Final Draft Water Resource Management Plan 2024

Annex 21: Managing and monitoring risk through our adaptive plan

May 2025

from Southern Water

Contents

List of Tables

List of Figures

Glossary

Acronym	Term	Definition
AMP	Asset Management Period	The AMP periods are 5-year cycles used by the Water Services Regulation Authority (Ofwat) to set the allowable price increase for consumers. AMP periods are five years in duration and begin on 1 April in years ending in 0 or 5; the current period is AMP7 (2020-2025)'
CSMG	Common Standards Monitoring Guidance	An agreed approach to the assessment of condition on statutory sites designated through UK legislation and international agreements.
Defra	Department of Environment, Food and Rural Affairs	The government department responsible for setting water policy.
DRA	Direct River Abstraction	In reference to a scheme by Thames Water to take water directly from the river at Teddington
DO	Deployable Output	The output of a source or bulk supply as per the licence (if applicable); pumping plant and/or well/aquifer properties; raw water mains and/or aqueducts; transfer and/or output main; treatment; water quality
dWRMP	Draft Water Resource Management Plan	Refers to the draft stage of developing Water Resource Management Plan.
DYAA	Dry Year Annual Average	A period of low rainfall and unrestricted demand.
DYCP	Dry Year Critical Period	The period(s) during the year when demand is at its highest and supply is generally its lowest.
EIP	Environment Improvement Plan	A government programme for improving the environment
fdWRMP	Final Draft Water Resource Management Plan	This current version of the WRMP that we are publishing in May 2025
GAC	Granular Activated Carbon	Filters used in water treatment, typically made from organic material
HoF	Hands-off flow	A term that can be used within abstraction licences to specify a flow below which the abstraction should stop.
LGS	Lower Greensand	Lower Greensand aquifer block
LTDS	Long Term Delivery Strategy	A component of the PR24 business plan
MAR	Managed Aquifer Recharge	MAR uses natural water sources and appropriately treated urban stormwater to increase groundwater storage using, for example, infiltration ponds and riverbank filtration.
MDO	Minimum Deployable Output	One of the drought scenarios assessed in our WRMP
Ml/d	Mega or million litres per day	Millions of litres per day. Unit of measurement for flow in a river or pipeline. 1 Megalitre = 1,000,000 litres.
NYAA	Normal Year Annual Average	The average of a quantity in a typical year. May refer to either water consumed or water supplied.
ONS	Office of National Statistics	An independent public statistical body that reports directly to Parliament.
PCC	average per capita consumption	Average per capita consumption of water typically measured in litres per head
PET	Potential Evapo-Transpiration	Potential evapotranspiration is the amount of evaporation which would occur if there was an unlimited supply of water.
RBVP	Regional Best Value Plan	A water resources plan optimised not solely on cost, but including other desirable objectives such as environmental improvement and social benefits and increased resilience.
rdWRMP	Revised Draft Water Resource Management Plan	Refers to the revised draft stage of the Water Resource Management Plan
RLCP	Regional Least Cost Plan	Plan based on cost effectiveness
SES	SES Water	SES water company
SESRO	South East Strategic Reservoir Option	A reservoir to be built in the upper Thames catchment.
STT	Severn Trent to Thames Transfer	Sussex North water resource zone
SuDS	Sustainable Drainage Systems	An infrastructure scheme to transfer water from the River Severn to the River Thames either by a new pipeline or restoration of the Cotswold canals.
T2ST	Thames to Southern Transfer	Nature based solution to increase recharge and/or reduce flooding
UKCP18	UK Climate Projections 2018	An infrastructure scheme to transfer water from the Thames catchment to the Southern region

Acronym	Term	Definition
UKWIR	United Kingdom Water Industry Research	Research and tools to predict future climate scenarios and impacts
VSD	variable speed drive pump	Independent water research body
WBS	water booster station	Borehole pump for better performance on start up
WINEP	Water Industry National Environment Programme	A station whose purpose is to augment the flow of water around the network
WRPG	Water Resources Planning Guidelines	A list of environment improvement schemes that ensure water companies meet European and national targets related to water
WRMP	Water Resources Management Plan	The guideline by the Environment Agency, Ofwat and Natural Resources Wales for developing WRMPs.
WRSE	Water Resources South East - regional water resource group	Statutory plan produced by UK water companies every five years to plan to meet supplies over a 25 to 50-year period.
WRZ	Water Resources Zone	Partnership of water companies and regulators in South East England working together to make best use of available water resources.
WSW	Water Supply Works	The largest possible zone in which all resources, including external transfers, can be shared and in which all customers experience the same risk of supply failure from a resource shortfall.

1 Introduction

This document sets out our Monitoring Plan for the adaptive planning approach we have adopted for our Water Resources Management Plan 2024 (WRMP24) to help us track and identify the supply-demand adaptive pathway (or 'situation') we are likely to be following into the future, and the options we will need to deliver to maintain our supply-demand balance.

We have adopted an adaptive planning approach in view of our complex needs and future uncertainties. This annex describes our approach to monitoring and reporting on the drivers that constitute our adaptive planning decision tree.

It briefly describes a background to our adaptive planning approach, the three key future drivers forming our adaptive pathways along with our proposed metrics, timeline for decision points, summary of the root branch scenarios, and reporting of outcomes. As was highlighted in the Environment Agency's response to our draft WRMP24 (dWRMP24), a range of risks to the plan have been now included to be able to monitor and anticipate them better, including demand management and key scheme delivery.

Using the WRMP annual review cycle and feeding into the Water Resources South East (WRSE) monitoring of the regional plan, as well as the 5-year water resources management planning cycle, we can ensure progress on the adaptive plan is monitored and updated regularly, and action is taken in timely manner to course correct if needed.

The planning cycle and annual review cycle also provides the necessary frameworks for consultation and engagement with customers, stakeholders, regulators and other water companies.

1.1 Our adaptive plan

We have continued to use an adaptive planning approach for our WRMP24 as we did for our Water Resources Management Plan 2019 (WRMP19). We have worked collaboratively with water companies in WRSE group to ensure our strategies address the range of uncertainties faced by the South East of the UK as a whole. In addition to Southern Water, WRSE includes Affinity Water, Portsmouth Water, SES Water, South East Water and Thames Water.

We recognise that the future is uncertain and the size of our supply and demand challenge could vary. The adaptive planning approach to allows us to respond to the challenges of the future and ensure that we continue to provide safe and secure supplies of drinking water.

Our regional assessment and WRMP24 Problem Characterisation (Annex 3) have shown that we, and the wider South East region, face particularly significant supply-demand balance risks related to the impacts of:

- Demand (including population growth and demand management)
- Our Environmental Destination (sustainability reductions to abstraction licenses), and
- Climate change impacts.

Our decision to undertake an adaptive planning decision framework is driven by the complexity of our supply-demand balance challenge resulting from these drivers and the consequent need to deliver large strategic options. This is summarised in Annex 3 and also discussed in our final draft WRMP24 (fdWRMP24) Technical Report.

Figure 1 summarises our adaptive planning approach for this plan. There are 9 different adaptive pathways or supply-demand balance 'situations' which represent different combinations of population growth, climate change and Environmental Destination. These are expressed as different magnitudes of supply-demand deficit. Our plan starts with a Stage 1 Root Branch (2025 and 2030), at Stage 2 (2030 to 2035) the plan branches into 3 branches determined by growth and Stage 3 (2035 and beyond) a further 9 branches determined by Environmental Destination, climate change impacts and growth.

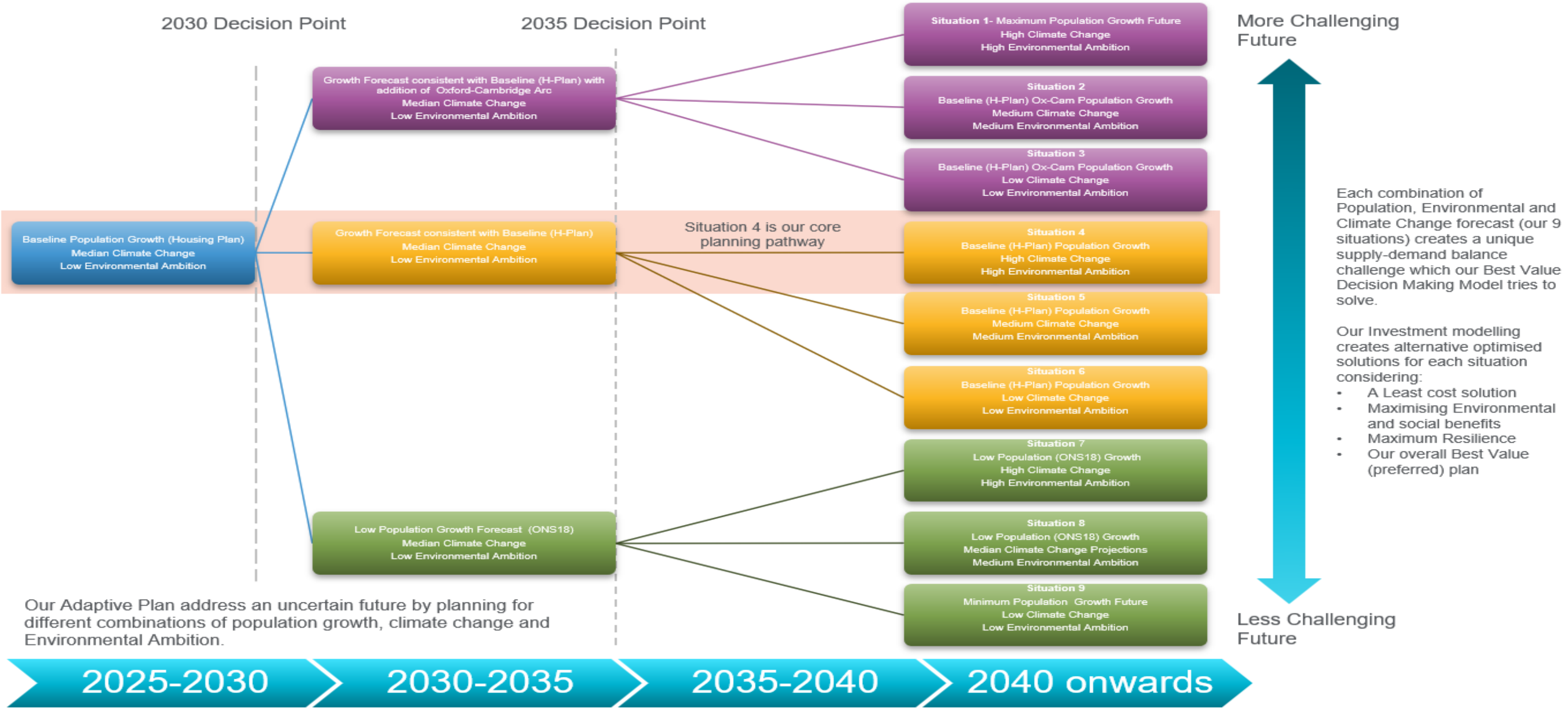


Figure 1: Summary of our adaptive planning approach.

The decision point in 2030 is based on the potential for diverging population growth forecasts, and the second decision point in 2035 splits into different situations depending on supply-demand deficits caused by climate change and the level of Environmental Destination.

This situation tree is applied to every Water Resource Zone (WRZ) against the four different supply scenarios i.e. normal year annual average (NYAA), 1-in-100 year dry year annual average (1:100 DYAA), 1-in-500 year dry year annual average (1:500 DYAA) and 1-in-500 year dry year critical period (1:500 DYCP). Therefore, there are four sets of situational trees for every WRZ, covering nine potential supply-demand balance forecasts.

Whilst the range of uncertainty explored in our adaptive plan is driven by uncertainty due to the three key drivers (climate change, population growth and Environmental Destination), there are a number of other combinations of discrete forecasts that can also produce similar levels of deficits (e.g. a Minimum Deployable Output (MDO) scenario). Therefore, our WRMP24 should not be solely seen as addressing 9 supply-demand balance situations from a combination of the three main drivers of uncertainty but rather as a plan that attempts to find solutions to a wide range of supply-demand deficits through the 'best value' decision-making process. The 'best value' decision-making process is discussed in our fdWRMP24 Technical Report.

