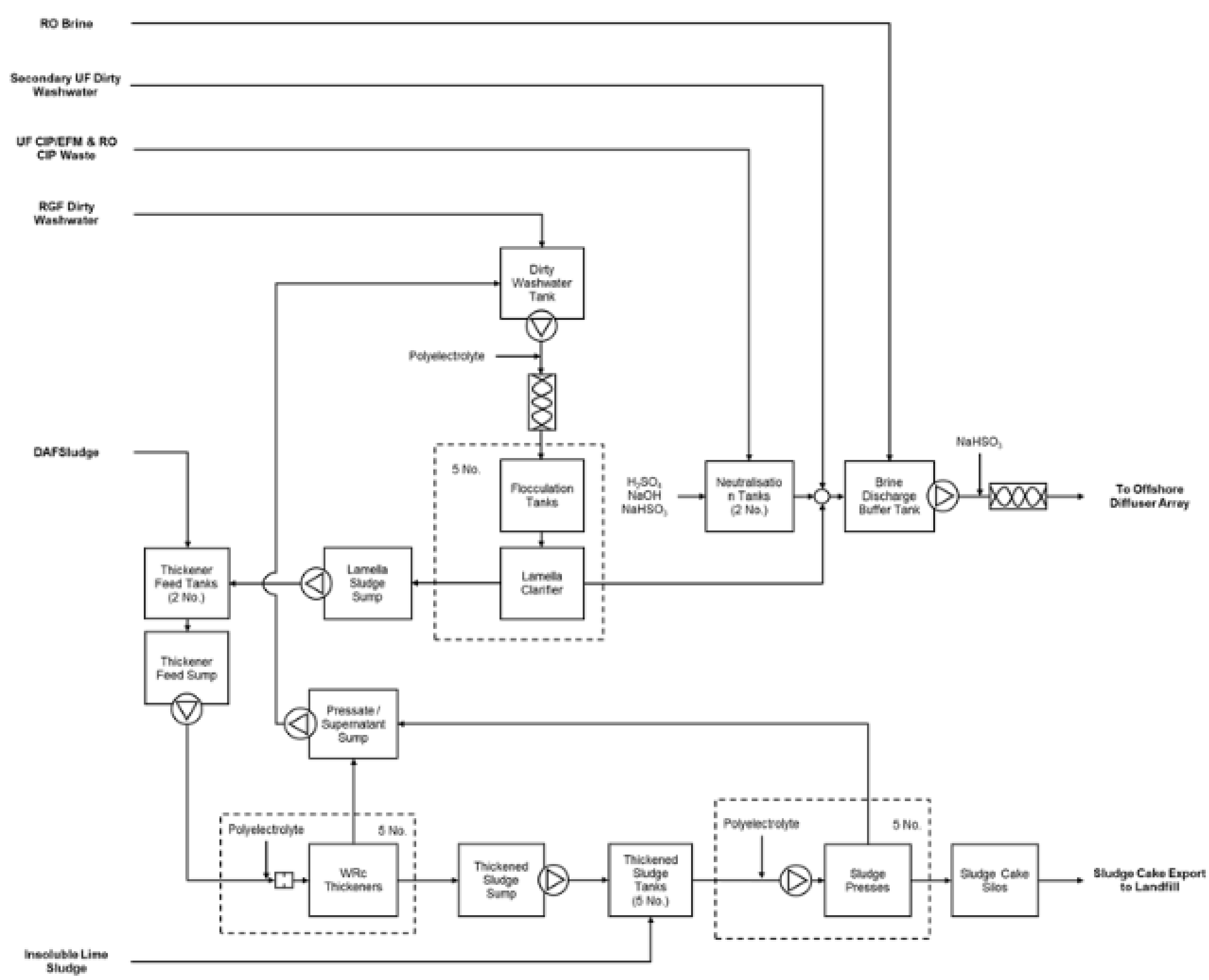

Figure 11 - Treatment residuals handling system PFD

Two neutralisation tanks employ a rotating batch fill-neutralise-drain operating regime, fed with chemical waste from the UF and RO processes; chemical cleaning is inhibited when neither tank is available and neutralised waste is transferred to the brine discharge buffer tank.

Five lamella clarifiers are provided to minimise the TSS concentration of the liquid fraction of the pre-treatment residuals; the lamellas are fed from the dual-celled dirty wash water tank, fitted with submerged mixers to maintain a homogenised feed of RGF wash water, thickener supernatant and dewatering filtrate. Five WRc thickeners consolidate the dilute solids from the DAF and lamella clarification processes into a thickened sludge suitable for dewatering by the five filter presses. The number of operational units in each process varies with the TSS of the abstracted seawater and the treated water output.

Trucks to export the dewatered cake to landfill will be scheduled on an ad-hoc basis, their frequency varying from two to three times per week under the minimum flow operating condition up to two to three times per day during drought operation with sustained poor seawater quality. Truck movements will be limited to daytime on weekdays as far as possible. A minimum three-day storage capacity is included for thickened sludge and seven days for dewatered cake.

2.2.3.3 Operating Strategy

Flow control for the desalination plant will be governed by the RO permeate flow set-point which is limited to increments of 15 Ml/d, from a minimum flow of 15 Ml/d to a maximum flow of 75 Ml/d. With each successive increment an additional RO stream (consisting of paired first and second pass membrane skids) must be brought online manually, and interlocks prevent the additional stream returning to service until sufficient units in the upstream processes are available to handle the additional flow.

In normal operation, the maximum allowable abstraction flow is dictated by the number of operational units in the pre-treatment system, preventing them from becoming hydraulically overloaded. Abstraction flow defaults to a flow set-point calculated automatically based on the assumption of 40% process recovery, provided the above condition is met. The flow set-point is adjusted automatically if the level in the UF feed tank deviates outside of a tolerable dead-band range; this prevents the process from ramping up during normal operation when the RGF wash water tank is recharging but compensates for the inherent variability of pre-treatment recovery, depending on feed water quality and the associated desludge / backwash requirements. All of the intake screens will normally be in operation regardless of the abstraction flow.

The UF process operates in a constant flow filtration mode, with individual unit flux varying according to the state of the other operational units; the filtrate flow set-point is based on the RO feed water demand, which is readily predictable based on the number of operational streams.

The re-lift PS at the post-RO buffer tank lifts the RO permeate through the remineralisation process to the inlet of the disinfection contact tank, from which point it flows to the clear water tanks and High Lift Pumping Station (HLPS). The pumped flow defaults to the total RO permeate flow, controlled automatically based on the flow meter at the re-lift PS. A secondary control mechanism increases or decreases flow if the post-RO buffer tank level deviates outside of the acceptable dead-band range ensuring the tank refills following the routine flushing events for RO membrane preservation.

The high-lift pumps will operate based on the level in the clear water tanks, ramping up or down as required to control the level within the defined dead-band range, with additional controls dictated by the interface requirements with the existing supply system.

It is estimated that the treated water flow can be ramped up from the 15 Ml/d minimum flow condition up to the 75 Ml/d maximum within a 16-hour period; return to service of the offline pre-treatment and remineralisation assets constitutes the majority of the lead-time with the UF and RO processes configured to support relatively rapid return to service.

2.2.3.4 Civil Design

The preferred site of the desalination plant is in Fawley, Southampton; Figure 12 illustrates the site boundary, border, the decommissioned Fawley Power Station site along the South-eastern section of the perimeter and SW's Ashlett Creek Waste Treatment Works (WTW) along the Northern section. The total site area is approximately 90,000 m^2 with a working area of 72,000 m^x, refer to Section 2.4. The Southern area of land is owned by various private landlords, and the Northern part of the site, to the South of the existing WTW, belongs to SW. The land along the Western boundary of the site will be used as temporary working and laydown area during the construction phase.

Figure 12 - Ashlett Creek site location ([redacted])

There are two key processes within the site that need to be considered when laying out the site: clean (desalination) and waste (solid and liquid). They are placed separately and divided by a road, to ensure separation. The waste stream has been placed at the Northern part of the site, closer to the existing Ashlett Creek WTW. The access road has been used as a means to separate the two parts of the site and to enable easy segregation for the gate house. As part of the design the administration building has been located so that site visitors do not need to enter operational areas in order to access these facilities.

The major of process units (DAF, RGF, UF, and RO) are located within a common building. The treatment chemicals are located on the outside of the building in clusters to allow for easy chemical delivery, and access to the individual dosing skids will be through the main process building. The contact tank is located at the Southern end of the works, following the natural flow of the site and is adjacent to the clear water tanks, which will house the high lift pumps which transfer treated water to the new Testwood WSR.

Adjacent to the clear water tanks at the South of the site is the brine tank, and this will feed the PS to the outfall back to the sea. The design put forward should optimise the fall of the site to reduce multiple hydraulic lifts across the site, illustrated in Figure 13.

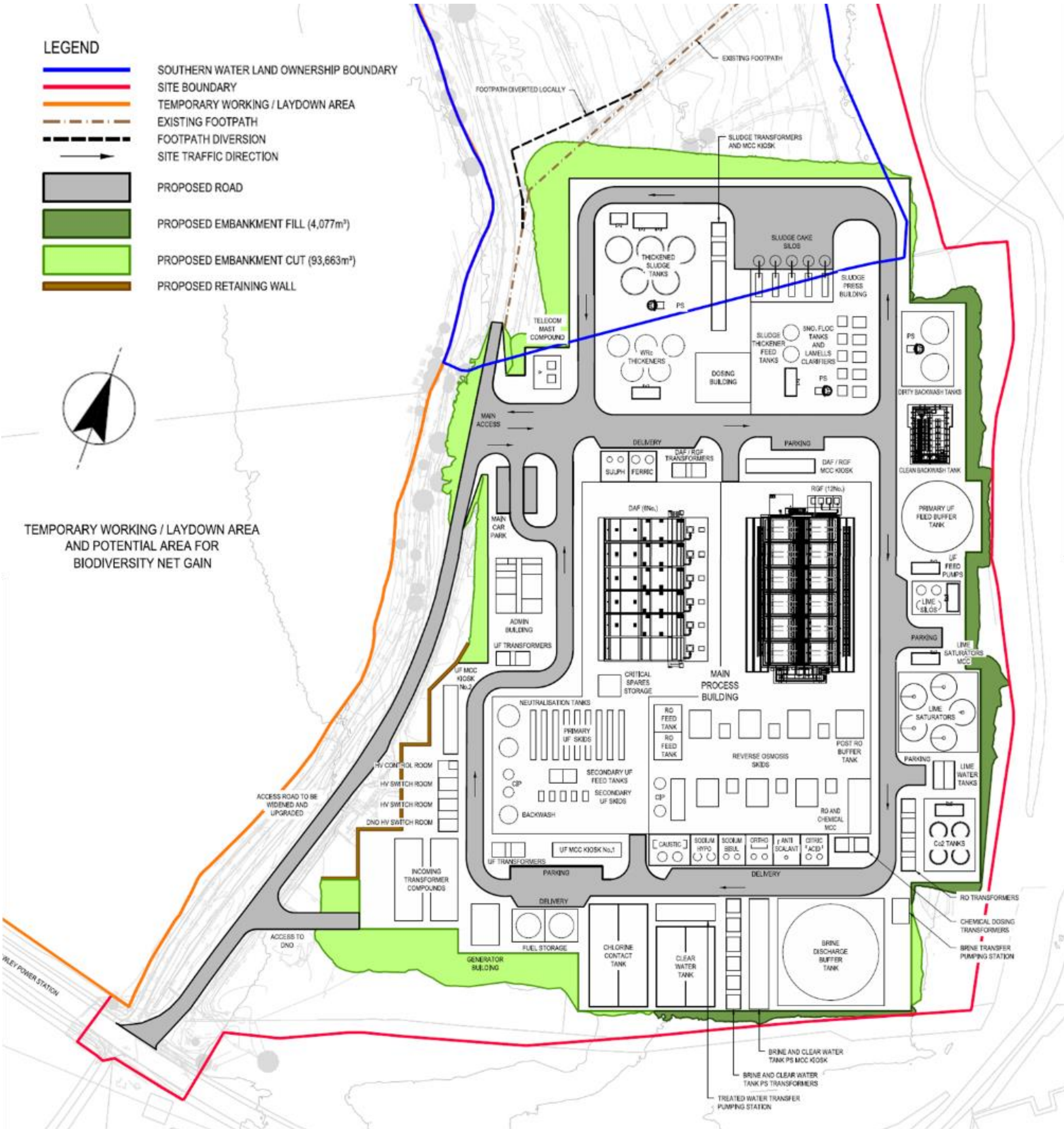

Figure 13 - Ashlett Creek site layout drawing

Several surveys have been completed to inform design decisions and costing. Light Detection and Ranging (LIDAR) data was used to create an Initial Digital Terrain Model (DTM), following which a topographical survey was conducted to verify the LIDAR data. From this data, sections were taken to inform the cut and fill volumes for the site and to help hydraulically set the site at a level to maximise gravity transfers.

Initial geotechnical desktop studies were carried out to inform the potential type of foundations for the site, highlighting the risk of Unexploded Ordinance (UXO) in the area and requiring an initial UXO study to be carried out. The site falls within a low-risk flood area (zone 1); however, a conservative approach to drainage has been taken, and an allowance has been made in costing for the roads to contain drainage crates with capacity for heavy rain events. This provides a retention time to the existing ditch running to the East of the site. Other methods have also been considered including green roofs on the main process building and using permeable hardstanding or grass-crate to reduce the impermeable surface area on site. There will be a site drain to capture any run-off from impermeable areas, and where chemical deliveries or spillages can occur, interceptor chambers will be provided to contain the spillage, with any spillages tankered from site.

The main process building will house the DAFs, RGFs, UF, and RO processes, complete with ancillaries and chemicals. The building is assumed to be a steel portal framed building with a continuous slab foundation supported on Continuous Flight Auger (CFA) piles. The footprint of the building is approximately 130 m by 140 m at its largest with a total height of approximately 12 m, accommodating the process assets and suitable lifting equipment. The building will be founded on a split level and will match the cut and fill profile to reduce the visual impact.

The main admin building will be a two-story conventional brick building approximately 20 m long, 17 m wide, and 6 m high; depending on the geotechnical surveys, this building may be suitable for a raft foundation. The building will house the central control room, office space, meeting rooms, and welfare facilities, including a kitchen, dining room, male and female toilets, drying room, and changing facilities. Space has also been reserved for an on-site laboratory to support operational water quality testing requirements. The foul sewer from here will connect to the existing WTW to the North of the site. The potable feed will be taken from the main leaving site.

For costing purposes, it has been assumed that the DAF and RGF are both reinforced concrete structures. The UF and RO skids will be assembled at supplier facilities, transported to site, and connected using steel pipework. Membranes will be stored in accordance with supplier specifications and installed as required during the dry (& clean water) testing period.

The residuals handling plant is expected to be sited on a 500 mm base slab with CFA piled foundations. To stop differential settlement each unit will be sited on an independent foundation.

The process pipework from the incoming main to the RO membranes has been sized to meet SW specifications and will be 1,200 mm welded steel. Downstream of RO it is envisaged 800 mm steel pipework will be sufficient due to the reduced volume of forward flow. All pipework will need to be designed to take seawater, and additional resistivity tests shall need to be carried out to check the suitability of the ground. The pipework will be laid with 300 mm surrounded with single-sized gravel and cover will be no more than 3 m.

The large buffer tanks situated throughout the system are either partially buried reinforced concrete tanks or Glass Fused to Steel (GFS) tanks positioned on reinforced concrete slabs at ground level approximately 500 mm thick and supported by piles.

2.2.3.5 Power Supply

Distribution Network Operator (DNO)

Power supply to the desalination plant will be obtained from the Fawley Grid Supply Point (GSP). This will consist of a dual transformer substation containing 20 MVA – 33 kV to 11 kV stepdown transformers and 11 kV switchgear. The transformer bays will be bunded and have an associated HV switch room.

Southern Water (SW)

Power supply to the different process areas of the desalination plant will be obtained from the SW HV switchboard provided in two identical halves. The HV switchboards will each have eight circuit breakers (VCB). Each half of the switchboards will have its own building / kiosk. The distance between the switchboards should be a minimum of 3 m apart to provide a fire break. The HV switchboards will have tripping batteries units.

[redacted]

[redacted].

The site will include road lighting, external task lighting and internal lighting within kiosk and buildings which will all be Light Emitting Diode (LED) based to provide the best Whole Life Cost (WLC). Illuminance levels shall be in accordance with standards. The external road and access lighting is photocell controlled with Supervisory Control and Data Acquisition (SCADA) override. All other lighting will be manually switched.

2.2.3.6 Provisions under the Security & Emergency Measures Direction (SEMD)

[redacted]

[redacted]

2.2.3.7 Safety and Construction Design and Management CDM Regulations

A Hazard Identification Checklist (HIC) and Significant Risk Log has been prepared for the Fawley site; the following significant hazards were identified:

- **Unauthorised access:** Unauthorised access to the desalination plant may cause danger to the operators, theft of equipment / materials, or deterioration of the water quality, which can affect thousands of customers. An SEMD report has been undertaken for the security classification of the site, and there are also proposed methods of risk mitigation; this can be provided upon request.
- **Asbestos in raw / friable condition:** Waste materials have historically been discarded on the Ashlett Creek site, and it is unknown whether asbestos is present among this waste. Inhalation of Asbestos fibres can cause mesothelioma, lung cancer, asbestosis, and pleural thickening.
- **Chemical storage:** Chemical bunds and storages are present on site. The treatment chemicals stored in bulk on site are sodium hydroxide, sodium hypochlorite, sodium bisulphite, orthophosphoric acid, citric acid, carbon dioxide, hydrated lime (calcium hydroxide), ferric chloride, sulphuric acid, a proprietary antiscalant (specific product to be confirmed) product, and a polyelectrolyte (product to be confirmed). Exposure to these products could lead to burns, illness, injury, or death.
- **Toxic gases:** Mixing of sodium hypochlorite with acids stored on site will generate chlorine gas. Exposure to low levels of chlorine can result in nose, throat, and eye irritation; at high levels, this can cause severe damage to skin, eyes, and lungs, and can be fatal. Mixing of sodium bisulphite with acids generates sulphur dioxide which is a strong irritant and mildly toxic if inhaled. Several other chemical combinations will result in highly exothermic reactions. Each chemical is provided with a dedicated kiosk and bunded area to prevent incompatible chemicals from mixing.
- **Explosive atmospheres:** Hazardous area classifications, as defined under the Dangerous Substances & Explosive Atmospheres Regulations (DSEAR), are to be confirmed.
- **Live electrical supplies:** Extra-high voltage (EHV) cables from Scottish & Southern Electricity Networks (SSEN) are near the Eastern and Southern boundaries of the site, and there is a risk of

strike that can lead to death. There are also major substations at the site of the Fawley Power Station and overhead power cables from national grid are close to the Southern boundary of the site.

2.2.4 Testwood Water Service Reservoir (WSR)

Testwood is located to the north-west of Southampton; it is an existing WSW which is owned and operated by SW. The existing feed to Testwood is from the river Test and feeds both the potable network and also an industrial feed, which provides a large industrial user and the Isle of White with potable water. The proposed Testwood reception tanks are to receive treated water from the new desalination plant at Fawley. From the reception tanks there will be connections with the treated water reservoirs which feed the HLPS, there will also be connections to the planned bidirectional main to Otterbourne WSW.

There will be two (2) 7,000 m³ working volume tanks constructed on a 500 mm thick concrete base, which will be founded on a CFA piled base. Each tank will have overflows to the existing Testwood overflow pipework which passes through a de-chlorination chamber within the Testwood WSW site boundary before discharge. The tanks will be cited along the southern boundary of the WSW, as illustrated in Figure 14.

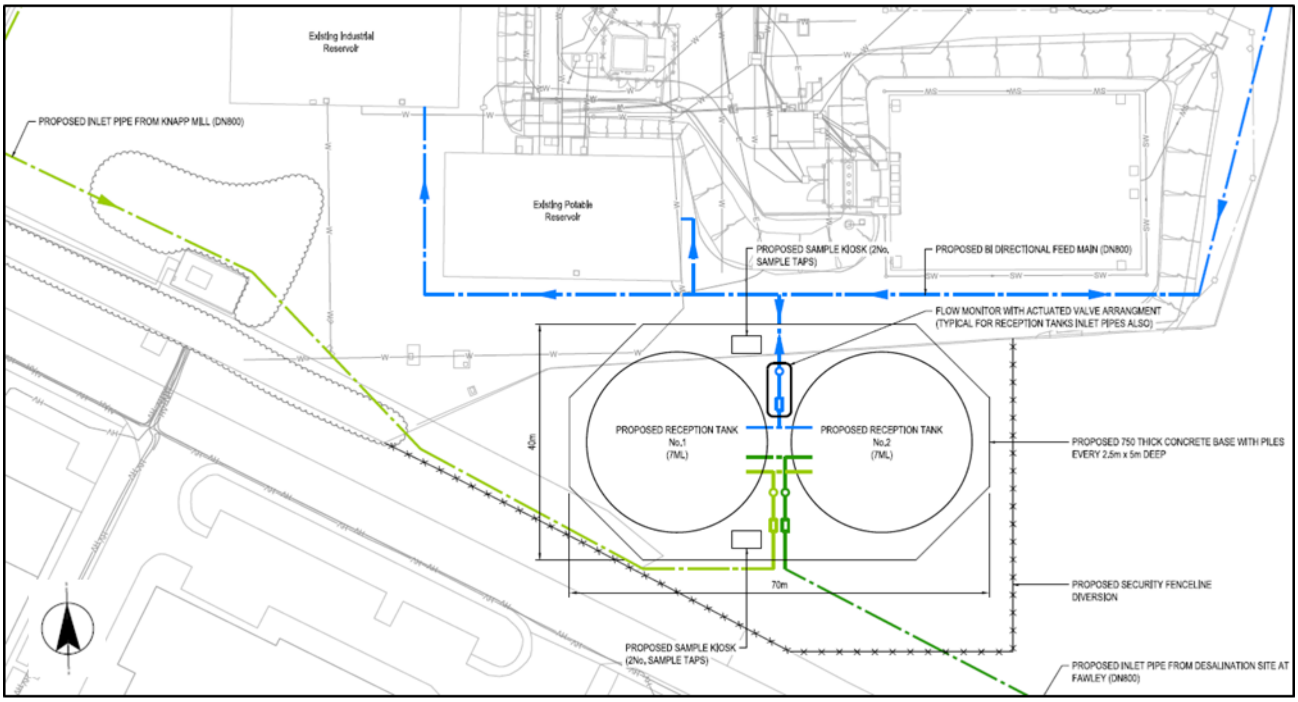

Figure 14 - Testwood WSR location and pipework arrangement

2.2.5 Drinking Water Quality Considerations

2.2.5.1 Desalination Plant Treated Water Quality Projections

RO permeate quality depends on the relative fluxes of water and salts across the membrane, with feed water temperature and salt concentration being uncontrolled variables and applied pressure the controlled variable exhibiting significant influence over these fluxes. In general, permeate quality deteriorates when the feed water temperature and/or salt concentration increase.

The RO permeate is stabilised by remineralisation, reducing the propensity for corrosion, increasing palatability, and (with disinfection) rendering it safe for human consumption. Table 7**Error! Reference source not found.** details the projected variations in treated water quality for the desalination plant, and a suite of corrosion indices, based on minimum, average, and maximum conditions for feed water temperature and TDS concentrations shows the projected variations of key parameters in treated water quality for the desalination plant.

Table 7 - Treated water quality projections (indices calculated using the WRc WaQCoM model)

	Units	Target	Min.	Avg.	Max.	Comments
Water Quality Parameters						
Total Dissolved Solids	mg/l	n/a[1]	326	325	343	Conversion applied: TDS = conductivity * 40/62.5
Conductivity	µS/cm	< 2,500[2]	509	508	536	
Total Hardness (as $CaCO_3$)	mg/l	n/a[1]	149	149	149	Both parameters determined by limewater, carbon dioxide & sodium hydroxide dosing
Alkalinity (as $CaCO_3$)	mg/l	n/a[1]	180	172	170	
pH	-	6.5 - 9.5[2]	7.7	7.6	7.5	Adjusted for positive LSI & CCPP
Sodium	mg/l	< 50[2]	26.7	27.8	34.5	Concentrations significantly below the reported taste threshold
Magnesium	mg/l	n/a	0	0	0	Magnesium concentrations are negligible
Calcium	mg/l	60 ± 0.5	59.7	59.8	59.8	Remineralisation dosing to 60 mg/l as Ca^{2+}
Chloride	mg/l	< 75[3]	15.3	23.1	35.2	Concentrations significantly below the reported taste / odour thresholds
Sulphate	mg/l	< 250[2]	0.5	0.8	1.1	
Boron	µg/l	< 850[3]	129	241	462	Concentrations significantly below the drinking water PCV
Bromide	µg/l	< 6,000	65	143	189	Concentrations significantly below the WHO health-based limit
Corrosion Indices						
LSI	-	0 - 0.5	0.1	0.1	0.1	Saturation indices indicate supersaturation (propensity for scaling)
CCPP	mg/l	0 – 10	2.6	2.8	4.4	
Aggressiveness Index (AI)	-	> 12	12.1	12.0	11.9	Marginal deviation identified, indicating potential to corrode cementitious materials
Larson Ratio (LR)	-	< 0.5	0.1	0.2	0.3	Non-corrosive to ferrous metals
Chloride-to-Sulphate Mass Ratio (CSMR)	-	< 0.8	31	29	32	Possible indicator of a propensity for galvanic corrosion of lead (limited evidence from literature)
Dezincification Potential (DZ)	-	< 1	0.2	0.4	0.6	Dezincification is not possible

[1]Treated water quality is adjusted to achieve positive LSI and CCPP values; these parameters are determined by the changing chemical dosing configuration used to achieve this objective.
[2]Drinking water PCV as defined under Schedule 1 & 2 of the Water Supply (Water Quality) Regulations 2016
[3]Revision to drinking water PCV based on SW's water quality risk tolerance for the given parameters.

Table 7 details consistently positive values for both LSI and CCPP. A marginal deviation in Aggressiveness Index (AI) below the risk threshold indicates limited conditions where cementitious materials could be vulnerable to corrosion; this is considered low risk given the small magnitude of the deviation.

The Chloride-to-Sulphate Mass Ratio (CSMR) consistently exceeds the recorded risk threshold for the galvanic corrosion of lead, this being based on limited empirical evidence from laboratory-based studies.

Galvanic corrosion of lead is only possible where lead pipework or solder has been used in contact with dissimilar metals in improperly fitted domestic plumbing. Evidence from a pipe loop corrosion pilot study found that maintaining a positive CCPP and LSI in remineralised RO permeate, consistent with the strategy applied for this plant, yielded sufficient mitigation for the elevated CSMR (Blute et al., 2008).

The Gate 1 submission flagged risks relating to the possible impact of desalinated water on agriculture if used for irrigation. The residual concentrations of key risk parameters (sodium, chloride, and boron) as detailed in Table 7 are projected to comply with the tolerances for the most sensitive crop species and remineralisation provides sufficient hardness to protect the soil structure.

2.2.5.2 Blending Impacts Under Minimum Flow Operation

Under drought operation, the supplies from Testwood and / or Otterbourne WSW will be suspended and customers across most of Southampton will receive solely desalinated water and desalinated water will also make up a large fraction of the water supply to the western side of the Isle of Wight.

The minimum flow operating condition reflects the future business-as-usual operating regime wherein the drinking water arriving at customers' taps will be blended down to a maximum of 24% desalinated water, with this fraction progressively reducing across the network through blending with additional conventional sources. Table 7 details the average blended water quality, and the corresponding corrosion risk indices, for the assets with the highest proportion of desalinated water under the minimum flow scenario alongside the five-year average profile for the other blending sources to provide context for the resulting risk profile.

The key water quality parameters for the calculated suite of corrosion indices are similar across the existing sources in the network; the corrosion risk profile for the water is therefore reasonably consistent as detailed across Table 7, although the actual corrosion risk profile for the network assets will vary according to age, condition, and construction materials. The results show no unacceptable adverse changes arising in water quality or the corrosion indices following the introduction of desalinated water under the minimum flow scenario, owing to the configuration of the remineralisation process, the high hardness of the existing supplies, and the relatively small proportion of desalinated water at each blending point.

Table 8 - Average water quality for individual sources and blends under minimum flow operating condition (calculated using the WRc WaQCoM model)

Parameter	Units	Desalination Plant	Testwood WSW	Testwood Blended	Carisbrooke WSW	Alvington High WSR	Otterbourne WSW	Otterbourne Blended	Comments
Conductivity	uS/cm	508	522	519	530	523	540	535	-
Total Hardness	mg/l as $CaCO_3$	149	270	262	271	266	298	290	-
Alkalinity	mg/l as $CaCO_3$	172	198	192	211	200	235	225	-
pH	-	7.6	7.5	7.5	7.3	7.4	7.4	7.4	-
Sodium	mg/l	28	13.5	16.9	17.6	17.2	12.1	13.2	Changes all significantly below the reported taste threshold
Magnesium	mg/l	0.0	2.0	1.5	3.1	2.2	2.2	2.1	Unlikely to significantly impact dietary intake
Calcium	mg/l	59.8	104.9	102.4	103.5	102.8	115.8	112.9	Marginal change (< 3%)
Chloride	mg/l	23.1	41.1	36.8	35.0	36.1	29.3	31.0	Changes all significantly below the reported taste / odour thresholds
Sulphate	mg/l	0.8	16.7	12.9	16.2	14.2	13.5	13.4	
Boron	µg/l	241	20	73	NO DATA	NO DATA	20	32	Concentrations increase but not above health-based or regulatory limits
Bromide	µg/l	143	66	85	125	101	56	62	
LSI	-	0.1	0.3	0.3	0.1	0.2	0.3	0.3	Saturation indices all indicate supersaturation (propensity for scaling)
CCPP	mg/l	2.8	16.1	14.9	7.3	11.7	22.3	20.3	
AI	-	12.0	12.2	12.2	12.0	12.1	12.2	12.2	Non-corrosive to cementitious materials
LR	-	0.2	0.4	0.3	0.3	0.3	0.2	0.3	Non-corrosive to ferrous metals
CSMR	-	28.9	2.5	2.9	2.2	2.5	2.2	2.3	All sources show propensity for galvanic corrosion of lead
DZ	-	0.4	0.3	0.3	0.2	0.3	0.1	0.2	Dezincification is not possible

2.2.5.3 Aesthetic Considerations

Taste and odour are each identified as regulated parameters. Compliance is achieved where the taste and odour of the water supply are “acceptable to consumers” and are subject to “no abnormal change”; compliance is assessed on the basis of customer contact rates. The risk of consumers rejecting water because of unacceptable taste or odour is also considered a risk to public health.

Drinking water should normally be odourless with a taste profile dictated primarily by the dissolved inorganic compounds in the water. The remineralised hardness (the calcium and magnesium content) of the desalinated water is significantly lower than the natural hardness of the existing sources, the likely consequence being a significant change in taste when desalinated water constitutes a large proportion of the supply to customers’ taps, as in the maximum flow scenario. The desalinated water would not normally be expected to bear any notable difference in odour from that of the conventional sources.

The hardness addition during remineralisation is as calcium hydroxide (hydrated lime), with dosing constrained by the excessive cost, embodied carbon, and logistical complexity associated with matching the hardness of the existing supplies. Magnesium sulphate dosing was discounted from the system, with magnesium typically constituting less than 5% of total hardness in the existing supplies, and the perception of high supply-side risk arising from the availability of just one Regulation 31 approved imported product. The concentrations of other taste causing inorganic compounds also differ; for example, the sodium concentration is two to three times higher, and the sulphate concentration is as much as 95% lower, but these changes all remain significantly below the reported taste thresholds and are expected to be a lesser consideration relative to that of hardness.

Under normal minimum flow operation, any abnormal change in taste will arise upon 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 in this scenario, if any, are expected to be subtle given the marginal changes in blended water composition detailed in Table 8. Provided advanced notification of affected customers by SW and continued liaison throughout the transitionary period, this should not result in regulatory failure.

Under the maximum flow operating scenario, desalinated water constitutes the sole source of supply for large populations across the Hampshire WRZs and changes in taste are inevitable. Maximum flow operation is a requirement under extreme drought conditions, so the call to operate will be planned with weeks of advanced notice. SW must leverage this predictability, enhancing its drought communication plans to ensure widespread customer awareness of upcoming source changeover events and the subsequent taste impact, emphasising the continued safety of the water despite the change in taste, to minimise customer contacts and / or complaints.

Adverse taste or odour can also be associated with a diverse array of anthropogenic contaminants. Shipping activities and industrial discharges associated with the Fawley refinery, and the Port of Southampton are considered to represent the largest anthropogenic contamination risks for the marine catchment, primarily petroleum derived hydrocarbons which can cause irreparable damage to RO membranes. Large scale pollution incidents from these industrial operators are considered high consequence but extremely low probability events which would require the desalination plant to ceasing operating to avoid damaging the treatment assets and to protect the wholesomeness of the downstream supply system. Communication plans must be established with the major industrial operators in the area to ensure early warning of pollution event. Oil-in-water monitoring is included at the intake to shut down abstraction in the event of a detection.

2.2.6 Water Safety Planning

2.2.6.1 Desalination Water Safety Plan (WSP) Development Progress

It was not possible to prepare a WSP for the desalination supply system as part of the Gate 1 submission, with site selection, system design, and operating regime yet to be confirmed, and with limited water quality data available to form a basis for this kind of assessment. Figure 15 illustrates the development timeline proposed in the Gate 1 Desalination Technical Annex, identifying the key data gathering exercises for each Gate necessary to support the timely completion of a WSP for the desalination supply system to fulfil SW's regulatory obligations.

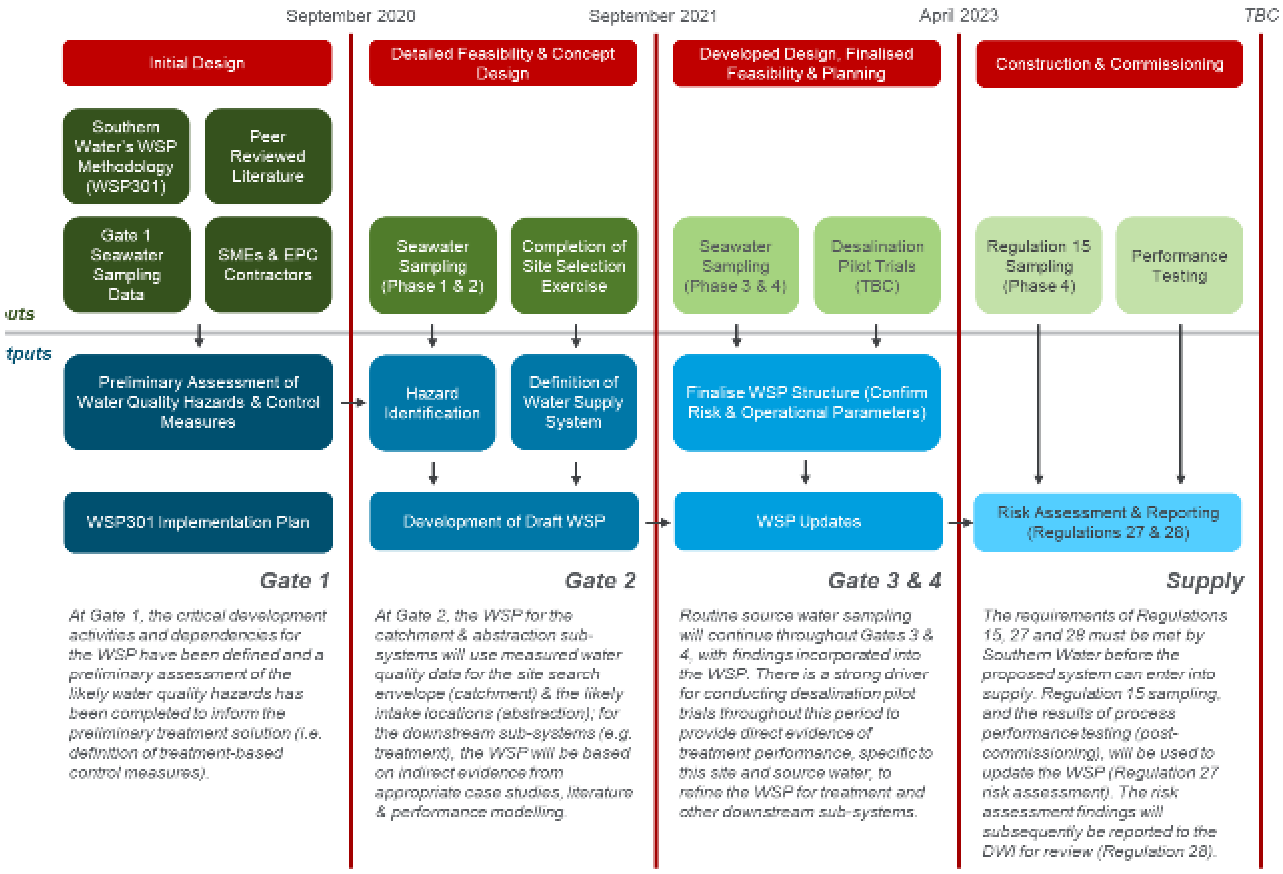

Figure 15 - Water safety plan development timeline

Aligned with the expectations illustrated in Figure 15, the progress made at Gate 2 include, but are not limited to the following:

- New WSP sub-systems have been defined for the desalination solution; each being assigned a WSP.
- 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 form the basis of the Gate 2 draft WSPs for the catchment and abstraction sub-systems.
- The WSPs were developed with input from a committee of water treatment practitioners and specific subject matter experts.
- Several meetings with the Drinking Water Inspectorate (DWI) were undertaken (on 16 September 2020, 15 December 2020, 22 December 2020 and 20 April 2021) to share findings and gather

implications of findings from a regulatory standpoint and to resolve issues and concerns arising from the findings.

Four new sub-systems were defined for the desalination solution as illustrated in Figure 16.

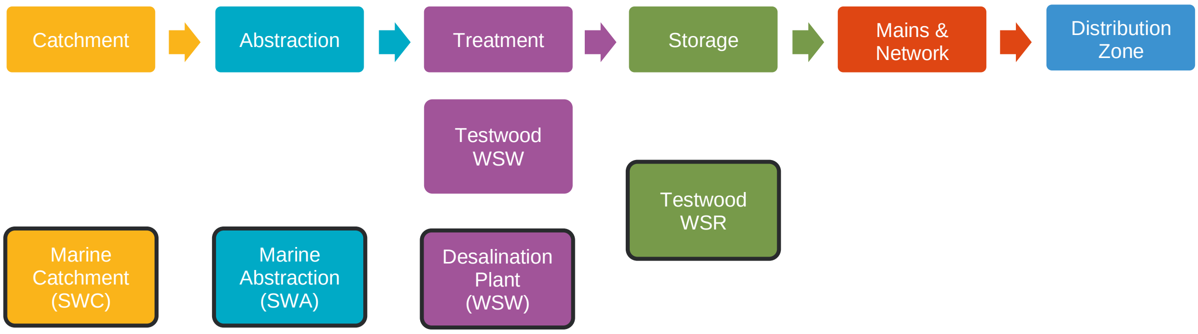

Figure 16 - Water supply sub-system used for desalination

Boundaries were defined for each of the sub-systems as stated:

- **Catchment:** The catchment is considered to encompass the Solent & Southampton Water, and the WSP utilises all the sampling data collected up to the start of May 2021; this will be superseded by more conventional catchment management investigations with continued development of the scheme.
- **Abstraction:** This is the point of seawater abstraction from the Solent / Southampton Water. The intake location is to be confirmed and data from those sample points closest to the short-listed locations have been used as the basis for this WSP for Gate 2.
- **Treatment:** The treatment sub-system is the desalination plant; the source water hazards do not vary across the short-listed intake locations therefore treatment barriers are expected to remain the same regardless of which location is selected.
- **Storage:** The storage sub-system is the new Testwood Service Reservoir, constructed adjacent to Testwood WSW, providing a controlled blending point between the existing supply and the desalinated water. Risks are cascaded to this sub-system from Testwood WSW and the desalination system.

Consequences scores were aligned to the DWI's parameter-based scoring, with suitable scores designated by SW's experts where data is not available. Likewise, likelihood ratings were scored through a range of different metrics, based on comparing the sampling data to the PCV and World Health Organization (WHO) guideline values where a PCV was not available, the rate of removal across treatment and comparing the blending scenarios downstream of the desalination plant were considered.

For consistency in the source-to-tap system, the risk scoring has cascaded from upstream processes to downstream WSP's i.e., the controlled risk scoring for the Marine Catchment became the uncontrolled risk score for the Abstraction Catchment.

Limitations arose in the development of the WSP:

- Accredited analytical methods for saline water, or methods with suitable MDLs, were not available from [redacted], or [redacted] sub-contracted labs, for the full suite of parameters identified for analysis in the Gate 1 Desalination Technical Annex (e.g., the MDL for vinyl chloride exceeded the PCV). [redacted] is working to develop new methods to expand the suite of analytes measured; data gaps were addressed in the catchment and abstraction WSPs based on an understanding of the sources of each hazard and literature from the WHO.
- The precise point of abstraction was not yet confirmed therefore the sampling points cover a large area of the Solent.

- Several determinants tested did not have a DWI code assigned, as a result holding codes were assigned to the list of determinants to include the additional compounds being tested as part of the catchment sampling plan.
- Sampling not being taken in the summer season which has led to low detections in algal counts, this will require sampling in the peak risk period to evaluate the risk.
- In the absence of pilot trials to provide direct evidence of process performance, literature has been used to assess the likely treatment capability of the process for the identified hazards, forming the basis for the treatment and storage sub-systems. A mass balance was constructed using the sampling data and Hydranautics' IMS Design RO projection software to develop treated water quality projections for the main inorganic components of the source water as a further input to the assessment.
- The risk of customer acceptance associated with the changes in the taste of water is not yet determined. This aspect of the delivery of the project can be considered through the "Risk Management and Communication" component of the WHO's WSP Framework.

The WSPs include the full suite of parameters currently reported under SW's WSP methodology (WSP 301) and all analytes measured under the coastal sampling programme. It is expected that once the final intake location and process defined by the Competitively Appointed Provider (CAP) for the proposed solution, the suite of hazards included in the desalination WSP will be reduced to the key risk and / or operational parameters; these will represent the parameters required for inclusion in the Regulation 15 sampling at the final intake location.

The following sub-sections summarise the key findings for each of the Gate 2 draft WSPs and provide examples of risk scoring for a selection of hazards cascaded through the desalination supply system (detailed through tablesTable 9 and Table 10).

2.2.6.2 Marine Catchment

Seawater is characterised by very high concentrations of a range of dissolved inorganic species, with these concentrations being unpalatable and unsafe for human consumption; this is reflected by the inclusion of an expanded suite of inorganic hazards in the desalination WSPs and the high-risk scores they have subsequently been assigned.

The presence of biological activity and Natural Organic Matter (NOM) is considered ubiquitous in natural waters; furthermore, moderate to high concentrations of suspended solids are to be expected given the turbulent hydrodynamic conditions present in coastal waters.

Extensive industrial activity is established along the Southampton Water coastline and the short-listed intake locations are close to busy shipping lanes; in particular, the Fawley Refinery, and the associated marine terminal, and the Port of Southampton are considered significant risk to water quality for this supply system, primarily in the event of large-scale pollution events. A suite of measurements for petroleum derived hydrocarbons has been incorporated into to the desalination WSPs; such anthropogenic contamination would pose a serious risk of damaging the proposed treatment system and / or compromising treated water quality, requiring outage during such pollution events.

Contaminants such as Trihalomethanes (THMs), chlorate, and acrylamide were assigned low likelihood scores, arising in drinking water systems primarily as by-product of treatment processes, with drinking water and municipal wastewater discharges expected to constitute a very small proportion of flows entering the marine catchment.

Table 9 - Extract from the Fawley Seawater Catchment WSP

Asset Name	Stage	Hazard	Pre-Likelihood	Pre-Consequence	Risk	Control Measure Details	Post Likelihood	Residual Risk
Fawley Seawater Catchment	Catchment	A002 – Turbidity	10 - Almost Certain	5 - Health Risk	50	No control measures	10 - Almost Certain	50
Fawley Seawater Catchment	Catchment	A022 - Iron (Total)	10 - Almost Certain	3 – Aesthetic	30	No control measures	10 - Almost Certain	30
Fawley Seawater Catchment	Catchment	B005 – Mercury (Total)	2 – Unlikely	5 - Health Risk	10	No control measures	2 – Unlikely	10
Fawley Seawater Catchment	Catchment	C001 - Total Coliforms (Confirmed)	10 – Almost Certain	5 - Health Risk	50	No control measures	10 – Almost Certain	50
Fawley Seawater Catchment	Catchment	C002 - E. coli (faecal coliforms Confirmed)	5 - Probable	5 - Health Risk	25	No control measures	5 - Probable	25
Fawley Seawater Catchment	Catchment	D011A - Trichloromethane-Chloroform (Total)	2 - Unlikely	5 - Health Risk	10	No control measures	2 - Unlikely	10

2.2.6.3 Seawater Abstraction

The post-likelihood score from the catchment WSP has cascaded into to the pre-likelihood for the abstraction WSP; in general, there is no change to the post-likelihood score at the abstraction stage with control measures limited to online monitoring for a small number of parameters (e.g., ammonia and oil-in-water) where high level detections would indicate large-scale pollution, necessitating a system shutdown.

The residual risk scores for the abstraction WSP demonstrate the need for treatment barriers for salinity, suspended solids, pathogens, and NOM, to achieve a robust wholesome water supply. Hence, there is a need for membranes, disinfection, and remineralisation treatment to treat the seawater.

Table 10 - Extract from the Fawley Seawater Abstraction WSP

Asset Name	Stage	Hazard	Pre-Likelihood	Pre-Consequence	Risk	Control Measure Details	Post Likelihood	Residual Risk
Fawley Seawater Abstraction	Abstraction	A002 - Turbidity	10 - Almost Certain	5 - Health Risk	50	No control measures	10 - Almost Certain	50
Fawley Seawater Abstraction	Abstraction	A022 - Iron (Total)	10 - Almost Certain	3 – Aesthetic	30	No control measures	10 - Almost Certain	30
Fawley Seawater Abstraction	Abstraction	B005 – Mercury (Total)	2 – Unlikely	5 - Health Risk	10	No control measures	2 – Unlikely	10
Fawley Seawater Abstraction	Abstraction	C001 - Total Coliforms (Confirmed)	10 – Almost Certain	5 - Health Risk	50	No control measures	10 – Almost Certain	50
Fawley Seawater Abstraction	Abstraction	C002 - E. coli (faecal coliforms Confirmed)	5 - Probable	5 - Health Risk	25	No control measures	5 - Probable	25

Asset Name	Stage	Hazard	Pre-Likelihood	Pre-Consequence	Risk	Control Measure Details	Post Likelihood	Residual Risk
Fawley Seawater Abstraction	Abstraction	D011A - Trichloromethane-Chloroform (Total)	2 - Unlikely	5 - Health Risk	10	No control measures	2 - Unlikely	10

2.2.6.4 Desalination Plant

The treatment WSP is used to assess the suitability of the desalination process for drinking water production; the assigned residual risk scores illustrate SW's expectation that the proposed use of extensive pre-treatment, RO, disinfection, and remineralisation ensures high treatment capability for the likely suite of source water contaminants. The notable exception to this is associated with the low likelihood occurrence of large-scale hydrocarbon pollution in the source water arising from mismanagement of industrial operations by third parties in the catchment; in such circumstances, outage of the desalination plant would be required.

The treatment process also introduces new hazards, disinfection by-products being one group of hazards which can be robustly controlled by strict adherence to conventional operational best practice, however the likely taste impact associated with this alternative supply is an uncontrolled hazard which must be managed through proactive customer engagement, as further detailed in Section 2.8.

The risk from vinyl chloride is also unknown as the limit of detection in the saline analysis is twice the PCV; it is considered unlikely that this will be present in the water, being a by-product of plastics manufacturing, but being a low molecular weight neutral organic compound, RO may be a less effective treatment barrier. Similarly, many volatile and semi-volatile organics have taste and odour thresholds significantly below the MDL for the saline analysis and may constitute a risk to customer acceptance, although this is also considered low probability given the expectation of high dilution from any point sources in the catchment.

This assessment has been prepared on the basis of indirect evidence; the expectations must be validated if this solution is developed beyond Gate 2 using pilot trials for the specific intake location. Key results are listed in Table 11.

Table 11 - Extract from the Fawley Desalination Plant WSP

Asset Name	Stage	Hazard	Pre-Likelihood	Pre-Conseq-uence	Risk	Control Measure Details	Post Likelihood	Residual Risk
Fawley Desalination Plant	Treatm ent	A002 - Turbidity	10 - Almost Certain	5 - Health Risk	50	Intake screening, DAF, RGF, UF, and RO. Continuous turbidity monitoring at raw, inter-stage and final water sample points high level alarms and shutdowns.	2 - Unlikely	10
Fawley Desalination Plant	Treatm ent	A022 - Iron (Total)	10 - Almost Certain	3 – Aesthetic	30	Coagulation, DAF, RGF, UF, RO, Remineralisation & Orthophosphoric Acid Dosing	1 - Most Unlikely	3
Fawley Desalination Plant	Treatm ent	B005 – Mercury (Total)	2 – Unlikely	5 - Health Risk	10	Coagulation, DAF, RGF, UF, and RO.	1 - Most Unlikely	5
Fawley Desalination Plant	Treatm ent	C001 - Total Coliforms (Confirmed)	10 – Almost Certain	5 - Health Risk	50	UF, RO, and Chlorine Disinfection. Online monitoring of chlorine residuals with	1 - Most Unlikely	5

Asset Name	Stage	Hazard	Pre-Likelihood	Pre-Conseq-uence	Risk	Control Measure Details	Post Likelihood	Residual Risk
						high- and low-level alarms and shutdowns. Online monitoring of turbidity at critical control points inter-stage and final with high level alarms and shutdowns.		
Fawley Desalination Plant	Treatment	C002 - E. coli (faecal coliforms Confirmed)	5 - Probable	5 - Health Risk	25	UF, RO, and Chlorine Disinfection. Online monitoring of chlorine residuals with high- and low-level alarms and shutdowns. Online monitoring of turbidity at critical control points inter-stage and final with high level alarms and shutdowns.	1 - Most Unlikely	5
Fawley Desalination Plant	Treatment	D011A - Trichloromethane-Chloroform (Total)	2 - Unlikely	5 - Health Risk	10	Coagulation with pH control for optimal DOC removal during pre-treatment (DAF, RGF, & UF). RO. Residual trim and high-level alarm / shutdown for chlorination.	2 - Unlikely	10

2.2.6.5 Testwood Water Service Reservoir (WSR)

During normal operation Testwood WSR will receive flows primarily from Testwood WSW and the desalination plant, blending them prior to distribution. The WSP takes the highest score from these two upstream sub-systems as the pre-likelihood score for the Testwood WSR. The residual risk from this asset is representative of that carried onwards into the existing distribution network.

Note that the risk attributed to some hazards has increased from the residual leaving the desalination plant, e.g., for turbidity detailed in Table 12, with capital schemes currently ongoing at Testwood to address existing water quality challenges.

Table 12 - Extract from the Testwood Blending Tank WSP

Asset Name	Stage	Hazard	Pre-Likelihood	Pre-Consequence	Risk	Control Measure Details	Post Likelihood	Residual Risk
Testwood Blending Tank	Storage	A002 – Turbidity	5 - Probable	5 - Health Risk	25	No control measures	5 - Probable	25
Testwood Blending Tank	Storage	A022 - Iron (Total)	2 - Unlikely	3 - Aesthetic	6	No control measures	2 - Unlikely	6
Testwood Blending Tank	Storage	B005 – Mercury (Total)	2 – Unlikely	5 - Health Risk	5	No control measures	1 - Most Unlikely	5

Testwood Blending Tank	Storage	C001 - Total Coliforms (Confirmed)	10 – Almost Certain	5 - Health Risk	50	No control measures	10 – Almost Certain	50
Testwood Blending Tank	Storage	C002 - E. coli (faecal coliforms Confirmed)	10 – Almost Certain	5 - Health Risk	50	No control measures	10 – Almost Certain	50
Testwood Blending Tank	Storage	D011A - Trichloromethane-Chloroform (Total)	2 - Unlikely	5 - Health Risk	10	No control measures	2 - Unlikely	10

2.2.7 Desalination Infrastructure Design

The following section details the pipeline route Options for the transfer of drinking water from the desalination plant to Testwood WSR.

2.2.7.1 Transfer Pipeline Infrastructure (Key Elements)

System Design & Hydraulics

Due to the low static head, single stage pumping is proposed for Options A.1, A.2. hydraulic analysis to determine the optimum pipe diameter will be undertaken during design development. Smaller diameter pipelines may result in the requirement for higher rated (PN26) pipes / fittings and operating costs but could provide a lower cost due to the infrequency of pumping at peak flow rates during drought periods, illustrated in the hydraulic profile in Figure 17.

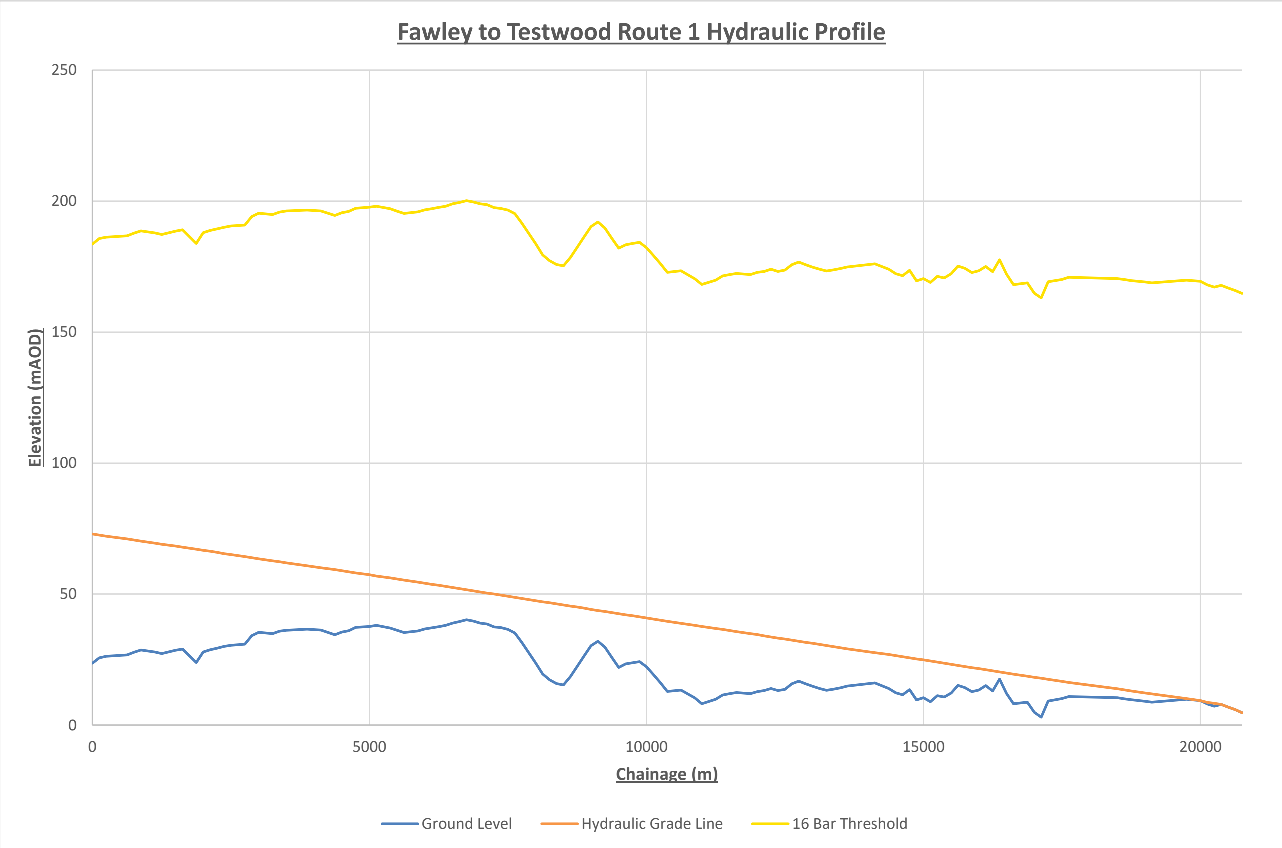

Figure 17 - Fawley to Testwood Route 1 hydraulic profile

Pumping Design

The HLPS at Fawley, to transfer flows to Testwood WSW, forms part of the Desalination plant design. .

Surge Protection

Due to the topography and distances of pumping, it is likely that surge vessels will be necessary at the PS to maintain transient pressures within acceptable limits.

Ancillary Equipment

The standard transfer system ancillary equipment of isolation vales, flow meters, sampling, washouts etc. has been included in the concept design to aid maintenance and monitoring of the transfer asset and water quality.

2.2.7.2 Pipeline Construction

Open Cut Construction

The proposed pipeline will be installed using standard construction methods conventionally used for cross-country pipelines.

Open cut excavation will be used for the majority of the route. The depth of the trench will vary dependent on the ground conditions but will be a minimum of 0.9 m in open fields to prevent frost damage and overloading from vehicle movements.

A maximum working corridor of 25 m between perimeter fences will be required for the pipeline installation. This will allow sufficient room for open excavation, storage of excavated material, construction plant transit and handing of pipelines. The working corridor will be reduced where construction allows and in order to minimise impact, for example when crossing hedgerows and ditches.

Trenchless Construction

No-dig techniques will be employed at critical crossings of main river; motorway; railways; at locations where this will reduce the impact on environmentally sensitive areas or where construction is otherwise restricted.

The construction methodology selected will be dependent on pipe diameter, length of trenchless crossing and ground conditions.

2.2.8 Key Engineering Risks and Opportunities

2.2.8.1 Non-infrastructure Works

Table 13 details the key non-infrastructure engineering risks identified at Gate 2. All these risks sit within either the WfLH Programme Level Risk Register or the relevant Project Level Risk Register where they are actively managed in accordance with the WfLH Risk Management Strategy and Process. In addition, in the event that these risks are considered ‘key project risks’, with risks detailed in Section 2.7.

Table 13 - Key non-infrastructure engineering risks

Risk Name	Risk ID*	Risk Description
Condition of Fawley Power Station assets	n/a	Intake Option 2 makes use of a disused outfall tunnel and surge shaft associated with Fawley Power Station; the condition of these assets is presently unknown and there is a risk that poor condition will be prohibitive or introduce costs or programme delays not presently accounted for. The size of the shaft for receiving the tunnelling machinery required for this Option is also uncertain.
Contaminated ground at Ashlett Creek site	ID 710059-010	There is a risk that the volume of contaminated ground encountered at the Ashlett Creek site will exceed the volume assumed for disposal in the cost estimates and programme.
Power infrastructure capacity	n/a	There is a risk that the available power infrastructure and capacity is insufficient for the proposed system leading to additional cost and construction programme delays.
FWL planning application	n/a	An outline planning application to redevelop the Fawley Power Station site has been approved. There is a risk that changes to the desalination plant design will be required, increasing the current estimated costs, to be respectful of the development.
Regulation 31 approval for RO membranes	ID 710059-018	No seawater RO membranes are currently approved for use under Regulation 31. There is a risk that DWI approval of a suitable membrane product is not granted within the required timescales of the programme delaying delivery of the Base Case.
Seawater metals concentrations	n/a	The design assumes that iron, manganese, and aluminium concentrations detected in the seawater are predominantly solid, with the dissolved fraction meeting the terms of the supplier's warranty. There is a risk that if the dissolved fractions are higher than expected, pre-treatment modifications will be required to protect the membranes, increasing costs.

Risk Name	Risk ID*	Risk Description
Residuals handling process design (opportunity)	ID 710059-006	There is an opportunity to optimise the conservative waste handling process included in the Gate 2 design, with the expectation of a reduction in scope, yielding reductions in cost and programme duration.
Use of disused Fawley Power Station intake (opportunity)	ID 710059-023	There is an opportunity to utilise the existing intake structure at Fawley Power Station (now part of the FWL development), yielding significant cost savings, schedule improvements and a decrease in the overall threat profile of the Base Case.
Use of disused Fawley Power Station outfall (opportunity)	ID 710059-024	There is an opportunity to utilise the existing outfall structure at Fawley Power Station (now part of the FWL development), yielding significant cost savings, schedule improvements and a decrease in the overall threat profile of the Base Case.
Use of single pass membranes (opportunity)	ID 710059-033	A single pass system operated at lower recovery could be used as an alternative to the proposed split-partial two-pass system to achieve the required permeate quality. This requires higher abstraction flow (larger pre-treatment) but a smaller RO plant. It would also be possible increase their proposed recovery rates at a higher risk level for boron and taste impact. The relaxation of the boron PCV is not yet confirmed so the conservative design has been retained at Gate 2.

**Risk IDs, where applicable, are aligned with the contents of section 2.7.2.*

2.2.8.2 Infrastructure Works

The key engineering and construction risks associated with the infrastructure components of the Desalination-based Options relate to possible route constraints in the land between the Ashlett Creek site and Testwood WSW.

[redacted]

Figure 18 illustrates the route Options with various possible route constraints denoted by the colour coded areas.

All route corridors include extensive work within the [redacted] and include traversing major road junctions. The Fawley bypass is a highly traffic sensitive route with limited diversion routes available. Extensive traffic management requirements are likely, and works may be limited as this is also the primary route to an industrial site. The above restriction will also limit construction traffic access to the Ashlett Creek site. There is a risk to meeting programme demands even with seven days working and extended hours. Alternative routes to avoid works within the carriage way have been investigated but are limited due to the extensive number of constraints either side of the [redacted] and may require routing through sensitive designations.

A number of high-risk services are situated along the [redacted] and there is a significant risk that construction is unfeasible due to road space availability for an additional large diameter main. Diversions of existing high-risk utilities mains would be costly and carry a high risk of disruption and is unlikely to be possible in many locations due to the following constraints on either side of the [redacted]. Further investigation of the existing utilities and engagement with utility providers and stakeholders will be undertaken.

2.2.9 Resilience Benefits

2.2.9.1 Background

A quantitative assessment of resilience for the Options progressed at Gate 2 was completed, which built on the methodology presented at Gate 1, and based on SW's Asset Resilience Tool. The tool is designed to assess a number of factors which contribute to a resilience assessment, hence, providing quantified resilience scores for comparison. The tool assesses risk drivers (impact, duration, likelihood, and vulnerability) and resilience control factors (redundancy, response & recovery, resistance, and reliability) for each site. These control factors align to both Ofwat's resilience expectations, and the resilience criteria defined by both RAPID and Water Resources South-East (WRSE).

The use of the SW Asset Resilience Tool has further ensured that the approach is focused on the ability of our key assets and sites to cope with and recover from shocks and stresses. It assesses the ability of sites within a water supply zone or catchment to endure these shocks through the controls already in place. The approach is consequence led in that a resilience assessment tool is used to quantify the potential consequence to customers, drawing out the risk drivers / causes and the strength of each control factor. This in turn enables the prioritisation of site improvement.

2.2.9.2 Approach

Testwood and Otterbourne WSW 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 with insufficient spare capacity in the network to compensate for full outage at either site. The resilience assessment focuses on the loss and the resilience criticality of two of these sites to provide a robust assessment against the resilience requirements at Gate 2.

Resilience has been assessed from two perspectives:

- The non-drought resilience benefit provided by desalination in a BAU situation
- The resilience benefit provided by desalination in the event of a 1-in-200-year drought (stressed)

The objectives of this assessment were as follows:

- To understand how the number of properties that will lose supply will change in the event of non-operation of either site in a drought or in a non-drought condition in comparison to a baseline situation in which desalination is not implemented
- To quantify the system resilience benefit when facing the four key shocks and stresses: raw water loss, severe flood, contamination, and critical asset failure
- To align to Ofwat's resilience expectations and assess against the resilience criteria defined by both RAPID and WRSE in the Gate 2 resilience criteria

2.2.9.3 Results

To ensure compliance with the RAPID and WRSE resilience criteria, the resilience benefit assessment quantified the impact on:

- The number of properties served
- The redundancy of the desalination plant
- Response & recovery, resistance and reliability for the proposed desalination plant
- The defined risk drivers (identified in section 2.2.9.1) for the desalination plant

Theoretically the redundancy element of the resilience benefit assessment is the distinguishing factor between the SROs in the BAU and stressed scenarios. Table 14 details the peak output flows, average daily flows, and the calculated headroom flows used to assess redundancy and provide the basis for assessing the redundancy scores in the SW Resilience Assessment Tool.

Table 14 - Summary of flows used to assess the redundancy for the Desalination-based Options

	Desalination Plant BAU			Desalination Plant Stressed (A.1)			Desalination Plant Stressed (A.2)		
Flows (Ml/d)	**Peak**	**Average**	**Headroom**	**Peak**	**Average**	**Headroom**	**Peak**	**Average**	**Headroom**
Fawley WSW (Desalination)	61.0	15.0	46.0	75.0	75.0	0.0	61.0	61.0	0.0
Testwood	79.8	37.1	42.6	0.0	0.0	0.0	0.0	0.0	0.0
Otterbourne	91.0	55.0	36.0	21.0	21.0	0.0	21.0	21.0	0.0
Remaining Water Sources	69.6	47.5	22.1	55.7	55.7	0.0	55.7	55.7	0.0
Other System Wide Impacts	94.2	63.4	30.8	83.8	66.2	17.6	83.8	80.2	3.6
Total	**395.6**	**218.0**	**177.6**	**235.6**	**218.0**	**17.6**	**221.5**	**218.0**	**3.6**

Table 15 compares the high level and quantitative resilience benefits for the Desalination-based Options against a baseline (no SRO) BAU scenario.

Table 15 - High level and quantitative resilience benefits for the Desalination-based Options

Treatment Works	No. Properties Served	Risk Category	Consequence Score	Resilience Score	Total Zonal Score*
Baseline – BAU (without SRO)					
Otterbourne WSW	106,165	High	55,347	-	-
Testwood WSW	100,711	High	64,347	-	-
Total Zonal	**298,654**	**-**	**-**	**0.26**	**220,908**
Desalination – BAU					
Otterbourne WSW	106,165	Moderate	904	-	
Testwood WSW	71,737	High	2,273	-	
Desalination	28,974	Low	0	-	
Total Zonal	**298,654**	**-**	**-**	**0.60**	**118,475**
Desalination – Stressed (A.1)					
Otterbourne WSW	40,641	High	3,462	-	
Testwood WSW	0	Low	0	-	
Desalination	144,871	High	1,695	-	
Total	**298,654**	**-**	**-**	**0.59**	**122,540**
Desalination – Stressed (A.2)					
Otterbourne WSW	40,641	High	6,925	-	
Testwood WSW	0	Low	0	-	
Desalination	144,871	High	1,695	-	
Total	**298,654**	**-**	**-**	**0.56**	**130,942**

**The total zonal score this includes all the WSW in the zone, not just the properties served by Otterbourne & Testwood WSW.*

The consequence score is an absolute measure of customer risk to loss of supply and is also known as “Properties at Risk”. The resilience score is a ratio between the total number of properties and the consequence score; the closer the resilience score to 1, the greater the resilience.

The results detailed in Table 15 show that the overall resilience scores between the baseline BAU and the Desalination BAU improve from 0.26 to 0.60, reducing the total zonal score from 220,908 to 118,475. The resilience scores are reduced from that of the desalination BAU scenario under the stressed scenarios for both Options A.1 and A.2, increasing their respective total zonal scores. It should be noted however that the stressed resilience for both Desalination-based Options still significantly exceeds that of the baseline BAU scenario, as shown by the lower total zonal scores and higher resilience scores for both Options.

The results also allow for a further comparison between peak output flows in the stressed scenarios for Options A.1 and A.2. The results show that Option A.1 is more resilient, with a resilience score of 0.59 at 75 Ml/d in comparison to 0.56 at 61 Ml/d, as this increases the redundancy of Otterbourne WSW.

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. Table 16 details the resilience impact for the Desalination SRO Options.

Table 16 - Desalination-based Options A.1 and A.2 resilience impact summary

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 in raw water sources and the greater capacity in the network. 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)	Only 4,065 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. This provides ability for response in an emergency situation as there will be no substantial delay in bringing the plant online. To increase the capacity of the desalination plant, however, can take up to 15 hours.
Regional resilience	The resilience score is more than doubled by the addition of a desalination plant in both stressed and BAU conditions. The reliability of the network is greatly improved by the desalination as fewer properties are vulnerable to supply loss in both a 1-in-200-year drought, but also in the event of failure of Testwood or Otterbourne.

2.2.10 Preferred Model of Ownership and Operation Expectation

2.2.10.1 Model of Ownership

The model of ownership is detailed in Section 2.11 of this document.

2.2.10.2 Operational Utilisation

The operational utilisation is detailed in Section 2.2.3.3.

2.3 Network Infrastructure – Hydraulic Modelling

2.3.1 Introduction

The WRMP19 sets out SW's response to the water supply challenge in the Western region. The response consists of a strategic new supply source, new and increased bulk supplies from neighbouring water companies, demand management, and new strategic transfer pipelines across the region. SW commissioned a modelling study to confirm the impact of licence reductions (via water resource modelling), and develop a strategic network model to:

- Simulate the connection of a new desalination plant to the SW distribution network
- Develop a network infrastructure scheme to transmit the new supply and other proposed WRMP19 additional transfers
- Identify how to integrate this new network with existing water distribution systems

The network model inputs incorporate the outputs from the water resource model, which includes all elements of the WRMP19, including new sources, licence restrictions of existing sources, new and existing bulk transfers and demand management schemes. The model is demand-driven and, in alignment with the water resources model, only uses the capacity of the new desalination plant required to meet demand. In alignment with the revised residual deficit identified in an earlier phase of the study, and reported in the Gate 1 submission, this is modelled as 61 Ml/d. The outputs from the water resource model are described separately in the Annex 4 Water Resources Modelling report.

This section describes how the strategic network model was developed to simulate the new water transfer system and its integration with SW's existing distribution network as an aid to the design process. A key output from the study is a set of Options for infrastructure elements that will form the interface between the new bulk transfer network and the existing distribution system; these Options will be developed further in a subsequent phase of the study. The objective of the study is not to make comparisons between desalination, water recycling or Havant Thicket SRO solutions (the preference for this is being determined in a separate, wider, process), but to inform the optimal preference for transmission network infrastructure elements within each SRO solution. This section describes how advanced modelling software was used to develop a set of optimised solutions for the new integration infrastructure and how this can be controlled effectively. It also outlines how a holistic real-time control system can be deployed to control the proposed new network and identifies the associated Information Technology / Operational Technology (IT / OT) requirements. This section also summarises engineering and environmental feasibility studies undertaken at the network integration sites to ensure the concept designs are feasible to install, and identifies the steps required in a subsequent phase of the study to determine the Preferred Option for the new interfacing infrastructure.

2.3.2 Overview of Pipeline Routes

Pipeline routes included in the hydraulic modelling study are illustrated schematically in **Error! Reference source not found.**19. The transfer routes included are:

- Knapp Mill (South West Water (SWW)) to Testwood WSW
- Desalination plant (Fawley) to Testwood WSW
- Testwood WSW to Otterbourne WSW (SLM (Southampton Link Main))
- Gater's Mill (Portsmouth Water (PW)) to Otterbourne WSW
- Otterbourne WSW to Yew Hill WSR
- Yew Hill WSR to Crab Wood WSR
- Crab Wood WSR to Andover (Micheldever Road Andover WSR / River Way Andover WSW)

Figure 19 - Pipeline schematic

Key routes in the existing distribution network were also modelled to ensure that derived solutions maintain acceptable levels of service. A diagrammatic overview of the entire model is illustrated in Figure 20. These key routes included:

- Otterbourne WSW to Otterbourne Hill WSR
- Otterbourne Hill WSR to South Hill Southampton WSR
- Otterbourne WSW to Twyford WSR
- Testwood WSW to Rownhams WSR
- Crab Wood WSR to Weeke Down WSR (new connection)
- Crab Wood WSR to Sarum Road Winchester WSR
- River Way Andover WSW to Micheldever road Andover WSR
- River Way Andover WSW to Upper Enham WSR
- Testwood WSW to the Isle of Wight
- Timsbury distribution zone to include Michelmersh WSR and Broughton Down WSR.

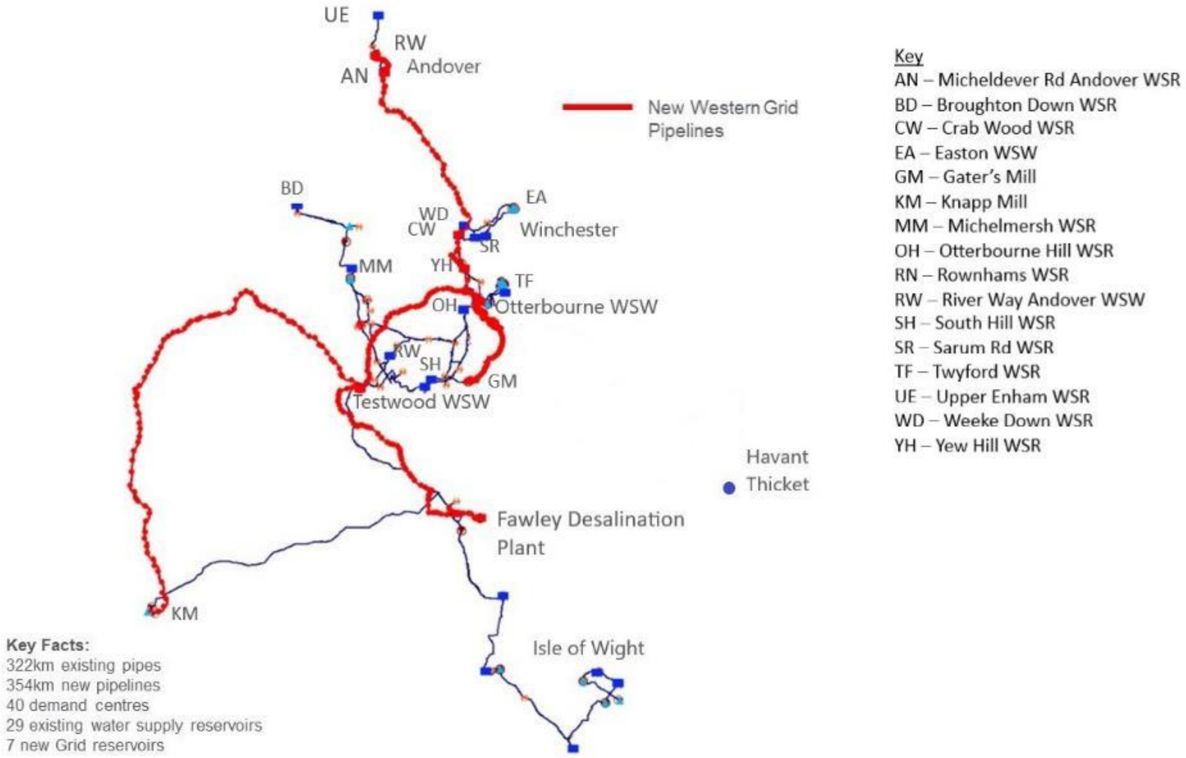

Figure 20 - Western Grid Infoworks WS Pro Model

2.3.3 Methodology

2.3.3.1 Aim

The aim of the hydraulic modelling project was to identify the optimal configuration and operation of assets to answer the question ***"What are we going to build?",*** with respect to infrastructure elements at interface sites between the new grid and the existing distribution network. This is dependent on factors such as operational constraints, capital and operational cost as well as technical and environmental complexities. As such, the study involves close collaboration with other stakeholders such as design teams and Operations.

Studies of the grid interface sites have been undertaken to verify the proposals were feasible with respect to constructability and operation, and in terms of environmental impact. Close liaison and cooperation were required between the modelling, design, enabling and operations teams to ensure the solutions are of acceptable complexity with respect to constructability, and can be operated within current operational constraints.

The design process is illustrated diagrammatically in Figure 21. The high-level solution was developed by the modelling team and fed to the design team, who liaised with Operations and Capital Maintenance design teams regarding control and planned works at the sites. Feedback from this was recorded and shared with the modelling team for amendment. Amendments were then confirmed and verified with the Operations and Capital Maintenance teams.

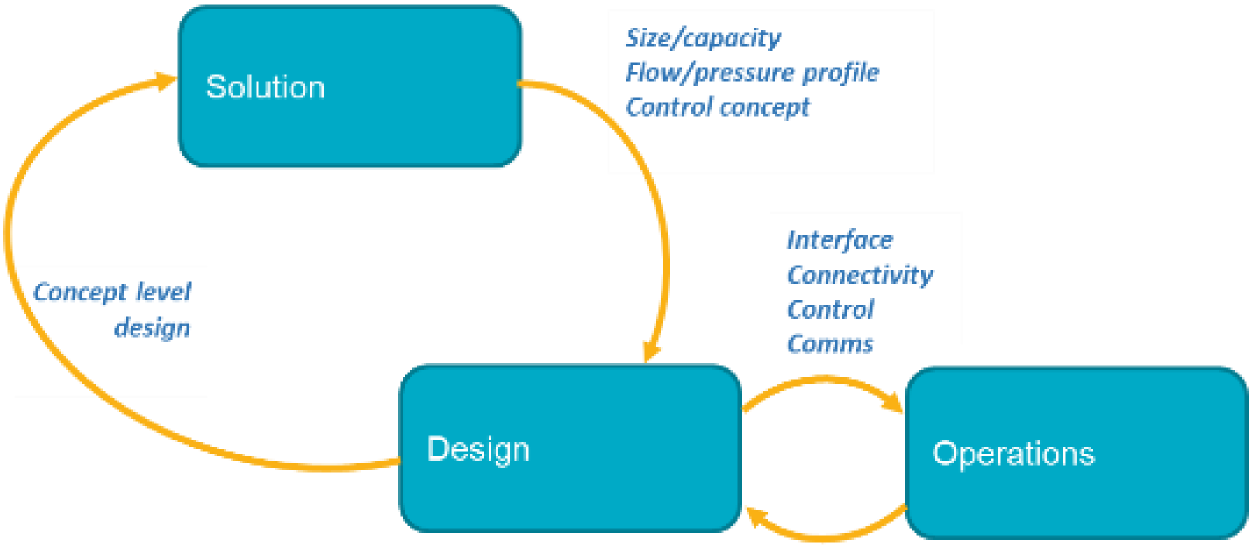

Figure 21 - Iterative modelling / design process

2.3.3.2 Approach

The project used a [redacted], to develop optimal asset configurations, and was chosen to bring efficiencies to the project in terms of program and expenditure. A traditional approach would typically involve a team of hydraulic modellers using an iterative "trial and error" method, but the large number of sites included would mean it would be impossible to evaluate all potential Options, and consequently the most efficient outcome might not be identified. Using [redacted], with which the InfoWorks WS Pro network model was linked as an embedded hydraulic engine, enabled the automatic evaluation of many thousands of trial solutions computing cost and performance, and incorporating operating constraints and design criteria. The modelling approach is illustrated in Figure 22.

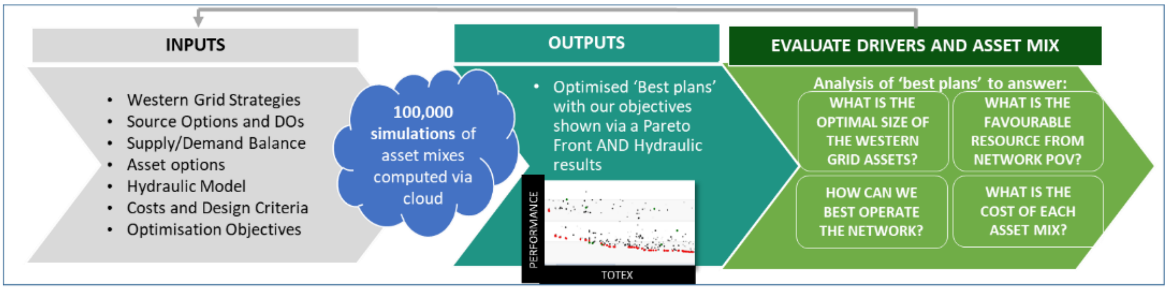

Figure 22 - Modelling approach

The [redacted] model produces a range of least-cost network solutions, including asset sizes (such as Grid tanks (potable water storage reservoirs) to balance inlet and outlet flows, and pipeline diameters) and maximising the efficiency of network operational performance, and considers both "normal day" and "severe drought day" supply/demand scenarios. The severe drought scenario reflects the 1-in-200-year drought described in WRMP19. Through the simultaneous assessment of cost and hydraulic performance based on data in the hydraulic model, [redacted] models a Pareto curve of plans of prioritized interventions, enabling informed choices about resource and asset allocation. The tool produces a set of plans along a Pareto front that represents the optimal-performing configuration for a budget cost, and therefore quickly identifies

Options to be analysed in further detail in the context of risk and operational requirements. An example Pareto graph is illustrated in Figure 23.

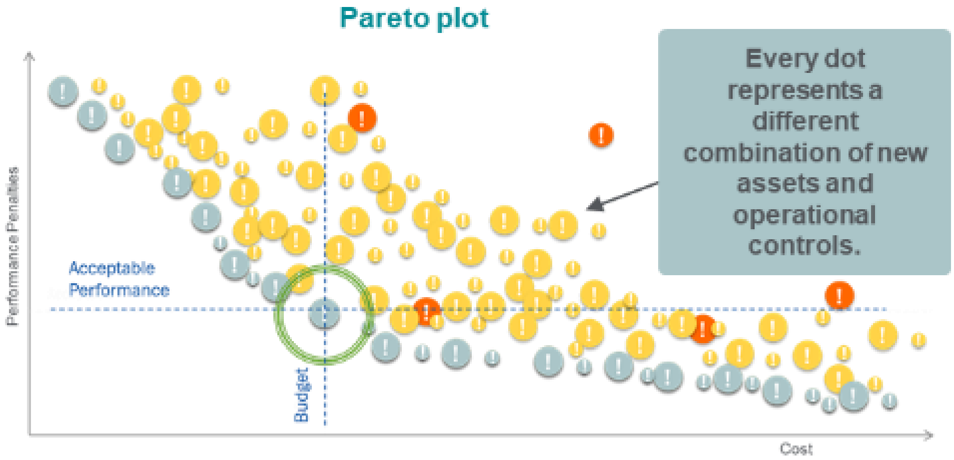

Figure 23 - Example Pareto graph

Developments in Phase 2

Phase 1 of the modelling study provided information for the WfLH Gate 1 submission, and Phase 2 has provided information for the Gate 2 submission. Phase 2 has been a refinement to the deliverables in Phase 1, with the key output being a set of results in which there is now a significantly higher level of confidence. Key developments have been the incorporation of the major Capital Works programmes at Testwood WSW and Otterbourne WSW, with the configuration of the hydraulic model updated to reflect these, and there has been further refinement of the operational controls. Phase 2 included model builds of more of the distribution network, which had been previously simplified in Phase 1, and also included the refinement of defined cost and performance metrics.

2.3.3.3 Setting up the Optimization Model

The optimization model includes three main components: inputs, decisions and criteria, and the WfLH elements of these are illustrated in Figure 24. The objectives of the optimization were to find the optimal asset configuration which will minimise cost and maximise hydraulic performance. A key development in Phase 2 was the incorporation of dynamic controls to enable the hydraulic model to react to different operational scenarios.

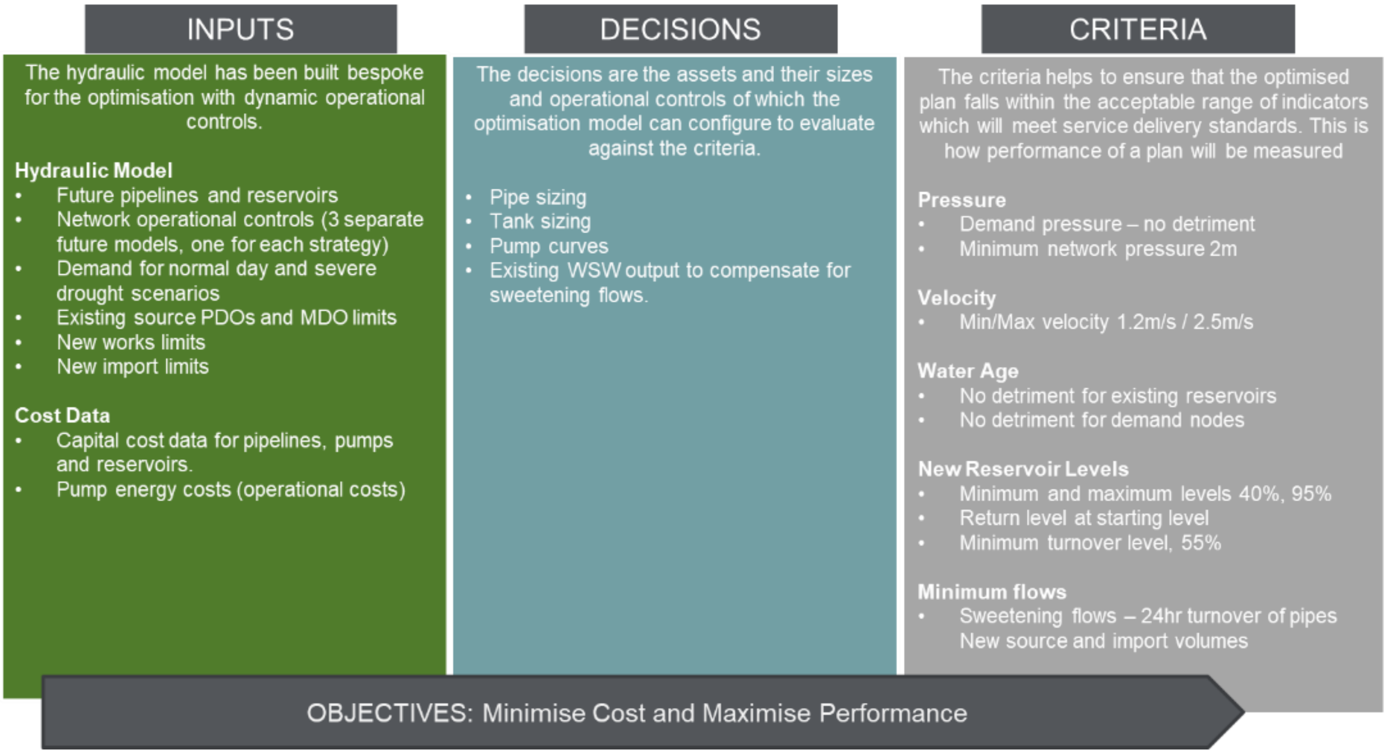

Figure 24 - Optimization model components

2.3.3.4 Optimising for both Normal Day and Severe Drought Day

Assets and operational controls were optimised for both ‘normal day’ scenario ‘severe drought day’ scenarios. The hydraulic model was set up for a single 48-hour model run so that the ‘normal day’ is for the first 24 hours and ‘severe drought day’ operations are for the second 24 hours. Figure 25 illustrates the input elements of the model, the differences to the model set up over the 2 periods, and what is being optimised.

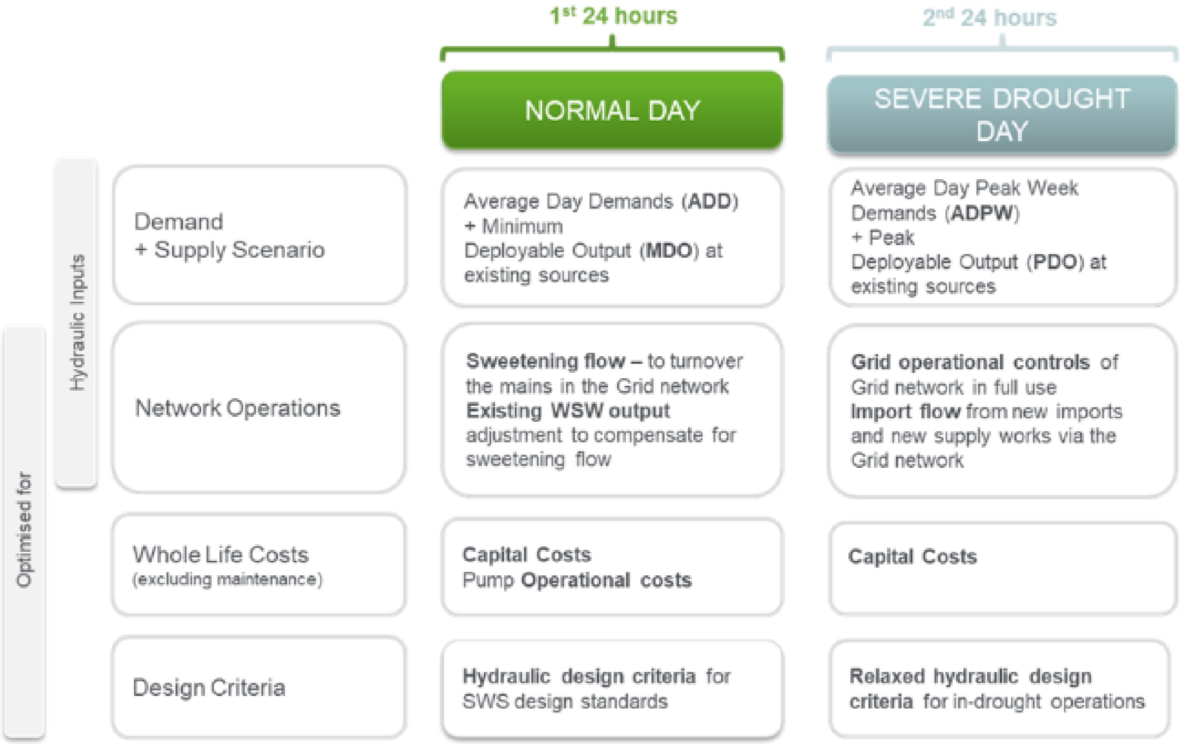

Figure 25 - Normal day and severe drought day optimization

2.3.3.5 Costs and Penalties

Cost Data

Indicative capital cost data was obtained from SW's Cost Intelligence Team (CIT). This was based on SW's capital cost curves but omitted elements such as contractor risk and internal and external overheads due to commercial sensitivities. The costs also excluded some ancillary elements such as cabling, fencing, landscaping, land purchase, access roads etc. and so do not represent the true cost of constructing such assets. As such the model does not give a true estimate of cost but provides a comparative cost assessment of different Options based on consistent data. Indicative capital costs are illustrated in Figure 26.