1.2 Background to adaptive planning and the WRMP

An adaptive planning approach is promoted by the National Framework[1] and the Water Resources Planning Guidelines (WRPG)[2]. It is consistent with UKWIR guidance[3][4] as an advanced approach suitable for our strategic needs and complexity as evidenced by our problem characterisation (see Annex 3). In accordance with the guidance and complexity of the uncertainty faced, we have chosen to use adaptive planning as a decision-making tool.

The UKWIR 2016 guidance sets out a decision-making process (Table 1) and risk-based evaluation framework that we have followed during the developing of our WRMP24, and to inform the design of the decision-making process and investment modelling tool developed by WRSE in consultation with member companies.

The framework is set out into the following phases:

- Data phase
- Modelling phase
- Refinement phase
- Reporting phase

The data phase involves:

- Stage 1: Collate and review planning information, supply-demand balances etc.
- Stage 2: Review list of unconstrained options
- Stage 3: Problem characterisation – evaluate strategic needs and complexity.

[1] Environment Agency, 2020. Meeting our future water needs: a national framework for water resources. Version 1.
[2] Environment Agency, 2023. Water Resources Planning Guideline. Version 12.
[3] UKWIR, 2016. WRMP 2019 methods – Decision Making Process: Guidelines. Report ref. 16/WR/02/10. UK Water Industry Research Limited.
[4] UKWIR, 2016. WRMP 2019 methods – Risk Based Planning. Report ref. 16/WR/02/11. UK Water Industry Research Limited.

The direction for when the decision to diverge from the root are made and which branches are followed in 2030 and 2035 will need to be set during the data phases.

Table 1: The development phases of a WRMP aligned with UKWIR decision making process.

UKWIR 16/WR/02/10 WRMP19 Methods - decision making process: guidance	Consultation with regulators & stakeholders (is continuous for each stage) Need to agree formal times, such as dWRMP pre-consultation, when crucial influence times occur for decision making.
dWRMP data phase	Stage 1: Collate and review planning information and supply-demand balance (previous WRMP, changes to supply-demand balance, WRPG etc) Stage 2: Review list of unconstrained options
	Stage 3: Problem characterisation- evaluate strategic needs & complexity
dWRMP modelling phase	Stage 4: Select appropriate modelling method Stage 5: Identify and define data inputs to the models
	Stage 6: Undertake decision making modelling
dWRMP refinement phase	Stage 7: Stress testing and sensitivity analysis
dWRMP reporting phase	Stage 8: Reporting to summarise and input to the WRMP

Information is gathered during stages 1, 2 as 3 as set out above to determine changes to previous forecasts and initial consideration of the ways to address any changes to the supply-demand balance deficits.

To determine the adaptive pathways, we have used the WRMP problem assessment process to audit and document for each of our operational areas:

- Population growth (demand side, problem characterisation metrics D(a), D(b) and D(c))
- Environmental Destination (supply side, problem characterisation metric S©)
- Climate change impacts (supply side, problem characterisation metric S(b))

We plan to incorporate a yearly review of progress against each of the 3 drivers as part of the WRMP annual review process as this is an essential update for reporting against our performance and delivery of programmes. This will also help facilitate consultation with regulators and stakeholders on progress for the adaptive pathways (see sections 3 and 4 below).

2 Outline of Monitoring Programme

2.1 Demand

2.1.1 Population growth

The population growth forecasts for our rdWMRP24 were developed by Edge Analytics in 2020[5] and updated in 2023[6]. Multiple growth projections were developed based on data from Local Plans, Office of National Statistics (ONS), Greater London Authority for each WRSE member water company at the WRZ level.

Following consideration of the full suite of projections by WRSE, the following five projections were used to inform demand forecasts for the Adaptive Plan (Table 2).

Table 2: Growth projections used for developing our adaptive plan.

Scenario	Description
Housing Plan Principal[a] (Baseline growth) – root branch from 2025 onward	A housing-led scenario, with population growth underpinned by each local authority's Local Plan housing growth trajectory. Following the final year of data, projected housing growth in non-London areas returns to the average of ONS-14 and ONS-16 long-term annual growth average by 2050. **This is the root and 'medium' scenario branch from 2025 onwards.**
Housing Need Principal[a] (Maximum growth) – used for the 'high scenario' from 2035	A housing-led scenario, with population growth underpinned by the trajectory of housing growth associated with each local authority's Local Housing Need or Objectively Assessed Housing Need. Following the final year of data, projected housing growth in non-London areas returns to the ONS-14 long-term annual growth average by 2050. **This is used in the 'high' scenario from 2035**
ONS-18 Principal[a] (ONS-18) – part of the 'low scenario' from 2030	ONS 2018-based Principal sub-national population projection, using a five-year history (2013-2018) to derive local fertility and mortality assumptions, a long-term UK net international migration assumption of +190k and two-year history (2016-2018) of internal migration assumptions. This scenario has been rebased to the 2021 mid-year estimate. **This is used in the 'low' scenario from 2030.**
ONS-18 Low[b] (Minimum growth)	Same as above but with a low rate of net migration. **This is used in the 'low' scenario from 2030 for situation 9 only.**
OxCam-1a Principal (Oxcam)	New Settlement' 23,000 dwellings per annum scenario, with ca.3,800 dwellings per annum above Housing Plan distributed between Cherwell (20%), Aylesbury Vale (20%), Central Bedfordshire (40%), South Cambridgeshire (20%). **This is used in the 'high' scenario from 2030.**

Growth in household population in each of our WRZs is shown in Table 3.

Table 3: Growth in population in each WRZ from 2025 to 2075.

WRZ	WRZ name	Housing Plan Principal	Housing Need Principal	ONS-18 Low	ONS-18 Principal	OxCam-1a Principal
HAZ	Hampshire Andover	15%	29%	6%	12%	15%
HKZ	Hampshire Kingsclere	22%	30%	-1%	4%	25%
HWZ	Hampshire Winchester	17%	29%	4%	10%	20%

[5] Edge Analytics, 2020. Population and property forecasts. Methodology and Outcomes. July, 2020.
[6] Edge Analytics, 2023. WRSE forecast comparisons. June, 2023.

WRZ	WRZ name	Housing Plan Principal	Housing Need Principal	ONS-18 Low	ONS-18 Principal	OxCam-1a Principal
HRZ	Hampshire Rural	16%	32%	11%	17%	17%
HSE	Hampshire Southampton East	20%	31%	5%	10%	19%
HSW	Hampshire Southampton West	17%	25%	4%	9%	17%
IOW	Isle of Wight	16%	23%	7%	13%	16%
SNZ	Sussex North	21%	33%	9%	15%	21%
SWZ	Sussex Worthing	24%	41%	12%	18%	26%
SBZ	Sussex Brighton	20%	34%	4%	10%	20%
KME	Kent Medway East	29%	42%	8%	14%	34%
KMW	Kent Medway West	35%	39%	4%	9%	28%
KTZ	Kent Thanet	36%	35%	13%	18%	37%
SHZ	Sussex Hastings	19%	29%	3%	8%	19%
SWS	**Southern Water**	23%	34%	7%	12%	24%

Population growth will be monitored as part of the WRMP Monitoring Plan and updated for each WRMP cycle. The next update will be undertaken for Water Resources Management Plan 2029 (WRMP29). This update will be used to support and determine the adaptive planning decision point for population growth in 2030 (Figure 2). The results will be compared with the results shown in Table 3 to see any significant change in growth projections for any WRZ.

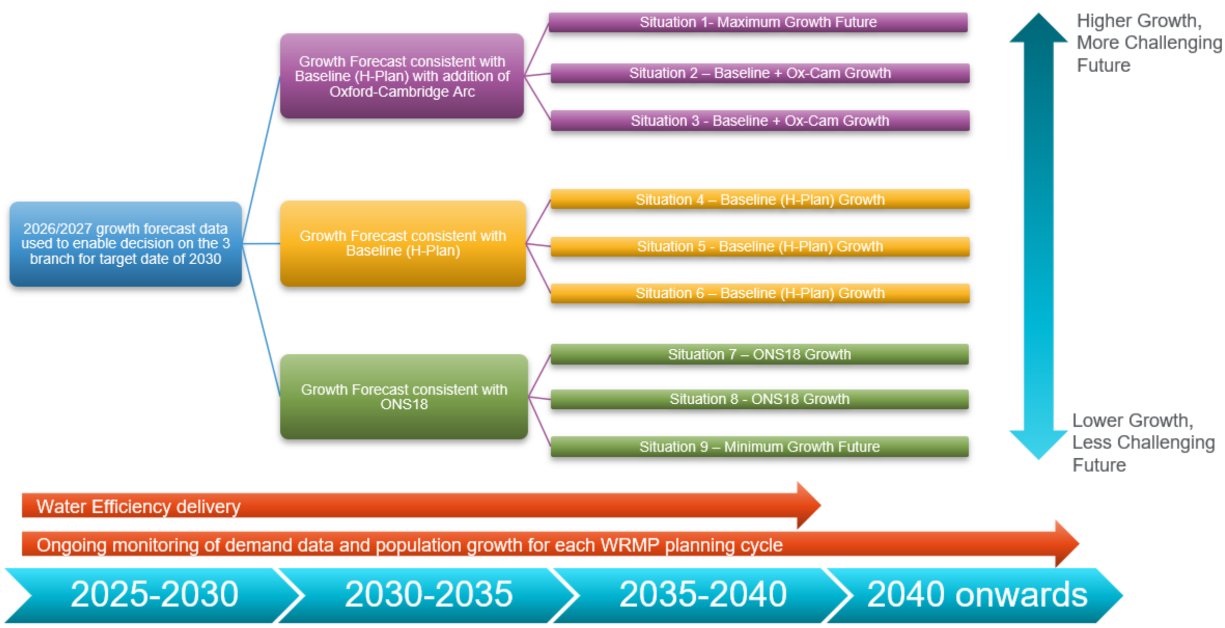


Figure 2: Summary of monitoring and decision points uncertainty associated with population growth.

2.1.2 Demand management

Demand management influences the range of water used in the future and should be considered alongside population growth to determine the water needs of future population. Our approach to demand management is based on three pillars, as described in detail in Annex 14.

- **Reduction in household water consumption:** We aim to reduce average Per Capita Consumption (PCC) to 110 litres per head per day under DYAA conditions by 2045. This is 5 years earlier than the 2050 date set out in the Environmental Improvement Plan (EIP) 2023[7].
- **Reduction in non-household water consumption**: Reduce non-household demand by 9% by 2037-38 compared to 2019-20.
- **Reducing leakage** by 53% by 2050 (from a baseline of 102.60Ml/d in 2017-18, to a target of 48.44Ml/d by 2050).

As highlighted by the Environment Agency's response to our dWRMP24 and in its review of England's revised draft regional and water resources management plans[8], the reliance on demand management to achieve supply-demand balance needs to be monitored closely, particularly in the short to medium-term. This includes:

- the timing of demand management activities (e.g. smart meter deployment), and
- the impact of these activities on water consumption. This is because demand management activities can be influenced by factors beyond the control of water companies (e.g. weather patterns, government-led policy changes), but also because some of the proposed activities are innovative and assumptions around their impact need to be validated.

Section 3 provides more details on the thresholds and triggers we are putting in place to monitor demand and mitigate the risk of non-delivery of water savings from demand management. This will enable us to adapt in case demand management does not result in the reductions forecast in the fdWRMP24, and in future WRMP cycles, and take action to compensate if needed.

We have identified the following monitoring components for demand management in the short to medium-term (see section 3 for more details):

- Annual review of smart metering deployment (from 2025-26) and impact (from 2026-27).

  Smart meters make up the bulk of consumption savings for the period until 2030, both for households and non-household consumers (around 2/3 of savings; see Figure 3 and Figure 4) and are essential to consumption reduction initiatives in later years. We will review their deployment against targets as part of our annual review.

  As the first batch of smart meters is planned for deployment in 2025-26 (with full deployment by 2030), we should already be able to have some insights into the impact of smart metering on household and non-household consumption in 2026-27. This will enable us to understand whether our assumption of a 4% reduction in household consumption as a result of smart metering is valid, and if not, the impacts this has on supply-demand balance, and whether remedial action is necessary. We will therefore be monitoring consumption for households and non-households as part of our annual review.
- Annual review of leakage reduction achievements against targets, at WRZ level and company-wide, to enable us to course correct if results are below expectations.
- Ongoing review of Government-led policy initiatives and their impact on water consumption. Government initiatives make up an increasing proportion of water demand reduction for households over time. As there is uncertainty around the timing of the delivery of Government initiatives, and their impact on demand, monitoring will need to take these into account both in our annual review as well as our future WRMPs to account for this risk.