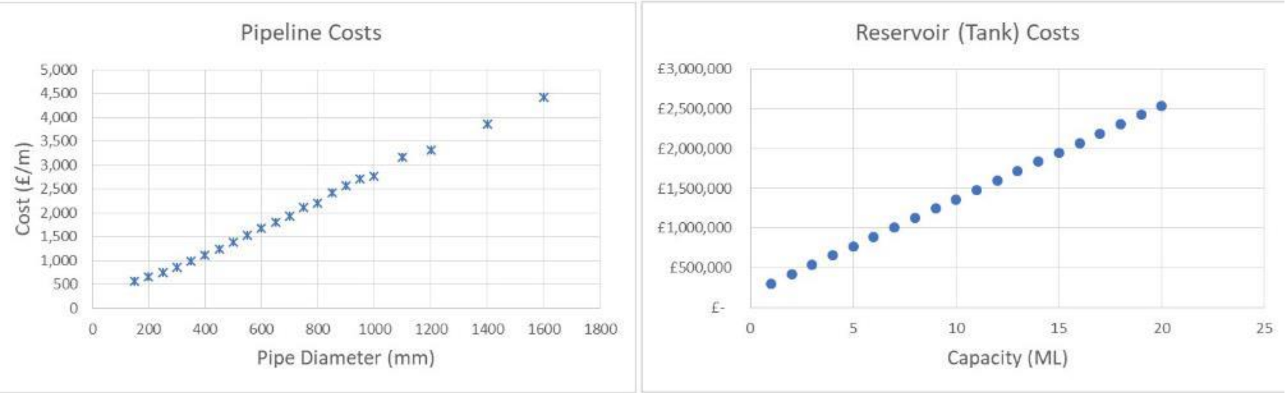

Figure 26 - Indicative capital costs

OPEX costs (pumping energy) were calculated using the formulas illustrated in Figure 27 below and extrapolated to reflect a 60-year design horizon. Base electricity tariff data was obtained from SW's energy team.

Annual Operating Cost (Energy)
=
Q*H*eP*A/(e*C)

Design Life Energy Cost
=
Annual Operating Cost /
$(1+r)^N$

Q = flow (L/s)
H = pump head (m)
eP = Energy Price = 0.1kWh
e = efficiency = 1
C = units conversion factor = 102.2
A = annual conversion = 365 days
R = nominal discount rate = 2.4%
N = design life = 60 years

Figure 27 - Formula for OPEX Cost calculation

Performance Penalties

The hydraulic performance of a solution is determined by penalties (monetised into £ units) applied when specified constraint criteria are violated; hence the optimisation model seeks to minimise cost penalties and therefore maximise hydraulic performance. The penalties were designed to drive the solutions towards balancing all network storage reservoirs. The higher the penalties applied; the more violations of the constraints have occurred which equates to a poorer network performance. Penalty criteria have been set by capturing operational constraints at existing WSW and WSR sites from operations teams, and from SW's technical standards documents. Different penalty criteria were set for new Grid tanks, to reflect their lower level of criticality to customer supply resilience (as customers are not supplied directly from the Grid tanks, but from existing WSRs). Constraints have also been set to pressures in existing distribution networks so that customers will not experience any detriment. Penalties were set to encourage existing WSRs to return to their level at the start of the model run, and Grid tanks to return to a set depth of 67% - this approach will be reviewed in the next phase to ensure adequate levels of resilience are being maintained. Performance penalties are illustrated in Figure 28 **- Performance penalties**below:

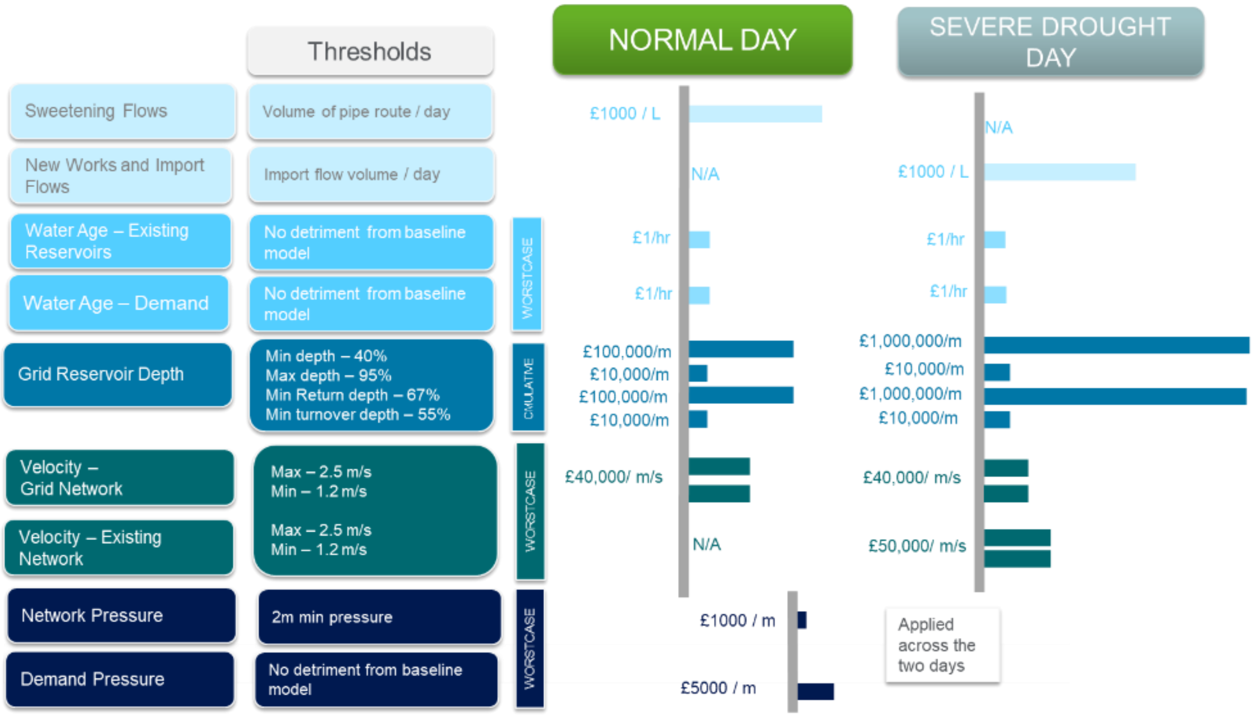

Figure 28 - Performance penalties

2.3.4 Option A Results

The model is demand-driven, and only delivers those supplies required to meet the demand as described in WRMP19. These demands are consistent between WRMP19 and the model and are constant for both Options A.1 and A.2; hence results for both are identical, with the extra capacity of supply in Option A.1 being unused. This is in alignment with the revised residual deficit identified in the Phase 1, and reported in the Gate 1 submission, of 61 Ml/d.

The Pareto curve presents results for 200 potential solutions, representing the best performance for a particular cost. On inspection of the hydraulic performance of the model results (not shown here) it can be seen that only a limited number (about 15-20 solutions) present a solution that could be considered potentially feasible, with the remainder of results showing hydraulic performance (such as tanks or service reservoirs draining to empty or over-topping due to imbalances in the model controls) that would not be acceptable in terms of operational constraints. It has consequently been decided that the Phase 2 results require further development before being considered as part of any Optioneering analysis.

The results reported here, therefore, should be considered as indicative and not as defining the potential solution to be constructed and commissioned. The results have, however, highlighted numerous aspects to be further investigated as part of the modelling and design process and can be considered as a key milestone to defining the infrastructure required as part of the WfLH Option selected for delivery, as detailed in Section 2.3.8.

The Pareto Curve of Option A results is illustrated in Figure 29 as under:

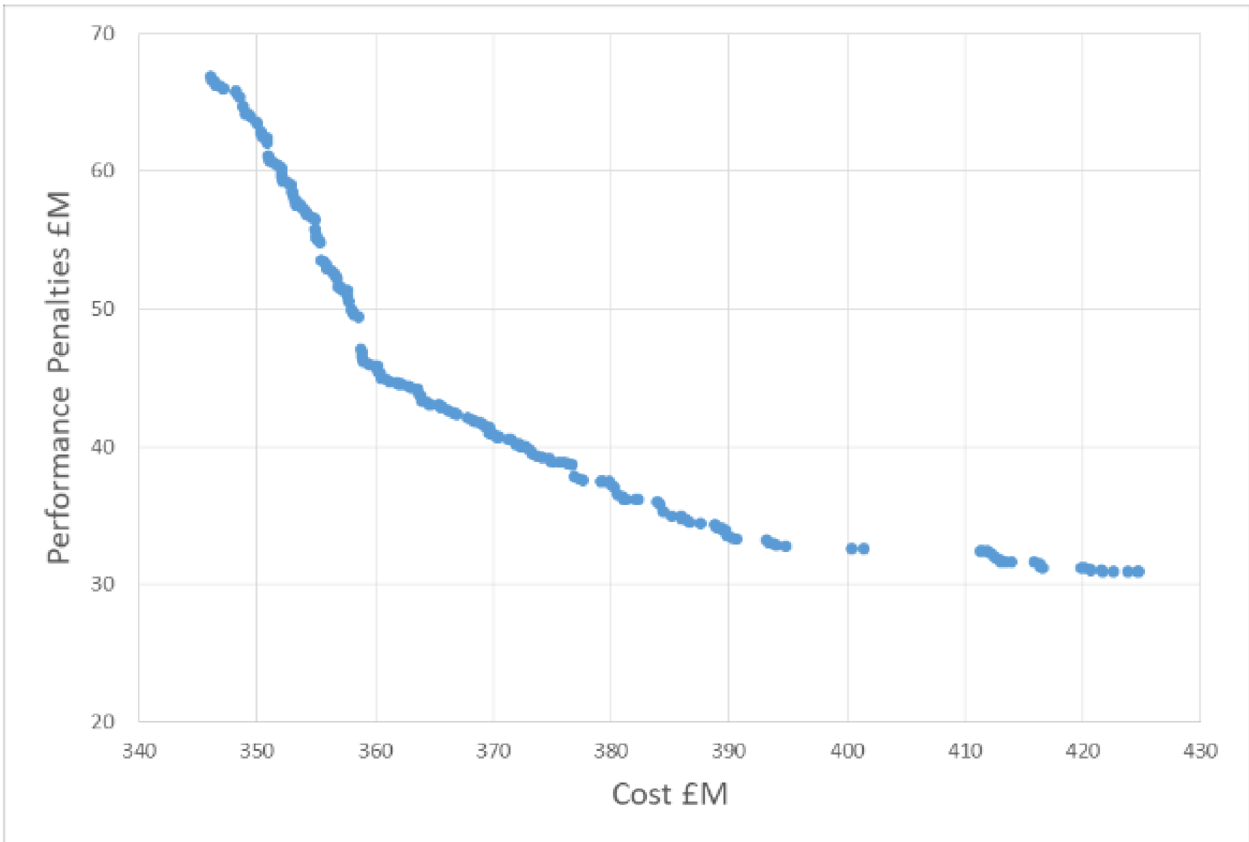

Figure 29 - Pareto curve of Option A results

The results present a selection of infrastructure elements of different sizes. Typically, Options with larger infrastructure elements will have better performance (i.e., lower performance penalties) and higher costs. Figure 30 illustrates results for a selection of Options comparing key infrastructure elements (potable Grid reservoir tanks) at Fawley, Testwood, Otterbourne and River Way Andover, as well as the SLM that transfers water between Testwood WSW and Otterbourne WSW. The graph shows the modelled volume of potable grid reservoir tanks (left-hand vertical axis) and the diameter of the Southampton (Soton) Link Main on the right-hand vertical axis. WLC for the model solutions is also shown on the right-hand vertical axis. On the horizontal axis model solution A.1 (not shown) would represent the least-cost and lowest-ranking Option, and model solution A.200 represents the highest-cost and best-performing Option. A review of the relationship between performance sacrificed verses cost saved is planned for the next phase.

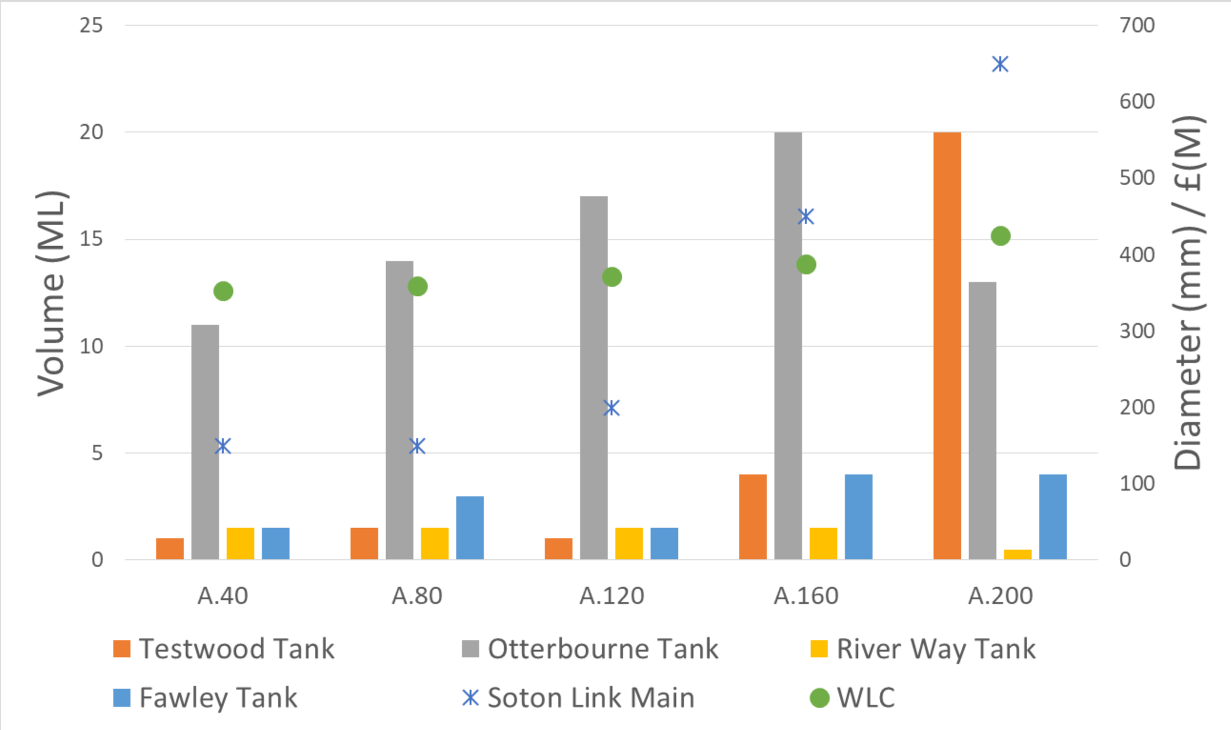

Figure 30 – Selection 30 of results from the Pareto curve

2.3.4.1 Commentary

Results for all Options show that there is adequate capacity in the existing infrastructure network from Otterbourne WSW to Yew Hill WSR and Crab Wood WSR, and that installing new transfer pipelines would not be required. Similarly, the model indicates that extra storage in terms of new Grid balancing tanks is not required at Yew Hill WSR or Crab Wood WSR. The model also selects transferring directly to River Way Andover WSW rather than interfacing at Micheldever Road Andover WSR – this is a probable consequence of including an operational constraint that blending of different source waters is to be in a tank rather than directly into the pipeline network.

Results indicate that a very large tank is required at Otterbourne WSW. Infrastructure feasibility studies have shown this site to be highly congested and constructing such a tank there will involve significant complexities. Mitigating this would involve constructing a similarly large tank at Testwood WSW, and the model solutions present the outcome of a “trade” between the comparative costs of pipelines and service reservoirs (with pipelines having a larger impact on costs than service reservoirs). It is noted that no Option includes additional storage at Yew Hill WSR or Crab Wood WSR (where more space is available) to mitigate this. Aspects relating to this interaction will be investigated further in Phase 3 of the study.

The assessment has been limited to providing adequate storage to balance the network, and no allowance has been included for resilience.

Example results are given as charts in Figure 31 and Figure 32. The charts show inlet & outlet flows and tank and WSR levels around Otterbourne WSW. The charts show how pump operations are controlled to maintain reservoir and tank storage levels within defined constraint levels (not shown), and how reservoir and tank levels react to differing inflows and outflows.

The chart titled “Otterbourne (In)” in Figure 31 (Normal Day Operation) show the levels in Otterbourne. Grid tanks appear to be the inverse of a typical diurnal demand profile, such that the level in the tank is high when demand is low, and lower when demand is high (as expected), and also how inlet flows to the tank from the

SLM and the Gater’s Mill transfer appear to control the tank level broadly within its level constraints of 40%-95%. However, it can be seen that the tank level at the end of the day’s model run is considerably higher than at the beginning (87% versus 55%) which might indicate issues with balancing the tank over a longer period. This is due to immaturity in the development of pump controls and not due to any disparity in the supply-demand balance. Issues such as this will be investigated in the next phase by running the model over a period of several days instead of just one.

The chart titled “Otterbourne (Out)” in Figure 321 (Normal Day Operation) shows the flow from Otterbourne WSW to Yew Hill WSR successfully controlling levels in the reservoir within set its constraints. Levels in Otterbourne Hill and Twyford WSRs are controlled as per the original SW InfoWorks network model and not by controls introduced for the wider WfLH transmission grid operation. It can be seen that reservoir levels remain within constraints, but do not balance their end of day level with that of the beginning. In the case of Otterbourne Hill WSR in particular (75% versus 60%) this could result in the reservoir over-filling over a longer model run time. The control of this reservoir has been copied directly from the existing network model and has not yet been further developed in this modelling study but will be addressed in a future phase.

The chart titled “Otterbourne (In)” in Figure 32 (Severe Drought Operation) shows that output from Otterbourne WSW falls to zero to reflect restrictions on its abstraction under the severe drought scenario. Inlet flows from the SLM and Gater’s Mill successfully maintain levels in Otterbourne Grid tank within constraints, although it can be observed that the level falls from 85% to 70% over the course of the 24-hour model run, indicating that the reservoir might drain to unacceptable levels over a longer period. This is due to immaturity in the development of pump controls and not due to any disparity in the supply-demand balance and will be investigated in the next phase.

The chart titled “Otterbourne (Out)” in Figure 32 (Severe Drought Operation) shows the Otterbourne to Yew Hill inlet main controlling levels in Yew Hill WSR adequately, and Twyford WSR remaining within constraints and balancing reasonably well over the 24-hour model run period. However, it can be seen that Otterbourne Hill WSR is over-topping for a period of approximately 4 hours in the morning, which is a level of performance that would not be considered acceptable. It was noted above that Otterbourne Hill WSR did not balance in the 24-hour Normal Day operation model run (that precedes the Severe Drought Operation run), and this is an issue that requires resolving as part of the next phase of solution development.

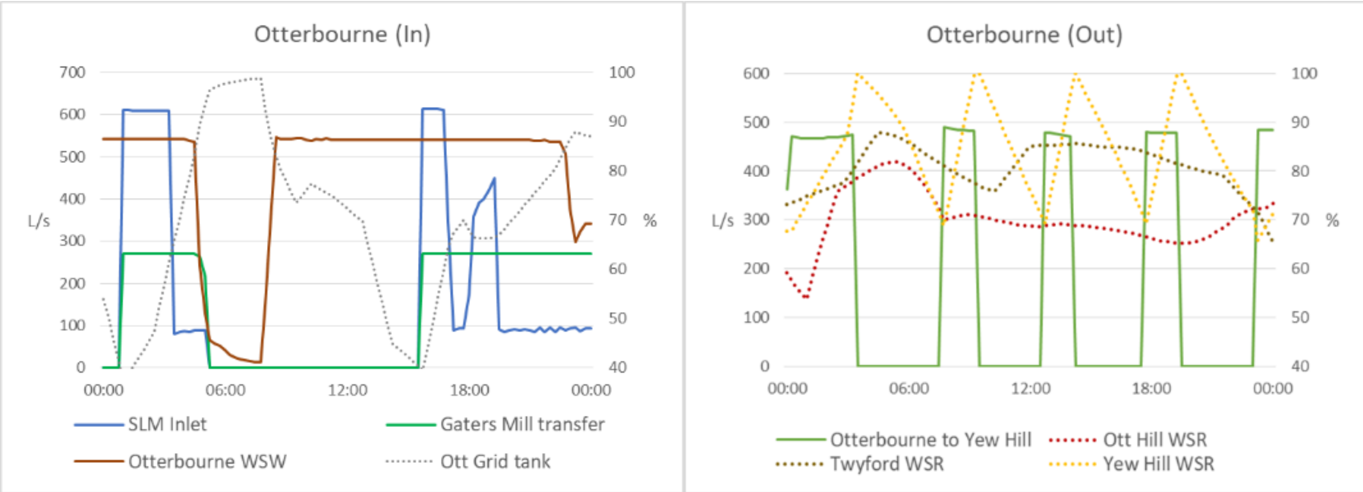

Figure 31 - Example results: Model solution A.200 Normal Day Operation

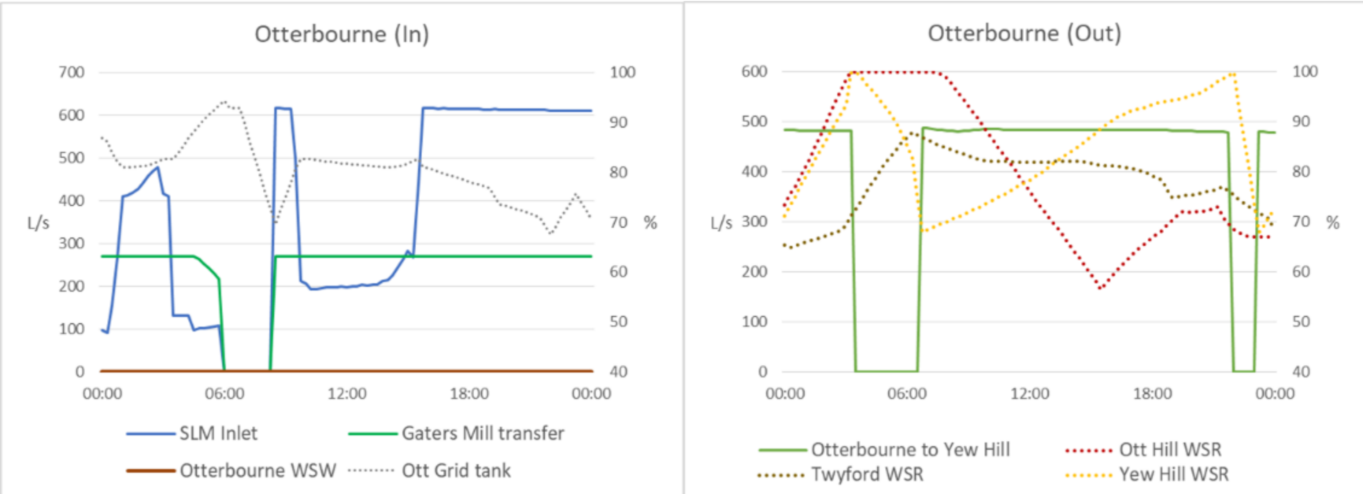

Figure 32 - Example results: Model solution A.200 Severe Drought Operation

2.3.5 New Transfer Infrastructure

Details of the design of the transfer pipeline from the proposed new source to SW's distribution network are given in the Engineering Design.

2.3.5.1 Interface Site Infrastructure

Studies have been undertaken to determine the feasibility of installing new infrastructure within existing site boundaries at the following sites that are interfaces between the proposed new Grid and existing distribution networks:

- Testwood WSW
- Otterbourne WSW
- Yew Hill WSR
- Crab Wood WSR
- Micheldever Road Andover WSR

- River Way Andover WSW

The scope of the feasibility studies included:

- Layout of the existing site
- Pipeline route corridors into / out of the site
- Existing utilities
- Geotechnical study
- Interaction with other SW projects
- Environmental impact
- Land availability
- Constructability

2.3.5.2 Key Findings

Testwood WSW

- The inlet pipeline routes from Knapp Mill and the desalination plant within the Testwood WSW boundary are feasible with respect to engineering and environmental complexities.
- The SLM must cross the River Test as it enters the site. The Preferred Option is to utilise the existing 800 mm diameter pipeline under the river. The existing pipe bridge could also provide feasible solutions.
- For the SLM route through the site, the most feasible Option is to run underground, using conventional buried pipeline construction.
- A feasible location for the Grid tank up to 20 ML volume has been established and aligns with the separate Phase 2 WSW capital works.
- Groundwater is known to be an issue on site, and construction methods that limit groundworks should be considered.

Otterbourne WSW

- The pipeline route into Otterbourne WSW from Testwood WSW is feasible but will be slow to construct and presents challenges to ensure access can be maintained.
- The pipeline route into Otterbourne WSW from the east crosses the River Itchen, which is heavily designated, and is highly challenging in terms on engineering and environmental complexities.
- Feasible locations for raw and potable water assets have been established that align with Phase 2 capital works.
- A Grid balancing tank volume of up to 12 ML can be feasibly sited on ground to the Northern end of the supply works site. A tank larger than this will need to be located to the Southern end of the site where the solar farm is currently located; this Option will require additional pumping to transfer water to the site high-lift pumps.

Yew Hill WSR

All interface Options investigated were determined to be feasible and relatively uncomplicated, e.g., there are no works proposed within sensitive designated areas, no conflicts with other utilities and the pipeline routes can be accommodated within existing sites.

Crab Wood WSR

All interface Options investigated were determined to be feasible and relatively uncomplicated, e.g., there are no works proposed within sensitive designated areas, no conflicts with other utilities and the pipeline routes can be accommodated within existing sites.

Micheldever Road Andover WSR

All interface Options investigated were determined to be feasible and relatively uncomplicated, e.g., there are no works proposed within sensitive designated areas, no conflicts with other utilities and the pipeline routes can be accommodated within existing sites.

River Way Andover WSW

All interface Options investigated were determined to be feasible and relatively uncomplicated, e.g., there are no works proposed within sensitive designated areas, no conflicts with other utilities and the pipeline routes can be accommodated within existing sites.

2.3.5.3 Southampton Link Main (SLM)

In 2016 an outline design was prepared, and information collected for Environmental Impact Assessment (EIA) for a raw water pipeline from Testwood WSW to Otterbourne WSW, and WfLH incorporated this route as its proposed strategic bi-directional potable water transfer linking the two sites. A review of the design outputs was undertaken to identify where further development is required to meet the needs of the project and to ensure the pipeline route is still feasible. As the design of the route is historical and based on different needs, it was concluded that a further reassessment of the design as part of a wider Optioneering study was required, and this will be undertaken in a future phase of the project.

Key findings of the design outputs review were:

- River Test Valley - alternative routes and construction methods to limit the impact on internationally designated sites
- New pipe bridge to cross the Little River Test - alternative trenchless construction methods
- A27 routing within the carriageway - potential to partially route through open land to the South
- M3 crossing - location and length of directional drill crossing
- A gap analysis of the Environmental Statement (ES) has identified a number of the technical assessments and surveys completed in support of the ES have now expired
- New requests for statutory utilities, land referencing, permissions for rail, motorway and main river crossings will also be required

2.3.6 Operational Control Concept

The Grid will have multiple points of interaction with the distribution networks, each requiring operating decisions to be made in a timely manner and to consider the effect of that decision on the wider connected Grid network. Traditional manual control of more localised supply and distribution networks will not be able to achieve such an optimised and efficient outcome. A holistic control system is therefore proposed that will coordinate operations across the whole Grid, from end to end, according to the optimised schedule. To undertake these multiple calculations and decisions are made in real time, which a traditional manual operation system would not be able to achieve. The integrated Grid is a significantly different type of network to the existing network of numerous separate distribution systems, as actions in one area will affect operations throughout the whole region.

Holistic real-time control has advantages of being able to use advanced analytics to predict demand and hence schedule transmissions in a planned and optimal way, rather than simply reacting to changes as they occur. This results in significantly lower pumping costs (a key element of whole life costing) as cheaper electricity tariff bands can be better exploited. It will also lead to more optimal asset sizes as constraints can be more accurately adhered to, meaning less headroom is required as a factor of safety. Such a system, predicting and analysing multiple alternate scenarios over a wide network, requires the optimisation of very high numbers of Options, which can only be carried out by centralised control system.

Holistic, real-time control systems can show operational benefits such as calm networks, reservoir turnover and water quality, as well as providing significant cost savings by optimising operations around energy tariff periods. Holistic real-time control will enable the Grid to be operated proactively – predicting network changes and planning the optimal way to respond – rather than a traditional, reactive system that typically responds to in a less efficient manner.

Holistic real-time control operates as a closed-loop process:

- **Predict**
    - Predict demand and associated storage levels over 24–48-hour period based on historical data around seasons, weather, weekday / weekend patterns, events (festivals etc.), using advanced analytics
- **Plan**
    - Plan optimal response to predicted demands around operational constraints, utilising best mix of pumping tariff periods, least-cost sources of water, most efficient pumps and cheapest transfer routes
- **Monitor**
    - Monitor changes to predicted demands in real time, refresh predicted storage levels and adjust response with a new, optimal solution every 30 minutes

Figure 33 below illustrates the closed-loop holistic control:

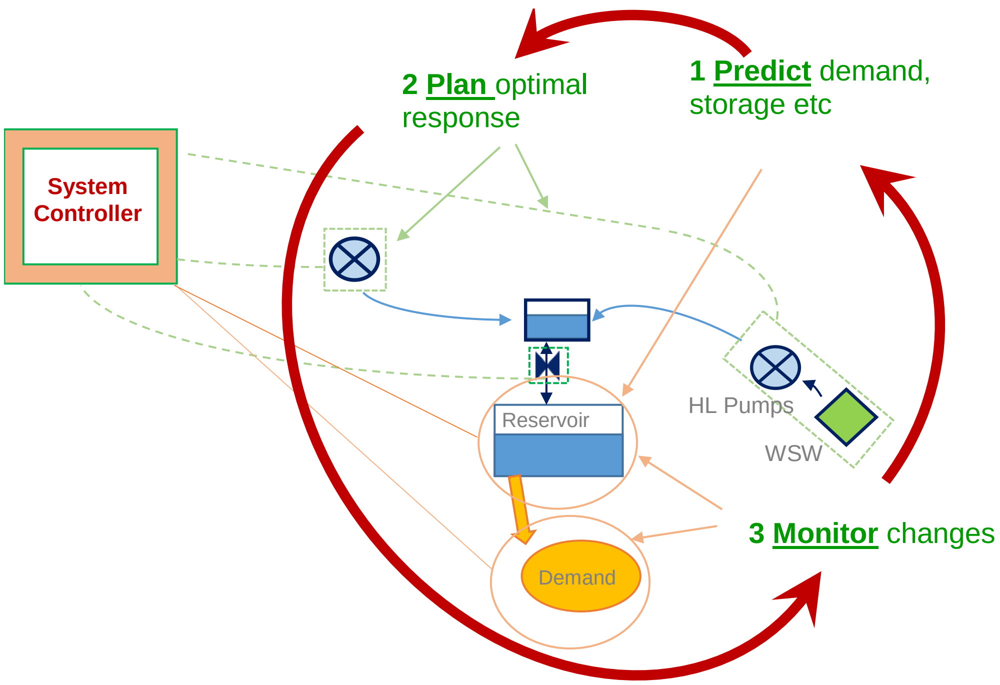

Figure 33 - Closed-loop holistic control

The holistic control system will operate the whole Grid network as a single coordinated system, scheduling pump and flow valve operations to meet operational constraints (such as reservoir storage levels and supply works outputs) and customer demand whilst minimising power costs. The system also selects pumps to operate at their best efficiency point to reduce energy usage and hence carbon impact.

The control system will ensure the network operates consistently within defined operational constraints, whilst ensuring supplies are transmitted to areas of demand or where there would otherwise be deficits. A study has been undertaken to assess the IT / OT capabilities required to support such an integrated monitoring and control process, as well as wider WfLH IT / OT needs and the risks associated with these, and the key outputs of this study are described in Section 2.3.7.0.

To minimise interference with the operation of the existing distribution system the Grid infrastructure will have controlled interfaces at a limited number of strategic locations. These are currently envisaged to be at [redacted], and are locations where bulk transfers of water between the Grid and distribution networks will be required.

As an example of potential operation, if the control system detected a deficit in Andover (to the North of the network) and needed to provide the supply from the proposed desalination plant (in the South), it would plan the optimal transfer operation required to transfer the water while keeping within BAU operational constraints at WSRs in the distribution system and also maintaining flow, velocity and reservoir level constraints in the Grid infrastructure. This would be undertaken while optimising the pump operation to minimise cost and carbon footprint whilst complying with other requirements such as reservoir turnover, water quality blending requirements and so on. In this way the Grid can be operated in optimal fashion without interfering with the manually controlled operation of the existing distribution network.

2.3.7 Information Technology / Operational Technology (IT / OT) Assessment

2.3.7.1 Overview

SW's IT team has undertaken an assessment to identify IT / OT requirements to enable the WfLH programme objectives. This section describes the key outputs of the assessment, which built upon the initial technology assessment conducted during Gate 1 to establish the IT and OT requirements to enable the WfLH grid operating philosophy as part of a phased approach to IT / OT design. The IT / OT requirements, and their associated costs and benefits for different solutions, will be included in the Optioneering process when determining the preferred solution.

The following key business needs were identified and evaluated to determine the IT and OT impact:

- The integrated Grid, made up of multiple assets, requires simultaneous calculations and coordinated decisions to be made in real-time (unlike traditional manual control of localised supply and distribution networks) to balance the end-to-end network, as actions in one area will affect operations throughout the whole region.
- Data driven, closed feedback loop-enabled intelligent monitoring and control of field assets is required to drive minimal manual intervention and ensure optimum asset performance within stipulated system constraints.
- The network should be designed to operate bi-directionally in all the transfer routes between Testwood and Otterbourne and between Otterbourne and Andover.
- The design should enable the ability to drive cost efficiencies and minimise carbon footprint by utilising the best mix of pumping tariff periods, lowest cost sources of water, most efficient pumps and cheapest transfer routes.
- The design should enable the remote capability to monitor water quality at water sources and at various points of the grid, with an ability to remotely isolate the affected network and re-route water transfer.
- The design should enable the ability to source water from supply that may not be owned or managed by SW into the existing network operations, e.g., Desalination plant or Havant Thicket.
- The design should enable the accurate prediction of demand and supply across the Hampshire region using historical data as well as inputs related to planned outages, rainfall, water level etc. and create appropriate production schedules in advance (in the order of days or weeks).
- The design should enable the ability to monitor the network to proactively locate leakages across the faulty pipeline with a view to minimise water loss.

To address the business needs and corresponding IT / OT requirements for WfLH, a high-level view of the required solution components has been depicted in the IT / OT functional landscape diagram illustrated in Figure 34. The layer model of technology and business systems is informed by ISA-95 standards (international standard from the International Society of Automation for developing an automated interface between enterprise and control systems). Some of these components are dependent on ongoing or planned SW transformation programmes within Asset Management Plan 7 (AMP7) whereas other components will require either enhancements to existing programmes or new initiatives unique to WfLH.

Site / Field Assets

- New Assets - For the proposed SRO and the grid network, a distributed network of new Programmable Logic Controller (PLC), Human Machine Interface (HMI), new remote communication devices (such as Remote Terminal Unit / Remote Telemetry Unit (RTUs), Edge Gateways and sensors) is required. These control system components will be connected to local site SCADA systems.
- Existing Assets – To enable the operating philosophy of an integrated Grid, the RTUs, SCADA, PLCs, HMIs and OT communications / instrumentation of existing assets that require uplifting to

support integration of control systems between existing and new assets will be assessed as part of the holistic control system feasibility study.

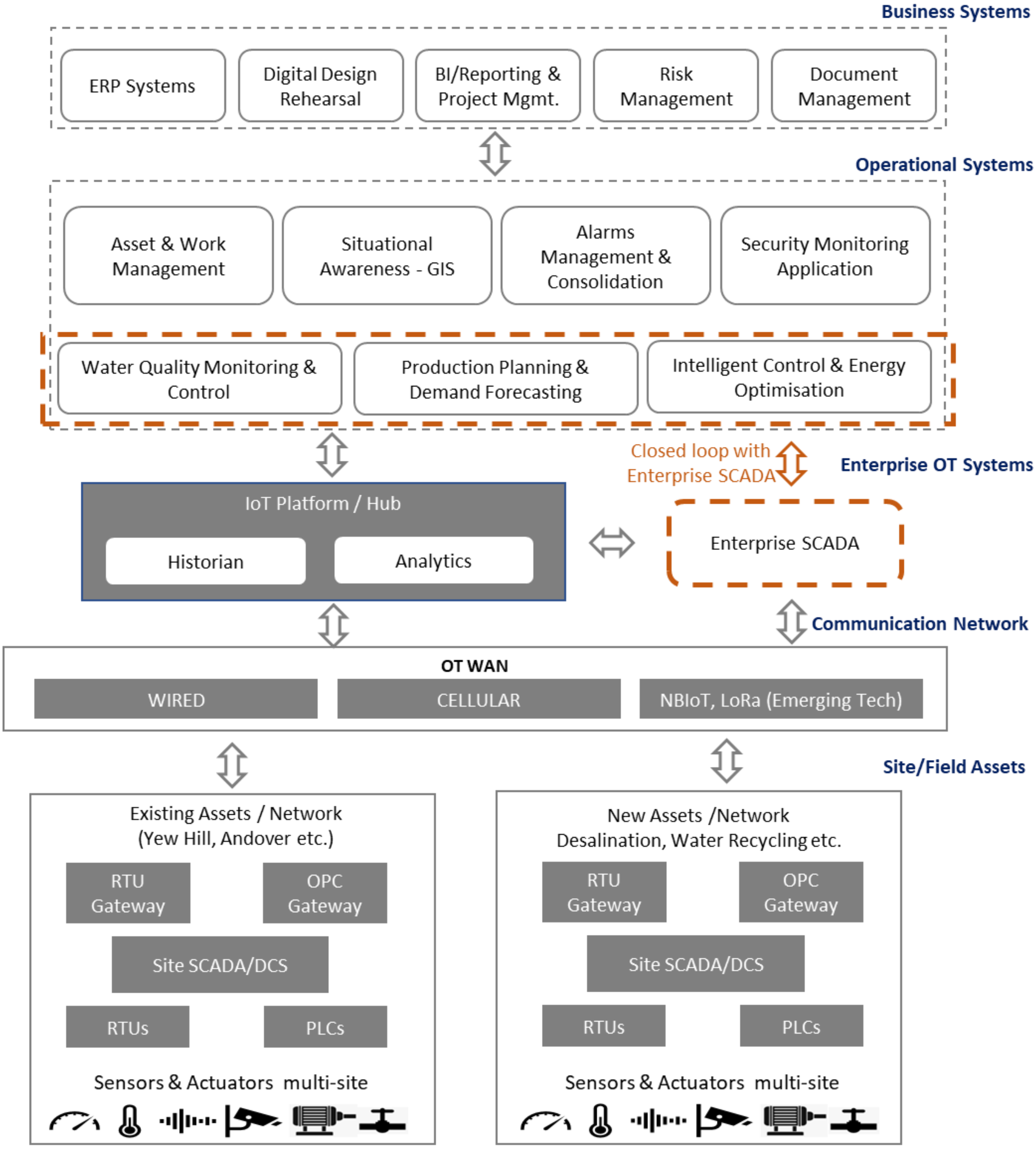

Figure 34 - IT / OT Solution Components across the ISA95 model

Communication Networks

WfLH will require the addition of a large volume of new and upgraded remote communication sensors / devices which will require integration with enterprise OT components. WfLH is dependent upon the ongoing OT Transformation programme in AMP7. This programme covers the implementation of technical standards, architecture and approved OT devices to establish resilient and secure OT Wide Area Network (WAN) integration with remote OT components via wired and wireless approaches.

Additionally, to ensure the design of the control system network is compliant to the Network and Information Systems Regulations 2018 (NIS) standards and National Cyber Security Centre (NCSC) cyber security principles, the detailed design of WfLH plant control solutions is dependent upon the secure OT network blueprint architecture currently being put in place as part of the OT Transformation programme.

Enterprise OT systems - Alarm Management and Enterprise Internet of Things (IoT) Hub

The functionality to monitor the SW owned / operated assets under WfLH programme will be reliant on SW's planned upgrade programme for the current Enterprise Alarm Management system. The upgrade programme is essential to incorporate additional monitoring / control points on new WfLH assets. Data will also be utilised within other SW OT systems and new enterprise asset management systems (Operational Asset Management (OAM)) for ongoing operational management. A subset of the control system data will be extracted from the plant control system via an Open Platform Communications (OPC) gateway and securely transmitted to the enterprise Alarm Management system hosted within SW Enterprise Data Centres.

The Enterprise IoT Hub platform implementation currently being trialled for the existing SW network will be extended to include WfLH requirements to acquire, store and analyse the field sensor data for analytics and operations. The historian / database within the Enterprise IoT Platform / Hub will be able to store and manage data acquired from sensors on the field assets and publish to operational systems for further analysis and provision of management information.

Operational systems

The decision-making related to the operational aspects of WfLH will be managed by solution components within 'Operational Systems'.

- A combination of solutions within the Operational Systems layer act as the integration and management point for the supply works control system, the telemetry outstations and remote sensors. These solutions with integration to Enterprise SCADA and Control systems will enable the closed loop system. As a closed loop system, the systems will monitor water quality at various points on the grid, prepare production plans based on demand forecasts or other operational factors to determine decision logic for automatic grid control actions. The control system will send these control actions to the sensors and RTUs / PLCs in the field, for example the optimal scheduling for pumps based upon multiple factors including energy tariffs, demand, etc. The integration of the Grid Control System and SW Enterprise Control System will require additional investment to pro-actively manage the water balance of the end-to-end network.
- Leverage a combination of existing and planned SW Enterprise Asset Management solutions to host core asset information for SW owned and operated WfLH assets to enable asset compliance, condition-based monitoring, incident management, and asset specific work management records.
- The existing solution components entailing Enterprise Alarm Management, Network and Security Monitoring with their corresponding visualisation suites will be enhanced to consolidate, monitor and report alarms/events generated by the new SW owned and operated WfLH assets.

Business systems

As subsequent phases of the WfLH programme will entail 3rd party and delivery partner involvement, it is imperative to have aligned business capabilities, stakeholder governance and streamlined business process management between the organisations. To support business operations and enable effective decision-making, existing SW enterprise systems as identified in the landscape will be leveraged to support.

2.3.7.2 Key Findings

The key findings from the assessment are summarised below:

- Further work is required to validate and understand the IT / OT impact on the future business operating model of the Grid (involving third party as well as SW owned and operated assets).
- The OT on the existing downstream network assets may require a significant uplift to enable integration of existing SW network assets with the new Grid assets, and this may impact the scope of planned or ongoing IT / OT initiatives.
- A holistic enterprise control system is required to manage the new bi-directional Grid network to enable end-to-end balance with the existing SW network.
- The proposed IT / OT landscape for the Grid builds upon the strategic SW initiatives including OT Transformation, Strategic Projects Digitalisation, and OAM. However, additional investments are required to either enhance the existing initiatives or mobilise new initiatives to enable the operating vision of the Grid. This will include potential changes to the SW's operating model.
- As business needs evolve in the subsequent stages of the WfLH programme, additional IT / OT impact may need to be considered.

2.3.7.3 Summary of Key Risks

Outlined below are the potential key risks that could delay delivery of IT / OT enablers thereby impacting WfLH programme objectives:

- There is dependency on the successful delivery of some of the foundational capabilities delivered via strategic and planned AMP7 initiatives. Any delay in implementation timelines or change in scope of these initiatives may have an impact on delivering to WfLH programme timelines.
- Additional system enhancements may be required beyond the planned scope of some of the ongoing or planned AMP7 transformation programmes. Without these additional enhancements or capabilities, the planned IT and OT capabilities would fall short of delivering to WfLH programme's envisioned operating philosophy.
- As the WfLH programme is currently at concept stage, there is a risk that further business needs may evolve during subsequent design and build phases of the programme. These incremental business needs may not be considered in scope for current planned or existing transformation initiatives and would need to be retrospectively developed leading to additional change implementation costs.
- Significant uplift maybe required to OT components of the existing network such as field instrumentation, sensors, communication networks and existing site-level SCADA / telemetry systems. Without this OT uplift, the integration required between existing network and new supply solutions or new network assets to deliver end to end balanced network management might not be possible.
- The proposed WfLH grid includes new water supply solutions to be owned / operated by 3rd party and new network assets to be owned/operated by SW. Without an overarching governance and clear operating model that includes new WfLH and existing SW network assets, it would lead to disparate operational system processes causing overheads and inefficiencies in managing the network.
- Due to the long-term horizon of the WfLH programme, there is a potential risk that the technology being proposed or considered might become obsolete at the time of commissioning the grid and additional investments for uplift, refresh or upgrade might be required.

2.3.8 Next Steps

Network Control and Optimisation

The next phase of the network infrastructure integration project (Phase 3) will develop the initial network solutions identified in Phase 2 into a short list of Options, which will then be considered in more detail, to determine the Emerging Preferred Option (EPO) that will be proposed as part of the WfLH solution. The short list Options must therefore be developed to a sufficient level of detail and confidence that will enable the successful design of the assets. A high level of liaison with operations, environmental and engineering teams will therefore be needed as part of the solution development. Pipeline routing will not be defined in this study but will be included in the engineering design phase, where considerations of planning and environmental implications will be addressed.

2.3.8.1 Model Review

The optimization model will be reviewed with respect to the impact of penalties and capital costs. The current model results include Options in which reservoirs empty or overflow which clearly cannot be considered feasible. Some solutions contain balancing reservoirs that are now understood to be too large to be easily constructed at congested sites (particularly Otterbourne WSW), and solutions will be developed that reflect engineering constraints identified in the site feasibility studies.

Capital Costs

The [redacted] model configuration and inputs will be reviewed to ensure results are representative and have a higher level of confidence than at present. For example, capital costs will be reviewed with the CIT to ensure they accurately represent the balance between pipeline and reservoir capital costs as there is a possibility that the current set-up might be underestimating the cost of storage infrastructure. The engineering team has recently commissioned a number of detailed CIT estimates for WfLH infrastructure as part of their feasibility studies, it is intended that this more accurate information be used in the study.

Operating Costs

Consideration will be given to better reflecting the energy tariff structure, which will have a significant impact on pumping costs and tariff avoidance. The current solution development regularly sets pumps to be active during peak / TRIAD periods.

Penalties

[redacted] penalties will be reviewed to ensure that the relative consequences of breached constraints are being captured. For example, the current solution development shows reservoirs or tanks breaching constraints at some points during the day which is clearly not acceptable in any solution, and it might be that [redacted] considers the penalty for this to be more beneficial than building more storage volume or the hydraulic model controls need to be adjusted. [redacted] results inform the decision-making process with respect to infrastructure choices, but SW will determine the preferred configuration by considering a number of varied factors. The review will ensure that penalties applied for breaching key constraints have sufficient impact on the solution such that the breach is avoided altogether.

2.3.8.2 Model Configuration

The following tasks will be undertaken as a combination of both manual network modelling tasks and as part of the optimization approach using [redacted].

Reservoir Volumes

Grid tank sizes will be limited to reflect the outcome of the engineering feasibility studies – especially at Otterbourne WSW. This might result in the [redacted] solutions placing storage at other sites where construction is more feasible, such as Yew Hill WSR or Crab Wood WSR.

Gater's Mill (Lower Itchen) Transfer

The current solution development assumes this transfer connects with the SW network at Otterbourne WSW. However, it might be beneficial to transfer the water to Twyford WSR or Moorhill WSR, and a study will be undertaken to investigate.

Otterbourne to Yew Hill main

The current solutions use the existing mains for the WfLH transfer. The feasibility of this needs to be confirmed, and in particular to include the operating regime which at present is for a number of short transfers at high flow rates.

Southampton Link Main (SLM)

The route of this main was developed for an earlier project (not commissioned) to transfer raw water from Testwood WSW to Otterbourne WSW and might not be optimal for the WfLH solution. Alternative routes will be considered, especially the concept of transferring via Rownhams WSR and Yew Hill WSR using a combination of new and existing infrastructure. This might result in Grid tank storage being selected at Rownhams WSR or Yew Hill WSR instead of at Testwood or Otterbourne WSW.

2.3.8.3 Solution Development

Initial solutions identified in the Phase 2 modelling study will be further developed to a level of detail and confidence so that they can be considered as feasible solutions. The level of detail developed in Phase 2 is not yet sufficient to achieve this with respect to operational constraints and engineering and environmental feasibility.

Operational Control

- Pump operations

The current solutions sometimes include multiple changes to pump status as flows react to reservoir levels. Consideration will be given to the feasibility of this, particularly when using older existing infrastructure. Smoother operation of pumps is more desirable and could also help reduce the required volumes of the new Grid tanks.

- Sweetening flows

Sweetening flows are currently operated at a fixed flow rate to reflect the daily turnover volume. This has the disadvantage of leaving the main unconditioned to higher, drought-scenario flows, and a mains conditioning process would need to be designed as part of the commissioning plan. This added complexity can be avoided by pumping sweetening flows for a shorter duration at higher, drought-scenario flows (and hence keeping the main conditioned to that flow), but at the detriment of more variance in reservoir levels and less calm networks. Consideration will be given to developing a solution that can maintain conditioning flows as the normal day operating scenario.

- Bi-directional flows

For reasons of improved resilience, the WfLH network is to be designed so it can operate bi-directionally in all the transfer routes (i.e., Testwood / Otterbourne and Otterbourne / Andover). The current solutions have not yet been developed to incorporate this. Bi-directional flow does not need to be optimized but must be shown to be feasible.

2.3.8.4 Operating & Commissioning Plan

A formal, approved Operating & Commissioning Plan will be developed for the Preferred Option. This will detail how the solution is to be operated on a ‘normal’ daily scenario and in a ‘severe drought’ stressed scenario, including the diurnal scheduling and flows of bulk transfers. Information on the strategic utilisation of the transfers (in terms of duration and frequency of use) is described in the Annex 4 Water Resources Modelling report. The plan will also detail how the network is safely transitioned (i.e., commissioned) from one state to the other. Approval of the plan will be by the Western Region Operations Manager.

Bulk transfer imports

The current model optimises the operation of bulk transfer imports according to the need to meet demand, and without consideration of any supply and / or operational constraints at the supply point. Recognising that these constraints need to be included in the network control and optimisation model, the next phase of the project will include liaison with PW and SWW to identify any constraints to the availability of the bulk transfer imports and will incorporate these constraints into the wider solution. The network control and optimisation model will then identify the diurnal usage profile of the bulk transfer import, incorporating constraints and operational requirements, as a key output.

2.3.8.5 Holistic Control

A study will be undertaken to determine the feasibility and requirements of using real-time, holistic control to operate the network identified in the Preferred Option. It will specify infrastructure and hardware requirements and identify cost benefits associated with such a system.

2.3.8.6 IT / OT Assessment

To validate assumptions and mitigate risks identified as part of the IT / OT assessment, the following activities will be carried out between Gate 2 and Gate 3 -

- Perform detailed design analysis of IT / OT changes based on ongoing engagement with broader stakeholder groups from across the WfLH programme and SW functions to continuously align with delivery timelines and scope of planned/ongoing transformation initiatives.
- Review the impact of and identify additional IT / OT changes based upon conclusion of the feasibility study to determine the OT uplift required on the downstream SW network assets due to integration constraints on the current legacy asset estate.
- Establish the extent to which asset and site-specific OT requirements will be delivered by delivery partners or 3rd parties. Additional detailed assessment will be required to identify handoffs of site/asset specific OT into SW IT and OT systems for appropriate integration.
- Analysis of business operating models, capability needs and impact assessment of operational handoffs between 3rd party owned / operated assets and SW owned / operated assets (both new and existing) to review impact and alignment of operating model on technology changes, transitional arrangements, overall ongoing business management and governance.
- Develop an end-to-end OT business and technical design for the WfLH Grid encompassing the water source solutions, the network assets and other WfLH work-streams; subsequently validate the IT / OT changes upon finalisation of the OT design and further refine the IT / OT costs in line with the evolution of technical design for WfLH.
- Determine the overall total cost of ownership and impact across all work-streams of the WfLH from a CAPEX and OPEX perspective, and the overall impact of the wider programme on SW.

2.4 Site Selection

2.4.1 Site and Route Selection Methodology

Following Gate 1, the site selection methodology outlined in the Gate 1 submission in Annex 9.1 Site Selection Report: Desalination for identifying potential suitable sites to locate a 61 Ml/d or 75 Ml/d desalination plant and its process components was reviewed and developed to ensure that it delivered a robust, planning led, Optioneering process as outlined in the Remediation Action Plan (RAP), March 2021. This allowed SW to take account of new and emerging circumstances as a result of ongoing engineering and feasibility assessments, further environmental studies and engagement with stakeholders.

The modified site selection process was applied to desalination, water recycling and water transfer solutions to ensure that preferred site locations were identified for each solution for inclusion within the subsequent Options appraisal process, and that the identification of configurations for each solution took into account the potential to be consented prior to the Consenting Evaluation and MCDA stages of the Options appraisal process.

The site and route selection methodology are provided in Section 2.1 of the Options Appraisal supporting document including details of the methodology updates made after Gate 1. Reference should also be made to the following documents for details about the scoring and detailed criteria applied during Stages 0 to 3 of the site selection process.

- Desalination Site Selection Framework, Desalination Site Selection Criteria Supporting Document (April 2021)
- Strategy A Desalination – Alternatives to Base Case at Fawley, Site Selection Stage 0 to 3 Output – Text for Gate 2 Update

2.4.2 Engagement with Key Stakeholders

The detail of engagement with key stakeholders for the site and route selection process is provided in Section 2.1 of the Options Appraisal support document.

2.4.3 Site and Route Selection Outcomes for Options A.1 and A.2

Stage 0 Results

Stage 0 comprised the establishment of two search areas: a terrestrial envelope for the desalination plant and a marine search envelope for the intake and outfall. These were developed based on a set of agreed engineering, operational and environmental parameters. The terrestrial search envelope was defined by the following factors:

- Western extent located at Bournemouth, approximate National Grid Reference, 409999 (Easting) 090956 (Northing). This was identified due to the potential for connectivity with the Knapps Mill WSW to Testwood WSW pipeline being installed during AMP7.
- Eastern extent located at Eastney, approximate national grid reference, 468474 (Easting) 099514 (Northing). This was extended to potentially identify locations where a transfer pipeline to Testwood WSW could be routed to avoid crossing through National Parks and other statutory designated sites.
- Northern extent, initially no further than 5 km from the coastline between the Western and Eastern extents and referred to as an initial 5 km check point. This was limited to 5 km initially as any increase in distance from the coast would result in an increase in emissions and embedded carbon from additional pumping and installation of pipework infrastructure and

- The application of the coastal resilience line (Report Ref: Water for Life Hampshire: Coastal Study for Site Selection Assessment - PB9638-RHD-ZZ-XX-RP-Z-0001, dated 21 July 2020). The coastal resilience line has been formed through the assessment of coastal geomorphology and management policies, to identify projected future rates of coastal change and zones susceptible to sea flooding in order to identify areas along the coastline where major infrastructure development would not be suitable.

Figure 35 illustrates the terrestrial search envelope.

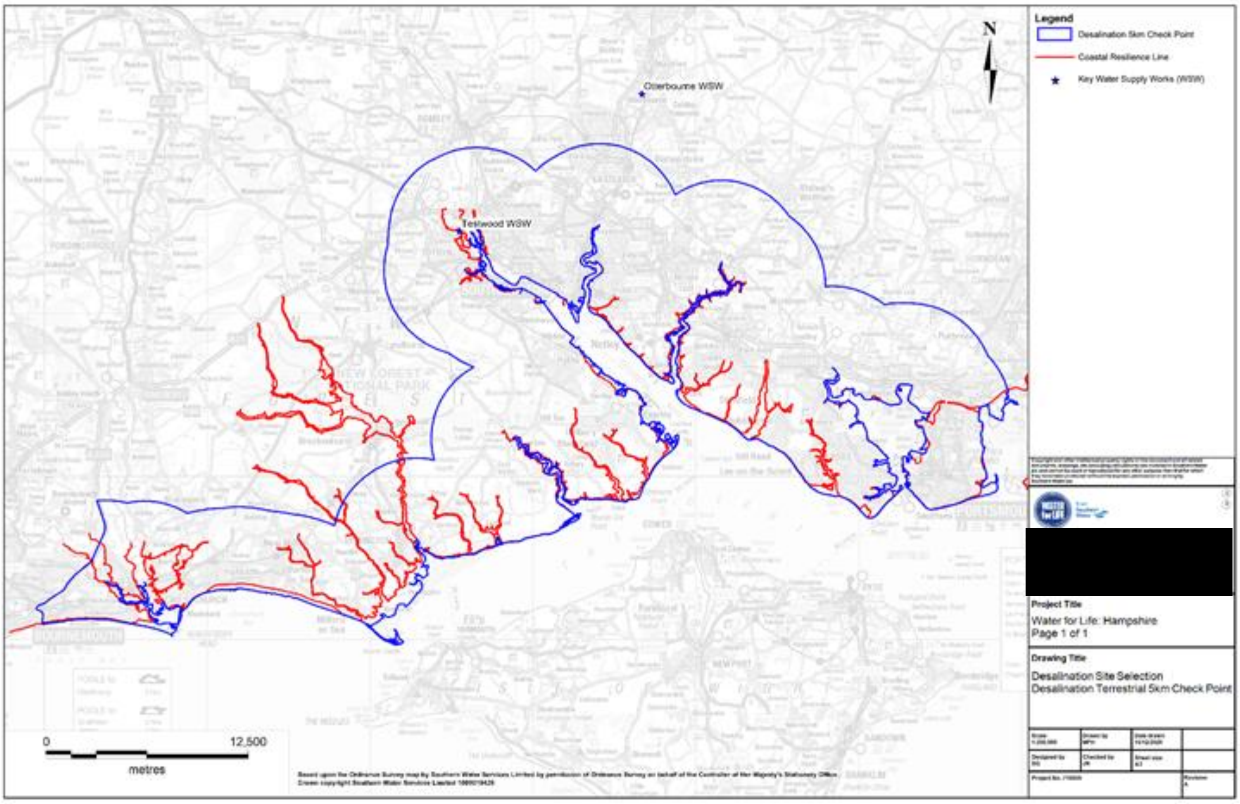

Figure 35 - Desalination Terrestrial Search Envelope

The marine search envelope was defined using the following parameters:

- A distance of no more than 800 m seaward from the terrestrial parcel to the end of the intake, based on the use of a passive wedge wire screen. The 800 m distance limit was established as the passive wedge wire screens require an air burst system to clean the screens. This system prevents marine fauna from entering the intake. The air burst system uses compressors to direct air down the pipework exiting from small nozzles and due to the size of compressors available and the head loss created in a long, small diameter pipe, the air would not exit the nozzles at a high enough pressure should the pipework be longer than 800 m. This was chosen as an environmentally and technically more acceptable solution than the mechanical intake screen.
- There is no technical distance limitation for the outfall, although locations nearer to the coastline are preferable from a construction and cost perspective. Therefore, the same 800 m envelope was initially used for the outfall as well as for the intake and
- The envelope ran parallel to the Eastern and Western extent of the terrestrial search envelope.

Figure 36 illustrates the marine search envelope.

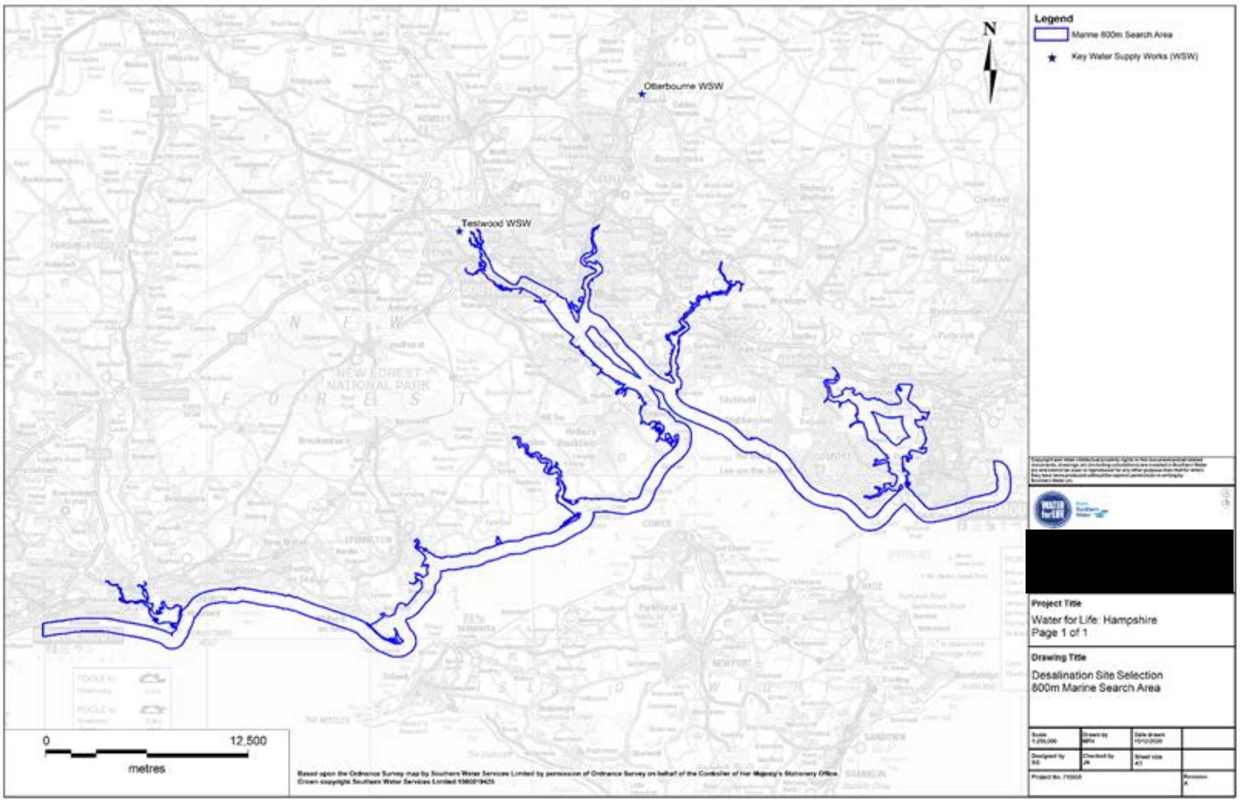

Figure 36 - Desalination Marine Search Envelope

Stage 1 Results

Following the definition of the search area for desalination at Stage 0, 159 terrestrial parcels and 38 marine intake parcels and 15 marine outfall parcels were identified at Stage 1. The location of the parcels is illustrated in Figure 37.

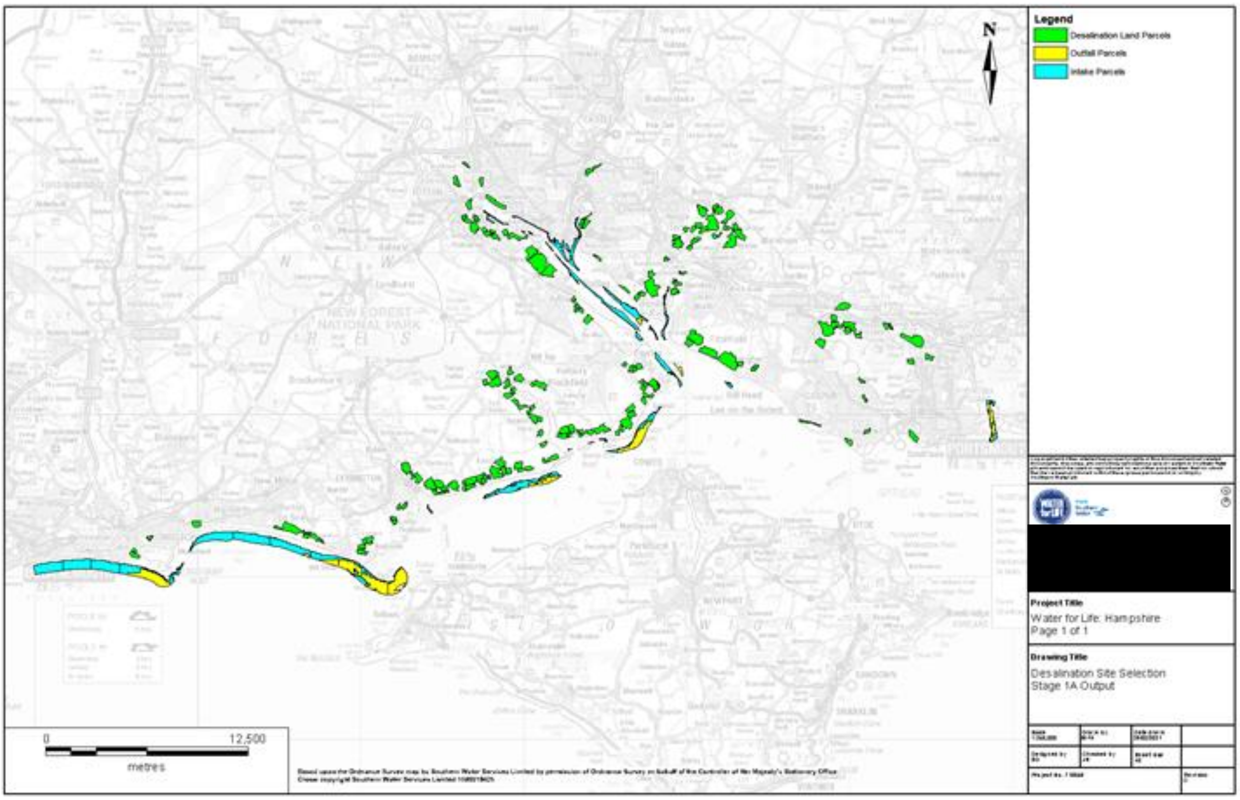

Figure 37 - Desalination Terrestrial and Marine Parcel Site Selection Stage

Stage 1b established geographical clusters of desalination plant terrestrial parcels, marine intake parcels and marine outfall parcels, which when configured together have the potential to form a desalination solution. A total of 54 terrestrial parcels, 26 marine intake parcels and 14 marine outfall parcels were identified in Stage 1b and progressed to Stage 2a. These parcels are split across five broad geographical areas, the Western extent being Christchurch and the Eastern extent Hill Head. Figure 38 illustrates the output of Stage 1b.

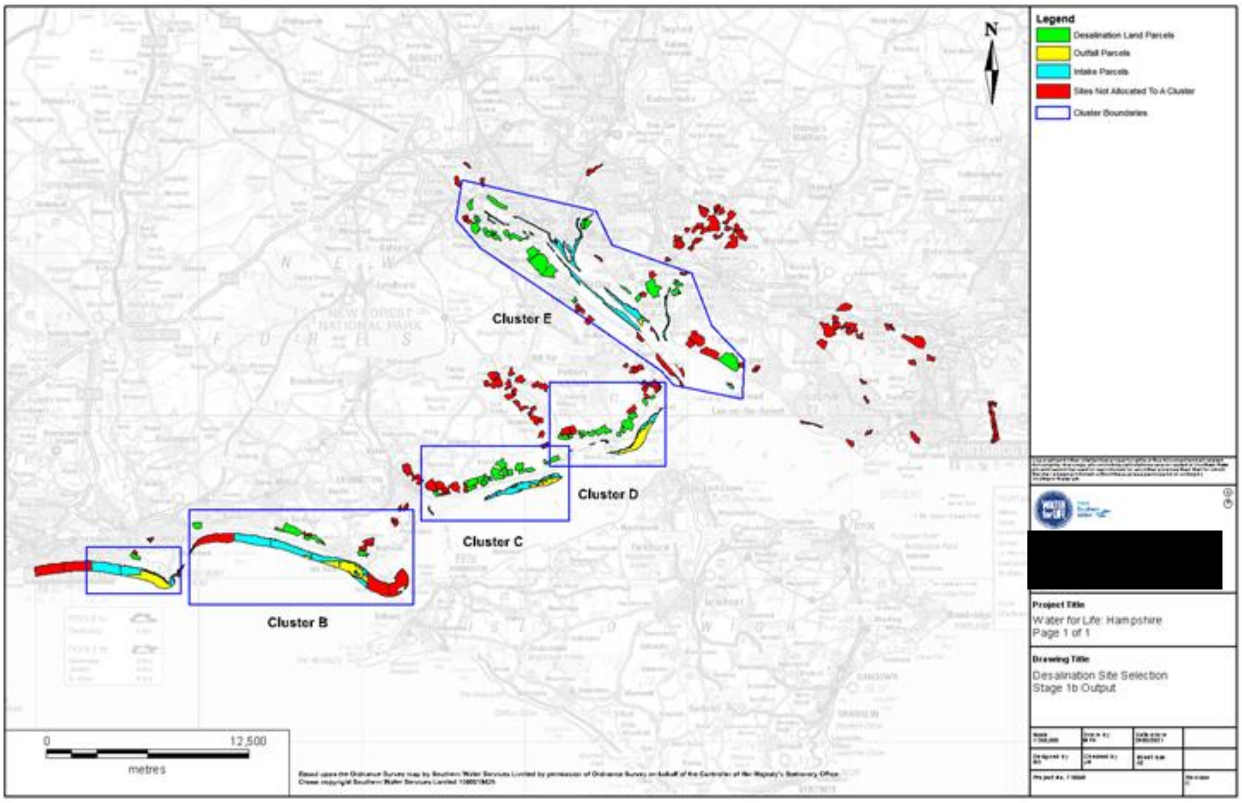

Figure 38 - Desalination stage 1b site selection output

Stage 2a Site Selection Results

A score was calculated for each parcel that progressed from Stage 1b, the higher the score, the better the parcel performed. A total of 54 parcels were scored, with the highest score attributed to a parcel being 32 points and the lowest being 17. To ensure a sufficient cohort of sites could be compared at later stages the five best performing parcels for each parcel type (if available) by cluster progressed to Stage 2b. Where more than 5 parcel types are scored the same for Stage 2a criteria, these same ranking parcels all progressed to Stage 2b.

In this instance, a total of 28 parcels progressed to Stage 2b. For these parcels the variance between the best performing parcels and the least well performing parcels is principally proximity to the New Forest National Park, Grade 1 and 2* Registered Parks and Gardens and Listed Buildings and Battlefield Sites and Ancient Woodland.

A total of 26 marine intake parcels were scored, the highest score attributed to a parcel was 29 points with the lowest being 21.

A total of 14 marine outfall parcels were scored, the highest score attributed to a parcel was 29 points and the lowest being 15. For these parcels the variance between the best performing parcels and the least well performing parcels is principally proximity to the Site of Special Scientific Interest (SSSI), terrestrial scheduled monuments or residential areas. It is noted that all the marine intake and outfall parcels are located within a Special Protection Area (SPA), the Solent and Dorset SPA stretches between Poole

Harbour and up to the Western extents of the Sussex coast and is present throughout the entire search area. The results of Stage 2a are illustrated in Figure 39.

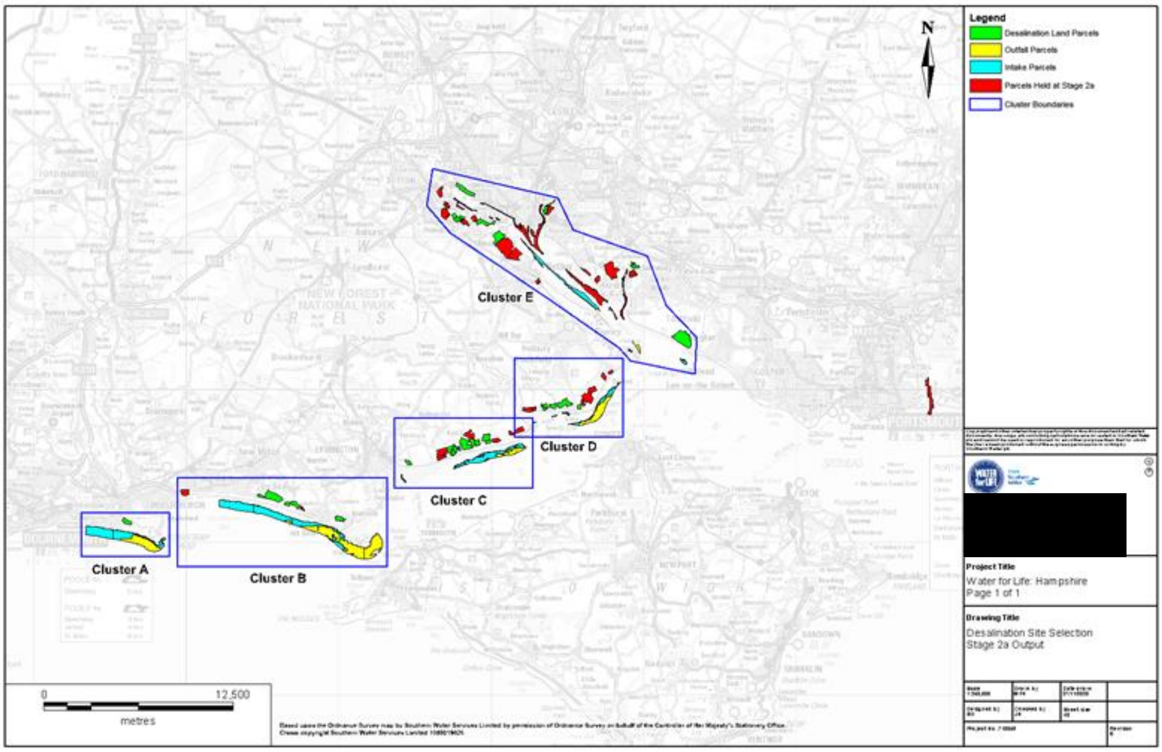

Figure 39 - Desalination terrestrial and marine parcel site selection stage 2a output

Stage 2b Results

None of the best performing parcels from Stage 2a had any conflict with DCO developments (within last five years), development subject to Transport and Works Act Orders (TWAO) under the Transport and Works Act 1992 and screened / scoped or validated and approved within the last three years in accordance with the relevant EIA Regulations or Marine Licences approved within the last three years under the Marine and Coastal Access Act 2009 for the marine environment that have been screened / scoped or validated and approved in accordance with the relevant EIA Regulations. As such all terrestrial and marine parcels progressed to Stage 3 (refer to Figure 40 for the Stage 2b results).

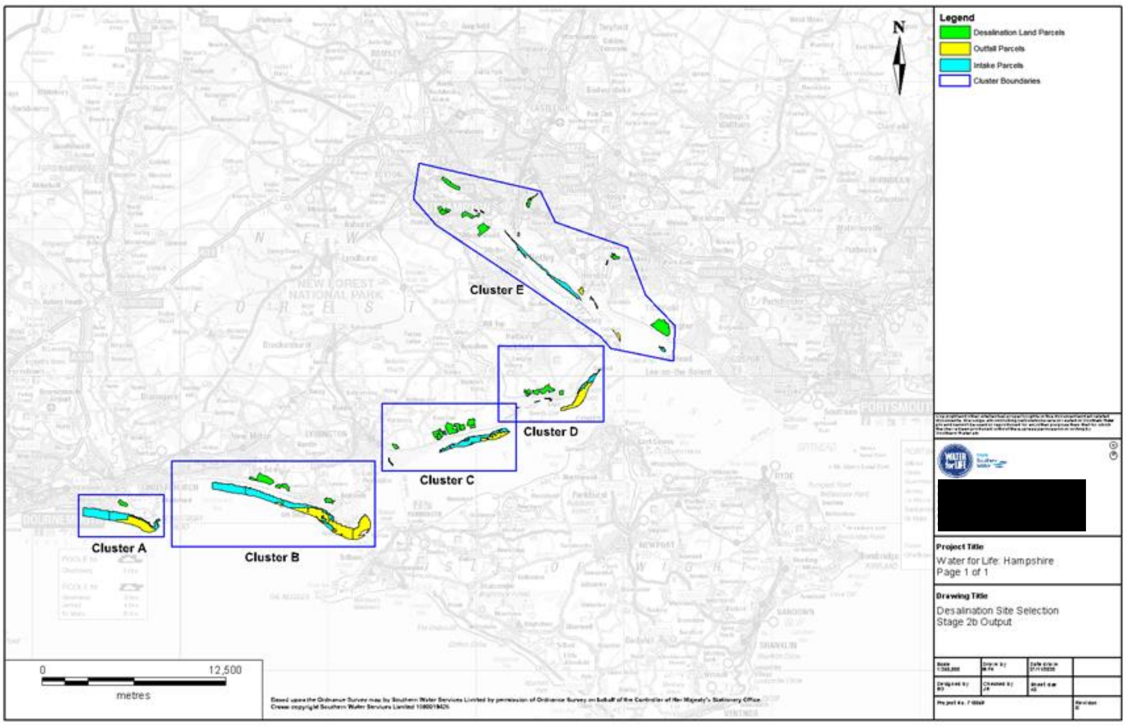

Figure 40 - Desalination Terrestrial and Marine Parcel Site Selection Stage 2b Output

Stage 3 Results

A total of 28 terrestrial parcels were scored at this stage, the highest score attributed to a parcel was 86 points with the lowest being 70. Given that the parcels were scored against 39 criteria with each criteria awarding a maximum of three and a minimum of zero points, a variance of 16 points between the 28 parcels across the clusters illustrated some differentiation could be made between the best performing and least well performing parcels through mapping and criteria application.

The 28 parcels were ranked with the top performing parcels within each cluster identified, a total of 16 terrestrial parcels across the 5 clusters were identified as potentially being appropriate to take forward to the next stage of the process.

A total of 19 marine intake parcels were scored, the highest score attributed to a parcel was 48 points with the lowest being 26. A total of 13 marine outfall parcels were scored, the highest score attributed to a parcel was 45 points with the lowest being 23. Given that the parcels were scored against 20 criteria with each criteria awarding a maximum of three and a minimum of zero points, a variance of 22 points between the 19 marine intake parcels and 22 points between the 13 marine outfall parcels, illustrated some differentiation between the best performing and least well performing parcels through mapping and criteria application. Figure 41 illustrates the output of Stage 3 of the process.

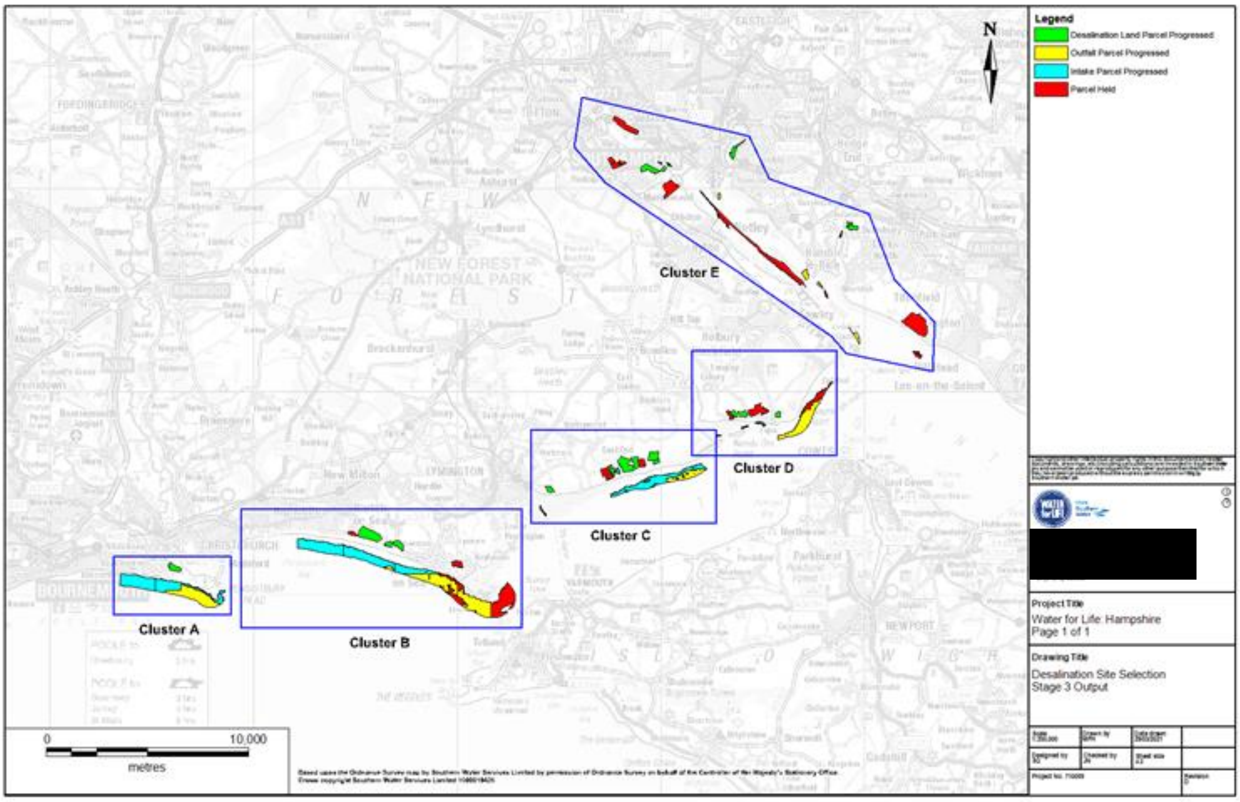

Figure 41 - Desalination Terrestrial and Marine Parcel Site Selection Stage 3 Output

Stage 3b Results

At the end of Stage 3, a total of 16 terrestrial parcels, 15 marine intake parcels and 11 marine outfall parcels were identified as the best performing within their respective clusters.

The intention of Stage 3b was to help differentiate between the clusters remaining at the end of Stage 3b in terms of the comparative risk to delivering the objectives of WfLH. On this basis, the purpose of Stage 3b was to recommend clusters to be held, and leading clusters to be taken forward for further, more detailed Consenting Evaluation.

The initial stage of the process reviewed the total scores allocated to each parcel within the clusters from Stage 3A and the pipeline scores. Based on quantitative review of the combined scores of pipelines and terrestrial / parcels, it was determined that Clusters A, B and C were poor performing compared to the parcels within Clusters D and E and therefore Clusters A, B and C were not to be progressed to the risk workshop.

A risk workshop was held that considered the engineering and feasibility constraints associated with the short-listed parcels (those within clusters D and E) and the potential connecting pipelines to Testwood or Otterbourne WSW. Risk workshop attendees were asked to score each criterion (set out below) against a number of objectives based on compliance, efficiency and resilience.

- Water Quality
- Traffic and Transport
- Security
- Public Safety
- Maintenance
- Navigation
- Tunnelling
- Defence
- Oil and Gas
- Port Development
- Dredging
- Marine Activity
- Contaminated Land
- Services (marine and land)
- Access
- Demolition
- Estimating
- Market appetite
- Procurement
- Outfall complexity
- Pipeline complexity
- Stakeholder complexity
- Sustainability
- Climate change
- Security
- Programme
- Environmental Compliance

The workshop was effective in exploring the engineering and environmental constraints associated to each cluster, but it was not possible to definitively define configurations based on the current level of site knowledge and 'ground-truthing', and understanding of the tunnelling requirements (design, environmental mitigation and construction) for the marine intakes and outfalls. It was possible however to develop sub-clusters within cluster E, based on the spatial relationship of individual land parcels, outfalls and intakes, and their relative engineering and environmental constraints, and pipeline routing. The sub-cluster exercise determined that Cluster E which extended along the length of Southampton Water did not differentiate between the level of risk of development within this water body from an environmental perspective and meant that there may be significant lengths between the marine intakes / outfalls and the terrestrial parcels owing to the distances between them.

The outcome of the risk assessment workshop indicated that all the clusters were likely to carry significant risks to delivery and the satisfaction of the objectives of WfLH. The assessed risk profiles of clusters E1 and E2 (upper and middle Southampton Water respectively) were deemed to be significantly higher than the other clusters (E3 (lower Southampton Water) and D. Following the risk workshop, it was therefore recommended that Clusters E3 (comprising terrestrial Parcel D55 and a marine intake and outfall in the lower Southampton Water), D and the Base Case were progressed to more detailed Consenting Evaluation.

Following further review of the approach for Stage 3b it was determined that a qualitative consenting lens needed to be applied to the parcels to understand the level of consenting risk when compared to national policy and the likelihood of being able to mitigate impacts to achieve policy compliance. Therefore, a back-check of the outputs of this stage was conducted as part of Stage 4 (see below).

Stage 4 Results

Stage 4 included a back-checking process to ensure that all relevant information and judgments were up to date, and to identify where there were any information gaps which would affect Stage 4. To ensure that planning considerations were a key factor in the short-listing of sites, it also included a review of the terrestrial and marine parcels associated with clusters A, B, C, D and E to determine if they were potentially more consentable alternatives to the Base Case at Ashlett Creek. Figure 42 illustrates the clusters considered.

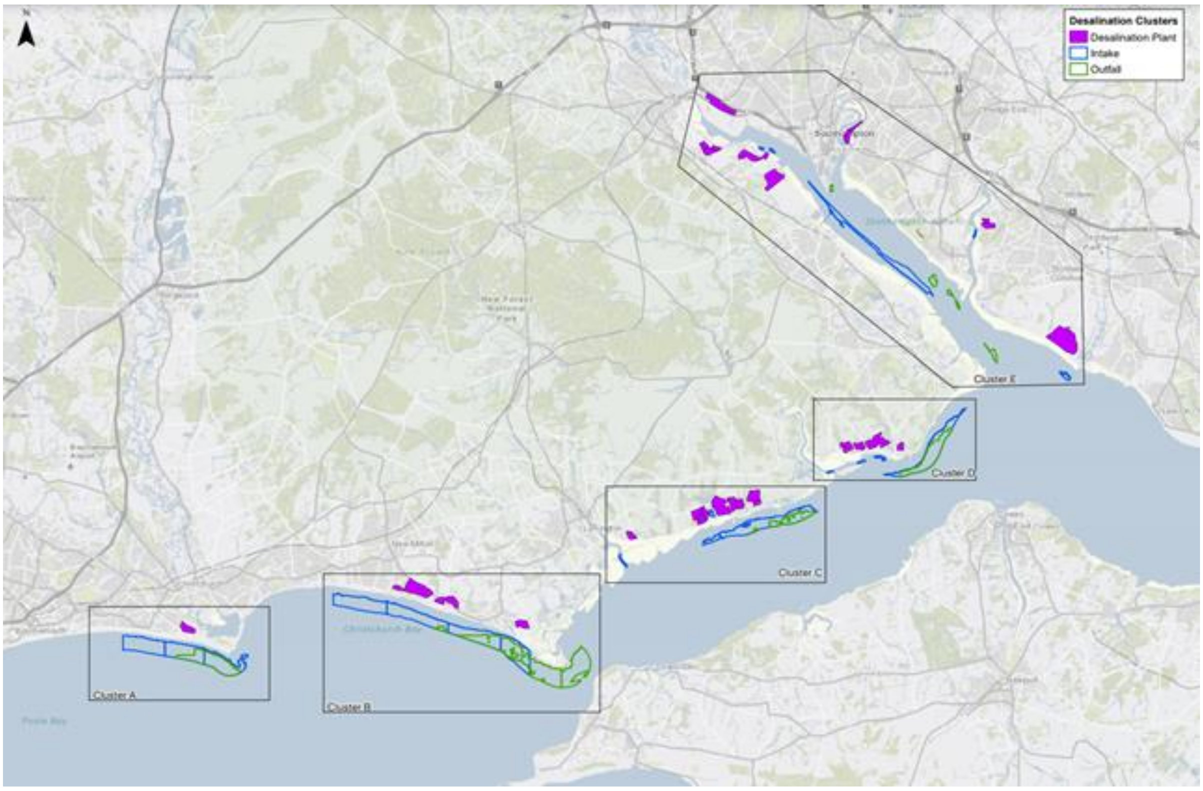

Figure 42 - Clusters and Corresponding Parcels considered in the back-check

A review was undertaken of the Habitats Regulations Assessment (HRA) risks associated with each of the marine intake / outfall locations as this is a key factor in the viability and consentability of any Desalination-based Option. On the basis of this review, it was determined that the marine components of clusters A, C, D and E were all very high risk owing to potential impacts on designated sites and therefore would not represent more consentable alternatives than the Base Case from this perspective.