[7] Environmental Improvement Plan 2023 - GOV.UK (www.gov.uk)
[8] A review of England's revised draft regional and water resources management plans - GOV.UK (www.gov.uk)

Our reliance on demand management becomes greater over time, reflecting increasing risks linked to factors that are beyond company control, specifically Government initiatives and their impacts for household water consumption (Figure 3).

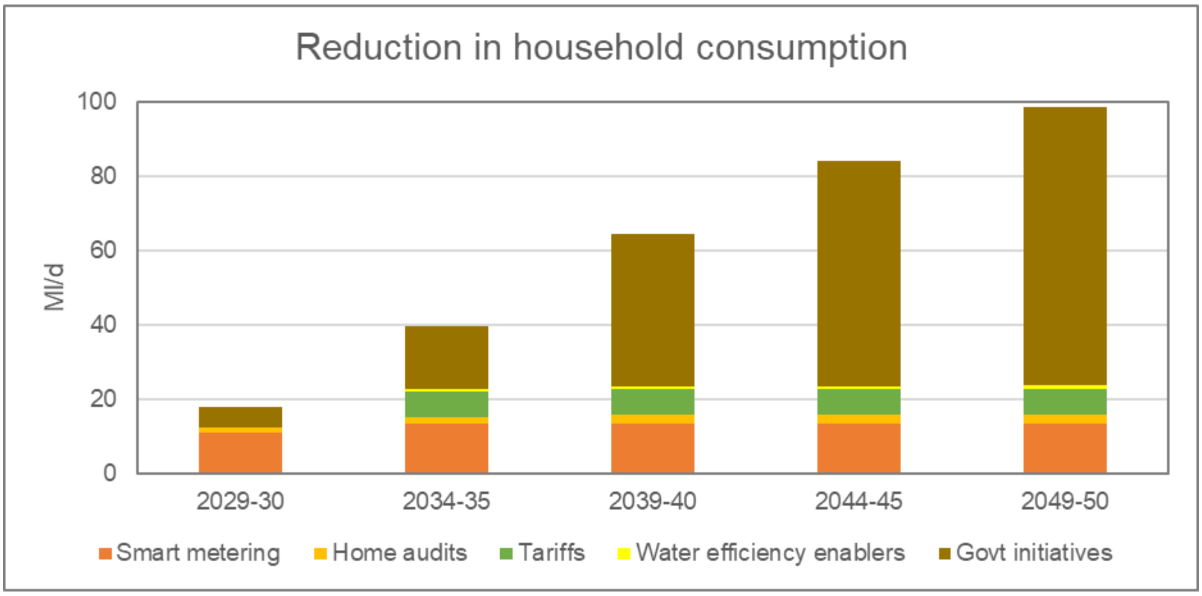


Figure 3: Forecast reduction in household consumption through different initiatives.

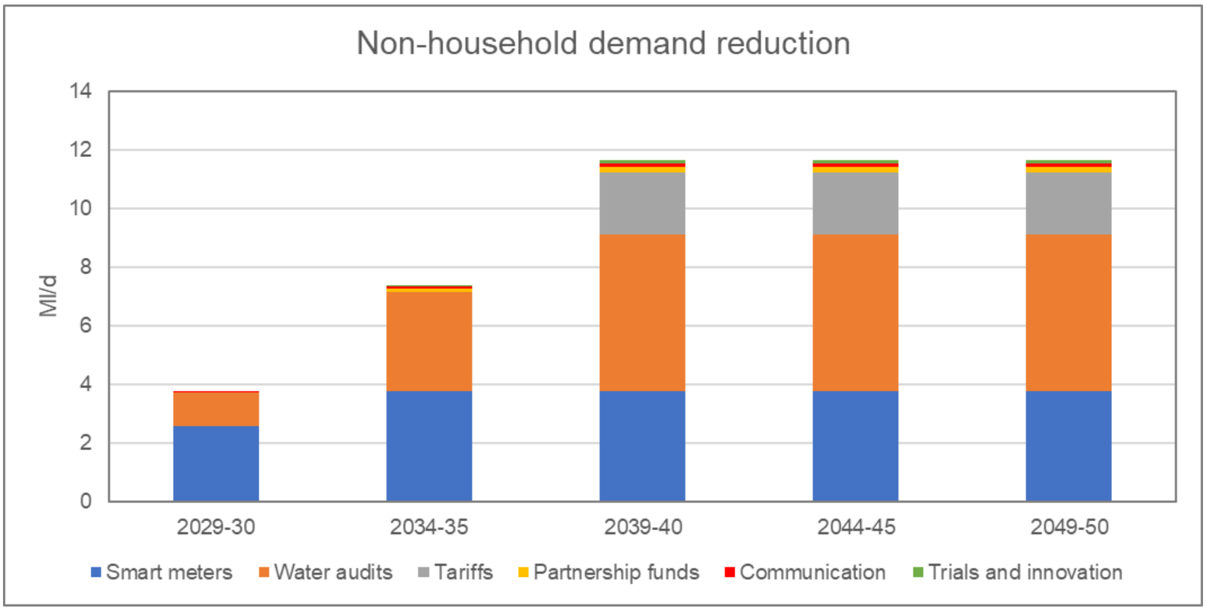


Figure 4: Forecast reduction in non-household demand through different initiatives.

It is worth noting that the risks around demand management will affect all water companies. As such, lower demand management results could also have knock-on effects on other supply-side options from other companies, e.g. bulk transfers from other companies to Southern Water may be compromised (reduced or cancelled) if they themselves are not achieving their forecast demand reduction. It is therefore important to monitor these potential knock-on effects going forward. We have consequently added bulk water imports as a component of our Monitoring Plan (see Section 3) and will work in close collaboration with the other companies through the WRSE Monitoring Plan to assess the risks to bulk imports from other companies.

2.2 Environmental Destination

Our Environmental Destination is intended to ensure that all our abstractions are sustainable. We have described the possible range of solutions, including abstraction licence changes and other mitigations such as river enhancement, that we might need to implement in our Environmental Destination scenarios in Annex 9 to our fdWRMP24 Technical Report.

In the Emerging Regional Plan published by WRSE in 2022[9], the proposed adaptive planning approach used the 'Central' Environmental Destination scenario as a core pathway up to 2040, thereafter the plan branched between 'Central', 'Enhanced' and 'Alternative' scenarios reflecting the range of potential supply reductions and the policy, stakeholder and customer choices at that time, which would determine the environmental pathway to be followed.

For the draft Regional Plan[10], and our dWRMP24, the adaptive planning approach was revised. Instead of the branching being primarily policy driven, our Environmental Destination has been simplified into three scenarios (high, medium and low) which reflect the magnitude of supply-demand balance impact. This allows greater flexibility as individual licence changes can be considered and tailored at a source or water body level as appropriate, but the range of uncertainty in terms of supply-demand balance impact is still covered within the three scenarios. The reduction in Deployable Output (DO) in each WRZ under each of these scenarios is shown in Figure 4.

Table 4: Summary of Deployable Output impacts for each Environmental Destination Scenario.

WRZ	1:500 DO reductions by 2050 for each branch (Ml/d)		
	Low	Medium	High
HAZ*	-11.61	-12.40	-15.54
HKZ	-4.16	-4.63	-4.16
HRZ	-3.45	-3.45	-3.45
HSE*	0.00	0.00	-20.49
HSW*	0.00	0.00	0.00
HWZ*	-9.41	-12.8	-22.71
IOW	-8.06	-11.02	-14.25
SNZ	-6.76	-6.80	-8.23
SBZ	-6.48	-20.99	-39.44
SWZ	-7.86	-17.87	-19.72
KME	-20.27	-48.51	-48.51
KMW	-3.31	-22.42	-22.70
KTZ	-11.94	-29.56	-29.56
SHZ	-1.56	-1.56	-1.56
Western area total	**-36.69**	**-44.30**	**-80.60**
Central area total	**-21.10**	**-45.66**	**-67.39**
Eastern area total	**-37.08**	**-102.05**	**-102.33**
Total	-94.87	-192.01	-250.32

[9] WRSE, 2022a. . A consultation on our draft regional plan for South East England. January 2022 (wrse-regional-plan-jan-22-consultation-doc-final.pdf)
[10] WRSE, 2022b. A consultation on our draft regional plan for South East England. November 2022 (10306a_wrse-bv-plan-2022final_online.pdf).

There is currently a lot of uncertainty about both the quantity and location of the abstraction licence changes we will need to deliver to protect the environment and the consequent potential impacts on our water supplies. We are addressing this through our wide-ranging Water Industry National Environment Programme (WINEP) and we expect to have completed investigations into the sustainability of most of our water sources by 2027. This will allow us to work with the Environment Agency, Natural England and other stakeholders to make robust, evidence-based decisions around the scale of abstraction reductions and other mitigations required to protect and restore the environment and improve its resilience to climate change. The conclusion of our WINEP investigations and options appraisal between 2024 and 2027 will therefore be critical to informing the Environmental Destination pathway we are likely to follow.

2.2.1 Environmental Destination monitoring points

As the vast majority of our WINEP investigations and options appraisals are due to be completed by 2027, we will have greater certainty on the Environmental Destination scenario we are likely to be following, and the consequent magnitude of DO reduction, for WRMP29.

The critical dates and mechanisms for reviewing our Environmental Destination are set out in Table 5 and Figure 5.

Table 5: Summary of Key Environmental Destination monitoring points.

Review Mechanism	Date of Review
Review of Environmental Policy and Water Resource WINEP emerging and confirmed outcomes reported in WRMP annual review	Annually
Conclusion of AMP7 and AMP8 WINEP investigation and options appraisal studies	2024-2027
Environmental Destination Update and Confirmed Sustainability reductions for WRMP29	2027-2029
Start of mitigations associated with 2027 WINEP investigation and Options Appraisal	2030 Onwards
Environmental Destination Update and Confirmed Sustainability reductions for WRMP34	2030 Onwards
Adaptive Branching point for Environmental Destination	2035

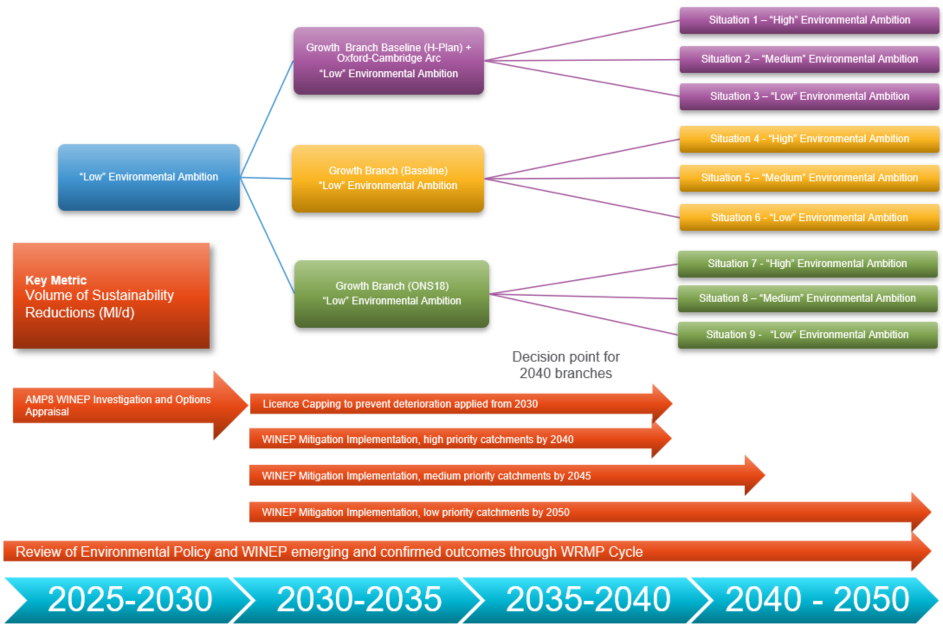


Figure 5: Summary of Environmental Destination driver decision point and metrics.

2.3 Climate change impacts

In addition to Environmental Destination, we expect that climate change will be the other major supply-side driver of reductions in Water Available for Use (WAFU).

The climate change impacts for WRMP24 have been assessed based on the UK Climate Projections 2018 (UKCP18), Representative Concentration Pathway 8.5 (RCP8.5) dataset. 28 climate scenarios (based on the regional and global circulation models) have been incorporated in our supply forecast to address uncertainty. We have used three forecasts of climate change impacts for our adaptive pathways.

- High climate change impact (from 2035)
- Median climate change impact (root branch from 2025 onwards)
- Low climate change impact (from 2035)

These are based on the median (medium), regional 'high' and 'low' severity outcomes from the WRSE regional climate change assessment approach.

2.3.1 Understanding the impacts of climate change

To assess and monitor the impacts of climate change on water supplies, we need to take a multifaceted approach to make adaptive planning decisions, including a robust narrative supported by risk assessments, data and complex water resources modelling.

Understanding the latest forecast of climate change is essential and we continue to utilise climate data, models, reports provided by Met Office and other hydrological data services.

Our approach to monitoring climate change for the purposes of the adaptive planning decisions is based on the following main components:

- Climate change vulnerability and impact of climate change on DO of water resources
- Southern Water climate change adaptation report 2021
- Met Office data, models and reports

2.3.2 Supply-side vulnerability assessment

To determine the supply-side impacts of climate change, we have followed a consistent approach with all WRSE companies[11]. This included the development of a sub-set of the stochastic climate replicates of rainfall and Potential Evapotranspiration (PET) to create 28 climate change scenarios. This approach is described in detail in Annex 8 to our rdWRMP2 Technical Report.

We have also assessed vulnerability to climate change impacts for each of our 14 WRZs (Table 6). We will report and continue to assess the trends and uncertainty of the impacts of climate change through the WRMP annual review process.

We will review the vulnerability of our WRZs to climate change for each WRMP cycle and, where required, will update our DO forecasts for potential climate change impacts.

Primarily this will be based on the range of potential changes to precipitation and temperature available in the UK climate projections (UKCP) datasets. We will use a range of projections to explore the uncertainty.

[11] WRSE, 2021. Method Statement: Climate Change – Supply Side Methods Updated version August 2021

Table 6: Summary of climate change vulnerability assessment of our WRZs.

Climate Change Vulnerability	WRZ	Comments
Highly vulnerable	HSW, HSE, SNZ and KTZ	High vulnerability influenced by flow conditions on River Test, Itchen and Rother (will be linked to Environmental Destination).
Medium vulnerability	SWZ, SBZ, SHZ and KMW	
Low vulnerability	HKZ, HAZ, HRZ, HWZ, IOW and KME	

In view of the comparatively long timescales over which climate change is expected to operate (compared to the water resource planning cycle) and the natural variability of the climate, we will need to look at projections and trends over several planning cycles to characterise its impact with confidence. The impacts on DO may be less obviously visible than other climate events such as extreme weather (e.g. heatwaves, droughts, floods). However, we also recognise that these extreme events themselves can also be difficult to directly attribute to climate change alone.

Our adaptive plan branches on the expected supply impacts we might face under median, and regional ‘high’ and ‘low’ impacts (Table 7). A potential comparison metric would be to use the modelled DO impact of climate change as a metric to assess the climate change adaptive branch we are potentially following.

However, there is currently a large uncertainty in the trajectory of climate change impacts and given the lead times, future trends will be influenced by policy choices, some of which are yet to be made.

Table 7: Summary of forecast climate change impacts on DO (1:500 DYAA) and uncertainty by WRZ.

WRZ	1:500 DYAA DO, 2070 Impact (RCP8.6 2060-2080 Time slice)			
	Median Impact (Ml/d)	Range (Ml/d)	‘Low’ Scenario (Ml/d)	‘High’ Scenario (Ml/d)
HAZ	0.00	0.00 to 0.00	0.00	0.00
HKZ	0.00	0.00 to 0.00	0.00	0.00
HWZ	0.00	0.00 to 0.00	0.00	0.00
HRZ	0.00	0.00 to 0.00	0.00	0.00
HSE	-20.49	12.65 to -20.49	-13.44	-20.49
HSW	0.00	0.00 to 0.00	0.00	0.00
IOW	0.51	0.90 to -0.51	0.51	0.12
SNZ	-10.08	0.88 to -11.27	-1.26	-10.63
SWZ	0.52	0.00 to 1.27	0.70	0.43
SBZ	0.25	3.43 to -2.97	1.25	-0.17
KMW	0.00	0.00 to 0.00	0.00	0.00
KME	-12.10	0.40 to -23.80	-8.80	-20.60
KTZ	3.13	0.40 to -23.80	3.64	2.52
SHZ	-2.77	-0.07 to -4.70	1.75	-3.90

We will therefore use the median climate change impacts from our water resource modelling as one guide of the likely trajectory of climate change and will compare that to the range of supply forecast impacts.

2.3.3 Climate variables

We published our Climate Change Adaptation Report[12] in 2021. It describes the climate risks we face in carrying out our essential services and the mitigations we are developing. We have used the latest scientific climate forecasts (UKCP18) for medium and high emissions scenarios in order to understand our level of preparedness to deal with potential climate change shocks and stresses.

The report highlighted four key climate drivers that we are already experiencing the impacts of, and which we expect to increase in severity and/or frequency over the coming years:

- Increased temperature and more extreme variations in temperature
- Less rainfall or longer dry periods (drought)
- More rainfall, or more intense rainfall (including an increasing number of extreme storms and lightning strikes)
- Sea level rise

For each of these drivers we propose to undertake the following monitoring, both to support our WRMP adaptive planning and wider climate change monitoring.

Increase in average temperature

The UKCP18 projections suggest that, under 2°C global mean warming, the UK will experience, on average, 1 to 2°C higher annual temperatures by the end of the century compared to the baseline period (1981-2010). The South East of England will experience higher warming, with average summer temperatures increasing by 3 to 4°C relative to the 1981-2010 baseline.

As part of our monitoring, we will review and report on the seasonal average mean air temperature for June July and August (summer) compared to long term trends.

Decrease in summer rainfall (drought)

We expect to see more prolonged periods of reduced rainfall in future, particularly in summer. Changes in seasonal rainfall will potentially affect river levels, with lower river levels in summer impacting water resources and water quality. According to UKCP18 data, under a high emission scenario UK summer rainfall could vary by -45% to +5% by 2070[13].

We will review and report on the seasonal average precipitation rate for June July and August (summer) compared to long term trends.

More rainfall or more intense rainfall (increased storminess)

The frequency of short, high-intensity rainfall events is likely to increase in both summer and winter. Overall, winters are likely to be wetter, potentially resulting in higher groundwater levels and associated flooding and increased flows to Wastewater Treatment Works (WTWs).

[12] Southern Water 2021. Climate Change Adaptation Report. (https://www.southernwater.co.uk/media/5453/5670_climatechangeadaptation_2021_v13.pdf)
[13] Met Office, 2022. UK Climate Projections. Headline Findings. August 2022 (ukcp18_headline_findings_v4_aug22.pdf (metoffice.gov.uk)).

Under a high emissions scenario winter rainfall is expected to vary by -3% to 39% by 2070 when compared with a 1981-2010 baseline[14].

We will review and report on the average precipitation rate for January, February and March (winter) compared to long term trends.

Sea level rise

Our region has a long coastline and the main centres of population lie along the coast. Some areas are close to current sea level and in a few cases, below mean high water levels. Several borehole sources are relatively close to the shoreline and, in conditions of extreme drought, are vulnerable to saltwater contamination. Sea-level rise is therefore likely to have an impact on our operations, both water and wastewater. Sea levels around the UK, including in the South East, will continue to rise well beyond 2050 under all future emissions scenarios.

We will review and report on the time-mean sea level anomaly which is available from the Met Office State of UK Climate annual review and any updates from the UKCP18 related to global and UK sea level predictions.

Heatwave

Extreme heatwaves are likely to become more common and intense in the future. By 2070, summer temperatures are expected to increase by 3.8^{o}C to 6.8^{o}C, with an associated increase in the frequency of heatwaves[15].

We will review and report on heatwaves experienced and use Met Office reports to determine if climate change attributed events are becoming more frequent or changing in intensity.

Met Office

We will use the latest scientific evidence, models and climate data available from the Met Office to help determine if changes to the average weather patterns are being attributed to climate change. The sources for review as part of the adaptive planning monitoring are:

- **UKCP and UKCP18** are the set of tools and data we use to determine statistical climate scenarios and projections. For our WRMP24, we are using a range of impacts based on RCP8.5 taken from UKCP18. This represents a future of high greenhouse gas emission. The Met Office currently does not have a planned timeline for updating the current dataset (UKCP18), and it continues to be enhanced and upgraded. We will ensure that as we update our forecast climate change impacts each planning cycle, we adopt the latest available projection dataset from the UKCP or any successor.
- **Climate Change attributions studies** are produced by the Met Office to determine if extreme weather events, such as the July 2022 heatwave, are caused by climate change.
- **State of UK Climate annual review**, published by the Met Office in the International Journal of Climatology, provides a review of the UK weather and climate for each calendar year within an historical context. It is based on observed climate datasets, assess trends, variations and extremes.
- **WRMP annual review**. For our WRMP annual reviews, we have been reporting the average temperature and total rainfall levels between April and September from 1910 to 2022 for the South

[14] ibid
[15] Met Office, 2022, UK Climate Projections, Headline Findings, August 2022, ukcp18_headline_findings_v4_aug22.pdf (metoffice.gov.uk)

East region of the UK to determine if the year can be classified as 'normal' or 'dry' under our planning scenarios. We also now actively use the Environment Agency hydrological catchment rainfall series data as part of our drought monitoring. These provide a consistent long-term rainfall record back to the 1890s which can be used to assess departure from long-term trends.

Using data and studies available from the Met Office, we will extend our weather conditions review to consider any weather events attributed to climate change and monitor the average summer temperatures, average summer rainfall, and average winter rainfall for the South East, as outlined in our Climate Adaptation Report. This will help us reflect on any statistically distinct weather and climate conditions experienced.

We will undertake this review each hydrological year (each autumn) and report its summary findings as part of our WRMP annual review. Figure 6 summarises then key metrics and decision point for the climate change driver.

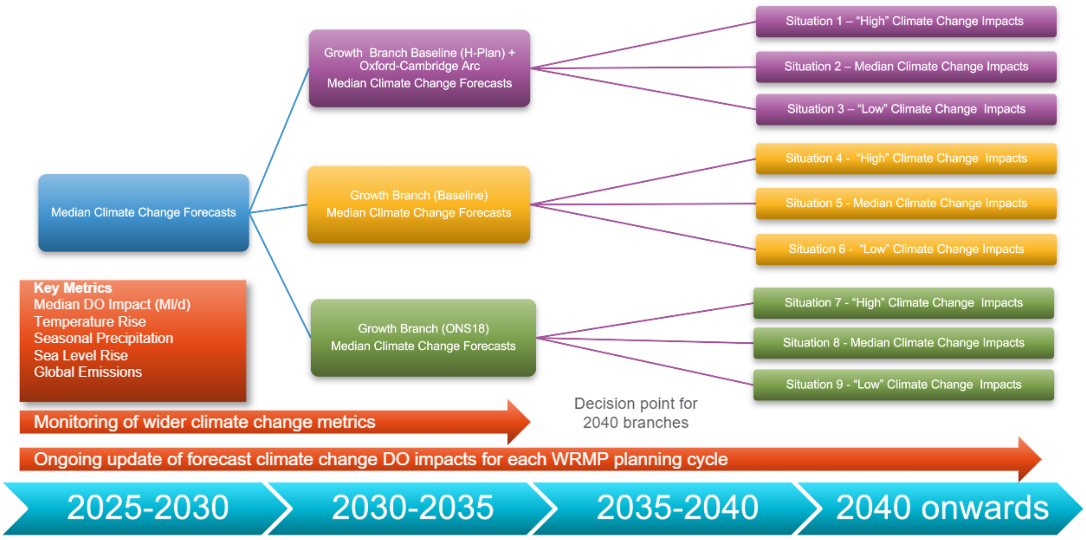


Figure 6: Summary of the key metrics and decision points for the climate change driver.