The Eastern part of cluster B nearer to Hurst Castle was also identified as having a very high HRA consenting risk but the Western part of that parcel near to Barton Sea was deemed to have a lower, albeit still high, HRA consenting risk. On this basis, a review of the terrestrial parcels that could connect to the marine intake / outfall in this location was undertaken. Whilst all the terrestrial parcels would be outside of the New Forest National Park the following consenting risks were identified:

- The extensive lengths of pipeline that would be required to connect to Testwood (and which would lie within the New Forest National Park)
- The proximity of the pipelines and their direct impact (intersection with) on a number of European Sites and nationally designated sites (SSSI)
- The geological SSSI designation (Milford Cliffs) along the coastline (in relation to the marine intake / outfall)

It was therefore confirmed that due to these factors, this cluster was not a viable alternative for a desalination solution from a consenting perspective.

A review was also completed of terrestrial parcel D55 (within Cluster E) and its associated marine intake / outfall into the Southern part of Southampton Water. Parcel D55 was identified as a possible alternative desalination location at Stage 3b. The review sought to identify whether there was a potential consentable alternative site outside of the New Forest National Park to the Base Case. This review determined that this Option would require completely new infrastructure within the Solent and Dorset Coast SPA and there would be potential consenting risks associated with impacts on mudflat and saltmarsh areas associated with the saline plume. The terrestrial parcel was also identified as having very high consenting risks owing to the designation of the site as a 'Core' area in the Solent Waders and Brent Geese Strategy[3]. This strategy identifies functional habitat linked to the Solent and Southampton Water SPA and Ramsar. It was therefore not considered a consentable alternative to the Base Case. On the basis of the Stage 4 site selection analysis, no alternative, viable and consentable parcels were identified within clusters A, B, C, D and E.

In addition, a review was undertaken of the discounted draft WRMP19 site at the Former Fawley Power Station to reconfirm that this was not a viable alternative to the Base Case site within the New Forest National Park. This concluded that:

- The terrestrial parcel, whilst not within the National Park, was still immediately adjacent to it and would likely incur significant landscape and visual impacts on the setting of the National Park. It was therefore deemed to have marginally lower, but still significant, consenting risk than the Base Case when assessed against key tests in the draft National Policy Statement (dNPS) and the National Planning Policy Framework (NPPF) – National Park policy. Development proposals for Fawley Waterside are significantly more advanced than when this Option was removed from the WRMP19 (outline consent has now been granted and the site was also allocated in the Local Plan for this purpose). The size of the plant is likely to consume most of the masterplan area allocated for business and industrial space and it would be very challenging to reconfigure to allow the new masterplan and the desalination plant to operate concurrently on that site. This incompatibility was deemed a very significant feasibility constraint and acquisition risk. Furthermore, as noted above the Fawley Waterside site would still have potential for significant landscape and visual amenity effects and the delivery risks associated with the Fawley Waterside site in relation to the housing allocation and planning permission were not deemed sufficient to prefer this site to the Base Case location at Ashlett's Creek.

Taking the above factors together, it was reaffirmed that the former Fawley Power Station site is not a viable alternative to the Base Case. Table 17 details the configuration that was taken through into Stage 4 of the site selection process.

[3] Whitfield, D (2020) Solent Waders and Brent Goose Strategy Hampshire and Isle of Wight Wildlife Trust. Curdridge.

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Table 17 - Parcels and pipelines taken into Stage 4 of the site selection process for the Base Case

Solution	Parcels	Intake and Outfall (Marine)	Pipelines
Desalination	Ashlett Creek	Fawley to Abstraction / Discharge Route 1 (intake from the existing Fawley Deep Dock and outfall most direct route to marine discharge parcel). Fawley to Abstraction Discharge Route 2 (Calshot Intake / Outfall) – note uses redundant Fawley Power Station water tunnels. Fawley to Abstraction Discharge Route 3 (Lepe). Fawley to Abstraction Discharge Route 4 (Lepe).	Fawley to Testwood Route 1 Fawley to Testwood Route 2 Fawley to Testwood Route 4 Fawley to Testwood Route SIA Pipeline Route 3 was discounted prior to Stage 4 owing to significant engineering feasibility issues associated with the routeing along a live freight railway.

Table 18 details a summary of the results of the site selection process for the Base Case. For details of the components considered in the site selection process refer to Figure 43 (the Ashlett Creek site is shown by the redline site boundary).

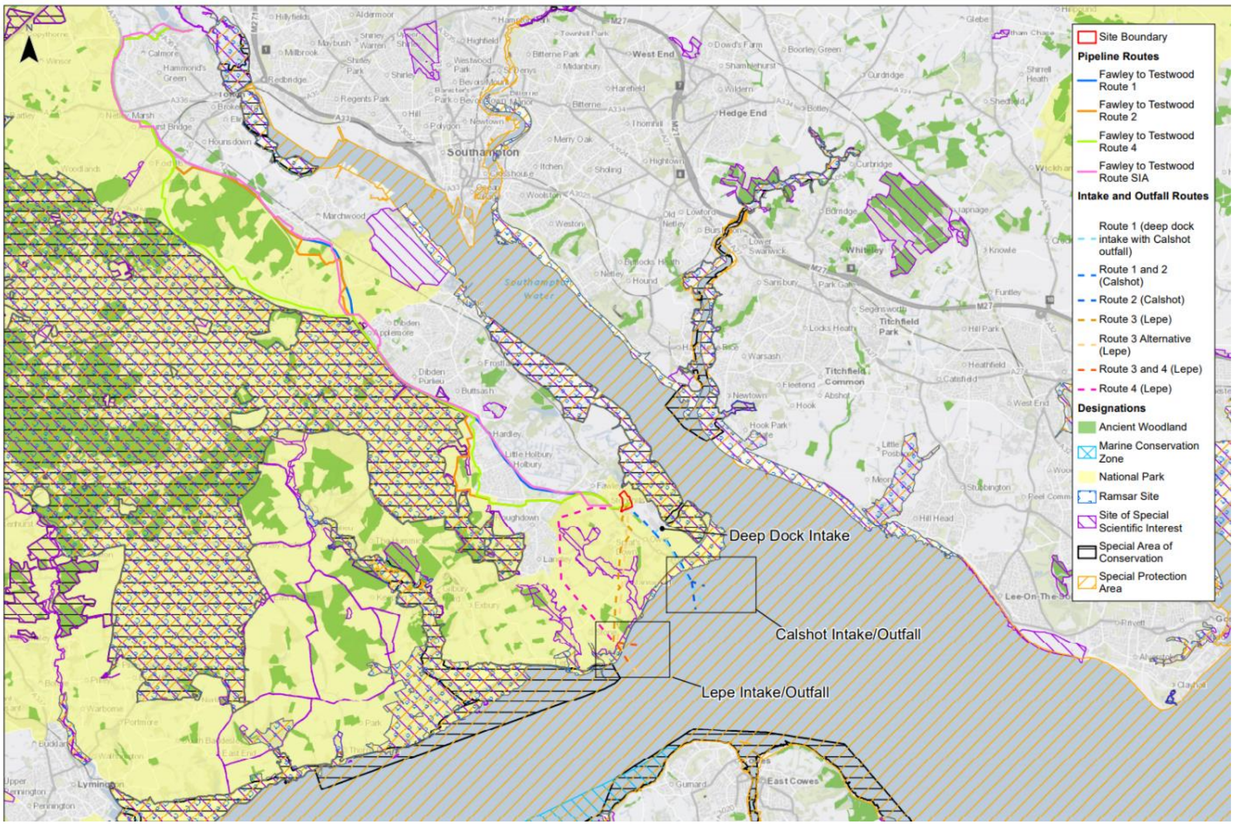


Figure 43 - Components of Site Selection

Table 18 - Summary of site selection and pipelines consenting risk evaluation for the Base Case

Option	Summary of Site Selection Outcomes	Consenting Risk
Terrestrial Parcel	This parcel lies within the New Forest National Park and therefore this represents a significant potential consenting risk. The draft NPS states: *"Great weight should be given to conserving landscape and scenic beauty in nationally designated areas. National Parks, the Broads*	There is no certainty that mitigation of National Park impacts could be provided. There would be a permanent impact on the

Option	Summary of Site Selection Outcomes	Consenting Risk
	and Areas of Outstanding Natural Beauty have the highest status of protection in relation to landscape and scenic beauty. Each of these designated areas has specific statutory purposes which help ensure their continued protection and which the Secretary of State has a statutory duty to have regard to in decisions. The Secretary of State should refuse development consent in these areas except in exceptional circumstances and where it can be demonstrated that the development is in the public interest…. (Paras 4.9.9 and 4.9.10)". The terrestrial parcel also lies in proximity to a number of internationally and nationally designated ecological sites and therefore there is the potential for indirect effects to affect the conservation objectives of these sites. This will require development of appropriate mitigation to ensure there is no adverse effect as the dNPS indicates that development consent should not normally be granted where there is likely to be an adverse effect.	National Park associated with the development of this parcel.
Marine Intake / Outfall Lepe Option	The proximity of the Lepe site to the Beaulieu River (part of the Solent and Southampton Water SPA) means that use of this location for the intake / outfall would have a very high consenting risk from a HRA perspective. This risk relates to disturbance to important foraging / roosting areas within the Beaulieu Estuary during the construction works (a temporary impact). The Beaulieu River and Needs Ore Point area is known to support Annex I 'Salicornia and Other Annuals Colonising Mud and Sand' habitat (part of the Solent Maritime SAC), which is highly sensitive to changes in suspended solids (water clarity). A known area of seagrass is located close to the westernmost extent of the modelled dispersion plume for the Lepe site. Seagrass is also considered to be highly sensitive to changes in water clarity, smothering and salinity changes. Although the extent of any sediment plume is unknown, the proximity of the Lepe site to the Solent Maritime SAC and the recorded area of seagrass increases the risk of adverse effects that cannot be mitigated. This would be an ongoing operational impact. Therefore, there are significant consenting risks associated with this site.	Further environmental information especially in relation to HRA risks is required to establish consenting viability and ability to be able to mitigate potential effects. Significant risk would remain until this survey information is completed. This potential location for the marine intake / outfall is considered to have potentially greater consenting risks than the Calshot Option considered below.
Marine Intake / Outfall Calshot Option	The HRA consenting risks are considered to be potentially lower for the Calshot intake and outfall Options as there is potential to re-use some existing infrastructure associated with the Fawley Power Station that would further reduce impacts to the marine environment. Use of the redundant Fawley power station infrastructure at the deep dock for the intake would be offset from the main Southampton Water channel which could reduce risks associated with the intake. If a new intake needed to be constructed, then this would be within the Western Solent. Although mitigation is proposed with the type of intake screen and mesh size to be used, further evidence will be required to determine impingement / entrainment and entrapment issues will not result in adverse effects. If required, the new offshore intake infrastructure would be outside the estuaries feature of the Solent Maritime SAC, but construction would be required in intertidal areas which are designated as part of the SAC and Solent and Southampton Water SPA and Ramsar. There is potential for an adverse effect on site integrity. There would be the dispersion of the waste-stream across the entrance to Southampton Water which leads to the spawning watercourses designated for Atlantic salmon (River Itchen SAC, River Meon (compensatory habitat) and River Test SSSI). Further investigation is needed regarding how any waste stream impacts	Further environmental information especially in relation to HRA risks is required to establish consenting viability. Significant risk would remain until this survey information is completed. In view of the potential to re-use existing infrastructure this Option is considered preferable to the Lepe intake / outfall Option above.

Option	Summary of Site Selection Outcomes	Consenting Risk
	could be mitigated and this would be developed through further modelling and survey information.	
Pipelines- Four Considered (1, 2, 4 and SIA)	Four pipelines were considered in the site selection process. Pipeline 3 was discounted prior to Stage 4 owing to significant engineering feasibility issues associated with the routeing along a live freight railway. Pipeline Stantec Insight Analytics (SIA) was developed after Gate 1 during a refinement of the pipeline corridors. This comprised the application of the SIA Route Planner Tool to back-check the routes developed at Gate 1, further optimise them and ensure that there was a consistent approach to developing all pipeline Options. Pipelines 1 and 2 have a lower impact on the New Forest National Park than Pipelines 4 and SIA, however there are significant constructability constraints related to construction within the Hythe bypass. There will be a need for further technical feasibility work and engagement with Hampshire County Council regarding the proposed pipeline construction. Pipeline SIA has potential significant ancient woodland impact. The dNPS states: *"The Secretary of State should not grant development consent for any development that would result in the loss or deterioration of irreplaceable habitats including ancient woodland the loss of ancient or veteran trees found outside ancient woodland…". (Para 4.3.14)* Pipeline 4 presents fewer engineering challenges but passes close to ancient woodland and is likely to require mitigation. All the pipelines have a potential intersection with Flood Zones 2 and 3 and therefore a Flood Risk Assessment will be required to ensure that all relevant tests within the dNPS are met.	The consenting risks are considered potentially lower for pipelines 1 and 2 as they have a reduced impact on the New Forest National Park and other national level designations although there remain significant challenges associated with the deliverability of these pipeline routes.

Site and Route Selection Conclusions

Based on the Stage 4 site selection process and the consideration of marine and terrestrial risks, it was determined that there was no consentable and viable alternative to the Base Case.

The Base Case therefore remained the preferred Desalination-based Option. The site selection process confirmed that for the Base Case, the Calshot marine intake / outfall Options should be taken forwards and the Lepe Options discounted as the former were deemed to have lower consenting risk from an HRA perspective.

Regarding the pipeline route Options, pipeline corridors 1 and 2 were recommended to be included within the preferred configuration. Stage 4 concluded that there remained a number of consenting risks that needed to be considered further in Stage 5:

- There remain significant HRA risks. There was significant residual uncertainty about the ability to mitigate the potential impacts associated with the marine intake and outfall, and the impact of the timescales on the scheme delivery programme that would be required to establish data on which acceptable proposals could be developed.
- The impact of the terrestrial parcel on the New Forest National Park and the ability to mitigate the impacts.
- The mitigation required to develop a deliverable pipeline connection to Testwood.

Table 19 details the components that were taken forwards into Stage 5 of the Consenting Evaluation process.

Table 19 - Components taken forwards into Stage 5 of Consenting Evaluation process

Infrastructure Component	Site Selection Outcome
Marine Intake / Outfall	Calshot Intake and Outfall (including potential use of the deep dock)
Terrestrial Parcel	Ashlett Creek
Pipeline	Pipelines 1 and 2

2.5 Environmental Assessment

2.5.1 Introduction

The Gate 2 Environmental Assessment builds upon the Environmental Assessments presented in the Gate 1 Submission: Annex 10.1 Environmental Assessment. The following environmental assessments and activities are summarised in this report for Options A.1 and A.2:

1. Strategic Environmental Assessment (SEA)
2. EIA progress and surveys
3. Marine Conservation Zone Assessment (MCZA)
4. Habitats Regulations Assessment (HRA)
5. Water Framework Directive (WFD) Compliance Assessment
6. Invasive Non-Native Species (INNS) Risk Assessment
7. Biodiversity Net Gain (BNG) and Natural Capital (NC) Assessment
8. Environmental Mitigation

Table 20 details the actions agreed for the Environmental Assessment as part of SW's Gate 1 submission to RAPID, and the information which has been requested by RAPID to accompany the Gate 2 Environmental Assessment and indicates where this information is located within this section.

Table 20 - Environmental Assessment actions agreed at Gate 1 / Gate 2 Environmental Assessment requirements

Source	Requirement for Gate 2 Environmental Assessment	Location with Gate 2 Environmental Appraisal
RAPID Gate 2 template section 3.5	Option-level environmental assessments that meet local requirements and provide information consistent with SEA, HRA and other statutory assessment requirements including consideration of in-combination effects and identification of environmental risks that need mitigating through the solution design and costing.	All following subsections
RAPID Gate 1 Final Decision – Action for Gate 2	Provide summaries of the further development of SEA, HRA, WFD assessment, NC Assessment, Environmental Social and Economic Valuation and Environmental Net Gain, that have been discussed and agreed with the EA, NE and any other relevant regulators, to meet gate two requirements and timescales.	All following subsections
RAPID Gate 2 template Section 3.5	Environmental, social and economic valuations (or metric benefits) consistent with principles in the National Policy Statement and Water Resource Planning Guidelines.	2.5.1.3.5 (BNG and NC Assessment)
RAPID Gate 1 Final Decision – Action for Gate 2	Conclude site selection process as detailed in Annex 9.1 [from the Gate 1 submission], in consultation with the EA and NE, to meet gate two 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.	Section 2.4 A dedicated desalination facility on the industrial site did not progress beyond Stage 4 of Site Selection so is not discussed in this section.

Source	Requirement for Gate 2 Environmental Assessment	Location with Gate 2 Environmental Appraisal
RAPID G2 template section 3.5	Include main conclusions and issues arising including results of environmental work carried out to date and plan for future work: 9. How the solution contributes to environmental net gain	2.5.1.3.5 (BNG and NC Assessment)
RAPID G2 template section 3.5	Include main conclusions and issues arising including results of environmental work carried out to date and plan for future work: 10. The carbon impact of the solution and initial outline of how the solution will take into account the carbon commitments.	Section 2.5.2.3
Gate 1 Submission, Annex 20 - Gate 2 delivery plan	Summary of the following (Varying maturity level depending on solution / Option) 11. Activities that have the potential to be accelerated and brought forward from Gate 3 activities into Gate 2 for the Base Case include: 12. Terrestrial and marine environmental and ecological surveys; 13. Scope and prepare outline Environmental Monitoring Plans; 14. Commencement of work to inform the Preliminary Environmental Information Report (PEIR)	2.5.1.2 Progress on EIA
RAPID Gate 1 Final Decision Action for Gate 2	Provide details of an 'Evidence Planning Strategy, which has been discussed and agreed with the EA and NE, to meet gate two requirements and timescales. Baseline methodologies and scopes to inform survey work needs to be agreed as a priority.	2.5.1.2 Progress on EIA

The purpose of this section of the CDR is to provide a concise summary of each of the environmental assessments that have been undertaken for A.1 and A.2. The full assessments are being made available to regulators as part of the ongoing consultation and engagement process.

This section explains the approach taken to each of the assessments and their key findings. Due to the intended length of the CDR, it is not possible to include full details of every aspect of the assessments in this section.

The environmental assessments have been undertaken based on the level of concept design information and evidence base available on each SRO at this stage in the scheme development process. After Gate 2, project level environmental assessments will be undertaken to support the DCO application for the Preferred Option. These assessments will be undertaken in compliance with the requirements of the dNPS for Water Resources Infrastructure, relevant legislation and guidance and supported by a full suite of environmental surveys and further consultation and engagement.

Assessments at this stage are primarily based on a qualitative expert-judgement approach, augmented by semi-quantitative data where available. Where gaps in information (e.g., survey data, modelling etc) have been identified, these are summarised in this section.

Method Statements, outlining the proposed approach to the environmental assessments for the SEA, HRA, Marine Conservation Zone (MCZ) Assessment, INNS Assessment and WFD Assessment were circulated to NE, the EA and the MMO for comment. Drafts of the BNG and NC assessments, including details of the applied methodology, were also circulated for comment. Full details of how the comments received have been addressed are included in the environmental assessments, and the key comments and details of how they have been addressed are summarised in this section of the CDR.

A summary of the key themes emerging from engagement with the regulators is detailed in Table 21.

Table 21 - Consultation summary - key themes

Comment Theme	Response
Gaps in baseline information	Several data gaps have been filled since Gate 1 (for example dispersion modelling); however, it is recognised that there are some gaps in baseline information (e.g., surveys), and the assessments draw upon desk-based information where no survey data is available. Further surveys will be undertaken as part of the EIA for the Preferred Option.
Uncertainty over scope of Gate 2 assessments and relationship with project level consent application assessments	The assessments have been used to inform site selection, consenting evaluation and Options appraisal. An EIA, HRA, WFD Assessment and other relevant project level assessments will be undertaken for the Preferred Option DCO application.
Specific comments on guidance and best practice to be used in assessments	The environmental assessments have been updated to ensure they reflect specific guidance referenced by stakeholders.

The environmental assessments reported in this section are based on the SRO configurations identified through the site and route selection process for A.1 and A.2.

The components of A.1 and A.2, for the configurations identified through the site and route selection process are as follows:

- Sea water intake:
  - Disused Fawley intake off Southampton Water [redacted] or
  - Offshore at Calshot
- Reject water and diffuser:
  - Offshore at Calshot utilising the disused Fawley outfall for some of the length
  - Offshore at Calshot but with completely new pipeline
- PS to be located south of Fawley
- Pipeline to / from intake and outfall and desalination plant along western boundary of Fawley site
- Desalination plant at Ashlett Creek
- Transfer pipeline to Testwood WSW (no water booster stations, or brake pressure tanks are required):
  - Route 1: Within the A326 Hythe bypass through New Forest Special Area of Conservation (SAC), SPA and Ramsar, then adjacent to it (West) to Testwood WSW
  - Route 2: As for Route 1 but extending to West of Holbury, and avoiding some junctions (Applemore Hill, junction with A35)
- Receiving tank at Testwood WSW

The components of A.1 and A.2 are illustrated in Figure 44.

[redacted]

2.5.2 Strategic Environmental Assessment (SEA)

As with the approach taken at Gate 1, the principles of SEA have been applied to inform the potential impacts associated with each SRO, a statutory SEA is not required.

The SEA Screening Assessment undertaken for A.1 at Gate 1 (Appendix 10.1 Environmental Assessment, Desalination Appendices: Appendix B to the Gate 1 submission) has been updated to reflect changes in the concept design and potential pipeline routes, and open-source data sources have been updated.

The five steps of SEA will be followed in this assessment:

- **Stage A** - Setting the context, establishing the baseline and deciding the scope
- **Stage B** - Developing and refining alternatives and assessing effects
- **Stage C** - Preparing the environmental report
- **Stage D** - Consultation
- **Stage E** - Monitoring implementation of the plan or programme

A summary of the above stages is provided below, with full details available in the SEA.

2.5.2.1 Stage A - Screening

The purpose of SEA screening is to identify which elements of the baseline are present and whether they are affected by the proposals. The assessment within this screening stage is informed by knowledge of the SRO design, open source environmental and societal data and key legislative requirements and guidance. At this stage it is acknowledged that there are data and knowledge gaps (both around the detail of the SRO and the environmental impact). Therefore, the aim of this screening has been to highlight 'showstopper' risks plus benefits or disbenefits related to a specific set of configurations to help support the overall feasibility assessment and to inform the more detailed environmental assessment and associated discussion only.

The screening has been developed to support the more detailed assessment and to provide a clear early assessment of risk. It does not take the place of the detailed assessment but rather provides a rapid assessment of significant adverse effects.

2.5.2.2 Stage B - Environmental Assessment of the Configurations

Stage B comprises the assessment of SROs against the SEA objectives and identifies whether mitigation measures are likely to be required. The SEA is based on the SEA appraisal framework; a Stage 2 High Level Appropriate Assessment, potential changes to WFD status; and the environmental and societal risk and benefits. The principles, of these environmental assessments, informs the narrative around environmental risks and benefits, and whether the SROs are feasible.

For each SEA objective, the residual effect is determined using the significance of effect matrix applied during WRMP19. This considers the value / sensitivity of the receptor (e.g., species, air quality, river water quality, landscape value, heritage feature) and the magnitude of the assessed effect. These key SEA topics are defined through a review of relevant policy and legislation, and it is this review that determines the specific SEA objectives. The significance matrix categorises effects on a scale ranging from 'major beneficial' to 'major adverse'. For the box signifying low magnitude and high receptor value / sensitivity, this could result in a greater than 'moderate' effects being assigned dependent on the sensitivity / value of the receptor. This colour coding is used to complete the columns for residual effects in the appraisal. Where major adverse effects are predicted, measures envisaged to prevent, reduce (and as far as possible, offset) these effects on the environment (because of implementing the measure) are outlined where relevant / appropriate.

To aid the overall assessment a summary visual evaluation matrix is completed for each SRO. This is used to summarise the key understanding of the SRO for each SEA objective following the identification within the HRA or WFD or where a legislative test cannot be met.

2.5.2.3 Stages C, D and E

- Stage C: Reporting. The SEA has been summarised in the Gate 2 documentation, with the full detail provided to the regulators separately.
- Stage D: Consultation. This will be undertaken leading up to the Gate 2 submission.
- Stage E: Requirements for monitoring will be identified and carried forward to the project stage assessment.

2.5.3 SEA Screening

Options A.1 and A.2 both have the potential for major adverse effects to biodiversity due to potential impacts on the National Site Network and national designated sites, both coastal and marine, and terrestrial sites. There are also major adverse impacts to water identified which are associated with the potential for impacts on the biology and physico-chemistry of the Southampton Water or Solent. There is the potential for major adverse impacts to cultural heritage due to the proximity to Scheduled Monuments and Listed Buildings, and the potential for buried and unknown archaeology, during construction of the transfer pipelines to Testwood WTW (Route 1 and 2). There is also the potential for major adverse impacts as a result of constructing the pipeline and desalination plant infrastructure within the New Forest National Park. There is the potential for a major impact on other SEA topics (including Population and Human Health, Air and Climate, Material Assets, and Soils and Geology), due to the long-term energy requirement for the desalination plant.

A.1 and A.2 are likely to result in moderate impacts on cultural heritage (proximity to Scheduled Monuments and Listed Buildings) and landscape and visual amenity to the New Forest National Park.

2.5.3.1 A.1 AND A.2 Abstraction from the Southampton Water or Solent, Pumping Station at Fawley & Transfer from Intake

Summary of Scheme Adverse Effects

One major adverse effect has been identified, relating to biodiversity flora and fauna (potential Adverse Effect on Integrity (AEoI) for several National Site Network Sites) due to the intake pipeline to the desalination plant. Two moderate adverse effects have been identified, relating to (material assets and resource use (estimated medium amounts of construction materials and waste generated), and landscape.

Summary of Scheme Beneficial Effects

Five minor beneficial effects have been identified, relating to population and human heath, material assets and resources, water and air and climate, through its contribution to water supply. The component provides a benefit by ensuring water provided by the other components reaches the right customers, communities and businesses. Additionally, the component reduces the vulnerability to risks (drought) associated with climate change effects and improves resilience to the likely effects of climate change.

2.5.3.2 A.1 AND A.2 Desalination Plant (at Ashlett Creek)

Summary of Scheme Adverse Effects

Four major adverse effects have been identified, relating to biodiversity flora and fauna (potential AEoIs for several National Site Network site designations, impacts to national designations due to construction traffic), material assets and resource use (large quantities of material for construction and waste generated for landfill, in addition to energy and chemicals requirements during operation), air and climate (major long-term energy requirement) and landscape and visual amenity (creation of a permanent feature on the landscape of a national park).

Summary of Scheme Beneficial Effects

Five major beneficial effects are anticipated, 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.

2.5.3.3 A.1 AND A.2 Waste Stream from Desalination Plant to Solent

Summary of Scheme Adverse Effects

Two major adverse effects have been identified relating to biodiversity flora and fauna (potential impacts to National Site Network Sites due to the hypersaline plume at the outfall) and landscape and visual amenity (creation of permanent features on the landscape of a national park). Two moderate adverse effects have been identified, relating to material assets and resource use (estimated medium amounts of construction materials and waste generated), and air and climate.

Summary of Scheme Beneficial Effects

Five minor beneficial effects have been identified, relating to population and human heath, material assets and resources, water and air and climate, through its contribution to water delivery resourced as part of the overall Fawley Desalination solution. The component provides a benefit by ensuring water provided by the other components reaches the right customers, communities and businesses. Additionally, the component reduces the vulnerability to risks (drought) associated with climate change effects and improves resilience to the likely effects of climate change.

2.5.3.4 A.1 AND A.2 Pipeline Transfer Route 1

Summary of Scheme Adverse Effects

Three major adverse effects have been identified, relating to biodiversity, flora and fauna (potential dust and air quality impacts of construction works towards National Site Network and national designations), material assets and resource use (large quantities of material for construction and waste generated for landfill) and landscape and visual amenity (impacts on the visual amenity of the landscape of a National Park during construction).

Summary of Scheme Beneficial Effects

Five minor beneficial effects have been identified, relating to population and human heath, material assets and resources, water and air and climate, through its contribution to water delivery resourced as part of the overall Fawley Desalination solution. The component provides a benefit by ensuring water provided by the other components reaches the right customers, communities and businesses. Additionally, the component reduces the vulnerability to risks (drought) associated with climate change effects and improves resilience to the likely effects of climate change.

2.5.3.5 A.1 AND A.2 Pipeline Transfer Route 2

Summary of Scheme Adverse Effects

Three major adverse effects have been identified, relating to biodiversity, flora and fauna (potential dust and air quality impacts of construction works towards National Site Network and national designations), material assets and resource use (large quantities of material for construction and waste generated for landfill) and landscape and visual amenity (impacts on the visual amenity in a national park during construction). Two moderate adverse effects have been identified in relation to air and climate (air pollutant emissions).

Summary of Scheme Beneficial Effects

Five minor beneficial effects have been identified, relating to population and human heath, material assets and resources, water and air and climate, through its contribution to water delivery resourced as part of the overall Fawley Desalination solution. The component provides a benefit by ensuring water provided by the other components reaches the right customers, communities and businesses. Additionally, the component reduces the vulnerability to risks (drought) associated with climate change effects and improves resilience to the likely effects of climate change.

2.5.3.6 A.1 AND A.2 Receiving Tanks at Testwood WTW

Summary of Scheme Adverse Effects

One major adverse effect has been identified, relating to biodiversity, flora and fauna (potential dust and air quality impacts of construction works towards National Site Network and national designations). Four moderate effects have been identified to material assets and resource use (small long-term energy consumption requirement), air and climate (air quality impacts of Heavy Goods Vehicles (HGVs) and carbon from construction materials) and greenhouse gases and archaeology and cultural heritage (the high potential for undiscovered archaeological remains during construction).

Summary of Scheme Beneficial Effects

Five minor beneficial effects have been identified in relation to population and human heath, material assets and resources, water and air and climate, through its contribution to water delivery resourced as part of the overall Fawley Desalination solution. The component provides a benefit by ensuring water provided by the other components reaches the right customers, communities and businesses. Additionally, the component reduces the vulnerability to risks (drought) associated with climate change effects and improves resilience to the likely effects of climate change.

2.5.3.7 Summary of A.1 AND A.2 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 effect 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 New Forest National Park. The pipeline Options will have short term major adverse impacts until vegetation / screening has established as is 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.

2.5.3.8 Progress on Environmental Impact Assessment (A.1 and A.2)

In addition to Gate 2 specific environmental assessments, work has progressed on the EIA process, namely work in relation to the preparation of an EIA Scoping Report. The purpose of the EIA Scoping Report is to determine the extent of issues to be considered in the assessment and reported in the Environmental Statement, required as part of the DCO application.

Development of Outline EIA Methodology Document

An outline EIA methodology document has been prepared which sets out a broad approach to EIA which can be applied to all the SROs currently being considered by WfLH. The outline EIA methodology document will be made bespoke for the preferred SRO once this is determined following Gate 2. The document is currently being quality assured, with the intention of submitting to regulators and stakeholders for comment in August / September 2021. As the preferred consenting route for all SROs is a DCO under the Planning Act 2008, the document has been prepared in line with the Planning Inspectorate (PINS) Guidance Notes, including 3 (EIA Notification), 7 (EIA PEIR, Screening and Scoping), 10 (HRA), 17 (Cumulative Effects Assessment) and 18 (WFD Assessment).

The outline EIA methodology document establishes approaches to:

- Defining baseline

- Assessment of Likely Significant Effects (LSE)
- Assessment of cumulative and in-combination effects
- Approach to determining and assessment mitigation

Specific assessment methodologies have also been prepared for the following EIA Topics:

- Air Quality and Odour
- Archaeology and Cultural Heritage
- Biodiversity
- Land Quality and Ground Conditions
- Land Use and Agriculture
- Landscape and Visual Impact
- Noise and Vibration
- Traffic and Transport
- Water Resources and Flood Risk
- Benthic and Intertidal Ecology
- Coastal and Marine Processes
- Commercial Fisheries
- Fish and Shellfish Ecology
- Marine Mammals
- Marine Water Quality
- Ornithology
- Shipping and Navigation
- Other Marine Users
- Carbon and Climate Change
- Human Health
- Major Accidents and Disasters
- Socio-economics, Tourism and Recreation

The outline EIA methodology document will provide a framework for the EIA Scoping Report which is due to be submitted shortly after the Section 35 application.

Development of Planning Policy Document

Taking a similar approach to the outline EIA methodology document, a planning policy document has also been developed to provide a high-level summary of the key relevant national, regional and local policies relevant to the proposed SROs. The document has been developed at programme level (i.e., covering all SROs) and will be tailored to provide a bespoke planning policy section for the EIA Scoping Report following selection of the preferred SRO.

Environmental Surveys

To support the EIA process, and supporting environmental assessments (e.g., HRA and 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, as detailed below in Table 22**.**

Table 22 - WfLH – Survey Protocols

Survey Protocol Name	Included Surveys
Terrestrial Ecology	• Badger • Bats • Amphibians • Riparian mammals • Hazel dormice • Birds
Aquatic Ecology	• Aquatic macroinvertebrates • Fish • White Clawed Crayfish • River habitat and corridor surveys
Marine Environment	• Intertidal habitats and species • Subtidal habitats and species • Fish ecology • Marine and coastal ornithology • Glass eel and Ichthyoplankton • Priority marine habitats • Sediment quality • Seawater quality

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. A number of ecology surveys have already commenced for A.1 AND A.2, including a Preliminary Ecological Appraisal (PEA) for Ashlett Creek and overwintering bird surveys for the Lepe / Calshot coastline. Hazel dormice and breeding bird scoping surveys have also now commenced.

The survey protocols for those detailed in Table 22 were issued to the EA, NE and the MMO for comment in June 2021. Following agreement of these survey protocols, SRO specific survey specifications will be developed and updated. At the time of preparing this CDR, some comments have now been received from regulators, which SW is currently taking into consideration.

The purpose of the protocols is to identify and agree:

- Types of survey to be undertaken
- Survey methodologies
- Preferred survey windows / seasonal restrictions
- Further desk studies required to inform the development of project level specifications (see below)

Following agreement of the survey protocols, individual specifications will be developed for the preferred SRO, which will:

- Identify suitable study / survey areas
- Provide detailed survey programmes
- Respond to outcomes of desk studies and consultation
- Detailed survey methodologies

A series of desk-studies relating to each of the EIA topics outlined above have also been identified which are due to be procured through SW's Studies and Investigations (S&I) Framework. These desk-studies will be used to further define the survey protocols and baseline chapters of the EIA Scoping Report. The full list of desk studies is available in the Outline EIA Methodology document (RHDHV, 2021). Desk studies for plankton, marine mammals, fish and shellfish, intertidal and subtidal habitats are already underway for A.1 AND A.2.

Once the preferred SRO formally enters the DCO process, following determination of the S35 application, SW proposes to adopt the Evidence Plan Process (EPP). The purpose of the EPP, a non-statutory and voluntary process now established as best practice for DCO applications, is to provide greater certainty to all parties on the amount and range of evidence that SW is required to collect to support the application and to help address and agree issues early in the pre-application process. In advance of formally entering into the EPP, SW is seeking to agree the extent and scope of surveys with regulators as they are developed.

2.5.3.9 Strategic Resource Option (SRO) A.1 and A.2

For the purposes of the following assessments, A.1 and A.2 are considered together as they have the same footprint and required infrastructure and are likely to generate similar environmental impacts. Potential differences in impacts between A.1 and A.2 are noted where appropriate in the following summaries.

Marine Conservation Zone Assessment (MCZA)

A MCZA has been completed for Gate 2. The proposed marine works for A.1 AND A.2 do not lie within any MCZ, however Yarmouth to Cowes MCZ, Needles MCZ and Bembridge MCZ are included in this assessment given their location within the Solent. MCZs outside of the Solent are considered to be sufficiently distant so as not to be within the zone of impact for the SROs, this is supported by the modelling work completed to date. A summary of the modelling work for A.1 and A.2 is provided below.

The modelling of the plume at the outfall location was undertaken for the maximum flow for A.1 which represents the 1-in-200-year drought event (discharge rate of 75 Ml/d) and a BAU flow of 15 Ml/d using both CORMIX (75 Ml/d and 15 Ml/d) and Mike 21, a 2D model (75 Ml/d only). Note that the BAU flow is likely to be the flow at which the plant operates for approximately 320 days in an average year and is therefore considered the more likely representative flow of an average day. The maximum flow for A.2 at 61 Ml/d was not modelled, however the output and impacts are within the envelope of effects assessed for A.1.

The CORMIX modelling for the discharge rate of 75 Ml/d showed that the discharge plume is heavier than the ambient water and does not reach the water surface. The mixing zone (adhering to a 5% baseline guideline, as per Bleninger T & Jirka G.H, 2011) under this scenario extends to approx. 250 m from the outfall location and baseline (i.e. within 1%) within 1 km. This is the zone of influence of the discharge plume for excess salinity.

For salinity for the 15 Ml/d scenario, the 5% baseline guideline is met within 150 m and baseline (i.e., within 1%) within 300 m. It is important to note that 15 Ml/d represents the majority of the operational year (approximately 320 days in an average year), and that the plume would effectively extend with the predominant current conditions, rather than laterally. All other parameters either met Environmental Quality Standards within the discharge or meet baseline or guideline values closer to the outfall location.

Based on the results of the modelling and specifically the extent of the plume, the inclusion of the MCZs mentioned above are considered sufficient for the MCZA. No pathway for impact exists for other MCZs that are not in the Solent.

2.5.3.10 Screening for the Yarmouth to Cowes MCZ

The screening phase of the MCZA of Yarmouth to Cowes MCZ for A.1 and A.2 is detailed in Table 23. As MCZ conservation objectives are not required to be considered at this stage (as stated by guidance on producing MCZ assessments (MMO, 2013)), a precautionary approach has been adopted for the screening stage. This applies to all subsequent screening assessments for The Needles MCZ and Bembridge MCZ. This approach is in line with recommendations made by NE in response to the Gate 2 MCZ Assessment Method Statement (PB9638-RHD-ZZ-XX-NT-Z-0045).

Table 23 - MCZ assessment screening for the Yarmouth to Cowes MCZ for A.1 and A.2

MMO screening criteria	Yarmouth to Cowes MCZ
Is the plan or project taking place within or near an area being put forward for, or already designated as, an MCZ	The desalination discharge location for A.1 AND A.2 is located at a distance of 4.5 km from the MCZ at its closest point.
Is the plan or project capable of affecting (other than insignificantly) either: The protected features of an MCZ; or Any ecological or geomorphological process on which the conservation of any protected feature of an MCZ is (wholly or in part) dependant	Construction and decommissioning- Marine infrastructure is not located within this MCZ and the nearest component is located approximately 4.5 km away from the MCZ boundary. Whilst temporary effects on suspended sediments could occur due to seabed disturbance during construction and decommissioning, these would be localised to the works and temporary and unlikely to extend into the MCZ boundary. Operation – the marine operational effects relate to the discharge of reject water and the intake of water to supply the plant. However, this MCZ does not include features related to fish species and therefore the intake of water does not present a pathway for effect on the MCZ. The only potential effect is therefore the dispersion of the reject water discharge. No pathway of effect exists for the geological features of the MCZ, as well as the estuarine rocky habitats, intertidal features, peat and clay exposures and sheltered muddy gravels. **Based on the above, this MCZ is screened into a Stage 1 assessment for A.1 and A.2 in relation to operational discharges only.**

2.5.3.11 Stage 1 Assessment for Yarmouth to Cowes MCZ

This stage of the MCZA considers the potential impacts of A.1 and A.2 on Yarmouth to Cowes MCZ, which was screened in Table 24 details the features of interest of the MCZ, their current conservation objectives and any potential impacts that may arise due to A.1 and A.2 from operational discharges.

Table 24 - Stage 1 assessment of A.1 and A.2 on Yarmouth to Cowes MCZ

Feature	Conservation objective	Description of the impact of A.1 and A.2 on the conservation objectives	Adverse impact as a result of the proposed project
Subtidal coarse sediment	Maintain in favourable condition	A modelling exercise was carried out which modelled the dispersion of the plume from the preferred outfall location for two different flows (A.1 75 Ml/d representing the 1-in- 200-year drought scenario and 15 Ml/d for the BAU flow). 61 M/d (A.2) was not modelled; however, A.1 is considered as the worst-case scenario. The zone of influence did not extend into the MCZ boundaries for any of the parameters modelled. Consequently, the scale of impact has been demonstrated through modelling to be low and no pathway for effect has been demonstrated by the modelling. As such, no adverse impact on the conservation objectives is predicted.	No adverse impact on conservation objective predicted
Native oyster (Ostrea edulis)	Recover to favourable condition		No adverse impact on conservation objective predicted
Sheltered muddy gravels			No adverse impact on conservation objective predicted
Subtidal chalk			No adverse impact on conservation objective predicted
Subtidal mixed sediments			No adverse impact on conservation objective predicted
Subtidal mud			No adverse impact on conservation objective predicted

2.5.3.12 Screening for The Needles MCZ

The screening phase of the MCZA of The Needles MCZ for A.1 and A.2 is detailed in Table 25.

Table 25 - MCZ assessment screening for The Needles MCZ for A.1 and A.2

MMO screening criteria	The Needles MCZ
Is the plan or project taking place within or near an area being put forward for, or already designated as, an MCZ	The desalination discharge location for A.1 and A.2 is located 20 km from the MCZ at its closest point. Based on this, the SROs are not considered to be near the MCZ.
Is the plan or project capable of affecting (other than insignificantly) either: The protected features of an MCZ; or Any ecological or geomorphological process on which the conservation of any protected feature of an MCZ is (wholly or in part) dependant	Construction and decommissioning - Marine infrastructure is not located within this MCZ and the nearest component is located approximately 20 km away from the MCZ boundary. Whilst temporary effects on suspended sediments could occur due to seabed disturbance during construction and decommissioning, these would be localised to the works and temporary and unlikely to extend into the MCZ boundary. Operation – the marine operational effects associated with A.1 relate to the discharge of reject water and the intake of water to supply the plant. However, this MCZ does not include features related to fish species and therefore the intake of water does not present a pathway for effect on the MCZ. The only potential effect is therefore the dispersion of the reject water discharge. **Therefore, this MCZ is screened into a Stage 1 assessment for A.1 for operational discharges only.**

2.5.3.13 Stage 1 Assessment for The Needles MCZ

This stage of the MCZA considers the potential impacts of A.1 AND A.2 on The Needles MCZ, which was screened in for operational discharges. Table 26 details the features of interest of the MCZ, their current conservation objectives and any potential impacts that may arise due to A.1 AND A.2.

Table 26 - Stage 1 assessment of Options A.1 and A.2 on The Needles MCZ

Feature	Conservation objective	Description of the impact of Options A.1 and A.2 on the conservation objectives	Adverse impact as a result of the proposed project
Sheltered muddy gravels Short-snouted seahorse (*Hippocampus hippocampus*) Stalked jellyfish (*Calvadosia campanulata*) Stalked jellyfish (*Haliclystus* species) Subtidal coarse sediment Subtidal sand	Maintain in favourable condition	A modelling exercise was carried out which modelled the dispersion of the plume from the preferred outfall location for two different flows (75 Ml/d representing the 1-in-200-year drought scenario and 15 Ml/d for the BAU flow). The zone of influence did not extend into the MCZ boundaries for any of the parameters modelled. Consequently, the scale of impact has been demonstrated through modelling to be low, whereby significant changes to water quality resulting from the discharge are not expected. As such, no adverse impact on the conservation objectives is predicted. .	No adverse impact on conservation objective predicted
Subtidal chalk Subtidal coarse sediment Subtidal mixed sediments Subtidal sand Subtidal mud Sheltered muddy gravels Seagrass beds Stalked jellyfish (*Lucernariopsis campanulata*) Peacock's tail (*Padina pavonica*) Native oyster (*Ostrea edulis*)	Recover to favourable condition		No adverse impact on conservation objective predicted

2.5.3.14 Screening for Bembridge MCZ

The screening phase of the MCZA of Bembridge MCZ for A.1 and A.2 is detailed in Table 27.

Table 27 - MCZ assessment screening for Bembridge MCZ for A.1

MMO screening criteria	Bembridge MCZ
Is the plan or project taking place within or near an area being put forward for, or already designated as, an MCZ	The desalination discharge location for Options A.1 and A.2 is located 17 km from the MCZ at its closest point. Based on this, the SROs are not considered to be near the MCZ.
Is the plan or project capable of affecting (other than insignificantly) either: • The protected features of an MCZ; or • Any ecological or geomorphological process on which the conservation of any protected feature of an MCZ is (wholly or in part) dependant	Construction and decommissioning- Marine infrastructure is not located within this MCZ, and the nearest component is located approximately 17 km away from the MCZ boundary. Whilst temporary effects on suspended sediments could occur due to seabed disturbance during construction and decommissioning, these would be localised to the works and temporary and unlikely to extend into the MCZ boundary. Operation – the marine operational effects associated with OPTION A.1 relate to the discharge of reject water and the intake of water to supply the plant. However, this MZC does not include features related to fish species and therefore the intake of water does not present a pathway for effect on the MCZ. The only potential effect is therefore the dispersion of the reject water discharge. This MCZ is therefore screened in for a Stage 1 assessment for A.1 and A.2 for operational discharge of reject water only. **Therefore, this MCZ is screened into the Stage 1 assessment for A.1 and A.2 for operational discharges only.**

2.5.3.15 Stage 1 Assessment for Bembridge MCZ

This stage of the MCZA considers the potential impacts of A.1 and A.2 on Bembridge MCZ, which was screened in for operational discharges only. Table 28 details the features of interest, their current conservation objectives and any potential impacts that may arise due to A.1 and A.2.

Table 28 - Stage 1 assessment of Options A.1 and A.2 on Bembridge MCZ

Feature	Conservation objective	Description of the impact of OPTION A.1 on the conservation objectives	Adverse impact as a result of the proposed project
Moderate energy infralittoral rock High energy infralittoral rock Moderate energy circalittoral rock	Maintain in favourable condition	A modelling exercise was carried out which modelled the dispersion of the plume from the preferred outfall location for two different flows (75 Ml/d representing the 1-in-200-year drought scenario and 15 Ml/d for the BAU flow).. Consequently, the scale of impact has been demonstrated through modelling to be low, whereby significant changes to water quality resulting from the discharge are not expected. As such, no adverse impact on the conservation objectives is predicted. .	No adverse impact on conservation objective predicted
Native oyster (*Ostrea edulis*) Sea-pens and burrowing megafauna Seagrass beds Subtidal mixed sediments Subtidal mud	Recover to favourable condition		No adverse impact on conservation objective predicted

2.5.3.16 MCZ Assessment Conclusions

Yarmouth to Cowes MCZ, The Needles MCZ and Bembridge MCZ were included in the Gate 2 MCZA 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 MCZA which also incorporated the modelling results, no adverse impact on the conservation objectives for any of the MCZs is predicted.

Habitats Regulations Assessment (HRA)

Introduction

The principles of HRA have been applied to inform the environmental feasibility and deliverability of each SRO for Gate 2. A statutory HRA is not required for Gate 2, however will be required to support the final SRO DCO application.

The purpose of this high-level information on HRA is to test if the SRO could significantly harm the designated features of a Habitats site (SAC), SPA and Ramsar sites. Any possible SAC (pSAC) and potential SPA (pSPA) are also considered in the HRA. These sites are collectively referred to as ‘Habitats sites’. In addition, effects on compensatory measures that have been proposed for other plans and projects to maintain coherence of the network have also been assessed.

The high-level information on HRA takes a highly precautionary approach in order to provide conservative conclusions to inform a robust Options appraisal for Gate 2.

This section summarises the key findings of the high-level information on HRA for A.1 and A.2, for full details please refer to the HRA document.

Gate 2 Methodology

Stage 1: Screening

Screening is the process which initially identifies the likely effects upon a Habitats site, either alone or in-combination with other projects or plans and considers whether these effects may result in an LSE. In line with feedback received from NE on the Gate 2 HRA method statement (PB9638-RHD-06-XX-RP-Z-0043), and in accordance with the 2018 European Court of Justice ruling in the case of People Over Wind, Peter Sweetman v Coillte Teoranta (C-323 / 17), mitigation has not been taken into account in State 1 Screening.

For the purposes of the Gate 2 HRA screening, a worst-case scenario approach is used which considers the distance and pathway to the closest component of the SRO infrastructure. Recognising the relative similarity of the two pipeline route Options between Fawley and Testwood and the high-level nature of the HRA at this stage, these two routes are assessed together with the worst-case scenario (either in terms of distance or pathway) used where applicable.

The screening stage follows a two-step process, as set out below.

Stage 1a: Pathway for Effect

In line with the Gate 1 HRA Stage 1 Screening Tables, and comments received from NE on the Gate 2 HRA Method Statement, a study area using a 10 km buffer from the SROs, as well as consideration of any wider potential effects (e.g. associated with construction traffic, and mobile species which may move beyond this study area, such as migratory fish), has been used to identify sites for consideration in the HRA Stage 1 screening.

This first stage of screening considers the typical range of the designated features and potential zone of influence from the components of the SRO based on expert judgement to determine any pathway for potential effect. Where there is no potential pathway for effect, the Habitats site or Ramsar site can be screened out from further assessment.

Stage 1b: Likely Significant Effect (LSE)

For Habitats sites and Ramsar sites with a potential pathway for effect, Stage 1b considers the condition and sensitivity of the designated features, conservation objectives and any management measures for each Habitats / Ramsar site to determine the potential for an LSE.

At this stage, consideration is also given to whether in-combination effects could occur and whether they contribute to or result in any additional LSE on any Habitats sites or Ramsar sites. Where there is no pathway for effect for the SROs there will be no in-combination effects with other plans and projects. Appendix 1 of the HRA Report provides screening of plans and projects with potential to interact with A.1 AND A.2. The projects identified for consideration in the in-combination assessment for Options A.1 and A.2 are detailed in Table 29 below:

Table 29 - Plans and Projects Screened-in to in-combination assessment

Project Name	Status	Description
AQUIND Interconnector	Awaiting decision	Development of AQUIND Interconnector with a nominal net capacity of 2000 MW between Great Britain and France located off the coast of Portsmouth offshore and between Portsmouth and Lovedean substation onshore.
Portsmouth City Council	Granted	Flood and coastal erosion management scheme comprising a combination of encasing sections of the existing sea wall with enhanced stepped revetment, construction of a new vertical sea wall with stepped revetment, improvements to 2no. existing slipways, removal of 1no. existing slipway, reconstruction and raising of the existing coastal footpath, provision of additional seating and viewing areas, creation of an offshore bird island, and all associated works, compounds, removal of trees and landscaping.

It is important to note that the evidence is to show, on the basis of objective information, that there will be no LSE; if the SRO may cause LSE on any Habitats sites or Ramsar sites, or it is not known whether the SRO may cause such LSE, that would trigger the need for an Appropriate Assessment.

Stage 2: High-level Information to Support Appropriate Assessment

Appropriate Assessment is the consideration of the potential adverse effect on the integrity of the Habitat sites screened in during Stage 1, either alone or in combination with other projects or plans. This section summarises the high-level Information to Support Appropriate Assessment based on available information for each SRO to determine whether there is objective evidence that adverse effects on the integrity (AEoI) of the Habitats site(s) or Ramsar site can be ruled out, with respect to the site’s conservation objectives and its structure and function. This stage also includes the identification of potential mitigation measures, where possible to avoid or reduce any possible effects. As Gate 2 is carried out at strategy level, it is recognised that further impacts may be identified in the full, project level assessment of the selected SRO.

Further information on the conservation objectives and designated features is provided in the HRA report.

The HRA is informed by the following:

- HRA Stage 1 screening undertaken at Gate 1 (Appendix 10.1 Environmental Assessment, Desalination Appendices: Appendix C to the Gate 1 submission)

- Technical Report 3: HRA Consenting Risks – Desalination (Ricardo, 2021a)
- Technical Report 5: Air Quality Assessment to inform Site Selection and Mitigation (Ricardo, 2021b)
- Technical Report 6: HRA Consenting Risks: Ornithology and Noise Disturbance (Ricardo, 2021c)
- WFD Compliance Assessment - Considerations for operational phases of the desalination and water recycling Options (Royal HaskoningDHV, 2021a)
- WFD Compliance Assessment
- Invasive Non-Native Species Risk Assessment

HRA Screening Summary

The following potential effects on Habitats and Ramsar sites as a result of A.1 and A.2 have been identified based on the available information for the required SRO infrastructure and assumptions on the construction methodology, detailed in Table 30.

Table 30 - Potential effects

Effect Category	Construction Effects	Operational 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, vibration and human activity – Changes to water quality – Temporary increases in suspended sediment – Release of pollutants – Introduction of 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, vibration, human activity and light – 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, vibration, human activity and light – Change in supporting habitat quality due to release in sediment during river crossing construction – Barrier to species migration / movement	• Direct habitat loss if located within a habitats site • Indirect effects – Disturbance due to noise, vibration, human activity and light

Effect Category	Construction Effects	Operational Effects
	– Changes to prey resource – Changes to air quality	– Barrier to species migration / movement
Freshwater	• Direct habitat loss if located within a Habitats site • Indirect effects – Temporary disturbance due to noise, vibration and human activity – Hydrological effects – Release of pollutants – Introduction of INNS – Barrier to species migration	• Connectivity with subtidal effects for migratory species

Table 31 details a summary of the HRA Screening conclusions.

Table 31 - Habitat sites screened in / out for A.1 and A.2 due to the potential pathway for effect

Sites	Qualifying Features	Closest distance to SRO	Screening conclusion	Summary
Briddlesford Copse SAC	• Bechstein's bat *Myotis bechsteinii*	9.8 km	No pathway	Briddlesford Copse SAC is located on the Isle of Wight at Wootton Bridge. It is not connected to the Solent and therefore there are no potential pathways for effect from the intake / outfall. There are also no pathways for an impact to occur based on the supporting habitat buffers for the SAC which indicate that the Bechstein's bat feature of the SAC do not forage this far afield (SW, 2020a) and therefore there is no pathway for LSE upon the bat population or any other supporting habitats associated with the SAC.
Emer Bog SAC	• Transition mires and quaking bogs	6.94 km	No pathway	The proposed pipeline will be sufficiently distant and separated by significant areas of urban development, from the designated site and associated groundwater and surface water buffer zones such that there is no potential pathway for effect.
Mottisfont Bats SAC	• Barbastelle *Barbastella barbastellus*	11.82 km	No pathway	The works at Testwood WSW are sufficiently distant from the identified functional habitat buffer around the Mottisford Bats SAC (7.5 km, for foraging bats) (SW, 2020a). Therefore, there is no pathway for effect.
New Forest SAC	• Alkaline fens (Calcium-rich spring water-fed fens) • Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*). (Alder woodland on floodplains)* • *Asperulo-Fagetum* beech forests. (Beech forests on neutral to rich soils) • Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrub layer (*Quercion robori-petraeae* or *Ilici-Fagenion*). (Beech forests on acid soils) • Bog woodland* • Depressions on peat substrates of the *Rhynchosporion* • European dry heaths • *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion*	0 km	Screened in	The pipeline will be installed adjacent to the SAC, with some potential overlap (to be minimised / avoided where possible). The following effects as a result of pipeline installation have been screened in: • Habitat loss • Temporary disturbance due to noise, vibration, human activity and light • Temporary changes to air quality • Changes to ground / surface water • Introduction of INNS All other components of the SRO are at sufficient distance to the New Forest SAC that there will be no LSE.

Sites	Qualifying Features	Closest distance to SRO	Screening conclusion	Summary
	caeruleae). (Purple moor-grass meadows) • Northern Atlantic wet heaths with *Erica tetralix*. (Wet heathland with cross-leaved heath) • Old acidophilous oak woods with *Quercus robur* on sandy plains. (Dry oak-dominated woodland) • Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and / or of the *Isoeto-Nanojuncetea*. (Clear-water lakes or lochs with aquatic vegetation and poor to moderate nutrient levels) • Oligotrophic waters containing very few minerals of sandy plains: *Littorelletalia uniflorae*. (Nutrient-poor shallow waters with aquatic vegetation on sandy plains) • Transition mires and quaking bogs. (Very wet mires often identified by an unstable 'quaking' surface): • Great crested newt *Triturus cristatus* • Southern damselfly *Coenagrion mercuriale* • Stag beetle *Lucanus cervus*			
New Forest SPA and Ramsar	• European nightjar *Caprimulgus europaeus* • Hen harrier *Circus cyaneus* • Eurasian hobby *Falco subbuteo* • Woodlark *Lullula arborea* • European honey buzzard *Pernis apivorus* • Wood warbler *Phylloscopus sibilatrix* • Dartford warbler *Sylvia undata* The site also qualifies as a Ramsar site under: Criterion 1 – valley mires and heaths	0 km	Screened in	Both Options for the pipeline (Route 1 or 2) will be installed adjacent to the SPA and Ramsar, with some potential for overlap (to be minimised / avoided where possible). The following effects as a result of pipeline installation have been screened in: • Habitat loss • Temporary disturbance due to noise, vibration, human activity and light • Barrier effects • Temporary changes to air quality • Temporary changes to ground and surface water • Introduction of INNS • In-combination effects

Sites	Qualifying Features	Closest distance to SRO	Screening conclusion	Summary
	Criterion 2 – diverse assemblage of wetland plants and animals Criterion 3 – mire habitats of high ecological quality and diversity and have undisturbed transition zones which supports important invertebrate fauna			All other components of the SRO are at sufficient distance to the New Forest SAC that there will be no LSE.
River Avon SAC	• Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation. (Rivers with floating vegetation often dominated by water-crowfoot) • Bullhead *Cottus gobio* • Brook lamprey *Lampetra planeri* • Sea lamprey *Petromyzon marinus* • Atlantic salmon *Salmo salar* • Desmoulin's whorl snail *Vertigo moulinsiana*	10 km	Screened in	The river is sufficiently remote from the desalination onshore components to have no direct or indirect effects on the river itself, however recognising that the intake and outfall pipes are within the potential migratory route for Atlantic salmon using the river, the following effects are screened in: • Temporary disturbance • Changes to water quality • Fish entrapment • Barrier effect • In-combination
River Itchen SAC	• Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation. (Rivers with floating vegetation often dominated by water-crowfoot) • Atlantic salmon *Salmo salar* • Brook lamprey *Lampetra planeri* • Bullhead *Cottus gobio* • Otter *Lutra lutra* • Southern damselfly *Coenagrion mercurial* • White-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes*	7.54 km	Screened in	The river is sufficiently remote from the desalination onshore components to have no direct or indirect effects on the river itself, however recognising that the intake and outfall pipes are within the potential migratory route for Atlantic salmon using the river, the following effects are screened in: • Temporary disturbance • Changes to water quality • Fish entrapment • Barrier effect • In-combination
River Meon compensatory SAC habitat	• Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation. (Rivers with floating vegetation often dominated by water-crowfoot) • Atlantic salmon *Salmo salar*	7.6 km	Screened in	While the River Meon is not a designated site, it is proposed for the development of compensatory measures for adverse effects on the integrity of Atlantic salmon from other schemes (e.g., the Lower Itchen Sources Drought Order). In order to maintain the effectiveness of the River Meon compensatory measures in maintaining the overall coherence of the habitats site network, it is important to assess the effects on Atlantic salmon using the river.

Sites	Qualifying Features	Closest distance to SRO	Screening conclusion	Summary
				The river is sufficiently remote from the desalination onshore works to have no direct or indirect effects on the river itself, however recognising that the intake and outfall pipes are within the potential migratory route for Atlantic salmon using the river, the following effects are screened in: • Temporary disturbance • Changes to water quality • Fish entrapment • Barrier effect • In-combination
River Test compensatory SAC habitat	• Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation. (Rivers with floating vegetation often dominated by water-crowfoot) • Southern damselfly *Coenargrion mercurial*	11.1 km	No pathway	While the River Test is not a designated site, it is proposed for the development of compensatory measures for adverse effects on the integrity of damselfly and Type III chalk river. Due to the distance between the compensatory habitat and the SRO, no pathway for effect is identified
Solent Maritime SAC	• Annual vegetation of drift lines • Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) • Coastal lagoons* • Spartina swards (*Spartinion maritimae*). (Cord-grass swards) • Estuaries • Mudflats and sandflats not covered by seawater at low tide. (Intertidal mudflats and sandflats) • Perennial vegetation of stony banks. (Coastal shingle vegetation outside the reach of waves) • *Salicornia* and other annuals colonising mud and sand. (Glasswort and other annuals colonising mud and sand) • Sandbanks which are slightly covered by sea water all the time. (Subtidal sandbanks) • Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes). (Shifting dunes with marram)	0.1 km from onshore components 2 km from marine components	Screened in	The Solent Maritime SAC terrestrial / coastal features are c.120 m from the desalination plant location. Indirect effects on the SAC due to changes to water quality as a result of run-off from the onshore works are screened in. The Solent Maritime SAC subtidal features are c.2 km from the outfall and intake locations. Effects on the subtidal features of the SAC from underwater noise during construction are screened in. With regards to the subtidal features, the results of the CORMIX modelling showed that suspended solids concentrations fall to approximately 20 mg/l within 300 m of the discharge for 75 Ml/d and within 50 m for 15 Ml/d. 20 mg/l is considered to be within natural variation experienced within the Solent. For iron, compliance is achieved prior to discharge. For pH, ambient values are reached within 200 m of the discharge location for both flow scenarios. With respect to salinity, modelled output indicates that the plume would be at 5% of ambient salinity within 250 m from the outfall for 75 Mld and within 150 m for 15 Ml/d. Note that the plume would extend with the prevailing currents rather than spread laterally.

Sites	Qualifying Features	Closest distance to SRO	Screening conclusion	Summary
	• *Vertigo moulinsiana*			With the closest subtidal features at c.2 km, there is no pathway for effect due to the operation of the outfall pipe. In-combination effects are also screened in.
Solent and Dorset Coast SPA	• Mediterranean gull *Larus melanocephalus* • Sandwich tern *Sterna sandvicensis* • Common tern *Sterna hirundo* • Little tern *Sternula albifrons* • Roseate tern *Sterna dougalli* • Dark-bellied brent geese *Branta bernicla* • Teal *Anas crecca* • Ringed plover *Charadrius hiaticula* • Black-tailed godwit *Limosa limosa*	0 km (from intake / outfall pipes)	Screened in	The intake and outfall areas are located within the Solent and Dorset Coast SPA and therefore the following potential direct and indirect effects on the seabird / wading bird features of the SPA, as well as subtidal supporting habitat, are screened in: • Disturbance due to noise, vibration, human activity and light • Barrier to species migration/movement • Changes to prey resource • Direct habitat loss from outfall and intake pipelines • Indirect effects on supporting habitat - changes to air quality and water quality • In-combination effects
Solent and Southampton Water SPA and Ramsar	• Black-tailed godwit (*Limosa islandica*) • Common tern (*Sterna hirundo*) • Dark-bellied brent goose (*Branta bernicla bernicla*) • Little tern (*Sternula albifrons*) • Mediterranean gull (*Ichthyaetus melanocephalus*) • Ringed plover (*Charadrius hiaticula*) • Roseate tern (*Sterna dougallii*) • Sandwich tern (*Thalasseus sandvicensis*) • Teal (*Anas crecca*) • Waterbird assemblage The site qualifies as a Ramsar under the following Criteria: • Criterion 1 – wetland habitats: saline lagoons, saltmarshes, estuaries, intertidal flats, shallow coastal waters, grazing marshes, reedbeds, coastal woodland and rocky boulder reefs.	0 km (from intake / outfall pipes)	Screened in	The intake and outfall pipes are located within the Solent and Southampton Water SPA and Ramsar and therefore the following potential direct and indirect effects on the seabird / wading bird features of the SPA, as well as subtidal supporting habitat, are screened in: • Disturbance due to noise, vibration, human activity and light • Barrier to species migration/movement • Changes to prey resource • Direct habitat loss from outfall and intake pipelines • Indirect effects on supporting habitat - changes to air quality and water quality • In-combination effects

Sites	Qualifying Features	Closest distance to SRO	Screening conclusion	Summary
	• Criterion 2 – The site supports an important assemblage of rare plants and invertebrates. • Criterion 5 – Assemblages of international importance: Species with peak counts in winter: 51343 waterfowl (5-year peak mean 1998/99-2002/2003) • Criterion 6 – species/populations occurring at levels of international importance (same species as listed under the SPA).			

High-level Appropriate Assessment

The following sections provide HRA information to inform the Options appraisal for Gate 2 and identify potential mitigation measures.

A full HRA will be undertaken on the selected SRO in order to support the consenting process, with the inclusion of the results of the survey work programmed to commence in 2021 and continue into 2022/3.

The sections below provide a high-level overview of the potential effects on the designated features of the habitat sites screened in. A detailed appropriate assessment will be required once the preferred SRO is selected to determine the potential for adverse effect on the integrity of the habitat sites.

New Forest SAC

Potential for direct and indirect LSE is identified as a result of pipeline construction for the two route Options. The following effects are of relevance to the features of the SAC.

Habitat Loss

It is not considered feasible to lay the pipeline within the existing wayleave which extends adjacent to the [redacted] through the New Forest SAC, SPA and Ramsar. Therefore, the pipeline will be routed within the highway itself, or the verge, for this section. The feasibility of laying the pipeline within the highway is uncertain, as the relevant Authority may not permit this.

The worst-case scenario is therefore installation within the verges which are part of the designation.

Further survey is required to understand the presence and condition of any designated features within these verges and therefore an AEoI cannot be ruled out at this stage. If the pipeline is installed within the verge, temporary habitat loss will occur during construction. The project level HRA will also consider the potential for long term / permanent effects depending on the features present.

Temporary Disturbance Due to Noise, Vibration, Human Activity and Light

The following designated features of the New Forest SAC have potential to be disturbed by pipeline construction works:

- Great crested newt
- Southern damselfly
- Stag beetle

The pipelines run adjacent to the New Forest SAC. The potential for adverse effects on the integrity of these features would be subject to the presence of these species and supporting habitat within the potential zone of effect of the construction works and therefore cannot be ruled out at this stage. The project level HRA will be informed by an Extended Phase 1 Habitat survey / high resolution aerial photography, followed by species-specific Phase 2 surveys as required. The Phase 2 species-specific surveys could include, but not be limited to, an invertebrate presence / absence survey alongside a Great crested newt population estimate survey, as being assessed in the survey protocols. The Great crested newt population estimate survey would also inform any mitigation licence applications to NE, if required, to ensure no harm to Great crested newts as a result of the construction works.

Barrier Effects

The potential for barrier effects on great crested newt would be subject to the findings of the potential disturbance effects outlined above and therefore cannot be ruled out at this stage.

Temporary Changes to Air Quality

Dust and air quality impacts from construction works (including nitrogen emissions from traffic queuing if lane closures are required) in such close proximity to the SAC have potential to affect the integrity of the designated features of the SAC.

Air quality modelling based on highly conservative assumptions (provided in Technical Report 5) shows there is potential for significant air quality impacts upon ecological receptors at the New Forest. As a result, it is not possible to rule out an AEoI at this stage. The project level HRA will be informed by traffic modelling, as recommended in Technical Report 5, and further air quality assessment / modelling.

Changes to Ground / Surface Water

The WFD compliance assessment considers effects to the groundwater in the area of the New Forest SAC (SW Hants Barton Group Groundwater). This concludes that there may be some localised minor effects to dependant surface water flow and Groundwater-Dependent Terrestrial Ecosystems (GWDTEs) where groundwater flow is perpendicular from the pipeline toward a surface water body.

In addition, crossings of small watercourses that flow into the SAC may be required. The WFD compliance assessment shows this could cause indirect impacts on river water bodies due to mobilisation of sediments from haul roads, open-cut excavations, pumping operations and potential washout events. Greater impermeable surfaces and disturbed ground could alter surface water drainage pathways throughout each catchment, resulting in changes to volume, energy or distribution of flows. Changes to physico-chemistry could also lead to loss or modification of riparian habitats.

NE (2014) New Forest SSSI Ecohydrological Survey Overview shows the presence of Valley Mire systems to the West of the Hythe Bypass, near Dibden Purlieu. These systems are in close proximity to the pipeline route and an AEoI cannot be ruled out at this stage.

Introduction of INS

The movement of personnel and plant has the potential to spread INNS, including but not limited to:

- Japanese knotweed *Reynoutria japonica*
- Himalayan balsam *Impatiens glandulifera*
- Giant hogweed *Heracleum mantegazzianum*
- *Gunnera* spp. (*G. manicata and G.tinctoria*); and
- Rhododendron *ponticum*.

This could include the transfer of new INNS into the SAC or increasing the spread of existing INNS within the New Forest. For example, the NE (2019) Supplementary Advice on Conservation Objectives (SACO) shows New Zealand pygmyweed *Crassula helmsii* is present in many permanent and temporary ponds throughout the New Forest and poses a threat to the native flora due to a shared ecological niche with many New Forest rarities such as *Pilularia globulifera*. The potential for adverse effects on the integrity as a result of INNS cannot be ruled out at this stage.

Potential Mitigation

Potential mitigations are detailed in Table 32.

Table 32 - Potential mitigation in the New Forest SAC

Effect	Potential mitigation requirements
Habitat loss	• Micrositing of pipeline route and construction compounds to avoid sensitive features, informed by Extended Phase 1 Habitat surveys and Phase 2 surveys where applicable
Temporary disturbance due to noise, vibration, human activity and light	• Application of appropriate buffer zones around protected habitats • Use of noise dampening features such as mufflers and acoustic barriers • Construction lighting will only be operational when required and will be positioned and directed to avoid sensitive ecological receptors
Changes to air quality	• Mitigation measures may be required to avoid significant dust dispersion and nitrogen deposition (from construction traffic and lane closures holding traffic in queues). Mitigation measures could include the following: – Dust mitigation measures as detailed within Institute of Air Quality Management (IAQM) guidance (IAQM 2014) – Construction Traffic Management Plan (CTMP) drafted with measures to limit HGV movements and therefore potential emissions – Enforcing of a ‘no idling’ rule for construction traffic, ensuring all vehicles turn off engines when stationary – Avoidance of the use of petrol- or diesel-powered generators where practicable
Changes to ground / surface water	• Best practice construction methods may comprise of: – Bunding and appropriate storage of sediment; – Onsite treatment / polishing of silted water; – Use of sediment traps; – Regular cleaning of haul roads prevent runoff of construction waste dirt; – Appropriate storage and application of both hazardous and non-hazardous waste and chemicals (i.e., diesel); and, – Application of onsite mitigation measures such as spill kits and barrier booms
Introduction of INNS	• Best practice biosecurity measures to ensure clothing, boots and machinery are free from propagules to avoid the spread of INNS

New Forest SPA and Ramsar

LSE is identified for indirect effects as a result of pipeline construction for any of the route Options. The following effects are of relevance to the features of the SPA and Ramsar:

Habitat Loss

As discussed above, the worst-case scenario is pipeline installation within the verges of the Hythe bypass, along the edge of the New Forest SPA and Ramsar. Habitat loss could affect the availability of prey species, particularly for the raptor features of the SPA. While effects are likely to be localised in the context of the wider prey resource, an AEoI cannot be ruled out at this stage. The project HRA will be informed by further field survey.

Temporary Disturbance due to Noise, Vibration, Human Activity and Light

Technical Report 6 considers the effects on the SPA, in particular the raptor and passerines species which are qualifying species of the New Forest SPA.

The technical report concludes that construction traffic is unlikely to cause a significant shift away from the baseline noise conditions in this area and thus a persistent increase in ambient noise is unlikely to be generated. Significant temporary and sporadic increases in noise associated with specific construction activities such as piling may cause temporary disturbance however, the literature indicates that impacts from such noise may only cause temporary disturbance, and in some cases no disturbance.

During raptor breeding season, studies and guidance suggest that construction disturbance may occur up to around 500 m from source. It should be noted this does not relate to noise in isolation. With pipeline installation immediately adjacent to and potentially overlapping the SPA, an AEoI cannot be ruled out at this stage. The project HRA will be informed by Extended Phase 1 Habitat and Phase 2 Surveys.

Barrier to Species Movement

Given the localised effects described above, it is unlikely that the construction of A.1 AND A.2 would result in barrier effects and therefore it is anticipated that an adverse effect on site integrity can be ruled out.

Temporary Changes to Air Quality

Construction of the pipeline along the Hythe bypass (A326) as well as transport to Ashlett Creek along the A326 has potential to reduce air quality in the SPA and Ramsar, which is adjacent to the A326.

Air quality modelling based on highly conservative assumptions (provided in Technical Report 5) shows there is potential for significant air quality impacts upon ecological receptors at the New Forest. As a result, it is not possible to rule out an AEoI at this stage. The project level HRA will be informed by traffic modelling, as recommended in Technical Report 5, and further air quality assessment.

Changes to Water Quality

The WFD compliance assessment considers effects to the groundwater in the area of the New Forest SPA (SW Hants Barton Group Groundwater). This concludes that there may be some localised minor effects to dependant surface water flow and GWDTEs where groundwater flow is perpendicular from the pipeline toward a surface water body.

In addition, crossings of small watercourses that flow into the SPA may be required. The WFD compliance assessment shows this could cause indirect impacts on river water bodies due to mobilisation of sediments from haul roads, open-cut excavations, pumping operations and potential washout events. Greater impermeable surfaces and disturbed ground could alter surface water drainage pathways throughout each catchment, resulting in changes to volume, energy or distribution of flows. Changes to physico-chemistry could also lead to loss or modification of riparian habitats. Therefore, an AEoI cannot be ruled out at this stage.

Introduction of INNS

The movement of personnel and plant has the potential to spread INNS within the valley mires, heaths and wetlands habitats of the New Forest Ramsar. The potential for adverse effects on the integrity as a result of INNS cannot be ruled out at this stage.

Potential Mitigation

Potential mitigations are detailed in Table 33.

Table 33 - Potential mitigation in the New Forest SPA and Ramsar

Effect	Potential mitigation requirements
Habitat loss	• Micrositing of pipeline route and construction compounds to avoid sensitive features, informed by Extended Phase 1 Habitat surveys and Phase 2 surveys where applicable
Temporary disturbance	• Should breeding birds be identified during breeding season, appropriate exclusion zones should be established immediately to prevent disturbance to breeding attempts
Barrier to movement	• N/A
Changes to air quality	• Mitigation measures may be required to avoid significant dust dispersion and nitrogen deposition (from construction traffic and lane closures holding traffic in queues). Mitigation measures could include the following: – Dust mitigation measures as detailed within IAQM guidance (IAQM 2014) – CTMP drafted with measures to limit HGV movements and therefore potential emissions – Enforcing of a 'no idling' rule for construction traffic, ensuring all vehicles turn off engines when stationary – Avoidance of the use of petrol- or diesel-powered generators where practicable

River Avon SAC, River Itchen SAC, River Meon (Compensatory Habitat)

The River Avon, River Itchen, River Meon are sufficiently remote from the desalination onshore works to have no direct or indirect effects on the rivers themselves, however recognising that the intake and outfall pipes are within the potential migratory route for Atlantic salmon using these rivers, entrainment and impingement effects have been screened in.

Atlantic salmon is a qualifying feature of the River Avon SAC and River Itchen SAC. While the River Meon is not a designated site, it is proposed for the development of compensatory measures for adverse effects on integrity from the Lower Itchen Sources Drought Order and therefore, in order to maintain the effectiveness of the River Meon compensatory measures in maintaining the overall coherence of the network, it is important to assess the effects on Atlantic salmon using these rivers, as well as the relevant SACs.

Ikediashi *et al.,* 2018[4] identified a high level of connectivity between the Atlantic salmon populations across chalk streams in the South / Southwest England. The work concludes that there is limited genetic differentiation between the individual river populations, suggesting no apparent fine-scale between-river population differences and as such potential effects on Atlantic salmon could relate to any of these rivers and so the assessment has been combined.

Fish Entrainment and Impingement

Technical Report 3: HRA Desalination Consenting Risks considers the effects of water abstraction on Atlantic salmon. The report concludes that, while mitigation is proposed with regards to the type of intake screen and mesh size to be used, further evidence is required to determine whether impingement and entrainment issues will result in an adverse effect to the population at the Calshot intake Option. The intake Option using the redundant Fawley power station infrastructure could possibly reduce the likelihood of intake issues for Atlantic salmon, however an AEoI cannot be ruled out at this stage. The project HRA will be informed by a desk-based review on migratory fish and survey information if required.

[4] C. Ikediashi J. R. Paris, R. A. King, W. R. C. Beaumont, A. Ibbotson† and J. R. Stevens (2018) Atlantic salmon Salmo salar in the chalk streams of England are genetically unique. Available at: http://www.hwa.uk.com/site/wp-content/uploads/2017/12/AF-DL-Ikediashi_et_al-2018.pdf

Changes to Water Quality

As discussed in Technical Report 3, there is limited evidence of migratory patterns in the marine environment. Similarly, there is a lack of information on sensitivity in the marine environment and parameters that risk interrupting migratory cues. The results of the CORMIX modelling showed that suspended solids concentrations fall to approximately 20 mg/l within 300 m of the discharge for 75 Ml/d and within 50 m for 15 Ml/d. 20 mg/l is considered to be within natural variation experienced within the Solent. For iron, compliance is achieved prior to discharge. For pH, ambient values are reached within 200 m of the discharge location for both flow scenarios. With respect to salinity, modelled output indicates that the plume would be at 5% of ambient salinity within 250 m from the outfall for 75 Mld and within 150 m for 15 Ml/d. Note that the plume would extend with the prevailing currents rather than spread laterally.

Underwater Noise

Atlantic salmon fall into the category defined by Popper et al 2014 'Fish species with swim bladder in which hearing does not involve the swim bladder or other gas volume'. These species are susceptible to barotrauma although hearing only involves particle motion, not sound pressure.

The required hammer energy for any piling associated with the installation of the intake and outfall pipes is not yet known and therefore it is not possible to rule out an AEoI of the Atlantic salmon features of these rivers. The project HRA will be informed by underwater noise modelling to understand potential levels of mortality as a result of underwater as well as behavioural effects which could lead to a barrier to migration subject to the potential range of effect.

Barrier Effects

Underwater noise and changes to water quality have the potential to deter upstream migration of Atlantic salmon. This has potential to affect spawning. The salmon in the River Itchen SAC are currently in unfavourable condition and therefore an adverse effect on the integrity of this feature cannot be ruled out at this stage.

In-combination Effects

The AQUIND interconnector HRA identifies LSE for changes in water quality due to suspended sediments and potential pollution, concluding no adverse effect on the integrity of the SPA. As the intake and outfall pipelines have potential to cause indirect effects on Atlantic salmon, an in-combination adverse effect with the AQUIND interconnector and Options A.1 and A.2 cannot be ruled out at this stage. The project level HRA for the preferred SRO will assess in-combination effects in full once the project details are understood.

Potential Mitigation

Potential mitigations are detailed in Table 34.

Table 34 - Potential mitigation in the River Avon SAC, River Itchen SAC and River Meon Compensatory Habitat

Effect	Potential mitigation requirements
Fish entrainment / impingement	• Screening
Changes to water quality	• N/A
Underwater noise	• Mitigation requirements would be subject to the noise levels. Could include seasonal restrictions if required
Barrier effects	• As per mitigation shown above

Solent Maritime SAC

The HRA screening identifies the following potential effects:

- Indirect effects on the features of the Solent Maritime SAC as a result of run-off from the onshore works; and
- Underwater noise on the subtidal Sandbank feature

Indirect Effects from Run-off

The desalination plant at Ashlett Creek is within c.120 m of the SAC at its closet point. A small watercourse runs to the East of the desalination plant location, between the plant location and the SAC, which is presumed to discharge into the estuary. In addition, the pipeline between the desalination plant and the PS is c.500 m from the SAC. Potential run-off from the construction of the desalination plant, PS and pipelines requires further assessment to determine the potential for an AEoI.

The Estuaries, Mudflats and Sandflats features of the SAC are currently deemed to be in unfavourable condition, while the coastal lagoons are in favourable condition. MESL (2016) Solent Maritime European Marine Site Sandbank Habitat Mapping Project does not cover the area of the SAC in proximity to the Ashlett Creek site and therefore a site characterisation survey would be required to understand the habitat at this location.

As discussed in Technical Report 3, the Solent Maritime SAC is the only site where smooth cordgrass *Spartina alterniflora* is found in the UK. It is also one of only two sites where small cordgrass *Spartina maritima* and Townsend's cordgrass *Spartina townsendii* are present. If these features are present in proximity to the construction works for the SRO, there is potential for an adverse effect on the integrity of these species. Technical Report 3, HRA desalination consenting risks shows that *Spartina* swards is sensitive to changes in suspended solids and smothering. An AEoI therefore cannot be ruled out at this stage. The project HRA will be informed by site specific survey to understand the presence of the designated features of the SAC in this location.

Introduction of INNS

The movement of personnel and plant has the potential to spread INNS. This could include the transfer of new INNS into the Solent SAC or increasing the spread of existing INNS within the Solent SAC. The spread of INNS would have potential to undermine the objectives of the compensatory habitat and therefore an AEoI cannot be ruled out at this stage. The project HRA would be informed by an Extended Phase 1 Habitat Survey which would include the identification of INNS.

Underwater Noise

Annex I Sandbank is the only subtidal designated feature of the Solent Maritime SAC, with the closest Sandbank c.2 km to the East of the intake and outfall area.

The citation for the Solent Maritime SAC states that the shallow sediment communities are typically colonised by a burrowing fauna of worms, crustaceans, bivalve molluscs and echinoderms. Where coarse stable material is present, species attached to the surface may include foliose algae, hydroids, bryozoans and ascidians. Mobile fauna at the surface of the sandbanks may include shrimps, prosobranch molluscs, crabs and fish. These mobile faunae have the potential to be affected by underwater noise. Underwater noise is unlikely to represent an AEoI of the Annex I Sandbank, however the project HRA will be informed by underwater noise modelling to understand the extent of potential noise impacts.

In-combination

The AQUIND interconnector HRA identifies LSE for increased suspended sediment and deposition (smothering), concluding no adverse effect on the integrity of the SAC. As the SRO has potential to cause run-off into the SAC from the onshore works, the construction of pipelines and operational reject water, an in-combination adverse effect cannot be ruled out at this stage.

The Portsmouth coastal management scheme HRA screened out this SAC due to no pathway for effect, therefore there will be no in-combination effect with this project.

Farlington WTW HRA does not consider this SAC and therefore it is expected there will be no in-combination effect.

Potential mitigation

Potential mitigations are detailed in Table 35.

Table 35 - Potential mitigation in the River Avon SAC, River Itchen SAC and River Meon Compensatory Habitat

Effect	Potential mitigation requirements
Indirect effects from run-off	• Best practice construction methods may comprise of: – Bunding and appropriate storage of sediment; – Onsite treatment / polishing of silted water; – Use of sediment traps; – Regular cleaning of haul roads prevents runoff of construction waste dirt; – Appropriate storage and application of both hazardous and non-hazardous waste and chemicals (i.e. diesel); and – Application of onsite mitigation measures such as spill kits and barrier booms
Introduction of INNS	• Best practice biosecurity measures to ensure clothing, boots and machinery are free from propagules to avoid the spread of INNS
Underwater noise	• N/A

Solent and Dorset Coast SPA and Ramsar

The HRA screening screens in the following potential direct and indirect effects on the seabird / wading bird features of the SPA as well as subtidal supporting habitat:

Disturbance due to Noise, Vibration, Human Activity and Light

The pipeline routes require a connection at Ashlett Creek and Testwood WTW and therefore depending on the final configuration could come within c.1.1 km and 2 km of the SPA at respective locations. A receiving tank is required to be constructed at Testwood which is c.1.8 km from the SPA. To enter the Testwood site, a [redacted] needs to be crossed (within the road but in close proximity). Use of offsite functional habitat around Testwood Lakes will need to be considered, although not identified as a supporting area by the Solent Waders and Brent Goose Strategy.

In the Ashlett Creek area a number of waterfowl species have been recorded including dark-bellied brent goose, ringed plover, sandwich tern and teal (shown in the National Biodiversity Network Atlas) which are features of the SPA. Within the wider area, common tern and little tern have also been recorded.

The construction process has the potential to disturb the designated features of the SPA, in particular nesting tern if using adjacent habitat. NE has advised (July 2020) that the tern species nest on habitat at the edge of the designated site and are extremely vulnerable to disturbance. The use of the SRO site as supporting or functional habitat will need to be determined through survey and therefore an AEoI cannot be ruled out at this stage.

Barrier to Species Migration / Movement

Given the relatively localised effects described above, it is unlikely that the construction of A.1 AND A.2 would result in barrier effects and therefore it is anticipated that an adverse effect on site integrity can be ruled out.

Changes to Prey Resource

The abstraction of water for desalination has the potential to impinge, entrain and entrap fish and invertebrates, resulting in a reduction in prey for tern and gull species. Small fish, consisting an important part of piscivorous birds' diet, would include eggs, larvae, post-larvae and very young fish.

In addition, construction of the outfall will be within the Solent and Dorset Coast SPA, and the hypersaline plume will potentially alter prey availability and foraging areas for the qualifying tern species.

Technical Report 3 provides a review of information on the Fawley power station intake included in the EA Review of Consent process. The Review of Consents considered whether the Fawley power station abstraction was having adverse effects on the Solent and Southampton Water SPA and Ramsar through the removal of fish (prey) with the abstracted water. The ability to quantify an impact to the qualifying bird species, if predictions can be made for the impingement and entrainment of small fish (prey), is noted to be difficult. The EA Review of Consents used the 7.4 tonnes / year as the threshold when determining adverse effects. This is less than proposed for A.1 AND A.2 and therefore an AEoI cannot be ruled out.

Changes to Air Quality

Construction plant and traffic at Fawley and Calshot has potential to increase emissions in proximity to the SPA and Ramsar. The desalination plant location at Ashlett Creek is c.1.1 km from the SPA at its closest point. At this distance it is unlikely that there would be an AEoI on the features of the SPA and Ramsar as a result of changes to air quality.

Direct Habitat Loss from Outfall and Intake Pipelines

The loss of benthic habitat within the Solent and Dorset Coast SPA will need site specific survey work to determine its importance and structural and functional role in supporting the tern populations. It is likely that the loss of habitat will be a small-scale effect in the context of the wider SPA, however the project level HRA will be informed by the survey to understand the importance of the habitats to the designated features of the SPA. Therefore, an AEoI cannot be ruled out at this stage.

Changes to Water Quality / Indirect Effects on Supporting Habitat

The desalination plant location at Ashlett Creek is within c.1.1 km of the SPA at its closest point. A small watercourse runs to the east of the desalination plant location, between the desalination plant and the SPA boundary, which is presumed to discharge into the estuary.

With regards to the subtidal features, the results of the CORMIX modelling showed that suspended solids concentrations fall to approximately 20 mg/l within 300 m of the discharge for 75 Ml/d and within 50 m for 15 Ml/d. 20 mg/l is considered to be within natural variation experienced within the Solent. For iron, compliance is achieved prior to discharge. For pH, ambient values are reached within 200 m of the discharge location for both flow scenarios. With respect to salinity, modelled output indicates that the plume would be at 5% of ambient salinity within 250 m from the outfall for 75 Mld and within 150 m for 15 Ml/d. This highly localised effect is unlikely to result in an AEoI of the SPA.

In-combination

The AQUIND interconnector HRA identifies LSE for disturbance, and changes in water quality and prey resource, concluding no adverse effect on the integrity of the SPA. As the construction and operation of the intake and outfall pipelines have potential to cause water quality and prey resource changes, an in-combination adverse effect cannot be ruled out at this stage. The project level HRA will assess in-combination effects in full once the project detailed are understood.

The Portsmouth coastal management scheme HRA screens out an LSE based on the small scale of potential effects; however, consideration should be given in the project level HRA as to whether these small effects could interact to provide an adverse effect when combined with the SRO.

Potential Mitigation

Potential mitigations are detailed in Table 36.

Table 36 - Potential mitigation in the Solent and Dorset Coast SPA and Ramsar

Effect	Potential mitigation requirements
Disturbance	• Seasonal restrictions on certain construction activities may be required to ensure disturbance effects do not result in an adverse effect on site integrity
Barrier effects	• N/A
Changes to prey resource	• Intake screening
Changes to air quality	• Management of dust and nitrogen loading (e.g., through traffic routing) to avoid adverse effects during onshore construction
Direct habitat loss	• Micrositing to avoid important habitats and minimisation of the seabed footprint
Indirect effects on supporting habitat	• Management of sediment runoff to avoid adverse effects during onshore construction • Careful design of the plant infrastructure and layout will be required to ensure any localised seepages and freshwater flows to the estuary are maintained and not permanently impeded.