3 Monitoring and Reporting

3.1 Interface with WRSE and the regional plan

Over the period building towards WRMP29, we are putting in place a system of monitoring, communicating and reporting on our adaptive plan to give regulators and stakeholders visibility of our progress in delivering our plan. This Monitoring Plan should be considered in conjunction with the regional Monitoring Plan established by WRSE.

Whilst the WRSE regional plan, and our WRMP24, set out 9 different supply-demand situations, one situation (Situation 4) to describe the investment plan required for the south east of England. The investment plans derived from this pathway feature in our Business Plan for Price Review 2024 (PR24) and our Long Term Delivery Strategy (LTDS)[16].

Given the range of different futures it is important to track annual progression with schemes and key output data to see if we are still following the forecasts describing Situation 4 and, if not, the situation we need to adapt to and the associated options that will be needed in the future.

Monitoring will be done through our WRMP annual review process and will feed into the WRSE regional Monitoring Plan, as well as the 5-year WRMP cycle. WRSE will prepare and publish an annual monitoring report, building upon the content of the company WRMP annual reviews. The key purpose of the WRSE Monitoring Plan is to track key indicators, set out the measure that will be used to trigger corrective actions, where necessary, and the timing of these corrective measures.

WRSE proposes to track a range of indicators to monitor supply-demand balance, with the target headroom[17] in each WRZ being proposed as the key indicator to trigger corrective action as follows:

- If actual headroom is higher than target headroom, then no immediate action is required but we will continue to monitor the situation.
- If the actual headroom in a WRZ falls below target headroom, then action is required to improve the situation.

Our Monitoring Plan is aligned with this approach and feeds into the WRSE regional monitoring strategy.

3.2 Monitoring as part of the WRMP annual review and planning cycle

In the WRMP annual review process, we will include a section on monitoring of our adaptive planning, where we will reflect and report on supply-side and demand-side components and the combined impacts on our supply-demand balance.

Table 8 outlines the components of our WRMP Monitoring Plan, which will be updated as part of the annual review process to ensure the data is collated and readily available for critical decision points annually and in the WRMP planning cycle.

[16] Southern Water, 2024. Long Term Delivery Strategy (srn12-long-term-delivery-strategy-technical.pdf (southernwater.co.uk)).
[17] In water resource planning, uncertainty is handled through the calculation of ‘target headroom’, which is defined as: ‘The minimum buffer that water companies are required to maintain between supply and demand in order to account for current and future uncertainties in supply and demand.’

Using the annual review process and the 5-year WRMP cycle as the basis, we can ensure progress on the adaptive plan is monitored regularly and provides the necessary framework for consultation and engagement with stakeholders, regulators and other water companies.

Tracking of indicators will highlight whether, for example, additional intervention is needed to accelerate progress on the demand side, or whether additional supply options may be required, giving time for the pre-consultation, modelling and refinement phases.

Table 8: Monitoring plan components.

Monitoring area	Type or Metric	Frequency of review	Follow-up action
1. Overall			
a. Supply-demand balance and target headroom (at WRZ level and overall)	• deficit or surplus (Ml/d) • % change from core plan forecast	Annual review and WRMP planning cycle.	Target headroom forecast to inform selection of future adaptive pathway and course correct if needed.
2. Supply-side components			
a. Climate change	• Average summer temperatures • Average summer and winter rainfall • Sea level rise • Weather events attributed to climate change	Review of climate variables as part of WRMP planning cycle.	Update of water resource modelling, impact and vulnerability assessment to inform selection of future pathway from 2030 onwards.
b. Environmental Destination (including licence capping)	Volume of sustainability reduction (Ml/d)	When WINEP investigations and 2026-27 WINEP data are available, and options appraisal are completed.	Priority catchments selected for WINEP and implementation of solutions or interim measures. Update to inform selection of future pathway from 2030 onwards.
c. Pulborough investigation	Decision on whether abstraction can continue	When outcome from investigation available (exp. in 2025).	Review of contingency options if license is revoked.
d. Bulk transfer imports from neighbouring companies	DO change (Ml/d) from core plan (from reduction or non-renewal)	Ongoing review and update of water resource modelling if changes to planned or ongoing bulk transfers are forecast or made.	Ongoing update of water resource modelling, impact and vulnerability assessment.
e. Delay or constraints to delivery of key supply options	Ml/d of DO change from core plan (from delay or constraints)	Ongoing review of schemes delivery timeline and update of water resource modelling if changes occur.	Ongoing update of water resource modelling, impact and vulnerability assessment.
3. Demand-side components			
a. Population growth	Population and housing growth and change from core plan forecast	WRMP planning cycle.	New regional forecasts will be commissioned in 2027 to enable decision on the selection of 2030 adaptive branch.
b. Leakage reduction	Reduction an annual average rolling 3-year average leakage (Ml/d) from the 2019-20 baseline and change from core plan forecast at WRZ level and company-wide	WRMP annual review and WRMP planning cycle.	Review and take measures to ensure targets are met. Future targets will be reviewed in line with learnings achieved within previous cycle to inform selection of future pathway.

Monitoring area	Type or Metric	Frequency of review	Follow-up action
c. Company-led consumption reduction	• Smart meter deployment (from 2025-26) more than 1 million by 2030 • PCC (annual average and % reduction of 3-year average) from the 2019-20 baseline • Reduction in non-household water consumption from the 2019-20 baseline	WRMP annual review and WRMP planning cycle, at WRZ and company level.	Review and take measures to ensure targets are met. Future forecasts will be reviewed in line with learnings achieved in previous cycle to inform selection of future pathway.
d. Government-led commitments to improve water efficiency	Government policy	On an ad-hoc basis, as and when policy commitments are delivered.	Future forecasts will be reviewed in line with learnings from previous cycle to inform selection of future pathway.
4. Other			
a. SEA monitoring indicators not covered by Southern Water reporting criteria[18]	This includes WRMP scheme monitoring of SEA indicators through Environmental Management Plan	WRMP planning cycle.	These do not have a direct supply-demand balance impact, but learnings and environmental monitoring will be reviewed to inform next WRMP cycle.

3.3 Monitoring thresholds and triggers

The WRPG supplementary guidance on adaptive planning state that our WRMP Monitoring Plan needs to identify:

- what our monitoring thresholds are
- how we will know when a threshold has been reached
- what action we will take when a threshold is reached.

If actual annual monitoring figures indicate that the supply demand balance/target headroom is outside the range that has been considered for the core pathway in our plan, we will flag how the investment strategies might need to be updated and whether adaptive options might need to be progressed earlier or enhanced (see Section 4.2). The Monitoring Plan should be reviewed in its entirety each year as whilst one component may be off track (i.e. demand reductions not being realised), this could be compensated by another component over performing (e.g. leakage reductions greater than forecast).

For each of the monitoring components in Table 8, we propose the following thresholds and action triggers outlined in Table 9 below.

Table 9: Thresholds and triggers for remedial action as part of our Monitoring Plan.

Monitoring area	Indicator (s)	Threshold	Action
1a. Supply-demand balance and target	• deficit or surplus (Ml/d) • % change from core plan forecast	If supply-demand balance / target headroom at WRZ	Review reasons for deficit/ deviation, identify

[18] reporting_criteria_2020_21.pdf (southernwater.co.uk)

Monitoring area	Indicator (s)	Threshold	Action
headroom (at WRZ level and overall)		level is forecast to be in deficit (>5% of forecast).	intervention, and revise forecast.
2a. Climate variables	• Average summer temperatures • Average summer and winter rainfall • Sea level rise • Weather events attributed to climate change.	If indicator is >5% deviation from selected climate change forecast for temperature and rainfall.	Review component 1a. and adaptive pathway for next WRMP cycle Flag for internal assessment of risk as part of climate adaptation strategy. In particular, risk to critical infrastructure from sea level rise / extreme weather events should be fed back into the WRMP process.
2b. Environmental Destination (including licence capping)	Volume of sustainability reduction (Ml/d) compared to forecast	>5% deviation from estimated sustainability reductions forecast in selected pathway.	Review component 1a. and adaptive pathway for next WRMP cycle. Bring forward /enhance contingency options if 1a. shows a forecast deficit
2c. Pulborough investigation	Outcome of investigation on abstraction license	Investigation concludes that abstraction must cease or be reduced.	Review component 1a. and adaptive pathway for next WRMP cycle. Bring forward /enhance contingency options if 1a. shows a forecast deficit.
2d. Bulk transfer imports from neighbouring companies	DO change (Ml/d) from core plan (from reduction or non-renewal)	Any new or future change in agreed bulk transfer imports from neighbouring companies	Review component 1a. and adaptive pathway for next WRMP cycle. Bring forward /enhance contingency options if 1a. shows a forecast deficit.
2e. Delay or constraints to delivery of key supply options	DO change (Ml/d) from core plan (from reduction or non-renewal)	Ongoing review of schemes delivery timeline and update of water resource modelling if changes occur.	Review component 1a. and adaptive pathway for next WRMP cycle. Bring forward /enhance contingency options if 1a. shows a forecast deficit.
3a. Population growth	Population and housing growth (000's)	>5% deviation from core plan forecast	Review component 1a. and adaptive pathway for next WRMP cycle. Investigate bringing forward / increasing other demand-side or supply-side options, depending on timing and scale of deviation.
3b. Leakage reduction	• % reduction in annual average and rolling 3-year average leakage from the 2019-20 baseline • % change from core plan forecast	>5% deviation from core plan forecast	Review component 1.a. and adaptive pathway for next WRMP cycle Investigate bringing forward/ increasing other demand-side or supply-side components, depending on timing and scale of deviation
3c. Company-led consumption reduction	• Smart meter deployment • Reduction in PCC (annual average 3-year	• >5% underperformance of smart meter deployment target.	Review component 1.a. and adaptive pathway for next WRMP cycle. Investigate bringing forward / increasing other demand-

Monitoring area	Indicator (s)	Threshold	Action
	rolling average) from the 2019-20 baseline) • Reduction in non-household consumption from the 2019-20 baseline	• >5% deviation of PCC target. • >5% deviation of non-household water consumption. At WRZ and company levels.	side or supply-side components, depending on timing and scale of deviation
3d. Government-led commitments to improve water efficiency	Track Government-led water efficiency initiatives	Lack of Government-led initiatives (e.g. water labelling, product standards)	Review component 1a. and adaptive pathway for next WRMP cycle. Investigate bringing forward/ increasing other demand-side or supply-side components, depending on timing and scale of deviation.
4a. WRMP SEA monitoring indicators	Overview of WRMP scheme monitoring of SEA indicators through Environmental Management Plan.	Where WRMP schemes' SEA indicators through Environmental Management Plan show 1. significant effects that may give rise to irreversible damage; and 2. significant effects where there was uncertainty in the SEA	Identify preventative or mitigation measures to mitigate unforeseen effects in SEA.

3.4 Adapting our plan for the future

3.4.1 Selecting adaptive pathways for the future

Table 8 outlines the components which will be monitored within and between WRMP cycles and will determine the adoption of pathways for the next WRMP cycles. Table 10 summarises the long-term targets we are working towards with regard to the main three variables: Environmental Destination, demand (including population growth) and climate change impacts. Updates on these will be communicated to stakeholders as part of the WRMP consultation process.

Table 10: Summary of integrated Monitoring Plan against required decision points for our WRMP24.