2.5.4 Solent and Southampton Water SPA and Ramsar

The HRA screening screens in the following potential direct and indirect effects on the seabird / wading bird features of the SPA as well as subtidal supporting habitat.

2.5.4.1 Disturbance due to Noise, Vibration, Human Activity and Light

The pipeline will be tunnelled under sections of the SPA, which has the potential to disturb species using the habitats either from the tunnelling itself or because of the presence of a launch pit and reception pit, with HGV and barge movements to remove the spoil.

The desalination plant at Ashlett Creek is within 140 m of the SPA at its closest point. The onsite habitat is considered unlikely to provide any functional role to the qualifying features, however, all three species have been recorded (shown in the National Biodiversity Network Atlas) in the Ashlett Creek area [redacted].

The pipeline requires a connection at Ashlett Creek and Testwood WTW and therefore depending on the final configuration could come c.200 m and 400 m of the SPA at respective locations. A receiving tank is required to be constructed at Testwood, which will take approximately 1 year to construct and is c.250 m from the SPA. To enter the Testwood site, [redacted] needs to be crossed (within the road but in the close proximity).

Construction impacts could occur from disturbance issues (noise, visual and lighting) and degradation of habitats through dust dispersion, sediment runoff and localised pollution incidents and therefore an AEoI cannot be ruled out at this stage.

2.5.4.2 Barrier to Species Migration / Movement

Given the relatively localised effects described above, it is unlikely that the construction of A.1 AND A.2 would result in barrier effects and therefore AEoI can be ruled out.

Changes to Prey Resource

The abstraction of water for desalination has the potential to impinge, entrain and entrap fish and invertebrates, resulting in a reduction in prey for tern and gull species. Small fish, consisting of an important part of piscivorous birds' diet, would include eggs, larvae, post-larvae and very young fish.

In addition, construction of the outfall will be located adjacent to the Solent and Southampton Water SPA, and the hypersaline plume will potentially alter prey availability and foraging areas for the qualifying tern species. The implications of this on the tern populations will need to be investigated.

Technical Report 3 provides a review of information on the Fawley power station intake included in the EA review of consent process. The Review of Consents considered whether the Fawley power station abstraction was having adverse effects on the Solent and Southampton Water SPA and Ramsar through the removal of fish (prey) with the abstracted water. The ability to quantify an impact to the qualifying bird species, if predictions can be made for the impingement and entrainment of small fish (prey), is noted to be difficult. The EA Review of Consents used the 7.4 tonnes / year as the threshold when determining adverse effects. This is less than proposed for A.1 AND A.2 and therefore an AEoI cannot be ruled out.

Changes to Air Quality

Construction plant and traffic at Fawley and Calshot has potential to increase emissions in proximity to the SPA and Ramsar. Any changes will be highly localised in the context of the wider SPA and Ramsar, therefore it is highly unlikely there will be an AEoI as a result of changes to air quality.

Direct Habitat Loss from Outfall and Intake Pipelines

The intake and outfall pipeline locations overlap the SPA. It is likely that these will be drilled under the Solent and Southampton Water SPA, however as a worst-case scenario, consideration is given to potential habitat loss.

The loss of benthic habitat within the Solent and Southampton Water SPA will need site specific survey work to determine its importance and structural and functional role in supporting the tern populations. It is likely that the loss of habitat will be a small-scale effect in the context of the wider SPA, however the project level HRA will be informed by the survey to understand the importance of the habitats to the designated features of the SPA. Therefore, an AEoI cannot be ruled out at this stage.

Changes to Water Quality / Indirect Effects on Supporting Habitat

Construction of the intake and outfall pipelines, PS, brine reception tank and pipeline to and from desalination plant will be required in proximity the SPA resulting in potential habitat degradation.

The operation of the upstanding intake and outfall pipelines in this dynamic subtidal environment could result in effects on coastal processes, primarily the potential for interruption of bedload sediment transport. There is likely to be a difference in effect depending on whether the pipe is in the nearshore area or offshore area. Any pipe on the bed in areas closest to the coast would have the potential to affect longshore sediment transport processes driven by waves. However, at Calshot, the pipe will be buried closer to shore and will therefore have no impact on coastal longshore patterns of transport. Hence, the potential effect will be in areas where tidal sediment transport is dominant further offshore. There is unlikely to be any significant effect on suspended sediment processes since the pipe would be relatively low above the seabed (the maximum height is to be defined). The speed of the tidal currents in the offshore and the sandy nature of the seabed indicates that some bedload sediment transport occurs under existing tidal conditions, with a net direction towards the South-West. The potential magnitude of the effect will depend on the local sediment transport rates; a lower rate would reduce the potential effect on sediment supply to wider areas. If the pipe does present an obstruction to this bedload transport the sediment would first accumulate one side (likely to be the North-eastern side given the tidal current residual direction) or both sides of the pipe (depending on the gross and net transport at that location) to the height of the protrusion. With continued build-up, it would then form a 'ramp' over which sediment transport would eventually occur by bedload processes, thereby bypassing the pipe. Once the ramp has been formed and sediment can move from one side to the other, the patterns of bedload transport across the pipe would not be affected significantly. These localised changes are unlikely to affect the form and function of the supporting habitat of the Solent and Southampton Water SPA.

During operation, there is the potential for the reject water to interact with the Saltmarsh and Mudflat habitats at Calshot Marshes and affect offshore feeding areas. With regards to the subtidal features, the results of the CORMIX modelling showed that suspended solids concentrations fall to approximately 20 mg/l within 300 m of the discharge for 75 Ml/d and within 50 m for 15 Ml/d. 20 mg/l is considered to be within natural variation experienced within the Solent. For iron, compliance is achieved prior to discharge. For pH, ambient values are reached within 200 m of the discharge location for both flow scenarios. With respect to salinity, modelled output indicates that the plume would be at 5% of ambient salinity within 250 m from the outfall for 75 Mld and within 150 m for 15 Ml/d.

The pipeline requires a connection at Ashlett Creek and Testwood WTW and therefore depending on the final configuration could come within 450 m and 250 m of the SPA at respective locations. A receiving tank is required to be constructed at Testwood. To enter the Testwood site, a [redacted] needs to be crossed (within the road but in close proximity).

In-combination

The AQUIND interconnector HRA identifies LSE for changes in water quality due to contaminants, concluding no adverse effect on the integrity of the SPA. As the construction of the desalination plant and intake and outfall pipelines has potential to cause indirect effects on the supporting habitat of the SPA, an in-combination adverse effect cannot be ruled out at this stage. The project level HRA for the preferred SRO will assess in-combination effects in full once the project details are understood.

The Portsmouth coastal management scheme does not identify this SAC as being within the study area for the HRA Screening of that project and therefore there will be no in-combination effect between Options A.1 and A.2 and this project.

2.5.4.3 Recommended Mitigation

Recommended mitigations are detailed in Table 37.

Table 37 - Potential mitigation in the Solent and Dorset Coast SPA and Ramsar

Effect	Potential mitigation requirements
Disturbance	• Seasonal restrictions on certain construction activities may be required to ensure disturbance effects do not result in an adverse effect on site integrity
Barrier effects	• N/A
Changes to prey resource	• Intake screening
Changes to air quality	• Management of dust and nitrogen loading (e.g., through traffic routing) to avoid adverse effects during onshore construction
Direct habitat loss	• Micro siting to avoid important habitats and minimisation of the seabed footprint
Indirect effects on supporting habitat	• Management of sediment runoff to avoid adverse effects during onshore construction • Careful design of the plant infrastructure and layout will be required to ensure any localised seepages and freshwater flows to the estuary are maintained and not permanently impeded

2.5.4.4 WFD Compliance Assessment

This assessment aims to determine whether the construction, operation and decommissioning of A.1 AND A.2 are compliant with the requirements of the Water Environment (WFD) (England and Wales) Regulations 2017, which remain in force following the UK's withdrawal from the European Union under the provisions of the Floods and Water (Amendment etc.) (EU Exit) Regulations 2019.

This report draws on the earlier WFD compliance assessment that was undertaken in support of the Gate 1 submission (Gate 1 Submission - Annex 10.1: Appendix F). The findings of the earlier assessment have been updated where appropriate to reflect the latest scheme information, and the updates in the baseline WFD classification data that were published in September 2020.

Approach

The WFD Compliance Assessment undertaken at Gate 1 has been updated and restructured to reflect the stages set out in PINS Advice Note 18 – Water Framework Directive, which provides an outline methodology for considering the WFD as part of the DCO process. This guidance represents the most comprehensive and up to date guidance for WFD compliance assessments and is equally applicable to Nationally Significant Infrastructure Projects (NSIP) and projects being considered under the Town and Country Planning Act 1990 (TCPA). As with the approach taken at Gate 1, the principles of WFD Assessment have been applied to inform the environmental feasibility and deliverability of each SRO for Gate 2. A statutory WFD is not required for Gate 2, however will be required to support the final SRO DCO application.

Further consideration has also been given to the following guidance -

- 'Clearing the waters for all' (EA, 2017) - Outlines a detailed methodology for assessing impacts on transitional and coastal water bodies
- 'WFD risk assessment' (EA, 2016a) - This provides information on how to assess the risk of a proposed activity, as well as guidance for proposed developments planning to undertake activities that would require a flood risk activity permit
- 'Protecting and improving the water environment' (EA, 2016b) - Provides guidance on the WFD compliance of physical works and other activities in river water bodies
- EUECJ C-461-13. Bund für Umwelt und Naturshutz Deutschland eV v Bundesrepublik Deutschland (ECJ, 2015) - This case confirms the detail around determining a deterioration in the status of a water body

The WFD Compliance Assessment comprises three stages:

- **Stage 1 Screening -** This stage consists of an initial screening exercise to divide the SROs into key components and identify relevant water bodies which have the potential to be impacted by the construction, operation and decommissioning of each SRO activity
- **Stage 2 Scoping -** This stage identifies whether there is potential for deterioration in water body status or failure to comply with WFD objectives for any of the water bodies identified in Stage 1
- **Stage 3 Outline WFD Impact Assessment -** This stage determines whether any project activities that have been put forward from stage 2 have the potential to cause deterioration and whether this deterioration will have a significant non-temporary effect on the status of one or more WFD quality elements at water body level

Further information on the methodology used to inform this assessment is provided in the separate Gate 2 WFD Assessment Method Statement (PB9638-RHD-06-XX-RP-Z-0042), and the full results of the assessment are presented in the WFD Report compliance assessment. During consultation on the Method Statement, NE requested that the WFD protected areas assessment for Habitats sites has reference and is compatible with the High Level HRA, which has been included in the assessment.

A summary of each stage of the assessment for A.1 and A.2 is provided in the subsequent sections.

Stage 1: Screening

For the purposes of this assessment, the SRO has been divided into the following key components:

- Sea water intake within Southampton Water [redacted] or sea water intake within the Solent (Calshot)
- Reject water marine infrastructure and discharge
- PS at Fawley
- Desalination plant at Ashlett Creek
- Transfer pipelines (Routes 1 and 2) to Testwood WSW
- Receiving tank at Testwood WSW

Screening and scoping are only undertaken for water bodies in which activities occur. If a risk is identified in this water body, then adjoining water bodies are considered in the Stage 3 assessment.

The surface and groundwater bodies screened in to the WFD compliance assessment are detailed in Table 38 which also highlights the relevant SRO components that could potentially impact upon each water body.

Table 38 - Screened in surface and groundwater bodies for A.1 and A.2

SRO component	Water body name	Justification for screening in
Sea water intake within Southampton Water [redacted]	• Southampton Water [redacted]	Surface water bodies - Screened in because this SRO component would be located within this water body and could therefore affect its biology, hydromorphology and Physico-chemistry during construction, operation and decommissioning. Groundwater bodies: No pathway for effect identified.
Sea water intake within the Solent (Calshot)	• Solent [redacted]	Surface water bodies: Screened in because this SRO component would be located within this water body and could therefore affect its biology, hydromorphology and Physico-chemistry during construction, operation and decommissioning. Groundwater bodies: No pathway for effect identified.

SRO component	Water body name	Justification for screening in
Reject water marine infrastructure and discharge	• Solent [redacted]	Surface water bodies: Screened in as this SRO component would be located within this water body and could therefore affect its biology, hydromorphology and Physico-chemistry during construction, operation and decommissioning. Groundwater bodies: No pathway for effect identified.
PS at Fawley	• Solent [redacted] • SW Hants Barton Group [redacted]	Surface water bodies: Screened in because this SRO component would be located within the onshore catchment of this water body and could therefore affect its biology, hydromorphology and Physico-chemistry during construction, operation and decommissioning. Groundwater bodies: Screened in because this SRO component would be underlain by this water body and could therefore affect the quality and quantity of groundwater.
Desalination plant at Ashlett Creek	• Southampton Water [redacted] • SW Hants Barton Group [redacted]	Surface water bodies: Screened in because this SRO component would be located within the onshore catchment of this water body and could therefore affect its biology, hydromorphology and Physico-chemistry during construction, operation and decommissioning. Groundwater bodies: Screened in because this SRO component would be underlain by this water body and could therefore affect the quality and quantity of groundwater.
Transfer pipeline to Testwood WSW	• Dark Water [redacted] • Langdown Stream [redacted] • Beaulieu [redacted] • Bartley Water [redacted] • Blackwater (Test and Itchen) [redacted] • Central Hants Bracklesham Group [redacted] • SW Hants Solent Group [redacted] • SW Hants Barton Group [redacted]	Surface water bodies: Screened in because this SRO component would be located within the catchment of this water body and could therefore affect its biology, hydromorphology and Physico-chemistry during construction, operation and decommissioning. Groundwater bodies: Screened in because this SRO component would be underlain by this water body and could therefore affect the quality and quantity of groundwater.
Receiving tank at Testwood WSW	• Test (Lower) [redacted] • Central Hants Bracklesham Group [redacted]	Surface water bodies: Screened in because this SRO component would be located within the catchment of this water body and could therefore affect its biology, hydromorphology and Physico-chemistry during construction, operation and decommissioning.

SRO component	Water body name	Justification for screening in
		Groundwater bodies: Screened in because this SRO component would be underlain by this water body and could therefore affect the quality and quantity of groundwater.

Stage 2: Scoping

This section describes whether there is potential for construction, operation and decommissioning impacts from the SRO components associated with A.1 and A.2 on the status of the surface as detailed in Table 39 and groundwater bodies as detailed in Table 40 scoped into the assessment. Note that further details are provided in the WFD Compliance Assessment Report.

Table 39 - Scoping assessment for screened in surface water bodies for A.1 and A.2

SRO component	Water body name	Ecological quality elements	Chemical quality elements	Protected areas	RBMP mitigation measures
Sea water intake within Southampton Water [redacted]	Southampton Water [redacted]	The construction and decommissioning of the intake could potentially affect the Physico-chemistry of the water body. However, any impacts would be temporary, highly localised and reversed once activities cease. The intakes would, however, be located within 500 m of a higher sensitivity habitat (saltmarsh). There is a risk of fish impingement during operation, which could impact on fish movement and life cycle stages within the water body. There is therefore potential for adverse impact on biological quality elements.	The construction and decommissioning of the intake could potentially result in the accidental release of priority substances and priority hazardous substances into the water body if present in the sediments. However, any impacts would be temporary, highly localised and reversed once activities cease.	No mechanism for impacts on Drinking Water Safeguard Zones or areas protected under the Habitats and Species, Conservation of Wild Birds, Bathing Waters, Shellfish Waters and Urban Wastewater Treatment Directives have been identified.	No mechanism for the activity to reduce the effectiveness of mitigation measures already in place to manage the impacts associated with dredging and sediment resuspension have been identified. No mechanism for the activity to prevent the future implementation of measures that are not yet in place to manage the impacts associated with flood defences, barriers to fish passage, hard bank protection or the preservation or enhancement of existing habitats have been identified.
Sea water intake within the Solent (Calshot)	Solent [redacted]	The construction and decommissioning of the intake could potentially affect the Physico-chemistry of the water body. However, any impacts would be temporary, highly localised and reversed once activities cease. The intakes would, however, be located within 500 m of a higher sensitivity habitat (saltmarsh). There is a risk of fish impingement during operation,	The construction and decommissioning of the intake could potentially result in the accidental release of priority substances and priority hazardous substances into the water body if present in the sediments. However, any impacts would be temporary, highly localised and reversed once activities cease.	No mechanism for impacts on Drinking Water Safeguard Zones or areas protected under the Habitats and Species, Conservation of Wild Birds, Bathing Waters, Shellfish Waters and Urban Wastewater Treatment Directives have been identified.	No mechanism for the activity to reduce the effectiveness of mitigation measures already in place to manage the impacts associated with dredging and sediment resuspension have been identified. Whilst sediment might be released as a result of working in the marine environment for intakes and outfall installation for example, this would be short term and localised to the outfall therefore would not impact on these long-term measures being in place.

		which could impact on fish movement and life cycle stages within the water body. There is therefore potential for adverse impact on biological quality elements.			
Reject water marine infrastructure and discharge	Solent [redacted]	The construction and decommissioning of the outfall could potentially result in the accidental release of substances into the water body that could impact on Physico-chemical parameters. However, any impacts would be temporary, highly localised and reversed once activities cease. The outfall would, however, be located within 500 m of a higher sensitivity habitat (saltmarsh). There is potential for operational discharges to impact on biological and Physico-chemical quality elements.	The construction and decommissioning of the outfall could potentially result in the accidental release of priority substances and priority hazardous substances into the water body if present in the sediments. However, any impacts would be temporary, highly localised and reversed once activities cease. Operational discharges may contain substances such as iron which could impact on water quality. As such, there is potential for impacts on chemical quality elements.	There is potential for construction, operation and decommissioning to impact on areas protected under the Habitats and Species, Conservation of Wild Birds, Urban Wastewater Treatment and Shellfish Waters Directives.	No mechanism for the activity to reduce the effectiveness of mitigation measures already in place to manage the impacts associated with dredging and sediment resuspension have been identified.
PS at Fawley	Solent [redacted]	Although onshore construction and decommissioning components could result in the accidental release of fine sediment and contaminants into the surface watercourses that drain directly into the water body, the application of best practice pollution prevention and control measures would minimise impacts and ensure that they are not sufficient to affect	Although onshore construction and decommissioning components could result in the accidental release of fine sediment and contaminants into the surface watercourses that drain directly into the water body, the application of best practice pollution prevention and control	No mechanism for impacts on Drinking Water Safeguard Zones or areas protected under the Habitats and Species, Conservation of Wild Birds, Bathing Waters, Shellfish Waters and Urban Wastewater Treatment Directives have been identified.	No mechanism for the activity to reduce the effectiveness of mitigation measures already in place to manage the impacts associated with sediment resuspension or habitat disturbance have been identified.

		biology, hydromorphology or Physico-chemistry at water body scale.	measures would minimise impacts and ensure that they are not sufficient to affect chemistry at water body scale.		
Desalination plant at Ashlett Creek	Southampton Water [redacted]	Although onshore construction and decommissioning components could result in the accidental release of fine sediment and contaminants into the surface watercourses that drain directly into the water body, the application of best practice pollution prevention and control measures would minimise impacts and ensure that they are not sufficient to affect biology, hydromorphology or Physico-chemistry at water body scale.	Although onshore construction and decommissioning components could result in the accidental release of fine sediment and contaminants into the surface watercourses that drain directly into the water body, the application of best practice pollution prevention and control measures would minimise impacts and ensure that they are not sufficient to affect chemistry at water body scale.	No mechanism for impacts on Drinking Water Safeguard Zones or areas protected under the Habitats and Species, Conservation of Wild Birds, Bathing Waters, Shellfish Waters and Urban Wastewater Treatment Directives have been identified.	No mechanism for the activity to reduce the effectiveness of mitigation measures already in place to manage the impacts associated with dredging and sediment resuspension have been identified. No mechanism for the activity to prevent the future implementation of measures that are not yet in place to manage the impacts associated with flood defences, barriers to fish passage, hard bank protection or the preservation or enhancement of existing habitats have been identified.
Transfer pipeline to Testwood WSW	Dark Water [redacted] Langdown Stream [redacted] Beaulieu River [redacted] Bartley Water [redacted] Blackwater (Test and Itchen) [redacted]	The construction and decommissioning of watercourse crossings and associated temporary works as part of the transfer pipeline to Testwood WSW could result in the direct disturbance of habitats for aquatic flora. Furthermore, the activity could also result in changes to the hydromorphology and Physico-chemistry of the water body that could affect habitat quality for aquatic flora, invertebrates or fish.	The construction and decommissioning of the transfer pipeline to Testwood WSW could potentially result in the accidental release of priority substances into the water body, for example through the accidental spillage of contraction materials or fuel and lubricants from construction equipment. This is therefore scoped into the assessment.	No mechanism for impacts on Drinking Water Safeguard Zones or areas protected under the Habitats and Species, Conservation of Wild Birds, Bathing Waters, Shellfish Waters and Urban Wastewater Treatment Directives have been identified.	The RBMP does not identify mitigation measures for Dark Water, Beaulieu River, Bartley Water or Blackwater (Test and Itchen). No mechanism for the activity to reduce the effectiveness of mitigation measures already in place in Langdown Stream to manage the impacts associated with urbanisation pressures have been identified. Similarly, no mechanism for the activity to prevent the future implementation of measures that are not yet in place to address urbanisation pressures have been identified.

		The operation of the SRO would not affect the quality of in-channel habitats for aquatic flora, invertebrates or fish, and is therefore scoped out of the assessment.	The operation of the SRO would not affect the quality of in-channel habitats for aquatic flora, invertebrates or fish, and is therefore scoped out of the assessment.		
Receiving tank at Testwood WSW	Test (Lower) [redacted]	Although construction and decommissioning components could result in the accidental release of fine sediment and contaminants into the surface watercourses into the water body, the application of best practice pollution prevention and control measures would minimise impacts and ensure that they are not sufficient to affect biology, hydromorphology or Physico-chemistry at water body scale.	The activity will not cause the release of priority substances, priority hazardous substances or other potentially hazardous chemicals into the water body. There is therefore no mechanism for impacts on chemical quality elements.	No mechanism for impacts on Drinking Water Safeguard Zones or areas protected under the Habitats and Species, Conservation of Wild Birds, Bathing Waters, Shellfish Waters and Urban Wastewater Treatment Directives have been identified.	The RBMP does not identify mitigation measures for the Test (Lower) water body.

Table 40 - Scoping assessment for screened in groundwater bodies for A.1 and A.2

Sub-component	Water body name	Quantitative quality elements	Chemical quality elements	Protected Areas
Sea water intake within Southampton Water [redacted] or the Solent (Calshot)	SW Hants Barton Group [redacted]	No mechanisms for this offshore activity to impact upon groundwater quantity were identified.	No mechanisms for this offshore activity to impact upon groundwater quantity were identified.	No mechanisms for this offshore activity to impact upon Drinking Water Protected Areas were identified.
Reject water marine infrastructure and discharge	SW Hants Barton Group [redacted]	No mechanisms for this offshore activity to impact upon groundwater quantity were identified.	No mechanisms for this offshore activity to impact upon groundwater quantity were identified.	No mechanisms for this offshore activity to impact upon Drinking Water Protected Areas were identified.
PS at Fawley	SW Hants Barton Group [redacted]	Construction and decommissioning components could potentially affect groundwater levels through dewatering and changes to the rate of groundwater recharge. Any changes in groundwater levels could potentially impact upon the surface drainage	Construction and decommissioning components could potentially introduce new sources of contamination and remobilise existing sources of contamination. This could introduce a new pathway for the contamination of GWDTEs and	No mechanisms for this activity to impact upon Drinking Water Protected Areas were identified.

Sub-component	Water body name	Quantitative quality elements	Chemical quality elements	Protected Areas
		network and associated GWDTEs. However, and changes are likely to be highly localised and not sufficient to result in deterioration in water body status. Any minor changes to groundwater flows or recharge during the operational phase of the activity would be highly localised and insufficient to affect groundwater quantity.	other dependent surface water features. However, the application of best practice pollution prevention and control measures would minimise impacts and ensure that they are not sufficient to affect groundwater quality at water body scale. Similarly, although there is potential for the accidental release of saline water and pollutants into the groundwater body during operation, the scheme will be designed to minimise impacts and ensure that they are not sufficient to affect groundwater quality at water body scale.	
Desalination plant at Ashlett Creek	SW Hants Barton Group [redacted]	Construction and decommissioning components could potentially affect groundwater levels through dewatering and changes to the rate of groundwater recharge. Any changes in groundwater levels could potentially impact upon the surface drainage network and associated GWDTEs. However, and changes are likely to be highly localised and not sufficient to result in deterioration in water body status. Any minor changes to groundwater flows or recharge during the operational phase of the activity would be highly localised and insufficient to affect groundwater quantity.	Construction and decommissioning components could potentially introduce new sources of contamination and remobilise existing sources of contamination. This could introduce a new pathway for the contamination of GWDTEs and other dependent surface water features. However, the application of best practice pollution prevention and control measures would minimise impacts and ensure that they are not sufficient to affect groundwater quality at water body scale. Similarly, although there is potential for the accidental release of saline water and pollutants into the groundwater body during operation, the scheme will be designed to minimise impacts and ensure that they are not sufficient to affect groundwater quality at water body scale.	No mechanisms for this activity to impact upon Drinking Water Protected Areas were identified.
Transfer pipeline to Testwood WSW	SW Hants Barton Group [redacted] SW Hants Solent Group [redacted] Central Hants Bracklesham Group [redacted]	Construction and decommissioning components could potentially affect groundwater levels through dewatering and changes to the rate of groundwater recharge. Any changes in groundwater levels could potentially impact upon the surface drainage network and associated GWDTEs. However, and changes are likely to be highly localised and not sufficient to result in deterioration in water body status.	Construction and decommissioning components could potentially introduce new sources of contamination and remobilise existing sources of contamination. This could introduce a new pathway for the contamination of GWDTEs and other dependent surface water features. However, the application of best practice pollution prevention and control measures would minimise impacts and ensure that they are not	No mechanisms for this activity to impact upon Drinking Water Protected Areas were identified.

Sub-component	Water body name	Quantitative quality elements	Chemical quality elements	Protected Areas
		Any minor changes to groundwater flows or recharge during the operational phase of the activity would be highly localised and insufficient to affect groundwater quantity.	sufficient to affect groundwater quality at water body scale. Similarly, although there is potential for the accidental release of saline water and pollutants into the groundwater body during operation, the scheme will be designed to minimise impacts and ensure that they are not sufficient to affect groundwater quality at water body scale.	
Receiving Tank at Testwood WSW	Central Hants Bracklesham Group [redacted]	Construction and decommissioning components could potentially affect groundwater levels through dewatering and changes to the rate of groundwater recharge. Any changes in groundwater levels could potentially impact upon the surface drainage network and associated GWDTEs. However, and changes are likely to be highly localised and not sufficient to result in deterioration in water body status. Any minor changes to groundwater flows or recharge during the operational phase of the activity would be highly localised and insufficient to affect groundwater quantity.	Construction and decommissioning components could potentially introduce new sources of contamination and remobilise existing sources of contamination. This could introduce a new pathway for the contamination of GWDTEs and other dependent surface water features. However, the application of best practice pollution prevention and control measures would minimise impacts and ensure that they are not sufficient to affect groundwater quality at water body scale. Similarly, although there is potential for the accidental release of saline water and pollutants into the groundwater body during operation, the scheme will be designed to minimise impacts and ensure that they are not sufficient to affect groundwater quality at water body scale.	No mechanisms for this activity to impact upon Drinking Water Protected Areas were identified.

A summary of the components carried through to Stage 3 is detailed in Table 41.

Table 41 - Summary of scoping output for A.1 and A.2

SRO component	Surface waters				Groundwater bodies		
	Ecological Quality elements	Chemical Quality elements	Protected Areas	RBMP mitigation measures	Quantitative	Quality	Protected Areas
Sea water intake within Southampton Water [redacted]	✓	×	×	×	×	×	×
Sea water intake within the Solent (Calshot)	✓	×	×	×	×	×	×
Reject water marine infrastructure and discharge	✓	✓	✓	×	×	×	×
PS at Fawley	×	×	×	×	×	×	×
Desalination plant at Ashlett Creek	×	×	×	×	×	×	×
Transfer pipeline to Testwood WSW	✓	×	×	×	×	×	×
Receiving tank at Testwood WSW	×	×	×	×	×	×	×

The potential impacts associated with the SRO components scoped in are considered in more detail in the subsequent sections.

Stage 3: Outline WFD impact assessment

Sea Water Intake (Fawley Marina and Calshot)

This component has been identified as having the potential to impact on the biology of the Southampton Water or Solent water bodies during operation.

The operation of the intake could result in fish impingement and increased mortality. However, the intake would be designed to ensure impingement and entrainment is minimised as far as possible (in the provision of suitable screening and alignment to water flows) and therefore any changes are not predicted to be sufficient to result in deterioration of the status of fish in the water body (within or between status classes). This means that this component would not result in deterioration in the status of this water body or prevent WFD objectives being achieved in this water body in the future.

Reject Water Marine Infrastructure and Discharge

This component has been identified as having the potential to impact on the biology, chemical physico-chemistry and protected areas of the Solent water body during operation.

Modelling of the potential impact associated with the discharge of reject water was undertaken using CORMIX to understand the near-field behaviour of the discharge such as the dilution and geometry of the near-field plume. MIKE21 was then used to provide an indication of mid / far-field behaviour and indicate the potential dispersion outside of the initial mixing calculated by CORMIX. Two scenarios were modelled, the likely maximum flow for A.1 at 75 Ml/d representing a 1-in-200-year drought flow and the BAU flow of 15 Ml/d which is likely to be the flow for approximately 320 days in an average year. Both maximum and average input values were modelled for a spring and neap tide. The 61 Ml/d maximum flow for A.2 was not specifically modelled given that the 75 Ml/d represented the least preferable for desalination SROs. It is anticipated that the results for 61 Ml/d would be very similar to the output for the 75 Ml/d flow but slightly reduced.

The results of the CORMIX modelling showed that, as anticipated, the discharge plume is heavier than the ambient water and even with a strong discharge velocity, it does not reach the water surface. Results for suspended solids indicate concentrations fall to approximately 20 mg/l within 300 m of the discharge for 75 Ml/d and within 50 m for 15 Ml/d. 20 mg/l is considered to be within natural variation experienced within the Solent. For iron, compliance is achieved prior to discharge. For pH, ambient values are reached within 200 m of the discharge location for both flow scenarios. With respect to salinity, modelled output indicates that the plume would be at 5% of ambient salinity within 250 m from the outfall for 75 Mld and within 150 m for 15 Ml/d. Note that the plume would extend with the prevailing currents rather than spread laterally.

Given that the 75 Ml/d would only be required in very dry prolonged weather, the results of the 15 Ml/d are considered to best represent the day-to-day operational effects. Overall, therefore, a deterioration in water quality of the Solent WFD water body on a water body scale is not predicted. Only under certain conditions is the plume likely to extend into the Southampton Water WFD water body and therefore, again a deterioration in this water body on a water body scale is also not predicted. As a result of the limited effects on water quality and natural baseline conditions within the Solent WFD water body which give rise to varying baseline salinities and suspended solids concentrations, effects on fish and offshore habitats are not predicted.

The modelling indicates that there would be an overlap of the reject water plume with designated shellfish waters in the Solent and in the mouth of Southampton Water. However, commercially fished beds would not be impacted as they are not located within the Stanswood shellfish water which is where the majority of the effect would manifest. Additionally, concentrations predicted in the modelling, outside the immediate vicinity of the outfall, indicate very small increases in salinity which are likely to be within baseline variations given the dynamic environment and various freshwater inputs to the system. Overall, therefore, effects on the shellfish waters are not predicted.

The previous sections demonstrate that, although the component could result in changes to water quality, the changes are not predicted to be sufficient to result in deterioration of the status of any quality elements in the water body (within or between status classes) on a water body scale. This means that this component would not result in deterioration in the status of this water body or prevent WFD objectives being achieved in this water body in the future.

Component: Transfer Pipeline to Testwood WTW

This component has been identified as having the potential to impact upon the biology, hydromorphology, physico-chemistry and chemistry of the Dark Water, Langdown Stream, Beaulieu River, Bartley Water and Blackwater (Test and Itchen) river water bodies as a result of the construction and decommissioning of watercourse crossings.

To avoid any non-temporary direct impacts on larger watercourses (i.e., extending beyond the construction or decommissioning period), main river crossings will be undertaken with directional drilling / trenchless crossings where possible. These will prevent the direct disturbance of the bed and banks of the watercourse and prevent impacts to in-channel habitats. Furthermore, site-specific investigations will be undertaken prior to implementation of any trenchless watercourse crossings to identify the appropriate locations of entry and exit pits, the optimal depth of pipe burial, and ensure that the breakout of inert drilling fluid does not occur. This will prevent adverse impacts on the hydromorphology, physico-chemistry and biology of the watercourses.

The proposed pipeline will be installed using standard open cut excavation methods conventionally used for a cross-country pipeline. Open cut excavation will be used for most of the route. A maximum working corridor of 25 m between perimeter fences will be required for the pipeline installation. This will allow sufficient room for open excavation, storage of excavated material, construction plant transit and handing of pipelines. The depth of the trench will vary dependent on the ground conditions but will be a minimum of 0.9 m in open fields. The installation or removal of the pipeline using open trench crossings would result in the direct disturbance of the bed and banks of the affected watercourse and the habitats that they support. However, the working corridor will be reduced where construction allows and to minimise impact (e.g., when crossing watercourses).

Although construction methodologies have not yet been finalised, trenching is likely to be undertaken within a dewatered area of channel (e.g., within a coffer dam, with flow over-pumped, piped or flumed). Where possible, the use of these barriers could potentially be confined to the amount of time required to install and reinstate the trench, thereby minimising impacts on the movement of flow, sediment and biota within each watercourse. In addition, the valuable gravel substrates which are found in many of the watercourses could potentially be stripped and stored separately from surrounding soils and sediments so that they can be successfully reinstated. Finally, the banks would be reinstated prior to the restoration of natural flows.

During construction or decommissioning in areas in proximity to watercourses, a minimum 8 m or 16 m buffer will be required from non-tidal riverbanks and tidal riverbanks, respectively. However, indirect impacts on river water bodies could occur from mobilisation of sediments from haul roads, open-cut excavations, pumping operations and potential washout events. Greater areas of impermeable surfaces and disturbed ground could alter surface water drainage pathways throughout each catchment, resulting in changes to volume, energy or distribution of flows. Increased fine sediment input to the water body could smother bed habitats, reducing light penetration and dissolved oxygen. Changes to physico-chemistry could also lead to loss or modification of in-channel habitats. The accidental spillage of oils and lubricants from construction equipment and subsequent runoff into watercourses could potentially impact upon the physico-chemistry and chemistry of the water bodies.

However, best practice measures to minimise the runoff of sediment and contaminants from construction components will be implemented to prevent deterioration in water body status. These are likely to include:

- Bunding and appropriate storage of sediment
- Onsite treatment / polishing of silted water
- Use of sediment traps
- Regular cleaning of haul roads prevents runoff of construction waste
- Appropriate storage and application of both hazardous and non-hazardous waste and chemicals (i.e., diesel)
- Application of onsite mitigation measures such as spill kits and barrier booms.

These measures will prevent adverse impacts on biology, hydromorphology, physico-chemistry and chemistry by minimising the supply of fine sediment and other contaminants into the surface drainage network. This means that this component would not result in deterioration in the status of this river water body or prevent WFD objectives being achieved in these water bodies in the future.

Overall conclusions

The outline WFD compliance assessment concludes 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 RBMP or adversely affect water-related Protected Areas. This means that these activities are unlikely to result in deterioration in the status of water body status or prevent WFD objectives being achieved in relevant water body in the future.

2.5.4.5 INNS Risk Assessment

Significance of Invasive Non-Native Species

Raw water is considered to be water in its natural state (e.g., a river or groundwater body). Water is abstracted and transferred from sources such as groundwater, rivers and reservoirs, via SW's raw water network, to WSW for treatment and subsequent distribution for potable water supply. The transfer of raw water has been identified as a key potential pathway of concern for the introduction, transfer and spread of INNS by Department for Environment Food and Rural Affairs (Defra) and the Great British Non-Native Species Secretariat (GBNNSS).

Invasive, non-native, alien or exotic species are species that have been released into an environment beyond their native bio-geographic range or habitat, either accidentally or intentionally. On arrival in a new environment, a non-native species may or may not become established, depending on its tolerances to the prevailing conditions, or other influencing factors such as predation. A species is classed as 'invasive' when it adapts too well to the new environment and out-competes native species. This has a detrimental impact on native habitats and native species, i.e., decimation of a native species population.

The transfer of raw water between two points may increase the risk of spreading INNS. The introduction of INNS to a waterbody can have a significant effect such as:

- Detrimental impact on ecosystem structure and function
- Jeopardise compliance with environmental legislation
- Failure to achieve WFD objectives
- Compromise the quality of drinking water
- Compromise the safe return of treated reject water to the environment, preventing effective treatment

2.5.4.6 Legislation and Policy

The transfer of INNS is subject to national legislation such as the Wildlife and Countryside Act 1981 (as amended), Invasive Non-native Species (Amendment etc.) (EU Exit) Regulations 2019, Invasive Alien Species (Enforcement & Permitting) Order 2019 and the Water Environment (WFD) (England and Wales) Directive 2017.

2.5.4.7 Objectives of this Assessment

An INNS Risk Assessment for each SRO has been completed for Gate 2. The overall objective of the Risk Assessment is to understand the physical and operational infrastructure of the proposed water transfer network and identify the risk of spread of INNS within the SW raw water transfer network. The Risk Assessment is both descriptive and quantitative. In accordance with the EA (2017) position statement *Managing the Risk of Spread of Invasive Non-Native Species Through Raw Water Transfers*, the assessment is focused on the pathways by which INNS can spread within the proposed raw water transfer network, rather than on the current distribution of INNS.

2.5.4.8 Risk Assessment Methodology

The Risk Assessment tool used for this assessment was originally developed by Wessex Water and amended by Northumbrian Water Group to meet the requirements of the EA's Price Review 2019 (PR19) guidance on the assessment of raw water transfers. The tool takes a pathway-based approach and is centred around a comprehensive list of functional groups of INNS. The use of functional groups accounts for all potential INNS at risk of spread, rather than just focusing on the species that are currently present within the source water body.

The assessment is based on a variety of data, which includes, but is not limited to, the following:

- Nature of the connection (e.g., piped, natural)
- Distance of each connection
- Time passage and volume of water
- Frequency of operation
- Details on operational activities
- Details of barriers to passage
- Details of processing / storage

The Risk Assessment uses a scoring matrix which is based on the above data to score the inherent risk for the water transfer. Mitigation measures and actions that might decrease or increase risk are added to the adjusted risk score. A final weighted risk score accounts for known INNS in source waters and protected sites and species near the receptor.

The following data sources detailed (Table 42) have been used to gather the data used to populate the Risk Assessment Matrices.

Table 42 - INNS Raw Water Transfer Risk Assessment Data Sources

Data Source	Description of data utilised
Southern Water	Raw water transfers in Geographical Information Systems (GIS) INNS management plans Biological records Biodiversity records centre data and incidental records received by Southern Water Ecologists
Biological Records Centre	Protected species and INNS data for Kent, Surry, Sussex, and Isle of Wight Local wildlife site data for Kent, Surry, Sussex, and Isle of Wight
Natural England Open Data	Designated sites
UK Water Industry Research (UKWIR)	INNS implications on the Water industry (UKWIR, 2016)
EA	UKTAG high impact list of invasive non-native species EA Water Body Risk Assessments (EA, 2014)
MAGIC	UK Government's Multi Agency Geographic Information for the Countryside (MAGIC) website (www.magic.gov.uk)

A list of known non-native species present at the various stages of the raw water transfer were obtained from the sources detailed in Table 42 above. The resulting non-native species records were then cross-referenced against the WFD UK Technical Advisory Group high impact list of invasive non-native species, UKWIR on INNS implications on the Water industry (UKWIR, 2016) and INNS list used by Northumbrian Water for conducting raw water Risk Assessments. The lists are not fully comprehensive when compared to the 2,000 INNS species identified by GBNNSS. However, it was considered that the source-pathway-receptor risk assessment approach based on these key species is sufficient to manage the risks of introduction and spread of INNS within the proposed transfers.

Data on the known location of protected species and INNS was collated using the local biodiversity records centre data and incidental records received from SW ecologists. No comprehensive surveys for INNS have been carried out for this Risk Assessment, therefore if no records exist, the absence of INNS cannot be assumed.

The proposed water transfer components of the SRO have been assessed by defining a start and end point (e.g., abstraction to desalination plant, desalination plant to Testwood and desalination plant to outfall) in line with approach set in EA (2017) Position Statement.

The Desalination plant will operate at a 15 Ml/d sweetening flow continuously and will only be required to operate at 75 Ml/d (A.1) and 61 Ml/d (A.2) to supply potable water during a 1-in-200-year drought event. However, this assessment has undertaken a conservative, worst-case approach and a transfer of 75 Ml/d was assumed.

The initial unweighted or 'inherent risk' calculation is calculated by multiplying the pathway occurrence by the pathway INNS score. This takes account of the frequency, volume and distance of the transfer. The 'adjusted risk' uses the inherent pathway INNS scores are adjusts to account for factors that may mitigate or increase the risk posed by the transfer. For example, screening or navigation, respectively. The final 'weighted risk' adds a weighting to the adjusted risk scores to allow for known INNS in source waters and protected species and designated sites near the receptor.

2.5.4.9 Results and Discussion

A.1 AND A.2 require the creation of new raw water transfers that will operate continuously all year round. This SRO can be divided into the following raw water transfer Options, detailed in Table 43:

Table 43 - Raw Water transfer Options

SRO Route Options	Raw Water Transfers
[redacted] to Testwood	• Abstraction of seawater at the disused [redacted] Intake to Ashlett Creek Desalination Plant (Abstraction & Discharge Route 1) • Transfer of treated water from Ashlett Creek Desalination Plant to Testwood WSW (via pipeline Routes 1 and 2) • Reject water discharge from the Desalination plant to the Solent via Calshot (Abstraction & Discharge Route 1)
Calshot Route 1 to Testwood	• Abstraction of seawater via Calshot to Ashlett Creek Desalination Plant (Abstraction & Discharge Route 2) • Transfer of treated water from Ashlett Creek Desalination Plant to Testwood WSW (via pipeline Routes 1 and 2) • Reject water discharge from the Desalination plant to the Solent via Calshot (Abstraction & Discharge Route 2).
Calshot Route 2 to Testwood	• Abstraction of seawater at the disused [redacted] Intake to Ashlett Creek Desalination Plant (Abstraction & Discharge Route 1) • Transfer of treated water from Ashlett Creek Desalination Plant to Testwood WSW (via pipeline Routes 1 and 2) • Reject water discharge from the Desalination plant to the Solent via Calshot (Abstraction & Discharge Route 1)

2.5.4.10 Abstraction

Seawater will be abstracted from the either the Southampton Water [redacted] for the [redacted] to Testwood Option or from the Solent [redacted] for the Calshot to Testwood Option. The water will be transferred via a terrestrial PS to the Ashlett's Creek Desalination Plant. The Desalination Plant is located in an area that does not have an assigned WFD waterbody due to restructuring of the water body catchments during the

River Basin Management Plans 2 (RBMP2). However, the area is closely connected to the surrounding coastal waterbodies (Southampton Water / Solent). For the purposes of this Risk Assessment, it is assumed that these abstractions will transfer water upstream within the same WFD waterbody.

Both abstraction route Options (Abstraction and Discharge Route 1 & 2) will utilise remaining sections of existing pipeline (associated with Fawley Power Station outfall). The [redacted] and Calshot Route 1 Options will both utilise existing pipeline whereas Calshot Route 2 will require construction of a new pipeline. Laying new pipeline represents a greater risk in terms of potential INNS transfers as this creates a new, additional pathway. It was assumed that 189 Ml/d of seawater would be transferred to the Desalination Plant as this is the amount of seawater required for the full transfer of 75 Ml/day to Testwood (MarineSpace and Ricardo, 2021).

INNS can be transferred through fishing equipment, clothing, boat hulls, anchors, propellers etc. and activities such as angling, boating and water sports could increase the risk of INNS spreading. The Solent and Southampton water (source waterbodies) are a popular area for navigation and boat use. Calshot Angling club also operate in this area and hold local competitions throughout the year. Similarly, Calshot activities centre offers water sports within the Southampton Water and the Solentat the source. The adjusted risk scores reflect the possibility of the Solent source regions being used for navigation, angling and water sports. It was assumed that 1 mm aperture passive wedge wire screens would be used at both abstraction locations. This is to be confirmed through detailed design and further consultation with regulators. Shock chlorination will be dosed intermittently in the abstraction pipe (MarineSpace and Ricardo, 2021). Both methods will actively reduce the risk of INNS spreading.

2.5.4.11 Fawley to Testwood

The proposed routes would provide a continuous transfer of water between the Fawley Desalination Plant and Testwood WSW. The transfer would be between WFD operational catchments for an approximate length of 22.2 km and 25.2 km for Route 1 and Route 2, respectively. Both the pipeline routes have the same level of INNS transfer risk. The transfer through underground pipelines represents little risk to INNS transfer during its transport. Protected species are present in or near the Testwood supply works and Himalayan Balsam *Impatiens glandulifera*, which has a high-risk classification, is known to be present at Testwood. Chlorination will be dosed prior to entering conveyance pipework to Testwood which reduces the adjusted risk of INNS transfer. Furthermore, the transfer will be direct to Testwood WSW and will not be stored in a bankside reservoir. This results in an overall risk score of zero for INNS spreading for the transfer between Fawley and Testwood.

2.5.4.12 Reject Water

Reject water will be discharged into the Solent [redacted] from the Desalination Plant at Ashlett Creek. Two routes are proposed, with the discharge from Abstraction and Discharge Route 1 requiring construction of new pipeline and the discharge from Abstraction and Discharge Route 2 utilising existing pipeline. Abstraction and discharge via Route 2 represent a downstream transfer within the same WFD water body (i.e., the Solent), whereas Route 1 represents a transfer downstream between WFD water bodies (i.e. from the Southampton Water to the Solent). The same recreational activities and risk described for abstraction above are relevant to the transfer destination here. The reject water discharge will be subject to screening and intermittent shock chlorination (to prevent biofouling) at the abstraction (see above) which reduces the adjusted risk of INNS transfer.

2.5.4.13 INNS Risk Scores

The total risk of transfer for both transfer Options that make up this SRO are detailed in Table 44. The Calshot Route 1 to Testwood represents the transfer Option with the least risk of INNS spreading as a result of utilising existing pipelines and both abstracting and discharging from the same WFD waterbody. Calshot Route 2 to Testwood has the greatest risk of INNS spreading as this will require construction of new underground pipeline, detailed in Table 44.

Table 44 - INNS Risk of spreading

Risk type	Input variable	[redacted] to Testwood	Calshot to Testwood
Inherent	Transfer pathway	New raw water transfers will be set up that include a run to waste	New raw water transfers will be set up that include a run to waste
	Transfer frequency	Year-round - continuous	Year-round - continuous
	Transfer volume	189 Ml/day seawater abstraction 75 Ml/day water transfer 114 Ml/d reject water	189 Ml/day seawater abstraction 75 Ml/day water transfer 114 Ml/d reject water
	Transfer distance	Abstraction upstream within same WFD Waterbody Water transfer between WFD Management Catchments Discharge downstream between WFD water bodies on same river	Abstraction upstream within same WFD Waterbody Water transfer between WFD Management Catchments Discharge downstream within same WFD Waterbody
	Score	**1,072**	**1,024**
Adjusted	How raw water is conveyed	Whole length – underground pipeline	Whole length – underground pipeline
	Facilitation works	Abstraction will partly utilise existing pipework Water transfer will require new underground pipeline Discharge will require new pipeline	Abstraction and discharge will partly utilise existing pipework Water transfer will require new underground pipeline
	Storage at transfer destination	Not applicable to pathway	Not applicable to pathway
	Navigation along transfer route	Medium traffic / boats in the Solent	Medium traffic / boats in the Solent
	Recreation at source / along transfer route	Local angling events and casual watersports at Calshot	Local angling events and casual watersports at Calshot
	Recreation at transfer destination	No	No
	Screening at source	1 mm mesh screen at Abstraction (current design assumption, to be confirmed through detailed design and further consultation with regulators)	1 mm mesh screen at Abstraction
	Chlorination at source or along route	Shock chlorination will be dosed intermittently in the abstraction pipe Chlorine will also be dosed prior to water transfer to Testwood.	Shock chlorination will be dosed intermittently in the abstraction pipe Chlorine will also be dosed prior to water transfer to Testwood.
	Transfer of water direct to WSW	Desalination Plant to Testwood will be Direct to WSW	Desalination Plant to Testwood will be Direct to WSW
	Treatment of transferred water	Not applicable to pathway	Not applicable to pathway
	Screening before discharge to receptor waterbody	No	No
	Saltwater barrier	No	No
	Specific operational protocol to mitigate risk	No	No
	Score	**2,741**	**1,671**
Weighted	Weighting of known INNS at raw water transfer source	Unknown / not surveyed	Unknown / not surveyed
	Protected species in or near receptor	Yes	Yes
	Protected sites at or near receptor	Internationally designated	Internationally designated
	Presence of existing connections between source and receptor	Other connections between source of water and receptor	Other connections between source of water and receptor
	Score	**9,968**	**6,104**

Biodiversity Net Gain (BNG) and Natural Capital (NC) Assessment

The latest methodologies for BNG and NC as set out by All Company Working Group's (ACWG) current guidance to SRO Environmental Assessment[5] have been applied. The requirements and outputs of the assessment are consistent with those in the WRSE Regional Plan Environmental Assessment Methodology Guidance, as well as the Water Resource Planning Guidance for WRMP24 and its supplementary guidance 'Environmental and Society in Decision Making' and UKWIR Environmental Assessment Guidance. Outputs are related to that required for Gate 2 activities in the context of Biodiversity and NC accounting related to more detailed feasibility than at Gate 1 of the conceptual design of a range of scheme configurations / components. In addition, it should be noted that for the accelerated Gate 1 BNG and NC assessment no formal guidance was available and as such this assessment has had to account for current guidance in the context of the gate-2 conceptual design updates. It should also be noted that in the context of the BNG assessment this has been based on the application of Defra's Biodiversity tool 'The Biodiversity Metric 2.0' (Defra BNG Metric) as a means of scoring the biodiversity gain or loss of each component. The updated Metric 3.0 was released in early July 2021 and will need to be used at Gate 3 at which point additional field data collection should been included noting that key current limitations with the current tool is that it primarily focuses on terrestrial habitats, with limited ability to calculate loss and mitigation for river and intertidal habitats. Furthermore, marine habitats not currently included. Consequently, the outputs are likely to both underestimate both losses and potential gain opportunities. As part of the BNG assessment a strategic assessment of offsite opportunity areas has been undertaken to identity suitable parcels of land where the best biodiversity gain and hence overall net gain could be achieved noting that mitigation would be required for any loss of irreplaceable habitat', such as certain priority habitats: furthermore marine habitats loss will require further assessment at Gate 3 together with gaining more evidence in terms of habitat quality as well as quantity for ground truthing.

The outputs of the BNG (losses and potential net gain opportunities) currently provide habitat type data upon which the NC assessment is compiled and account for the NC biodiversity metric. The National Character Area (NCA) has been carried out to identify the potential environmental benefits of the SRO components with consideration of the socio-economic aspects of impacted features. Key ecosystem services have been assessed and monetised in accordance with the ACWG guidance (i.e., climate and natural hazard regulation) in terms of both NC loss (temporary and permanent) and on- and off-site creation related to the BNG calculations. In the context of recreation and amenity value this, at Gate 2, can only be assessed as a loss given uncertainty regarding where habitat creation may be sited and local ambitions, whilst agriculture is also shown as temporary and permanent loss, noting that agricultural loss is accounted for a grassland within the BNG tool and hence valued as part of climate regulation and biodiversity net gain. Water purification has been provided in quantitative high-level assessment terms due to limited local data for this gate as ORVAL data for example is too coarse for comparison: more data collection will be required at Gate 3. At this stage water regulation has not been include give that overall aim of each of these schemes is related to water regulation so limited differential: this is especially so given that the assessment has focused on terrestrial habitats, due to the limitations of aquatic data at this stage. This will need to be revisited at Gate 3. Overall, the aim of the NCA assessment has been to include an assessment of baseline natural capital assets and their ability to provide ecosystem services, and how these are likely to change as a result of the SROs (see Technical Report 2: Biodiversity Net Gain and Natural Capital Assessments report for more details and associated NC and BNG Appendices).

For both the BNG and NC the assessment initially provided outputs per scheme component and subsequent to the completion of the site selection work, assessments of the key SRO configurations were completed to inform both the MCDA assessment and provide the outputs for the key BNG and NC documented outputs. The key findings of the assessment are presented in the Technical Report 2: Biodiversity Net Gain and Natural Capital Assessments report document (Appendices A4.V to A4.XLIV. These tables include key NC elements as outline in the ACWG plus an assessment of both temporary and where known permanent habitat losses and total off-site habitat creation requirements

[5] All Company Working Group (2020). WRMP environment assessment guidance and applicability with SROs

for 10% net gain overall in hectares). All separate components and those not included in the final decision making can be found in the Technical Report 2: Biodiversity Net Gain and Natural Capital Assessments report and associated Appendices for comparison.

No cumulative assessment with other schemes or plans has not been undertaken, as the assessment assumes that for any biodiversity loss not fully mitigated, compensation (offsetting) will be undertaken with an additional provision of 10% net gain. Cumulative assessment would only be necessary / feasible when specific land parcels are identified and if these have been identified and providing mitigation or net gain opportunity for another scheme. At that stage a cumulative assessment of opportunity net gain potential would be necessary to ensure no double counting of habitat uplift.

Table 45 below details the configurations and components assessed which are consistent with the desalination scenario (Options A.1 and A.2) noting that those elements in bold related to the marine intake/outfall, site, pipeline route and other infrastructure components are include in the configuration. Those elements in italic are included as additional components only. The summary data for each configuration and additional components is detailed in Table 45, with summary biodiversity net gain assessment information included in tables Table 46 andTable 47.

Table 45 - Summaries of the configurations and components

	Scenarios*	
	A1 Fawley	A2 Fawley
Marine intake and outfall	Calshot intake / outfall *Fawley Intake*	Calshot intake / outfall *Fawley Intake*
Site	Ashlett's Creek	Ashlett's Creek
Pipeline route	Route 2 (AC to Testwood WSW *Route 1*	Route 2 (AC to Testwood WSW *Route 1*
Other Infrastructure / Components (included in the configurations)	New Pipeline to Calshot (re-use of existing tunnels)	New Pipeline to Calshot (re-use of existing tunnels)

***Bold** = related to configuration *Italic* = component only

Table 46 - Summary of BNG and Natural Capital Assessment for A.1/A.2

Configuration	Metric	Assessment	Units
Option A.1 and A.2 Fawley (Ashlett Creek) Configuration – with Pipeline Route 2 (AC to Testwood WSW)	Biodiversity		**Hectares (ha)**
		Total temporary habitat lost during construction	[redacted]
		Total permanent habitat loss	[redacted]
		Total on-site re-instatement /creation	[redacted]
		Total off-site habitat creation / BNG uplift	[redacted]
	Climate regulation		[redacted]
		Change in non-traded carbon sequestration value for temporary habitat loss during construction	[redacted]
		Change in non-traded carbon sequestration value for permanent habitat loss	[redacted]
		Non-traded carbon sequestration value for on-site re-instatement/creation	[redacted]
		Non-traded carbon sequestration value for off-site habitat succession	[redacted]
	Natural hazard regulation		[redacted]
		Change in natural hazard regulation value for temporary habitat loss during construction	[redacted]
		Change in natural hazard regulation value for permanent habitat loss	[redacted]
		Natural hazard regulation value for on-site re-instatement / creation	[redacted]
		Natural hazard regulation value for off-site habitat succession	[redacted]
	Recreation & tourism		[redacted]
		Estimated Welfare Value	[redacted]
		Estimated visits	[redacted]
	Agriculture		[redacted]
		Temporary loss estimated agriculture value	[redacted]
		Permanent loss estimated agriculture value	[redacted]
	Water purification	***Current provision***: arable, pasture, woodland and grassland habitats. *Impact related to abstraction = none:* Water for the Ashlett Creek desalination plant will be abstracted from The Solent. The Solent has a SPA and SAC designation. *Impact related to construction = minor negative:* desalination plant will receive water from Fawley FAWPS Site so permeant land cover change to engineered structure. *Water transfer = improvement:* desalinised water will be transferred to Testwood WSW which will reduce the abstraction in the River Test. River Test (Lower) WFD waterbody is currently achieving Moderate status. Therefore, the increase in flow (as desalination plant will transfer 75 Ml/d or 61 Ml/d) has a potential to dilute any pollutant impacts.	

Table 47 - Summary of BNG and Natural Capital Assessment for A.1 AND A.2 (remaining components from Stage 4 of Site Selection)

Components	Metric	Assessment	Units
Options A.1 and A.2 Fawley marina intake component	Biodiversity		**Hectares (ha)**
		Total temporary habitat lost during construction	[redacted]
		Total permanent habitat loss	[redacted]
		Total on-site re-instatement/creation	[redacted]

Components	Metric	Assessment	Units
		Total off-site habitat creation/ BNG uplift	[redacted]
	Climate regulation		[redacted]
		Change in non-traded carbon sequestration value for temporary habitat loss during construction	[redacted]
		Change in non-traded carbon sequestration value for permanent habitat loss	[redacted]
		Non-traded carbon sequestration value for on-site re-instatement/creation	[redacted]
		Non-traded carbon sequestration value for off-site habitat succession	[redacted]
	Natural hazard regulation		[redacted]
		Change in natural hazard regulation value for temporary habitat loss during construction	[redacted]
		Change in natural hazard regulation value for permanent habitat loss	[redacted]
		Natural hazard regulation value for on-site re-instatement/creation	[redacted]
		Natural hazard regulation value for off-site habitat succession	[redacted]
	Recreation & tourism		[redacted]
		Estimated Welfare Value	[redacted]
		Estimated visits	[redacted]
	Agriculture		[redacted]
		Temporary loss estimated agriculture value	[redacted]
		Permanent loss estimated agriculture value	[redacted]
	Water purification	***Current provision:*** urban and grassland habitats. *Abstraction from Marina = potential impact:* Water will be abstracted from the marina from The Solent. The Solent has a SPA and SAC designation.	
Options A.1 andA.2 Ashlett Creek to Testwood WSW Route 1 component	Biodiversity		**Hectares (ha)**
		Total temporary habitat lost during construction	[redacted]
		Total permanent habitat loss	[redacted]
		Total on-site re-instatement / creation	[redacted]
		Total off-site habitat creation / BNG uplift	[redacted]
	Climate regulation		[redacted]
		Change in non-traded carbon sequestration value for temporary habitat loss during construction	[redacted]

Components	Metric	Assessment	Units
		Change in non-traded carbon sequestration value for permanent habitat loss	[redacted]
		Non-traded carbon sequestration value for on-site re-instatement/creation	[redacted]
		Non-traded carbon sequestration value for off-site habitat succession	[redacted]
	Natural hazard regulation		[redacted]
		Change in natural hazard regulation value for temporary habitat loss during construction	[redacted]
		Change in natural hazard regulation value for permanent habitat loss	[redacted]
		Natural hazard regulation value for on-site re-instatement / creation	[redacted]
		Natural hazard regulation value for off-site habitat succession	[redacted]
	Recreation & tourism		[redacted]
		Estimated Welfare Value	[redacted]
		Estimated visits	[redacted]
	Agriculture		[redacted]
		Temporary loss estimated agriculture value	[redacted]
		Permanent loss estimated agriculture value	[redacted]
	Water purification	***Current provision:*** arable, pasture, woodland and grassland habitats. *Abstraction from Solent = no impact:* Fawley desalination plant will abstract from the Solent. The Solent has a SPA and SAC designation. *Water transfer = potential improvement:* The desalinised water will be transferred to Testwood WSW which will reduce the abstraction in the River Test. River Test (Lower) WFD waterbody is currently achieving Moderate status. Therefore, the increase in flow (as desalination plant will transfer 75 Ml/d or 61 Ml/d) has a potential to improve water purification services as dilution of pollutants downstream will increase.	

Environmental Mitigation

The purpose of this section is to summarise potential environmental mitigation measures requiring further consideration for this SRO. The EIA Regulations, and a number of supporting assessments (e.g., HRA, WFD), require a description of the measures envisaged to avoid, prevent, reduce or (where possible) offset any significant adverse effects on the environment. Mitigation measures are also required to address some of the risks outlined in Section 2.7 of this document.

This summary is not exhaustive, example mitigation measures have been identified based on emerging concept designs and current understanding of potential impacts. Mitigation measures have been summarised from the individual environmental assessments (e.g., HRA, WFD) reported above.

Details of the approach to decommissioning have not been confirmed at this stage, however any mitigation measures associated to decommissioning would be developed in line with industry best practice. A full suite of mitigation (and potentially compensatory) measures will be further developed and assessed during the scheme development, EIA and detailed design processes, and where appropriate agreed with relevant regulatory bodies prior to submission of the DCO. SW proposes to submit a Mitigation Route Map with the DCO application to confirm how mitigation measures will be delivered / secured.

For the purposes of this preliminary assessment, two types of mitigation are discussed, as defined within the Institute of Environmental Management and Assessment (IEMA) Guide to Shaping Quality Development (IEMA, 2015):

- Primary (inherent) mitigation – an intrinsic part of the project design - For example, reducing the height of a development to reduce visual impact
- Secondary mitigation – requires further activity in order to achieve the anticipated outcome – For example, description of certain lighting limits that will be subject to submission of a detailed lighting layout as a condition of approval

Tertiary (i.e., inexorable) mitigation is not considered specifically here, however will be identified through the EIA process where appropriate.

To align with the EIA assessment process, mitigation measures for this SRO are detailed in Table 48 in relation to anticipated EIA Topics (see leftmost column). Some EIA topics, such as Health, typically draw from impacts and mitigation measures identified in other chapters (in this example noise, air quality etc) so have not be identified separately.

Table 48 - Potential mitigation measures for A.1 and A.2

EIA Topic	Example potential impact occurring during construction, operation and decommissioning	Example potential embedded mitigation measures to be explored during scheme development and EIA	Example potential secondary mitigation measures to be explored during EIA
Air Quality	• Impacts of dust and particulate matter on dust soiling, human health and nature conservation designations • Impacts of emissions from construction phase plant on human and ecological receptors • Impacts of emissions from increased traffic movements on human and ecological receptors (construction and operation) • Impacts of emissions from additional vessel movements on human and ecological receptors (construction)	• Routing of infrastructure, pipelines and construction routes to avoid sensitive sites where possible (see mitigation for traffic and transport, biodiversity etc) • Emissions during operation (e.g., back-up generators) designed / located to reduce AQ impacts	• HGV movements and construction vehicles could be routed and potentially timed to avoid peak traffic periods and sensitive receptors; • Development and implementation of Construction Environmental Management Plans; • Dust suppression measures could be utilised during construction; • Air quality monitoring could be undertaken if required / where appropriate (with an adaptive plan in place to manage unacceptable effects arising); and • Low emissions plant and vehicles could be used.
Archaeology and Cultural Heritage (terrestrial and marine)	• Direct (physical) impacts • Indirect (physical) impacts • Indirect (non-physical) changes to the setting of heritage assets	• Pipeline route to seek to avoid direct impact to sites and buildings of cultural and heritage importance • Design / layout of above ground infrastructure to consider setting of listed building / scheduled monument • Archaeological assessment of pre-construction survey data, including high resolution geophysical data to inform scheme development	• Recording and removing / relocating archaeological material (preservation by record) • Archaeological Exclusion Zones could be established around sensitive interest features • Develop protocol for archaeological discoveries to account for unexpected finds • Written Scheme of Investigation (WSI) to set out measures for ground clearance appropriate to the categorisation of the area • Heritage awareness initiatives with local interest groups / schools
Biodiversity	• Degradation or loss of habitats • Killing or injuring of fauna through the removal of resting or breeding sites • Loss of foraging or breeding areas • Loss of ecological connectivity • Introduction of INNS	• Pipeline routes to seek to avoid nationally or internationally important terrestrial and marine habitats where possible, or areas identified as functionally linked or supporting protected / notable species • Sensitive selection of pipeline river crossings to minimise impacts to groundwater flows and water dependent habitats. Use of trenchless techniques where appropriate. • Biodiversity enhancement measures and delivery of net gain	• Clearance of vegetation to be undertaken prior to the breeding season where possible • Restoration or compensation of terrestrial, coastal or marine habitat where possible on completion of construction. • Translocation of species prior to construction • Appropriate isolation, removal and post-construction control measures implemented to minimise spread of INNS • Avoid significant dust dispersion, sedimentation runoff, nitrogen deposition (from construction traffic and lane closures holding traffic in queues). Consideration will also need to be given to the

EIA Topic	Example potential impact occurring during construction, operation and decommissioning	Example potential embedded mitigation measures to be explored during scheme development and EIA	Example potential secondary mitigation measures to be explored during EIA
		• Design measures to reduce risk of INNS (e.g. screens)	location of construction compounds to avoid designated areas. Traffic may need to be routed away from any sensitive habitats to avoid increases in nitrogen loading.
Land Quality and Ground Conditions	• Exposure of workforce and the public to contaminated soils and groundwater and associated health impacts • Impacts on ground water quality and groundwater resources • Impacts on surface water quality • Sterilisation of future mineral resources	• Avoidance of known areas of contaminated land through design of the SRO using good design principles • Avoidance of mineral sterilisation through design of the SRO using good design principles	• Reinstatement of land following construction where possible • Remediation if required • In-situ ground improvement techniques or excavation and replacement of poor material
Land Use and Agriculture	• Loss of agricultural production on agricultural land and disruption of farming practices • Loss or disruption to recreational assets • Loss or diversion of PRoW and/or cycle paths	• Routing of the pipeline to avoid agricultural land where possible • Routing of the pipeline to avoid recreational land and Public Rights of Way where possible • Take appropriate mitigation measures to address adverse effects on National Trails, other PRoW and open access land and, where appropriate, to consider what opportunities there may be to improve the network and other areas of open space and improve access	• Topsoil retained and replaced once construction is complete • Where green infrastructure is affected, the functionality and connectivity of the green infrastructure network should aim to be maintained
Landscape and Visual Impact	• Effects to landscape fabric and features • Effects to landscape / townscape / seascape character • Effects to visual amenity within landscape designations (including consideration of wildlife and natural beauty) • Effects to visual amenity	• Appropriate siting of above ground infrastructure to consider viewpoints / tranquillity / landscape designations • Sensitive lighting design in accordance with best practice • Landscaping schemes to screen infrastructure • Materials and finishes of infrastructure to be given careful consideration	• Preparation and implementation of Landscape Management Plan
Noise and Vibration	• Noise impacts to humans from construction plant, vehicles or vessels • Noise impacts to ecology from construction plant, vehicles or vessels (above ground and underwater)	• Construction methods selected to reduce noise • Adequate distance between source and noise-sensitive receptors	• Reduction of noise at point of generation and containment of noise generated • Restriction of activities allowed – specifying noise limits or times of use • Potential use of acoustic barriers

EIA Topic	Example potential impact occurring during construction, operation and decommissioning	Example potential embedded mitigation measures to be explored during scheme development and EIA	Example potential secondary mitigation measures to be explored during EIA
	• Vibration impacts to humans (construction) • Vibration impacts to buildings (construction)	• Layout of structures or buildings to screen noise	
Traffic and Transport	• Driver delay to road users including pedestrians, cyclists and equestrians • Severance or loss or pedestrian/cycle amenity • Reduction in road safety	• Selection of route Options which avoid heavily congested areas / roads • Consideration could be given to the utilisation of waterborne and rail transport to deliver large quantities of construction materials	• HGV movements and construction vehicles could be routed and timed to avoid peak traffic periods and sensitive receptors; • Use of best practice methods including the development and implementation of Construction Traffic Management Plans; • Siting and construction activities could be undertaken so as to minimise any short term adverse effects on public rights of way • Control numbers of HGV movements to and from the site in a specified period during construction and operation where possible and consider the impacts of alternative transport routes
Water Resources and Flood Risk	• Changes to flood risk and the hydrology of surface watercourses. • Changes to the geomorphology of surface watercourses • Changes to the geomorphology and quality of surface waters • Temporary or permanent changes to surface and groundwater quality • Changes to groundwater recharge and groundwater levels resulting from changes to surface and sub-surface hydrology.	• The timing, method and location of release of reject water from desalination plants should be adequately investigated to minimise the effects on aquatic flora and fauna. Discharge pipes with multiple outlets may assist in promoting mixing and diffusion. The location of dscharge could also seek to identify those areas with the greatest potential for diffusion. • Sustainable drainage approaches and other measures such as planting could be adopted to ensure no net change in fluvial, estuarine or surface water flood risk, arising from site run-off. • Where required flood storage measures could be included in the design of development.	• Adherence to pollution control practice and pollution prevention guidance • Best practice used to prevent silt, concrete or fuel oil polluting water courses or ground water
Benthic and Intertidal Ecology	• Habitat loss / physical disturbance • Re-mobilisation of contaminated sediments • Increased turbidity and smothering	• Route / outfall selection to avoid sensitive habitats and a suitable buffer placed around potential areas of interest to prevent interaction	• Best practice to be followed to ensure that risks of disturbance or damage to species or habitats is minimised

EIA Topic	Example potential impact occurring during construction, operation and decommissioning	Example potential embedded mitigation measures to be explored during scheme development and EIA	Example potential secondary mitigation measures to be explored during EIA
	• Introduction of INNS	• Mitigation of subtidal habitat loss should consider micro-siting to avoid important habitats and minimisation of the seabed footprint	• Where applicable techniques/equipment can be used to minimise suspended sediment increases • Clean, Check, Dry protocols can be put in place to minimise spread of INNS
Coastal and Marine Processes	• Changes in sediment transport and morphology • Changes in tidal currents and waves • Loss of seabed area	• Design of outfalls / intakes optimised to minimise potential permanent changes to coastal processes	•
Commercial Fisheries	• Reduced access to or exclusion from fishing grounds • Increased pressure on adjacent fishing grounds • Displacement of commercially important fish and shellfish resources • Increased vessel traffic within fishing grounds	• Design of outfalls / intakes optimised to minimise potential permanent changes to coastal processes • The location of any outfall or intake should be chosen to avoid areas important to commercial fisheries • Construction activities will be confined to minimum areas required for the works	• Local Notice to Mariners published to ensure awareness of activities to prevent interaction between vessels
Fish and Shellfish Ecology	• Habitat loss / disturbance or entrainment of species • Increased suspended sediments and sediment re-deposition • Re-mobilisation of contaminants • Underwater noise and or vibration • Changes to prey resources	• Siting of outfall / construction areas to avoid areas of significance for fish / shellfish and eels • Appropriate design of screens on intake pipes minimise the risks of impingement/entrainment to fish and eels	• Timing of construction could be explored to minimise impacts (e.g., migratory periods)
Marine Mammals	• Changes in water quality • Changes to prey resources • Underwater noise / vibration from construction works and disturbance from vessels • Increased risk of collision	• Species and habitat surveys could be undertaken pre, during and post construction to inform the application of appropriate management and mitigation procedures	• Best practice mitigation for noisy activities e.g., JNCC guidelines for piling activities (if piling required for diffuser) • Acoustic deterrent devices or other noise abatement methods • Vessel speed limits in sensitive areas
Marine Water Quality	• Deterioration in water quality due to an increase in suspended sediment • Deterioration in water quality due to the release of contaminated sediment • Deterioration in water quality due to discharge from SROs	• Design measures to mitigate the risk of adverse effects on aquatic flora and fauna could be identified and implemented including, for example, the timing, method and location of discharges from desalination plant	• Adherence to pollution control practice. • Changes in water quality managed through construction techniques to minimise sediment disturbance.

EIA Topic	Example potential impact occurring during construction, operation and decommissioning	Example potential embedded mitigation measures to be explored during scheme development and EIA	Example potential secondary mitigation measures to be explored during EIA
		could be considered to minimise the effects on marine flora and fauna • Careful design of the desalination plant infrastructure and layout will be required to ensure any localised seepages and freshwater flows to the estuary are maintained and not permanently impeded	
Ornithology	• Disturbance and displacement (e.g., noise, light and human activity) • Direct habitat loss and fragmentation • Indirect impacts through effects on habitats and prey species	• Informed by surveys, sensitive location of infrastructure and construction compounds to avoid impacts to sensitive features (e.g., nests, breeding/feeding areas)	• Timing of construction works to minimise potential impacts to breeding / overwintering birds where possible
Shipping and Navigation	• Increased risk to navigational safety due to the presence of construction vessels at the construction site and new structures • Increase in number of vessels navigating within waterways to facilitate construction • Potential impacts of new lighting within inshore and coastal working areas on navigational safety	• Lighting requirements will be reviewed and should be undertaken in line with British Standards Institution publication on Road Lighting, BS5489 • Navigational Risk Assessment completed to inform necessary mitigation	• Notice to Mariners published to inform mariners of vessel movements and marine construction activities • A Navigation Management Plan could be produced to set out procedures to be followed and aids to navigation to be provided to mitigate risks to navigation
Carbon and GHG	• Embodied GHGs within construction materials • GHG emissions from construction and operation vehicle and vessel movements • GHG emissions from construction and operation site activities	• New infrastructure could be designed to incorporate the use of energy efficient materials, building techniques and energy efficient pumping and water treatment equipment • Opportunities could be sought for the use of, or generation of, renewable energy to help offset additional operational carbon emissions	• The use of low emission plant during construction could be considered; • Maximising the use of on-site materials could reduce HGV movements; • Use of pre-fabricated construction materials and off-line build to minimise materials used.
Major accidents	• Flooding • Storm surges, other extreme weather • Cyber attacks • Disease • Industrial action	• The design of the proposed SRO will be informed by the appropriate health and safety regulations, design codes and other legal requirements. Adhering to these requirements will minimise the risk of major accidents and disasters	• Management plans developed, in line with best practice guidance and relevant legislation, to minimise operational risks associated to major accidents and disasters

2.5.4.14 Carbon

Carbon, both Capital, Operational and Whole Life Cost for each SRO, has been estimated and included with in the MCDA and Planning Appraisal work.

Capital carbon emissions were based on scoping information in CIT costing sheets developed by SW. Where costs were developed using a bottom-up approach or based on quotes from suppliers rather than cost models, a general approach to account for additional capital carbon was applied based on the relative proportion of the total cost. For example, if 90% of the total cost was based on cost models and 10% was bottom up, the total capital carbon was scaled up accordingly to account for the additional assets. This approach was taken due to the wide range of assets which had been costed without reference to standard cost models and was a time-effective estimate of the carbon associated with these assets.

Operational carbon emissions were calculated based on quantities for power use, chemical use, transport and operational maintenance requirements.

The whole life carbon estimates comprise the capital carbon emissions, annual operational emissions and additional emissions associated with capital maintenance. The estimated annual carbon emissions profile was based on the whole life cost profile, as summarised below:

- Years 1-4: planning
- Years 5-8: construction
- Year 5: Proportional to 25% of planning costs and 20% remaining CAPEX costs
- Year 6: Proportional to 25% of planning costs and 35% remaining CAPEX costs
- Year 7: Proportional to 25% of planning costs and 35% remaining CAPEX costs
- Year 8: Proportional to 25% of planning costs and 10% remaining CAPEX costs
- Years 9-108: operation & capital maintenance

The monetised cost of carbon was also calculated using the traded and non-traded carbon price forecasts from the Green Book Supplementary Guidance: Valuation of energy use and greenhouse gas emissions for appraisal (Table 49, Carbon prices and sensitivities 2010-2100 for appraisal, 2018 £/tCO2, central price). The traded carbon price was applied to power related emissions only, with the non-traded carbon price applied to all other emissions.

The current estimate of emissions provides a view of how much the Options would add to SW's existing emissions once commissioned. Under SW's net zero operational emissions by 2030 commitment these operational emissions will need to be reduced and potentially offset by 2030. The potential costs of offsets have not been included as this would be considered as part of SW's overall net zero and offsetting strategy.

Table 49 details 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 49 - Summary of Carbon Calculations

Operating regime	Flow (Ml/d)	Capital carbon (tco2e)	Operational carbon (tco2e)	Whole life carbon (tco2e)	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

It is recognised that SW will need to provide data to demonstrate no overall impact on the atmosphere from its carbon emissions within a net zero boundary. Residual emissions will also need to be considered by determining the amount of carbon sequestration from the atmosphere. The water sector has not yet defined how the sector's net zero ambition will apply at programme, project, or company level whilst also accounting for its duty to maintain efficient and affordable services for customers. Once net zero plans are finalised, it will be easier to understand which programmes of work will be most cost-effectively meet net zero targets.

2.5.5 Next Steps

Listed below are the key next steps in progressing the environmental assessment activities related to A.1 and A.2 post Gate 2 and leading into Gate 3.

- Continuation of ecological and environmental surveys to establish baseline / mitigation requirements
- Appointment of EIA consultant and submission of an Environmental Scoping Request to the PINS following any S.35 Direction from the Secretary of State
- Incorporation of Scoping Opinion into EIA process and scheme development
- Detailed environmental desk studies to establish baseline for all EIA Topics
- Commencement of early environmental and other impact assessment activities to inform the next round of non-statutory consultation and scheme development
- Commencement of the PEIR
- Establishment of Expert Topic Groups to support EIA process
- Environmental input to scheme development to refine route / corridor selection and appraisal
- Increased levels of stakeholder, community and landowner engagement in accordance with SW's Stakeholder Engagement Strategy and Engagement Plans (see Section 2.8)

2.6 Planning and Consenting

2.6.1 Executive Summary

This planning strategy builds on the planning strategy submitted as part of SW's Gate 1 submission. It outlines the variety of consenting activities undertaken since Gate 1 to progress the development of the scheme, including, importantly, the development of a consenting programme for delivery and review of the consenting route for the proposed project.

The consenting programme provides helpful visibility and certainty to the delivery programme, enabling key consenting, engagement, scheme development and environmental assessment activities to be properly defined, planned, integrated and executed.

The consenting route review reaffirms SW's initial view at Gate 1 that a DCO is the preferred route to consent based on a number of factors, including the need for the scheme and benefit of timely delivery, the scale and significance of the scheme, it's complex terrestrial and marine interfaces and various consents required, and likely significant impacts across a 'larger than local' area.

The strategy also confirms that, based on current understanding of the project characteristics, access into the DCO consenting regime would not be automatic, i.e., the project does not currently meet the thresholds for being defined as a NSIP. Projects can however be directed into the DCO regime through a s35 direction by the Secretary of State – SW's consideration of the factors to support such a direction suggest that a strong case can be made.

In addition, the strategy outlines the likely DCO application deliverables, the secondary consents and licences required in conjunction with planning consent and potential land acquisition powers, the approach to environmental assessment and potential consenting risks. Key next steps are also set out, which will include ongoing review and refinement of this strategy as the project develops. An update of progress on consenting activities will be provided at Gate 3.

2.6.2 Background and Objectives

As part of its Gate 1 submission in September 2020, SW provided an early planning strategy to primarily establish an initial view of likely consenting route for the delivery of the preferred SRO, which was the Desalination Base Case as set out in SW's WRMP19[6].

That strategy considered the pros and cons of the two principal consenting routes under the TCPA and the Planning Act 2008 (i.e., the DCO process). Based on the emerging characteristics of the project at that time, it was determined that the DCO consenting route offered the most beneficial pathway to achieving consent.

The planning strategy set out multiple commitments and requirements in respect of the planning activities and outcomes that should be achieved for Gate 2. These were supplemented by additional requirements in subsequent RAPID and Ofwat documentation detailed below.

The objectives of this strategy are broadly to demonstrate progress against those requirements, update on the preferred consenting route for the SRO and set out key next planning steps and activities for the consenting process, including to Gate 3.

[6] Water Resources Management Plan 2020–70 (southernwater.co.uk)

2.6.3 Introduction

2.6.3.1 Overview

The Gate 2 Planning Strategy builds upon the initial consideration of the principal consenting route presented in the Gate 1 Submission: Annex 13 Planning Strategy.

The Planning Strategy is structured around the following sections:

- **Executive summary, background and objectives**
- **Introduction:** Overview of the Planning Strategy and confirmation of how actions agreed at Gate 1 have been addressed
- **Overview of work undertaken since Gate 1:** Detailing the work undertaken by SW's Town Planning team since Gate 1 to initiate early pre-application work, including that to inform selection of a principal consenting route for the Desalination Base Case
- **Development description:** Defining the preliminary description of development and development assumptions
- **Preferred consenting route:** Confirmation of preferred consenting route for the Base Case, informed by further legal and planning consideration
- **Schedule of main application deliverables and responsibilities:** Review and update of principal deliverables and responsibilities
- **Consenting programme for delivery**
- **Summary of consenting risks and countermeasures**
- **Conclusions and next steps**

2.6.3.2 Actions Agreed at Gate 1 & Gate 2 Requirements

Table 50 details the actions agreed for the Planning Strategy as part of SW's Gate 1 submission to RAPID, and the information which has been requested by RAPID to accompany the Gate 2 Planning Strategy. Table 50 confirms where this information is located within the Gate 2 Planning Strategy.

The table confirms that the requirements for the Gate 2 Planning Strategy specified in the Gate 1 submission and subsequent Gate 2 template and guidance have been fulfilled by this document.

Table 50 - Planning Strategy actions agreed at Gate 1 / Gate 2 Planning Strategy requirements

Source	Applicable Option	Requirement for Gate 2 Planning Strategy	Location within the Gate 2 Planning Strategy
G1 Planning Strategy (SW)	Base Case	For the Base Case solution, explore scope for requesting and obtaining a direction under section 35 (s35) of the Planning Act 2008.	Section 2.6.4: Overview of work undertaken since Gate 1
G1 Planning Strategy (SW)	All Options	Engagement with Defra, MHCLG and PINS and the local authorities.	Section 2.6.4: Overview of work undertaken since Gate 1
G1 Planning Strategy (SW)	All Options	Further assessments to confirm the development parameters for each progressed solution and Option type.	Section 2.6.4: Overview of work undertaken since Gate 1 Section 2.6.5: Development description
G1 Planning Strategy (SW)	All Options	Defining preliminary description of development, application boundary and development assumptions.	Section 2.6.5: Development description
G1 Planning Strategy (SW)	All Options	Consenting risk workshop.	Section 2.6.11: Summary of consenting risks & countermeasures

Source	Applicable Option	Requirement for Gate 2 Planning Strategy	Location within the Gate 2 Planning Strategy
G1 Planning Strategy (SW)	All Options	Preparation of an updated technical note supported by further legal and planning advice on selection and confirmation of preferred consenting route.	Section 2.6.6: Preferred consenting route
G1 Planning Strategy (SW)	All Options	Approach to EIA and associated assessments (e.g., HRA, WFD).	Section 2.6.8: Approach to EIA & associated assessments
G1 Planning Strategy (SW)	All Options	Preparation of a Planning Strategy setting out the deliverables and strategy for the preferred principal consenting route.	Section 2.6.6: Preferred consenting route. Section 2.6.7: Schedule of main application deliverables and responsibilities.
G1 Planning Strategy (SW)	All Options	Review and update the application programme; review inputs / outputs, dependencies and critical path.	Section 2.6.10: Consenting programme for delivery
G1 Planning Strategy (SW)	All Options	Review and update principal deliverables and responsibilities.	Section 2.6.7: Schedule of main application deliverables and responsibilities
G1 Planning Strategy (SW)	All Options	Establish application documents and plans (and owners).	Section 2.6.5: Schedule of main application deliverables and responsibilities
G1 Planning Strategy (SW)	All Options	Develop approach to other consents and licences.	Section 2.6.9: Approach to Other Licences & Consents
G1 Planning Strategy (SW)	All Options	Monitor the progress of consent applications being prepared by Portsmouth Water (Havant Thicket) and Bristol Water (Cheddar 2 Reservoir) and consider implications for consenting strategy.	Section 2.6.4: Overview of work undertaken since Gate 1
G1 Gate 2 Activity Plan (SW)	Base Case/ Desalination	For the Base Case solution, explore the engagement and development activities associated with the Scoping Report	Section 2.5 Environmental Assessment. Section 2.6.8 Approach to EIA and associated assessments.
G1 Determination (Ofwat)	All Options	Recommendation: Provide further detail on the planning risks and the planned mitigation measures.	Section 2.6.11: Summary of consenting risks and countermeasures
G2 Submission Template (RAPID)	All Options	Explain the preferred consenting route – DCO or TCPA	Section 2.6.6: Preferred consenting route
G2 Submission Template (RAPID)	All Options	Pre-planning application activity plan (land referencing, field surveys, environmental permitting plans)	Section 2.5 Environmental Assessment. Section 2.6.2 Overview of work undertaken since Gate 1.
G2 Submission Template (RAPID)	All Options	Highlight key planning steps and risks	Section2.6.6: Preferred consenting route. Section 2.6.11: Summary of consenting risks and countermeasures Section 2.6.12 Conclusions and Next steps

2.6.4 Overview of Work Undertaken since Gate 1

Since the Gate 1 submission, SW has progressed a number of key activities to initiate and progress early pre-application work, including that relating to the selection of a principal consenting route for the Base Case (Desalination) and to support the site and scheme selection process. These activities include:

- The appointment of a Planning & Consenting Lead for the WfLH programme, supported by a Town Planning team
- Delivery of a programme of consenting route workshops

- The design and implementation of a robust planning-led evaluation exercise as part of site / route and scheme selection for Gate 2 (see Section 2.4)
- Assessment work to confirm development parameters
- Stakeholder engagement – guided by a comprehensive approach to consultation and engagement
- Preparation of a draft request for a S35 direction under the Planning Act 2008
- Land referencing and engagement with landowners to secure land access for surveys
- Full consenting schedule reviews for the Base Case and alternatives
- Initiation of the procurement process to source the planning and consenting resource required to deliver consent for the Preferred Strategic Resource Option
- Identification of consenting risks
- Monitoring of applications for other strategic water resources

2.6.4.1 Consenting Route Workshops

SW's Town Planning team has undertaken a series of internal consenting route workshops for the Base Case and each of the alternative Options.

The purpose of the workshops was to define and test the development parameters and characteristics for each Option and its component parts to identify the key pertinent factors that will influence the development of a consenting strategy (e.g., temporary / permanent physical development required; land requirements; protected sites and species; utilities; transport undertakings; local policy; local authority administrative areas; and EIA).

Those attending the consenting route workshops included project managers, engineers, programme managers, land agents, environmental specialists, town planners and legal advisors.

2.6.4.2 Assessments to Confirm Development Parameters

The consenting route workshops enabled an assessment of the proposed development against relevant legislation and guidance to further consider the principal consenting regime for the Base Case and each alternative Option. SW will continue to review the approach to consenting route beyond Gate 2 and as the project develops further.

It has also enabled SW to identify the secondary consents and licences required to support each Option, confirm consultation requirements and define a consenting programme.

2.6.4.3 Stakeholder Engagement

SW's overall approach to pre-application engagement for the Base Case comprises different 'stages' of engagement, including specific public consultation exercises, which SW will undertake prior to submission of an application for consent.

In accordance with this approach, a non-statutory consultation exercise was undertaken between February 2021 and April 2021 ('the Stage 1 Consultation'). This focused on the Base Case and introduced the alternative solutions with a broadcast element to raise awareness of the WfLH programme. A Consultation Feedback Report, summarising issues raised in response to the consultation, was published in September 2021 to raise awareness and provide transparency in respect of the feedback received. The feedback received is being considered in the work to develop the preferred solution and SW will report on how that feedback has been taken into account and influenced its proposals at the next public consultation stage for the project. Section 2.8 Stakeholder & Customer briefly describes the nature of feedback received.

Following completion of the non-statutory consultation, ongoing engagement continued up to the Gate 2 submission. This included engagement with many of the key stakeholders specified under the various planning and regulatory regimes applicable to the delivery of SW's SRO, including the Defra, the PINS, statutory environmental bodies (EA, NE, MMO) and local authorities. This engagement principally focused on SW's site, route and scheme selection process, including methodology, assessment criteria and outcomes from the various process stages. The feedback helpfully flagged key issues important to those stakeholders in terms of technical inputs and outcomes and enabled SW to progress confidently towards Gate 2.

Whilst the Gate 1 Planning Strategy stated that engagement with the Ministry of Housing, Communities and Local Government (MHCLG) should be undertaken, SW does not consider that this is necessary at this stage in the programme or would be of benefit to the development of the approach to planning and consenting.

Beyond Gate 2, engagement will continue with key stakeholders across a number of technical disciplines (e.g., planning, environmental assessment, scheme development) as SW progresses the pre-application activities for the preferred solution. This will include up to two additional stages of public consultation (both statutory and non-statutory) if SW progresses along the DCO consenting route. This will enable all interested parties to provide meaningful input into SW's emerging proposals.

2.6.4.4 Section 35 Direction

SW has developed its case for obtaining a direction under s35 of the Planning Act 2008 for the Base Case and has discussed the scope of a potential application for a direction with Defra. This is because based on current information, the Base Case does not meet the relevant thresholds in terms of 'Deployable Output (DO)', as defined in the Planning Act 2008, to automatically fall within the Planning Act 2008 regime. However, this fact alone does not preclude a s35 direction being sought, subject to the below.

The key test in deciding whether to give such a direction is whether the Secretary of State considers a project that falls within one of the 'fields' prescribed in the legislation (one of which is 'water') to be 'nationally significant'. SW's 'case for national significance' for the Desalination Base Case is formed around the following key factors:

- Needs case – WRMP19 preferred strategy that responds to s20 Agreement and the WFD requirements to reduce river abstractions in drought conditions
- Project type – Recognising that the Base Case will be a desalination pathfinder for the UK and a potential controversial project / technology in its own right
- Size of the project and impacts across a 'larger than local' area – Noting the scale of plant and length of pipeline proposed, and likely impacts across sensitive marine and terrestrial environments, including National Park
- Economic significance – Recognising the importance of maintaining effective water supplies
- Timely delivery of consents – Noting the benefits of working to prescribed timescales as part of the DCO consenting regime
- Benefits of a largely single authorisation process provided by the Planning Act 2008 – Recognising the requirement for multiple marine and terrestrial consents, permits and licenses, as well as potential land acquisition
- Contribution to the UK Government's environmental objectives – i.e., in relation to water supply, WFD, etc.

It is not fatal that the size of the project (in terms of 'DO') does not automatically fall to be a NSIP for the purposes of the Planning Act 2008 – the case for 'national significance' is based on a number of factors that need to be taken together. Accordingly, and based on the above factors when considered together, SW considers that there is a strong case for receiving such a direction.

The intention is to apply for a direction shortly after SW's Gate 2 submission should the Base Case be confirmed as the preferred strategic resource solution.

2.6.4.5 Land Referencing, Access and Surveys

SW has undertaken the following activities prior to Gate 2:

- All potential main sites and pipeline routes have been referenced and identified registered owners contacted to obtain information on known land interests and constraints
- Where land is unregistered, site notices have been posted requesting those with land interests to make contact
- Information obtained has been collated to inform the development of the proposals and the Book of Reference
- Crown land and 'special' interests in, or categories of land under, S127 to S132 of the Planning Act 2008 have been identified
- Land interests have been contacted to secure agreement where access is required for engineering and ecological surveys

Activities proposed in the period to Gate 3 will include:

- Ongoing negotiations to secure land access for surveys
- Ongoing information gathering to inform SW's emerging proposals and develop the Book of Reference
- Engagement with land interests in accordance with s 42(1)(d) of the Planning Act 2008
- Early negotiations with landowners over potential Option agreements for securing land interests

2.6.4.6 Planning Application Monitoring

The Gate 1 Planning Strategy identified that SW should monitor the progress of consent applications being prepared by Bristol Water (Cheddar Reservoir 2) and Portsmouth Water (Havant Thicket Reservoir (HTR)) and consider implications for the consenting strategy. SW has closely monitored the progress of these two schemes.

Bristol Water – Cheddar Reservoir 2

The monitoring of this proposal was initially proposed on the basis that the Cheddar Reservoir 2 scheme could provide a potential source of water supply to SW. An extant (unimplemented) hybrid planning permission exists for the second reservoir at Cheddar, but this will expire in November 2021, and it is understood that this will not be implemented by Bristol Water. At the time of writing, SW is not aware that Bristol Water has progressed with either with the implementation of the extant consent or the preparation or submission of a further planning application for the Cheddar Reservoir 2 project. Moreover, SW's own consideration of this scheme has shown that it would not be a feasible water supply proposition.

It is considered that the current planning status of this scheme does not therefore have implications for the Base Case. This is because a new planning application for Cheddar Reservoir 2 is not under preparation and the consented scheme does not have an interaction with the Base Case.

Portsmouth Water – Havant Thicket

Hybrid planning applications for the HTR scheme, made under the TCPA, were submitted by PW to East Hampshire District Council and Havant Borough Council in November 2020. An outline planning application for the associated pipeline was submitted to Havant Borough Council at the same time. The hybrid approach to the reservoir planning application sought full planning permission for some components of the scheme and outline planning permission for others.

Resolutions to grant consent were made at the respective authorities' Planning Committees in June 2021, subject to completion of s 106 Agreements. SW will continue to monitor these applications through to issuing of formal planning consents and has more recently engaged with PW on the implications of these forthcoming consents on SW's emerging proposals for both its water transfer and water recycling proposals.

It is considered that the current planning status of the Havant Thicket scheme does not have implications for the Desalination Base Case. This is because the HTR scheme does not have an interaction with the Base Case, i.e., they are completely independent schemes.

2.6.5 Development Description

Site selection work has been undertaken prior to Gate 2 to determine the likely locations for key components of the Base Case (i.e., sites for desalination plant and corridors for pipeline). This has been necessary to determine the consentability of all SROs in order to confirm SW's preferred solution for delivery.

Post Gate 2, more detailed site and pipeline route planning will take place as part of scheme development for the preferred solution to determine land requirements and ultimately inform any application boundary for the project. Construction methods for the Base Case are being assessed as appropriate to the current level of design work completed to inform the proposals. Further consideration, including the method for laying of the pipelines, will be developed through the engagement, design and contracting processes.

It is important to note that any DCO application could, where appropriate, adopt a maximum 'design parameters' approach to design detail for the project rather than a detailed design that might be expected for a traditional full planning application approach.

Work undertaken to date to select likely locations for scheme plant and pipeline components has been based on areas of interest and indicative corridors. Sites and routes would be further defined through any DCO consenting process, including through comprehensive consultation and engagement, to determine appropriate application boundaries (or order limits) for the various aspects of the scheme. At this early stage of the process with considerable Optionality around the proposals, it is not possible or appropriate to indicate an application boundary.

2.6.5.1 Proposed Development

The principal elements of the Desalination Base Case that a consent application would be sought for are:

- Water abstraction intake structures within the Solent, PS and associated pipeline. The intake structures would comprise an underwater pipe located within the Solent that would transfer seawater to a terrestrial PS and a further pipeline to transfer the water from the PS to the Desalination Plant
- Desalination Plant at Fawley with an output in the range of between 61 and 75 million litres of water per day (Ml/d) in severe drought conditions
- Outfall infrastructure within the Solent, and tunnel / pipelines to connect the Desalination Plant to the outfall
- Underground pipeline to transfer water from the Desalination Plant at Fawley to Testwood WSW

These principal elements of the development would be support by 'associated development'. This could include (but is not limited to) receiving / blending tank infrastructure at Testwood WSW, temporary works to support construction, permanent works to support operation / maintenance, landscaping, accesses and utility connections for the site including electrical substation, telecoms, water and sewerage facilities, and environmental mitigation, enhancement and compensation measures.

2.6.5.2 Site Location

Each element of the Base Case would be located within the administrative areas of the New Forest District Council and New Forest National Park Authority, and Hampshire County Council as county authority.

Site selection work leading up to Gate 2 has had regard to consultation and engagement feedback to determine the preferred site location for the Desalination Plant at Fawley; the water abstraction intake structures and PS; outfall and tunnel / pipelines; and the pipeline to transfer water from the Desalination Plant at Fawley to Testwood WSW.

The broad location of the Desalination Plant infrastructure would be in Fawley, Hampshire as per the WRMP19 Preferred Strategy. The site is a field adjacent to the former Fawley power station site. Fawley is situated within New Forest District and New Forest National Park, on the Western shore of the Solent, approximately 22 km south of Southampton.

The Testwood WSW is located in [redacted]. [redacted] is situated [redacted].

The proposed water abstraction intake structure and outfall would be within the Solent and outer areas of Southampton Water (all areas within the MMO's administrative area and beyond the local authorities' administrative boundaries) which are of high biological and nature conservation importance. Whilst the exact location is to be confirmed, the site would fall within the Solent and Dorset Coast SPA, which has been designated for important bird species that breed and feed in the area. These elements of the Base Case may also need to pass through, or near to, the North Solent SSSI and the Solent and Southampton Water SPA and Ramsar, which support large numbers of breeding seabirds.

Large areas of the surrounding coastline are also designated under the Solent Maritime SAC. A number of MCZs are designated in the Solent and wider English Channel, the nearest of which is the Yarmouth to Cowes MCZ located on the North-West coast of the Isle of Wight.

Some terrestrial elements of the Base Case could be located within the New Forest National Park, which carries a high level of protection under national planning policy to ensure the protection of natural beauty, wildlife and cultural heritage.

2.6.6 Preferred Consenting Route

2.6.6.1 Overview

As set out in SW's Gate 1 Planning Strategy, two principal consenting routes are potentially available for the Base Case and alternative Options: planning permission under the TCPA and a DCO under the Planning Act 2008.

Works in the marine environment would require a Marine Licence under the Marine and Coastal Access Act 2009, which can be included (on a 'deemed' basis) within a DCO.

The benefits and disbenefits of each principal consenting route were also included in the Gate 1 Planning Strategy. This assessment and consideration of consenting route has been reviewed and developed following the further appraisal and consultation work which has been undertaken since September 2020.

2.6.6.2 Assessment

For the Base Case, the opportunities and risks for each principal consenting route are detailed in Table 51 for the TCPA regime and Table 52 for the DCO regime.

Table 51 - TCPA regime – opportunities and risks associated with the consenting regime

Opportunities / Benefits	Disadvantages / Threats
• More common consenting route, familiarity by local authorities. • The mechanisms for material amendments under the TCPA are established and understood. • Likely to be quicker to obtain Planning Permission over a DCO (assuming no lengthy public inquiry which is not guaranteed). • A lower level of pre-application consultation and associated evidence required at submission, less 'front loaded'.	• Multiple planning permissions required due to the scale of the project, may present difficulties in terms of coordination of approach / lead authority and inconsistent consents, or risk of one element of the project failing at a late stage and delaying the ability to implement other elements. • Increases the number of separate secondary consent applications required. • Determined in accordance with the local development plan. • Lower requirements for community / stakeholder pre-application consultation, unforeseen risks / issues may arise during determination. • A full planning application is likely to require a much higher level of design detail than a DCO, based upon precedent from other similar projects and planning applications. • Potential for greater risk to challenge on EIA (no requirement for the preparation of a PEIR under TCPA). • No supplementary powers are available through the TCPA process when compared to the wide range of powers and consents that can be 'wrapped up' in a DCO. • No mechanisms of regulating relationships with key stakeholders, particularly in terms of asset protection (in contrast to a DCO, which can include 'protective provisions' for regulating key interfaces). • The ability to secure compulsory acquisition and temporary possession powers in respect of land required fall outside of the TCPA process – therefore a separate process would be required after the planning permission is granted in the event that land purchase cannot be agreed. This would potentially create significant delay in the programme if required.

Table 52 - DCO regime – opportunities and risks associated with the consenting regime

Opportunities / Benefits	Disadvantages / Threats
• The certainty of timely delivery and the largely single authorisation of consents enabled by the Planning Act 2008 regime would be critical for SW to meet its s20 Agreement obligations – absent this, a range of different consenting applications would be required, which increases risks in terms of programme and delivery. • The DCO regime would provide for a more flexible consent on an adaptive basis in terms of DO (a TCPA planning permission would be limited to a threshold below 80 Ml/d) enabling greater capacity to be secured if future modelling requires higher water resource requirements. • Provides policy certainty as the draft NPS establishes the needs case where schemes are specified in a water company's WRMP.	• Secretary of State may refuse a request for a direction to make the project qualify as a NSIP • Likely to take longer to secure than Planning Permission (if no public inquiry or compulsory acquisition hearings and TCPA advisory timescales are met – this is not guaranteed, so in reality the timescales may well be similar). • Requires significant investment upfront - 'front loaded' approach (e.g., surveys, consultation with stakeholders and the community, issue resolution). • Overall cost is likely to be more for DCO compared to TCPA (cost of front-loading, documentation, consultation and examination, expert team, etc) • Retaining flexibility in the design (e.g., the 'envelope' or parameters-based environmental

Opportunities / Benefits	Disadvantages / Threats
• The DCO regime has now been in place for some time, meaning it is a tried and tested method for achieving consent for large infrastructure projects. Linked to this, good practice has evolved significantly – as such, no need to 're-invent the wheel' in respect of preparatory work. • High success rate, particularly for projects with NPS support. Front loaded nature and PINS acceptance gate before examination helps to reduce successful judicial review challenges. • Land requirements (in terms of both the need for land to be acquired compulsorily and occupied temporarily) - a DCO would avoid the need for separate processes which could otherwise create delays and risks in programme - dealing with issues once means 'making the case' for compulsory acquisition can be more straightforward. • Greater potential to avoid historic issues of lengthy / costly delays during consideration of the application. Inquisitorial examinations are typically more favourable than adversarial inquiries • Reduces the number of separate consent / permit applications required. Enables the Applicant to incorporate a range of other critical consents and powers within the one instrument, including the ability to compulsorily acquire land and to agree protective provisions where third party interests may be affected, resulting in a consistent consent in terms of requirements/conditions. • Suited to developments crossing large areas and multiple local authorities (e.g. pipelines). • DCO consents typically build in a greater level of design flexibility through assessments based on 'envelopes' ('Rochdale Envelope' - a parameters-based assessment, for example setting maximum building size/footprint). A DCO typically also includes 'limits of deviation' to allow flexibility during detailed design/construction. • Can incorporate mechanisms to deal with key interfaces (e.g. assets of statutory undertakers and other bodies) through protective provisions and therefore meaning objector management can be more straightforward.	assessment) may result in conservative assessments and greater impacts reported. • Material amendments to DCOs have not been tested (the first is currently going through the process) and the material amendment procedure is similar to that for making a new DCO application but in a shortened form (only non-material amendments have been approved to date and that is a well understood process). Some Applicants revert to TCPA to amend consent as a result (in terms of development that does not constitute the NSIP).

2.6.6.3 Consenting Strategy

The consenting strategy set out in this section represents SW's current preferred approach, which may be subject to change if the Base Case is developed further beyond Gate 2.

Drawing on the benefits and disbenefits of the principal consenting routes for the Base Case, and consistent with the Gate 1 Planning Strategy, a DCO continues to be the favoured consenting route at this stage due primarily to:

- The certainty of timely delivery and the largely single authorisation of consents enabled by the Planning Act 2008 regime which is critical for SW to meet its 'all best endeavours' s20; Agreement with the EA - absent this, a range of different consenting applications would be required, which increases risks significantly in terms of programme and delivery.
- The ability to include powers to compulsorily acquire and temporarily occupy land, as well as other critical consents, which would otherwise need to be sought separately - a DCO would avoid the need for separate processes which could otherwise create delays and risk in the programme).

- The scale and complexity of the Base Case, which would impact the number and extent of consents ordinarily required, for example significant marine works for the desalination plant. The need to obtain a number of different consents for both the terrestrial and marine elements of the Base Case would otherwise place a burden on the determining authorities.
- Clarity and support of national policy, in the form of the expected National Policy Statement (NPS) for Water Resources Infrastructure, which identifies desalination as an infrastructure type to address England's future water supply needs and is likely to confirm the 'need' for a particular scheme when it is included in a WRMP.
- High success rate, particularly for projects with NPS support. Front loaded nature and PINS's acceptance gate before examination helps to reduce successful judicial review challenges.
- Significant opportunities for public participation.
- The scope of powers and other provisions that can be included, beyond traditional consents (e.g., in relation to operation and for multiple marine and terrestrial licences).

Whilst a DCO is currently SW's preference, the activities and schedule for a TCPA consenting route have been broadly considered, should further detailed work show that a TCPA route is more preferable or that a s35 direction is not forthcoming. The work in respect of the TCPA route has not been included here for brevity, although the high-level learning from that work is that whilst a TCPA consenting route may appear to be a quicker route to consent, it does not offer the certainty of consenting timescales provided by the DCO route including in relation to land acquisition powers.

It is recognised that the Base Case, with an output of 61-75 Ml/d under drought conditions, does not automatically qualify as a NSIP under the Planning Act 2008 since it falls short of the 80 Ml/d qualifying threshold on DO. Therefore, it can only proceed under the DCO consenting route where it is the subject of a s35 direction. As outlined above, SW has engaged with Defra on the scope of a s35 request and it is anticipated that an application will be made to Defra shortly after the Gate 2 submission, should the Desalination Base Case be confirmed as SW's preferred SRO.

The key test in deciding whether to give such a direction is whether the Secretary of State considers a project to be 'nationally significant' under s35 (2)(c) of the Planning Act 2008. This is not based on bare 'DO' alone – instead, a range of factors will need be considered 'in the round' and these are considered earlier in this chapter.

On the basis of the factors identified, SW considers that a strong case can be made that the Base Case Option is 'nationally significant'.

2.6.7 Schedule of Main Application Deliverables and Responsibilities

Table 53 - **Indicative schedule of main application deliverables and responsibilities**details an indicative schedule of the potential main application deliverables and responsibilities for the Base Case, on the basis that the DCO regime is the principal consenting route for this Option.

Regulations 5, 6 and 7 of the Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 ('the Regulations') set out the statutory requirements for what must accompany an application for development consent made under the Planning Act 2008.

In formulating the schedule for the Base Case, SW has given regard to the 2009 Regulations as well as guidance issued by the Department for Communities and Local Government (now Ministry of Housing, Communities and Local Government) and relevant Advice Notes published by the PINS[7].

The schedule of main application deliverables is at this time indicative. In due course, SW will engage with the PINS to discuss the schedule as part of pre-application discussions. The precise list of application deliverables would be confirmed nearer to the submission of the DCO application.

The 'Responsible workstream' column in Table 53 - **Indicative schedule of main application deliverables and responsibilities**reflects workstreams of qualified professionals established within SW to develop the development consent application.

Table 53 - Indicative schedule of main application deliverables and responsibilities

Category	Document Type	Responsible Workstream
Application cover documents	Application form	Planning & Consenting
	Introduction to the application	
	s 55 checklist	
	Glossary	
	Electronic index	
	Signposting document	
	Copies of newspaper notices	
Plans / Drawings / Sections	Location plan	Engineering & Design
	Land plans	
	Works plans	
	Access / rights of way plan	
	Site layout plan	
	Elevation drawings	
	Floor plans	
	Access / parking / landscape	
	Drainage / surface water	
	Other detailed plans	
	Plan of statutory / non-statutory sites or features	
	Plan showing statutory or non-statutory historic or scheduled monument sites	
	Charts for marine schemes	
Draft DCO	Draft proposed DCO	Legal
	Explanatory memorandum to draft DCO	
Compulsory Acquisition Information	Statement of reasons	Land & Property
	Funding statement	
	Book of reference	
Reports / Statements	Consultation report	Planning & Consenting

[7] Planning Inspectorate (2021) Advice Note Six: Preparation and submission of application documents. Available at: https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-six-preparation-and-submission-of-application-documents/

Category	Document Type	Responsible Workstream
	Project overview	
	Funding statement	Strategy & Regulation
	Transport assessment	Environmental
	WFD assessment	
	Details of other consents and licences	Planning & Consenting
	Biodiversity net gain report	Environmental
EIA & habitat regulations information	ES	Environmental
	ES technical appendices	
	Non-technical summary	
	Scoping opinion	
	Habitats Regulation Assessment	
	Mitigation route map	
	Publicity requirements	Stakeholder Engagement
Photographs	Photographs and photomontages	Engineering & Design

2.6.8 Approach to Environmental Impact Assessment (EIA) and Associated Assessments

Outlined below is a summary of SW's approach to undertaking an environmental assessment of the Base Case, including other associated assessments. Further detail can be found in the Environmental Chapter of this report.

In accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations), and as the project is likely to fall within the remit of the EIA Regulations, a formal EIA will be required as part of the application for a DCO or TCPA consent. An ES, the report documenting the EIA process, will be prepared. The ES will describe the likely significant effects predicted to occur as a result of the construction and operation of the project, whether alone or in combination with other relevant development. It supports, and is submitted as part of, the DCO application.

In summary, the EIA process will consist of the following key stages:

- **EIA Scoping**: Scoping is the first major milestone of the EIA process and sets out the initial project description, identifies the key topics of potential environmental impact and sets out the proposed methodologies by which these impacts are proposed to be investigated and assessed. The 'Scoping Opinion', published by the PINS in response to a Scoping Request from the project promoter, is a crucial part of the Scoping process, in which it outlines its response to the scope, and level of detail the Applicant is proposing to include in the ES. In accordance with Regulation 14(3)(a) of the EIA Regulations, where a Scoping Opinion has been adopted, the Applicant's ES should "*be based on the most recent scoping opinion adopted (so far as the proposed development remains materially the same as the proposed development which was subject to that opinion)*".
- **Preliminary Environmental Information (PEI)**: PEI is the overarching term that describes a range of information that is provided by the Applicant in advance of the formal submission of the final ES alongside the DCO to assist consultees in understanding the likely environmental effects of the Project, and to inform their consultation responses. The PEI can include an early version of the ES, although it is not a requirement, to allow stakeholder feedback to inform the final submission and

aims to reach agreement with key stakeholders on key impacts and mitigation proposals in advance of the DCO examination where possible; and

- **ES**: The ES is the final report which sets out the methods, data, assessments, consultation and recommendations of the EIA process to inform the decision-makers during the examination and determination process.

A key role of the EIA process will be to set out measures envisaged to avoid, prevent, reduce or (where possible) offset any significant adverse effects on the environment.

To date, SW has progressed work on the EIA process, namely in relation to the preparation of an EIA Scoping Report. An EIA methodology document has been prepared and is currently being quality assured. The EIA methodology document will provide a framework for the EIA Scoping Report, which will be submitted to PINS (or the Local Planning Authorities in the event of a TCPA consenting route). SW will engage with relevant statutory and non-statutory bodies, including local authorities, on the development of this methodology as a precursor to engage on the subsequent scoping report.

The EIA process will be supported by a number of other assessments, including for example an assessment under the Habits Regulations (HRA) and a WFD compliance assessment.

The HRA for the Base Case will follow the four-stage process defined by PINS (2012), as summarised below.

1. **Stage 1**: Screening is the process which initially identifies the likely impacts upon a National Site Network site of a project or plan, either alone or in-combination with other projects or plans and considers whether these impacts may be significant. It is important to note that the burden of evidence is to show, on the basis of objective information, that there will be no significant effect; if the effect may be significant, or is not known, that would trigger the need for an Appropriate Assessment (Stage 2).
2. **Stage 2**: Appropriate Assessment is the detailed consideration of the impact on the integrity of the National Site Network site of the project or plan, either alone or in-combination with other projects or plans, with respect to the site's conservation objectives and its structure and function. This is to determine whether there is objective evidence that adverse effects on the integrity of the site can be excluded. This stage also includes the development of mitigation measures to avoid or reduce any possible impacts. Where adverse impacts on the integrity of a site cannot be ruled out, it is necessary to proceed to Stage 3.
3. **Stage 3**: Assessment of alternative solutions is the process which examines alternative ways of achieving the objectives of the project or plan that would avoid adverse impacts on the integrity of the National Site Network site, should avoidance or mitigation measures be unable to prevent adverse effects. Where no alternative solution can be identified which would meet the strategic objectives of the project, and adverse effects remain, it is necessary to proceed to Stage 4.
4. **Stage 4**: At Stage 4 an assessment is made as to whether the development is necessary for Imperative Reasons of Overriding Public Interest (IROPI) and, if so, of the compensatory measures needed to maintain the overall coherence of the National Site Network.

A WFD compliance assessment will be required to assess compliance of the proposed construction, operation and decommissioning activities with The Water Environment (England and Wales) Regulations 2017. This assessment will comprise of screening, scoping and detailed assessment stages, in accordance with guidance from the PINS (PINS, 2017) and the EA (EA, 2016). It will outline any appropriate mitigation measures required to ensure compliance with the WFD.

A MCZA will be required where there are interactions with a MCZ, as required under the Marine and Coastal Access Act (2009). HRA and MCZA will be dealt with in parallel to the EIA.

2.6.9 Approach to Other Consents and Licences

Table 54 - **Secondary licences and consents**below is an update of the table presented within SW's Gate 1 Planning Strategy and sets out the secondary licences and consents that may be required for the Desalination-based Option. As set out previously, the list, which is not exhaustive at this stage of design development, presents the licences and consents that may be required as part of the solution design, scheme construction and operational phases of the project.

To reiterate, under a DCO consenting route, some secondary consents will be automatically disapplied by the Planning Act 2008 (Category A), some will only be included (or 'deemed') with the agreement of the consenting body (Category B), and the need for others can be overridden by powers in the DCO itself (Category C). This enables the DCO to act, as far as possible, as a single overarching consent.

Table 54 - Secondary licences and consents

Activity	Licence / Consent / Permit or Permission	Regulating or Consenting body	Timescale to prepare application documents (approx.)	Timescale for determination	Surveys and assessments Required	Category	Notes	Options A.1 and A.2
Land based developments (environmental buffer, booster stations, pipelines)								
Works within, or with the ability to affect, a SSSI	SSSI Assent	NE	4 weeks	28 Days	Phase 1 Ecology Survey	C	The consent is personal to the owner / occupier of the land included in the SSSI (s 28E WCA 1981). Where consent is required for operations on a SSSI, this must be sought from Natural England by the owner/occupier so that those operations may lawfully be carried out	Yes All pipeline routes have the potential to impact SSSIs (e.g., The New Forest, North Solent SSSI etc)
Works that could disturb European protected species (e.g., badger, bats, great crested newt, listed birds).	European Protected Species Licence	NE	Species-dependent	30 Days	Protected species surveys	B	Some species may require translocation under licence.	Yes Desk-based assessment has indicated presence of protected species within study area (e.g., GCN, reptiles, bats)
Works affecting an important hedgerow, if the hedge is: A rural hedge, more than 20 m long (or any part of such a length). Less than 20 m long but meets another hedge at each end. Located on or next to: Land used for agriculture or forestry. Land used for keeping horses, ponies or donkeys Common land. A site of special scientific interest. A local nature reserve. A public right of way	Hedgerow Removal Notice	Local Planning Authority	4 weeks	6 weeks	Phase 1 Habitat Survey High Resolution Aerial Photography Hedgerow condition assessment.	C	The hedgerow removal notice must be served by either the owner of the hedgerow or a 'relevant utility operator' (as defined by the HA 1997, if to be removed by or on behalf of that operator) who is not the owner, following which the LPA will either serve on that person written notice that the hedgerow may be removed, or the 42-day period has expired without the LPA serving a hedgerow retention notice (Regulation 5, HR 1997). Reg 6(1)(e) of the Hedgerow Regs permits hedgerow removal if it is required for development authorised by a planning permission or deemed planning permission - hence may perhaps be disapplied by grant of a DCO.	Yes Aerial photography has indicated the presence of hedgerows along pipeline routes which are likely to be deemed important through survey
Works to trees with Tree Preservation Orders	Tree Preservation Order Consent	Local Planning Authority	6 weeks	8 weeks	Arboriculture Impact Assessment and Method Statement	C	Regulation 13 TPR 2012 states that subject to the exceptions in regulation 14, no person shall—(a) cut down;(b) top;(c) lop;(d) uproot;(e) wilfully damage; or(f) wilfully destroy, any tree to which an order relates, or shall cause or permit the carrying out of any of the activities in sub-paragraphs (a) to (f) to such a tree, except with the written consent of the authority and, where such consent is given subject to conditions, in accordance with those conditions	Potentially applies To be confirmed through desk study, maps to be obtained from relevant LPAs
Works to trees located within a Conservation Area	Notification of works	Local Planning Authority	6 weeks.	6 weeks	Arboriculture Impact Assessment and Method Statement	A	The outcomes are either: the local authority makes a TPO to protect the tree; or does not make a TPO and allows the work to go ahead.	Potentially applies Conservation Areas to be mapped as part of planning policy review
Tree Felling Licence required where more than 5m^3 per quarter for non-statutory functions, i.e., habitat restoration/management.	Tree Felling Licence	Forestry Commission	4 weeks	12 weeks	Arboriculture survey Arboriculture Impact Assessment and Method Statement	B	An application for a felling licence may be made by 'a person having such an estate or interest in the land on which the trees are growing as enables him, with or without the consent of any other person, to fell the trees' (s 10 FA 1967).	Yes Whilst impacts to trees to be avoided where possible, some trees will require felling (e.g., Ashlett Creek)
Requirement to temporarily close a public right of way	Temporary Closure Order	Local Planning Authority	2 weeks	8 weeks	Public Right of Way condition assessment	A	The DCO would include a schedule of roads and PRoW to be closed. However, there would still be a requirement to serve notice of the closure. Closures and diversions are likely to be required at multiple stages	Yes A number of pipeline routes are constructed in/along/near to Public Rights of Way

Activity	Licence / Consent / Permit or Permission	Regulating or Consenting body	Timescale to prepare application documents (approx.)	Timescale for determination	Surveys and assessments Required	Category	Notes	Options A.1 and A.2
Requirement to permanently close or divert a public right of way	Stopping up or extinguishment of a public right of way	Local Planning Authority	2 weeks	16 weeks	Public Right of Way condition assessment	A	As above	Yes Footpath known to cross northern part of Ashlett's Creek, connecting Ashlett with Stonehills
Works of demolition, alteration or extension to a listed building that affect its character as a building of special architectural or historic interest. The requirement applies to all types of works and to all parts of those buildings covered by the listing protection (possibly including attached and curtilage buildings or other structures), provided the works affect the character of the building as a building of special interest.	Listed Building Consent	Local Planning Authority	2 weeks	8 weeks	HER Records Search Heritage statement	A		Potentially applies A number of Listed Buildings located along route, potential impacts associated to HGV movement (routes unknown at this stage, setting etc.
Works and other activities that physically affect a scheduled monument.	Scheduled Monument Consent	Historic England	8 weeks	8 weeks	HER Records Search Heritage statement	A		Potentially applies Whilst no direct impacts anticipated, potential impacts to setting to be confirmed through assessment
Works in, over, under or affecting the flow of an ordinary watercourse	Ordinary Watercourse Consent	Local Planning Authority or Internal Drainage Board	4 weeks	8 weeks	Flood Risk Assessment	B	s 120(3) of the Planning Act 2008 states that an order granting development consent may make provision relating to, or to matters ancillary to, the development for which consent is granted. s 120(4) and Schedule 5 states that this may include in particular the diversion of navigable or non-navigable watercourses. s 23(1) of the LDA 1991 provides that no person shall erect any mill dam, weir or other like obstruction to the flow of any ordinary watercourse or raise or otherwise alter any such obstruction or erect a culvert in an ordinary water course or alter a culvert in a manner that would be likely to affect the flow of an ordinary watercourse, without the consent of the drainage board concerned. s 23(6) states that nothing in this section shall apply to any works carried out or maintained under or in pursuance of any Act or any order having the force of an Act. The DCO is an order having the force of an act, so land drainage consent is not required.	Yes A number of pipeline routes are constructed in, or near to, Ordinary Watercourses
Works on or near a main river, on or near a flood defence structure, in a flood plain or, on or near a sea defence	Standard or Bespoke Flood Risk Activity Permit EA	12 weeks Flood Risk Assessment	4 weeks		Topographic Survey Flood Risk Assessment WFD Compliance Assessment Phase 1 Ecology Survey	B	Environmental Permits are granted to the 'operator' of a regulated facility ((Reg 13, EPR 2016). The 'operator' is the person who has control of the facility (Reg 7, EPR 2016). The regulator (the EA in England) may transfer an Environmental Permit to a proposed transferee on the joint application of the operator and proposed transferee (Reg 21, EPR 2016).	Yes
	Flood Risk Activity Exemption	EA	4 weeks	7 days	-			
Discharging liquid or wastewater into surface water that does not comply with the 'Temporary dewatering from excavations to surface water'	Standard or Bespoke Environmental Permit for dewatering	EA	4 weeks	12 weeks	Flood Risk Assessment Protected Species Surveys	B		Potentially applies Requires ECI

Activity	Licence / Consent / Permit or Permission	Regulating or Consenting body	Timescale to prepare application documents (approx.)	Timescale for determination	Surveys and assessments Required	Category	Notes	Options A.1 and A.2
New water discharge activity	Standard or Bespoke Environmental Permit	EA	8 weeks	12 weeks	Flood Risk Assessment	B		Yes
Operation of a Part A1 Low Impact Installation	Standard or Bespoke Environmental Permit	EA	8 weeks	16 weeks	Protected Species Surveys Habitats Regulation Assessment Environmental Impact Assessment WFD Assessment	B		
Operation of Part B Activities related to Local Air Pollution Prevention and Control (this includes the processing of used concrete with a mechanical crusher (for use onsite or at another designated site).	Environmental Permit	Local Planning Authority	12 weeks	Four weeks' notice of deployment	Environmental Impact Assessment	B		Yes
New requirement to abstract over 20 cubic metres a day and / or impound water by creating a new sluice, weir or dam	Abstraction/Impoundment Licence	EA	12 weeks	16 weeks	Protected Species Surveys Habitats Regulation Assessment WFD Assessment	B		Yes
Temporary abstraction of more than 20 cubic metres of water a day over a period of less than 28 days	Temporary abstraction licence	EA	12 weeks	28 days	-	B		Potentially applies, to be confirmed by ECI
Connection to a mains sewer		Local Water Authority	8 weeks	Varies	-	C		Yes
New potable mains water connection		Local Water Authority	8 weeks	Varies	-	C		Yes
For connection of a business to the main sewer supply	Trade Effluent Consent	Local Water Authority	8 weeks	Up to 2 months	-	C		Yes
Activities involving use, treatment, disposal or storage of waste (e.g., screening and blending of waste, aerosol crushing, composting, etc.).	Standard or Bespoke Environmental Permit for using, treating, storing and disposing of waste	EA	8 weeks	Up to 4 months	-	B		Yes
	Exemption for using, treating, storing and disposing of waste	EA	8 weeks	5 working days	-	B		Yes
Treatment of waste bricks, tiles and concrete by crushing, grinding or reducing in size	T7 waste treatment exemption	Local Planning Authority	4 weeks	5 working days	Ground investigation	C		Potentially applies To be confirmed through ground investigation
Approval for noise generating activities during construction	Section 61 consent (noise and/or vibration)	Local Planning Authority	4 weeks	4 weeks	Noise Impact Assessment	C		Yes Proximity of development to residential/sensitive receptors
The operation of a mobile plant for the treatment of soils and contaminated material, substances or products.	Standard rules mobile plant permit	EA	8 weeks	Up to 4 months	Ground Investigation	B		Potentially applies Will depend on ground investigation
Permanent alterations or improvements to a public highway.	Section 278 highways agreement	Local Planning Authority	8 weeks	Up to 6 months	Topographical Survey Traffic Count Data Visibility Splays	C		Yes Likely to be required for Ashlett's Creek
Transport of an Abnormal Load	Notification	Police, Highways Authorities and bridge and structure owners like Network Rail	8 weeks	1 week	-	C	An 'abnormal load' is a vehicle that has any of the following: • a weight of more than 44,000 kg • an axle load of more than 10,000 kg for a single non-driving axle and 11,500 kg for a single driving axle	Potentially applies Requires Early Contractor Involvement (ECI) input

Activity	Licence / Consent / Permit or Permission	Regulating or Consenting body	Timescale to prepare application documents (approx.)	Timescale for determination	Surveys and assessments Required	Category	Notes	Options A.1 and A.2
							• a width of more than 2.9 metres • a rigid length of more than 18.65 metres	
Transport of a Special Load	Notification	Police, Highways Authorities and bridge and structure owners like Network Rail	8 weeks	Up to 10 weeks	-	C		As above
Applications for road closures and other restrictions which require a Temporary Traffic Regulation Order (TTRO). This includes restrictions on county roads, footpaths and bridleways.	Temporary Traffic Regulation Order	Local Planning Authority	4 weeks	12 weeks	-	C		Yes
Works affecting Network Rail Land (Within 15 m)	Asset Protection Agreement	Network Rail	12 weeks	8 weeks		C		Yes Pipeline routes will need to pass beneath Main Line Connecting Totton with Ashurst
Hold certain quantities of hazardous substances at or above defined limits.	Hazardous Substance Consent	Local Planning Authority	9 weeks	8 weeks	-	C		Potentially applies
Works within Common Land and/or village greens	Section 38 Consent	Planning Inspectorate	8 weeks	6 months	Environmental Impact Assessment	C	Land referencing complete for A1, currently proposed for remaining SROs	
Marine based development (including intake structures, outfalls)								
Following activities within the UK marine area: Construction (including laying of cables, maintenance, alteration or improvement of existing structures and assets) Dredging Deposit of any substance or object Removal of any substance or object Incineration of any substance or object	Full Marine Licence	MMO	12 weeks	13 weeks (target)	Environmental Impact Assessment WFD Assessment Habitat Regulations Assessment	B		Yes Requires construction activity below MHWS
Works affecting marine protected species	Marine European Protected Species Licence	MMO	-	30 Days	Protected species surveys	B		Yes
Works involving the laying, maintenance and operation of cables and pipelines on the seabed around England, Wales and Northern Ireland out to twelve nautical miles.	Licence to lay and operate a pipeline	Crown Estates	-	Dependant on type, location and size of activity	Environmental Impact Assessment WFD Assessment Habitat Regulations Assessment	C		Yes
Works involving the extraction of marine sand and gravel resources from the seabed	Licence to extract aggregate/ undertake dredging	Crown Estates		1 year	Habitat Regulation Assessment	C		No No extraction currently anticipated

2.6.10 Consenting Programme for Delivery

The indicative programme below (as illustrated in Figure 45 **- Desalination - indicative DCO consenting programme**) provides an optimised schedule for DCO delivery. It identifies the key consenting related activities that drive the consenting critical path, including s35 direction, scoping, PEIR, public consultation, EIA and DCO application and examination.

The programme provides important visibility of the key consenting stages and timelines for the project and enables more detailed activities to be defined and planned moving forward. SW's P6 schedules for the Base Case and alternative strategic resource Options contain the detailed deliverables and activities required against the timelines within the indicative consenting programme below.

Key assumptions behind this programme include:

- Only one SRO being progressed post Gate 2 submission into the planning process;
- Sufficient resourcing is in place to deliver this programme on time;
- External assurance, dependencies and approvals are in place as and when required;
- Consenting deliverables for subsequent RAPID gates represent progress updates aligned to the consenting schedule;
- Two further public consultations are required; and
- The level of design detail for any DCO application will be at a 'maximum design parameters' level of design rather than 'detailed'

Although timescales have been broadly considered, a contingency programme for a Town & Country Planning Application consenting route has not been prepared for the Base Case at this stage due to the high degree of confidence that a desalination proposal of the scale and complexity envisaged would be directed by the Secretary of State (via a s35 Direction) as a NSIP, enabling its entry into the DCO consenting regime.

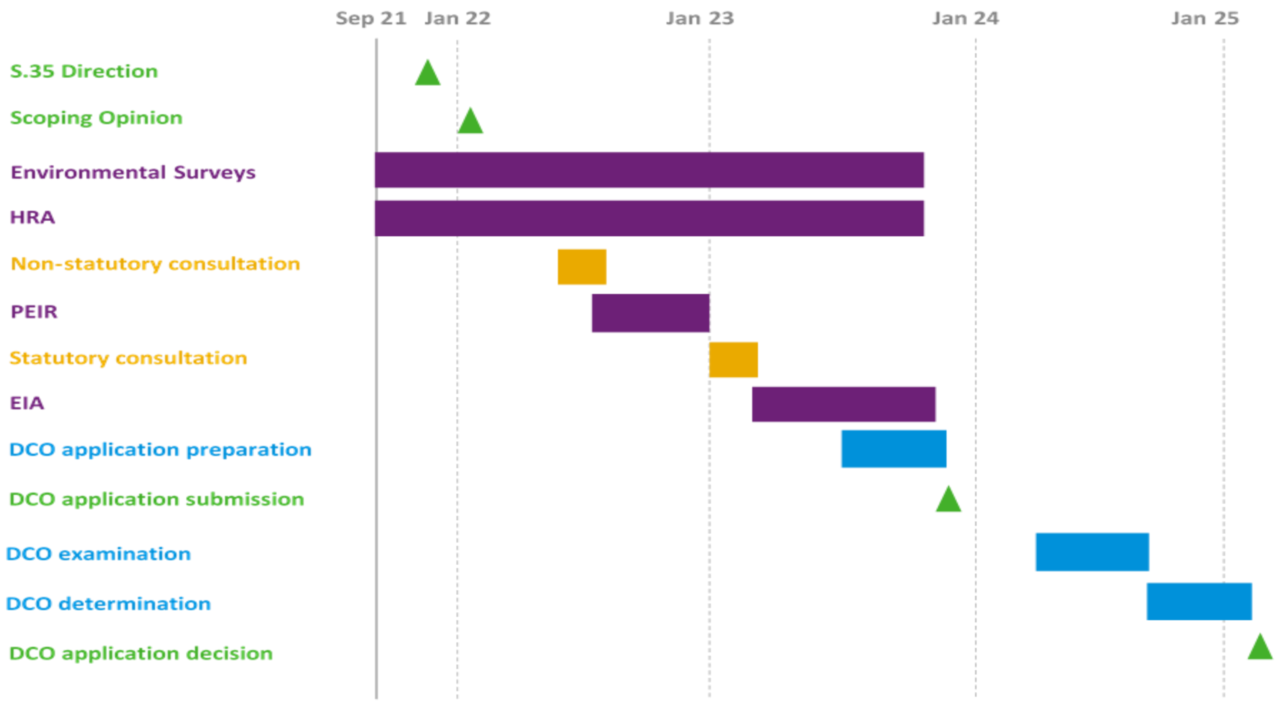


Figure 45 - Desalination - indicative DCO consenting programme

2.6.11 Summary of Key Consenting Risks and Countermeasures

The key consenting risks associated with the proposed Desalination-based Option are as detailed in Table 55 below. All these risks sit within either the WfLH Programme Level Risk Register or the relevant Project Level Risk Register where they are actively managed in accordance with the WfLH Risk Management Strategy and Process. In addition, in the event that these risks are considered 'key Project risks' (see Section 2.7 Risk Management for definition), they are included in more detail in Section 2.7.2 and the risk ID is included below for reference.

Table 55 - Key consenting risks and countermeasures

Risk	Risk Description	Risk Mitigation
s35 Direction (Aligned to risk ID Prog-R22. See Section 2.7.2)	SW's preference to utilise the DCO consenting regime cannot be realised because the SRO is below the NSIP thresholds, and a s35 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 2.7.2)	Progress of the SRO through the DCO consenting route is frustrated because there is delay in obtaining a timely s35 Direction.	As above. Ensure stakeholder awareness of consenting activities that affect critical path.
TCPA route (Aligned to risk ID Prog-R22. See Section 2.7.2)	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 processes are not sufficiently robust.	Undertake rigorous Consenting 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 2.7.2)	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 2.7.2)	Desalination proves not considered to be consentable at this location, at this time if other less environmentally damaging alternative solutions are available to meet the WRMP19 need.	Apply a rigorous Consenting 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. See Section 2.7.2)	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 Consenting 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.

2.6.12 Conclusions and Next Steps

The consenting route review within this planning strategy reaffirms SW's initial view at Gate 1 that a DCO is the preferred route to consent based on a number of factors, including the need for the scheme and benefit of timely delivery, the scale and significance of the scheme, it's complex terrestrial and marine interfaces and various consents required, and likely significant impacts across a 'larger than local' area.

The strategy also confirms that, based on current understanding of the project characteristics, access into the DCO consenting regime would not be automatic, i.e., the project does not currently meet the thresholds for being defined as a NSIP. Projects can however be directed into the DCO regime through a s35 direction by the Secretary of State – SW's consideration of the factors to support such a direction suggest that a strong case can be made.

In addition, the strategy identifies likely DCO application deliverables, the secondary consents and licences required in conjunction with planning consent and potential land acquisition powers, the approach to environmental assessment and potential consenting risks. Overall, it demonstrates that sufficient progress has been made in undertaking various planning and consenting activities in line with Gate 1 commitments and Gate 2 requirements.

Listed below are the key next steps in progressing the consenting activities related to the Base Case post Gate 2, informed largely by the draft consenting schedule in section 2.6.9 above, and assuming that the Base Case remains the preferred solution for delivery:

- Ongoing refinement of high-level consenting schedule, aligned with other regulatory and procurement processes, and incorporation of detailed activities to achieve key consenting milestones into P6 schedule;
- Submission of s35 Request to Defra;
- Submission of a Scoping Request to the PINS following any s35 Direction from the Secretary of State;
- Commencement of early environmental and other impact assessment activities to inform the initial environmental appraisals / PEIR for the next stage of public consultation;
- Mapping out the key stages of project design development to align to the consenting process and key stages of consultation and engagement;
- Refinement of the approach, procurement of the necessary resource, and mapping out of the deliverables required for next stage of public consultation, including any Statement of Community Consultation;
- Ongoing resource planning and procurement of resource necessary to progress through the planning process; and
- Increased levels of stakeholder, community and landowner engagement in accordance with SW's approach to stakeholder engagement

2.7 Risk Management

2.7.1 Risk Management Methodology

2.7.1.1 Risk Management Strategy Summary

The key assumption, risk and issue information detailed throughout this section have been captured, assessed and managed in accordance with the WfLH Programme Risk Management Strategy that was detailed within Section 1 of Annex 14 Risk Report WfLH Strategic Programme of the SW, WfLH Gate 1 submission.

The WfLH Programme Risk Management Strategy has been created specifically for the WfLH Programme through utilisation of the defined WfLH Programme Structure (Programme, Workstream and Project), and alignment to the Risk Management Process within the SW Risk Management Handbook, as well as the wider SW Engineering & Construction (E&C) Risk Management Strategy, where appropriate, as illustrated in Figure 46. Alignment with the SW E&C Risk Management Strategy was considered to be appropriate as the Project types within the WfLH Programme, whilst complex, are sufficiently similar to those delivered by the wider SW organisation. However, for the purposes of Section 2.7, only the elements of the WfLH Programme Risk Management Strategy which are relevant to the SROs are discussed.

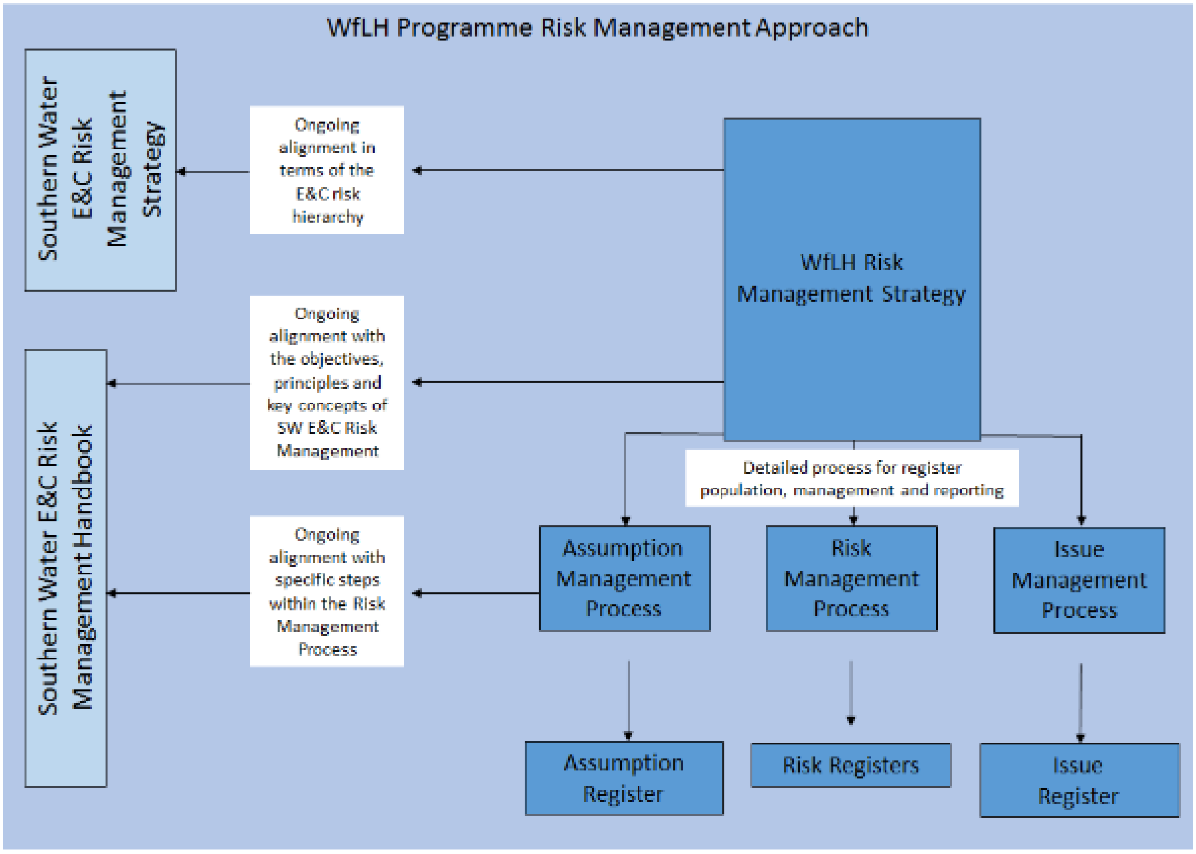


Figure 46 - WfLH Programme Risk Management Strategy

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. It defines and communicates the approach relating to the management of assumptions, risks and issues that could impact on the achievement and satisfactory delivery of all objectives associated with the WfLH Programme. The WfLH Programme Risk

Management Strategy is then supported by the relevant Process, which explains in detail how relevant assumptions, risks and issues will be identified, assessed, mitigated, reviewed, escalated and communicated. Therefore, in relation to the SROs within the wider WfLH Programme, this ensures coverage across all aspects of their lifecycle from concept to operation, as illustrated in Figure 47, and through the full extent of the WfLH Programme Structure from Programme, Workstream to Project. An example of this hierarchy, and an indication of the levels within the hierarchy where risk information is captured, is illustrated in the summary diagram within Figure 48. As illustrated in Figure 48, risk information is not captured at the Workstream level. This is aligned to the wider SW E&C Risk Management Strategy.

For further detail in relation to the specific dates of the future RAPID gates as well as the tendering, construction and handover phases illustrated in Figure 47, see Section 2.9, Schedule.

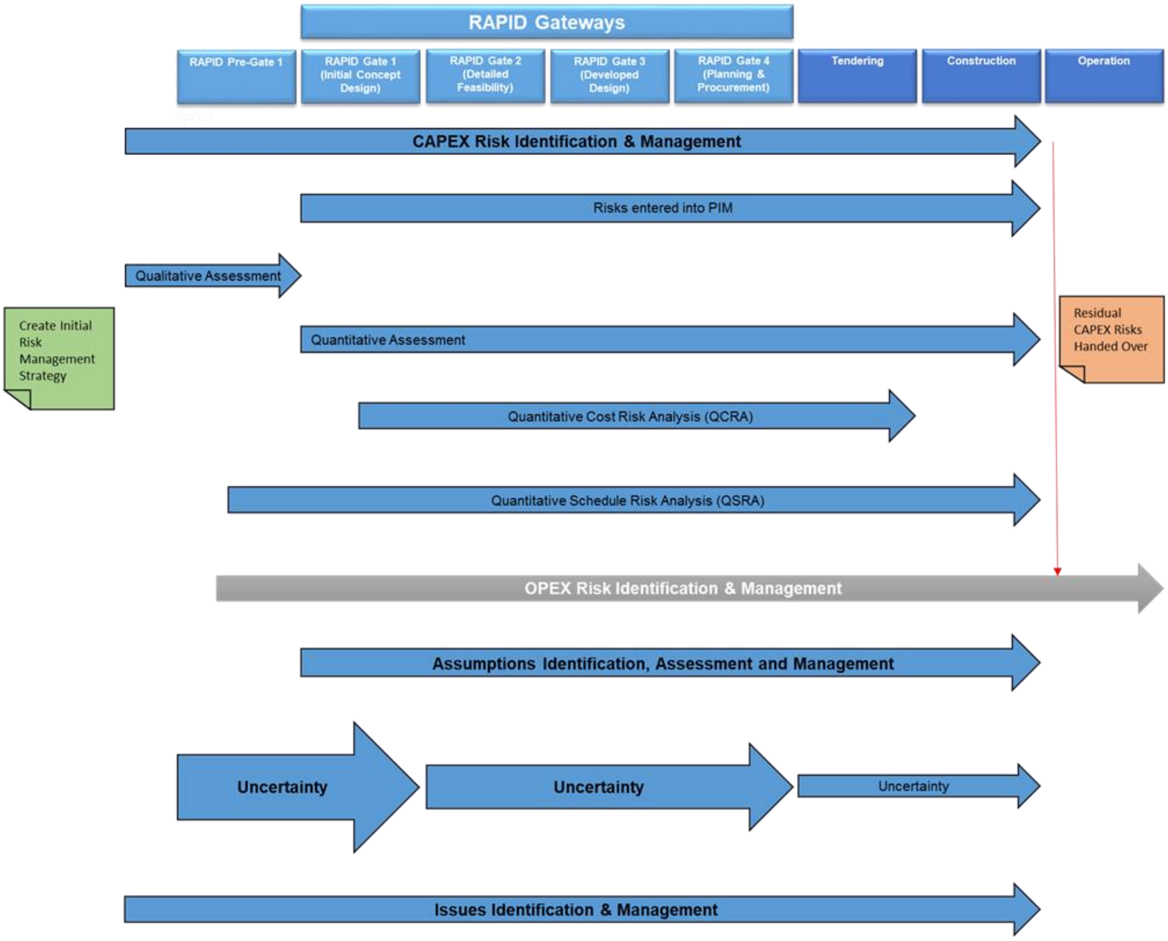


Figure 47 - WfLH Programme Risk Management Timeline

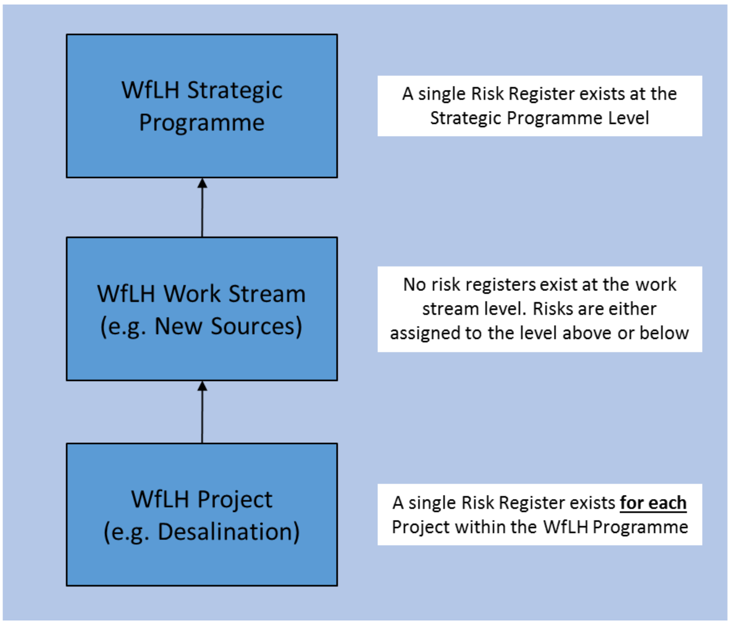


Figure 48 - WfLH Programme Risk Management Structure Summary

Administering the WfLH Programme Risk Management Strategy effectively in relation to the SROs within the WfLH Programme involves undertaking a number of key activities. These activities have included the development of the WfLH Programme Risk Management Strategy utilising the defined WfLH Programme Structure (Programme, Workstream and Project), following the steps within the Assumptions Management, Risk Management and Issues Management Processes, and undertaking any specific, specialist risk management techniques, as indicated within the relevant sections of the WfLH Programme Risk Management Strategy.

Since Gate 1, the following risk management activities have been completed:

a) The entering of risk information into the mandated SW E&C Risk Management System, Programme Insight Manager (PIM) in accordance with SW governance requirements
b) Quantification of new and existing risk information incorporating evolving sources of information and the changing Programme lifecycle stage
c) Reporting of key risk information at the agreed WfLH Programme governance forums including Project Boards, Monthly Performance Reviews, WfLH Programme Steering Group and the WfLH Executive Programme Board as part of the automated monthly reporting cycle
d) Development of the Base Case and Strategic Alternative cost estimates using quantitative cost modelling techniques
e) Strategic Risk Modelling utilising the latest information in relation to the realisation of the benefits of the schemes contained within the WRMP19 Preferred Strategy to determine the Supply Demand Deficit value
f) A Schedule Risk Profile has been applied to each of the development schedules to express the risk and uncertainty contained within the schedule assumptions

The following risk management activities are undertaken on an ongoing basis:

- The ongoing management and communication of the quantified risks contained within those previously created registers utilising the Risk Management Process as detailed in the Risk Management Strategy

- The ongoing management and communication of the assumptions contained within the previously created register utilising the process as detailed in the Risk Management Strategy
- The ongoing management and communication of the issues contained within the previously created register utilising the process as detailed within the Risk Management Strategy

Following Gate 2, in addition to the above ongoing activities, the following risk management activities will take place:

- An updated review of the risk and uncertainty, with further modelling undertaken as required
- Refinement of the Base Case cost estimate, again utilising quantitative cost modelling techniques that integrate base cost, uncertainty and risk
- Ongoing review of the P6 schedule to refine the risk profile as schedule detail increases, utilising risk modelling techniques as appropriate

2.7.1.2 Risk Terminology

Throughout this section 2.7, unless expressly stated, the term 'risk' incorporates both threats and opportunities. This is in accordance with Section 1.3 of the SW Risk Management Handbook, the wording of which is illustrated in Figure 49.

Risk

A risk is an uncertain event or set of circumstances that, should it occur, will affect (in either a positive or negative way) the achievement of one or more objectives. A positive risk event that will have a beneficial effect on one or more of the objectives or facilitate other benefits is referred to as an Opportunity. A negative risk event that will have an undesirable effect on one or more of the objectives is referred to as a Threat.

For the remainder of the Handbook, the term Risk refers to both Threats and Opportunities, unless it is explicitly stated otherwise.

Figure 49 - Threat and Opportunity Terminology

2.7.2 Risk Management Analysis

2.7.2.1 Gate 2 Key Information Selection Approach

Section 2.7.2.3 details2.7.2.3 the key assumptions, key risks and key issues that have the potential to impact on the successful delivery of the Desalination Solution, which incorporates two specific Options (A.1 and A.2) as detailed in Table 56. For more information in relation to the Desalination Solution, see Section 2.1.

Table 56 - Desalination-based Options

Solution	Option No.	Option Name
Desalination	**A.1 (Base Case)**	**75 Ml/d desalinated water direct to Testwood WSW**
	A.2 (Strategic Alternative)	61 Ml/d desalinated water **direct** to Testwood WSW

It should be noted that A.1, a 75 Ml/d Desalination Plant at Fawley, is included within the Preferred Strategy in WRMP19, and is referred to as the Base Case. A.2, along with other Strategic Alternatives, is also included in the Gated Process and is assessed as required by Ofwat in 2019 PR19: Final Determinations, to satisfy requirements for the consideration of alternatives under regimes such as the Habitats Regulations and WFD in the context of the consenting process, and in case the Base Case is determined not to be deliverable.

Owing to the similarities between A.1 and A.2, for efficiency, the key assumptions, key risks and key issues are listed for the Desalination Solution in its entirety. A summary of the tables and their contents is detailed in Table 57 below.

Table 57 - Summary of Section Tables

Content	Key Assumptions	Key Threats	Key Opportunities	Key Issues
Desalination (Option A.1 & A.2)	Table 61	Table 62	Table 63	Table 64

Key Assumption Criteria

Stability:	Sensitivity:
A – Very Confident B – Fairly Confident C – Uncomfortable D – Very Uncomfortable	A – Minor Impact B – Manageable Impact C – Significant Impact D - Critical Impact
Confidence that the assumption will turn out to be correct?	Impact in the event that the assumption turns out to be incorrect.

Figure 50 - Assumptions Analysis Assessment Criteria

K2.7.2.3ey assumptions within the risk register have been selected for inclusion based on a combination of their stability (confidence in the assumption) and sensitivity rating (impact of an incorrect assumption), as per Gate 1 and illustrated in Figures 50 and 51. Both stability and sensitivity are scored on a scale of A to D. Similar to risks and issues, assessment is undertaken as the assumption is identified but reassessment takes place through the life of the assumption as further information is obtained. For those assumptions that, when assessed, return a score of CC, CD, DC or DD, they are transferred to the appropriate risk register, and managed as part of the Risk Management Process.

The focus of the key assumptions in this section 2.7.2.3is therefore not on those assumptions that have already been transferred to the Risk Management Process, but instead on those that are close to being considered as risks. Therefore, in order to be selected as a key assumption for inclusion within Section 2.7.2.3 the assumption must score as either BC, CB, BD or DB against stability and sensitivity respectively.

Whilst not a selection criterion for the purposes of this document, in addition to stability and sensitivity, each assumption is also assigned a Red, Amber, Green (RAG) status to indicate the current state of the assumption in terms of management intervention. The RAG status definitions are illustrated in Figure 51.

Basic RAG Definitions	
Red	Escalated. Item requires urgent management action to mitigate or remedy
Amber	Problem(s) identified and/or building up. Expectation is that this can be handled within the Programme Team. However, flagged amber to notify management of potential future escalation
Green	Satisfactorily managed/tolerated. No management action required at this point in time.

Figure 51 - Assumptions RAG status

Key Risk Criteria

The term key risk translates within Section 2.7 as key project risk. This is to ensure it is distinguished from key technical risks (e.g., key engineering risks) that are referenced in other sections within this document. In relation to the key risks, the key threats shown throughout Section 2.7.2.3have been selected for inclusion based on their Current Risk Score. Key threats are defined as those threats with a Current Risk Score of 19 or greater (the most significant risks). This ensures that all threats scored as high when plotted on the WfLH Programme Probability Impact Diagram (PID) are included, as illustrated in Figure 52.

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

Figure 52 - WfLH Programme Probability Impact Diagram

All opportunities, regardless of Current Risk Score, are included within the key opportunity tables.

Key Issue Criteria

In relation to the key issues selected, these have been included within Section 2.7.2.3 based on their impact on the successful delivery of the Solution in the event that mitigations were not undertaken. Issue impact is rated on a scale of negligible, minor, major and critical. For the purposes of the key issues contained within Section 2.7.2.3 only those issues assessed as having a major or critical impact on the successful delivery of the Solution are included.

2.7.2.2 Gate 2 RAPID Requirements

The following narrative has been prepared to specifically respond to the comments received by RAPID within the Gate 1 Final Decision.

Actions and Residual Risk Relationship

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 to ensure an ongoing link between the identified actions and the Residual Risk Score.

Despite the above, it is still important to note that the approach does not guarantee that the proposed implementation of mitigation actions will result in a change to the Residual Risk Score, when compared to the Current Risk Score. However, it does guarantee that **consideration** of the mitigation actions will be given when assessing the Residual Risk Score. In addition, 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.

Scoring Criteria

Since Gate 1, the information contained within the key risk tables have been updated to provide greater clarity and transparency in relation to the Current and Residual Risk Scores. This has resulted in the key risk tables now including the input score assigned to the probability and each individual impact, in order that the Current and Residual Risk Score calculations are visible.

For each risk, the probability is assessed in a quantitative manner on a scale of 1% to 99%. This quantitative value is then assigned a qualitative score based on the parameters illustrated in Figure 53 (opportunities) and Figure 54 (threats) below. This approach is in accordance with the wider Risk Management Process as contained within the SW Risk Management Handbook.

PROBABILITY				
VL	L	M	H	VH
Less than 11%	11 to 30%	31 to 50%	51 to 70%	Over 70%

Figure 53 - Qualitative Probabilities for Opportunities

PROBABILITY				
VL	L	M	H	VH
Less than 11%	11 to 30%	31 to 50%	51 to 70%	Over 70%

Figure 54 - Qualitative Probabilities for Threats

In addition to the probability, each risk is assessed against 5 potential impacts. These impacts are detailed in Table 58 and can either be positive (opportunities) or negative (threats).

Table 58 - Risk Impact Descriptions

Impact	Impact Description
Cost	The risk results in a financial change to the relevant cost objectives.
Time	The risk results in change to the delivery date of one or more key milestones within the schedule.
Reputation	The risk results in company exposure to either a regulator, industry press, or the wider media.
Quality	The risk results in a change to the suitability of the end product being delivered.
Operational Service	The risk results in a change to the service normally received by SW customers.

Similar to the probability assessment, each impact is qualitatively assessed on a scale of 1 (Very Low) to 5 (Very High), as illustrated in Figure 53 (opportunities) and Figure 54 (threats). These Qualitative Impact tables, similar to the Qualitative Probability tables, are utilised as the approach is in accordance with the Risk Management Process within the SW Risk Management Handbook. However, if following assessment of an impact, it is deemed that the impact does not apply to a particular risk, the impact may be scored with a 0 (Negligible). In the event that an impact is scored as 0, this is not included within the key risk tables within Section 2.7.2.3. It should also be noted the cost impact is now assessed in the first instance as a quantitative impact using a 1-point (Most Likely cost), 2-point (Minimum and Maximum cost) or 3-point (Minimum, Most Likely and Maximum cost) estimate, which is then translated to a qualitative impact for the purpose of calculating the risk score. This is a significant step forward in the risk assessment process since Gate 1 and shows in practice the evolving nature of the Risk Management Strategy designed for the WfLH programme.

Impact Score		Very Low (1)	Low (2)	Medium (3)	High (4)	Very High (5)
Cost	RSK – OPPORTUNITY CLASSIFICATION	<=1.25% saving of Project Forecast outturn (excl. risk). 1.25% is VL.	>1.25% - 2.5% saving of Project Forecast outturn (excl. risk); 2.5% is L.	>2.5% - 5% saving of Project Forecast outturn (excl. risk); 5% is M.	>5% - 10% saving of Project Forecast outturn (excl. risk); 10% is H.	>10% saving of Project Forecast outturn (excl. risk); More than 10% is VH.
Time		Time saving on key milestone by 7 days (1 week).	Time saving on key milestone of 8 - 14 days (1 - 2 weeks).	Time saving on key milestone of 15 - 28 days (2 – 4 weeks).	Time saving on key milestone of 29 - 56 days (1 - 2 months).	Greater than 57 days (2 months) time saving on key milestone, and / or any time saving to regulation date or project completion date.
Reputation		Insignificant reputational enhancement.	Local reputational enhancement and increased stakeholder satisfaction.	Local reputational enhancement and increased stakeholder confidence.	Beneficial regional reputational enhancement and increased stakeholder confidence.	Extremely beneficial reputational enhancements, association with high profile national interests.
Quality		Minor enhancement to functionality of solution.	Some enhancement to functionality of solution.	Significant enhancement to functionality of solution.	Major enhancement to functionality of solution.	Major enhancement to functionality of solution, and / or programme outputs.
Operational Service		Service supply benefits would be negligible to public.	Small numbers of customers would benefit better supply.	Moderate numbers of customers would benefit from better supply.	Large numbers of customers would benefit from better supply.	Large numbers of customers benefit. Significant geographical area improvement.

Figure 556 - Qualitative Impacts for Opportunities

Impact Score		Very Low (1)	Low (2)	Medium (3)	High (4)	Very High (5)
Cost	RSK – OPPORTUNITY CLASSIFICATION	>0 - <=1.25% of Project Forecast outturn (excl. risk); 1.25% is VL.	>1.25% - 2.5% of Project Forecast outturn (excl. risk); 2.5% is L.	>2.5% - 5% of Project Forecast outturn (excl. risk); 5% is M.	>5% - 10% of Project Forecast outturn (excl. risk); 10% is H.	>10% of Project Forecast outturn (excl. risk); More than 10% is VH.
Time		Up to 7 days (1 week) added to key milestone date.	8 - 14 days (1 - 2 weeks) added to key milestone date.	15 - 28 days (3 - 4 weeks) added to key milestone date.	29 - 56 days (1 - 2 months) added to key milestone date.	Greater than 57 days or more (2 months) added to key milestone date and / or any impact to regulation date or project completion date.
Reputation		Insignificant reputational impact.	Local press article low running order. E.g. Operations action criticised from partner forums, local pressure groups, alleged "expert", etc.	Criticism in industry press or local press front page. E.g. Southern Water Operations proposals / outcomes receive negative reaction in the national water forums, and / or from Regulator(s).	Local TV / tabloid press low running order. E.g. Southern Water reputation impacted (e.g. incident, business performance, HR issue, etc.) and publicised negatively by Regulator(s) and water pressure groups.	National media coverage in TV and newspapers. Failure to adequately address known problem or to anticipate or prepare for unpredictable occurrence. Southern Water Group bondholder's confidence severely impacted.
Quality		Negligible requirements impact; functionality of solution / deliverable not impacted.	Some requirements impacted; functionality of solution / deliverable will be fit for purpose.	Key requirements impacted; functionality of solution / deliverable will be fit for purpose.	Key requirements will not be achieved; functionality of solution / deliverable severely impacted and / or anticipated programme outputs will not be achieved.	Solution / deliverable will not be fit for intended purpose and / or programme outputs will not be achieved.
Operational Service		Effects would be "invisible" to customers.	Small numbers of customers would be affected. Minimal degradation of Standard of Service.	Moderate numbers of customers affected. Moderate degradation of service delivery.	Large numbers of customers affected. Widespread degradation of service delivery.	Large numbers of customers affected. Widespread failure.

Figure 567 - Qualitative Impacts for Threats

Once the probability and impact are assessed for each risk, these input scores, ranging from 1 (Very Low) to 5 (Very High) for probability and 0 (Negligible) to 5 (Very High) for each impact, are automatically plotted on a Probability Impact Diagram (PID), which then determines the overall risk score. Separate assessments are conducted for the current and residual positions.

The key risk tables in Section 2.7.2.3 have therefore been updated to show the both the current and residual qualitative probability score and current and residual qualitative impact scores in order to provide this enhanced clarity of the Current and Residual Risk Scores. In addition, the key impact or impacts that are driving the risk score are highlighted in bold in order to provide further clarity.

Risk Categorisation

As stated in the narrative above, the information within Section 2.7 relates only to key items impacting on the SRO Solution (and specific Options), as per the assessment criteria detailed. As explained at Gate 1, the risk identification process has been designed to be suitably robust to support the agreed scope of risk management as defined in the WfLH Programme Risk Management Strategy. This scope is defined as "those items that have the potential to impact on the successful delivery of their respective benefits and objectives, across all SRO relevant aspects of the WfLH Programme lifecycle from concept to operation, and throughout the SRO relevant extent of the defined WfLH Programme Structure".

In order to constantly review the robustness of this identification process to ensure full coverage of the information captured, assessed and managed, each assumption or risk is assigned an appropriate SW category depending on whether the risk sits at the Programme level (illustrated in Table 59) or Project level (illustrated in Table 60). In addition, these SW categories have been mapped to the RAPID categories used in the Quarterly Dashboards to ensure alignment and consistency for both reporting internally and externally.

Table 59 - Programme assumption and risk categories

WfLH Programme Category	RAPID Category
Programme Scope, Requirements & Benefits	Other
People & Resourcing	Stakeholder
Engineering & Technical	Water Quality
Reputation & Public Perception	Stakeholders
Regulatory	Stakeholders
Budgetary & Financial	Budget
Planning & Consents	Planning
Legal	Planning
Operational	Stakeholder
Schedule	Timetable
Commercial & Supply Chain	Stakeholders

Table 60 - Project assumption and risk categories

WfLH Project Category	RAPID Category
Access	Land
Asset Condition	Stakeholders
Contractor Performance	Stakeholders
Design Development	Other
Estimating	Budget
Ground & Environmental Conditions	Environment
Handover to Operations	Stakeholder
Procurement	Stakeholders
Scope & Requirements	Other
Stakeholders & Approvals	Stakeholders
Testing & Commissioning	Other

Ongoing analysis of these categories is then undertaken to provide confidence that all types of assumptions and risk have been considered, and that specific types of assumptions and risks are not being overlooked. This has helped to ensure that items relating to cost, benefits, project activities (e.g., environmental, engineering, process design, etc.), dependencies, regulatory barriers, and the long-term operation of the asset have, as a minimum, all been considered, and will continue to be considered, throughout the risk management process.

Therefore assumptions, risks and issues may well be referenced throughout other sections of this Conceptual Design Report. However, given the explanation of the criteria used for enabling the inclusion of any key assumptions, key risks and key issues within Section 2.7.2.3 2.7.2.3, these items listed elsewhere in this Conceptual Design Report may not be repeated in Section 2.7.2.3 and therefore may not appear to show alignment. However, alignment checks have been undertaken and assessment of each of those items has been undertaken. Where those items have been assessed and meet the criteria detailed in the narrative above, alignment will exist with Section 2.7.2.3. Where 2.7.2.32.7.2.3those items do not meet the selection criteria, those items will only be listed in their respective technical section.

Sections where assumptions, risk and issues information can be found elsewhere within this Conceptual Design Report include:

1. Section 2.2 Engineering Design: Section 2.2.8
2. Section 2.3 Network Infrastructure; Section 2.3.8.3
3. Section 2.6 Planning and Consenting: Section 2.6.9
4. Section 2.9 Schedule: Section 2.9.4

RAPID Quarterly Dashboard Alignment

The key risk and issues contained within Section 2.7.2 are fully aligned to those contained within the latest RAPID Quarterly Dashboard.

2.7.2.3 Key Assumptions, Key Risks and Key Issues

Table 61 - Desalination Key Assumptions

Assumption ID	Assumption Description	Stability	Sensitivity	Validation / Mitigation Strategy	RAG Status
WfLH-A0066	It is assumed that there will be sufficient capacity locally within landfill sites throughout the life of the asset to receive the solid waste (namely sludge cake) generated by the wastewater treatment process. This relates to the ongoing operation of the plant.	C	B	Validation: Treatment is expected to be required to reduce the concentrations of suspended solids, and treatment chemical residuals, in the wastewater generated by the pre-treatment processes. The waste streams from the treatment process are yet to be characterised and the terms of any environmental discharge permit for the works are unknown. Gate 2 activities specified to support with progressing environmental discharge permit applications (e.g., site selection and more detailed desalination process design). The solid waste produced by this system is expected to have minimal residual value, making it likely that disposal in suitable waste facilities will be required. Mitigation: The ongoing design activities include development of the process design, supported by the seawater sampling programme; this is expected to include construction of a mass balance, which will be used to evaluate solid waste production, and the composition of the waste streams. This information will be used to assess suitable export destinations and relevant third parties (e.g., landfill operators) will be engaged to determine their capacity to support these exports. This will also include investigation into whether the waste could be used within our own treatment centres.	A
WfLH-A0082	It is assumed that during the tunnelling works associated with the Intake and Outfall structures, as assumed in the latest schedule, no UXO strike will occur.	B	D	Validation: The threat profile associated with UXOs during the tunnelling works only takes into account delay owing to investigation and removal of suspected and confirmed UXOs. Mitigation: Specialist contractors will be engaged in order to provide information on likelihood of encountering UXOs during the tunnelling works, as well as the tunnelling procedures to mitigate against UXO strike during the construction works.	A
WfLH-A0024	It has been assumed that there is sufficient market appetite for the DPC process to be utilised whilst still delivering on SW's legal obligations, including timescales.	B	D	Validation: Current concerns over the varying complexity of Options being taken through the early Gate stages, and the impact this will have on the market. In addition, there are concerns over the current tight timescales for delivery, and the impact this will have on appetite to respond. The procurement process is currently one of the key drivers to successfully delivering the strategic solution in accordance with the s20 agreement obligations, including timescales. Informal engagement with potential bidders has taken place to obtain information on the current market appetite and to capture key concerns in order that these can be resolved in advance of the formal tender process. Mitigation: Ensure that evaluation criteria are suitably selected to not discourage potential bidders. Look at benchmarking / lessons learned of other major national projects in order to understand the level of information that will be expected to be available for potential bidders to be interested in the Project. Continue with informal engagement with potential bidders in order that interest is maintained, and SW are aware of concerns. Set clear expectations with potential bidders around the management of bid costs.	G

Assumption ID	Assumption Description	Stability	Sensitivity	Validation / Mitigation Strategy	RAG Status
WfLH-A0085	It is assumed that only one SRO will be progressed following the Gate 2 submission and developed into the Planning Process.	B	C	Validation: Assumption is based on the delivery schedule and the purpose of the RAPID Gate 2 for an Option to be selected for development. However, a Back-Up Option may be maintained in the event of concerns with the chosen SRO. Mitigation: Following the conclusion of the Options Appraisal process ensure that any work on the back-up solution does not undermine the Base Case.	A
WfLH-A0083	It is assumed that there is no requirement from SW Operational Leads to include an Option for replacing the single 800 mm diameter pipe with two x 600 mm diameter pipes.	B	C	Validation: The spatial constraints along the route result in this potential change not being viable. There is no engineering requirement for a twin main solution to be considered. Reverting to a twin main solution from the single 800mm diameter design would result in a significant cost increase owing to additional materials. Mitigation: Final confirmation of engineering standards that a twin main design is not required. Ensure narrative included to state that physical route constraints mean that a twin main design is not viable.	G
WfLH-A0084	It is assumed that, to align with SW Standards, a 2nd main is not required to be included within the design at critical crossings for resilience purposes.	B	C	Validation: The SW standard is to install a 2nd main at critical crossings. However, the design lead has engaged with the principal and owing to precedent on other works, plus that fact that all assets will be sleeved at critical crossings, it has been agreed that this is not required. Installation of a 2nd main at critical crossings would result in a significant cost increase owing to additional materials. Mitigation: Final confirmation from principal through the design development process to ensure approval of design.	G
WfLH-A0064	It is assumed that variations in source water salinity will remain sufficiently low that a high-capacity buffer volume is not required as part of the abstraction provisions to mitigate the control issues associated with large and rapid deviations in this key process variable.	B	C	Validation: The available sampling data shows variations up to 15% at individual sampling points from the phase one sampling off the Fawley coast; this variation is expected to be due to tidal movements in these estuarine waters, taking place over the course of several hours. In order to create an issue that needs resolving using a high-capacity buffer volume, the variance would need to be an order of magnitude higher. Variation exists in both the natural variation of salinity as well as the interaction between the intake and the outfall structures. Mitigation: Continued measurement of seawater salinity under the coastal sampling programme to confirm that variations are within the assumed levels.	G

Table 62 - Desalination Key Threats

Risk ID	Description	SW RBS	RAPID Category	Start Date & Activity ID	Expiry Date & Activity ID	Probability	Impact	Score	Mitigation Strategy	Probability	Impact	Score
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.	Schedule	Timetable	31/3/27	29/10/30 DSLN.TCH.00150	5	**Reputation: 5** Op. Service: 4	25	Following finalisation of the P6 schedule at Gate 2, 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.	4	**Reputation: 5** Op. Service: 4	24
710059-008	Owing to the need to gain approval from a number of stakeholders (ABP Southampton, MMO, EA and NE) and 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 & Approvals	Stakeholders	28/9/20	21/4/25 DSLN.CON.02200	5	**Cost: 5** **Time: 5** Reputation: 4 Quality: 2	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.	4	**Cost: 5** **Time: 5** Reputation: 4 Quality: 2	24

Risk ID	Description	SW RBS	RAPID Category	Start Date & Activity ID	Expiry Date & Activity ID	Probability	Impact	Score	Mitigation Strategy	Probability	Impact	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 & Consents	Planning	27/1/22 NWSR.KEY.00020	21/4/25 DSLN.CON.02200	4	**Quality: 5 Op. Service: 5**	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.	3	**Quality: 5 Op. Service: 5**	22
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).	Estimating	Budget	18/7/23 DSLN.DGN.00100	24/9/25 DSLN.PRO.03140	5	**Cost: 4**	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.	4	**Cost: 4**	21

Risk ID	Description	SW RBS	RAPID Category	Start Date & Activity ID	Expiry Date & Activity ID	Probability	Impact	Score	Mitigation Strategy	Probability	Impact	Score
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 Section 35 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 & Consents	Planning	28/9/20	14/12/21 DSLN.CON.00150	4	Cost: 1 **Time: 5** Reputation: 4 Quality: 2 Op. Service: 3	24	Prepare and submit a robust and well-reasoned request for Section 35 direction to the Secretary of State, taking into account any comments resulting from any Defra pre-submission engagement.	3	Cost: 1 **Time: 5** Reputation: 4 Quality: 2 Op. Service: 3	22
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 & Approvals	Stakeholders	28/9/20	21/4/25 DSLN.CON.02200	4	Cost: 3 **Time: 5** Reputation: 4 Quality: 2	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.	3	Cost: 3 **Time: 5** Reputation: 4 Quality: 2	22

Risk ID	Description	SW RBS	RAPID Category	Start Date & Activity ID	Expiry Date & Activity ID	Probability	Impact	Score	Mitigation Strategy	Probability	Impact	Score
710059-004	There is a risk that compensatory habitats are required in relation to the Desalination Scheme, resulting in additional costs and potential delays depending on the habitat required.	Ground & Environmental Conditions	Environmental	30/1/21	21/4/25 DSLN.CON.02200	4	**Time: 5** Cost: 4 Reputation: 3	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.	3	**Time: 4** Cost: 4 Reputation: 3	19
710079-018	There are currently no SWRO membranes approved for use under Regulation 31 of the Water Supply (Water Quality) Regulations 2018. There is a risk that DWI approval of a suitable SWRO membrane is not granted within the required timescales of the programme, leading to a delay to the delivery of the Base Case.	Stakeholders & Approvals	Stakeholders	28/9/20	16/9/24 DSLN.CON.00310	3	**Time: 5** **Reputation: 5** Quality: 4 Operational Service: 3	22	Continue to feed our requirements to interested suppliers as they become clear to be considered within the Thames membrane approval process. Continue liaison with [redacted] to understand application progress. Commence market engagement with potential suppliers. Provide DWI with update on progression towards the end of 2021.	2	**Time: 5** **Reputation: 5** Quality: 4 Operational Service: 3	18
Prog-R79	Owing to the latest update from OFWAT and their reservations around undertaking multiple CP processes, there is a risk that the impact on the DPC timelines of moving CP-B from July 2021 to after the Gate 2 determination period (Feb 2022) cannot be mitigated sufficiently, thus leading to a delay to the achievement of key milestones, and ultimately the s20 milestone.	Commercial & Supply Chain	Timetable	1/2/22 NWSR.GWY.12350	24/9/25 NWSR.GWY.16250	3	**Time: 5** Reputation: 4 Op. Service: 3	22	Develop joint approach with OFWAT and RAPID that ensures that the Control Points do not impact on the delivery schedules. This includes the duration around the determination periods. Submit draft documents in advance of CP to mitigate duration associated with review periods.	2	**Time: 5** Reputation: 4 Op. Service: 3	18

Risk ID	Description	SW RBS	RAPID Category	Start Date & Activity ID	Expiry Date & Activity ID	Probability	Impact	Score	Mitigation Strategy	Probability	Impact	Score
Prog-R83	Owing to the level of effort required for the previous and current RAPID Gates, there is a risk that the level of resource (internal and external) required to meet RAPID compliance is greater than assumed, leading to redirection of resource from the delivery programme, impacting on the quality and the timescales associated with the Planning Process.	People & Resourcing	Planning	27/1/22 NWSR.KEY.00020	21/11/23 DSLN.CON.00070	3	**Time: 5** Reputation: 4	22	Dialogue required with RAPID to agree that Gate 3 and Gate 4 should be a snapshot of the current progress, rather than a key driver to the delivery schedule.	2	**Time: 5** Reputation: 4	18
710059-010	Owing to the previous use of the land in the Fawley / Ashlett Creek area, there is a risk of encountering contaminated ground over and above that assumed in the cost estimate and programme, leading to additional costs and programme delays.	Ground & Environmental Conditions	Budget	29/12/25 DSLN.ENW.00010	21/7/27 DSLN.ENW.00030	4	**Cost: 3** **Time: 4**	21	Ensure that borehole surveys are arranged in advance to ensure any contamination can be factored into future costings / programme.	4	**Cost:** 3 Time: 3	17
Prog-R60	Owing to the use of saline water to produce drinking water, even following a two stage RO process, there is a risk that the water is not considered wholesome and acceptable to the end users, resulting in reputational damage to SW.	Reputation & Public Perception	Water Quality	29/10/30 DSLN.TCH.00150	29/10/31	4	**Reputation: 4**	21	Work out the optimum blending technique / ratio when running the plant at 15 Ml/d and establish how the plant is operated to minimise issues with taste / odour variations. Further utilise the Customer Acceptance Group to continue to understand the current perception within the customer base to introducing Desalinated water into the supply network. Agree the remineralisation approach with the DWI.	2	**Reputation: 4**	14

Risk ID	Description	SW RBS	RAPID Category	Start Date & Activity ID	Expiry Date & Activity ID	Probability	Impact	Score	Mitigation Strategy	Probability	Impact	Score
710059-013	Owing to the significant number of unknowns in relation to the any mitigated habitat requirements, there is a risk that the level of the mitigations assumed to be required from the HRA / SEA is not sufficient, resulting in increased costs and potential delays depending on the habitat required.	Stakeholders & Approvals	Stakeholders	30/4/21	21/4/25 DSLN.CON.02200	3	Cost: 1 **Time: 4** Reputation: 3 Quality: 3	19	Continue to develop HRA Assessments with a specialist consultant to understand the extent to which habitat mitigation will be required and factor into cost estimate.	3	Cost: 1 **Time: 3** **Reputation: 3** **Quality: 3**	13
710059-007	Owing to the number of environmental (proximity to the National Park) and spatial constraints (pipe route not able to be physically located in [redacted] owing to pipe diameter / importance of A road to the area) affecting the pipeline corridor from Fawley to Testwood, further clarifications are required around the scheme prior to consent being granted, leading to delays to the consenting process and overall delivery programme.	Stakeholders & Approvals	Planning	21/11/23 DSLN.CON.00070	21/4/25 DSLN.CON.02200	3	Cost: 2 **Time: 4** Quality: 1	19	Follow up initial land referencing work with further contact of key stakeholders to commence land access process. Develop bespoke engagement plans with each identified stakeholder indicating the types of ecology survey that will be required. Continue to work through the route selection process, identifying key risks to enable specific mitigation plans to be developed as appropriate. Continue engagement with the Legal Team over the potential use of statutory powers to gain access to land, if necessary, to ensure that the delivery team has the correct approvals obtained in advance in order to utilise section 172 powers for survey access if required.	2	Cost: 2 **Time: 4** Quality: 1	14

Table 63 - Desalination Key Opportunities

Risk ID	Description	SW RBS	RAPID Category	Start Date & Activity ID	Expiry Date & Activity ID	Probability	Impact	Score	Realisation Strategy	Probability	Impact	Score
710059-002	Owing to the difficulties in constructing a new pipeline from Fawley to Testwood, there is the opportunity to utilise an existing Industrial Main to transport potable water from Fawley to Testwood, resulting in significant cost and schedule improvements.	Scope & Requirements	Other	28/9/20	7/4/22 NWSR.GWY.03150	1	Cost: 3 **Time: 5** Reputation: 2 Op. Service: 2	15	Undertake a study looking at concrete pipes, particularly pre-stressed concrete mains. A feasibility assessment of the main is also being undertaken. Following the outcome of the feasibility assessment, a site survey may be undertaken. Undertake scoping out of the Stage 4 survey works. Confirm with Operations whether an intrusive survey is the correct technique to be using on the operational asset.	2	Cost: 4 **Time: 5** Reputation: 2 Op. Service: 2	18

Risk ID	Description	SW RBS	RAPID Category	Start Date & Activity ID	Expiry Date & Activity ID	Probability	Impact	Score	Realisation Strategy	Probability	Impact	Score
710059-006	Site selection was ongoing through the concept design period; the Gate 2 process design was therefore based on seawater quality data collected from the Fawley sample points (D2, D3 and F1) between November 2020 and February 2021. This winter sampling data is expected to present a worst-case scenario for pre-treatment and waste handling requirements ensuring the design is conservative at this stage of solution development. There is an opportunity that the current design basis is conservative enabling reductions in scope, costs or programme timescales.	Scope & Requirements	Other	30/1/21	7/4/22 NWSR.GWY.03150	1	Cost: 1 **Time: 4**	10	Following the receipt of further water quality data, perform iterative review of the pre-treatment design to understand whether pre-filtration and clarification processes can be rationalised.	1	Cost: 1 **Time: 4**	10

Risk ID	Description	SW RBS	RAPID Category	Start Date & Activity ID	Expiry Date & Activity ID	Probability	Impact	Score	Realisation Strategy	Probability	Impact	Score
710059-023	Owing to the current complexities (spatial, stakeholder, environmental) identified in relation to construction of a new intake structure, there is an opportunity to utilise the existing Intake structure at the Fawley Power Station site (now part of Fawley Waterside Limited development), thus leading to significant cost savings, schedule improvements and a decrease in the overall threat profile of the Base Case.	Scope & Requirements	Other	1/4/21	18/7/23 DSLN.DGN .00100	2	Cost: 3 **Reputation : 3**	14	Continue engagement with the landowner at [redacted]. Obtain the necessary licence agreements to be able to undertake structural surveys of the existing assets. Develop the design of the proposed opportunity in order to refine savings and present to key stakeholders.	3	Cost: 3 **Reputation: 3**	19

Risk ID	Description	SW RBS	RAPID Category	Start Date & Activity ID	Expiry Date & Activity ID	Probability	Impact	Score	Realisation Strategy	Probability	Impact	Score
710059-024	Owing to the current complexities (spatial, stakeholder, environmental) identified in relation to construction of a new outfall structure, there is an opportunity to utilise the existing outfall structure at the Fawley Power Station site (now part of Fawley Waterside Limited development), thus leading to significant cost savings, schedule improvements and a decrease in the overall threat profile of the Base Case.	Scope & Requirements	Other	1/4/21	18/7/23 DSLN.DGN .00100	2	Cost: 3 **Reputation : 3**	14	Continue engagement with the landowner at [redacted]. Undertake the next phase of Hydrodynamic Modelling (dispersal modelling) to the EA. Obtain the necessary licence agreements to be able to undertake structural surveys of the existing assets. Develop the design of the proposed opportunity in order to refine savings and present to key stakeholders.	3	Cost: 3 **Reputatio n: 3**	19

710059-033	The current design comprises a 2 pass R / O system to achieve the required output flow and concentration. There is an opportunity to move to a single pass system, thus resulting in smaller R / O plant requirements and therefore cost savings, although an increased risk profile in terms of Boron.	Scope & Requirements	Other	27/9/21 NWSR.GWY.00 040	18/7/23 DSLN.DGN .00100	2	**Cost: 3 Quality: 3**	9	As this opportunity would result in higher TDS in water which would further impact on taste, thus impacting on wholesome water, ensure the outcome is fed into Risk ID Prog-R60 Engage with the DWI to talk about the timescales around the change in requirements for Boron. In addition, ensure internal discussions are held within SW to understand SW appetite in relation to this alternative approach. Use the market engagement to test the opportunity proposal with the wider market. In addition, the EPC would need to be consulted. Engage with agricultural customers to understand whether a change in Boron levels would cause significant impact. This will	3	**Cost: 3 Quality: 3**	13

Risk ID	Description	SW RBS	RAPID Category	Start Date & Activity ID	Expiry Date & Activity ID	Probability	Impact	Score	Realisation Strategy	Probability	Impact	Score
									be conducted through the stakeholder engagement team.			
710059-038	The current design assumption is that brine waste will be intermittently discharged into the marine environment, hence the requirement for onsite storage. However, there is the opportunity to increase the frequency of the discharge, leading to a reduction in the volume of the storage tanks required on site and therefore a cost saving.	Scope & Requirements	Other	27/9/21 NWSR.GWY.00040	21/11/23 DSLN.CON.00070	4	**Cost: 1**	7	Obtain feedback from the process engineering and environmental teams on the link between discharge permits and DO rates. Investigate whether at lower DO Rates, discharge frequency could be increased and therefore storage capacity reduced. If the response is positive, understand to what level storage would be required compared to what we have assumed.	4	**Cost: 1**	7

Risk ID	Description	SW RBS	RAPID Category	Start Date & Activity ID	Expiry Date & Activity ID	Probability	Impact	Score	Realisation Strategy	Probability	Impact	Score
710059-036	At present, the assumption is that CFA piles are used across the site for the main structure, ancillary structures and the road network. There is an opportunity for a percentage of these piles to be removed from the design once further ground investigation works have taken place, resulting in a cost saving.	Design Development	Other	27/9/21 NWSR.GWY.00040	21/11/23 DSLN.CON.00070	2	**Cost: 1**	2	Obtain the necessary licence agreements to be able to undertake geotechnical surveys across the site location. Undertake ground investigation surveys to refine ground data that feeds into design. Prior to GI surveys, ecology and archaeology surveys need to be undertaken to ensure access is allowed.	2	**Cost: 1**	2

Risk ID	Description	SW RBS	RAPID Category	Start Date & Activity ID	Expiry Date & Activity ID	Probability	Impact	Score	Realisation Strategy	Probability	Impact	Score
710059-035	Owing to the current crossing length under the South West Mainline being generated by a route planning tool, once site surveys have commenced, there is an opportunity to reduce the length crossing, leading to a cost saving.	Design Development	Other	27/9/21 NWSR.GWY.00040	21/11/23 DSLN.CON.00070	2	**Cost: 1**	2	Obtain the necessary licence agreements to be able to undertake required surveys across the site location. Undertake ground truthing of the site, as well as using topographical data, to establish the crossing length. Work closely with Network Rail to agree on the length / location of the crossing.	2	**Cost: 1**	2

Table 64 - Desalination Key Issues

Issue ID	Issue Description	RAPID Category	Issue Priority	Issue Impact	Mitigation Strategy
WfLH-Iss-014	There is currently no agreement with the EA or the Operational Team at Testwood on how to manage (discharge) the high volume of water required for commissioning the Fawley to Testwood pipe route.	Stakeholders	Medium	Major	Design to be developed to incorporate commissioning approach. Approach to be presented to and agreed with relevant stakeholders, particularly over the large volume of water that will require disposal. Agreed approach to be fed into the commissioning schedule as the timing around the discharge flow rate during the commissioning process could impact significantly on assumed commissioning durations.
WfLH-Iss-006	The currently planned timetable for Gates 1 to 5 does not fully align with the emerging capital delivery programme aimed at successfully delivering the Desalination Plant and related Infrastructure by 2027.	Timetable	Urgent	Major	We have developed an accelerated Gate timetable and will work closely with RAPID to ensure that we have an approach that works for all parties.