Planning Cycle and Decision Timing	Environment Destination	Demand / Population Growth Progress	Climate Change Impacts
PR19 / AMP7	WINEP investigations and options appraisal		Ongoing review of climate variables
PR24 / AMP8 2028: 2026-27 growth and water demand data **must** be available to enable decision on the selection of 2030 adaptive branch (reflected in LTDS)	WINEP investigations and options appraisal completed. 2026-27 WINEP data available	Water efficiency programme delivery 2028: Decision point related to monitoring of water demand compared to scenarios	Ongoing review of climate variables
PR29 / AMP9 - **2030 target branch for growth** 2033: Environmental Destination restrictions on abstractions, climate change and growth / water demand data to inform selection of 2035 adaptive branch (reflected in LTDS)	**Environmental Destination decision point** WINEP and implementation of solutions or interim measures in the highest priority catchments	Water efficiency programme delivery	Update of water resource modelling, impact and vulnerability assessment for WRMP29

Planning Cycle and Decision Timing	Environment Destination	Demand / Population Growth Progress	Climate Change Impacts
PR34 / AMP10 - **2035 target** branch for environment ambition and climate change impacts	**Adaptive branching point for Environmental Destination** WINEP and implementation of solutions in highest priority catchments	Water efficiency programme delivery **Target:** Reduce non-household demand by 9% by 2037-38 compared to 2019-20	Update of resource modelling, impact and vulnerability assessment for WRMP34 The Western area WRZ's high vulnerability to climate change will partially be determined by Environmental Destination outcomes for the rivers Test, Itchen and Rother.
PR39 / AMP11	Implementation of solutions in medium priority catchments	Water efficiency programme delivery	
PR44 / AMP12	Implementation of solutions in low priority catchments	Water efficiency programme delivery **Target**: reduce average Per Capita Consumption (PCC) to 110l/h/d under dry year (DYAA) conditions by 2045	
PR49 / AMP13	**Target: Good Ecological Status by 2050**	Water efficiency programme delivery **Target:** 1. Reduce leakage by 53% by 2050	

3.4.2 Developing decision point timelines for individual options

Our plan is entirely adaptive and that is not just for the top-level decision points for selecting adaptive branches. This approach allows us to monitor the individual need at a scheme level rather than relying on the planning cycle to initiate a change. One key assumption in our Monitoring Plan is that we would have sufficient time to adapt to urgent regulatory changes particularly with regard to reducing abstraction through the Environmental Destination.

Our Monitoring Plan will help us to determine the supply-demand future situation we are likely to be following. However, the strategic-level decision points do not necessarily map well to the planning, development, and construction lead times required for individual schemes. Therefore, we have developed bespoke scheme-level decision points and trigger thresholds that will enable us to determine the key decision point and trigger thresholds (in terms of supply-demand balance) at which we will need to begin development of a scheme.

Figure 7 illustrates the development of these trigger thresholds and decision points for a generic adaptive option.

The overall plot shows the area level supply-demand balance on the Y-axis. This is the overall driver of the need for a new water resource option. As an alternative to supply-demand balance, the Y-axis could also be replaced with the magnitude of sustainability reductions (licence change), the impact of climate change upon DO or increase in demand due to population growth or low impact of water efficiency measures, which all directly impact the supply-demand balance.

- The X-axis shows the change in supply-demand balance (or other drivers) through time.
- The plotted lines show the supply demand (or other drivers) pathways for each of the situations.
- Solid coloured lines show the supply-demand adaptive pathways (situations) for which a given scheme is required, as determined by the WRMP ‘best value’ investment modelling.

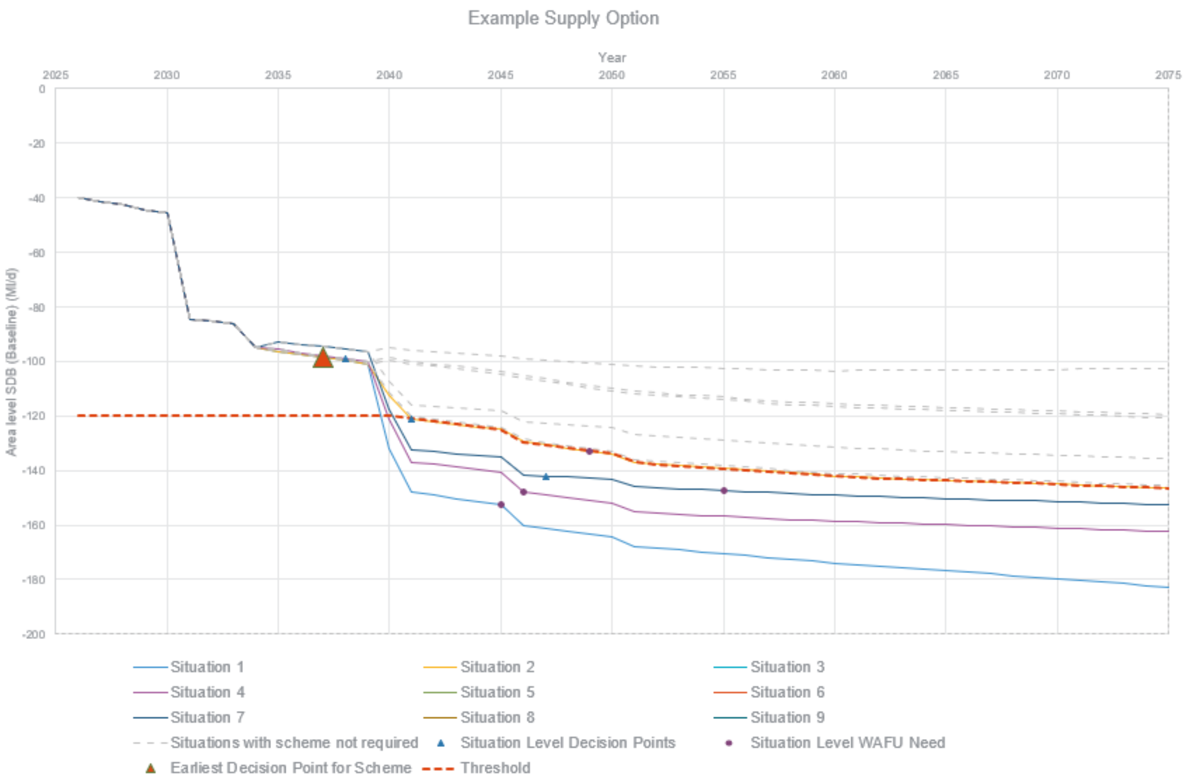


Figure 7: Area level supply-demand balance.

- Dashed grey lines show the supply-demand adaptive pathways (situations) for which a given scheme is not required, typically this is either because the supply-demand challenge is smaller or because an alternative suite of supply-demand schemes represents the best value solution.
- Purple coloured circles show the adaptation tipping points. These are the points at which, for a given adaptive pathway (situation), the specific scheme is required to be developed and in operation to contribute to meeting the overall supply-demand balance (i.e. in this case in 2045, 2046, 2049 or 2055).
- Blue triangles show the scheme-level decision points for a given adaptive pathway (situation). This represents the point at which, based on assumptions around scheme lead-in time for planning, development and construction, the latest point at which a 'go/no go' decision could be taken to ensure that the scheme is available when required to meet the supply-demand balance challenge (i.e. when the adaptation tipping point is crossed).
- The larger red triangle shows the earliest of those decision points and shows the earliest date at which a 'go/no go' decision for the scheme needs to be taken to ensure it is developed in time to meet the earliest supply-demand balance challenge. This point will be the key decision point in WRMP and business planning context to ensure that funding is available at this point to being delivery of the scheme if required.
- The dashed red 'threshold' line shows the trigger threshold that defines the need for the scheme through time, i.e. if the driver (supply-demand balance, climate, environmental or population growth) is either observed to or is predicted to cross this threshold at the time the decision point is reached then the scheme will be required. The scheme-level thresholds can either be defined as:
  - A constant value through time determined by the supply-demand balance at the earliest decision point.
  - A custom value through time, determined by consideration of the shape of the future adaptive pathways (situations) for which the scheme is required.
  - A time series showing a variable threshold through time. The example plot shows (Figure 8) this type of threshold with a fixed value early in the planning period, and then following the maximum value of one of the adaptive pathways for which the scheme is required.

- These threshold plots can be developed for each of the key adaptive planning options which are required under a subset of the future adaptive planning pathways and the decision points and trigger thresholds used to determine both a time and a trigger for which a given scheme is required. This will then enable schemes that require decision points or development to be started within planning cycles to be planned more efficiently than if decision points only relating to the planned adaptive pathway branches (in 2035 and 2040) were used.
- We will track the magnitude of the drivers (i.e. the solid-coloured lines) through our adaptive plan monitoring approach outlined above and report progress and forecasts through our WRMP annual review process. The decision points and trigger thresholds would also be formally revised at each new WRMP and Business Plan planning cycle.

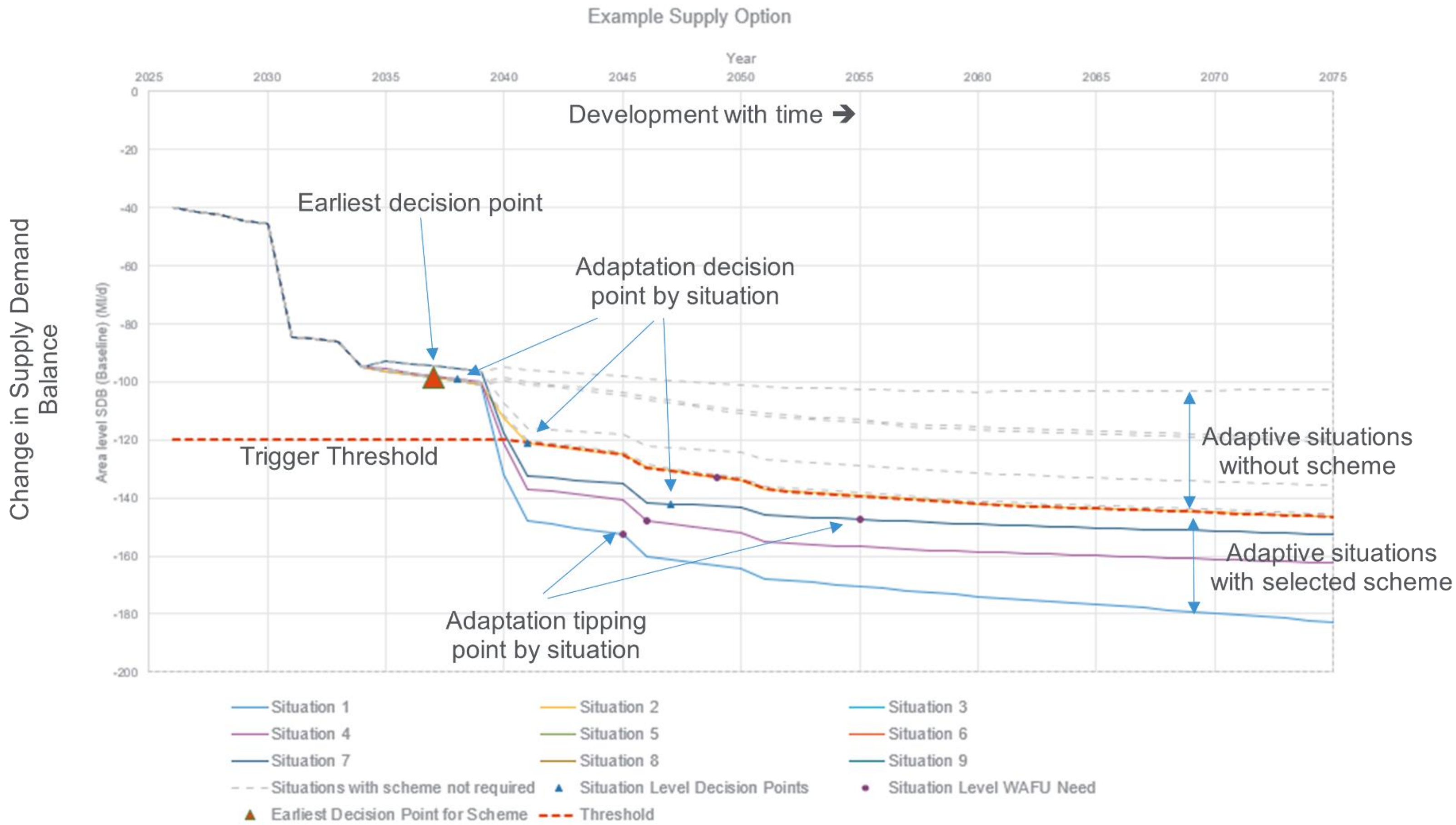


Figure 8: An example of adaptive planning decision-making trigger threshold plot.

4 Interface with Delivery and the Business Plan

4.1 General approach

The first ten years of our adaptive plan identifies the investment needed across all the pathways for both a 'least cost' and 'best value' planning approach. These 'no and low regret' options will need to be delivered regardless of which longer term future adaptive situation we eventually end up following.

The first five years of the plan will also include any preparatory work for options that we expect could be needed in future years even if they are ultimately not developed further due to the trajectory we eventually follow through the adaptive plan. Doing so will reduce overall risk for options that are delivered over long timescales.