2.8 Stakeholder and Customer

2.8.1 Engagement Overview

This section outlines SW's engagement activities between Gate 1 and Gate 2 and sets out SW's plans for future engagement. Engagement has been undertaken on all the solutions taken forward past Gate 1: desalination, water recycling and water transfer, but it has primarily focused on Option A.1 as the Base Case.

Some of the Options rely upon the development of a new reservoir at Havant Thicket (promoted by PW). The promotion of Havant Thicket reservoir is separate to the solutions SW is progressing to Gate 2, which propose additional enhanced uses of the proposed reservoir. The recycling and water transfer Options being considered by SW at Gate 2 that interface with the Havant Thicket reservoir have been developed in collaboration with PW, including joint communications and engagement with stakeholders, where appropriate.

SW's engagement activities encompass engagement with customers, stakeholders, regulators and consultees within the planning process (including communities and landowners), outlined in Table 65.

Table 65 - A snapshot of examples of engagement with stakeholder, consultee and community groups

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

Care has been taken to incorporate the other areas of water resource planning in Hampshire into SW's approach to engagement, including measures to tackle leakage and promote water efficiency to reduce demand. Incorporating this overarching narrative into SW messaging enables SW to communicate its holistic approach to the water resources challenge in the county and its commitment to improving the resilience of water supplies and protecting the environment. It also reduces the likelihood of duplication of engagement.

Tailored and proactive engagement is key to understanding and having regard to stakeholder concerns and challenges. As reported at Gate 1, SW's customer and stakeholder insight for WfLH first focused on immersing with what it already knew from WRMP19, PR19 and global experts. SW then built a deliberative programme that was designed through the use of its Participation Principles and aligned to best practice guidance by Consumer Council for Water (CCW) [1].

Engagement for regulator and other statutory body stakeholders has been managed at both WfLH programme level and at SRO project level. Annex 9 Customer and Stakeholder Methodology contain details of the multiple engagements carried out with Customer groups and Stakeholders.

SW has held a non-statutory public consultation on the Base Case and used this as an opportunity to introduce the concept of back up alternatives to planning consultees, including members of the public.

Feedback has been analysed and a feedback report has been published reporting on the key themes emerging from the consultation.

Ongoing and regular engagement has taken place with the EA, NE and the MMO, in their dual roles as both key statutory environmental bodies and regulators. The EA and NE in particular have been engaged on the scope and outputs of the various environmental reports that have been produced to assess the performance of the Options, as well as on the detail of the assessments.

Southern Water has also briefed Historic England and all of the local authorities likely to be affected by the various Options on the methodology and results of the OAP.

Feedback from this engagement has informed the scope of environmental reports and judgements on the nature of the likely impacts of the Options, as well as providing confidence in the OAP methodology.

There has also been general engagement and a briefing session during the non-statutory consultation with the Parish Councils in the communities likely to be impacted by the Base Case. This included discussing the proposals for the Base Case and the information on the desalination plant that was being consulted on at the time.

Responses from this wide range of audiences has been detailed within Annex 9 Customer and Stakeholder Methodology of the Gate 2 submission and this section of the Technical annex contains only those responses which relate to Desalination.

2.8.2 Stakeholder Engagement – Summary of Activity

2.8.2.1 Regulatory Engagement

SW continues to consult regularly and proactively with its regulators and their specialist advisers (RAPID, Ofwat, Defra, EA, NE, DWI, CCW) across the various stages of the project to:

- Promote collaboration, based upon the exchange of knowledge and ideas
- Seek feedback on developing methods and approaches in advance of formal submissions
- Ensure regular dialogue and transparency in decision-making
- Identify and seek to resolve regulator concerns and issues and
- Ensure compliance with relevant legislation and guidance.

SW's ongoing engagement with its regulators, RAPID and their advisers (Ofwat, Defra, EA, NE, DWI, CCW) has continued at various levels within its respective organisations since the Gate 1 submission. SW has met with RAPID more than 20 times since Gate 1 and has held numerous workshops and individual meetings with regulators and their advisers.

SW has continued to seek specific feedback from NE and the EA on the scope of the environmental assessment, surveys and the development of its Options Appraisal methodology.

Annex 9 Customer and Stakeholder Methodology contains details of the engagement details at programme level. This will be included in the Gate 2 submission.

Throughout Gate 2 there has been solution specific engagement with key stakeholders to share, discuss and consult on key elements of the Gate 2 project activities.

In its non-statutory consultation, responses were received from consultees, including the three regulatory bodies, EA, NE and Historic England. A summary of consultee responses is detailed in the Annex 9 document and in the published Consultation Feedback Report.

The EA provided comments on the method of consultation, the Base Case, the alternatives and programme.

NE considered that there were significant omissions in the consultation documentation with regards to the scale and extent of potential impacts likely to arise from the Base Case and alternative solutions.

The response from Historic England focused on the Options for pipeline routing on the Base Case alternative solutions, with a particular focus on the pipeline routing associated with the Base Case.

2.8.2.2 Non-statutory Consultation and Outputs

Following RAPID's final determination in January 2021, SW launched an early non-statutory consultation on elements of the desalination Base Case (pipeline routes and inlet / outfall locations), as well as introducing the concept of Back-Up Options. Due to Covid-19 restrictions, SW was unable to undertake traditional face-to-face engagement, such as in community centres, shopping centres and village halls, as it normally would for this type of planning consultation. Accordingly, its early non-statutory consultation was run as a virtual consultation from February 8 to April 16, 2021.

The consultation was advertised in local newspaper adverts and editorial articles, on SW's website and social media platforms, and shared by relevant local authorities and other organisations through their networks. An online questionnaire and feedback form were created to allow people to respond to the consultation and provide their views in response to the questions that were asked.

The website recorded a total of 4,537 page impressions, which came from a total of 3,224 individual users. A total of 216 responses were received from customers and stakeholders.

SW has analysed the feedback received and identified themes of interest, ideas and areas of concern. A feedback report has been published setting out the feedback received from consultees. The feedback themes are summarised below.

It is important to note when considering the responses to the consultation that a total of 67% of respondents stated that they lived within the local area of the programme, whilst 38% stated that they lived close to the proposed Base Case Option. As a result, we can expect that the issues and concerns that are more relevant to those respondents who are local to the Base Case are better represented in the responses.

The non-statutory consultation did not consult on the water recycling or water transfer alternatives in detail, so we do not have informed consultation responses on the potential issues and impacts that are of concern to consultees on these Options.

Water recycling and water transfer alternatives were both viewed by consultees as generally being an acceptable alternative solution, should the Base Case not be delivered, based on the information available at the non-statutory consultation, which had limited information on the Back-Up Options to inform consultees' responses. Consultees were not asked to pick a Preferred Option out of the Base Case and the alternatives, so it is not possible to conclude which Option is preferred by the consultees who responded.

Impact of brine on the Solent

A total of 24% of individual respondents raised concerns about releasing the wastewater (brine) back into the Solent, increasing to 35% when taking into account statutory and non-statutory group responses. Concerns mainly related to the impact on the marine environment (with particular reference to the Solent and Dorset Coast SPA), and some respondents noted that the Solent is already in an 'unfavourable' condition due to poor water quality which could make it more vulnerable to the impacts of brine. Concerns about potential impacts included the potential to alter the chemical composition of the water through the release of brine, with associated impacts on the marine wildlife.

Some respondents questioned whether the Solent was a viable location for the release of brine due to its shallow depths and suggested alternative locations may be more suitable to release the brine due to larger tidal shifts and deeper waters. A few respondents queried whether the release of brine would affect the tidal flow. Questions were also raised about whether the discharge of brine would impact on the bathing water quality and recreational activity on the Solent.

Impact of abstraction and discharge pipes

Some respondents showed concern about the impact the abstraction and discharge pipes would have on the local environment. In particular, this included the impact of pipe construction on the seabed off Calshot, and the potential for fish entrainment in the pipelines.

Waste to landfill

Some individual respondents noted that the desalination plant would involve sending concentrated solid matter waste product to landfill and raised concerns about this. Suggestions were made to explore other Options for waste disposal, along with requests for further detail about the content of the solid waste and location for disposal.

Traffic and transport

Concerns were raised by some respondents about the impact of the pipeline routing on the A326. It was noted that there is existing pressure on the road, particularly at peak times, and that this is only due to increase as other developments in the Local Plan are brought forward, including the Fawley Waterside housing development.

Confirmation was requested that the development would not result in closure, diversion or traffic management measures on the A326 due to its use for employees of businesses in the area including the Budds Farm WTW and Industrial User.

Some respondents were accepting of short-term construction impacts (and associated noise impacts) on the local road network. Other respondents raised general concerns about the impact of the construction of the desalination plant on the local road network, and the associated air quality and noise impacts which would affect local residents.

Landscape, visual impacts and seascape

Some respondents raised concern about the landscape and visual impact of the desalination plant and requested clarity on the proposed design. Of particular concern in this regard was the proximity to the New Forest National Park, the coast and the surrounding area.

Historic environment

The historic environment was a feature of some respondent's comments. In particular, reference was made to the potential for pipeline routing to impact upon heritage features (both scheduled and non-scheduled) and the need to ensure appropriate mitigation. It was noted that the excavation associated with the pipeline routing may on the other hand provide opportunities for developing greater understanding of the heritage of the local area.

Noise, light pollution and air quality,

Many respondents raised concerns about the noise and vibration associated with the operation of the plant and the impact on residents, in particular due to the PS. Concerns were expressed relating to cumulative noise impacts with other developments in the area and impacts of noise on biodiversity. Additional information was requested in relation to noise.

Light pollution was also mentioned, and associated impact on terrestrial ecology and local residents, along with the air quality impacts of the operation.

Biodiversity

Where respondents provided comments relating to biodiversity, these mostly related to the impact of abstraction and discharge on the marine environment and in particular the European designated sites.

Comments relating to biodiversity tended to be quite general, with respondents noting that the proposed development would impact on the wildlife, particularly in the New Forest National Park.

The Habitat Regulations were referenced in some consultation responses, citing the need to ensure that there are no feasible alternative solutions that would be less damaging.

Access and recreation

A few respondents noted the potential impact of construction on public rights of way, in particular those in regular use by horse riders, walkers and cyclists. A concern was that some of the pipeline routing Options would sever public rights of way, affecting safe access to the New Forest and resulting in users having to use the local road network which itself would be affected by greater levels of construction traffic resulting in safety concerns.

Socio-economic

It was recognised by some respondents that the desalination plant would be likely to bring investment and employment opportunities. Some respondents raised concern however that local businesses would be affected by the presence of the desalination plant, and others queried the impact of the brine on fish stocks and how that could impact the local fishing industry. The impact of the brine on the oyster beds in the Solent was of some concern.

Climate change and carbon emissions

Many respondents raised concerns about the energy usage associated with a desalination plant. These concerns primarily related to the associated carbon output and associated cost.

Based on the energy demand, some respondents queried whether a desalination plant would be aligned to both national government and local authority targets for net zero carbon. It was also queried whether a desalination plant would be aligned to SW's target as an organisation to be carbon neutral by 2030.

Some respondents raised questions about how the desalination plant would be supplied with energy including reference to low carbon energy sources and working with local community energy groups.

Location of the desalination plant

Significant concerns were raised by some respondents about the proposed location of the desalination plant. Whilst some respondents noted that details of the precise location, size and design of the plant should be provided to enable an informed comment, others raised concerns about the general area within which the desalination plant is proposed.

The most common concern raised relating to the location was the siting of the plant within the New Forest National Park due to the associated environmental impacts, followed by the proximity to environmental designated areas. The responses included suggestions that the plant should be located on a brownfield site or located away from residential areas and Ashlett Creek. It was also noted by some respondents that the currently proposed location would result in further urbanisation of the New Forest Solent Waterside and impact on the Fawley Waterside redevelopment and that the road capacity in this area was already restricted.

Pipeline to transfer to network

Some respondents expressed concerns about the pipeline routing to transfer the drinking water to Testwood WTW. This primarily related to the disruption likely to arise for residents and businesses during construction, particularly to those in the Waterside area, and in combination with other developments in the area. The need to avoid archaeological sites was noted, along with reference to impacts on the Fawley branch line.

Cumulative impacts

Concerns over cumulative impacts with other existing and proposed developments in the area were raised throughout the consultation responses.

Some respondents made reference to the Fawley Waterside Development and, in particular, the combined impact of the two developments on the local road network, which is already considered to be under pressure, along with the impacts on the landscape which is becoming increasingly industrialised.

Noise was raised as a concern by some respondents, making reference to existing developments which already result in noise disturbance to local residents, and the additional noise that would arise through the proposed PS.

Cumulative impacts with the Solent Freeport, A326 road improvements and the potential re-opening of the Fawley railway line as a passenger line were also noted.

Construction impacts

Where respondents cited concerns and raised queries relating to construction impacts, the most common responses related to the disruption to local residents associated with the proposed development, the impact on the local road network and the potential disruption that pipeline routing would cause.

Respondents requested further information about the likely disruption, and some raised concerns about the impact on the environment and the likely noise and air quality impacts.

Some respondents recognised that construction impacts would be short term and either mitigated or managed, and others noted that the disruption would be excessive, particularly for local residents and users of the local road network.

Cost

Many respondents raised concern about both the upfront and long-term cost associated with the desalination plant. Clarification was requested about whether the costs would be passed on to customers through water bills and queries were raised by a number of respondents about whether the perception of high associated cost would be economically viable based on the understanding that the plant would be used at full capacity only intermittently.

Water quality and resources

Some respondents queried whether the water produced by the desalination plant would be up to drinking water standard, particularly as the Solent experiences heavy shipping activity. Other respondents noted that the water would be softer, which would be of benefit to SW customers although engagement would be needed as residents are used to hard water and some have water softeners installed.

Full details of the issues raised can be found in the Consultation Feedback Report document www.southernwater.co.uk/our-story/water-for-life-hampshire/consultations

2.8.3 Customer Insight Engagement Findings

Following CCW best practice and SW Customer Participation Strategy, SW's focus has been on high quality and meaningful engagement with customers – with the objective to ensure it had the insight SW need for any of the potential resource Options to be successfully consented, delivered and operating. Following Gate 1, SW has engaged with over 240 informed customers through deliberative approaches and over 1,950 in quantitative surveys. This built on the insight from Gate 1 with over 250 informed customers, 2,300 HH and 350 Businesses through joint work with WRSE and the thousands of interviews from WRMP19 (>5,000) and PR19 (>42,000).

This section provides a summary of feedback from SW insight projects run since Gate 1 for the WfLH programme. The summary has taken the key insights as identified by research reports[8] and has been assured by the independent research team who led SW's Customer Action Group (CAG). For more detailed information on the methods, approaches and sample used to gather the insight, please see Annex 9 – Stakeholder and Customer Engagement.

2.8.3.1 Initial Reactions to Desalination

SW's insight has shown that customers have superficial knowledge of desalination, although first thoughts are that it is robust and reliable. However, on reflection and when customers investigate more, concerns relating to the potential environmental and financial impacts are raised. Once informed through a deliberative methodology, it is consistently the least Preferred Option across all customer groups and insight projects that we have sampled, based on the questions we have asked these groups. Customers that accept the solution, in principle, tend to offer pragmatic agreement towards desalination rather than active support. If customers truly understand there is a need (which SW has seen through its CAG) and are reassured that all other solutions have been explored – then SW sees more active and pragmatic support. However, a significant cohort of opposition tends to remain, in particularly with those more concerned about the potential environmental impacts or effect on affordability of bills.

8 **Annex 9: Customer and Stakeholder Methodology**, Figure 3 – Overview of Customer Insight Projects for Gate 2, References 1, 2, 4, 5, 6, 7, 8

2.8.3.2 Customer Benefits and Concerns regarding Desalination[9]

Primary Customer Benefits:

- ✓ Efficient: plentiful resource
- ✓ Perceived as sustainable
- ✓ Innovative
- ✓ Sea is a natural source
- ✓ Reliable, long-term, resilient to drought;
- ✓ Common sense
- ✓ Proven technology

Primary Customer Concerns:

- X Environmental impact –carbon footprint and marine life
- X High energy use
- X Cost to build and run– impact to bills
- X Water quality - taste
- X Brine production;
- X Local disruption – landscape/visual 'eye sore'
- X Complexity

2.8.3.3 Key Questions to Find out More - From Customer Action Group Members[10]

CAG Members raised the following questions where future engagement would need to ensure SW is able to provide the relevant answers:

- *Cost implications once up and running – what will the impact be on the bill payer?*
- *Long term ramifications of brine production and what actions can mitigate this?*
- *How will any energy used / carbon emissions produced by the plant be offset?*
- *What will the developed site look like in the context of the size, local landscape etc.?*

Comparison of Desalination vs Alternative Solutions: SW's customer engagement demonstrated that customers and stakeholders understand that the WfLH programme is not about one overall solution, but a combination of measures that work together, with everyone all playing their part. When looking at the Options of desalination, water recycling and transfers – desalination is consistently rated through each of SW's research projects by the different customer groups as the least Preferred Option, based on the specific questions that those groups were asked. It is well understood to be an effective solution, although the potential environmental impacts and cost implications means customer support is limited. Water recycling is seen as more sustainable with perceived lower cost and environmental impacts based on the information available to the customer groups. Customer feedback indicates that transfers are seen as a support role for Hampshire but customers are not confident The below figures are summary charts taken from SW's CAG, young person's research [11] [12] .Customer feedback indicates that transfers are seen as a support role for Hampshire, but customers are not confident that transfers can provide a long term resilient supply as it is perceived to be simply moving water between areas rather than providing a new supply. The below figures are summary charts taken from SW's CAG, young person's research [13] [14] .

[9] From Gate 1 Submission, (Annex 15 – Stakeholder and Customer Report, sections 4.1, 4.2 and 4.3WRSE_Supply-side solutions workshop note_190820

[10] **Annex 9: Customer and Stakeholder Methodology**, Figure 3 – Overview of Customer Insight Projects for Gate 2, Burst Reports: *Water for Life Hampshire Burst 11 Oct '20 up to Burst 18 Jun '21*

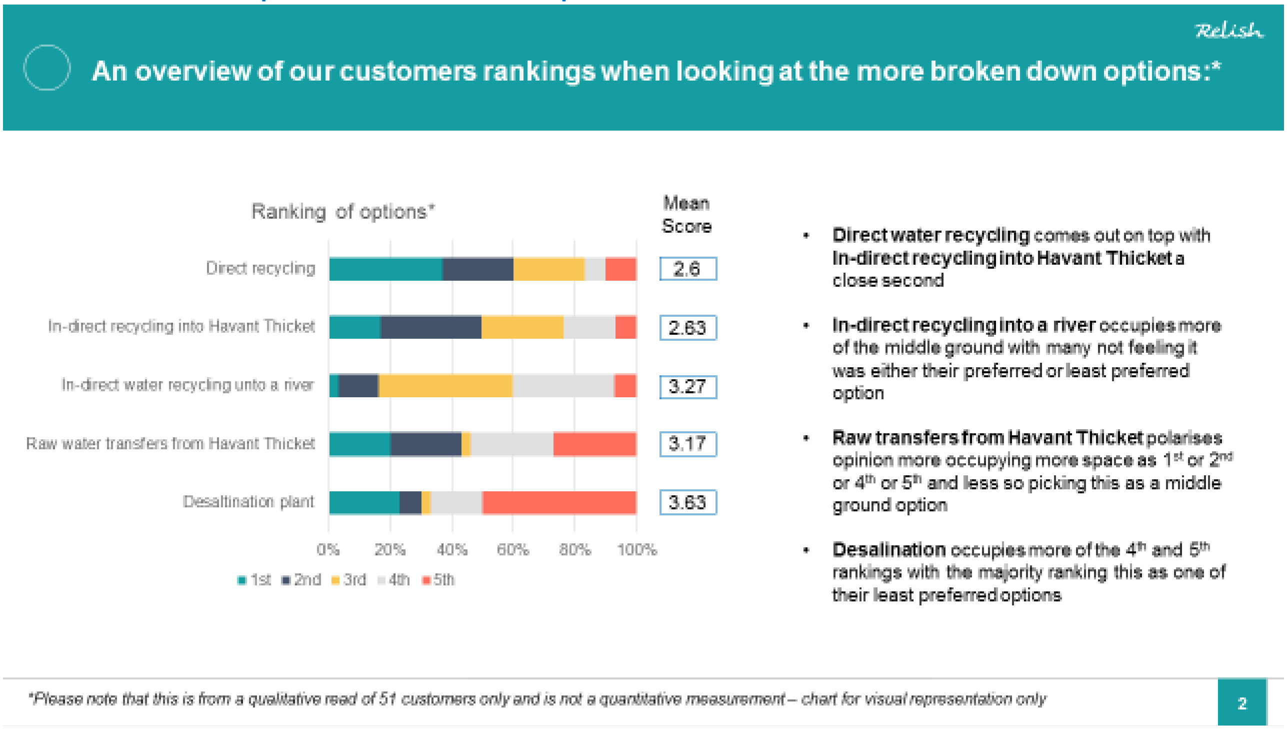
[11] **Annex 9: Customer and Stakeholder Methodology**, Figure 3 – Overview of Customer Insight Projects for Gate 2, Ref 8: Water Futures 2050 – Wave 2, Apr '21

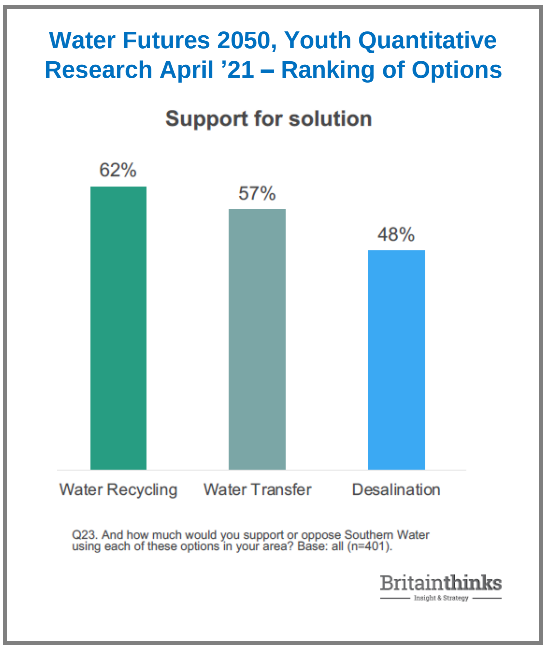
[12] **Annex 9: Customer and Stakeholder Methodology, Figure 3 – Overview of Customer Insight Projects for Gate 2, Ref 7 Quantitative Option Preferences – Debrief March 2021**

[13] **Annex 9: Customer and Stakeholder Methodology**, Figure 3 – Overview of Customer Insight Projects for Gate 2, Ref 8: Water Futures 2050 – Wave 2, Apr '21

[14] **Annex 9: Customer and Stakeholder Methodology, Figure 3 – Overview of Customer Insight Projects for Gate 2, Ref 7 Quantitative Option Preferences – Debrief March 2021**

Customer Action Group members voted on their preferred solutions[15]:





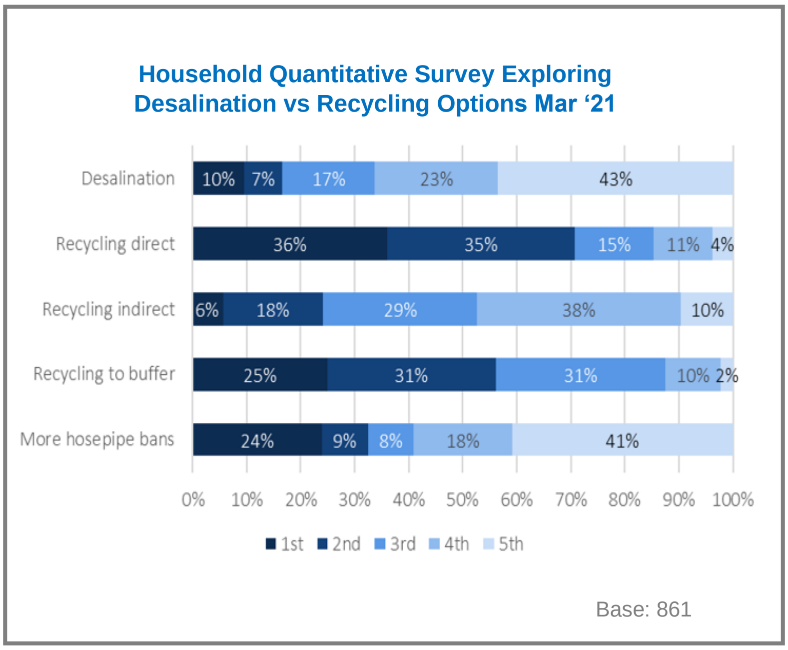


Figure 57 - Customer Action Group members voting summary

15 **Annex 9: Customer and Stakeholder Methodology**, Figure 3 – Overview of Customer Insight Projects for Gate 2 Ref 1: Water for Life Hampshire Burst 18 Jun '21

2.8.3.4 Differing Views of Desalination across Customer Groups

When presented as the lead Option, desalination can receive some pragmatic support from the customers groups who were sampled, who quickly agree the need for new supply sources. However, once informed through a full range of materials support reduces and other Options, particularly water recycling, is strongly preferred. Once the potential bill impact to customers is explored, strength of opinion towards recycling grows further.

SW's CAG accepts that desalination could be part of the overall solution, and SW's Youth Committee from Water Futures 2050 pragmatically accepted desalination, but neither group actively support it based on the information that was made available to them.

- **Future customers**[16] through SW's insight were particularly surprised that the South East was water stressed as their experiences are of an abundant and plentiful supply in the UK. However, they understood the climate change issues and are then particularly focused on environmental impact – which underpins their lack of support for desalination.
- **Customers with affordability concerns**[17] told SW they were also concerned with the environmental impact of desalination but are more likely to be driven by the bill impacts. As such, they preferred the transfer and recycling solutions that can be delivered at lower cost to desalination. They were most concerned with a reliable and consistent supply. Whilst minimising environmental impact was important, it was a weaker factor when compared to affordability impacts than was the case in other customer groups.
- **Customers from more diverse cultures**[18] shared that some customers have heightened awareness of water scarcity, either from personal experience (e.g., such as living in other parts of the world) or through their family. For those who also have concerns with affordability, the cultural differences can lead to less experience in managing bills which can exacerbate the impact of higher cost solutions.
- **Businesses**[19] through SW's in depth interview research tended to be a little more pragmatic in their ranking of Options and focused on reliability and consistency of supply – although cost and the environment are still a concern. They felt Fawley was a good geographical fit by using an existing industrial location and would create jobs. If they had reassurances that all Options had been fully evaluated with relevant parties and desalination was deemed the most suitable, they would broadly support. Regardless of the final solution, those businesses reliant on water quality for their end product or service require early engagement.

2.8.3.5 Primary Actions to Mitigate Concerns and Increase Customer Acceptance

From SW's insight there are 9 primary actions identified by customers that would mitigate their concerns , as detailed in Table 66. The table indicates how the mitigation could be developed in SW's future engagement plans.

16 **Annex 9: Customer and Stakeholder Methodology**, Figure 3 – Overview of Customer Insight Projects for Gate 2 Ref 8, *Water Futures 2050 – Wave 1 Report, Dec '20 and Water Futures 2050 – Wave 2, Apr '21*

17 **Annex 9: Customer and Stakeholder Methodology**, Figure 3 – Overview of Customer Insight Projects for Gate 2 Ref 4, Affordability Concerns and Diverse Cultures - April 2021

18 **Annex 9: Customer and Stakeholder Methodology**, Figure 3 – Overview of Customer Insight Projects for Gate 2 Ref 5, Affordability Concerns and Diverse Cultures - April 2021

19 **Annex 9: Customer and Stakeholder Methodology**, Figure 3 – Overview of Customer Insight Projects for Gate 2 Ref 6, Hampshire Water Resource Business Challenge Report 21.04.2021

Table 66 - Primary actions to mitigate concerns and increase customer acceptance

	Desalination: Primary Actions to Mitigate Concerns - as i*dentified by customers through SW's insight programme*	**Key Actions Planned to Mitigate Each Concern**	**Ownership**
1	Developing a much stronger understanding of the rationale for desalination through engagement on water scarcity, and in particular the protection of chalk streams and the environment.	SW's engagement for WfLH has already begun in the explanation around the protection of the chalk streams. SW's water efficiency programme (Target 100) has already started for AMP7 with communication with investment through a range of channels and using SW's insight to develop messaging. This will need to continue through Gate 2 and towards Gate 3.	WfLH – Communications Team
2	The use of solutions in the process, building and running of desalination that can mitigate against the environmental impacts.	If the solution is developed, SW will need to present more information to customers and stakeholders on how its design has progressed and sought to avoid impacts through design, to mitigate impacts and to offset or compensate for remaining impacts. SW will need to engage with customers on the types of mitigation being used, and to draw on best practice from desalination projects around the world, as well as advice from qualified expert environmental consultants and statutory nature conservation bodies. There would be further public consultation to enable customers and stakeholders to comment on proposed designs and mitigation measures. From April 2021 SW is using low carbon energy to power its sites.	WfLH Strategic Leadership Team
3	As the least preferred solution, customers and stakeholders would need clear reassurances that all other Options have been fully explored fully and to see evidence that demonstrates this.	Future engagement would focus on ensuring SW demonstrates the depth, breadth and rigour of the Option and site selection processes undertaken as part of the programme.	Water Resource Planning Team, WfLH Strategic Leadership and Communication Teams
4	Clear justification around the impacts to customer bills in the short term and long term – ensuring a smooth profile to minimise extreme changes. Support measures would need to be clear for those with affordability concerns.	SW's MCDA analysis for the recommended solution has used a number of weighting scenarios, including focusing on bill affordability. SW will be able to demonstrate to customers how affordability concerns were considered in the decision-making process. SW is committed to developing solutions that balance long-term bill impacts and that keep customer's bills as smooth as possible. .	WfLH Strategic Leadership Team
5	Renewables should be used in the building and running of the desalination plant to minimise environmental impact. For future customers, they would very strongly oppose the use of non-renewable energy sources.	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.	WfLH Strategic Leadership Team

	Desalination: Primary Actions to Mitigate Concerns - as *identified by customers through SW's insight programme*	**Key Actions Planned to Mitigate Each Concern**	**Ownership**
6	Intergenerational fairness helps provide a reason for new solutions and protecting for future generations.	SW's engagement materials for WfLH will need to focus on the explanation for protecting resources and the environment for future generations.	WfLH – Communications Team
7	In advance of any change in water source to the home, proactive engagement would be needed to help customers to understand any differences.	Proactive engagement through a range of channels is planned for the WfLH programme. Channels would include advertorials through the press, social media, website and direct communications - however, the exact scope is dependent on the final solution, timing and outputs from pilots / trials which will provide data as to the exact difference on water quality depending on the source.	Water Resource Planning Team, WfLH Strategic Leadership and Communication Teams
8	Customers would need reassurance on the quality and specifically any health risks when drinking 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.	WfLH Strategic Leadership and Communication Teams
9	The process of desalination should be explained in a way that demonstrates the natural components so as not to alarm customers that the water would be artificial.	SW's semiotics insight output provides practical frameworks and tools to enable the water recycling process to be explained through highlighting links to the natural process.	WfLH – Communications Team

2.9 Schedule

2.9.1 Background

SW has an obligation under a s20 Agreement[20] to implement, 'using all best endeavours', a 75 Ml/d desalination plant, in the Fawley area, in accordance with the preferred strategy in WRMP19. This Option is A.1 and is discussed in this document, along with Option A.2, a 61 Ml/day desalination plant in the same location.

In addition, Ofwat has requested that, as part of the RAPID Gated Process, SW also considers a number of alternatives to the Base Case. The assessment of alternatives in this way also represents prudent risk management and business planning, to ensure that, should it be required, there is an alternative available to meet SW's supply obligation, in the event that for any reason it is not possible to implement the Base Case, despite SW using all best endeavours to do so. Essentially, the alternative solutions act as 'back up' Options, in case the Base Case cannot be implemented. In addition, the consideration of alternatives is required in order to support important assessments such as SEA, HRA and Water Framework Directive Assessment (WFDA) as part of the Gated Process, and EIA, HRA and WFDA in the context of the subsequent planning and consenting process for the Base Case.

At RAPID Gate 2, SW has developed and is evaluating multiple Options. The Options discussed within this section are:

A – a new **Desalination** plant:

- Option A.1 - 75 Ml/d Desalinated water direct to Testwood WSW; and
- Option A.2 - 61 Ml/d Desalinated water direct to Testwood WSW

Each Options, outlined above, supply raw water to be treated at an existing SW WSW, before entering its potable water supply network. These Options are required by SW on an intermittent basis and coincidental with a 1-in-200-year drought event.

2.9.1.1 Purpose of this Document

This is the supporting document to the delivery schedules for delivering the Desalination solution types.

The developed delivery schedules are comprehensive schedules that detail the full suite of activities, dependencies and interfaces required to deliver this highly complex project. This document is to be read in parallel as it details the supporting narrative, highlights key features and aspects of the schedule and documents key assumptions and dependencies.

2.9.1.2 s20 Agreement

SW has an obligation under a s20 Agreement to implement, 'using all best endeavours', a 75 Ml/d desalination plant, in the Fawley area, in accordance with the Preferred Strategy in WRMP19.

The desalination schedule assumes that the SRO taken to planning will be a 75 Ml/d desalination plant located in the Fawley area (named in the WRMP19 Strategy A schemes referred to in the s20 Agreement).

A key assumption is that in accordance with the Draft National Policy Statement for Water Resources Infrastructure, the WRMP provides the robust 'need' case for the DCO application and that the Option taken

[20] Section 20 Agreement of the Water Resources Act with the Environment Agency (EA) and the Secretary of State for the Department of Food & Rural Affairs (Defra), which references the Strategy A in the SW Water Resources Management Plan for 2019 (WRMP19)

to planning should align with what is in the current WRMP. If the Option in the DCO application is materially different from the WRMP, it would be preferable to have the WRMP revised before the DCO application is submitted, which could be assumed a 'reasonable endeavours' delivery approach. However, if the WRMP revision is in preparation only, it will still be capable of being an important and relevant matter, and SW will need to provide the project need and justification material at the application level and not be able to rely on this in the WRMP document alone. This would add material risk to the planning process and likely require additional time within the pre-application stage of the project.

If, during the 'all best endeavours' delivery of the Option, it is found that the Option has insurmountable obstacles to delivery or is significantly different from the Option listed in Strategy A of WRMP19, a material change to the Option within the WRMP may need to be sought.

For the Desalination-based Options, it is unlikely that a material change would be required to WRMP19, however using 'all best endeavours' does apply. The schedules developed for the project are based upon this level of endeavour and are designed to expedite the project in the fastest overall sequencing possible. As a result, there are significant parallel running activities that must be managed and interfaced to facilitate the effective delivery of the project. Key dependencies and assumptions are detailed later within this document.

2.9.2 Delivery Schedule Development

2.9.2.1 Methodology

During the period between Gate 1 and Gate 2 the schedule has been further developed and refined in parallel with the wider project development. The project has evolved significantly since Gate 1 as SW has further developed the design, undertaken significant investigatory activities, formulated likely construction techniques, integrated specialist suppliers and engaged with key stakeholders.

SW's schedules are owned by its Project Leadership team and present a fully integrated plan for the delivery of a highly complex project. It maintains and updates project schedules in real time throughout the month and has formal reviews every two weeks to maintain focus on quality and progress.

As part of the schedule development process, a series of deep dive workshops were held on key interface areas such as:

- Environmental and planning consent
- Procurement and commercial and
- Engineering and process design

Where activities were common to the Base Case and strategic alternatives, workshops were combined for all the projects, with separate sessions held to develop project specific detail.

To inform the workshops, several project delivery assumptions were developed in advance, as is discussed later in this chapter. Specialist suppliers were engaged to provide key information, aligned with industry benchmarks, for the activities proposed. In particular, these were associated with ecological surveys, tunnelling and pipeline construction. The objective of the workshops was to develop the detail of activities further from Gate 1, to test the logic between the activities identified and ensure that a robust plan was developed through to completion, incorporating all development and learning from SW's Gate 1 activities.

Following the initial deep-dive workshops, the draft output schedules were then tested through a high-level risk analysis to ensure a realistic output. The schedule was then passed through another phase to scrutinise the logic and timeframes; this was done through identification of activities longer than nine months, without a fixed start date and introducing parallel workstreams where possible (rather than sequential).

Throughout the process, a number of scenarios were identified which will be further explored in Gate 3 with the objective to continue to optimise the schedule and explore opportunities as the project scope and design further develops. To fully develop and exploit these opportunities, SW generally needs to engage extensively with the market, stakeholders and suppliers. The opportunity to explore these opportunities is significantly improved as Options are rationalised and SW moves into the next phase of the DPC delivery process.

2.9.2.2 Schedule Work Breakdown Structure

The schedule has been developed to 7 Levels at present, with Level 1 to 4 of the Work Breakdown Structure (WBS) being identical all across all SROs. Table 67 has detailed SW's high-level WBS and the contents within lower levels within each section.

Table 67 - WBS Level 2 Headings scope and activities

WBS Level	Item	Detail
L2	Key Milestones	High level milestones to include: Direct Procurement for Customers (DPC) milestones RAPID gate dates OFWAT Control Points DCO process milestones Construction start, complete, commissioning complete, plant / facility operational milestones
L2	Gate (RAPID)	Project level capturing the governance and assurance of tasks associated with the RAPID process
L2	Ofwat	Activities associated with DPC Control Points and any interface points that require information from other functional teams within the project.
L2	Consent & Permit & Licencing	Required activities and processes informing DCO supported by statutory permitting, statutory and non-statutory consultation, DCO documentation application and submission
L2	Procurement & Commercial	Service routes for DCO sourcing teams, contract and equipment package awards including land acquisition and appointment of consultants, early contractor involvement and the procurement of Competitively Appointed Provider
L2	Design	Conceptual design, feasibility designs informing non-statutory and statutory consultations for non-infrastructure and infrastructure scope
L2	Surveys	Execution of surveys pertaining to land access, environment and engineering design works
L2	Post Contract Award	Site establishment, clearance and remediation and ground works, detailed designs, site investigation, procurement and site works undertaken by the CAP
L2	Test & Commission & Handover	Testing and commissioning of assets, handover followed by benefits realisation period
L2	Operational Readiness and Training (ORAT)	This section of the schedule is yet to be fully developed as it is dependent upon activities to be undertaken if future stages. This area will detail all activities to ensure that people, processes and systems are in place to ensure an effective asset commissioning and operation.

2.9.2.3 Schedule Gantt Charts

SW has developed a comprehensive series of P6 schedules for each of the solutions being progressed to RAPID Gate 2.

The full schedule for Desalination-based Option A.1 and A.2 can be found in Appendix A. The schedule submitted at the time of Gate 2 is progressed up to July 2021, as this was the cut-off date for the development of the Gate 2 submission.

The solution, A.1 and alternative A.2, only differ in deployable output capacities. Therefore, Option A.2 shares the same approach, logic and durations with A1 to procurement, regulatory approval and Design and Build under a DPC route. A separate schedule has not therefore been developed for A.2.

The level of schedule detail is sufficient to enable the agreed execution plan to be modelled and analysed. Activities are measurable, quantifiable and (where practical) linked to deliverables. Activities are not less than one month in duration unless absolutely necessary. Attention has been paid to incorporate a realistic logic chain for DCO submission and parallel procurement activities, enabling timely appointment of a CAP.

Engineering activity durations consider expediting requirements, review and approval cycles and regulatory requirements. Logic for the key activities identify where interfaces between SW and consultants / contractors are required. Permits are aligned to relevant design and construction type activities where applicable.

The construction schedule is 'physical area' using discrete identified areas. Each area contains a number of work packages and units which are defined scope of construction work consisting of logical units and subdivisions based on geographical area. Phasing of the early and site preparation and main construction methodology and durations derive from multiple sources and are recorded within the Assumptions and Dependencies section.

Benefits realisation is currently estimated at one year. SW will keep this under review and update as it further develops the benefits realisation processes and key benefits realisation measures are agreed.

2.9.2.4 Risk Alignment

SW have a comprehensive risk management process that is complementary to its schedule development processes. This process, and the outcomes of it is detailed within Section 2.7.

Overall, SW has followed a similar process to that at Gate 1, in line with the development of the Strategic Outline Case. From a schedule perspective, SW has articulated a delivery date range that is cognisant of the project's key opportunities and threats. This is detailed within Section 2.9.4. It should be noted that the 'ABE' obligation means that most schedule opportunities, particularly those associated with client led activities, are embedded within the schedule. SW has a limited number of opportunities that still require further engagement with external parties to understand the full costs and benefits. These will be explored with key stakeholders, partners, and the market within the next phase of activity.

The threat range is articulated through the use of the Green Book methodology to establish ranges of out-turn delivery dates. This aligns with UK best practice in complex project development and dovetails with the approach that SW has taken for cost estimating for consistency.

2.9.3 RAPID Gate 2 Delivery Schedules

The full delivery schedule is available upon request, please see section 2.9.3.1 for an overview of 'Plan on a Page'. These detail all relevant milestones, activities, durations, dependencies and governance gates. Each SRO project is highly complex in nature and must follow clearly identified development and governance paths for procurement, consenting, environmental and engineering development and funding.

These are fully articulated in the master schedules. SW has however created a simplified version of this plan to articulate the key features of the overarching project delivery schedule.

2.9.3.1 Plan on a Page

The ‘Plan on a Page’ gives a simplified, visual overview of the key governance points, overarching consenting and procurement activities and key design, construction and commissioning durations. It does not detail the full suite of interfaces and dependencies.

The Plan on a Page details the proposed RAPID Gates and Ofwat Control Points.

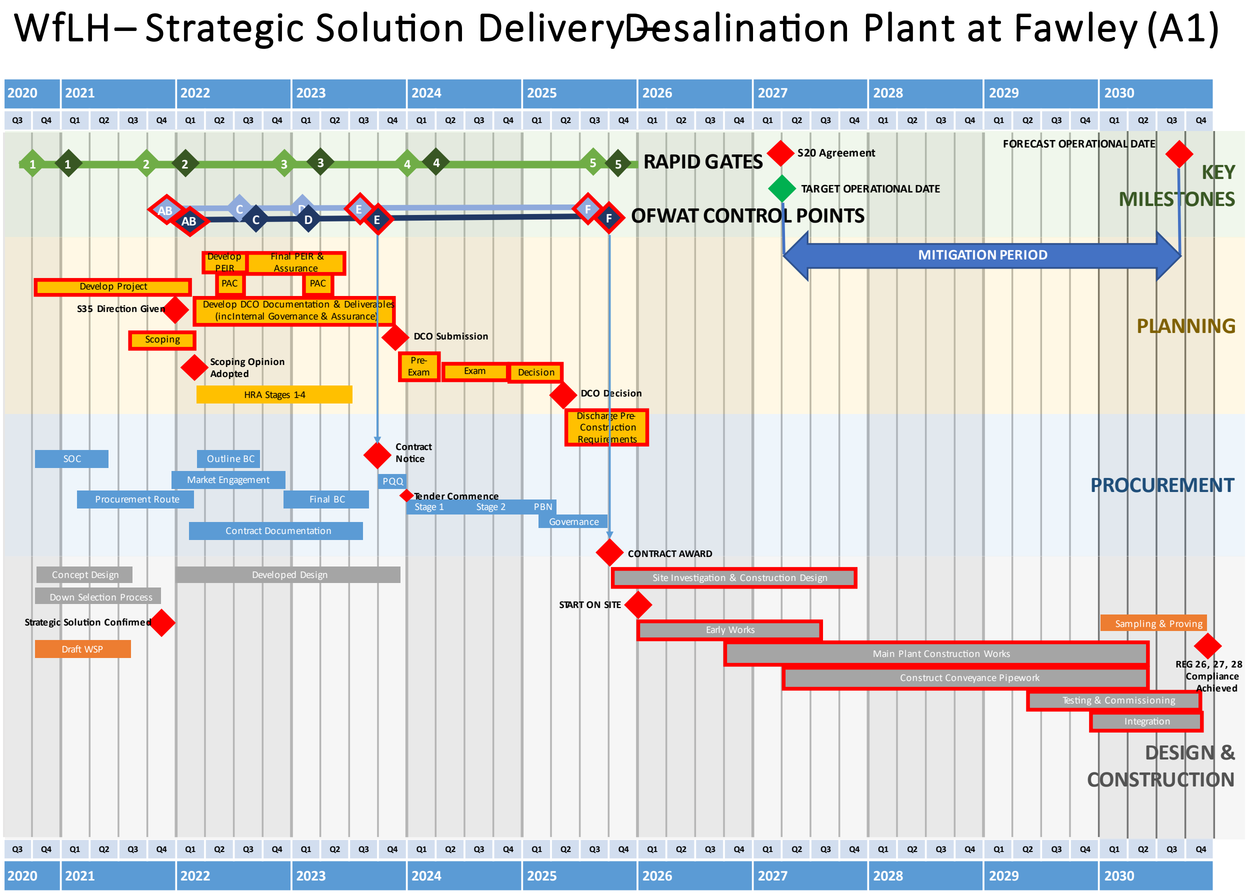


Figure 58 – WfLH – Strategic Solution Delivery Desalination Plant at Fawley

The key block of activity required to develop a DCO submission and undertake examination are detailed including the timing of these critical activities.

SW’s procurement process and timeframes are based upon executing the project under the DPC delivery model. A two-stage tender process is currently proposed to be utilised to facilitate the CAP competition.

Design activities are detailed, including those activities that are undertaken by SW and those that will be undertaken by the successful CAP. Construction and Commissioning durations are also detailed. These have been significantly updated in line with the project evolution between Gate 1 and Gate 2 and are now based on bottom-up estimates and comparative durations.

2.9.3.2 Key Interdependencies and Critical Path

Given the number of parallel processes that are being undertaken simultaneously, there a number of critical path and sub-critical path activities that are incredibly sensitive to being critical should there be relatively small movements within the overall delivery schedule. The below narrative highlights areas on the primary critical path along with key areas that are very close to the primary critical path.

A full copy of the critical path schedule is appended in Appendix B.

The Key Critical Path starts from Gate 2 as that currently drives the submission of the section 35 request. Following submission of the draft S35, SW was informed that Defra were not willing to pass comment on the draft S35 while Optionality was still present within the process. As Gate 2 is the end of this Optionality, it has been utilised as the commencement of this process, although delays to the schedule have been mitigated by the undertaking of substantial preparatory work associated with the section 35 request.

The Key Critical Path then flows through the surveys, which have already been commenced for those survey windows that are currently open or haven't started yet this year, and then through into the main DCO pre-application process.

Concurrently the DPC procurement process is also on the Key Critical Path. Virtually all procurement activities form part of the Critical Path. This includes the development of Control Point C, D and E materials and the progress and development Project Business Case. The CAP competition also forms the critical path.

Doe to the above, and the fact that they are absolute governance milestones, Control Point E and F are currently critical path activities. SW is working closely with Ofwat to ensure that it is closely engaging through the pre-activities to ensure that the Control Point materials are understood and that there are unlikely to be major surprises which should assist with minimising timeframes to pass the hard governance gates.

Control Point F is positioned to allow Contract Award post DCO consent being granted, and judicial review being completed. This is a key dependency to ensure that key risk items are address ahead of the award of the DPC delivery contract.

Elements of design activities and investigatory activities form part of the critical path. It is crucial that these activities are delivered on time as these will inform both procurement and consenting workstreams.

The consenting activities are currently sub-critical, however are very close to the critical path. Delays in the progression of the consenting activities will quickly move the process on to the critical path. Scoping activities, ecological surveys, public consultations and the development of the key pre-application data and information are all very close to being on the critical path. The DCO application and examination activities do form part of the primary critical path, indicating just how closely linked and sensitive the parallel progression of procurement and consenting activities are.

Post Contract Award the Key Critical Path flows through the detailed design of the Outfall tunnel which runs concurrently with the intrusive investigations needed to feed this design and the successful CAP's TBM procurement process.

Completion of the detailed design and procurement drives the commencement of the outfall construction which in turn drives the start of the wet commissioning activities, this is due to the need to be able to discharge and flows that are required for wet commissioning.

Following the Contract Award there are both secondary and tertiary Critical Paths that are only very short durations from becoming the Key Critical Path. These flow through the intrusive investigations, detailed design and construction of the conveyance pipework and the intrusive investigations, detailed design and construction of the desalination plant respectively. Relatively minor delays in these activities would bring them on to the critical path. SW will be working closely with the market and supply chain in the next phase of activity to develop risk management strategies to build float into these activities wherever possible.

2.9.3.3 Key Milestones

At RAPID Gate 1 SW suggested key milestones associated with the delivery of the project. The below table details those milestones and the current forecasted dates associated with the milestones.

Table 68 - Key Milestones

Key Milestone	Gate 2 Forecast Date
RAPID Gate 2	Q3 2021
DCO: Section 35 Request	Q4 2021
DCO: Section 35 Direction given by SoS	Q4 2021
DCO: Redline for Preferred Route Announcement (PRA) confirmed	Q3 2021
DCO: Masterplan published	N/A
DPC: Ofwat Control Point E	Q3 2023
DPC: OJEU Contract Notice to be issued	Q3 2023
DCO: Submission of the DCO application	Q4 2023
DPC: Ofwat Control Point F	Q3 2025
DCO: DCO decision (end of DCO Stage 5)	Q2 2025
Construction: end of DCO requirements discharged allowing plant construction to commence	Q4 2025
Construction: Commissioned asset in use	Q4 2030

2.9.3.4 Key Assumptions and Dependencies

Given the stage of development of the schedule, there are a number of assumptions that have been made in order to develop the schedule. There are also significant dependencies within the schedule where activities have a knock-on impact upon subsequent activities. SW details some of the key assumptions and dependencies through tables 69 to 75.

Table 69 – Consenting

Assumption / Dependency	Description	Rationale and impacts of change
Assumption	Planning approval is sought and obtained at the first attempt via DCO consenting route rather than Town and Country Planning. The critical path mostly comprises activities required for the DCO submission.	Should S35 direction not be given then the impact of following the TCPA consenting route likely include delay due to the more fragmented approach that need to be followed for a project of this complexity.
Assumption / Dependency	DCO follows a post Gate 2 2-stage consultation process with additional non-statutory and statutory consultations and is currently assumed to be dependent on the submission of the Section 35 which is therefore on the critical path.	Two additional stages of consultation will enable us to adequately address the rigorous consultation requirements associated with the DCO consenting process, ensuring that interested and affected stakeholders are given meaningful opportunities to influence our proposals as they are developed. This mitigates the risk of non-acceptance of the DCO application due to the inadequacy of consultation.
Dependency	DCO consent is required before Contract Award	DCO consent drives OFWAT Control Point F which allows SW to award contract to the final preferred CAP bidder.
Assumption	All stakeholders and regulators, can resource adequately to meet the schedule.	Stakeholder Engagement strategy is being developed to support the establishment of resourcing levels for key stakeholders to ensure the schedule can be met.
Dependency	ECI is a key predecessor for multiple activities.	Delay to the mobilisation of the ECI could impact DCO application submission.

Table 70 – Procurement and Commercial

Assumption / Dependency	Description	Rationale and impacts of change
Assumption	One DPC contract is being issued containing all of the elements of work.	Multiple contracts may result in potential for delay via resource and interfaces required to award. Further packaging assessment will be undertaken in the next phase of activity.
Assumption / Dependency	DWI approves use of recommended RO membrane supplier consolidated via approved BS6920 Test results and approved laboratory testing.	Without approved RO membranes water into supply could not be achieved.
Assumption / Dependency	Procurement of DCO sourcing team in support of the Planning & Consents Manager concludes end 2021 / Jan 2022.	Specialist resources will be required to support these activities and ensure that the DCO consenting process is delivered successfully.
Dependency	Judicial Review application period completion for the DCO consent drives the financial closure period.	Market engagement has informed SW that potential bidders may struggle to the contract until such time that DCO consent has been achieved and any conditions reviewed, and risks associated with those conditions have been quantified and apportioned. This linkage between DCO Consent and the procurement process is highly critical and will be a key area of focus for the next stage of market engagement.
Assumption	CAP award initiates CAP site investigations, designs (procurement) and construction sequentially.	With desalination solutions, there are extensive marine activities. These may require confirmatory investigations by the CAP to finalise construction and tunnelling methodologies.

Table 71 – Design

Assumption / Dependency	Description	Rationale and impacts of change
Assumption	Feasibility design for statutory consultation is sufficient quality to enable meaningful stakeholder engagement.	Inadequate feasibility design would impact on high quality consultation, potential risking the success of the engagement strategy.
Assumption	Feasibility design continues after Statutory consultation period for a period of 2 months.	Failure of feasibility design continuing post Statutory Consultation would result in feasibility design not being developed in line with feedback received from interested and affected stakeholders resulting in risk to DCO Consent.

Table 72 – Surveys

Assumption / Dependency	Description	Rationale and impacts of change
Assumption	We agree negotiated access with the majority of landowners ahead of undertaking surveys.	Use of statutory powers for access may result in negative opinion of affected stakeholders.
Dependency	SW perform all relevant surveys within feasibility design periods.	Feasibility design not sufficiently developed for DCO and DPC processes and survey data not available.
Assumption / Dependency	CAP performs own intrusive site investigations on commencement of CAP award.	Given the sensitivities of the marine environment and extensive tunnelling activities, SW has allowed time to undertake confirmatory investigations post-contract award. This assumption will be further explored with market participants on the next phase of activity.

Table 73 – Early Enabling Works

Assumption / Dependency	Description	Rationale and impacts of change
Assumption	No site works commenced until site clearance and compound set up available.	Need to promote and safe and efficient work environment for the site team.

Table 74 – Main Construction Works

Assumption / Dependency	Description	Rationale and impacts of change
Assumption / Dependency	Sequencing and durations of construction is reflective of design maturity at the time of this submission, and which has been used for all other aspects of this submission. It will require further development as the design matures to validate.	Changes and evolution to the design will inevitably impact on the construction durations. This could be in a positive or negative direction.
Assumption	Pipeline construction is based on 150 m per week.	This is based on three teams working concurrently extended hours 7 days a week as required but Hampshire County Council for all pipelaying works within the A326.

Table 75 – Testing & Commissioning & Handover

	Assumption	Rationale and impacts of change
Assumption	Commissioning will be performed in 2 stages.	SW has developed an indicative commissioning approach based upon the commissioning of desalination plants with the configuration currently adopted. Alternative single stage approaches may result in the inability to keep process units commissioned through the entirety of the commissioning process, impacting on the ability to successfully commission the plant.

2.9.3.5 Schedule Evolution since Gate 1

Some of the key changes and evolutions to the Gate 2 schedules to those presented at Gate 1 are:

- It was assumed at Gate 1 that SW could progress more quickly into the DCO development process for the Base Case. Engagement with key stakeholders meant that SW has agreed to delay the Request for S35 Direction until a single solution was confirmed. This has held back elements of activity that were planned in the current phase.
- At Gate 1, the assumption was that there would need to be 2 consultations associated with the consenting aspect of the project. These would be in the form of a non-statutory consultation ahead of Gate 2 and a Statutory consultation ahead of DCO submission. Following feedback from SW's non-statutory consultation, SW believe that a further non-statutory consultation will be required in order to generate necessary stakeholder support for the project.
- At Gate 1, the design element of work had little impact on the overall critical path. Following SW's project evolution, the design and development activities are far more intwined with each aspect of the project. Design, Consenting, Procurement and Stakeholder Management interfaces are now much more clearly defined, understood and documented.
- Following SW's post Gate 1 market engagement activities, it became clear that it needs to make a time allowance to facilitate the successful Financial Closure of the successful DPC CAP. This had not been accounted for at Gate 1.
- Ofwat Control Point C includes key activities such as market engagement and testing appetite of DPC procurement route from potential suppliers. It is a critical Control Point as it is the first point that

Ofwat can designate the scope for a DPC delivered project. Following SW's Gate 1 activities, engagement with Ofwat and wider lessons learnt, SW has a stronger understanding around the level of activity and coordination with the market and stakeholders that this will entail. SW has allowed more time as a result within Gate 3 / DPC Stage 3 activities.

Significant work has taken place between Gate 1 to Gate 2 to evolve designs, construction techniques, related-site investigations and main construction site works durations. This involved activity from SW's team members and specialist suppliers where applicable. This has resulted in much greater granularity in bottom-up plans whilst improving confidence in delivery plans.

The tables, shown in Section 2.9.5 give a detailed narrative of movements between the Gate 1 schedule milestones and the Gate 2 schedule milestones.

2.9.3.6 Solution Required Date

Q1 2027 is the target delivery date for the project. Following SW's extensive schedule development, engagement and optimisation activities, this date is forecast now as Q4 2030. Please see the section 2.9.5 for information on the movement of key milestones.

SW has been working very closely with regulators and stakeholders to communicate and understand the impacts associated with late delivery against the target dates. SW proposes to deploy an agreed and extensive mitigation strategy to ensure that the gap between the target date and the current forecast completion date can be effectively managed from a Supply / Demand balance perspective. See SW's Level 2 Submission Documents for details of its proposed mitigation approaches.

2.9.3.7 Timeframes for Future RAPID Gated Process

The schedule details indicative schedule dates for subsequent RAPID Gates (see Section 2.9.3.1).

The milestones are fully detailed in Section 2.9.5. It should be noted that the proposed dates for RAPID Gate 4 and 5 are indicative only at this stage and will flex as the project continues to evolve and continue through the project delivery lifecycle.

RAPID Gate 3 is now positioned at a point where SW can demonstrate technical and commercial feasibility for the solution, ensure that it is embedded within its approved WRMP and carries stakeholder and customer support. To meet these objectives, the gate is now positioned following Control Point C, SW non-statutory consultation and following any update to WRMP19. The forecast date for Gate 3 is November 2022.

RAPID Gate 4 is broadly positioned to align with the start of the DPC procurement process and the DPC application. SW will continue to work closely with RAPID to determine the precise timings of this gate, and where in the project lifecycle best fits to align with the procurement and consenting process. It is currently forecast to be Q4 2023.

RAPID Gate 5 is positioned to align with the completion of the DCO consenting process, the determination of Control Point F and the award of the DPC delivery contract. It is currently forecast to be Q2 2025.

2.9.3.8 Missing Information

At this stage SW does not believe that there is significant outstanding information that would be expected at the Strategic Outline Case stage of major project development.

SW will continue to develop further granularity, engage specialist suppliers and secure further detail input as it moves into the next phase of activity. ECI will be secured to test and challenge construction and commissioning schedules to ensure that these are robust and optimised.

The Gate 3 activities will include significant engagement with the market, stakeholders and regulators which will continually feed into and update the delivery plans.

2.9.4 Delivery Range of Earliest Deployable Output

2.9.4.1 Future Opportunities

There are a number of areas of opportunity that are not currently incorporated into SW's base delivery schedule. These areas relate to the post-DPC Contract timeframe and are mainly related to construction activities. At this stage SW has not included them within the base schedule because they are either:

- Conflict with one of SW's regulatory obligations (such as delivering Value for Money (VfM) for Customers); or
- SW needs additional information from the market to make an objective assessment

Full details of the opportunities are in Appendix C.

In summary, SW believes that there may be up to 6 months of time opportunity associated with the most viable opportunities that have been identified. This 6-month period will be fully validated and examined in the next phase of activity, including through SW's ECI engagement and market engagement activities associated with the Control Point C submission.

2.9.4.2 Optimism Bias (OB)

To calculate the threat range, SW has utilised the same OB approach that it utilised at Gate 1. This is consistent with the development of the Strategic Outline Case.

There are a series of statements that have been developed to substantiate the OB assessment. Please see Section 2.7 for details. These statements apply to both cost and schedule and are consistent for both areas.

Table 76 below summarises the current Original and Adjusted OB percentage of the works duration.

Table 76 - Current Original and Adjusted Optimism Bias percentage of the works duration

Option	Non-Standard Split	Standard Split	Original OB Percentage (%)	Adjusted OB Percentage (%)
A1	100	0	25%	16.46%
A2	100	0	25%	16.46%

Option A.1 and A.2 have the same works duration of 60 months. Table 77 below details the Original OB Works durations.

Table 77 - Original Optimism Bias Works durations

Option	Works Duration (months)	Original OB Percentage (%)	Original OB Threat allowance (months)	Total Works Duration inc. Original OB (months)
A1	60	25	15	75
A2	60	25	15	75

Table 78 below details the Adjusted OB Works Durations.

Table 78 - Adjusted Optimism Bias Works Durations

Option	Works Duration (months)	Adjusted OB Percentage (%)	Adjusted OB Threat allowance (months)	Total Works Duration inc. Adjusted OB (months)
A1	60	16.46	10	70
A2	60	16.46	10	70

2.9.4.3 Overall Delivery Range

Incorporating the above factors, the delivery range for the Desalination SRO is detailed in Table 79

Table 79 - Delivery range for the Desalination SRO

Option	Earliest Opportunity Date	ABE Delivery Date	Adjusted OB Delivery Date	Original OB Delivery Date
A.1 AND A.2	Q2 2030	**Q4 2030**	Q3 2031	Q1 2032

2.9.5 Extended Milestone Dates with Comparison to Gate 1 Dates

There are eight sets of milestones, they are categorised based on the WBS breakdown structure from the previous section of this report. Tables Table 80 toTable 88 detail the extended series of milestones, movements since Gate 1, the narrative around those movements and any relevant assumptions.

Table 80 - Gate Dates

Activity ID	Description	Date at Gate 1	Option A1/A2	Narrative	Assumptions
DSLN.KEY.00740	Gate 2 Submission	Q3 2021	Q3 2021	Gate 3 has been moved back following the development of key areas of the schedule such as non-statutory consultations and the Ofwat Control process. This ensures that the Outcomes proposed for Gate 3 can be met. Gates 4 and 5 have been aligned with appropriate points on the delivery schedule.	
DSLN.KEY.00760	Gate 2 Decision	Q1 2022	Q1 2022		
DSLN.KEY.00770	Gate 3 Submission	Q2 2022	Q4 2022		
DSLN.KEY.00780	Gate 3 Decision	Q3 2022	Q1 2023		
DSLN.KEY.00800	Gate 4 Submission	Q1 2023	Q4 2023		
DSLN.KEY.00820	Gate 4 Decision	Q3 2023	Q1 2024		
DSLN.KEY.00830	Gate 5 Submission	Q3 2024	Q2 2025		
DSLN.KEY.00840	Gate 5 Decision	Q4 2024	Q4 2025		

Table 81 - Ofwat Control Point Dates

Activity ID	Description	Date at Gate 1	Option A1/A2	Narrative	Assumptions
DSLN.KEY.00850	Ofwat Control Point A - Submission	Q4 2020	Agreed with OFWAT to combine with B	SW has held a series of informal, exploratory meetings with Ofwat to discuss how best to schedule the control points. RAPID has joined some of the meetings. These discussions are ongoing and will include the examination of any assumptions being made by SW, as well as the format and content of each report.	At G1, SW's initial thinking was that each Control Point had to be submitted separately. However, following further consideration and discussion with Ofwat, SW has combined Control Point A and B. This is because most of the content for Control Point A would also be produced for Control Point B. By combining the two, SW would thus increase efficiency whilst also achieving Control Point B Determination at the point where SW has a single preferred solution, in line with its discussions with Ofwat.
DSLN.KEY.00860	Ofwat Control Point A - Decision	Q1 2021	Agreed with OFWAT to combine with B		
DSLN.KEY.00870	Ofwat Control Point B - Submission	Q2 2021	Q4 2021		
DSLN.KEY.00880	Ofwat Control Point B - Decision	Q3 2021	Q1 2022		
DSLN.KEY.00890	Ofwat Control Point C - Submission	Q4 2021	Q3 2022		It is currently felt that the optimum submission time is ahead RAPID G3.
DSLN.KEY.00900	Ofwat Control Point C - Decision	Q4 2021	Q3 2022		
DSLN.KEY.00910	Ofwat Control Point D - Submission	Q1 2022	Q4 2022		Combining Control Point D with Control Point C was considered, given the apparent closeness in submission dates. However, this is currently deemed to be impractical given the amount of information required for Control Point D. Control Point D's submission scheduling will thus need to take into account the need to await Control Point C determination and feedback. It will now be more closely aligned with Control Point E.
DSLN.KEY.00920	Ofwat Control Point D - Decision	Q2 2022	Q4 2022		

DSLN.KEY.00930	Ofwat Control Point E - Submission	Q2 2022	Q3 2023		As part of Control Point E, SW intends to undertake a further VfM analysis, in addition to gathering all relevant information required for an Outline Business Case.
DSLN.KEY.00940	Ofwat Control Point E - Decision	Q3 2022	Q3 2023		
DSLN.KEY.00950	Ofwat Control Point F - Submission	Q2 2024	Q3 2025		Control Point F is dependent on the point at which SW internally identifies a Preferred Bidder. The Preferred Bidder’s proposal will in turn enable the Full Business Case to be completed as well as enabling SW to undertake all relevant governance prior to submission of Control Point F to Ofwat
DSLN.KEY.00960	Ofwat Control Point F - Decision	Q3 2024	Q3 2025		

Table 82 - Consent & Permit & Licencing

Activity ID	Description	Date at Gate 1	Option A1/A2	Narrative	Assumptions
HTRW.KEY.00910	SRO Consolidation (MCDA- 3no SROs become 1) (circa Oct 2021)	Q4 2021	Q4 2021	No change to the Gate 1 date	
HTRW.KEY.01000	WRSE 24 - COMMENCE PUBLIC CONSULTATION	Q1 2022	Q2 2022		
HTRW.CON.10130	Section 35 Direction - SoS s35 Direction Given	Q2 2021	Q4 2021	Following submission of the draft S35, SW was informed that Defra were not willing to pass comment on the draft S35 while Optionality was still present within the process. This rendered the Gate 1 S35 direction date unobtainable	The schedule has been updated to reflect the direction given by Defra with the issuing of the draft S35. It is now driven by the Gate 2 submission to RAPID as this is the point at which a Preferred Option will be presented. The same activities and logic have largely been retained resulting in the movement of the S35 direction given date from Q2 2021 to Q4 2021
HTRW.KEY.00510	FINAL WRMP 19 PUBLISHED	Q4 2022	N/A	WRMP does not need to be reconsulted on or republished for Option A1 as such the activities and logic relating to this process has been dissolved.	

Activity ID	Description	Date at Gate 1	Option A1/A2	Narrative	Assumptions
HTRW.KEY.00010	s20 AGREEMENT - SRO Operational (75 Ml/d DE-SAL @ FAWLEY OPERATIONAL)	Q1 2027	N/A	s20 Agreement date is a constrained date within the schedule and as such has not been affected by the schedule development.	

Table 83 – Scoping Opinion and DCO

Activity ID	Description	Date at Gate 1	Option A1/A2	Narrative	Assumptions
DSLN.CON.01400	REQUEST for a SCOPING OPINION - SUBMITTED to PINS	Q3 2021	Q4 2021	The movement in the Scoping Opinion being submitted to PINS is directly related to the movement in the S35 date.	The Scoping Opinion cannot be submitted to PINS until the S35 direction has been given. The schedule logic has been amended so that the submission of the Scoping Opinion is driven by the S35 Direction. Significant preparatory work on the Scoping documentation being undertaken at risk prior to S35 direction to mitigate the movement as much as possible.
DSLN.CON.01430	SCOPING OPINION - ADOPTED by PINS	Q4 2021	Q1 2022	The movement in the Scoping Opinion being submitted to PINS is directly related to the movement in the S35 date.	
DSLN.CON.00070	DCO APPLICATION SUBMITTED	Q1 2023	Q4 2023	DCO Application submitted date movement is a result of earlier delays to the S35 Direction and the key decision to undertake a two-stage consultation process post Gate 2.	SW's approach to public consultation is proposing two further stages of consultation, including both a non-statutory and statutory consultation. Two additional stages of consultation will enable SW to adequately address the rigorous consultation requirements associated with the DCO consenting process, ensuring that interested and affected stakeholders are given meaningful opportunities to influence SW's proposals as they are developed. This mitigates the risk of non-acceptance of the DCO application due to the inadequacy of consultation
DSLN.CON.00110	DCO ACCEPTED	Q1 2023	Q4 2023	The movement in all of these activity dates are aligned with the above reasoning.	The statutory process, logic and stated durations have remained. The internal durations for development of design maturity post consultation phases and internal governance periods have undergone rigorous
DSLN.CON.02140	EXAMINATION STARTED	Q2 2023	Q2 2024		

Activity ID	Description	Date at Gate 1	Option A1/A2	Narrative	Assumptions
DSLN.CON.02160	EXAMINATION ENDED	Q4 2023	Q4 2024		challenge both internally during deep dive session with SMEs and externally via legal review.
DSLN.CON.02200	DECISION ISSUED	Q2 2024	Q2 2025		
DSLN.CON.02220	JUDICIAL REVIEW PERIOD COMPLETED	Q3 2024	Q2 2025		
DSLN.CON.2680	Non-Statutory Consultation Commence	Q1 2021	Q2 2022	Non-Statutory Consultation was undertaken in Q1 2021 as per the Gate 1 schedule. The date now presented in the Gate 2 schedule represents the key decision to undertake a two-stage consultation process post Gate 2. The date presented here is the additional non-statutory consultation.	
DSLN.CON.2730	Statutory Consultation Complete	Q3 2022	Q2 2023	The movement in all of these activity dates are due to the key decision to undertake a two-stage consultation process post Gate 2	

Table 84 - Procurement

Activity ID	Description	Date at Gate 1	Option A1/A2	Narrative	Assumptions
DSLN.PRO.02390	DCO - CONSULTATION SUPPORT START DATE	N/A	Q4 2021	These new additional activities are representative of the increased granularity within the schedule presented at Gate 2	SW has identified key areas where the programme would benefit from commissioning external parties to apply their expertise. This is the proposed timeline for the procurement of specialist support expertise.
DSLN.PRO.10100	DCO - CONSENT SUPPORT START DATE	N/A	Q1 2022		

Activity ID	Description	Date at Gate 1	Option A1/A2	Narrative	Assumptions
DSLN.PRO.02530	ECI CONSULTANT START DATE	N/A	Q1 2022	Due to the changes in the DCO consultation strategy and the Control Points detailed above, there is a subsequent impact on the dates associated with these activities	
DSLN.PRO.02800	RO - Handover to Contract Manager/Owner	N/A	Q3 2022		SW has identified a key risk to Option A1 and A2 relating to the lack of DWI Regulation 31 approved reverse osmosis membranes. Following market engagement, and the development of a procurement strategy, SW is targeting this date to commence a commercial arrangement with preferred suppliers who either have attained approval for their membranes or have committed to by the CAP contract award date.
DSLN.PRO.03050	CAP - ISSUE CONTRACT NOTICE (OFWAT E dependent)	Q3 2022	Q3 2023		
DSLN.PRO.03070	CAP - COMMENCE TENDER STAGE 1 PROCESS	Q1 2023	Q1 2024		
DSLN.PRO.03090	CAP - Inform Bidders of Tender Shortlist	Q3 2023	Q2 2024		
DSLN.PRO.03110	CAP - Preferred Bidder Negotiations Complete	Q1 2024	Q1 2025		Following market engagement with potential CAP participants a logic link has had to be incorporated into the schedule resulting in a SW and CAP financial close period of 60 days post DCO Judicial Review application period. This also ensures that any final consent conditions are known, can be assessed and the risk associated quantified and apportioned.
DSLN.PRO.03140	CAP - CONTRACT AWARD	Q3 2024	Q3 2025		
DSLN.PRO.03170	CAP - CONTRACT START DATE	Q3 2024	Q4 2025		

Table 85 - Design

Activity ID	Description	Date at Gate 1	Option A1/A2	Narrative	Assumptions
DSLN.CON.00120	(GIVE) - SUFFICIENT DESIGN COMPLETE for DCO SUBMISSION	Q4 2021	Q3 2023	SW has worked through the interfaces in detail and is now allowing additional design effort to support throughout the consenting and procurement phases of activity. Following the key decision to undertake a two-stage consultation process post Gate 2 there has been further movement within this date.	
DSLN.DGN.00100	(GIVE) - SUFFICIENT DESIGN COMPLETE for PROCUREMENT	N/A	Q3 2023	This is a new key activity that has been included during the development of the schedule.	This activity has been linked to the Statutory Consultation process to mitigate the risks associated with having SRO information in the public domain that is not representative of what is being presented at Statutory Consultation and to limit the potential for change to the documentation during the tender process due to the incorporation of commentary from interested and affected stakeholders

Table 86 - Surveys

Activity ID	Description	Date at Gate 1	Option A1/A2	Narrative	Assumptions
EC SURVEY 1020	Ecological Surveys - THE START DATE	N/A	Q4 2021	These new additional activities are representative of the increased granularity within the schedule presented at Gate 2.	
DSLN.PRO.01890	INFRA SURVEYS & DESIGNS SUPPLIERS - START DATE	N/A	Q1 2022		
DSLN.SVY.060	Permit for Access granted for Survey Works	N/A	Q2 2022		

Table 87 - Post Contract Award

Activity ID	Description	Date at Gate 1	Option A1/A2	Narrative	Assumptions
DSLN.KEY.00400	Earliest Start on Site	Q2 2025	Q4 2026	The movement in the post Contract Award activities is representative of the increased knowledge that the WfLH programme has in this area. The Gate 1 post Contract Award schedule was developed following market engagement and comparisons with comparable global projects. SW has undertaken significant design, engineering and engagement activities that have allowed it to start to build up a more detailed understanding of the asset, site and engineering challenges. Specialist work has been undertaken to understand the activities in the marine environment which are now driving the critical path following the development of the construction techniques and associated schedules that underpin these activities.	Documentation utilised for construction schedule build 629451-SWS-DS-FL-DR-C-00111 P01.17 629451-SWS-DS-FL-DR-C-00131 P01.3_Intake PS 629451-SWS-DS-FL-DR-C-00125_marine survey_V1 629451-SWS-DS-FL-BQ-Z-00002_Intake CIT Sheet 629451-SWS-DS-FL-BQ-Z-00003_Clean CIT Sheet 629451-SWS-DS-FL-BQ-Z-00004_Sludge CIT Sheet 629451-SWS-DS-FL-BQ-Z-00005_General CIT Sheet SW - WG - W4L - Tunnels Programme Shifts - 27-05-21 - [redacted] Costing 629451-SWS-DS-FL-DR-C-00125 P01.5_Intake/Outfall Routes Raw data used for SW AMP7 programme algorithm has been used to inform durations for individual process units. Historical project experience has been used where comparable projects could not be identified in the algorithm raw data. The main terrestrial layout has been split up based on available space, utilising multiple work fronts where applicable. Expert supply chain has been used for discrete schedule area development such as the conveyance pipework and tunnelling and associated marine works. Planning planet durations have been used for civil and construction enabling works.
WBS SUMMARY	Superstructure Complete	N/A	Q1 2029		
WBS SUMMARY	Envelope Complete	N/A	Q2 2029		
WBS SUMMARY	Fit Out Complete	N/A	Q4 2028		
DSLN.KEY.00550	CONSTRUCTION COMPLETE	Q2 2027	Q2 2029		

Table 88 - Test & Commission & Handover

Activity ID	Description	Date at Gate 1	Option A1/A2	Narrative	Assumptions
DSLN.MCW.00530	Wet Commissioning Ready to Start [Intake Pump Station]	Q1 2027	Q4 2027	The movement in the post Contract Award activities is representative of the increased knowledge that the WfLH programme has in this area. The Gate 1 post Contract Award schedule was developed following market engagement and comparisons with comparable global projects. We have undertaken significant design, engineering and engagement activities that have allowed us to start to build up a more detailed understanding of the asset, site and engineering challenges. Specialist work has been undertaken to understand the activities in the marine environment which are now driving the critical path following the development of the construction techniques and associated schedules that underpin these activities.	Documentation utilised for construction schedule build 629451-SWS-DS-FL-DR-C-00111 P01.17 629451-SWS-DS-FL-DR-C-00131 P01.3_Intake PS 629451-SWS-DS-FL-DR-C-00125_marine survey_V1 629451-SWS-DS-FL-BQ-Z-00002_Intake CIT Sheet 629451-SWS-DS-FL-BQ-Z-00003_Clean CIT Sheet 629451-SWS-DS-FL-BQ-Z-00004_Sludge CIT Sheet 629451-SWS-DS-FL-BQ-Z-00005_General CIT Sheet SW - WG - W4L - Tunnels Programme Shifts - 27-05-21 - [redacted] Costing 629451-SWS-DS-FL-DR-C-00125 P01.5_Intake/Outfall Routes Raw data used for SW AMP7 programme algorithm has been used to inform durations for individual process units. Historical project experience has been used where comparable projects could not be identified in the algorithm raw data. The main terrestrial layout has been split up based on available space, utilising multiple work fronts where applicable. Expert supply chain has been used for discrete schedule area development such as the conveyance pipework and tunnelling and associated marine works. Planning planet durations have been used for civil and construction enabling works
DSLN.KEY.00580	INTRODUCE WATER INTO SUPPLY (PLANT OPERATIONAL)	Q1 2028	Q4 2030		

2.9.6 Gate 3 Schedule Development

Further schedule development work will take place between Gate 2 to Gate 3 as SW moves into the development of the Outline Business Case. SW will be further developing design, consenting and procurement activities to strengthen the underlying data.

SW will also be engaging extensively with stakeholders and the market as it moves into the next phase of activity. This will also shape SW's delivery plans and schedules as the project evolves.

2.10 Cost Modelling

2.10.1 Introduction to the Cost Chapter

Following on from the Gate 1 submission to RAPID in September 2020, SW has undertaken further work to both rationalise and refine existing and additional Options in order to ensure that the abstraction resilience criteria has been fully explored for the Western Grid programme of works.

This has enabled a suite of six Options to be shortlisted for outline design and the subsequent production of cost estimates.

CAPEX has been generated utilising first principals estimating for the infrastructure and tunnelling elements in conjunction with SW's delivery partner [redacted] and the [redacted] tunnelling team. Risk registers have been produced and costed collaboratively with SW stakeholders and SMEs to ensure gap analysis and avoidance of double counting. OB has been undertaken in accordance with Treasury Green Book recommendations and ACWG 3 stage approach. Average Incremental Cost (AIC) values have been derived from the cost and NPV calculation process.

The following estimates (cost and carbon) have been produced:

- CAPEX
- Risk
- OB
- OPEX
- Capital Carbon
- Operational Carbon
- NPV
- AIC

Overall, the comparison between Options remains the same from a CAPEX perspective with the Desalination-based Options (A1 / 2) being the highest cost with reduced costs for the Reuse Options (B2 & B5) and further reductions for the Alternative / Havant Thicket Options (B4 & D2).

It should be noted that the difference in CAPEX between the Options is less marked than at Gate 1 as subsequent studies have noted significant technical constraints for the Otterbourne and Havant Thicket components which are described further within the risk register and within the chapters covering the engineering solutions. As this report relates specifically to desalination, the focus will be on Options A.1 and A.2.

Overall, the Gate 2 submission provides an increased level of cost granularity to underpin further Option selection.

Table 89 details the Gate 2 solution comparison and Gate 1 to Gate 2 journey.

Table 89 - Gate 2 Solution Comparison and Gate 1 to Gate 2 Journey (cost base 2017 / 18)

Gate 2 Solution Comparison and Gate 1 to Gate 2 Journey								
Options		**A1**	**A2**	**B2**	**B5**	**B4**	**D2**	**CeraMac**
G1	CAPEX (£m)	802	759	461	587	458	176	0

Gate 2 Solution Comparison and Gate 1 to Gate 2 Journey								
G2	CAPEX (£m)	745	745	480	562	451	261	158
G2	CAPEX Inc 50% CeraMac (£m)	745	745	559	641	530	340	

Overall CAPEX values have remained consistent with the exception of D2 where a complex tunnel solution has superseded a previous open cut pipeline design between HTR and the proposed HLPS.

As a CeraMac plant is required at Otterbourne WSW for all B and D Options, the cost for this has been expressed above at 50% of CAPEX as this is deemed to be the percentage of this proposed asset which will treat flows produced by these Options to enable a comparison to be made between A, B and D Options.

2.10.2 Key Solution Cost Information, Building on Gate 1 with Reduced Uncertainty in Costs and Benefits:

The solutions considered for the strategic Option of Desalination are Options A.1 and A.2 – Desalination at Fawley and pipeline to Testwood WSW. The two Options which include desalination at Fawley only differ in terms of the process output. A1 is scoped to produce an output of 75 Ml/d and A2 61 Ml/d. The general arrangement of both Options is illustrated in Figure 59 below.

[redacted]

In moving from Gate 1 to Gate 2 exercises were undertaken to reduce uncertainty in both costs and benefits of the solutions being considered.

In order to achieve this for the Desalination-based Options, the following activities have been undertaken:

- Improved design definition for both the proposed desalination complex at Fawley and the reception facilities for flows at Testwood WSW. This enabled estimates to be produced on a more granular process level rather than overall solution models.
- The assessment of multiple engineered solutions and locations for the abstraction of seawater from the Solent and the return of extracted brine from the desalination process. This enabled the relative costs of the Options to be considered along with the engineering constraints represented. This allowed a specific Option to be costed as part of the estimate rather than the general allowance utilised at Gate 1, prior to the design being undertaken.
- Four Options have been reviewed for the pipe routes between the proposed site at Fawley and Testwood WSW each of which has been priced to understand the relative costs. Additional input was provided by SW's infrastructure delivery partner [redacted] in order to understand the practical constraints in terms of constructability and to ensure that these are represented both in the base cost and risks as necessary.
- The assessment of risk sums has been robustly undertaken in the form of costed risk registers for each individual Option rather than the SW risk percentage uplift utilised at Gate 1.
- OB has been calculated as per the ACWG guidance and applied for each individual Option rather than at the higher desalination and reuse levels utilised at Gate 1. For more detail on the OB process and values, refer to Section 2.10.7.
- Additional Project Costs (APC) have been revised based on inputs from subject matter experts such as the statutory undertakers [redacted], Land Managers [redacted] and Environmental Consultants [redacted]. The following APC components have been revised:
  - Land - Independent cost benchmarking by [redacted]
  - Power - Desktop quotations provided by [redacted]
  - Pilot Project Costs - Reviewed and updated with project team
  - Planning - Reviewed and updated with project team
  - Public Consultation - Reviewed and updated with project team
  - Legal - Reviewed and updated with project team
  - Environment - Reviewed with SW's environment team and [redacted]

  Construction costs have been collated using the CCS Candy Estimating platform by the SW cost intelligence team to ensure a consistent approach with the supply chain. Infrastructure and tunnelling elements have been priced from first principles utilising current market data in conjunction with [redacted] and [redacted] respectively and linked back to the design information. Process and Desalination plant costs have been derived from a combination of SW and industry cost data and reviewed against market norms. As such the level of granularity of cost and scope has been improved from the information available at Gate 1, which was both at a lower level of granularity of design information and costed largely only using parametric models.

Overall costs of the solution, construction, and operation for each Option:

The overall CAPEX and OPEX, as well as NPV and AIC values over 108 years are detailed below in Table 90 (to cost base 17 / 18). It should be noted that as the only difference between A1 and A2 is 14 Ml/d DO. The CAPEX costs are deemed to be similar at this stage with changes in power and consumables reflected in the relative OPEX costs. OPEX, NPV and AIC values presented are for the 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.