The principles of adaptive planning for water resources underpin WRMP24 and the LTDS; they are being embedded within the company's processes and decision-making and are reflected in our Business Plan. These processes have enabled a better understanding at the corporate level of how future decisions, using evidence-based thresholds and triggers, allow us to move between pathways should challenges materialise. Adaptive planning options which are not currently in our core plan still need to be developed to take account of lead in times and uncertainties in relation to demand, climate change and Environmental Destination. We will continue to plan and develop alternative options to retain the adaptive options up to decision points. This approach is supported by Ofwat guidance on LTDS[19].

Our Monitoring Plan includes annual updates of our proposed metrics to allow them to be considered and reported on within our WRMP annual review. The thresholds and trigger points we have included are embedded within our WRMP annual review and feed into WRSE monitoring, taking into account the completion of our WINEP investigations for establishing the Environmental Destination and the planning cycle for our WRMP and Business Plan.

If an adaptive threshold is met in the period between planning cycles, we have allowed sufficient time to take action to develop the solution that would allow us to progress that scheme without waiting for the next planning cycle.

Given the need to verify the evidence base for demand management, we are only considering bringing forward or enhancing supply options at this stage. If we find that the elasticity of demand management is higher than estimated and would enable us to achieve more savings than our current targets, we will also consider bringing forward demand management or leakage options where possible.

Ofwat allows enhancement funding in cases where preparatory or development work is needed to start work on schemes even where there is still uncertainty of need[20]. This will be where investment may be necessary for preparatory work, such as pre-planning application activities and investigations or part-delivery of the scheme, in advance of an adaptive pathway being triggered. Preparatory investment would be over and above normal option investigation, development, and appraisal activity, which is expected to be covered through base expenditure allowances.

[19] Ofwat 2022. PR24 and beyond: Final guidance on long-term delivery strategies
[20] PR24_final_methodology_Appendix_9_Setting_Expenditure_Allowances.pdf (ofwat.gov.uk)

Our annual review of monitoring indicators (see Table 8) will enable us to understand whether we are deviating from the forecast, and whether this is affecting target headroom in WRZs. If these deviations are not compensated by other components, we would take action to implement adaptive options, either on the demand or the supply-side, depending on the scale, scope and timing of the forecast shortfall.

4.2 Risk management

A secure supply of water is essential and relies on a healthy and resilient environment. Central to achieving this outcome is to ensure the WRMP is deliverable and can manage future risks and uncertainties. Given the importance of maintaining a secure supply of water to our customers, we take the management of risk and uncertainty very seriously.

Our approach to risk management as part of the WRMP is embedded within our company-wide approach to risk, as stipulated in the WRPG on adaptive planning. Risk management is a core component of our governance and internal control framework, and is integrated within all areas of the business, enabling risks to be escalated to the appropriate level. Our risk and value (R&V) process is designed with the intention of delivering the best value in the way we invest in, build and run our assets, with six checkpoints that act as technical milestones to support investment decision points.

This section sets out our process for risk identification and the actions envisaged to manage risks to supply-demand balance in the short-term (through implementation of contingency options prior to 2029-30) and medium to long-term.

4.2.1 Identifying risks to our plan

As part of the design of our plan, we undertook stress testing and sensitivity analysis to help us to identify and understand the assumptions and factors that have the greatest influence on the plan, potential risks, key decision points, and range of potential alternative options, and thus ensure that the plan is robust under a wide range of uncertainties. The purpose of sensitivity testing is twofold:

- To ensure the plan is as robust as possible in the face of uncertainties. This provides confidence in the portfolio of schemes selected;
- To understand the range of potential alternative options if preferred options cannot be implemented for whatever reason. This may require feasibility studies, investigations or planning activity to be carried out in parallel to the main portfolio of options in the strategy.

As part of our sensitivity analysis, we examined uncertainties around particular demand or supply options; bulk supplies, sustainability assumptions, and policy assumptions. We also considered specific scenarios which were requested by the Environment Agency in their representation to our interim dWRMP24. An overview of the risks considered as part of sensitivity testing are outlined below. Detailed outputs from sensitivity tests are covered in our main rdWRMP24 Technical Report.

The main themes considered as part of the sensitivity testing were:

- **Demand-side options**: If demand management benefits are less than expected.
- **Environmental Destination:** More ambitious sustainability reduction levels, and/or deployed earlier than forecast (considering both a single source and a combination of sources).
- **Supply schemes**: Delays, reductions, or exclusion of a single or a combination of supply schemes.
- **Bulk transfers**: Reduction or exclusion of specific bulk transfer schemes.

The results fall into three main categories.

1. **Changes that resolve supply-demand balance through an alternative solution**. These include:

   - Delaying first year of benefit from Sandown recycling option to 2034-35 from 2030-31
   - Delaying first year of benefit from Sandown recycling option and the 21Ml/d bulk import from Portsmouth Water (linked to development of Havant Thicket Reservoir) to Itchen WSW to 2034-35 from 2030-31

- Maintaining bulk import from SES Water through rezoning of customers to 1.3Ml/d instead of 4Ml/d and not delivering Petersfield and West Chiltington groundwater options in SNZ
- Reducing bulk import from Portsmouth Water to Pulborough WSW from 15Ml/d to 10Ml/d in SNZ under all planning scenarios
- Reducing bulk import from Portsmouth Water to Pulborough WSW from 15Ml/d to 5Ml/d in SNZ under all planning scenarios
- Bringing forward implementation of Environmental Destination in SWZ to 2030-31
- Reducing Pulborough groundwater DO in SNZ from 13Ml/d to 5.55Ml/d from 2025 followed by full revocation from 2030-31
- Maintaining bulk import from SES Water through rezoning of customers to 1.3Ml/d instead of 4Ml/d and reducing bulk import from Portsmouth Water to Pulborough WSW from 15Ml/d to 10Ml/d under all planning scenarios in SNZ
- Maintaining bulk import from SES Water through rezoning of customers to 1.3Ml/d instead of 4Ml/d and reducing bulk import from Portsmouth Water to Pulborough WSW from 15Ml/d to 5Ml/d under all planning scenarios in SNZ

2. **Changes that result in supply-demand balance deficits that are either too small and/or appear post 2050 allowing sufficient time to be resolved.** These are:
   - Reducing benefit from Littlehampton recycling option to 12.5Ml/d from 15Ml/d and excluding Petworth groundwater option in SNZ
   - Reducing benefit from Littlehampton recycling option to 12.5Ml/d from 15Ml/d and excluding Petworth groundwater option in SNZ
   - Maintaining bulk import from SES Water through rezoning of customers to 1.3Ml/d instead of 4Ml/d; not delivering Petersfield and West Chiltington groundwater options and removal of River Adur Offline Reservoir in SNZ
   - Maintaining bulk import from SES Water through rezoning of customers to 1.3Ml/d instead of 4Ml/d; not delivering Petersfield and West Chiltington groundwater options in SNZ and removal of Isle of Sheppey desalination option in KME
   - Maintaining bulk import from SES Water through rezoning of customers to 1.3Ml/d instead of 4Ml/d; not delivering Petersfield and West Chiltington groundwater options in SNZ and removal of Thames Estuary and River Medway desalination options in KMW
   - Maintaining bulk import from SES Water through rezoning of customers to 1.3Ml/d instead of 4Ml/d; not delivering Petersfield and West Chiltington groundwater options in SNZ and removal of East Thanet desalination option in KTZ
3. **Changes that result in supply-demand balance deficits that are either too big to be resolved with existing options and/or appear early in the planning period allowing insufficient time for alternatives to be developed**. These are:
   - Early implementation of Common Standards Monitoring Guideline (CSMG) on the River Itchen
   - Early implementation of stricter Hands-Off Flow (HoF) conditions on the River Itchen
   - Delaying first year of benefit from HWTWRP to 2039-40 from 2034-35
   - Reducing DO benefit from River Medway recycling option to 10Ml/d from 14Ml/d
   - Removal of River Medway recycling option
   - Delaying first year of benefit from the Sittingbourne recycling option to 2034-35 from 2030-31
   - Removal of Sittingbourne recycling option
   - 25% lower savings from company demand-management initiatives

4.2.2 Short-term mitigation: contingency options

In the short-term (prior to 2030), annual monitoring based on the Monitoring Plan components and thresholds/ triggers identified in Table 8 and Table 9 will enable us to determine whether action is needed to address some of the risks we have identified, and their scale (timing and location).

To mitigate these potential risks, we have identified a list of contingency options which may be deployed at any time in the short-term if our Monitoring Plan shows that action is needed to resolve supply-demand balance[21]. The trigger for us decide to progress short-term contingency options is based on forecast target headroom in each WRZ as described in Section 3.2.

The high-level contingency options are presented by WRZ in Appendix A. The estimated scale of benefit is taken from WRMP options, or headroom on licence abstraction within the recent actual and growth factors for 2030 to reduce risk of No Deterioration.

The more exact scale of benefit will need to be confirmed during option development and feasibility review in terms of the assessment of environmental impact, water resource benefit, regulatory requirements, and consideration of deliverability/planning issues.

Complexity to deliver is presented based on:

- Low – Expected standard complexity and risk
- Medium – Higher than usual risk and complexity
- High – Very high level of uncertainty and risk

Estimated expense is presented based on:

- Low: £100k to £1m
- High: >£1m to £10m
- Very high: >£10m

We have followed the following process to identify short-term contingency options:

1. **A formal review of short-term contingency options already in the plan that could be implemented or brought forward.** The option chosen will depend on the size and location of the supply-demand deficit, as well as its timing (e.g. during a drought period). We will inform regulators if any of the schemes are likely to be triggered, in order to discuss requirements for environmental assessments as an initial screening to the likely acceptability of the scheme. The type and scope of the environmental assessment required will vary from option to option and may involve consultation with several regulators and other stakeholders. This will be done through direct liaison and any changes included in the WRMP annual review.
2. **If these short-term mitigation options are not possible or insufficient**: We would define a process to identify alternative options that might have previously been rejected and bring those into the plan (see Annex 12 to the main rdWRMP24 Technical Report). Selection criteria include DO benefit, timeliness, WRZ, cost-benefit analysis, and risks associated with the proposed option. Timeliness includes a consideration of where in the planning cycle the change is identified, i.e. is there sufficient time to undertake options appraisal and get the alternative schemes into the next WRMP/regional plan/business plan, or if it needs to be brought into the annual review? As part of the selection process, we would reflect on the significance of change to the plan, and review if a change is material enough that further consultation is required.
3. **If no feasible short-term options are identified**, we would have to consider a greater level of risks to the supply-demand balance, which may lead to some of the following consequences:
    a. delays to licence changes as envisaged in our Environmental Destination;
    b. greater risk of drought orders/ permits;

[21] In addition to this, Annex 20 includes a list of short-term resilience options submitted as part of rdWRMP24, which have primarily focussed on the Western area (Hampshire and the Isle of Wight). These are planned for progression as part of our rdWRMP24 to improve the resilience of our plan in the Western area, with benefits available from 2030 onwards.

c. reductions in the level of service to our customers, including more reliance on Temporary Use Bans than our target.

The most appropriate course of action would need to be discussed and agreed with regulators and relevant stakeholders.

4.2.3 Medium-term: identifying and selecting adaptive options

In the medium-term (5-10 years), we will be progressing the options identified in our preferred plan ('No and low regret' options). These options are required under every potential future scenario. There is no or low regret in undertaking their development and construction, because they will be required regardless of the adaptive pathway. Typically, these options are implemented in the first 10 years of the plan, when there is greater certainty about demand driven by population growth.

To manage risks, we have identified key alternative or adaptive options that we may need to investigate in parallel with the preferred plan. These include the following types of options:

- Schemes that are currently planned for later in our plan but can be brought forward or enhanced. This would include:
  - bringing new supply options forward, taking into account lead in time for delivery; and
  - planning for different capacities of supply options to be brought forward at different times, e.g. for modular options such as water recycling or desalination.
- 'Adaptive' options: At the regional level, sensitivity testing was carried out to identify two types of adaptive options:
  - schemes that have been identified either in an alternative situation of the preferred regional plan (adaptive options for uncertainty), or
  - in Situation 4 of an alternative 'what if' plan (scenario adaptive options). Figure 9 and Table 11.