Table 90 - Desalination CAPEX and OPEX Totals, NPV and AIC values (cost base 2017 / 18)

Operating Regime	FLOW (Ml/d)	CAPEX (£M)	OPEX (£M/y)	NPV (£M)	AIC (p/m3)
			A1		

Operating Regime	FLOW (Ml/d)	CAPEX (£M)	OPEX (£M/y)	NPV (£M)	AIC (p/m3)
MAX (DO)	75	745	22.5	1,319	209
MIN	15	745	7.7	979	155
AVERAGE	15.6	745	7.9	983	156
			A2		
MAX (DO)	61	745	19.0	1,239	241
MIN	15	745	7.7	979	191
AVERAGE	15.46	745	7.9	982	191

The CAPEX, 60-year OPEX and 60-year NPV values produced at Gate 1 are detailed in Table 91. Note the OPEX costs are not easily comparable against the new Gate 2 estimates for the following reasons:

- Approach for developing operational regime estimates were different between Gate 1 and Gate 2, most significantly the flow regime considered. Gate 1 attempted to model a flow regime that included a range of potential operating flows in varying years. In Gate 2 OPEX costs are reported for minimum and maximum (DO) flows, as well as an average as described above.
- For Gate 1, power and chemical use were estimated by the costing team. For Gate 2, the power and chemical consumption has been estimated and provided by SW's design team.
- Gate 1 OPEX values were reported as the total operating cost over 60 years. Gate 2 OPEX values are costs per year.
- Gate 1 OPEX costs included OB. This is not included in Gate 2 OPEX estimates (see Section 2.10.7 for further information).

Table 91 - Gate 1 CAPEX, OPEX, NPV

Option	DO (Ml/d)	CAPEX (£M)	60yr OPEX (£M)	60yr NPV (£M)
A1	75	802	608	1,65
A2	61	759	597	964

2.10.3 Detail of Capital Expenditure (CAPEX)

CAPEX for the Desalination-based Options is detailed in is illustrated in Figure 60 below.

[redacted]

Figure 60 - Option A1 / 2 Desalination-based Options CAPEX

Summary of the process undertaken to prepare the CAPEX estimate:

The process undertaken to prepare the CAPEX estimates for the Desalination-based Options is as follows (please note that elements highlighted in Blue below forms an improved process from Gate 1):

- Appraisal of the Options by the estimating team with the design leads to obtain understanding of scope and known constraints. Discipline specific design and estimating leads appointed to enable the collaborative production of estimates covering the infrastructure, non-infrastructure and tunnelling specific elements of scope.
- Production by the design team of scope (CIT) documents aligned to SW's process drivers, to enable the scope to be represented as a Cost Breakdown Structure (CBS) in order to be priced.
- Third party support procured to collaboratively review constructability of key scope [redacted] (Tunnelling) and [redacted] (Pipeline routes).
- Estimating of Direct Costs for each Option from a combination of SW and Industry data supported by first principles estimating of the pipeline and tunnels elements.

- Estimates combined into comprehensive priced schedule of works in CCS Candy.
- Estimates reviewed by design leads to ensure that the scope had been correctly interpreted.
- Risk Registers collaboratively populated and costed with relevant subject matter experts Contractor indirect cost allowances calculated from SW's percentage uplifts (SMART targets) to align with PR19 allowances.
- Additional project costs reviewed with subject matter experts with external assistance from statutory undertakers to ensure appropriate benchmarks applied.
- Costs are based upon the same land take considered at Gate 1.
- Client costs calculated from SW's percentage uplifts (SMART Targets) to align with PR19 allowances.
- OB percentage collaboratively calculated with relevant subject matter experts in a formal facilitated workshop.
- Costs tested collectively to mitigate against gaps in known data or double counting between base cost, risk, and optimism bias.
- In order for the estimates to align to the PR19 submission to Ofwat all costs have been indexed. Currently all costs are 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 (OBR). This provides an indexation from current Q2'2021 back to 2017 / 18 of –8.084%.
- CAPEX costs and estimate structure is provided to align with the production of OPEX, Carbon, NPV and AIC summaries for each Option.

2.10.4 Detail of Operating Expenditure (OPEX)

The process undertaken to prepare the **OPEX estimates** for the Desalination-based Options is as follows:

- OPEX estimates for each Option have been prepared, divided into fixed OPEX and variable OPEX to align with WRSE requirements.
- Fixed OPEX is made up of operational maintenance (calculated as a percentage of CAPEX) and staffing costs, whereas variable OPEX is made up of abstraction charges, transmission and network pumping costs, electricity and consumables used in treatment.
- Two operating regimes were used for deriving variable OPEX for each Option. These operating regimes are consistent with those detailed in Section 2.2, Engineering Technical Design and are as follows:
  - The minimum operating scenario is the lowest flow the Option can operate at and is the usual Base Case
  - The maximum operating scenario is the flow the Option can deliver in a drought event (DO)
  - A third regime, Average operating scenario, was derived from the minimum and maximum assuming the maximum occurs for 1 year in 100 years and the minimum flows occur for the remaining years.

Table 92 - Min, Average, Max flows for A1-A2

Option	Min flow (Ml/d)	Max flow (Ml/d)	Average Flow (Ml/d)
A1	15	75	15.60
A2	15	61	15.46

- The cost of water has been estimated using abstraction costs from the EA for ground water abstraction, with factors applied to derive costs for other water sources (including tidal abstraction for desalination schemes).
- Staff costs for treatment plants and transfer infrastructure have been based on staffing level assumptions and hourly unit costs provided by SW.
- Chemical costs have been derived using chemical volumes supplied by SW design engineers for the desalination plant for 15 Ml/d, 61 Ml/d and 75 Ml/d operating regimes. Unit costs for chemicals were taken from SW's OPEX tool where available or from industry data.
- Power demand estimates for the infra and non-infra schemes were provided by SW design teams and converted to annual power consumption.
- Operational transport costs were estimated for staff undertaking operations and maintenance activities. These estimates included vehicle leasing and fuel use and were based on unit rates provided by SW.
- The transport and disposal costs for WTW waste (grit, screenings, and sludge) have been derived using unit rates provided by SW and estimated waste quantities.
- Annual operational maintenance costs have been estimated based on a percentage of the initial capital costs at the Option level. These percentages are based on common assumptions used in the water sector for such infrastructure. Civil maintenance was calculated as 0.5% of the Infra and non-infra civil costs whilst Mechanical and Electrical (M&E) maintenance was calculated as 2.5% of Infra and non-infra M&E costs which aligns to the approach taken within the Water Resource Management Plan 2024 (WRMP24) exercise.
- The variable OPEX cost per ML was derived by dividing the total variable OPEX by the flow estimated for that Option.

The process undertaken to prepare the **Capital Maintenance estimates** for the Desalination-based Options 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 (see table in assumptions Section 2.7.2.3.
- 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 Net Present Value (NPV) and AIC analysis. Capital maintenance / renewals cycles have been taken as starting in year 9 (first operating year).

No **additional risk or optimism bias** has been added to the OPEX for Gate 2. The key risk factors affecting potential OPEX costs were identified as being significant changes in unit costs of OPEX consumables such as power and chemicals, or if the scheme needs to run more regularly than currently anticipated. At this point there was not considered the need to apply potential real terms cost inflation for unit rates as this was not seen as a significant risk that could be modelled. To account for the potential for more regular operating requirement a range between the minimum and maximum operating cost has been provided as well as the estimated average operational costs, which accounts for the most likely operating costs.

2.10.5 Net Present Value (NPV) and Average Incremental Cost (AIC)

The approach to calculating the NPV and AIC values has followed guidance in terms of process from the ACWG to ensure consistency in the calculation of NPVs and AICs across all SROs. The ACWG Cost Consistency report reviewed approaches to calculation of financing costs and recommended a consistent approach.

NPV estimates have been calculated over a 108-year period[21], 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

[21] Note that the ACWG guidance recommends a total 80year NPV period.

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. The Option Financing costs have then been calculated as a stream of annual costs over the life of the Option, using an assumed 2.92% Weighted Average Cost of Capital (WACC). The NPV of all costs has then been calculated using the Treasury Test Discount rate as set out in the HM Treasury Green Book (Appraisal and Evaluation in Central Government, HM Treasury 2018). This is 3.5% for years 0-30 of the appraisal periods, 3.0% for years 31-75, and 2.5% for years 76-125.

AIC values have been estimated based on deployable output. Three denominators are used – minimum utilisation, maximum utilisation, and average utilisation (assuming 99 years of minimum utilisation and 1 year of maximum utilisation). In all cases the denominator (discounted DO over the life of the scheme) is the same - i.e., it is a unit cost for making available a capacity. In each case the flows are discounted over the life of the scheme using the Green Book discount rates.

2.10.6 Carbon Analysis

The process undertaken to prepare the **Capital Carbon emissions** estimates for the Desalination-based Options is as follows:

- The capital carbon assessment was based on scoping information from the CIT costing sheets.
- Analogous to cost models, the capital carbon models are based on curves created from data points, relating a driver defining the size of the asset to its carbon emissions. The carbon models are not based on the same underlying information as the cost models, and not all cost models have a directly corresponding carbon model. The size drivers also do not always match. Cost models were mapped to carbon models as closely as possible, with standardised assumptions made where drivers needed converting between units or different estimates of the asset size were required.
- Where costs were developed using a bottom-up approach or based on quotes from suppliers rather than cost models, a general approach to account for additional capital carbon was applied based on the relative proportion of the total cost. For example, if 90% of the total cost was based on cost models and 10% was bottom up, the total capital carbon was scaled up accordingly to account for the additional assets. This approach was taken due to the wide range of assets which had been costed without reference to standard cost models and was a time-effective estimate of the carbon associated with these assets.

The process undertaken to prepare the **Operational Carbon emissions** estimates for the Desalination-based Options is as follows:

- Quantities for power use, chemical use and transport were taken from the operational cost estimates, with power and chemical use estimates provided by the SW design team.
- Power:
  - Emissions factors for grid electricity taken from Department for Business, Energy and Industrial Strategy (BEIS) Green Book projections and take into account projected grid de-carbonization from 2029 to 2100, with the emissions factor assumed to be constant after 2100.
  - BEIS Green Book values always appear to lag 2 years behind the Defra reported value in each year. Therefore, the values used for 2030 correspond to the 2028 value in the Green Book etc.
- Chemicals:
  - Where available, emissions factors were taken from the Carbon Accounting Workbook (CAW). Chemical quantities were taken from the OPEX calculations, converted into the amount of pure chemical used.

  - Where not accessible from the CAW, an emissions factor for CO2e was found from an alternative source. Note that no reasonable emissions factor could be located for anti-scalant, and therefore this was assumed to have the same emissions factor to orthophosphoric acid.
- Transport:
  - Emissions factors were taken from the CAW, which provides tCO2e / km travelled
  - Assumes operational journeys completed by van, large HGVs (>33 t) used for sludge trucking and smaller HGVs (3.5-3.3 t) for screening and grit transportation
- Operational maintenance:
  - Carbon emissions associated with operational maintenance were assumed to be negligible and primarily associated with labour rather than significant additional materials use

The whole life carbon estimates comprise the capital carbon emissions, annual operational emissions and additional emissions associated with capital maintenance. The estimated annual carbon emissions profile was based on the whole life cost profile developed for the NPV and AIC cost calculations.

- Years 1-4: planning
  - Assumed no carbon emissions associated with planning phase
- Years 5-8: construction
  - Assumed all capital carbon emissions occur in years 4-8 in proportion to the following capex breakdown:
    - Year 5: Proportional to 25% of planning costs and 20% remaining CAPEX costs
    - Year 6: Proportional to 25% of planning costs and 35% remaining CAPEX costs
    - Year 7: Proportional to 25% of planning costs and 35% remaining CAPEX costs
    - Year 8: Proportional to 25% of planning costs and 10% remaining CAPEX costs
- Years 9-108: operation & capital maintenance
  - Capital maintenance emissions were assumed proportional to capital maintenance costs, e.g., if capital maintenance costs in year 13 are 1% of total CAPEX, the capital maintenance carbon emissions in year 13 were estimated as 1% of total capital carbon emissions.
  - Annual operational carbon emissions were included and calculated as above. As grid decarbonization projections are included in the analysis, year 1 is assumed to be 2021 and the first operational year is assumed to be 2029.

The monetised cost of carbon was also calculated using the traded and non-traded carbon price forecasts from the Green Book Supplementary Guidance: Valuation of energy use and greenhouse gas emissions for appraisal (Table 93, Carbon prices and sensitivities 2010-2100 for appraisal, 2018 £ / tCO2, central price). The traded carbon price was applied to power related emissions only, with the non-traded carbon price applied to all other emissions.

The current estimate of emissions provides a view of how much the Options would add to SW's existing emissions once commissioned. Under SW's net zero operational emissions by 2030 commitment these operational emissions will need to be reduced and potentially offset by 2030. The potential costs of offsets have not been included as this would be considered as part of SW's overall net zero and offsetting strategy.

Table 93 details 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.

Table 93 - Capital, operational and whole life carbon estimates and monetised cost of carbon (2018 £ / tCO2)

OPERATING REGIME	FLOW (Ml/d)	CAPITAL CARBON (tCO2e)	OPERATIONAL CARBON (tCO2e)	WHOLE LIFE CARBON (tCO2e)	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

2.10.7 Estimating Uncertainty, Risk and Optimism Bias (OB)

Following the development of the base cost (direct costs) using the priced bill of quantities underpinned by the CIT sheets (quantified schedules of works) received from the relevant Design Teams, consideration must still be given to the remaining uncertainty contained within both the pricing assumptions (e.g., assumed unit rates) and the design assumptions (e.g., assumed ground conditions).

In order to do this, any significant assumptions made during the design and estimating process are interrogated in formal risk workshops to understand the level of variance that remains within these assumptions. Discussion of the assumptions between the design team, estimating team and risk team within the workshop enables each assumption to be assigned, as appropriate, to one of estimating uncertainty, risk or OB and ensures that all these three elements of the estimate are fully integrated and considered in accordance with each other to avoid either cost duplication or cost gaps.

For clarity, and to prevent this cost duplication throughout the cost estimating process, the three elements are defined as follows:

- Estimating Uncertainty: Percentage ranges around the component costs and productivity rates of the defined scope to account for variance inherent in the input values.
- Risk: Discrete and specific events that have the potential to impact (positive or negative) on the successful achievement of the defined and agreed scope.
- OB: A percentage uplift applied to those elements of the Project Delivery that are not sufficiently defined or understood to enable an agreed scope to be defined and therefore discrete, specific risks to be applied. This approach is ensured through the adjustment of the OB percentage utilising the information contained within the quantified risk register.

Estimating uncertainty

Through these integrated discussions, those items where it is appropriate for estimating uncertainty to be applied are identified. Subsequently, on completion of the base cost for each Option estimate, Level 1 costs are generated through a summarisation of the individual costs within the Bill of Quantities. Uncertainty ranges are then applied to these Level 1 costs (summarised major headings from the Bill of Quantities). The ranges are applied in the form of percentages, with each Level 1 summary cost having a negative (e.g., -10%) and a positive (e.g., +20%) percentage applied. These specific uncertainty range percentages were selected based upon the estimating teams' level of confidence in likely level of change to component cost and productivity for the specific Option scopes with the final range reflecting the remaining level of uncertainty associated with the respective element. These estimated uncertainty values are then applied to the BASE cost for each Option to provide a Net Direct Cost. As stated above, where potential variance in an assumption is agreed to be expressed using estimating uncertainty, these specific assumptions are no longer considered as part of the subsequent risk or optimism bias assessments to prevent duplication.

Risk

Through the integrated discussions, those items that are considered specific risks (threat or opportunity) to the agreed design, and therefore scope, are captured on a quantified risk register and their current probability of occurrence and range of cost impacts are estimated and agreed. This process is undertaken for both the infrastructure elements and the non-infrastructure elements of each Option. This ensures that a comprehensive list of discrete risks is identified and allows a fully quantified risk register to be developed for each Option based on the assumptions made during the design process.

In order to estimate the probability for each risk, the probability is assessed in a quantitative manner on a scale of 1% to 99% using group consensus during the facilitated cost risk workshop, with final approval granted by the Project Manager. This approach is in accordance with the wider Risk Management Process as contained within the SW Risk Management Handbook and is explained in more detail in Section 2.7.

When estimating the range of cost impacts for each identified risk, Minimum, Most Likely and Maximum cost impacts are considered. However, it should be noted that given the level of uncertainty that remains within the Options, the starting point for each range of cost impacts was to populate only the Minimum and the Maximum costs. Only in the event that the integrated discussions agreed that a Most Likely cost could be identified (i.e., we have sufficient knowledge to specifically suggest a Most Likely cost), was a Most Likely cost included within the Range of cost impacts. Similar to the probability, these values are estimated using group consensus during a facilitated workshop, with final approval granted by the Project Manager. All costs are aligned with those values used in the base cost build up.

The risk cost impacts captured initially within the risk register are direct costs only. However, within the cost risk model input sheet, indirect uplifts have then been applied to the individual cost impacts to reflect the application of indirect cost percentages to ensure that the modelled risk value presented within the estimate is aligned to all the other capital costs, which themselves have been uplifted by indirect costs. Following the estimation of the probability, the range of cost impacts for each risk item, and the application of the indirect cost uplifts, the cost risk inputs have been modelled using Monte Carlo simulation within the @Risk software. This has enabled a range of risk output values to be calculated, with the P50 value being selected for inclusion within the cost estimate.

The above risk approach has been applied across all the Options, except in the event that the integrated discussions agreed that the level of design maturity for a particular element did not support the use of a quantified risk register. For the Desalination-based Options, these elements include the Intake and Outfall Structures (Option A.1 and A.2). Under these circumstances, the risk approach for these specific elements relied on a percentage uplift approach rather than a list of specific, discrete quantified risks. However, the values resulting from this percentage uplift were still incorporated within the cost risk model and therefore the total risk value for each relevant Option.

The P50 risk values for Options A1 and A2 are detailed in the Table 94 below, along with the risk percentage when compared to the base cost. In addition, the Gate 1 Base Cost and Risk Values are included for comparison.

Table 94 - Risk Values at Gate 1 (Q3 2020 values) versus Gate 2 (Q2 2021 values)

Option	Gate 1 Base Cost	Gate 1 Risk Value*	Gate 1 Risk Percentage*	Gate 2 Base Cost	Gate 2 P50 Risk Value	Gate 2 Risk Percentage
A1	£395m	£309m	78%	£497m	£152m	31%
A2	£357m	£300m	84%	£497m	£152m	31%

*At Gate 1, the risk value was applied against the net direct cost portion of the Gate 1 Base Cost only. However, to enable direct comparison of value with Gate 2, the Gate 1 risk value has been uplifted with indirect costs.

Table 94 therefore details that since Gate 1, the risk values (and percentages) associated with the cost risks for both Option A1 and Option A2 have reduced, as the quantified risk process has predominantly removed the need for the use of percentage uplifts. This shift to a quantified risk approach, resulting from a maturing design, has enabled a more realistic view of the cost risk profile at Gate 2, and in this instance has resulted in a decreasing risk profile as more information is obtained through the design process.

At this stage of design, a preferred pipe route has is to be selected as the Options are not suitably mature in their design and have not concluded the stakeholder consultation activities as part of the planning process. Therefore, a range of pipe routes were examined as part of the cost estimating exercise with only one pipe route costed as part of the base estimate. To ensure that the costs associated with the alternative pipe routes were not excluded from the cost estimates, these were instead represented within the cost risk model. However, it is necessary to communicate the value associated with these items in order that their contribution to the overall risk value is visible in the event that the overall risk values are deemed high for the stage of the Project Lifecycle.

Whilst the reduction in the risk value from Gate 1 to Gate 2 is a positive step, within the £152 m of risk value there is circa £25.3 m of cost associated with pipe route Optionality. £6.3 m relates to the Fawley to Testwood pipe route and £19 m relates to the Intake / Outfall pipe routes. Therefore, removing this cost from the risk value reduces the risk value even further (£127 m), further improving the latest cost risk profile.

Within the circa £152 m of risk value shown above, the key cost risk drivers (excluding route Optionality items) are:

- Material Volatility
- Compensatory Habitats
- Environmental aesthetic considerations to Desalination Plant
- Contaminated Land
- Schedule Delay

Optimism Bias (OB)

In order to undertake the OB process, the guidance contained within the HM Treasury Green Book Supplementary Guidance: Optimism Bias has been followed, ensuring that any updated guidance from the ACWG has also been incorporated (see Section 2.10.7). This ensured that the appropriate Project Type was applied when commencing the OB assessment and that the appropriate adjustments are made to the OB percentages throughout the assessment.

OB has been applied once to each Option, rather than being applied at a more granular level within each Option. In order to determine the level of OB to be applied to each Option, the Project Type relating to each Option is first confirmed (Stage 1). Throughout all Options, the Project Type has been selected as Non-Standard Civil Engineering, in accordance with the guidance contained within the ACWG technical note. In relation to Option A1 and A2, 100% Non-Standard was selected owing to a combination of the Desalination Plant and Marine Structure being categorised as Non-Standard and the transfer route, whilst initially being selected as Standard, being adjusted to Non-Standard owing to its length, diameter, and particular spatial constraints. This provided a Combined Upper Bound OB percentage as detailed in Table 95.

Following the agreement of the Project Type split, each statement within the OB template is assessed for confidence (Stage 2). The templates used at Gate 1 were updated to ensure alignment with the ACWG guidance and then utilised as the starting point for the Gate 2 assessment, with the previous confidence levels assessed to understand whether there had been an improvement as more information has been made available, or whether there has in fact been a reduction in confidence as previous clarity has diminished. This provided an Adjusted OB percentage.

Prior to this Adjusted OB percentage being applied to the Base Estimate (excluding risk), Stage 3 of the OB assessment was undertaken. This involved mapping the specific risk items from the cost risk model, where appropriate, to the relevant contributory factors within the OB template. Once completed, the confidence level associated with the contributory factor was further assessed in order that the quantified risk inputs were taken into account and to prevent duplication of costs. This generated a Risk Adjusted OB percentage (as detailed in Table 95) and this percentage value was then applied to the estimate, excluding the previously calculated total risk value, in order to provide an overall Option Project Cost, subject to AACE range and Indexation adjustments.

Table 95 - 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 (Stage 1)	Gate 2 Adjusted OB Percentage (Stage 2)	Gate 2 Risk Adjusted OB Percentage (Stage 3)	Gate 2 Risk Adjusted OB Value
A1	40.3%	£203 m	66%	42.%	32.%	£160 m
A2	40.3%	£203m	66%	42.%	32.%	£160 m

Similar to the risk value and percentage, the OB percentage and value have reduced 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 Green Book recommends applying optimism bias to operating costs and benefits as well as to CAPEX, the Supplementary Green Book 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 optimism bias 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.

2.10.8 Estimating Assumptions and Exclusions

Classification of estimates

The design which underpins this estimate remains at an early level of maturity, the estimate is deemed to be of AACE Class 4 accuracy (+30% /-5%). There is a risk that design development may identify alternative solutions and or methodologies which may have significant cost impact both positively and negatively. As such the current accuracy envelope can only cater for fluctuations in cost of the current solution. Any changes to estimated solutions would require a reassessment of the estimate and confidence level.

Bases of estimates

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

- The OB percentage used for the CeraMac Plant only estimate is based on the responses provided for the Non-Standard Civil Engineering element of the B2 Option OB assessment, with the Non-Standard Civil Engineering element adjusted to 100% (i.e., 0% Standard Civil Engineering)

Construction general

- An allowance has been included for piling, specifically for all the proposed buildings and selected process plant base slabs.
- Where ground conditions are yet unknown, an additional allowance for piling to other structures has been incorporated into the Risk values.
- No allowance has been made for any ground stabilisation works.
- No allowance has been made for meeting any planning or environmental costs unless advised within the estimate and risk/optimism bias sums.
- No allowance has been made for dealing with any impact that the proposed works may have on any existing or proposed assets plant or foundations.
- SW provided costs such as the allowances for land purchase, DNO, Public Consultations etc are taken at face value and included within the relevant estimates.
- No allowance has been made for environmental mitigations for invasive or protected species of fauna and flora unless stated within the estimate and risk / OB sums.
- An additional allowance for special design or requirements of planning consent are included at a rate of 30% of the base cost of the buildings in Options A1 & A2.
- No information is available as to the current ground conditions of the proposed plant.
- Process plant and pipework sizing has not yet been finalised. Allowance has been made within the risk register for limited fluctuations in sizing.
- Quantum for Bulk Earthworks Allowances for dealing with Cut / Fill / Disposal have been provided by the designers and adopted by estimating. It would be beneficial for a detailed review to be undertaken in the next phase.
- A Provisional Sum allowance of £250 k has been included in Options A1, A2 for costs for updating navigation assets.
- Brine Abstraction and Return - Route 2 has been included in Options A1 & A2.
- Pipeline Option Fawley to Testwood – Route SIA 5 has been included in Options A1 & A2.
- All works are assumed to be carried out during normal day time working hours.
- It is assumed that the working area is not impacted in any way by hazardous working conditions with the exception of the marine works.
- It is assumed that there are no restrictions to access.
- For any materials which may be sourced from abroad, no allowance has been made for any fluctuation to these rates for exchange rate or tariff obligations.
- No additional allowance has been made for any restrictions placed on the works due to adverse weather conditions other than the factors included within the risk register for prolongation as a result of bad weather.
- As the projects are currently at concept stage no quantities have yet been finalised thus all quantities assumed in the preparation of costs are indicative.
- No allowance has been made for 3rd party works such as utility upgrades or diversions & connections unless specifically stated otherwise.
- Specialist Dewatering is excluded from the base cost. An allowance has been included within the risk values.

Open Cut Pipework

- Standard working hours are assumed as 50 hr week (apart from critical TM phases and continuous micro tunnelling).
- All crossings assumed to be 1200 diameter sleeve installed by Micro tunnel.
- All crossings assumed to be single pipe.
- All crossings assumed to have 9 m diameter launch shafts x 9 m deep to formation.

- All crossings assumed to have 4.5 m diameter reception shafts x 9 m deep to formation. All shafts to be backfilled with imported aggregate.
- 150 mm bed and haunch in fields 30% of arisings to tip replaced with imported granular material Spreading surplus spoil across the easement within fields.
- 150 mm bed in roads 100% of arisings to tip replaced with imported granular material.
- 25 m easement in fields.
- Stock fencing both sides of easement Livestock crossing point every 300 m, Footpath crossing every 500 m.
- Land drain crossing in fields every 20 m, Clay stank in fields every 25 m.
- Allowance has been made for a bend every 167 m of route.
- No thrust blocks required - use of anchor gaskets assumed.

OPEX assumptions

Cost of abstracted water:

- Cost of water is based on abstraction costs from the EA. Cost assumed to be £19.23 / ML for ground water abstraction, with factors applied to get costs for other water sources. Desalination schemes assume tidal abstraction, applying a factor of 0.2 (£3.85 / ML) and its assumed this is reasonable for water recycling as water from treatment works is discharged into estuary and abstracted downstream into the water recycling plant.
- The cost of water supplied from PW assets such as Havant Thicket attracts Zero cost / ML as it is deemed to be owned by SW.

Staff costs:

- Desalination Plants are assumed to require 6 operators and 2 managers, 8 hr/day, 365 days a year
- Transfer infrastructure assumed to require 1 operator, 8 hr/day, 365 days a year
- Hourly rate for operator is assumed to be £22.10 /hr, Manager £34.00 /hr, costs from SW OPEX calculating tool

Chemical costs:

- Chemical volumes supplied by SW design engineers for desal and water recycling plants, for 15 Ml/d, 61 Ml/d and 75 Ml/d operating regimes.
- Assumed that a smaller 15 Ml/d water recycling plant would require the same chemical use as the 75 Ml/d plant operating at 15 Ml/d.
- Costs for chemicals taken from SW OPEX tool where available and provided by Mott MacDonald where unavailable. Where chemical costs were only available for concentrations other than those specified, the price was pro-rated accordingly.

Power:

- An ‘all in’ average electricity price of 12 p/kWh has been used (from the SW OPEX tool)

Operational transport costs:

- Includes costs of van rental and fuel use for operational maintenance
- For staff transport a trip of 15 miles to site and back each day per FTE has been assumed
- Costs of petrol were taken as 25 p per mile
- An estimate of £1500 a year per van has been used after discussion with SW
- The transport and disposal costs of WTW waste have been provided by SW
- The waste disposal volumes have been estimated as 0.025% of the flow as sludge, and 0.005% as grit and screenings
- Includes transport and treatment of sludge produced on site assumes £5 /m3 of sludge for transport, and £140 / tonne of sludge treated

Operational maintenance:

- Civil maintenance cost per year is calculated as 0.5% of the Infra and non-infra civil costs
- M&E maintenance cost per year is calculated as 2.5% of Infra and non-infra-M&E costs which aligns to the approach taken within the WRMP24 exercise

NPV and AIC calculations assumptions

- The WACC has been taken as 2.92% in accordance with ACWG guidance. Discount rates are as per the HM Treasury Green Book.
- Planning costs are split 25:25:25:25 for the first 4 years, and construction costs are split 20:35:35:10 over years 5-8.
- 50% of client indirect costs are treated as planning and development costs whilst the remaining client indirect costs are considered construction costs.
- Total direct costs are attributed to a range of asset categories which dictate the capital maintenance regime and whole life cost. The remaining capital costs (contractor indirect costs and 50% of client indirect costs) are split equally across the asset categories.
- Capital Maintenance lifecycles - The capital maintenance cycles used in the NPV calculations are as follows as per ACWG guidance and are relative to year 9 (first operating year).

2.10.9 Confirmation that Solution Costs are in Line with Relevant Methodologies Agreed with Regulators and Relevant Green Book Guidance

- The estimates have been prepared in line with relevant guidance requirements and methodologies.
- The approach to calculating the NPV and AIC values has followed the process from the ACWG to ensure consistency in the calculation of NPVs and AICs across all SROs. This process is aligned with HM Treasury Green Book. The calculation covers a period of 108 years rather than 80 years as detailed above.
- OB – The OB assessment approach was aligned to the HM Treasury Green Book Supplementary Guidance: Optimism Bias and the latest guidance from the ACWG to enable consistency of OB assessments across all SROs. Therefore, whilst the OB assessment process undertaken at Gate 1 was initially used, the recent process has ensured that all subsequent guidance has been appropriately incorporated prior to the values being submitted as part of the Gate 2 submission.
- Estimates have been developed in line with WRSE guidance where appropriate.

2.10.10 Summary and Next Steps

In Summary the Gate 2 cost and carbon estimates have benefited from an enhanced level of design input than was available at Gate 1. The key elements to review for the next stage Gate (G3) from a cost perspective is:

- Undertake further investigations to finalise details of the saltwater extraction and brine return assets
- Obtain clarity on planning conditions and site investigation analysis at the proposed desalination plants at Fawley
- Undertake further analysis of the pipe routes to Testwood WSW for desalinated flows
- Work to mitigate and manage key risks
- Undertake detailed market engagement to obtain further surety on key cost and time elements
- Produce detailed construction schedule to enable mapping time related threats and opportunities
- Review contract strategy to enable improved market confidence in terms of delivery
- Fully understand key regulatory threats from national statutory bodies such as the EA

This will enable a marked improvement in cost confidence and a step change in project maturity resulting in a higher level of confidence for business planning.

2.11 Procurement, Ownership and Operation

2.11.1 Commercial and Procurement Strategy

2.11.1.1 Introduction and Context

SW has developed a procurement strategy to support the delivery of the Desalination (A.1) solution. The strategy reflects the conceptual design, the current cost profile, the relevant risks and required schedule for delivery. This section sets out the procurement strategy[22] along with an assessment of the solution's suitability for delivery through the DPC model. This section addresses the requirements of RAPID Gate 2[23], as well as considering the requirements of the Ofwat DPC guidance[24]. This section includes:

1. A summary of the scope of the DPC-delivered project and the CAP Agreement to be tendered
2. The framework for the DPC eligibility assessment, a summary of the results and a conclusion as to the suggested delivery route for the solution
3. Details of the procurement plan, including a procurement and contract timetable
4. An explanation as to the level of design maturity and technical readiness that SW intends to reach by the point of Contract Notice
5. Confirmation of the preferred tender and commercial models
6. Evidence of internal approval for the procurement approach
7. An outline of the anticipated contractual arrangements with the CAP, and a summary of key activities to develop the key commercial terms as the programme develops

The key conclusions of SW's procurement strategy detailed in this section are summarised below. The development of the procurement approach has been subject to SW's internal programme governance process, and the conclusions have been reviewed by SW's external technical and legal advisers.

1. The eligibility assessment carried out based on Ofwat's guidance and utilising the information available at this time indicates that the solution[25] is considered somewhat suitable for delivery under a DPC model. This assessment also depends on:
    - RAPID's guidance and principle that solutions are assumed to be suitable for DPC unless clearly demonstrated otherwise[26]
    - A VfM analysis based on Ofwat's standard assumptions. The VfM analysis will need to be reviewed as the project evolves, and as further market engagement feedback is obtained during subsequent gates and Control Points
2. The proposed procurement plan for the CAP aims to maximise competition and deliver best value for customers. The procurement plan takes the project's critical path into consideration, reflects risk and opportunity, and is designed to ensure that the process is run productively and efficiently. SW anticipates that the procurement will be launched as a Competitive Dialogue, or similar (compliant with the Utilities Contract Regulations (UCR) 2016). SW anticipates running a multi-stage tender process including a pre-qualification stage, a two stage Invitation to Tender (ITT), and a preferred bidder stage leading into financial close.

[22] SW has allocated internal resource to the production of its procurement strategy and associated documentation. This will be aligned to APM best practice and will be prepared as SW works towards Control Point C and RAPID Gate 3.
[23] RAPID (Feb 2021) Accelerated gate two submission template, page 7.
[24] Ofwat (Feb 2020) Appendix 2: Direct Procurement for Customers; Briefing Note on the Procurement Process for 2020-2025, page 24.
[25] As detailed in section 2.11.1.2, the solution contains elements that will be procured through DPC and elements that will be delivered through SW's capital delivery model. For the purpose of this section 'solution' refers to the elements of the works that are shown as 'In scope for DPC' in **Error! Reference source not found.**.
[26] RAPID (Feb 2021) Standard gate one submission template, page 6.

3. By the point of publishing the contract notice, SW will have developed a level of design that is sufficient for the planning process, whilst retaining sufficient Optionality to ensure that minimal constraint is applied to bidders' designs.
4. SW has identified the late model with early market engagement as the preferred tender model for the desalination solution. Under this model the solution will be tendered out as Design, Build, Finance, Operate and Maintain (DBFOM).
5. The procurement approach is consistent with SW's internal governance processes for a project of this size and nature
6. The proposed commercial model reflects both the technical features and expected utilisation of the solution and the feedback received from the informal market engagement undertaken to date. It is expected to evolve further as the project develops. SW is considering offering a fixed price contract with a 20-year operational term (plus construction) and an end-of-contract bullet payment as part of the DPC model. Payments to the CAP are envisaged to start post commissioning and will be primarily based on an availability charge combined with a volumetric element to cover variable OPEX linked to asset utilisation with performance targets and associated incentives / penalties.

This document builds on SW's Gate 1 submission[27], continuing the development of the commercial strategy. The content presented in this document is consistent with the findings and conclusions from Gate 1 which SW has progressed further as part of its Gate 2 submission taking into account development of the project scope and further feedback from market engagement.

SW will continue to test and validate the assumptions that underlie this submission as it further develops the scope of the solution. SW will continue its analysis of the solution's suitability for DPC as part of Control Point C and will further document, test and validate the suggested delivery route and progress the commercial model as part of the Gate 3 submission and Control Point C.

External Advisers and Assurance

SW has commissioned the following external capability to support in the development of its commercial and procurement strategy as detailed in Table 96 below:

Table 96 - SW's external advisers

Position	In role
Commercial and procurement support	[redacted]
Legal and commercial support	[redacted]
External assurance	[redacted]
Technical subject matter expertise	Various providers commissioned to support SW with specifical technical and engineering aspects of the project.

2.11.1.2 A Summary of the Scope of the DPC Delivered Project

This section sets out the components of the A.1 solution which are within the scope of a potential DPC procurement. It also considers the results of informal market engagement and summarises the anticipated appetite for the project within the market.

A.1 is a 75 Ml/d Desalination plant comprising a sea water intake, treatment works, a coastal brine discharge, residuals treatment and disposal works and a transfer to SW. Section 2.2. Engineering Technical Design includes further detail on the technical aspects of the scope.

[27] Southern Water (28 September 2020) Strategic Solution Gate 1 Submission: Preliminary Feasibility Assessment; Southern Water (28 September 2020) Strategic Solution Gate 1 Submission: Annex 11 Commercial Strategy.

While there are other configurations being considered within Gate 2, given that the solution has not yet undergone detailed design, SW considers that relatively minor differences in capacity and choice of route for pipelines that are captured by other configurations would not change market participants' views on the relative attractions and disadvantages of the solution and hence the procurement and commercial strategy developed for solution A.1 can be extrapolated to other configurations at this stage.

Scope of the DPC Procurement

The scope set out under the DPC model is built upon a series of working assumptions regarding the nature of the solution. The scope and assumptions set out in this section remain subject to further development and change. Table 97 below details the elements of the solution that SW considers in and out of scope for delivery through the DPC procurement.

Table 97 - Summary of project scope considered for DPC

Project scope	Works	Rationale
In scope for DPC	• Desalination plant • Sea water in-take • Treatment works • Brine discharge • Transfer to Testwood	These works comprise the core components of the proposed asset which will be constructed and operated by the CAP. As such, these works have been identified as part of the scope for the DPC-delivered project.
Out of scope for DPC, but required to facilitate DPC works	• Blending / storage tank at Testwood	Works at Testwood are required to facilitate the integration of the desalination asset with SW's network. Namely a blending / storage tank will need to be constructed at Testwood, which is SW's existing treatment works. SW considers it would not be suitable for a CAP to operate a single process unit on a site that is currently operated by SW, as this would likely be inefficient and introduce logistical challenge and additional contractual complexity between SW and the CAP. For these reasons, SW considers that the treatment works form a natural point of division between CAP works and SW works.
Out of scope for DPC	• Transfer beyond Otterbourne • Any upgrades required at or beyond Otterbourne treatment works	Works at Otterbourne WSW are associated with a DWI notice and are also planned to be delivered as part of the WfLH programme. These works are out of scope for DPC because Otterbourne WSW is an existing asset, currently operated by SW. For a CAP to conduct the necessary works it would likely be necessary to transfer the asset to the CAP, which would likely be less efficient than if SW undertakes the works itself. Also, an asset transfer from SW to the CAP would significantly increase the complexity of the proposed deal.

The current assumptions that underline this scope are as follows[28]:

- It is assumed that the scope of the solution being considered for DPC includes 26 km of 800 mm diameter conveyance pipeline from Fawley to the Testwood WSW. This would not include any additional works on existing SW sites as these would be part of SW's current operation.
- For elements of the works which are out of the DPC scope, SW anticipates that it will procure them through its capital delivery model, although the exact arrangements are yet to be agreed[29]

Key Assumptions for the Procurement Approach

The following assumptions are applicable to the analysis of the procurement approach at this stage in project development:

[28] Significant changes in solution scope may fundamentally change the recommended procurement and contractual approach. This may be for a variety of reasons, such as where there is change in the skillset required for construction, or where a different allocation of risk is implied. SW's approach will continue to be refined as the solution is further developed.
[29] See Section 2.11.1.4 for further information on the alternative procurement routes considered.

- The commercial analysis undertaken is based on the Gate 2 cost estimates, which will be developed further and will be revisited in future RAPID and DPC submissions
- The asset's primary purpose is to provide drought resilience in line with established resilience criteria[30]. Due to high costs and operational complexity, the plant will typically operate at a minimum flow level (c.15 Ml/d), with output increased only where required to meet resilience requirements. Output will increase in 15 Ml/d increments up to a maximum of 75 Ml/d. In a 1-in-200-year drought scenario, the asset will be operated at maximum (75 Ml/d) capacity. Present forecasts anticipate that such a scenario would require the plant to be operated at an increased capacity for c.49 days[31].
- A full understanding of water salinity levels will be critical to design and operation. Salinity levels are seasonal, and so a sampling campaign must run over an entire calendar year to take account of changes over time. SW will complete a process of water quality sampling to support its design and procurement development.
- SW's regulatory obligations require the asset to be operational by 2027

Market Appetite

Initial informal market engagement[32] was undertaken to inform the Gate 2 submission and the development of the procurement strategy. Participants 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. Engagement with construction contractors and investors revealed that the solution will attract significant interest in the market, with 18 parties expressing their interest in participating in a future CAP procurement. The participants were of the opinion that the complexity of the desalination solution will unlock opportunities for innovation and efficiencies, allowing bidders to submit competitively priced bids.

Of those interested in the solution, 6 presented themselves as experts in the field of desalination, citing examples of delivering and operating plants across the globe, including one who noted their involvement in the world's largest desalination project in the United Arab Emirates. Others gave examples of other desalination plants in different jurisdictions as evidence of the efficacy of the technology employed and experience with operating in a regulated environment. Generally, these parties were open to assuming the CAP role or to joining a consortium, depending on the project requirements.

When asked for views on the scope of the solution, participants expressed familiarity with the arrangements set out, with many citing experiences of operating similar plants across the globe. Key feedback from the market was as follows:

- Participants reinforced the importance of pilot trials for understanding the site-specific nature of the abstraction and seasonal variability of intake. The results of these trials will allow for the maximisation of efficiency through the fine-tuning of plant operation. Participants recognised that it was not essential for SW to conduct pilot trials in advance of / parallel to the procurement (that is, this would have no bearing on the bidders' appetite for the CAP tender), although completing a pilot trial would inform the pre-treatment element of the process to ensure there is Optionality for the future CAP and that SW is not being overly prescriptive in the contract or post contract award[33]. To reduce potential risks collecting substantive pilot information prior to commencing procurement will allow for the most up-to-date information to be available to all bidders.
- Both the minimum-flow and on/off operating models can be achieved, albeit each holds different implications for costs and Operation and Maintenance (O&M) resilience. Participants' preference appears to lean towards the minimum-flow model.
- So long as SW sets out clear maximum / minimum flow requirements, it is possible to configure RO membrane desalination plants to meet different flow requirements as necessary, potentially with

[30] See section 2.2.3 Resilience Benefits for full details.
[31] See section 2.2 Engineering design for further information on anticipated levels of operation.
[32] Informal market engagement exercises have been undertaken in 2019, as part of SW's Gate 1 submission and in 2020-21 as part of SW's Gate 2 submission.
[33] Informal market engagement participants noted that whilst pilot trials would be useful, and would likely be undertaken bidders / a CAP, they are not essential for the bidding process, and as such SW does not plan to undertake pilot trials in advance of the procurement.

different RO trains operating at different capacities as required. Effective membrane operation and maintenance is key to facilitating swift ramp-up and ramp-down of flows, however, the market has experience of these practices and is comfortable with the outlined flow requirements.

Ofwat DPC Process

Ofwat expects companies to identify the most appropriate route for the delivery of the project[34], considering both in-house and DPC models and selecting the Option that presents greatest benefit to customers. As part of each of the business case submissions as required by Ofwat's DPC Control Point process, SW is required to set out its preferred procurement approach, providing justification and reasoning for the decision. The key Ofwat Control Points for the DPC procurement are:

- Control Point A will be submitted as part of the Control Point B submission
- Control Point B – the Strategic Outline Case (SOC), addressing the chosen strategic supply Option
- Control Point C – The procurement plan, setting out the detail of the procurement and contract strategy
- Control Point D - The full suite of procurement documents and the form of the CAP agreement
- Control Point E – The submission of the Outline Business Case, re-affirming that DPC continues to offer VfM for customers when compared to the in-house counterfactual
  - "Ofwat's consent is required under the Appointee's licence conditions before it can commence the procurement" (i.e., issue the Find-a-Tender service (FTS) Contract Notice); and
- Control Point F – The submission of the Full Business Case, setting out the nature and terms of the deal that has been achieved through the competitive procurement process
  - "Ofwat consent is required for the Appointee to enter into the CAP Agreement" (i.e., Contract Award).

SW intends to submit its SOC shortly after its Gate 2 submission[35], which will address Ofwat's requirements as set out in the DPC Briefing Note[36] and include additional details on developing commercial and procurement strategy.

2.11.1.3 DPC Eligibility Assessment

Eligibility Assessment Framework

To ascertain the project's eligibility for delivery through the DPC model, SW has applied a three-step framework based on Ofwat's DPC process guidance[37]:

- A size test based on the £100 m threshold for whole life costs
- An assessment of the discreteness of the asset; and
- A quantitative VfM assessment

Table 98 details the objectives of each step in the framework, the basis of assessment for each test, and the impact of each test's outcome on the solution's eligibility for delivery through the DPC delivery route. SW's Gate 1 submission[38] contains further detail on the approach and methodology of the DPC eligibility assessment framework.

[34] Ofwat (2020) Direct Procurement for Customers: Briefing Note on the Procurement Process for 2020-2025
[35] Milestone dates for SW's DPC activities are available in section 2.9. Schedule – Direct Procurement for Customers (DPC) Control Points.
[36] Ofwat (2020) Appendix 5 – Direct Procurement for Customers – Briefing Note on the Procurement Process for 2020-2025.
[37] Ofwat (February 2020) Appendix 2: Direct Procurement for Customers; Briefing Note on the Procurement Process for 2020-2025.
[38] Southern Water (28 September 2020) Strategic Solution Gate 1 Submission; Annex 11 Commercial Strategy

Table 98 - DPC eligibility assessment framework

	1. Size	2. Discreteness	3. Value for Money (VfM)
Objective	Assess the size of the solution(s) against Ofwat's threshold.	Assess the separability of the solution(s) based on Ofwat guidance published as part of its PR19 methodology.	Assess the solution's scope to deliver customer VfM through quantitative analysis.
Test	Solution costs will be considered on a nominal and real basis, including: 1. Development costs 2. Initial CAPEX 3. Renewal CAPEX 4. OPEX	Consider specific operational and technical considerations of the asset within the wider context of SW's network based on 4 key criteria: • Stakeholder interactions and statutory obligations • Interoperability considerations • Output type and stability • Asset and operational failures	To determine if a solution will have greater scope to deliver customer VfM if undertaken via DPC, solutions will undergo analysis comparing the NPV cost to customers of the Factual and Counterfactual: • Factual: A solution carried out by a third-party provider under DPC arrangements • Counterfactual: A solution carried out by SW under the PR19 framework A number of assumptions will be considered under both scenarios. A VfM assessment provides the impact on the costs to customers of completing the solution under different approaches.
Outcome	Solutions that are within close proximity to the Ofwat threshold, are technically suitable and could provide scope for customer VfM when considered under the qualitative assessment. Options will undergo a quantitative assessment to demonstrate customer VfM if required.		Solutions that are shown to provide customer VfM through the DPC delivery route are suitable for DPC and progressed where appropriate through the RAPID Gated Process and Ofwat's DPC Control Points.

The eligibility assessment indicates that the solution is considered somewhat suitable for delivery under a DPC model. Further details on the findings from the size test, discreteness test and VfM analysis are provided further below in this section.

As project specific inputs are developed further**,** the VfM test will also be refined from a high-level assessment based on Ofwat's standard assumptions to one specifically tailored to the solution. This will include market views on financing inputs such as debt terms and gearing, and a more detailed commercial model and risk allocation.

SW is also cognisant of its s20 obligation to deliver the programme to the committed 2027 date. The timetable constraints and the evolving understanding of the project's critical path will be an important factor in the selection of the appropriate delivery route for the project.

Size Test

The forecast Total Expenditure (TOTEX) over the contract life (including a construction period of 4 years and a 20-year contract period) on a real basis is £0.9-1.2 bn[39], and the TOTEX over the whole asset life (including a construction period of 4 years and a 60-year asset life) ranges from £1.7-2.8 bn[40]. The solution therefore exceeds the £100 m threshold and passes the size test.

[39] Minimum utilisation scenario totex estimate: £0.895bn. Average utilisation scenario totex estimate £0.898bn. Maximum utilisation scenario totex estimate: £1.215bn.
[40] Based on an asset life of 60 years. Minimum utilisation scenario totex estimate: £1.794bn. Average utilisation scenario totex estimate £1.804bn. Maximum utilisation scenario totex estimate: £2.755bn.

The cost estimate has been updated for Gate 2. It is based on a series of assumptions and includes allowances for estimating uncertainty, risk and optimism bias (see Section 2.10 Cost Modelling for further information) that will be further refined as the solution develops.

Project Discreteness Test

SW has applied a discreteness assessment based on four key criteria, each of which has been equally weighted: stakeholder interactions and statutory obligations, interoperability considerations, output type and stability, and asset and operational failures.

The assessment set out here builds on that undertaken as part of SW's Gate 1 submission and reflects the latest developments in the project scope. At Gate 1, the assessment against the asset and operational service failures criterion indicated that the solution's characteristics made it somewhat less suitable for DPC because at that time there was a potential for the asset to supply an oil refinery classified as critical national infrastructure. This potential use, however, is no longer considered applicable. The discreteness assessment has been revised accordingly to reflect that the solution's other characteristics make it more suitable for DPC against this criterion.

The output of the assessment shows that whilst the desalination solution exhibits some characteristics that may make it less suitable for DPC, these are largely offset by characteristics that make it more suitable. The solution has well understood the manageable interfaces and risks associated with operational service failures. Challenges exist around stakeholder management and the level of uncertainty over the need requirement (detailed in Table 99), however the overall assessment is that the solution is somewhat more suitable for DPC:

Table 99 - Solution A.1 DPC eligibility assessment - Discreteness test - Summary

Key criteria/considerations	Assessment by criteria	Overall assessment
Stakeholder interactions and statutory obligations	Characteristics somewhat less suitable for DPC	The Desalination (A.1) solution exhibits some characteristics which make it more suitable for DPC, and some which suggest it may be less suitable. Overall, the analysis (based on Ofwat's guidance) suggests that the solution should be considered 'discrete' and somewhat suitable for DPC.
Interoperability considerations	Characteristics somewhat more suitable for DPC	
Output type and stability	Characteristics somewhat more suitable for DPC	
Asset and operational service failures	Characteristics somewhat more suitable for DPC	

Stakeholder interactions and statutory obligations

This criterion considers the number of stakeholders and regulators who are likely to be involved in the delivery of the solution, the frequency of that involvement and the prospect of regulatory enforcement against SW for issues in delivery.

- **Number of stakeholders -** The assessment highlighted that a variety of stakeholders (including customers, third-party finance providers, industry and environmental regulators and government) were likely to be involved. Each would have differing concerns and objectives.
- **Frequency of involvement -** In the event of an asset or operational failure, the need to actively manage and co-ordinate multiple third parties has the potential to increase the cost and risk associated with the planning and implementation of a response
- **Prospect of regulatory enforcement -** These include customers' and the DWI's concerns about the 'wholesomeness' of desalinated water (from which all minerals are removed during the desalination process), which holds the potential to delay project development and negatively impact SW's

reputation, and the need to seek a discharge licence for the desalination brine by-product from the EA, responsibility for which would be difficult to transfer contractually to a CAP

Each of the factors outlined have the potential to increase project risk, and as there is no precedent for desalination plants of this scale in the UK, they may result in additional stakeholder uncertainty and increased contracting costs and bid pricing. Given the 2027 deadline set by Defra / the EA for the delivery of this solution and the nascent state of the DPC market, there also exists a risk of delay in the project finance process which, if not properly managed, may jeopardise SW's delivery against committed timescales. For these reasons, the stakeholder interactions and statutory obligation characteristics of the solution make it somewhat less suitable for DPC.

Interoperability

This criterion considers the number, type, and nature of interfaces between the asset and SW's network, the nature of the asset operation (active or passive), its separation by physical location, and the potential to generate economies of scope.

- **Number and type of interfaces -** For the intake and discharge points, there will be a requirement for the CAP to engage with the EA, comply with environmental requirements and undertake surveying / sampling activity. These factors may increase costs, and the CAP may wish to undertake further independent sampling as part of its technical due diligence during the detailed design stage, however these are relatively standard regulatory requirements and would not be difficult to comply with.
- **Nature of asset operation -** For the injection point there will be a requirement for a new buffer tank, which will need to be disinfected with chlorine before first use and gaps in operation should the asset be shut down. Also, the route to the injection point has not yet been selected and may involve passage through a combination of urbanised areas and environmentally constrained areas.
- **Physical location separation –** The preferred route for the transfer between the plant and injection point is yet to be selected but could involve urbanised and environmentally constrained areas
- **Potential to generate economies of scope -** Due to the unique nature of the desalination technology, there is little opportunity to generate an economy of scope, and so there is limited potential for the loss of synergy between the plant and SW's network. The breakdown of operating costs (c.£16.5 m p.a.) suggests that asset separation and third-party management will have a limited loss of synergy and efficiency when compared to operation as part of SW's network.

This assessment suggests that the solution can be considered discrete, as whilst there are three interface points (sea water intake, brine discharge and desalinised water injection), these are not complex in nature, the costs for each are well understood and do not present a significant obstacle to the interoperability as they are relatively well defined and should be manageable through the DPC contractual arrangements. The asset is also separable from an operational perspective, and so its characteristics are suggestive of a discrete asset, supporting the suitability of the DPC model for delivery.

Output type and stability

This criterion assesses the day-to-day source of supply, resilience, volatility of output and any available alternative sources of supply.

- **Day-to-day source of supply -** Sampling to determine seawater quality will be critical for plant design and must be undertaken throughout the year to account for seasonality. There is the potential for some duplication of costs under the DPC model as the CAP will likely undertake its own sampling as part of its due diligence process, however these costs are not considered to be material as a proportion of the whole-life cost of the solution.
- **Resilience -** The RO technology is key to the operation of the site. SW will therefore wish to assure the integrity of the membranes at hand back to ensure that performance remains within operating standards, meaning the CAP will need to be incentivised to maintain the asset until the point of transfer. This may be challenging as the long-term performance of desalination plants in this, or a similar geographical region is not known.

- **Volatility of output -** At this time, the operational regime and output requirements (such as minimum and maximum flow levels) for the solution have not been defined, but will be prior to tender launch, meaning that the commercial arrangements with the CAP would need to be reflective of output uncertainty and able to account effectively for variances. Despite this challenge to clear output specification, the market is familiar with availability-based contracts that provide for a combination of availability and volumetric payments, and so it is possible to address this issue commercially.

As contractual mechanisms exist to address variable output requirements and to incentivise asset condition at hand back, the output and stability characteristics of the solution render it somewhat more suitable for DPC.

Asset and operational service failures

This evaluates the simplicity and complexity of the asset, the presence or technology precedent, the impact of failure on customers and the maturity of the supply chain.

- **Simplicity and complexity –** The desalination process requires the use of RO membranes that must be properly maintained in order to prevent operational service failures
- **Impact of failure –** Operational / service failures may result in reputational damage to SW, negatively impact upon SW's performance commitments (including C-Mex) and result in action by the DWI for non-compliance which could result in loss of SW's licence as water undertaker (albeit this is unlikely)
- **Technology precedent and maturity of supply chain** - Whilst there is an established global market and supply chain for the RO membrane technology used in the treatment process, there is no current precedent within the UK. As the use of the membrane technology is novel in the UK and regulatory consent for its use must be sought from the DWI, stakeholders may consider that this technology introduces additional risk to be represented in bid prices.

The reputational risk and stakeholder scrutiny SW would face in the case of an asset or operational service failure are no different under the DPC model. A CAP with prior experience in operating a desalination plant of a similar nature may be able to minimise the risk of asset and operational service failures to a level above that which SW could achieve. On the basis of these characteristics, the solution can be considered somewhat more suitable for DPC.

Value for Money (VfM) Assessment

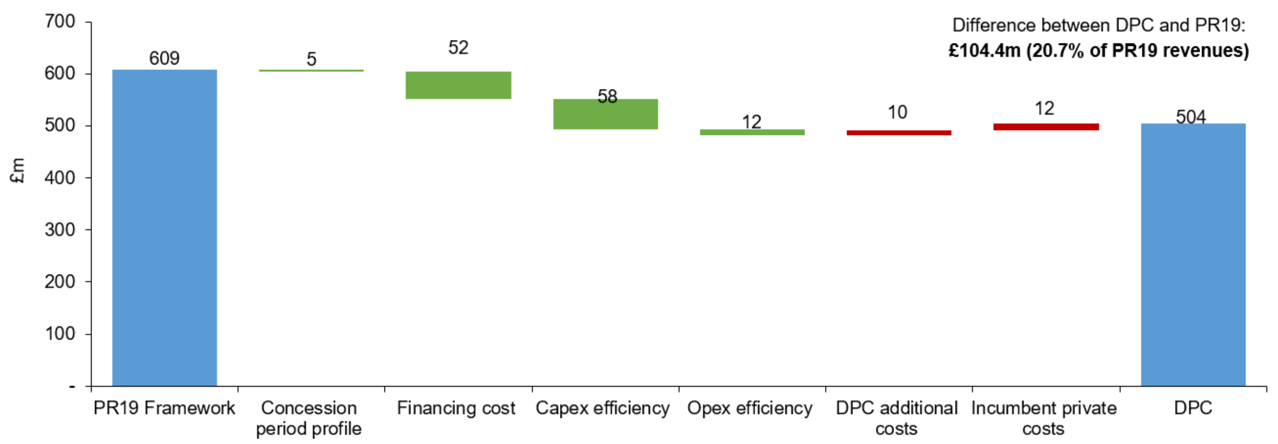
VfM analysis considers the costs to customers under the Factual (DPC) case versus delivery under the Counterfactual (In-house) case. Revenues are calculated under both cases and then discounted at the Social Time Preference Rate (STPR) to generate an NPV[41]. The difference in NPV between the two cases and the key value drivers are compared to determine the VfM of delivery via DPC. The difference between the Factual and Counterfactual is calculated based on project specific inputs (such as Gate 2 cost estimates), macroeconomic factors, and Ofwat's standard assumptions which include a mid-case assumption and an upper- and lower-case sensitivity (for example gearing of 85% in the mid-case, 90% in the upper and 80% in the lower-case).

Figure 61 illustrates the results of the VfM analysis under the mid-case, showing the key value drivers between the Factual and Counterfactual cases. Under the mid-case, delivering the scheme under DPC would result in lower costs to customers than if the scheme was delivered by SW under the PR19 framework. The cost to customers in NPV terms of A.1 under the Factual (DPC) case is £504 m compared with £609 m under the Counterfactual (In-house). The difference in the costs to customers is £104.4 m which is equivalent to c.20.7% of the 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 20-year operations period results in a smaller scope for potential savings for OPEX versus CAPEX compared to

[41] More details on the approach and methodology of the VfM model are set out in the Gate 1 submission, however, note that the Gate 2 value for money analysis set out in this document reflects the updated cost estimate developed for the Gate 2 submission.

longer term contracts. The benefits under the DPC model are, however, to some extent offset by the impact of additional costs to the DPC and the incumbent private costs effect (made up of procurement costs and contract management costs) which would not be incurred if SW were to deliver the asset.

Value driver analysis



Total costs to consumers are discounted to the start of construction (2026)

Figure 61 - Desalination A.1 VfM analysis results

The Figure 62 below illustrates the results of the sensitivity analysis for the scenarios set out by Ofwat in its standard assumptions. Under all scenarios delivery of the desalination plant is shown to have greater value for customers under a DPC model based on the approach and assumptions provided by Ofwat.

Variables	Assumptions under different cases*			DPC compared with in-house NPV	
	Low	Mid	High	Low	High
Contact life (years)	20	20**	40	**	(86.1)
Depreciation rate (%)	25% faster	As per in-house	*Not specified*	(104.5)	*Not specified*
Equity IRR, real (%)	10%	8%	7%	(68.7)	(122.2)
Gearing (%)	80%	85%	90%	(68.2)	(140.4)
Capex efficiency (%)	5%	10%	15%	(74.5)	(134.5)
Opex efficiency (%)	5%	10%	15%	(98.4)	(110.6)
Procurement costs (% of Capex)	2%	1%	0.5%	(95.2)	(109.1)
Bidder costs (% of Capex)	3%	2%	1%	(99.4)	(109.6)
Contract mgmt. costs (annual)	£300k	£150k	*Not specified*	(101.7)	*Not specified*

* Scenarios as specified in Ofwat assumptions within IAP 'Direct Procurement for Customers detailed actions'
Totex scheme profile is based on SW's final Gate 1 costs assumptions
** Under the mid case SW assumes a 20-year contract length in line with the proposed commercial model for DPC versus the 25-year contract suggested by Ofwat's standard assumptions.

VfM of DPC improves vs Mid-Case
VfM of DPC deteriorates vs Mid-Case

Figure 62 - Sensitivity analysis

Overall, based on Ofwat's standard assumptions, and current cost projections for A.1, delivery under a DPC framework would deliver greater value for customers from a VfM standpoint. This result, however, does not reflect project specific inputs from the market (for example, debt terms and gearing).

To enable the most accurate VfM analysis, the assumptions and inputs used to compare the Factual (DPC) and Counterfactual (In-house) cases should be tailored to reflect the nature of the solution. This should include considerations of the technical characteristics of the asset, its risk profile and the proposed contractual model. However, as the technical aspects of the solution and the commercial model are still in development, there is limited scope to establish project-specific assumptions at this stage. As such SW has not adjusted or otherwise changed any of Ofwat's standard assumptions at Gate 2. SW will revisit the VfM analysis once these aspects have been developed, specifically at Control Points C (Procurement Plan) and E (Outline Business Case).

Review of Ofwat's Standard Assumptions

At Initial Assessment of Plans (IAP) stage of PR19 Ofwat recognised that there are significant differences in the assumptions used in the VfM analysis by companies to identify the NPV differential between the Factual (DPC) and Counterfactual (In-house) models. To address this, Ofwat set out a series of standard assumptions[42] which were used for the purpose of the VfM assessment set out in this document.

Whilst Appendix 9 of the PR19 final methodology[43] provides some rationale for Ofwat's assumptions and references to some data sources, many of the assumptions do not appear to be supported by sufficient evidence or are sourced from an underlying evidence base which has not been made publicly available (for example, Ofwat's estimate for contract management costs[44]). Other assumptions are underlined by datasets that are either small (and hence does not appear to be representative) or are focused on older precedents[45]. Ofwat has focused on the Offshore Transmission Owner (OFTO) model as a principal source of precedent for the DPC model. Whilst there are similarities between the characteristics of the OFTO and DPC models, the former appoints a provider responsible only for the operation and maintenance of assets that have already been constructed, resulting in a fundamentally different risk profile to DPC projects[46].

To better understand the position of Ofwat's standard assumptions within the observable range for applicable precedents and similar projects SW has carried out an initial benchmarking exercise, focusing primarily on Ofwat's financing cost and efficiency assumptions. This exercise has considered precedents from a selection of comparable projects across various infrastructure sectors including, but not limited to:

- Energy, such as OFTO and Interconnector projects
- Waste, water and Energy from Waste (EfW) projects
- Social housing, education, accommodation and other similar infrastructure projects
- Transport infrastructure projects, including bridges, tunnels, roads and rail transit

The review of precedents was based on desktop research using a combination of publicly available information and anonymised commercially sensitive data provided by SW's advisors. This review has not considered any of the qualitative or intangible benefits or costs of DPC.

Overall, SW's desktop analysis suggested that the Ofwat standard assumptions are broadly within the range observed for comparable projects and precedents (albeit in the lower end of the range in some instances) for a "typical" DPC project. Some of SW's key observations are set out below.

- **Efficiency assumptions (CAPEX and OPEX)** – The Ofwat efficiency assumptions are applied on top of the estimated cost for in-house delivery. The approach does not take into account the maturity of the cost data, SW's inhouse procurement model for these projects, and the residual risks that will need to be borne by SW. SW will continue to review the efficiency assumptions considering the above factors in subsequent stages of the Gate submissions. There may be limited scope to improve upon these assumptions through market engagement, as potential bidders may be unwilling to

[42] Ofwat (2019) Southern Water Direct procurement for customers detailed actions
[43] Ofwat (2017) Appendix 9: Direct Procurement for Customers
[44] Ofwat states that it has assumed Appointee contract management costs based on its own assumed DPC management costs, however it does not explain how this value has been derived.
[45] Ofwat primarily relies on CEPA 2016 (Evaluation of OFTO Tender Round 2 and 3 Benefits) for evidence of financing savings, however this document references reported secondary market returns in UK PFI between 2003 and 2011; a period covering the 2008 financial crisis and exhibiting different market conditions.
[46] Given that financing costs are typically reflective of project risk, the OFTO asset class can be used to draw comparisons with the anticipated cost of debt for DPC projects' operations period, however this may not be reflective of the financing efficiency that could be achieved by a provider responsible for arranging whole-life financing.

reveal information that might harm their competitive advantage or will not be in a position to provide more meaningful data until much later in the process. This means that SW will supplement the VfM analysis with robust sensitivity analysis to address uncertainty until the actual values obtained through bid submissions can be used in the project's VfM analysis.

- **Procurement and bid costs** – Ofwat's standard assumptions or the precedents do not account for the first-of-a-kind premium that will likely be applicable for the first cohort of DPC projects. In addition, it is likely that the final choice of Option will involve desalination or water recycling plants (effluent re-use for potable water). In both cases the technologies involved are largely or entirely new to the UK and will require significant input from contactors overseas. To the best of SW's knowledge there are no UK suppliers of either technology on a **'**turnkey' basis. The regulatory and policy frameworks for using these technologies in public water supply are also immature in the UK. For these reasons, the assumptions given by Ofwat are likely to underestimate the actual costs that incumbents and bidders will incur throughout the process. A robust bottom-up costing exercise will be undertaken to firm up initial assumptions and reduce uncertainty once there is more clarity and certainty about the structure and timings of the procurement process.
- **Cost of Equity and other financing assumptions** – For the same reasons as set out above for the procurement and bid costs, the initial DPC projects will be considered by the market to carry a higher risk and thus financing costs of these early DPC projects are likely to be subject to a first-of-a-kind premium. This can be seen in several other programmes including the initial OFTO Tender Rounds (which had a higher cost of equity). This is currently not reflected in Ofwat's standard assumptions.
- **Breadth of observed ranges** – At this early stage in SW's RAPID process, the benchmarked ranges are relatively wide and reflect the level of detail currently available about key project terms. As the solution is progressed through the DPC process and more clarity is gained over scope, risk allocation and the contractual model, SW will look to identify which of the available precedents provide the most accurate comparison to the project. In particular, it may be possible to identify project deals which are comparable to the solution (including risk allocation and commercial terms) and thus provide a more suitable benchmark.
- **Time frame** – Ofwat does not set out a timeframe for the DPC process, but SW has a fixed timeframe in which it needs to commission the solution driven by the s20 agreement with the EA to use "all best endeavours" to have the WRMP strategy, including the Options being considered here as candidates for DPC, by 2027. The fixed timeframe could also influence costs, as it will compress the time available for optimising design and capital costs, the process of identifying and negotiating risk allocations satisfactory to all parties and the time available for CAP contract development. Bidders will be aware that SW has fixed timescales, and this could act against finding the provider and set of contracts that provide best value for SW's customers. As context the recently completed bulk supply contract for PW to build and operate the HTR on behalf of SW took c.3 years to negotiate, at a multimillion-pound cost to SW.

In summary, SW will refine the assumptions used in the VfM analysis based on project-specific detail and market feedback obtained during the later stages of the procurement process. Although the correct assumptions to be used under the Factual (DPC) model of the VfM analysis will ultimately only be available once bidders provide their final bids at ITT stage 2, SW has identified a number of activities that hold the potential to improve the VfM assumptions in future Gate submissions:

- Undertaking further sensitivity and scenario analyses that reflect project-specific risks and opportunities
- Reviewing and updating the assumptions – especially those related to financing costs, financing assumptions, procurement costs and contract management costs – to reflect the first of a kind nature of SW's project
- Reviewing the cost efficiency assumptions to reflect the maturity of the costs for in-house delivery, and SW's approach to inhouse procurement for this solution
- Further benchmarking of the costs of debt and equity to reflect the risk profile of the SW's project more closely, and to reflect changes in macroeconomic factors and market conditions
- Better reflection of the efficiencies built into the Price Review process (frontier shift and efficiency challenges) for in-house delivery route and

- Reviewing the non-financial implications of the DPC model, including its impact on timelines and SW's licence obligations

2.11.1.4 Procurement Plan, including Procurement and Contract Timetable

This section sets out SW's approach to conducting a CAP procurement under the DPC model, including the anticipated timetable, the stages of the procurement process and the evaluation framework that will be applied to identify the CAP. It also considers the activities that SW will undertake outside of the CAP procurement to facilitate project delivery.

Procurement Routes Considered

Whilst SW's analysis has recommended that the project is suitable for delivery under the DPC model, SW has also considered the applicability of procurement routes other than DPC. Examples of current capital delivery routes under SW's capital delivery model include:

- 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

For large infrastructure projects such as the desalination solution, SW's framework agreements may not be suitable, as they are not designed for works of this scale and technical complexity. This means that were the project to be delivered in-house, SW would likely 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 also shown that large-scale design and build procurement models typically include ECI to safeguard solution design as well as optimise risk balance, providing more cost efficient and predictable contract values and delivery timescales. The nature of risks identified for this project further assert the benefit of ECI. SW's approach to procuring ECI support is discussed in more detail below.

Timeline of Procurement under the DPC Model

In Figure 63 SW has illustrated the anticipated timeline in draft for the procurement of the desalination solution, including its pre-DPC activities, governance, and submissions to Ofwat as part of the DPC process. At the date of the submission of this report, the timelines (including the underlying breakdown of response periods) are still subject to further change in the future iterations of the schedule. As such, a high-level view of the plan up to CAP award is provided at this time, covering the key activities in aggregate (business case development, design and planning, CAP procurement etc.) without showing a breakdown for each individual task.

Figure 63 - DPC procurement timeline

CAP Procurement Plan

Development of the CAP procurement plan

SW has designed its CAP procurement plan in a manner that will maximise competition and deliver best value for customers. The plan takes the project's critical path into consideration, reflects risk and opportunity, and is designed to ensure that the process is run productively and efficiently. It has been prepared in conjunction with SW's external procurement, commercial and legal advisers. The procurement process will be run in a fair and transparent manner, and in compliance with the requirements of the UCR 2016.

SW has considered the resourcing and governance requirements of the procurement process in the development of its approach and the timetable set out above. To achieve a fully assured and competitive process, SW will ensure that appropriate resources are available as required to ensure that SW can:

1. Maintain and manage the competitive dialogue with bidders
2. Conduct the necessary evaluations at each stage of the process within the timescales set out
3. Give effect to its programme and procurement governance and assurance processes

Other relevant factors that have been considered in the development of the procurement plan, include (but are not limited to) the complexity of the process, the required duration at each stage and the requirements of the UCRs. The following factors are specific to procurement under DPC or to the nature of the solution, and as such have also been considered in procurement design:

- The DPC model is novel and as such the market is still forming. While there are parallels with other procurement routes, precedent for the use of concepts or approaches applied elsewhere (such as in Public Private Partnership (PPP) / Private Finance Initiative (PFI) deals) has not yet been established for DPC.
- The plan also recognises the significant investment required by bidders to participate in the procurement competition. With these considerations, an effective and valuable procurement that confidently delivers for customers is contingent upon attracting a sufficient volume of compelling and

credible prospective bidders. SW has undertaken significant market research to understand the constraints and considerations for CAP bidders to determine whether they will invest in the tender process. The plan reflects the findings.

- SW understands that whilst desalination is widely used outside the UK (there are in excess of 1700 operational plants globally), it is not an established treatment process within the UK at this scale. To give the market confidence that Desalination is a viable Option, SW recognises that it must work proactively with the market to ensure that the RO membranes required for the desalination plant's operation achieve DWI certification in a timely fashion (i.e., in advance of CAP appointment). SW's plans to secure membrane licencing are discussed in more detail below.

As SW progresses beyond Gate 2, its procurement plan and documentation will be subject to extensive internal challenge and external assurance (including legal review) as they are developed and agreed prior to the formal commencement of the procurement process. This will include any submissions as required under RAPID's gates process and Ofwat's DPC control points, and as such the CAP procurement plan remains subject to further amendment as the project matures.

Market engagement in advance of the procurement process

In line with the selected tender model (late with early market engagement), SW intends to conduct structured formal and informal market engagement, keeping records of engagement activities completed, with the market (including contractors and finance providers) throughout SW's procurement development process and initial design phase. This is intended to enhance transparency and promote dialogue with bidders, and to prevent the unfair exclusion of any interested parties. SW's approach will continue to be informed by and may be updated to reflect the results of future market engagement exercises.

SW anticipates that through market engagement it will also be able to outline the stages and timetable of the procurement process to interested parties. This will be important as it will allow and prompt those interested in the project to form bidding parties (for example joint ventures, and other forms of consortia), ready for the formal commencement of the procurement process.

Prior to the formal launch of the competitive tender process, SW will formally notify organisations of the forthcoming opportunity through the release of a Prior Information Notice (PIN). The audience for this market engagement will be kept as wide as possible, as SW aims to reach all available suppliers, including those that may subcontract to the CAP. Bidders' ability to form and submit a competitive tender will be contingent on supplier support through the procurement process. It is therefore beneficial to promote this opportunity to both potential CAPs and the wider supply chain. From this market engagement, SW will seek voluntary responses from interested parties who wish to provide feedback on the proposed procurement plan and contract. This will not have impact on the bidder's ability to bid in the procurement. This will be followed by a briefing presentation in which SW will seek to address questions bidders may have relating to the information submission as well as the procurement process. Given this briefing interface the entire market and the key members of SW's senior leadership team will participate and deliver in this briefing, plus be made available to the wider market following briefings. Should significant challenges to the procurement strategy be prompted in this market engagement, SW can reassess and chose to conduct further market engagement.

Procurement process

SW's procurement process comprises a Selection Questionnaire (SQ)[47] period launched at Contract Notice, followed by a two-stage ITT process, leading into Financial Close and Contract Award. Figure 64 shows this process, however, the exact response and assessment periods for each procurement stage are still under development[48].

[47] SQ stands for Selection Questionnaire under the Find-a-Tender (FTS) UK procurement process, replacing the OJEU PQQ, or pre-qualification questionnaire.
[48] Please refer to section 2.9 Schedule for current durations

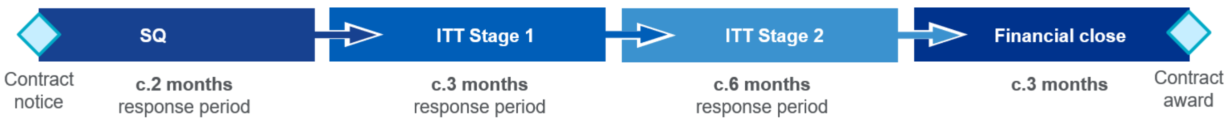


Figure 64 - Procurement stage

Upon publication of formal contract notice, and in line with its obligations under the UCRs[49], SW will release all appropriate documentation. Full disclosure of procurement documentation at this initial stage will allow the market to appraise the opportunity and make an informed decision on whether to participate in the competition. The documents published will include, but are not limited to:

- All assessment documentation for each stage of the process, including the questionnaires for SQ and ITT stages 1 and 2
- The evaluation criteria to be applied at each stage
- The draft of the CAP agreement
- All applicable technical documentation and requirements

SW plans to launch the procurement as a Competitive Dialogue, or similar (subject to regulation changes), that facilitates discussion with bidders during the procurement process[50]. This approach will allow SW to engage directly with bidders throughout the process to discuss aspects of the solution and their submitted proposals (once ITT stage 1 submissions have been made). Engagement throughout the process should lead to the submission of final tenders that are compelling, competitive, and fully satisfy the objectives of the procurement process.

SW has scheduled a c.seven-week period from Contract Notice to SQ response. This will test the capability and capacity of CAP bidders relative to the project requirements. It is imperative that this process is thorough to ensure that appropriate bidders are selected to progress to the next stage. It is also important that the submission requirements are appropriately detailed to allow for a thorough assessment of bidder capability, whilst balancing the need to ensure that the costs bidders incur in preparation of their responses are not prohibitive to participation in the process. At SQ, bidders will likely be assessed on a mixture of their certification, policy compliance and previous experience of successfully delivering comparable projects.

SW will assess all responses received at SQ stage. Once complete, the results of SW's detailed assessment will be assured and confirmed through SW's established programme and procurement governance processes. SW anticipates inviting the four highest scoring CAP bidders to prepare a tender. However, this may be as few as three, or as high as six, depending on the quality of SQ responses and relative proximity of scoring. SW anticipates that by progressing four bidders beyond SQ stage, it will maintain effective competition during the ITT stages of the competition. Under this approach, SW also considers that effective competition could be maintained should one bidder drop out of the process once the ITT stage has commenced.

The ITT will be a multi-stage process[51]. ITT stage 1 will span a c.three-month period from invitation to the submission of responses. This submission will cover aspects of price and proposals on the technical solution, including elements relating to construction, operation and maintenance. Bidders' proposals need not be fully complete at ITT stage 1; however, the purpose of this stage is to understand bidders' proposed solutions so that SW can engage in meaningful dialogue with those bidders who are taken forward to ITT stage 2. SW anticipates that it will invite three of the four ITT stage 1 bidders to progress to stage 2[52]. To enable SW to meaningfully assess responses received at ITT stage 1 and to down select to the bidders who will progress to stage two, SW must be able to assess and fix some components of bidders' stage 1 submissions. The exact components that will be fixed are yet to be determined but will likely include some

[49] Utilities Contract Regulations 2016, regulation 73 - Electronic availability of procurement documents
[50] Whichever procurement route SW follows will be compliant with the Utilities Contract Regulations 2016.
[51] SW recognises the time and cost implications of the two-stage tender process; however, it considers that the benefits of this approach (limiting bidders' costs by focusing the competition early on those with a realistic prospect of winning and allowing sufficient time for the internal governance approval processes) are sufficient to warrant this approach. SW's approach has been subject to external legal review.
[52] The volume of bidders progressed may increase to four, depending on the quality of submissions and relative scores of responses.

components of a bidder's pricing schedule and will need to be applied in a consistent manner throughout all stages. This approach is additionally beneficial as it allows SW to limit bidders' costs, as only those with a realistic prospect of winning the competition will be taken through to ITT stage 2.

Stage two will require bidders to prepare a full tender over a c.six-month period. While the previous c.three-month tender stage has been scheduled with consideration to the costs bidders would incur, stage two reflects a duration sufficient (for bidders that have progressed to this point in the competition) to develop a full proposal, which will include (but is not limited to) the bidders' design and final price to deliver the works. Bid costs are likely to be the most significant at this stage, as bidders produce detailed designs and finalise their responses. At this stage, competition between participants will work to drive the best possible proposals at the lowest possible costs.

During stage two, SW may request interim non-binding draft submissions from the bidders. This will enable SW to ensure bids are developed to a high standard and ensure any necessary clarifications are addressed. It will also enable effective, transparent, and fair competitive dialogue and will help to secure the quality of responses. Where SW receives Interim Updates during ITT stage 2 this may also help to make the final assessment process more efficient as SW will have the opportunity to understand and consider developments prior to final response submission, although the feedback process will need to be managed and controlled closely to avoid leading or guiding bidders.

Key procurement dependencies

The CAP procurement process has two critical dependencies; the need to secure DWI Regulation 31 licencing for the RO membranes used in the treatment process, and the need to secure planning permission through the DCO process.

RO membranes may only be used in the desalination process where they have achieved DWI Regulation 31 certification[53]. Certification can take 1-2 years, can require a significant amount of investment, and approval is not guaranteed. To de-risk this dependency, SW intends to create a market for Regulation 31 certified RO membrane suppliers who can provide the necessary membranes for the A.1 Desalination solution. To this end, SW has carried out market engagement with four suppliers (following a formal PIN without call for competition) in 2020 to understand the level of supplier appetite to achieve certification. SW has also engaged with [redacted], who has recently awarded an RO membrane framework contract to two suppliers, to understand the challenges within their procurement strategy. In early 2021, SW also engaged with the two suppliers on Thames Water's framework to understand the extent to which they may be able to meet the needs of the A.1 Desalination solution. Following an Options appraisal, SW intends to go to market in early 2022 (once the Gate 2 determination has been received) to engage a competitive multi-supplier framework of RO membrane suppliers with the necessary certification (or a promise to obtain such)[54]. 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.

SW will progress its DCO application in tandem with the procurement process. SW's current programme timetable provides for the submission of its DCO application in late 2023, with determination anticipated to be given in early 2025. This means that:

- The full details of SW's application will be available to bidders in advance of the procurement process, and that determination would be given before the end of the procurement process, allowing bidders to reflect any changes in their submission.
- SW will be responsible for managing the risk that changes resulting from the DCO approval cause disruption to procurement process, for example where approval is dependent upon a key change that has the potential to influence bidders' responses. Should the DCO process result in some

[53] Regulation 31 certification is applicable for all chemicals and construction products used by water undertakers, from the source of the water, up to the point of delivery to the consumer's building.
[54] Note, there is a risk that CAP bidders secure exclusivity with Residual Osmosis membrane suppliers, which may potentially hamper competition. See section 2.7 Risk management for further information.

variability of solution, this will be managed through communications with all CAP bidders and in line with procurement regulations, which in an extreme case could require a restart of the procurement process.

- Whilst SW anticipates that full approval will be achieved prior to award, procurement timescales may need to be adjusted to reflect any changes. It is noted that the DCO application process sits on the critical path for the project, meaning that delays to the DCO process will likely have a knock-on effect on the CAP procurement process and timetable.

Key procurement risks

SW has identified a series of key risks to the procurement process, as detailed in Table 100. At this stage, this is a high-level non-exhaustive list of potential key risks to procurement that will be considered in more detail as the procurement plan is developed further. SW has set out its early views of potential risk mitigations, however, these also remain subject to refinement as the plan development progresses.

Table 100 - Procurement risks

Procurement risk	Description	Outline view of potential mitigations
Lack of market appetite for the project	The risk that the market does not consider the project attractive, meaning no or limited responses are received to the Contract Notice. Factors that may affect market appetite could include, inter alia: • Negative perception of the commercial model (incl. outline terms of the CAP agreement) • Concern over programme timeline, including dependency with DCO process	This risk is best mitigated through engagement with prospective bidders in advance of the procurement process, allowing SW to share information on the project, including key commercial terms, and obtain feedback from the market in advance of Contract Notice. This process will help to ensure that prospective bidders are well-informed about the project and will allow SW to understand and address any concerns held by the market.
Limitation / absence of supply chain capacity	The risk that there is insufficient capacity in the market to deliver a project of this nature, likely due to engagement on other similar projects, resulting in a diminished level of competition.	SW's engagement with the market to date has indicated that there is sufficient capacity in the market for the project, however SW will continue to monitor this risk through future engagement exercises.
Delay to the procurement process	The risk that the procurement process is delayed, resulting in additional cost and affecting SW's ability to meet its s20 obligations for the delivery of the project. Causes of delay could include, inter alia: • Bidder requests for additional time to prepare responses • Delayed or extended governance processes • Delays in parallel activities, such as the DCO application process • Legal challenge (discussed below)	Mitigations against delay include: • The development of a clear procurement timeline based on past experience of similar projects, giving due consideration to key dependencies, and allowing sufficient time for each activity • Providing bidders with as much information as possible at the outset and engaging frequently throughout to ensure clarifications are addressed • Legal input throughout the design and implementation of the procurement process

Procurement risk	Description	Outline view of potential mitigations
Diminished competition in the procurement process	The risk that one or more bidders exit the procurement process, resulting in a diminished level of competition between remaining participants.	Measures to ensure competition is maintained include: • Limiting the need for bidder investment in the early stages of the process, so that the prospect of 'sunk costs' does not deter participation • Holding a reserve bidder from PQQ into ITT stage 1 in case one of the successful bidders exits the process – which will be communicated to potential parties through the ITT process • Reducing the competition to a smaller number of bidders at ITT stage 1 so that remaining bidders have a greater chance of winning and are less likely to exit the process • Inviting 3 bidders to ITT Stage 2 so that competitive tension can be maintained even if one of the bidders exists the process
Legal procurement challenge	The risk that unsuccessful bidders challenge the conduct of the procurement process, or the application of the assessments, suggesting that the UCR 2016 have not been followed.	It is not possible to exclude bidders' right to raise a legal challenge against the procurement process, however all of SW's procurement processes are managed in compliance with the UCR 2016, and its procurement plan will be subject to continuing legal review as it is being developed.

CAP Tender Evaluation Framework and Assessment Criteria

This section presents the evaluation framework for the SQ and ITT stages. Figure 65 illustrates the evaluation process with indicative timings for each stage that will be tested and verified further.

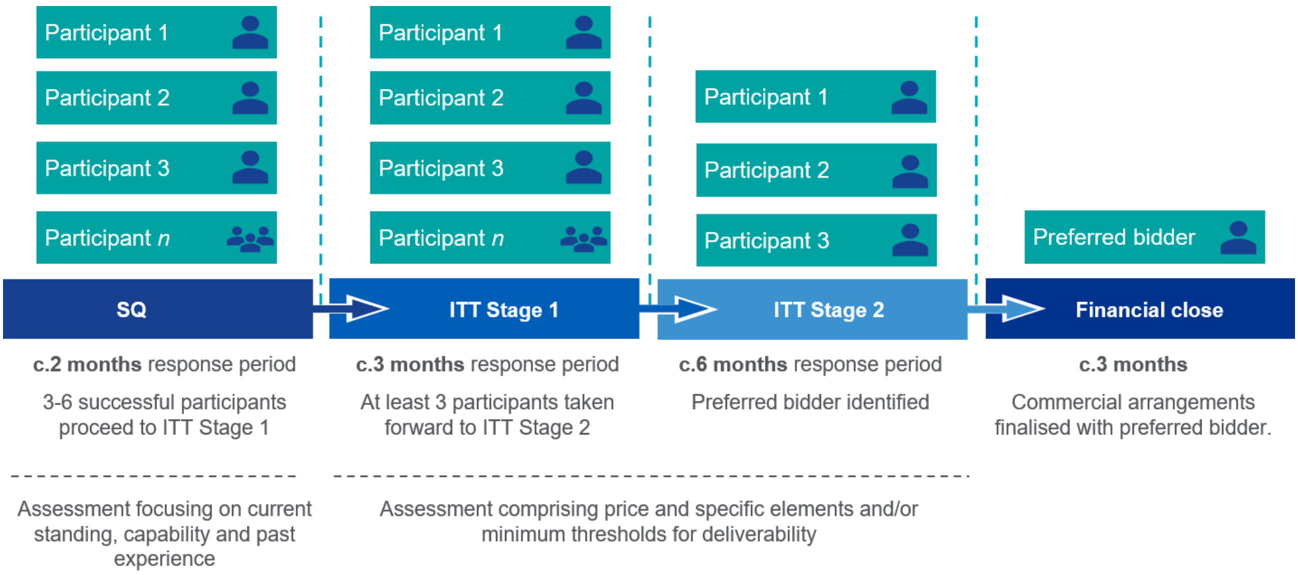


Figure 65 - Evaluation process

Each stage of the evaluation process will aim to achieve different objectives:

- **SQ** - Assesses the bidders' competence and ability to deliver the solution on a backward-looking basis; bidders that demonstrate historical competency based on a minimum threshold on a pass or fail basis are to be passed to the next stage. It is expected that the SQ will focus on the identity and financial credibility and capability of bidders and so as part of the SQ SW will likely assess bidders' structure, financial statements and performance, and experience delivering similar projects. SW will consider the depth of these assessments (i.e., light-touch review or detailed assessment of all bidder parties) as the evaluation framework is developed further. Depending on the number of bidders achieving a pass there may be further down-selection to take c.3-6 bidders through the next stage based on the best SQ responses.
- **ITT stage 1** - Assesses the bidders' project deliverability, and potentially to a smaller extent on their indicative prices, to identify 3 bidders to proceed to ITT Stage 2 for detailed design; bidders that demonstrate robust financial, commercial and technical deliverability on an overall scoring basis may be passed to the next stage. SW will consider whether to set any minimum thresholds for deliverability and will seek an understanding of a bidder's delivery model, the structure of their planned activities, their approach to risk mitigation and their plan to secure and maintain the necessary skills and capabilities throughout the life of the contract. At this stage SW will look to reach a balance, requiring bidders to provide enough information to undertake a deliverability assessment without incurring unnecessary bid costs. As part of the calibration of the deliverability assessment SW will also consider the time and effort requirement of the bid evaluation.
- **ITT stage 2** - Assesses developments in deliverability against design requirements but is likely to be driven by the price; the Most Economically Advantageous Tender (MEAT) will win. Further deliverability assessment will focus on the design activities carried out by bidders and will test that the design proposed by bidders fits minimum requirements of various technical elements, reflecting developments in SW's consenting and permitting activity. At this late stage, SW's primary aim will be to drive VfM through competitive tension whilst ensuring that the bidders' proposed solution is fit for purpose.

The detailed evaluation criteria for each stage will need to cover technical, commercial and legal aspects of the project, taking into account SW and Ofwat objectives. The evaluation framework will be designed such that it is fair, transparent and fully documented, ensuring that any potential challenges from losing bidders can be robustly defended, so that the risk of such a challenge is minimised.

Key Pre-DPC Activities to Implement the Preferred Tender Model and Commercial Model

Recognising the time-sensitive nature of some aspects of the project development, it will be necessary for SW to undertake certain pre-DPC activities to support the implementation of the preferred tender and commercial models. A variety of activities are currently under consideration including, but not limited to, early feasibility works[55], enabling works[56] and pre-DPC construction works, however, these are reflective of the level of detail currently available; and it is likely that some areas will evolve in terms of scope and priority as the project develops further.

Conflict of interest

SW has engaged a variety of suppliers to support its project development. Where frameworks have been established, due consideration has been given to conflict of interest, ensuring that appropriate safeguards are in place for frameworks suppliers who may also participate in the DPC procurement process. SW has established conflict of interest arrangements with all suppliers engaged to date. Similar arrangements will be sought with suppliers engaged in the future, and SW will continue to actively manage any potential conflicts of interest as the project develops.

Studies & Investigations (S&I) framework

[55] Feasibility studies identify the practicality of a project, considering relevant contextual factors (economic, commercial, technical, regulatory etc.) in order to determine whether a project should be progressed.
[56] Enabling works is a generic description for the site preparation works that take place prior to work under the main CAP construction contract. The term also covers the statutory and non-statutory works required to gain Development Consent Order (DCO) and Direct Procurement for Customers (DPC) approvals.

To support its pre-DPC activities SW has established several specialist S&I frameworks. This was following an extensive programme of market and stakeholder engagement and a competitive procurement process. The majority of the enabling works packages are within the scope covered by SW's S&I Framework and can be procured through this route. Other packages will either be procured through the Catchment Management Specialist Framework, or for packages which cannot be procured using existing frameworks a procurement decision will need to be made. Call-off from these frameworks has been used to secure the majority of pre-DPC and pre-DCO workstreams. This is following a fully competitive OJEU[57] / FTS[58] procurement where 23 lots were awarded across the 5 S&I frameworks[59].

The specialist frameworks have been established with due consideration to conflict of interest, ensuring that appropriate safeguards are in place for frameworks' suppliers who may also participate in the DPC procurement process. Similar arrangements will be sought with suppliers engaged in the future, and SW will continue to actively manage any potential conflicts of interest as the project develops.

Enabling works

SW's procurement approach for its pre-DPC activity has been developed in two phases. Phase 1 focuses on meeting SW's early feasibility needs. Phase 2 comprises enabling works and pre-DPC construction works. The majority of work packages under Phase 1 have been delivered to budget and within required timescales. In the most part, these packages relate to obtaining consents (including planning, consenting, environmental constraints, permitting, and other environmental considerations) and as such include a variety of surveys in support of SW's Gate 2 submission, DCO preparation and EIA.

For Phase 2 of its pre-DPC activity, SW will continue to utilise the established S&I frameworks. The contents of Phase 2 have been in development during Q2 and Q3 of 2021. It will include additional sub-strategies which focus on pieces of work that lie on the critical path and must be completed in order to achieve DCO approval and allow for a CAP to be appointed. This phase of activity is being prepared in consultation with key stakeholders including regulators (EA, NE, Ofwat etc.) and other members of the delivery team and will include but is not limited to:

1. Environmental technical appraisals and studies
2. Modelling, including Cormix and 3D modelling
3. Support activities to further SW's Optioneering, DCO and EIA processes
4. Terrestrial ecology surveys, including bats, breeding birds, Hazel Dormouse and badgers
5. Aquatic ecology surveys, including river habitat and corridor surveys
6. Marine ecology surveys

SW intends to agree its procurement acquisition strategy for Phase 2 in 2021. The scope of this second phase of pre-DPC activity remains under development, once this has been agreed SW will develop a strategy for the allocation of these works between lots.

For its future enabling work packages, SW has identified the relevant suppliers within the S&I framework and is in the process of engaging suppliers on each framework to better understand their capacity relating to the different packages required. Actions related to the identification of pre-DPC suppliers will include:

- Verifying the capacity of existing framework suppliers to undertake specific packages of work.
- Proactively maintaining conversations with suppliers to understand their long-term capacity. This may allow SW to secure resource for a longer term and understand whether added value can be gained from awarding bulk packages to specific suppliers.
- Identifying those packages of work that will not be awarded to framework suppliers and develop procurement routes for such packages.

[57] OJEU refers to the Official Journal of the European Union, contains public sector contract tenders and notices from every EU member country.
[58] FTS refers to the Find-a-Tender service, which is a UK procurement portal launched following the UK's exit from the European Union.
[59] The 5 S&I frameworks include Catchment Management Strategy and Delivery, Wastewater investigations, Environmental monitoring, assessment & implementation, Asset investigations and flow monitoring, and Water Resourcing Management and Investigations.

DCO planning support services

To support in the development of its DCO strategy and its application and consultation process SW requires input from a variety of services and specialisms. Of these, planning and consenting support services are required urgently, as an in-house planning team does not exist. SW has sought Board approval to make a direct award to Ove Arup and Partners (under the S&I framework) who will provide interim support until December 2021, by which time the tender for the DCO partner will have concluded. SW will not preclude Ove Arup and Partners from competing in the procurement process for the full support works but has ensured that appropriate conflict provisions (such as information barriers) are in place to prevent any unfair advantage.

DCO consultation

The activities required within the DCO consultation are also urgent and there is currently no internal resource that can fulfil the consultation resourcing requirements needed for this SRO. The activities required fit within the SSP framework service scope and can be procured under the SSP framework. The SSP is composed of [redacted] with subcontractors [redacted] and [redacted]. [redacted] and [redacted] are believed to have the required experience and capability to deliver DCO consultations. SW is currently preparing to engage the suppliers on this framework to test their capability and will then assess the most appropriate procurement route. SW is currently exploring contract Options for the DCO consultation package.

Pre-DPC engineering and design surveys

In addition to enabling works, SW will also undertake some pre-DPC construction activity. The packages of work and schedules for delivery for these construction works are currently in development, however amongst the packages identified thus far there is a focus on design support required for this solution. SW is currently reviewing which of these work packages can be undertaken by internal resource. For work packages where external resources are required a full scope of work for the packages will be developed that SW will procure using the SSP framework, S&I framework, Environmental framework (EIA), or may undertake a separate procurement (compliant with the UCR 2016) to make an award to a supplier who can support SW with these requirements.

Early Contractor Involvement (ECI)

ECI denotes the introduction of a contractor’s skillset in the early stages of a project to bring design ‘buildability’ and cost efficiency to the pre-construction phase. SW recognises the unique, large and complex nature of its WfLH programme, and therefore considers that it will benefit from contractor expertise extending across SROs and the DCO and DPC processes. It is anticipated that ECI support will be needed throughout project development, procurement and potentially beyond CAP award, however the long-term scope for the ECI is yet to be determined. At this time, SW is developing its ECI strategy and engaging with relevant suppliers. As the WfLH programme develops, a detailed schedule of activity for the ECI will be developed, however to date SW has identified the following requirements:

- Constructability reviews and construction schedule development (including the production of construction phase plans)
- Advice on the necessary mechanical and electrical systems, commissioning durations, tunnelling approach and other discrete areas as applicable
- Support through SW’s statutory consultation process
- Tender evaluation during the assessment stages of the procurement process, focusing on technical questions
- Reviewing sub-contractors’ Risk Assessment Method Statements (RAMS)

These requirements will be further improved or extended during negotiation/dialogue sessions SW has planned as part of the Competitive Procedure with Negotiations procurement route which will be conducted to engage a suitable ECI contractor. SW will seek ECI parties who can demonstrate an extensive background in civil and mechanical engineering, a history of experience in similar or major infrastructure projects, and experience of working with clean water assets.

To secure the support it requires, SW proposes to undertake a competitive dialogue with negotiation procurement process (with a pre-qualification stage and two-stage tender) to engage two non-DPC ECI parties, with award anticipated for July 2022. SW anticipates that these ECI parties will be engaged on a New Engineering Contract (NEC) Option C (target cost) or E (cost reimbursable) basis, over a 9-12-month period, working in parallel and competing for a single award for the construction period.

The successful ECI party will be integrated into SW's WfLH team and will initially be required to undertake a review of the WfLH outline project design statements (and associated documents / plans / drawings, specifications and schedules) currently under development. The design/buildability resource is expected to deliver a number of agreed outcomes regarding the design/buildability of the WfLH project including, but not limited to:

- Providing design and constructability input, including review of key documentation, implementation of best practices and (where possible) standardisation, and the development of a constructability plan
- Creating and maintaining a constructability lessons-learned database and cost-effective design modification database
- Undertaking constructability workshops prior to the CAP tender process, focused on the discussion of concepts and sharing of input, developing a plan for constructability implementation during project execution and the identification of opportunities and concerns
- Providing discrete areas of advice, for example in relation to underground works, major crossings (watercourses, road crossings, critical services etc.) and for works in specific environmental conditions
- Reviewing and assisting with the development of a variety of DCO design deliverables

To address its urgent need for support in its construction and commissioning schedule development (whilst it procures formal ECI support) SW has engaged early Buildability Construction Management (BCM) support under its SSP framework.

2.11.1.5 Design Maturity

Detailed information on SW’s design development can be found at the following locations in this document:

1. The anticipated level of design maturity can be found in sections 2.2 Engineering Design, 2.3 Network Infrastructure and 2.4 Site and Route Selection
2. Detail on project risks and their potential to impact the development of design maturity can be found in section 2.7 Risk Management
3. Detail on SW’s planning and consenting strategy (including EIA) can be found in section 2.8 Planning and Consenting

To facilitate the procurement process, SW will ensure that the design process balances the certainty required for the purpose of planning applications and the DCO approval process (sufficient to mitigate the risk that planning is not achieved), with the need to maintain a level of flexibility and Optionality that will allow bidders to demonstrate their knowledge and skillset, and to add value to the final solution design. A less tightly defined scope will provide bidders opportunity to develop the most efficient and cost-effective engineering solutions.

Engineering documentation provided for the tender process will be split between “rely-upon information” (information that has been used to inform the DCO application), and the remaining information (provided “for information only”) that will be provided to enable the bidders to submit a detailed submission that can be normalised for evaluation.

Informal Market Engagement Feedback

As part of the Gate 2 solution development, SW ran a series of informal market engagement meetings[60] with potential bidders. The key points noted by strategic investors and construction contractors were as follows:

- Since the detailed design is expected to be developed by bidders, initial design carried out by SW should still give bidders the flexibility to innovate whilst adhering to DCO process requirements. Participants believed that an optimum pre-tender design leaves room for change and improvement.
- Participants suggested that SW should progress the design envelope enough to meet the DCO approval requirements without limiting the CAP's ability to drive innovation and cost savings.
- Participants highlighted that clarity on the level and scope of the initial design and SW's expectations for the detailed design would be key to developing bid submissions as part of the tender process.
- Participants were favourable towards SW engaging with an early design contractor to help develop the initial design especially in preparation for the DCO approval.
- Overall, stakeholders believed that it is not necessary for SW to undertake pilot trials in advance of the CAP procurement, although they are considered to be useful to bidders for the optimisation of solution design (e.g., how many RO membranes will be required). This takes into consideration that any pilot trials completed by the preferred bidder will not be able to be used in re-negotiating key aspects of the agreement. At the same time potential bidders noted that water quality sampling will be essential for them to develop their bids.

This feedback is consistent with the late model, under which bidders will expect SW (as incumbent) to have secured the necessary planning permissions based on a reference design. SW will work with its ECI contractors to ensure that the planning, consenting and DCO processes do not unduly restrict the ability of bidders to optimise their designs. Having considered participants feedback in respect of pilot trials, SW does not intend to undertake any such trials in advance of the procurement process.

2.11.1.6 Confirmation of Preferred Tender Model and Commercial Model

Tender Model

The late model with early market engagement tender has been identified as the preferred tender model for the Desalination solution. Under this model the solution is tendered out as a DBFOM[61] after SW obtains the consent.

To reach this decision, SW has developed and applied an assessment framework against the four potential tender models identified at Gate 1. Internal workshops were conducted to down-select 2 models to be tested with the market as part of SW's Gate 2 informal market engagement[62]. Bringing together feedback from the informal market engagement with SW's assessment, the late tender model with early market engagement was selected as the preferred model. Table 101 below details the stages of tender model review.

Table 101 - Preferred tender model stages of review

Review stage	Scope
Initial review of tender models	Four tender models assessed that have been identified for further progression at Gate 1: a) late with early design, b) late with early market engagement, c) late with novation of early designer or d) late with split Design and Build (D&B) from finance
Workshops with key SW SMEs	Preference for late with early market engagement or late with split D&B from finance
Informal market engagement feedback	Preference for late with early market engagement

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

[60] To date, market engagement exercises have been undertaken in 2019, as part of SW's Gate 1 submission and as part of SW's Gate 2 submission.
[61] Design, Build, Finance, Operate and Maintain
[62] The late tender model with early market engagement, and the late tender model with split D&B from finance.

- The late model (or a version thereof) is necessitated by SW's timetable constraints. Were SW to follow the early model, the procurement of the CAP and planning application process would typically be undertaken sequentially. Given the time required for each of these activities, SW would be unable to meet its timetable obligations. Under the late model, SW is able to pursue the necessary planning and consents in parallel with its procurement process to enable the solution to be delivered as quickly as possible once a CAP is appointed. The late model is therefore the most time-efficient of the Options considered.
- Although there are limited examples of desalination plants in the UK, there is a wide pool of international contractors expected to drive competition from a D&B perspective and therefore there is less need for SW to propose the late split model in order to keep competitive tension throughout the tender process.
- Tendering the full spectrum of DBFOM activities will lead to a more straightforward risk allocation between the CAP and SW and will minimise the number of interfaces required at the early stages of the project.
- The late with early market engagement Option emerged as the clear preference of potential bidders. Potential bidders believe that under the proposed late model with early market engagement they would be able to offer greater VfM through the integration of all DBFOM activities into one proposal, facilitating innovation, minimising interface risks and ensuring overall alignment of risk allocation.

Under this tender model SW will play a key role in the need identification, Option selection, design and consenting activities. The project hand over to the CAP will occur before the detailed design stage, once consent has been obtained based on the initial design developed by SW. The CAP will be responsible for the detailed design, construction, operation, maintenance and financing of the solution. Under this model the ownership of the solution would sit with the CAP for the duration of the contract term, after which it would be transferred back to SW, or if SW chose to re-tender, transferred to a new owner. Figure 66 illustrates the key activities under the late model with early engagement for SW and CAP.

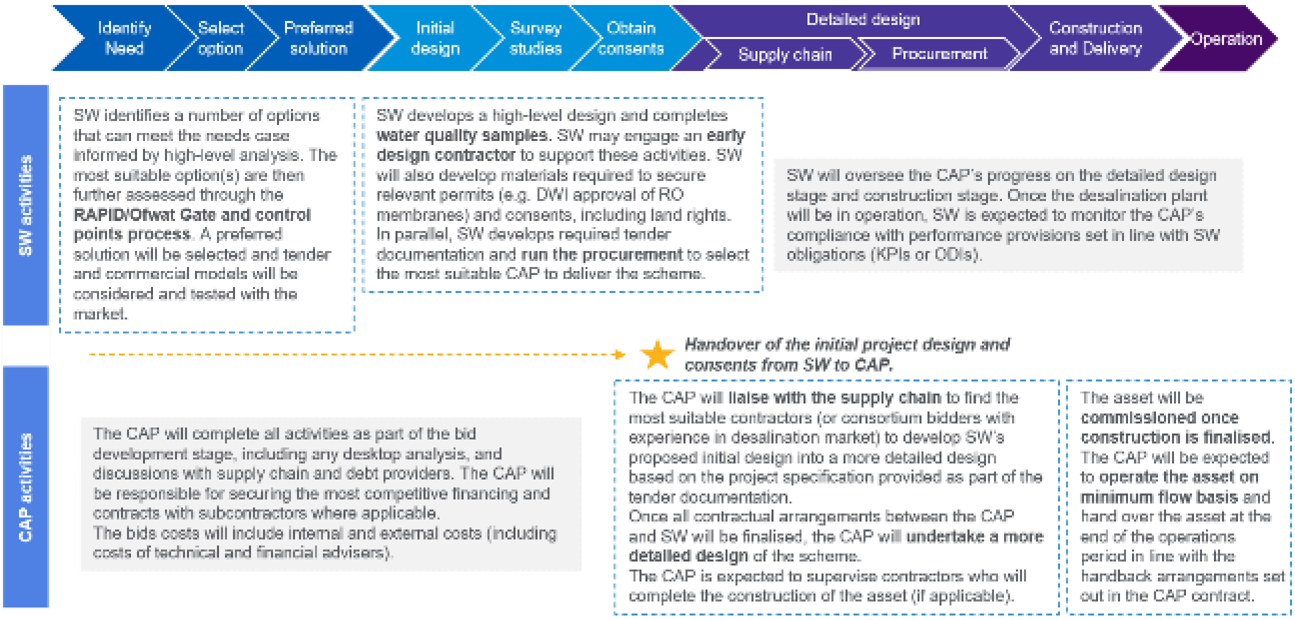


Figure 66 - Key activities under late model with early engagement

Commercial Model

The commercial model further develops the work carried out as part the Gate 1 Submission and is built upon the basis of the late tender model with early market engagement being identified as the preferred model. The proposed commercial model reflects both the current understanding of the solution and the feedback received from the informal market engagement undertaken to date. It will evolve as the project develops. The commercial model also incorporates a variety of inputs from the wider industry, including Ofwat's DPC guidance, internal workshops with SW SMEs and analysis of precedents from PFI / PPP type projects in the water, energy, rail, and wider infrastructure sector that share similar risk profile, business model, asset type, or appointee structure to the solution.

The commercial model covers key contractual principles and main categories of risk allocation, both of which have been tested with market engagement participants.

Contract with the CAP

SW considers that a fixed price contract with the CAP, on a DBFOM basis is the most suitable Option. A fixed price contract provides the greatest protection for SW and customers from price increases. As the expertise in delivering desalination assets is expected to come from bidders, they are considered to be best placed to bear the risk of cost overruns.

Table 102 details SW's high-level proposal for how the contract with the CAP would be structured before the issues are discussed below.

Table 102 - Overview of proposed commercial model

Area	Proposed approach
Contract length	• The recommended operational term is 20 years • The contract will also cover a design implementation period of 1 year[63] and the construction period of 4 years
End of contract asset treatment	• A bullet payment will be made to the CAP based on the end of contract asset value • At the end of the contract, the asset will either be retendered by SW or transferred to SW's control and an amount equivalent to the end of contract asset value added to SW's Regulatory Capital Value (RCV)
Termination	• 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 • Refinancing gains to be shared 50:50 between the CAP and the customers[64] • Performance targets with associated incentives / penalties
Acceptance and late service commencement	• Liquidated damages for late service commencement • Financial incentive for timely asset delivery • Clearly defined criteria and process for acceptance
Operational performance	• Most risks are expected to be transferred to the CAP, e.g., EA water quality risk, process risk, leakage, response time and critical spares • Some will be shared between the parties (e.g., DWI water quality risk, volume uncertainty

1. An **operational term**[65] of 20 years has been selected as the term that achieves the best alignment between the nature of the solution, the asset lives of its principal components, the appetite of stakeholders (such as SW's regulators), the market, the available financing solutions, the project's VfM proposition and SW's long-term objectives.

[63] This timescale is an estimation only at this stage. SW anticipates that the CAP's design activity will be predominantly undertaken during the procurement process, and that post-award, the CAP will place the necessary orders with its supply chain and put in place arrangements for delivery. See section 2.9 Schedule for further information on the anticipated timetable for project delivery.
[64] SW anticipates that a refinancing event may take place post-commissioning. The current 50:50 assumption is in line with Ofwat's guidance but will be tested further to ensure that the CAP is appropriately incentivised to reduce financing costs.
[65] Here, operational term refers to the operational period which begins once the asset has been successfully commissioned.

2. The solution's **renewal CAPEX profile** forecasts significant expenditure in operational year 2021[66]. If financed by a CAP this would require the maintenance of inefficient cash reserves throughout the contract term, diminishing the VfM provided by the project. Assuming a straight-line depreciation over the asset life the large renewal CAPEX in operational year 2021 significantly increases the bullet payment at the end of the contract should a term beyond 20 years be selected. Further, the selected contract length matches bidders' preference for a shorter contract[67], and aligns with the typical length for bank financing, which is considered the most likely financing route for this solution due to its first-of-a-kind nature. Shorter terms also allow bidders to fix their O&M costs[68], creating opportunity to drive additional efficiency. In all, these factors coalesce to present a 20-year operational term as the optimal length.
3. Taking the above into account for the **end of contract asset treatment**, SW has elected to make a bullet payment to the CAP at the end of the contract term. This approach reflects the difference between the 100-year life of the asset and the 20-year term of the CAP agreement, ensuring that customer affordability is not compromised in favour of full repayment over the term.

   Whilst a bullet payment will be made, this may be subject to an assessment of the asset condition at hand back[69]. Once finalised, the asset depreciation profile will drive the size of the bullet payment, however this is yet to be determined and will be subject to further calibration. Market engagement has shown that bidders are open to and generally supportive of the inclusion of a bullet payment. It will be key to understand how the potential size of the bullet payment may impact bidders' appetite to participate in the procurement and their submitted prices. SW may look to test the financial implications of various depreciation profiles to ascertain their impact upon customer benefit and consider questions related to intergenerational fairness (such as bill impact and affordability). At the end of the CAP contract, the asset will either be retendered to find another provider to take over the asset, or will return to SW's control, with an addition made to SW's RCV equal to the remaining value of the asset.
4. **Termination rights** are typical for PPP / PFI project finance arrangements and will be expected by the market, in particular for certain no fault (e.g., force majeure), Appointee default (e.g., non-payment) and CAP default scenarios.

   Ofwat has recognised that the requirements of SW's licence and other statutory obligations cannot be transferred to the CAP. SW must retain the contractual right to address service failures, which may result in adverse effects for customers and liability for SW. As such, SW is likely to seek automatic step-in rights where certain water quality standards are compromised[70] (for example, where cryptosporidium is detected), and to introduce a "termination for convenience" clause, whereby the contract can be terminated at SW's will without the need for cause, providing a safeguard for SW in its activities as water undertaker.
5. With regard to the **payment mechanism**, a hybrid model will include an availability-based payment (likely linked to the provision of a set minimum-flow level) and a volumetric element covering variable OPEX reflecting the level of asset utilisation (e.g., an increased level of asset output). Variable costs will also be based on a schedule, that is, defined costs at different levels of operation.

   This approach reflects the solution's position as a resilience asset and will increase the VfM for customers, who will pay for asset utilisation (above an agreed minimum flow) only where it is required, for example in drought conditions. Further performance penalties and incentives (tailored to the detailed operational characteristics of the solution) may also be employed to ensure that the CAP is appropriately incentivised to maintain the asset's availability in times of need. SW will also consider additional components of the payment mechanism which may help to drive additional VfM, including a refinancing

[66] Based on the Gate 2 cost estimate profile, c.£194m of renewal capex will be required in OY21.
[67] In the market engagement conducted to date, bidders expressed a preference for a contract term of 30 years or below.
[68] Bidders would likely seek contractual mechanisms that would allow maintenance costs to be adjusted in the event of a longer-term agreement.
[69] Asset condition at hand back could be accounted for through several different approaches, including (inter alia) a deduction from the residual value payment, a deduction from the availability charge (where asset deterioration had been identified earlier in the contract term), and/or the imposition of a requirement for the CAP to post security. The relative merits/demerits of each approach will be considered further as the commercial model continues to develop. Additionally, consideration will be given to the potential process for asset handover, and how a new provider or SW could be given confidence in the end of contract surveys and inspections undertaken by the original CAP. It will also be important to ensure that evidence exists to demonstrate that the maintenance regime has been adhered to over the life of the contract.
[70] During market engagement, one bidder suggested that termination rights should be based on performance-related penalties.

gain share[71] (expressed through a reduction in customer charges) and the potential for the indexation of revenue streams, subject to further analysis.

6. **Acceptance and late service commencement** provisions will need to ensure that the CAP is financially incentivised to ensure timely delivery. It will need to avoid creating a disproportionate downside exposure that would be reflected in bid prices.

   The payment mechanism will meet this objective in part, as revenues to the CAP will not commence until the asset is commissioned, in line with Ofwat's guidance[72]. However, given SW's need to implement the solution in time for its 2027 regulatory deadline, liquidated damages and early-delivery bonuses may be implemented to ensure committed schedules are achieved. During market engagement, bidders have noted that clear acceptance criteria will be crucial to ensuring that the asset can enter operation in line with both SW's and the CAP's expectations. An independent certifier / verifier may also be engaged, providing both parties with guidance and allowing for an independent and objective view of acceptance.

7. Once in service, SW and the market agree that most **operational performance** risks will be transferred to the CAP, reflecting its assumption of responsibility for operation under the CAP agreement. As noted above, there are risks (particularly relating to statutory obligations) which SW will be unable to transfer, with the effect that both parties will need to co-operate effectively to manage these. SW will also look to ensure asset condition inspections are undertaken regularly as this will inform the asset's deterioration profile.

The contractual arrangements between the CAP and SW will be outlined in more detail as the commercial model is developed further and will be reflective of a more developed understanding of project risks.

Risk Allocation

The principles bulleted below underline the high-level risk allocation exercise that has been undertaken to date:

- Ofwat's DPC principles state that risks should be allocated to those best able to manage them
- Risk allocation impacts bidders' appetite to participate in the CAP tender and submit a bid
- The information shared with bidders will affect their willingness to accept ownership of risk. The more information is shared with bidders during the procurement the more likely they will accept responsibility for a particular risk.
- Bid prices will be reflective of the level of information shared and the overall allocation of risks between the parties
- SW may consider reopeners for risks that cannot reasonably be managed by the CAP

Table 104 below identifies some of the key risks that are applicable to the delivery of the solution within the DPC model. Risks are allocated at a high-level between customers, the CAP and SW, reflecting the party principally responsible for each risk, or whether a particular risk is expected to be shared between parties.

SW has tested its outline risk allocation with the market through an informal market engagement exercise. Participants were provided with a version of the table 8 below that detailed a summary explanation of the risk and the rationale for its allocation. The exercise provided SW with valuable feedback on individual risks, which has been incorporated into the explanations set out below. Overall, participants agreed that the proposed risk allocation was appropriate, noting its similarity with other comparable projects.

Table 103 - High-level allocation of risk between parties

Risks and considerations	Customer	CAP	SW
Consenting			
Planning			

[71] The 50:50 refinancing gain currently proposed is based on existing PFI guidance and precedent.
[72] This position aligns with Ofwat's DPC principle that customers should not pay for assets until they are in receipt of the benefit they provide.

Risks and considerations	Customer	CAP	SW
Reference design			
Detailed design			
Ground conditions			
Programme			
Sub-contractor performance			
Asset handover			
Commissioning			
Land access rights			
Construction Costs			
Operating costs			
Interoperability/Interface			
Finance			
Regulatory (Ofwat/RAPID/DWI)			
Availability risk			
Operational performance			
Force majeure			
Change in law			
Bad debt			
Other risks *Other risks to be considered as part of the risk allocation include: ecology risk, water conditions risk, first of a kind risk, risk related to stakeholders, power, grid capacity, DCO, archaeology, incentives, 3rd party providers, liabilities and guarantees, operating concession, asset hand back/condition, consents, uninsurable events, etc.*			

At a high level, the risk allocation in the table above reflects the use of the late model for the procurement of the CAP. As is typical for the late model, SW will assume responsibility for planning, consenting, reference design and other early risks associated with the activities it will undertake in advance of contract award to support the delivery of the scheme. Should any of these risks materialise SW will bear the costs associated (including once CAP appointment has occurred), for example costs associated with the granted DCO and any other consenting activities undertaken pre-award.

Once an award has been made, the CAP will take ownership for detailed design, programme and project management (including the management of sub-contractor performance), construction, financing, operation, maintenance, and other delivery risks. It will be responsible for delivering the solution in line with all DCO conditions and for managing any associated risks. Under a fixed price contract, the CAP will also assume the risk of cost overruns during both construction and operation.

Some risks will be more complex in their allocation, leading to a sharing of responsibility between parties, typically between SW and the CAP, but in some instances with costs also passed to customers. SW has engaged with market participants about risk allocation[73] and found support for the positions adopted.

- **Ground risk** - Ground risk represents one of the most significant challenges to the delivery of large assets, particularly during the construction phase. Understanding the environment typically requires

[73] During the market engagement exercise, SW showed participants a version of Table 6 – High-level allocation of risk between parties, with a selection of summary points beneath each item as a prompt for discussion.

a programme of surveys, studies, and investigations to be undertaken, generating information that can be used to allocate risk based on the specific characteristics of the area in question[74]. SW currently anticipates that the CAP will assume the risk of standard ground condition variations, whilst SW will retain unforeseeable ground condition risk, although it is noted that bidders are only likely to accept risk exposure for ground conditions where a sufficient level of geotechnical and topographical information is made available as part of the tender process[75]. Uniquely to the Desalination solution, the CAP will need to be comfortable undertaking construction works in the marine environment (for the seawater intake and outfall components of the solution). As it has limited experience operating in such an environment, SW will likely look to the CAP to assume this risk, however these atypical challenges will need to be explored further as part of a more detailed risk allocation exercise. SW is contemplating the use of a Geotechnical Baseline Report as a mechanism to allocation and manage ground risk between itself and the CAP.

- **Land and access rights** - Risks related to land and access rights will also be shared between SW and the CAP. SW will bear the initial risk as it acquires the necessary rights, before granting the rights to the CAP to enable them to comply with their commitments and obligations under the agreement. The CAP must ensure that it complies with the terms of any rights as set by SW, who will likely seek to ensure that it has a route to compensation where liability arises in response to the CAP's conduct or activity. SW will need to also consider any reputational issues arising through the CAP's activities, and as such will likely look to work proactively with the CAP throughout delivery and operation.
- **Interface risk** - This risk will be shared between SW and CAP, as whilst the CAP will be responsible for constructing a fit for purpose interface between the solution and SW's wider network, it will be reliant upon a clear specification from SW upon which it can base its design. Once operational, risk related to issues arising from co-ordination of the asset's operation and the flow of information between parties will be shared between SW and the CAP. The key mitigant to this risk will be a clear definition of asset to network interfaces and operational input and output requirements.
- **Change in law risk** - Regulatory change and change in law will need to be monitored throughout the project and has the potential to significantly impact all facets of project delivery. At the national level, general changes in law (that is, changes to working time regulations, national minimum wage, and so on) are likely to be borne by the CAP who will be expected to consider these factors as it prepares its bid. SW's current assumption is that specific changes to the regulatory framework (including changes in Ofwat's / RAPID requirements) will likely impact both parties and will be shared between SW, the CAP and customers in some instances. The market engagement participants have challenged this position, suggesting that SW may be best placed to manage this risk. During the procurement, bidders will look to understand the regulatory requirements that currently apply to the project and the potential scope for changes. Where regulatory change is perceived to be likely or significant, this will be reflected through increases in bid prices.
- **Operational risks** - SW intends for the CAP to operate the asset throughout contract term, and as such expects the CAP to assume responsibility for most operational risks, including process, leakage and response time (in the event of a water quality incident or service interruption). Further, it is anticipated that the payment mechanism will be linked to availability, incentivising the CAP to operate the asset effectively and maintain performance levels. However, SW cannot transfer operational risk to the CAP entirely, retaining responsibility for its statutory and licence obligations as water undertaker along with the associated penalties arising from service interruptions and water quality issues. Further, the associated risk to reputation will also continue to be held by SW. As the asset's principal purpose is to provide resilience in dry weather conditions, it is likely that any service failures during a period of increased asset operation (such as during a drought) would both damage SW's reputation and render it subject to regulatory penalty. To address this exposure, SW will likely look to ensure that contractual mechanisms are in place to allow it to recoup any penalty costs from the CAP.
- **Bad debt** - Under the DPC model, the Tender Revenue Stream (TRS) will be paid to the CAP by SW. In turn, SW will recover these revenues from customers through the charges regime. Ofwat has

[74] It is commonplace for a Geotechnical Baseline Report to be developed and used to allocate risk between parties through a series of baselined parameters.
[75] The level of information shared with bidders during the tender process will impact the contingency built into bids.

stated its preference for certainty in the TRS, and that the current regulatory (building-block) mechanism for the recovery of customer bad debt will therefore continue to apply for DPC revenues. On this basis, this risk will be shared between SW who bears the initial cost of under-recovery, and customers from whom the charges will be recovered in future years.

As stated above, SW has developed its commercial model to a level of detail necessary for its Gate 2 and Control Point B submissions. SW will continue to develop the commercial model and risk allocation as solution development progresses beyond these submissions.

2.11.1.7 Internal Approval of Procurement Approach

SW operates a defined governance process for the approval of the 'Strategy' stage of any procurement with a value over £250 k. The Strategy stage is the point at which the preferred procurement route, the process for tender evaluation and award, the supplier payment and contract management approach are all set out.

Authority for approval of the Procurement Strategy is delegated dependant on the value of the procurement, the thresholds for delegated authority approval are set out in the Procurement Gateways Approvals. All procurements valued over £5 m must be approved by both the Head of Procurement and the relevant Functional Director. Additionally, the Procurement Strategy for all Material CAPEX Agreements (such as the CAP agreement) valued over £25 m must be approved by SW's Board.

2.11.1.8 Commercial Arrangements

Outline Contractual Arrangements with the CAP

SW has considered those contractual arrangements which are essential to establishing the commercial model for the CAP. These are set out in Section 2.11.1.6 above and are summarised in **Error! Reference source not found.**. As the project develops, a broader range of contractual arrangements will be considered at a greater level of depth in preparation for the procurement process.

Key Activities to Develop Commercial Arrangements with the CAP

The commercial terms outlined in this document are at the principal level and SW will further document, test and validate the suggested delivery route as part of the Gate 3 submission and Control Point C. This will include:

- **Conducting further market engagement** - including but not limited to the issuance of non-call for competition notice release requesting suppliers (including contractors and finance providers) to express interest in pre-market engagement. SW will clarify objectives to potential bidders and describe the anticipated procurement process and contract structure to receive feedback. SW will use the market engagement to inform bidders about the regulatory framework underpinning the delivery of the solution and give them confidence in the process through the representation of RAPID at the market engagement.
- **Developing the detail of the commercial DPC arrangements** - including, but not limited to:
  - **Payment mechanism terms** – Calibration of the operational incentives / penalties, review of the proposed financial gain share mechanism, establishing the approach to indexation and considering potential pass-through items
  - **Approach to commissioning** – Considering the benefits of a possible staged approach and potential revenue payment to CAP during the commissioning period
  - **Bid cost reimbursement** – Focusing on the optimal level of bid cost reimbursement that would drive competition in the bidding process while minimising costs to customers
  - **Collaboration** – Looking at how ongoing improvement and efficiency can be achieved through the DPC model

  - **Termination and termination payments** – Exploring monitoring requirements, minimum performance targets and required step-in rights, as well as the associated termination payments in various termination scenarios
  - **Acceptance and late service commencement** – Assessing the right level of liquidated damages; considering the role of the Independent Technical Advisor (ITA) and an independent certifier / verifier facilitating acceptance, commissioning, maintenance, solution handover and evaluating the efficacy of a bonus payment to facilitate/incentivise timely delivery
- **Refining the risk allocation** - Refining risk allocation to reflect the details of the commercial model focusing on the risks that will be shared between the CAP and SW, such as planning risk, ground conditions, sea and marine works, land access rights and ownership, interoperability, water quality risk, 3rd party providers, regulatory risk and change in law and force majeure events. Each of these risks will be assessed individually along with potential mitigants. Sharing arrangements will be calibrated based on a tailored approach to ensure market interest for the tender process and a VfM outcome for customers. SW will explore which change control mechanisms are required for efficient risk sharing arrangements that provide adequate protection against price increases and thus safeguard the value to customers under the DPC model. Risk allocation will be informed by feedback collected from potential bidders as part of the market engagement exercise. As part of the risk allocation SW will consider the regulatory framework to ensure there is no misalignment between the CAP contract and SW's regulatory framework that could put customer value at risk.

Further Activity to Develop the Procurement Strategy

SW will also undertake the following activities to further develop and enhance its procurement strategy:

- **Continuing the VfM analysis -** SW will confirm the solution's suitability for DPC as part of Control Point C by revisiting the VfM analysis based on latest information on solution scope and cost information and considering other factors that may impact the value proposition under a DPC model.
  - SW will revisit Ofwat's standard VfM assumptions and will use the market engagement to set the key inputs in the VfM analysis to ensure the results are reflective of the nature of the solution and a possible future CAP tender outcome to the extent possible
  - SW will develop and use a robust financial model bringing together key aspects of the solution delivery, such as cost profiles, maintenance regime, financings costs, depreciation profile, etc. to capture all key cost factors which may influence VfM under the DPC model. SW will also consider whether the solution is suitable for a DPC model in light of the current timeline. Specifically, SW will assess how the DPC model may impact the overall delivery schedule, SW's ability to meet its obligation under s20 and what mitigation can be considered to address the risk of any delay.
- **Developing the evaluation framework** - Developing a detailed tender design and evaluation framework to be applied to bidders as part of the procurement. The SQ and ITT questions and evaluation guidance will need to be prepared in line with the objectives set for the procurement process as a whole as well as for the individual stages. A financial model will need to be developed capable of comparing the DPC 'Factual' case against the SW-delivered 'Counterfactual' for the purpose of carrying out the VfM assessment. As part of the tender design development key considerations will include the level of technical detail / design expected as part of the bid submission, whether bidders will be required to provide fully committed financing, delivery plan, risk mitigants, etc. SW will also consider how collaboration can be applied throughout the tender process to mitigate procurement risk. As part of this work, SW will prepare a negotiation plan, outlining those commercial terms that are non-negotiable as well as the process for negotiating with bidders (and Ofwat[76]) throughout the tender process.
- **Refining the critical path** - Refining the implementation plan to reflect emerging views on the outline design and DCO processes. This will include key consideration on the critical path under both DPC and non-DPC delivery routes, interdependencies across DCO, outline design, procurement, the

[76] SW notes Ofwat's requirement that it should be notified of changes agreed to during the procurement that materially impact customer charges. The nature of SW's engagement with Ofwat during the procurement process is yet to be determined.

trade-offs between various configurations of the overall process and input / output relationships between activities.

- SW will identify key risks to the delivery timeline and establish possible mitigants to keep solution's schedule in line with SW's legal and regulatory obligations. SW will assess what activities could be brought forward and what ECI work could be delivered before DCO approval to accelerate the overall solution delivery. As part of this SW will investigate the opportunity to decouple specific activities from the scope of the DPC procurement and bring forward activities either through the appointment of an ECI contractor or by reimbursing costs to facilitate the CAP's mobilisation and progress with specific aspects of the design. SW will carefully examine how accelerating certain activities will impact on the CAP's ability to innovate and drive value to customers. The recommended approach will aim to balance the timeline constraints with retaining flexibility in the process for the CAP.
- SW will continue to consider both DPC and in-house procurement Options in the context of the project's critical path. SW will review its programme to determine at which point in time a switch from the DPC model to in-house delivery may delay the overall schedule and may put timely delivery of the solution at risk. Findings from the work on the implementation plan will be considered when establishing the solution's suitability for DPC.

In parallel to the validation of the suggested delivery route, SW's activities to secure key approvals as part of the pre-tender preparation and to prepare for the CAP tender must also continue. These will include, but are not limited to:

- Further development of SW's initial design to a level sufficient for the procurement and DCO processes.
- Procuring support for the DCO consultation and planning processes.
- Obtaining DCO approval to facilitate the CAP's delivery of the solution. The procurement documentation and project agreement will need to reflect any conditions imposed as part of the granted DCO.
- Securing the market of DWI-licenced RO membrane suppliers.
- Securing a discharge licence for the desalination brine by-product from the EA.
- Completing the Control Points (A, B, C, D, E and F) in Ofwat's DPC process.
- Procuring an ITA.

3 Appendix A – Option D.1

Option	Description
Option D.1	A combination of 40 Ml/d Desalinated water to a large coastal industrial facility with existing South West Water (SWW) supply diverted to SW 30 Ml/d In addition, a 40 Ml/d DO recycled water (indirect) sent to EBL and treated at Otterbourne WSW (WRP supplied by Budds Farm WTW);

Option D.1 ranked towards the bottom of the hierarchy at Gate 1, and following further technical investigation after Gate 1, significant risks around the feasibility and deliverability of this Option were identified. As a result, Option D.1 is considered too unreliable for it to be a genuine alternative to the Base Case, particularly in the context of the urgent need to meet the duty to supply through the WfLH Programme.

This decision was taken through the WfLH programme governance and confirmed by the Executive Programme Board, excluding it from the OAP.

Description of Option D.1

- Option D1 was proposed to provide 40 Ml/d desalinated water for dedicated industrial use at an existing large coastal industrial facility
- The existing 30 Ml/d supplied by South West Water (Knapp Mill WTW) to this facility was then intended to be released and redirected to SW at Testwood and re-purposed for drinking water supply
- The existing 10 Ml/d supplied by SW to this facility was then intended to be released and redirected to SW at Testwood and re-purposed for drinking water supply
- The remainder of the supply as part of Option D.1 was to be provided from a new water recycling plant using treated effluent from Budds Farm

Background to decision

Part of this Option relies on an abstraction from a local chalk stream source that already has significant pressures on it, which increases the uncertainty in being able to rely on the 30 Ml/d supply from Knapp Mill during drought conditions, when river levels are lower.

The EA has embarked on a programme to reduce reliance on chalk streams due to environmental matters. The 30 Ml/d Knapp Mill supply that would form part of Option D.1 abstracts from the River Avon, which is a chalk stream similar to the River Test and River Itchen - the rivers that the WfLH Programme is delivering new water resources to protect. As a result, there are significant security of supply risks around the future availability of this source due to the EA's programme to reduce reliance on chalk streams. It is also not prudent for SW to design its SRO so that it relies on abstracting from this type of source if there are alternative Options available.

There are further risks and uncertainties around the commerciality of Option D.1, which identified that the cost of supply for the desalination element of this Option is potentially commercially unviable as it would require a considerable increase in the cost of supplying the Industrial Facility compared to their existing commercial arrangements. This creates a significant risk around the overall commercial viability of Option D1, as SW does not have a commercial mechanism to make the Industrial Facility accept this new supply and rate, meaning SW may be required to supply this water at a significant financial loss.

The existing South West Water supply to the Industrial Facility is covered by a Statutory Instrument (1955: No 930) and under this up to 40 Ml/d is to be provided to the facility, which would be diverted to SW as part of Option D1. SW consider that this Option may require a transfer of obligations from SWW to SW under the Statutory Instrument including the provision of 24/7 supply to industrial users requiring process parameters which SW is not in a position to provide given the WRMP19 supply deficit already identified. The obligation to provide a 24/7 supply to the Industrial Facility also increases the risks around attracting investors and operators for the desalination plant as they are it increases the level of operational risks, and the consequential premium for that risk, that they would be required to take due to the obligation to supply water 24/7 with only one operational shut down in every three year period.

SW also identified further possible contributory risks due to the proximity of the Industrial Facility relating to Control of Major Accident Hazard Regulations 1999 (COMAH), and also the applicability of DPC, which further add to the risks and uncertainties with Option D.1.

Conclusion

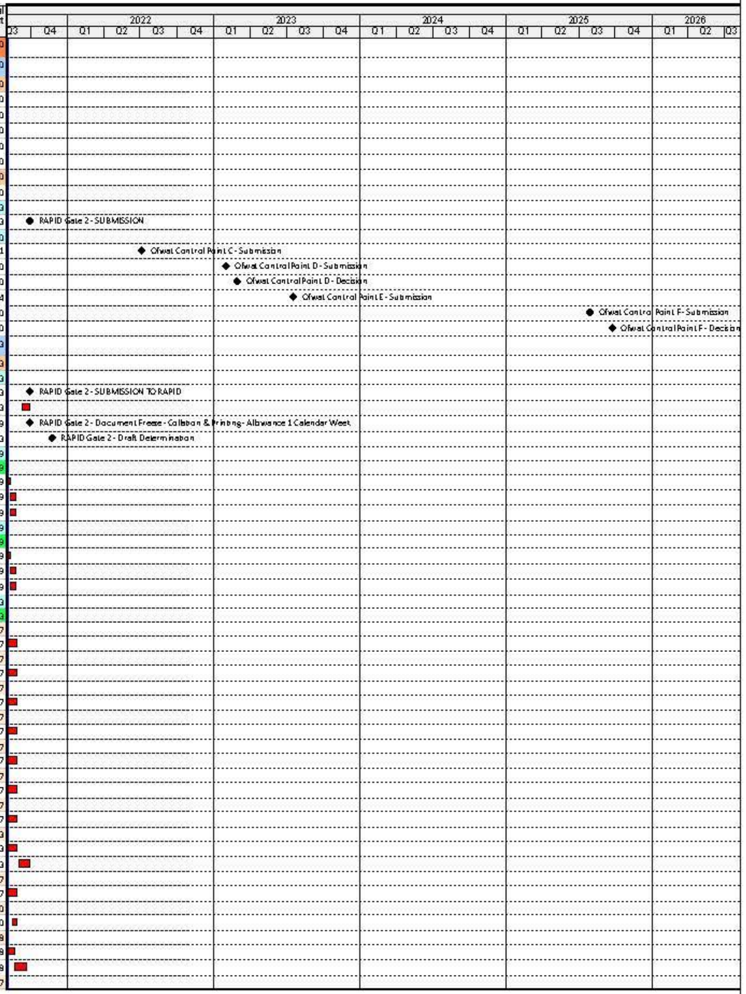
- As detailed above, Option D1 was considered unfeasible and undeliverable and therefore work on this Option ceased in in July 2021 and therefore it has not taken through the full OAP
- Option D1 was considered too unreliable for it to be a genuine alternative to the Base Case. Particularly in the context of the duty to supply through the WfLH programme.

4 Appendix B – Critical Path Schedule

Scenario1: DESALINATION PLANT at FAWLEY (ABE STAGE 2 - FURTHER REDUCTION OF DURATION)
Progressed to 06-Aug-21

Print: 25-Aug-21

Activity ID	Activity Name	Remaining Duration	Activity % Complete	Start	Finish	Total Float
Scenario1: DESALINATION PLANT at FAWLEY (ABE STAGE 2 - FURTHER REDUCTIOI		2558		06-May-21 A	27-Oct-31	0
KEY MILESTONES		2522		27-Sep-21	27-Oct-31	0
LEVEL 1 PROJECT MILESTONES		260		29-Oct-30	27-Oct-31	0
DSLN.KEY.00100	ID4 Approved	0	0%		29-Oct-30	0
DSLN.KEY.00090	DESALINATION PLANT BENEFICIAL USE	0	0%		29-Oct-30	0
DSLN.KEY.00110	Complete One Year of Benefits Realisation	0	0%		27-Oct-31	0
DSLN.KEY.00120	ID5 Approved	0	0%		27-Oct-31	0
DSLN.KEY.00130	PROJECT COMPLETION	0	0%		27-Oct-31	0
LEVEL 2 PROJECT MILESTONES		2267		27-Sep-21	29-Oct-30	0
DSLN.KEY.00580	INTRODUCE WATER INTO SUPPLY (PLANT OPERATIONAL)	0	0%		29-Oct-30	0
RAPID GATEWAYS		0		27-Sep-21	27-Sep-21	-13
DSLN.KEY.00740	RAPID Gate 2 - SUBMISSION	0	0%		27-Sep-21	-13
OFWAT CONTROL POINTS		805		04-Jul-22	23-Sep-25	0
DSLN.KEY.00890	Ofwat Control Point C - Submission	0	0%		04-Jul-22	-1
DSLN.KEY.00910	Ofwat Control Point D - Submission	0	0%		30-Jan-23	0
DSLN.KEY.00920	Ofwat Control Point D - Decision	0	0%		27-Feb-23	0
DSLN.KEY.00930	Ofwat Control Point E - Submission	0	0%		18-Jul-23	-4
DSLN.KEY.00950	Ofwat Control Point F - Submission	0	0%		29-Jul-25	0
DSLN.KEY.00960	Ofwat Control Point F - Decision	0	0%		23-Sep-25	0
GATEWAYS (RAPID)		217		06-May-21 A	22-Jun-22	-13
GATEWAY 2		76		06-May-21 A	22-Nov-21	-13
MANAGEMENT		54		08-Sep-21	22-Nov-21	-13
NWSR.GWY.00040	RAPID Gate 2 - SUBMISSION TO RAPID	0	0%		27-Sep-21	-13
NWSR.GWY.00030	RAPID Gate 2 - SW Governance Approvals	14	0%	08-Sep-21	27-Sep-21	-13
NWSR.GWY.00020	RAPID Gate 2 - Document Freeze - Collation & Printing - Allowance 1 Calendar Week	0	0%		27-Sep-21	-19
NWSR.GWY.00055	RAPID Gate 2 - Draft Determination	0	0%		22-Nov-21	-13
SUBMISSION SUMMARY		14		03-Aug-21 A	25-Aug-21	9
SUMMARY		14		03-Aug-21 A	25-Aug-21	9
NWSR.GWY.00080	Summary Doc - 2nd Line of Assurance (Internal)	4	0%	03-Aug-21 A	11-Aug-21	9
NWSR.GWY.00100	Summary Doc - 4th Line of Assurance (External)	10	0%	12-Aug-21	25-Aug-21	9
NWSR.GWY.00090	Summary Doc - 3rd Line of Assurance (External)	10	0%	12-Aug-21	25-Aug-21	9
CONCEPTUAL DESIGN REPORTS		14		03-Aug-21 A	25-Aug-21	9
DOCUMENTATION I/II/III - DESAL/RECYCLE/HVT		14		03-Aug-21 A	25-Aug-21	9
NWSR.GWY.00130	CDR i/ii/iii - 2nd Line of Assurance (Internal)	4	0%	03-Aug-21 A	11-Aug-21	9
NWSR.GWY.00150	CDR i/ii/iii - 4th Line of Assurance (External)	10	0%	12-Aug-21	25-Aug-21	9
NWSR.GWY.00140	CDR i/ii/iii - 3rd Line of Assurance (External)	10	0%	12-Aug-21	25-Aug-21	9
LEVEL 3A		36		06-Jul-21 A	27-Sep-21	-13
ANNEX 1/2/3 - DESAL/RECYCLE/HVT		36		06-Jul-21 A	27-Sep-21	-13
BACKGROUND AND OBJECTIVES		16		02-Aug-21 A	27-Aug-21	7
NWSR.GWY00220	4th Line of Assurance (External) - Bkgrd & Objectives	16	0%	02-Aug-21 A	27-Aug-21	7
OVERVIEW OF SOLUTION		16		02-Aug-21 A	27-Aug-21	7
NWSR.GWY00290	4th Line of Assurance (External) - Overview Soln	16	0%	02-Aug-21 A	27-Aug-21	7
ENGINEERING DESIGN		16		02-Aug-21 A	27-Aug-21	7
NWSR.GWY00370	4th Line of Assurance (External) - Engineering Dsgn	16	0%	02-Aug-21 A	27-Aug-21	7
NETWORK INFRASTRUCTURE		16		02-Aug-21 A	27-Aug-21	7
NWSR.GWY00440	4th Line of Assurance (External) - Newtwork Infra	16	0%	02-Aug-21 A	27-Aug-21	7
SITE SELECTION		16		06-Aug-21	27-Aug-21	7
NWSR.GWY00520	4th Line of Assurance (External) - Site Select	16	0%	06-Aug-21	27-Aug-21	7
ENVIRONMENTAL		16		06-Aug-21	27-Aug-21	7
NWSR.GWY00600	4th Line of Assurance (External) - Environmental	16	0%	06-Aug-21	27-Aug-21	7
PLANNING AND CONSENTING		16		02-Aug-21 A	27-Aug-21	7
NWSR.GWY00670	4th Line of Assurance (External) - Planning & Consent	16	0%	02-Aug-21 A	27-Aug-21	7
RISK MANAGEMENT		36		06-Jul-21 A	27-Sep-21	-13
NWSR.GWY00730	3rd Line of Assurance (External) - Risk Mgmt	16	0%	06-Jul-21 A	27-Aug-21	-13
NWSR.GWY00740	4th Line of Assurance (External) - Risk Mgmt	20	0%	31-Aug-21	27-Sep-21	-13
STAKEHOLDER AND CUSTOMER		16		02-Aug-21 A	27-Aug-21	7
NWSR.GWY00810	4th Line of Assurance (External) - Stakeholder & Customer	16	0%	02-Aug-21 A	27-Aug-21	7
SCHEDULE		10		16-Aug-21	27-Aug-21	0
NWSR.GWY00880	4th Line of Assurance (External) - Schedule	10	0%	16-Aug-21*	27-Aug-21	0
COST MODELLING		31		14-Jul-21 A	20-Sep-21	-8
NWSR.GWY00950	3rd Line of Assurance (External) - Cost Model	11	0%	14-Jul-21 A	20-Aug-21	-8
NWSR.GWY00960	4th Line of Assurance (External) - Cost Model	20	0%	23-Aug-21	20-Sep-21	-8
PROCUREMENT OWNERSHIP AND OPERATION		16		02-Aug-21 A	27-Aug-21	7



Remaining Work
Critical Remaining Work
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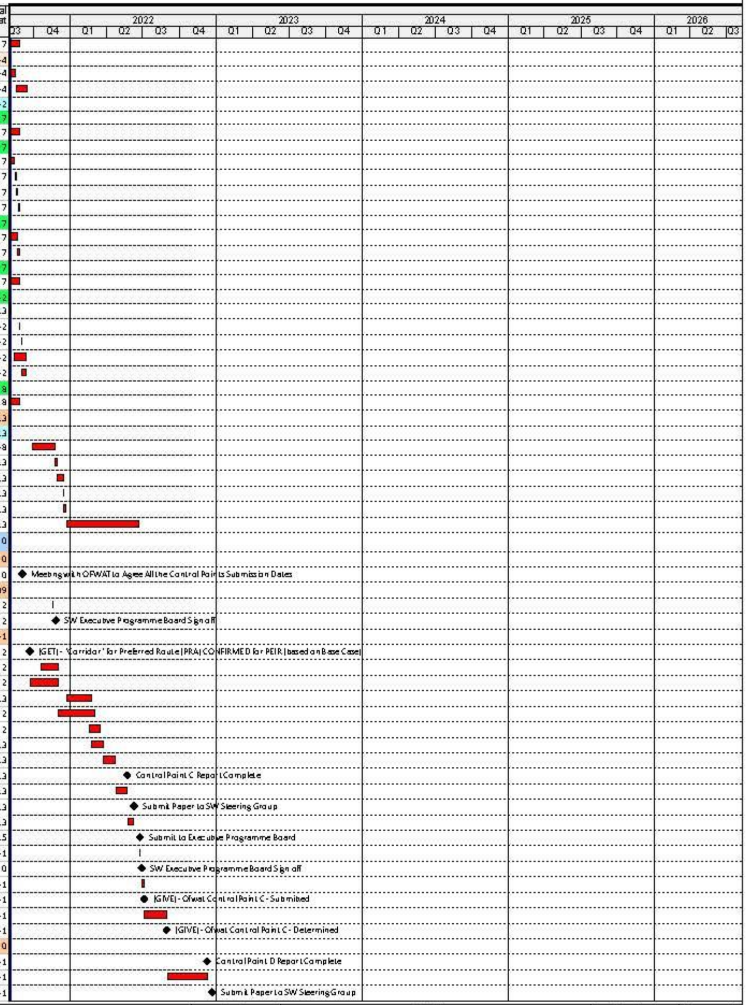
Project ID: 710059-2-4 CURR Standard Layout for Distribution

Date	Revision	Checked	Approved
25-Aug-21	Desalination Schedule for G1.5 Submission	DC	JK

Print: 25-Aug-21

Scenario1: DESALINATION PLANT at FAWLEY (ABE STAGE 2 - FURTHER REDUCTION OF DURATION)
Progressed to 06-Aug-21

Activity ID	Activity Name	Remaining Duration	Activity % Complete	Start	Finish	Total Float
NWSR.GWY01030	4th Line of Assurance (External) - Owner Operation	16	0%	02-Aug-21 A	27-Aug-21	7
GATE 3 ACTIVITY PLAN		27		26-Jul-21 A	14-Sep-21	-4
NWSR.GWY01090	3rd Line of Assurance (External) - G3 Activity Plan	7	0%	26-Jul-21 A	16-Aug-21	-4
NWSR.GWY01100	4th Line of Assurance (External) - G3 Activity Plan	20	0%	17-Aug-21	14-Sep-21	-4
LEVEL 3B		25		06-May-21 A	10-Sep-21	-2
ANNEX 4 - WATER RESOURCE MODELLING		16		02-Aug-21 A	27-Aug-21	7
NWSR.GWY.01170	4th Line of Assurance (External) - Annex 4	16	0%	02-Aug-21 A	27-Aug-21	7
ANNEX 5 - OPTION APPRAISAL		16		09-Jul-21 A	27-Aug-21	7
NWSR.GWY.01190	Legal Team Review Draft Document - Annex 5	6	0%	09-Jul-21 A	13-Aug-21	7
NWSR.GWY.01200	2nd Line of Assurance (Internal) - Annex 5	2	0%	16-Aug-21	17-Aug-21	7
NWSR.GWY.01210	3rd Line of Assurance (External) - Annex 5	4	0%	18-Aug-21	23-Aug-21	7
NWSR.GWY.01220	4th Line of Assurance (External) - Annex 5	4	0%	24-Aug-21	27-Aug-21	7
ANNEX 6 - EFFICIENCY OF EXPENDITURE		16		06-Aug-21	27-Aug-21	7
NWSR.GWY.01290	3rd Line of Assurance (External) - Annex 6	10	0%	06-Aug-21	19-Aug-21	7
NWSR.GWY.01300	4th Line of Assurance (External) - Annex 6	6	0%	20-Aug-21	27-Aug-21	7
ANNEX 7 - EXTERNAL ASSURANCE		16		02-Aug-21 A	27-Aug-21	7
NWSR.GWY.01360	4th Line of Assurance (External) - Annex 7	16	0%	02-Aug-21 A	27-Aug-21	7
ANNEX 8 - LEGAL AND REGULATORY MANAGEMENT		25		06-May-21 A	10-Sep-21	-2
NWSR.GWY.01370	Draft & Further Development of Document - Annex 8	0	100%	06-May-21 A	06-Aug-21	13
NWSR.GWY.01390	1st Line of Assurance (Internal) - Annex 8	1	0%	27-Aug-21*	27-Aug-21	-2
NWSR.GWY.01400	2nd Line of Assurance (Internal) - Annex 8	1	0%	31-Aug-21	31-Aug-21	-2
NWSR.GWY.01420	4th Line of Assurance (External) - Annex 8	20	0%	13-Aug-21	10-Sep-21	-2
NWSR.GWY.01410	3rd Line of Assurance (External) - Annex 8	8	0%	01-Sep-21	10-Sep-21	-2
ANNEX 9 - STAKEHOLDER AND CUSTOMER ENGAGEMENT METHODOLOGY		15		30-Jul-21 A	26-Aug-21	8
NWSR.GWY.01490	4th Line of Assurance (External) - Annex 9	15	0%	30-Jul-21 A	26-Aug-21	8
GATEWAY 3		181		29-Sep-21	22-Jun-22	-13
DELIVERABLES		181		29-Sep-21	22-Jun-22	-13
NWSR.GWY.03010	RAPID Gate 3 - Create Submission Structure	40	0%	29-Sep-21	22-Nov-21	-8
NWSR.GWY.03020	RAPID Gate 3 - Review & Incorporate Feedback from RAPID Gate 2 Draft Determination	5	0%	23-Nov-21	29-Nov-21	-13
NWSR.GWY.03030	RAPID Gate 3 - Sign Off by Director, Legal	10	0%	30-Nov-21	13-Dec-21	-13
NWSR.GWY.03040	RAPID Gate 3 - Confirm by RAPID	1	0%	14-Dec-21	14-Dec-21	-13
NWSR.GWY.03080	RAPID Gate 3 - Brief Authors	5	0%	15-Dec-21	21-Dec-21	-13
NWSR.GWY.03090	RAPID Gate 3 - Create Gateway Deliverables	120	0%	22-Dec-21	22-Jun-22	-13
OFWAT		1012		01-Sep-21	23-Sep-25	0
CONTROL POINT A (TO COMBINE WITH CONTROL POINT B)		0		01-Sep-21	01-Sep-21	0
NWSR.GWY.10000	Meeting with OFWAT to Agree All the Control Points Submission Dates	0	0%		01-Sep-21*	0
CONTROL POINT B (COMBINE WITH CONTROL POINT A)		4		18-Nov-21	24-Nov-21	39
NWSR.GWY.12270	SW Steering Group Review & Sign Off	0	0%	18-Nov-21	18-Nov-21	2
NWSR.GWY.12290	SW Executive Programme Board Sign off	0	0%		24-Nov-21	2
CONTROL POINT C		233		21-Sep-21	30-Aug-22	-1
NWSR.GWY.13110	(GET) - 'Corridor' for Preferred Route (PRA) CONFIRMED for PEIR (based on Base Case)	0	0%		21-Sep-21	2
NWSR.GWY.13160	Market Engagement Material Sign off	30	0%	20-Oct-21	30-Nov-21	2
NWSR.GWY.13140	Prepare for Market Engagement (Attendees, Invites, Objectives)	50	0%	22-Sep-21	30-Nov-21	2
NWSR.GWY.13250	Received Cost Intelligence Data (drive from G3 Deliverable)	40	0%	22-Dec-21	23-Feb-22	-13
NWSR.GWY.13170	Market Engagement Activities (Based on RAPID G2 Draft Determination)	60	0%	01-Dec-21	02-Mar-22	2
NWSR.GWY.13180	Gather Market Engagement Feedback	20	0%	17-Feb-22	16-Mar-22	2
NWSR.GWY.13270	Produce Control Point C Report (30% Complete) (Inc Eligibility Assessment)	20	0%	24-Feb-22	23-Mar-22	-13
NWSR.GWY.13280	Produce Control Point C Report (70% Complete)	20	0%	24-Mar-22	22-Apr-22	-13
NWSR.GWY.13310	Control Point C Report Complete	0	0%		23-May-22	-13
NWSR.GWY.13290	Produce Control Point C Report (100% Complete) Incorporate OFWAT Comment from Control Point B	20	0%	25-Apr-22	23-May-22	-13
NWSR.GWY.13350	Submit Paper to SW Steering Group	0	0%		08-Jun-22	-13
NWSR.GWY.13340	Procurement Team to Submit Report for Internal Assurance	10	0%	24-May-22	08-Jun-22	-13
NWSR.GWY.13370	Submit to Executive Programme Board	0	0%		23-Jun-22	-15
NWSR.GWY.13360	SW Steering Group Review & Sign Off	1	0%	23-Jun-22	23-Jun-22	-1
NWSR.GWY.13380	SW Executive Programme Board Sign off	0	0%		28-Jun-22	0
NWSR.GWY.13390	Amend Paper Incorporating Comments from Programme Board	5	0%	28-Jun-22	04-Jul-22	-1
NWSR.GWY.13450	(GIVE) - Ofwat Control Point C - Submitted	0	0%		04-Jul-22	-1
NWSR.GWY.13460	Ofwat Control Point C - Review Period	40	0%	05-Jul-22	30-Aug-22	-1
NWSR.GWY.13470	(GIVE) - Ofwat Control Point C - Determined	0	0%		30-Aug-22	-1
CONTROL POINT D		123		31-Aug-22	27-Feb-23	0
NWSR.GWY.14260	Control Point D Report Complete	0	0%		08-Dec-22	-1
NWSR.GWY.14250	Produce Control Point D Report (100% Complete) Incorporate OFWAT Comment from Control Point C	72	0%	31-Aug-22	08-Dec-22	-1
NWSR.GWY.14280	Submit Paper to SW Steering Group	0	0%		22-Dec-22	-1



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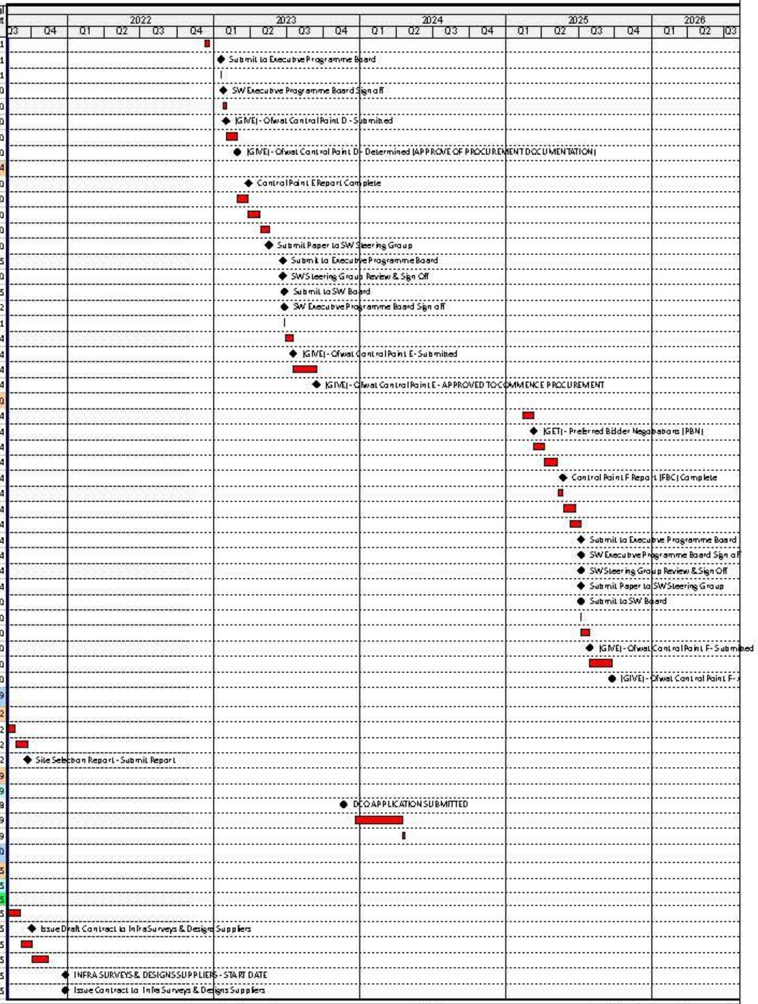
Scenario1: DESALINATION PLANT at FAWLEY (ABE STAGE 2 - FURTHER REDUCTION OF DURATION)
Progressed to 06-Aug-21

Print: 25-Aug-21

Activity ID	Activity Name	Remaining Duration	Activity % Complete	Start	Finish	Total Float
NWSR.GWY 14270	Procurement Team to Submit Report for Internal Assurance	10	0%	09-Dec-22	22-Dec-22	-1
NWSR.GWY 14310	Submit to Executive Programme Board	0	0%		19-Jan-23	-1
NWSR.GWY 14290	SW Steering Group Review & Sign Off	1	0%	19-Jan-23	19-Jan-23	-1
NWSR.GWY 14330	SW Executive Programme Board Sign off	0	0%		24-Jan-23	0
NWSR.GWY 14340	Amend Paper Incorporating Comments from Programme Board	5	0%	24-Jan-23	30-Jan-23	0
NWSR.GWY 14350	(GIVE) - Ofwat Control Point D - Submitted	0	0%		30-Jan-23	0
NWSR.GWY 14360	Ofwat Control Point D - Review Period	20	0%	31-Jan-23	27-Feb-23	0
NWSR.GWY 14370	(GIVE) - Ofwat Control Point D - Determined (APPROVE OF PROCUREMENT DOCUMENTATION)	0	0%		27-Feb-23	0
CONTROL POINT E		137		28-Feb-23	13-Sep-23	-4
NWSR.GWY 15230	Control Point E Report Complete	0	0%		27-Mar-23	0
NWSR.GWY 15220	Produce Control Point E Report (100% complete) Incorporate OFWAT Comment from Control Point D	20	0%	28-Feb-23	27-Mar-23	0
NWSR.GWY 15240	Procurement Team to Submit Report for Internal Assurance	20	0%	28-Mar-23	26-Apr-23	0
NWSR.GWY 15250	External Assurance Period	15	0%	27-Apr-23	18-May-23	0
NWSR.GWY 15260	Submit Paper to SW Steering Group	0	0%		18-May-23	0
NWSR.GWY 15280	Submit to Executive Programme Board	0	0%		22-Jun-23	-5
NWSR.GWY 15270	SW Steering Group Review & Sign Off	0	0%		22-Jun-23	0
NWSR.GWY 15300	Submit to SW Board	0	0%		27-Jun-23	-5
NWSR.GWY 15290	SW Executive Programme Board Sign off	0	0%		27-Jun-23	-2
NWSR.GWY 15310	SW Board Sign off	1	0%	27-Jun-23	27-Jun-23	-1
NWSR.GWY 15320	Amend Paper Incorporating Comments from SW Board	15	0%	28-Jun-23	18-Jul-23	-4
NWSR.GWY 15330	(GIVE) - Ofwat Control Point E - Submitted	0	0%		18-Jul-23	-4
NWSR.GWY 15340	Ofwat Control Point E - Review Period	40	0%	19-Jul-23	13-Sep-23	-4
NWSR.GWY 15350	(GIVE) - Ofwat Control Point E - APPROVED TO COMMENCE PROCUREMENT	0	0%		13-Sep-23	-4
CONTROL POINT F		155		12-Feb-25	23-Sep-25	0
NWSR.GWY 16100	Received Cost Intelligence data	20	0%	12-Feb-25	11-Mar-25	-4
NWSR.GWY 16090	(GET) - Preferred Bidder Negotiations (PBN)	0	0%		11-Mar-25	-4
NWSR.GWY 16110	Produce Control Point F Report (FBC) (30% complete) (Inc Eligibility Assessment)	20	0%	12-Mar-25	08-Apr-25	-4
NWSR.GWY 16120	Produce Control Point F Report (FBC) (70% complete)	20	0%	09-Apr-25	09-May-25	-4
NWSR.GWY 16140	Control Point F Report (FBC) Complete	0	0%		23-May-25	-4
NWSR.GWY 16130	Produce Control Point F Report (FBC) (100% complete)	10	0%	12-May-25	23-May-25	-4
NWSR.GWY 16180	Procurement Team to Submit Report for Internal assurance	20	0%	27-May-25	23-Jun-25	-4
NWSR.GWY 16190	External Assurance Period	20	0%	10-Jun-25	07-Jul-25	-4
NWSR.GWY 16250	Submit to Executive Programme Board	0	0%		07-Jul-25	-4
NWSR.GWY 16260	SW Executive Programme Board Sign off	0	0%		07-Jul-25	-4
NWSR.GWY 16240	SW Steering Group Review & Sign Off	0	0%		07-Jul-25	-4
NWSR.GWY 16230	Submit Paper to SW Steering Group	0	0%		07-Jul-25	-4
NWSR.GWY 16270	Submit to SW Board	0	0%		08-Jul-25	0
NWSR.GWY 16280	SW Board Sign off	1	0%	08-Jul-25	08-Jul-25	0
NWSR.GWY 16300	Amend Paper incorporating comments from Programme Board	15	0%	09-Jul-25	29-Jul-25	0
NWSR.GWY 16320	(GIVE) - Ofwat Control Point F - Submitted	0	0%		29-Jul-25	0
NWSR.GWY 16330	Ofwat Control Point F - Review Period	39	0%	30-Jul-25	23-Sep-25	0
NWSR.GWY 16360	(GIVE) - Ofwat Control Point F - APPROVED TO CAP AGREEMENT	0	0%		23-Sep-25	0
CONSENT & PERMIT & LICENCING		675		12-Jul-21 A	22-Apr-24	19
SITE SELECTION		32		12-Jul-21 A	21-Sep-21	2
DSLN.CON.02610	Site Selection Report - Technical Review & Assurance	12	0%	12-Jul-21 A	23-Aug-21	2
DSLN.CON.02620	Site Selection Report - Legal Review & Update	20	0%	24-Aug-21	21-Sep-21	2
DSLN.CON.02630	Site Selection Report - Submit Report	0	0%		21-Sep-21	2
DCO CONSENT PROCESS		101		21-Nov-23	22-Apr-24	19
Submission & Determination		101		21-Nov-23	22-Apr-24	19
DSLN.CON.00070	DCO APPLICATION SUBMITTED	0	0%		21-Nov-23	18
DSLN.CON.02130	PRE-EXAMINATION PERIOD (Assumed to be no more than 80 working days)	80	0%	19-Dec-23	19-Apr-24	19
DSLN.CON.02250	PRELIMINARY 1 DAY MTG	1	0%	19-Apr-24	22-Apr-24	19
PROCUREMENT & COMMERCIAL		1058		20-Jul-21 A	31-Oct-25	0
SURVEYS		150		20-Jul-21 A	14-Mar-22	15
ENGINEERING-RELATED SURVEYS		150		20-Jul-21 A	14-Mar-22	15
Infrastructure		150		20-Jul-21 A	14-Mar-22	15
DSLN.PRO.01820	Works Information Available for InfraSurveys & Designs	20	0%	20-Jul-21 A	03-Sep-21	15
DSLN.PRO.01840	Issue Draft Contract to InfraSurveys & Designs Suppliers	0	0%		01-Oct-21	15
DSLN.PRO.01830	Procurement to Produce Contract Documentation for InfraSurveys & Designs	20	0%	06-Sep-21	01-Oct-21	15
DSLN.PRO.01850	Supplier Submit Cost & Schedule for InfraSurveys & Designs	30	0%	04-Oct-21	12-Nov-21	15
DSLN.PRO.01875	INFRA SURVEYS & DESIGNS SUPPLIERS - START DATE	0	0%		24-Dec-21	15
DSLN.PRO.01870	Issue Contract to InfraSurveys & Designs Suppliers	0	0%		24-Dec-21	15



Remaining Work
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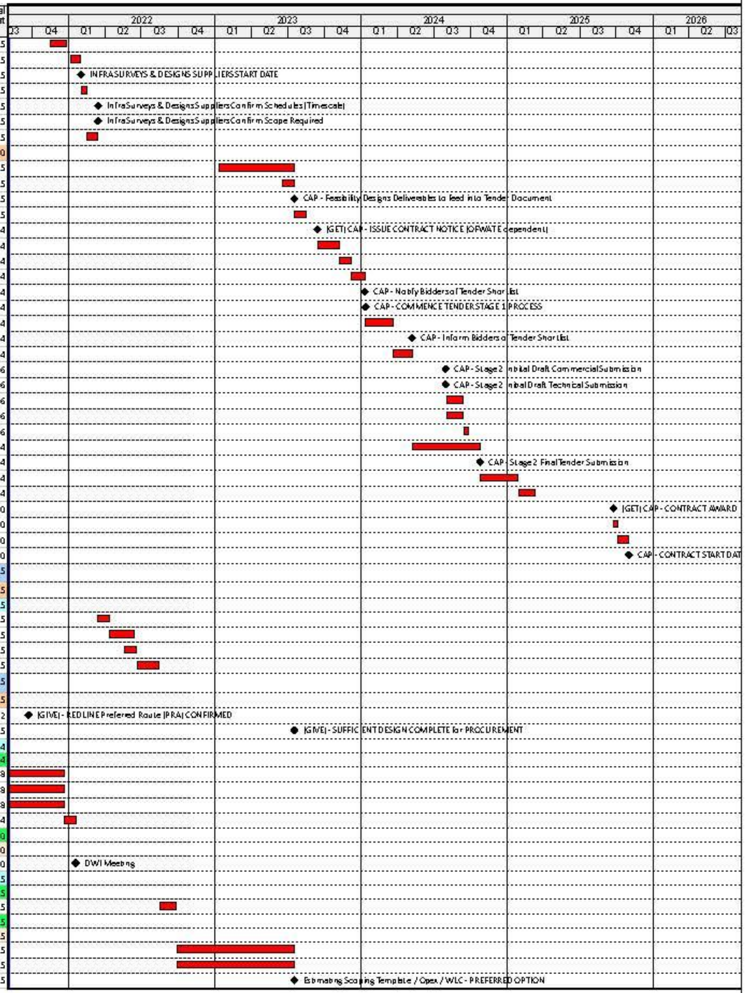
Date	Revision	Checked	Approved
25-Aug-21	Desalination Schedule for G1.5 Submission	DC	JK

Annex 1 Desalination

Scenario1: DESALINATION PLANT at FAWLEY (ABE STAGE 2 - FURTHER REDUCTION OF DURATION)
Progressed to 06-Aug-21

Print: 25-Aug-21

Activity ID	Activity Name	Remaining Duration	Activity % Complete	Start	Finish	Total Float
DSLN.PRO.01860	Contract & Cost & Schedule Negotiation with Infra Surveys & Designs Suppliers	30	0%	15-Nov-21	24-Dec-21	15
DSLN.PRO.01880	Infra Surveys & Designs Supplier Step Down Contracts to Sub-Contractors	20	0%	04-Jan-22	31-Jan-22	15
DSLN.PRO.01890	INFRA SURVEYS & DESIGNS SUPPLIERS START DATE	0	0%		31-Jan-22	15
DSLN.PRO.01900	Infra Surveys & Designs Supplier Mobilisation	10	0%	01-Feb-22	14-Feb-22	15
DSLN.PRO.02920	Infra Surveys & Designs Suppliers Confirm Schedules (Timescale)	0	0%		14-Mar-22	15
DSLN.PRO.02910	Infra Surveys & Designs Suppliers Confirm Scope Required	0	0%		14-Mar-22	15
DSLN.PRO.02900	Workshops with Infra Surveys & Designs Suppliers	20	0%	15-Feb-22	14-Mar-22	15
COMPETITIVELY APPOINTED PROVIDER (CAP)		702		13-Jan-23	31-Oct-25	0
DSLN.PRO.03020	CAP - Refine Tender Documentation	129	0%	13-Jan-23	18-Jul-23	15
DSLN.PRO.03030	CAP - Procurement Assurance & Governance	22	0%	19-Jun-23	18-Jul-23	15
DSLN.PRO.03010	CAP - Feasibility Designs Deliverables to feed into Tender Document	0	0%		18-Jul-23	15
DSLN.PRO.03040	CAP - Procurement Assurance & Governance (Ready for Issue Contract Notice)	22	0%	19-Jul-23	17-Aug-23	15
DSLN.PRO.03050	(GET) CAP - ISSUE CONTRACT NOTICE (OFWAT E dependent)	0	0%		13-Sep-23	-4
DSLN.PRO.03060	CAP - Pre-Qualification Questionnaire (PQQ) Response Period	40	0%	14-Sep-23	08-Nov-23	-4
DSLN.PRO.03061	CAP - PQQ Evaluation Period	20	0%	09-Nov-23	06-Dec-23	-4
DSLN.PRO.03062	CAP - Assurance and Governance	20	0%	07-Dec-23	11-Jan-24	-4
DSLN.PRO.03063	CAP - Notify Bidders of Tender Shortlist	0	0%		11-Jan-24	-4
DSLN.PRO.03070	CAP - COMMENCE TENDER STAGE 1 PROCESS	0	0%	12-Jan-24		-4
DSLN.PRO.03080	CAP - Stage 1 Tender Period	50	0%	12-Jan-24	21-Mar-24	-4
DSLN.PRO.03090	CAP - Inform Bidders of Tender Shortlist	0	0%		07-May-24	-4
DSLN.PRO.03092	CAP - Stage 1 Assessment and Governance	30	0%	22-Mar-24	07-May-24	-4
DSLN.PRO.03101	CAP - Stage 2 Initial Draft Commercial Submission	0	0%		31-Jul-24	16
DSLN.PRO.03102	CAP - Stage 2 Initial Draft Technical Submission	0	0%		31-Jul-24	16
DSLN.PRO.03104	CAP - Stage 2 2nd Draft Commercial Submission	30	0%	01-Aug-24	12-Sep-24	16
DSLN.PRO.03105	CAP - Stage 2 2nd Draft Technical Submission	30	0%	01-Aug-24	12-Sep-24	16
DSLN.PRO.03106	CAP - Stage 2 2nd Draft Review, feedback and Dialogue	10	0%	13-Sep-24	26-Sep-24	16
DSLN.PRO.03100	CAP - Stage 2 Tender Period	120	0%	08-May-24	24-Oct-24	-4
DSLN.PRO.03107	CAP - Stage 2 Final Tender Submission	0	0%		24-Oct-24	-4
DSLN.PRO.03108	CAP - Stage 2 Tender Assessment	60	0%	25-Oct-24	28-Jan-25	-4
DSLN.PRO.03110	(GIVE) CAP - Preferred Bidder Negotiation	30	0%	29-Jan-25	11-Mar-25	-4
DSLN.PRO.03140	(GET) CAP - CONTRACT AWARD	0	0%		23-Sep-25	0
DSLN.PRO.03150	CAP - Standstill Period	10	0%	24-Sep-25	03-Oct-25	0
DSLN.PRO.03160	CAP - Execute Contract	20	0%	03-Oct-25	31-Oct-25	0
DSLN.PRO.03170	CAP - CONTRACT START DATE	0	0%		31-Oct-25	0
SURVEYS		105		15-Mar-22	15-Aug-22	15
ENGINEERING SURVEYS FOR FEASIBILITY DESIGNS		105		15-Mar-22	15-Aug-22	15
Geotechnical		105		15-Mar-22	15-Aug-22	15
DSLN.SVY.310	Geotechnical and Geoenvironmental Desk Study	20	0%	15-Mar-22	11-Apr-22	15
DSLN.SVY.330	Geotechnical and Geoenvironmental Desk Study Report	40	0%	12-Apr-22	13-Jun-22	15
DSLN.SVY.360	Geotechnical Site Investigation Spec	20	0%	20-May-22	20-Jun-22	15
DSLN.SVY.370	Geotechnical Site Investigation (LAND REF SCHEDULE / NOTICE REQUIRED)	40	0%	21-Jun-22	15-Aug-22	15
DESIGN		485		14-Jun-21 A	18-Jul-23	15
FEASIBILITY DESIGN		485		14-Jun-21 A	18-Jul-23	15
PRA REDLINE	(GIVE) - REDLINE Preferred Route (PRA) CONFIRMED	0	0%		21-Sep-21	2
DSLN.DGN.00100	(GIVE) - SUFFICIENT DESIGN COMPLETE for PROCUREMENT	0	0%		18-Jul-23	15
Desalination Plant		110		14-Jun-21 A	18-Jan-22	14
PROJECT DESIGN LEAD		110		14-Jun-21 A	17-Jan-22	14
DSLN.DGN.00310	Risk Reduction Assessments	96	0%	14-Jun-21 A	20-Dec-21	8
DSLN.DGN.00300	SEMD Initial Engagement	96	0%	14-Jun-21 A	20-Dec-21	8
DSLN.DGN.00290	Design Decision Log	96	0%	14-Jun-21 A	20-Dec-21	8
DSLN.DGN.00320	Design Estimate (SW)	20	0%	21-Dec-21	17-Jan-22	14
PROCESS		0		18-Jan-22	18-Jan-22	0
WQ Risk Identification Workshop		0		18-Jan-22	18-Jan-22	0
DSLN.DGN.01150	DWI Meeting	0	0%		18-Jan-22*	0
Pipeline Route		230		16-Aug-22	18-Jul-23	15
Civils Designs		30		16-Aug-22	27-Sep-22	15
DSLN..DGN.01540	Preliminary Pipe Routing 3D Model	30	0%	16-Aug-22	27-Sep-22	15
Other Deliverables		200		28-Sep-22	18-Jul-23	15
Pre-Construction		200		28-Sep-22	18-Jul-23	15
infra.DGN.0490	Design Drawings to support the Planning DCO Process	200	0%	28-Sep-22	18-Jul-23	15
infra.DGN.0480	3D Model Layouts	200	0%	28-Sep-22	18-Jul-23	15
infra.DGN.0280	Estimating Scoping Template /Opex /WLC - PREFERRED OPTION	0	0%		18-Jul-23	15



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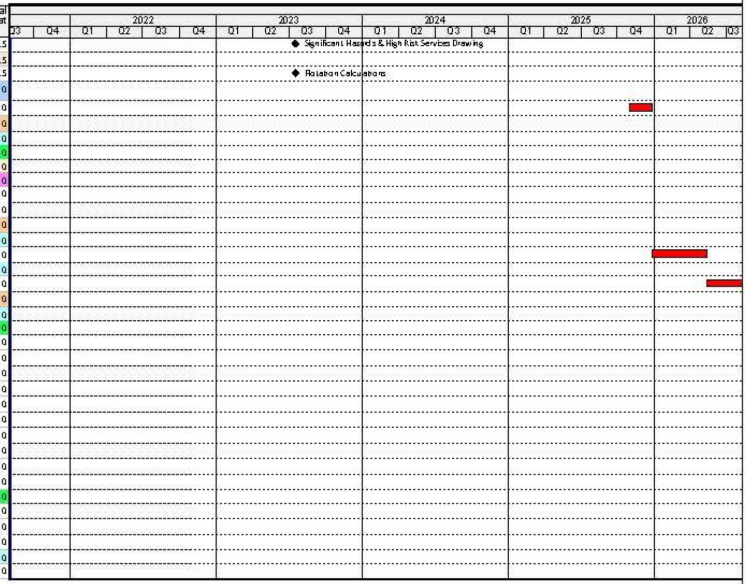
Scenario1: DESALINATION PLANT at FAWLEY (ABE STAGE 2 - FURTHER REDUCTION OF DURATION)
Progressed to 06-Aug-21

Activity ID	Activity Name	Remaining Duration	Activity % Complete	Start	Finish	Total Float
infra.DGN.0220	Significant Hazards & High Risk Services Drawing	0	0%		18-Jul-23	15
Outline Operational Strategy		0		18-Jul-23	18-Jul-23	15
infra.DGN.0350	Flotation Calculations	0	0%		18-Jul-23	15
POST-CONTRACT AWARD (DPC-ROUTE)		1301		31-Oct-25	28-Oct-30	0
DSLN.SVY.00070	Contractor Mobilisation & Step down 2nd Tier Suppliers	40	0%	31-Oct-25	26-Dec-25	0
DESALINATION PLANT		665		16-Sep-26	04-Apr-29	0
Construction		665		16-Sep-26	04-Apr-29	0
Main Works		665		16-Sep-26	04-Apr-29	0
ENVELOPE		665		16-Sep-26	04-Apr-29	0
OUTFALL		665		16-Sep-26	04-Apr-29	0
DSLN.MCW.00410	Outfall - Construction Tunnel & Structures (10% TRA included)	665	0%	16-Sep-26	04-Apr-29	0
DSLN.MCW.00420	Outfall - Construction Dispersal Arrangement	20	0%	07-Mar-29	04-Apr-29	0
PIPELINE INFRASTRUCTURE		188		26-Dec-25	16-Sep-26	0
Site Investigations		98		26-Dec-25	13-May-26	0
DSLN.SVY.00040	Outfall Site Investigation Works (98d to hit end of refurbished TBM Procurement)	98	0%	26-Dec-25	13-May-26	0
Designs		90		13-May-26	16-Sep-26	0
DSLN.DGN.05020	Detailed Design - Outfall	90	0%	13-May-26	16-Sep-26	0
TEST & COMMISSION & HANDOVER		408		04-Apr-29	28-Oct-30	0
COMMISSIONING		408		04-Apr-29	28-Oct-30	0
FIRST PHASE COMMISSIONING		381		04-Apr-29	20-Sep-30	0
DSLN.TCH.00020	1st Ph - Intake Pump Station (assume reduced duration from 120d 1MO Removed)	100	0%	04-Apr-29	22-Aug-29	0
DSLN.TCH.00040	1st Ph - DAF/RGF	100	0%	22-Aug-29	09-Jan-30	0
DSLN.TCH.00030	1st Ph - Sludge Area	100	0%	22-Aug-29	09-Jan-30	0
DSLN.TCH.00050	1st Ph - UF	65	0%	09-Jan-30	10-Apr-30	0
DSLN.TCH.00060	1st Ph - Remineralisation Chemicals Must Be Available	0	0%		10-Apr-30	0
DSLN.TCH.00070	1st Ph - RO	65	0%	10-Apr-30	10-Jul-30	0
DSLN.TCH.00080	1st Ph - Contact Tank	15	0%	10-Jul-30	31-Jul-30	0
DSLN.TCH.00090	1st Ph - Treated Water Storage Tank	15	0%	31-Jul-30	21-Aug-30	0
DSLN.TCH.00100	1st Ph - Conveyance Pipework	5	0%	21-Aug-30	28-Aug-30	0
DSLN.TCH.00110	1st Ph - High Lift Pump Station	22	0%	21-Aug-30	20-Sep-30	0
SECOND PHASE COMMISSIONING		43		28-Aug-30	28-Oct-30	0
DSLN.TCH.00130	2nd Ph - DAF/RGF	22	0%	28-Aug-30	27-Sep-30	0
DSLN.TCH.00120	2nd Ph - UF	22	0%	28-Aug-30	27-Sep-30	0
DSLN.TCH.00140	2nd Ph - RO	22	0%	27-Sep-30	28-Oct-30	0
HANDOVER		0		28-Oct-30	28-Oct-30	0
DSLN.TCH.00150	Handover Test Period (Part of Beneficial Period)	0	0%	28-Oct-30	28-Oct-30	0



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