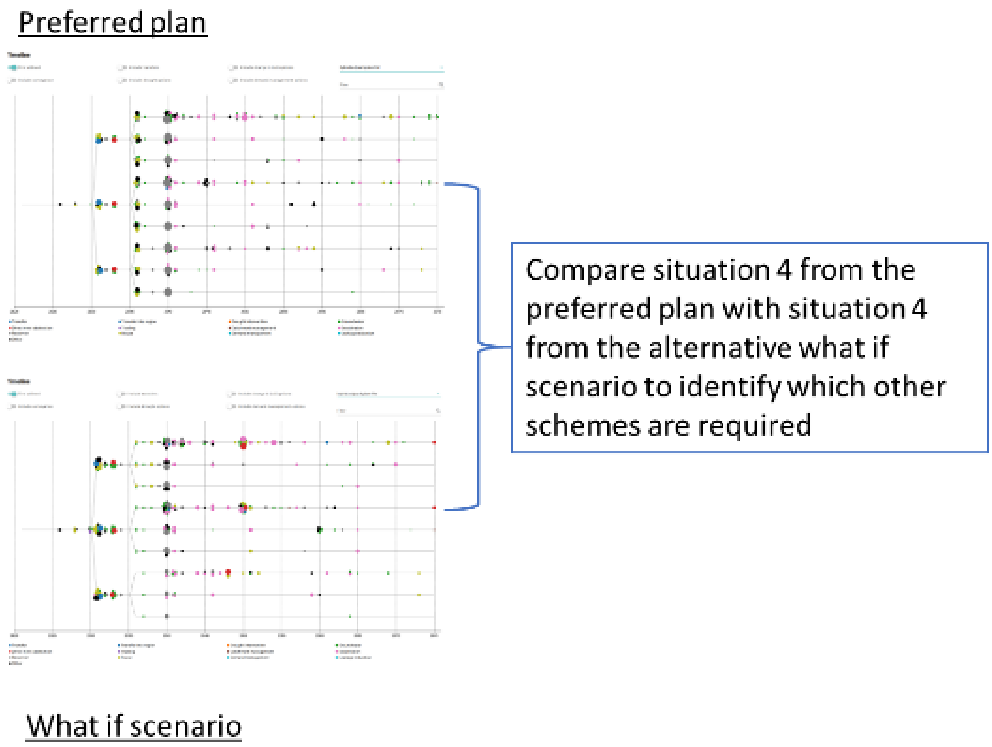


Figure 9: Identifying adaptive options based on uncertainty (by comparing two different situations in the preferred regional plan - top) and scenarios (by comparing Situation 4 of the preferred regional plan with Situation 4 of a 'what if' scenario - bottom).

Table 11 outlines the 'what if' scenarios that were considered against the preferred regional plan, to identify scenario adaptive options. There are several types of 'what if' scenarios considered:

- **Scenarios with varying demand management profiles (Scenario 1-4 and 11)**. These differ from the demand management profile of the preferred regional plan which is C+ (Low government savings from 2025; medium from 2030 and high from 2035, full cumulative benefits by 2050). More information on demand management scenarios is available in Annex 14.
- Scenarios excluding or modifying key regional **schemes (Scenario 5-10 and 12-13)** and with varying demand management profiles.

Table 11: 'What if' scenarios considered by WRSE against the preferred regional plan to determine scenario adaptive options.

'What if' scenario number and name	Description
1. st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybrida-2075	Regional Least Cost Plan (RLCP) with hybrid-a government interventions (influencing demand management: low until 2040 and medium from 2060). Full cumulative benefits by 2075.
2. st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridb-2075	RLCP with hybrid-b government interventions (influencing demand management: Low until 2040 and medium from 2060 and high from 2080). Full cumulative benefits by 2095.
3. st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridc-2075	RLCP with hybrid-c government interventions (influencing demand management: Low until 2040 and medium from 2050 and high from 2060). Full cumulative benefits by 2075.
4. st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridd-2075	RLCP with hybrid-d government interventions (influencing demand management: Low from 2025; medium by 2040; high by 2075). Full cumulative benefits by 2090.
5. st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-excl-sesro-2075-bvp-05_00-v2	Regional Best Value Plan (RBVP) with hybrid-c+2 government interventions excluding South East Strategic Reservoir Option (SESRO).
6. st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-excl-sesro-excl-stt-2075	RLCP with hybrid-c+2 government interventions excluding SESRO and Severn Trent to Thames Transfer (STT).
7. st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-excl-sesro-excl-stt-minworth-2075	RLCP with hybrid-c+2 government interventions excluding SESRO and STT Minworth diversion.
8. st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-excl-sesro-excl-vyrnwy-2075	RLCP with hybrid-c+2 government interventions excluding SESRO. Exclude Vyrnwy STT support options.
9. st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-excl-ted-dra-2075	RLCP with hybrid-c+2 government interventions excluding Teddington DRA.
10. st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-excl-wbgws-2050-2075	RLCP with hybrid-c+2 government interventions excluding West Berkshire Groundwater Schemes from 2050 onwards.
11. st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-low-dmp-sew-med-gov-led-2075	RLCP with hybrid-c+2 government interventions including only low demand management options (except PRT which uses medium) but medium government led C+2 for SEW.
12. st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridcp2-only-sesro150-2075-bvp-07_50-v2	BVP run with hybrid-c+2 government interventions including only SESRO 150Mm3.
13. st-hybrid-dy-w1-tree16.05-options-v61-gov-led-hybridh-large-sws-prt-transfer-v4-only-sesro150-2075	RLCP with hybrid-h government interventions with increased capacity of Thames to Southern Transfer (T2S) transfer to 200Ml/d and increased Itchen WSW to Portsmouth Water transfer to 95Ml/d. Extend River Test and Candover drought permits to 2040.

The result of this analysis at the regional level has identified the schemes set out in Table 12 below as adaptive options. It should be noted that the adaptive options identified in the table below look out as far as 2040 i.e. those schemes that need to have their development started in the first 15 years of the plan.

The next regional plan will be published in December 2027, and therefore many of the schemes will be reviewed, but it is important to ensure that adaptive and preferred options continued to be developed. The dates in Table 12 below represent when the earliest point when development (not construction) of the scheme needs to begin, as well as the situations/'what if' scenarios when they have been selected. Demand options are not included in Table 12 due to lead in time being less of a constraint, but will also be considered as part of options to remedy the forecast target headroom in a given WRZ.

Table 12: Adaptive options (uncertainty and scenario-based) identified at the regional level that are selected before 2040 which could be brought forward or enhanced to manage risks.

Note: this table does not include options that are selected in the preferred plan and which will be progressed over the course of AMP8.

Type of supply option	Adaptive options for SWS (uncertainty and scenario-based)	Earliest decision year (preferred plan)	Earliest decision year (sensitivity.)	Supply-demand balance situation in the RBVP									Situations 4 of 'what if scenarios'												
				BVP Sit 1	BVP Sit 2	BVP Sit 3	BVP Sit 4 (core)	BVP Sit 5	BVP Sit 6	BVP Sit 7	BVP Sit 8	BVP Sit 9	Scenario. 1	Scenario. 2	Scenario. 3	Scenario.4	Scenario. 5	Scenario.6	Scenario.7	Scenario.8	Scenario.9	Scenario.10	Scenario. 11	Scenario. 12	Scenario. 13
Bulk transfers within region (raw)	Bulk export (SNZ): Pulborough to Havant Thicket (20Ml/d)	n/a	2035																						
Bulk transfers within region (raw)	Bulk export (SNZ): Pulborough to Havant Thicket (50Ml/d)	2036	2035																						
Bulk transfers within region (raw)	Bulk import (SNZ): Havant Thicket to Pulborough (20Ml/d)	n/a	2035																						
Bulk transfers within region (raw)	Bulk import (SNZ): Havant Thicket to Pulborough (50Ml/d)	2036	2035																						
Bulk transfers within region (treated)	Bulk import (HAZ): Andover spur from T2ST to Micheldever - potable (20Ml/d)	2053	2032																						
Bulk transfers within region (treated)	Bulk import (SNZ): SEW (RZ5) to Pulborough (10Ml/d)	2035	2036																						
Bulk transfers within region (treated)	Interzonal transfer (HSW-HSE): Woodside transfer valve bi-directional (10Ml/d)	n/a	2040																						
Bulk transfers within region (treated)	Interzonal transfer (HSW-IOW): Triplicate cross-Solent main bi-directional (8Ml/d)	n/a	2026																						
Bulk transfers within region (treated)	Interzonal transfer (KME-KTZ): KME-KTZ bi-directional (15.8Ml/d)	n/a	2038																						
Bulk transfers within region (treated)	Interzonal transfer (SNZ-SWZ): Pulborough to Tenants Hill (60Ml/d)	n/a	2035																						
Conjunctive use operation of sources	Conjunctive use benefit (HSE): Portsmouth Harbour and Havant Thicket 20Ml/d	2031	2036																						
Desalination	Desalination (KME): Isle of Sheppey (20Ml/d)	2031	2030																						
Desalination	Desalination (KMW): Thames Estuary (10Ml/d)	n/a	2036																						

Type of supply option	Adaptive options for SWS (uncertainty and scenario-based)	Earliest decision year (preferred plan)	Earliest decision year (sensitivity.)	Supply-demand balance situation in the RBVP									Situations 4 of 'what if scenarios'												
				BVP Sit 1	BVP Sit 2	BVP Sit 3	BVP Sit 4 (core)	BVP Sit 5	BVP Sit 6	BVP Sit 7	BVP Sit 8	BVP Sit 9	Scenario. 1	Scenario. 2	Scenario. 3	Scenario.4	Scenario. 5	Scenario.6	Scenario.7	Scenario.8	Scenario.9	Scenario.10	Scenario. 11	Scenario. 12	Scenario. 13
Desalination	Desalination (KMW): Thames Estuary (10Ml/d) Phase 2	n/a	2038																						
Desalination	Desalination (KMW): Thames Estuary (20Ml/d) Phase 2	2037	2038																						
Desalination	Desalination (KTZ): East Thanet (20Ml/d)	2031	2036																						
Desalination	Desalination (SWZ): Tidal River Arun (20Ml/d)	n/a	2031																						
Groundwater	Groundwater (SHZ): Reconfigure Rye Wells (1.5Ml/d)	2031	2026																						
Increase water treatment works capacity	Treatment capacity (T2ST): New treatment works at SESRO and/or STT	2033	2031																						
New reservoir	Storage (SNZ): River Adur Offline Reservoir (19.5Ml/d)	2030	2029																						
New reservoir	Western Rother licence and storage programme	2036	2037																						
Potential Transfer Resource (Raw)	Bulk export resource (PWE): Havant Thicket	2031	2036																						
Reclaimed water, water re-use, effluent re-use	Recycling (HSE): Recharge of Havant Thicket reservoir from Portsmouth Harbour (20Ml/d)	2056	2036																						
Reclaimed water, water re-use, effluent re-use	Recycling (SHZ): Hastings conjunctive use with Darwell (15.3Ml/d)	2045	2030																						
Reclaimed water, water re-use, effluent re-use	Recycling (SHZ): Tonbridge to Bewl Reservoir (5.7Ml/d)	n/a	2032																						
Reclaimed water, water re-use, effluent re-use	Recycling (SHZ): Tunbridge Wells conjunctive use with Bewl (3.6Ml/d)	n/a	2030																						
Reclaimed water, water re-use, effluent re-use	Recycling (SNZ): Horsham conjunctive use with Storage at Pulborough (11.5Ml/d)	2057	2030																						

Appendix A: Short-term Contingency Options

WRZ	Type	Location	Option	Estimated DO Benefit (Ml/d)	Lead Time (Years)	Complexity to Deliver	Est. Expense	Comments / Key risks
SNZ	Production	Pulborough	The site runs at 75Ml/d with a potential additional 10Ml/d available from the tidal River Arun abstraction. The treatment on site is adequate for treating the current and additional flow. However, 2.5Ml/d lost as washwater is returned to the river rather than to the head of the works. The reason for the loss of the water is due to poorly functioning filter presses and the acrylamide content of the concentrate. Once the out of service filter presses are repaired, this will allow water to be returned to the head of the works along with the settled supernatant rather than being discharged to the river. Repairing or replacing these presses would enable the sludge to be thickened to a much higher concentration, allowing the filtrate to be returned to the process.	2.5	2	Medium	Very high	Will require further option investigation. Under the drought scenarios covered by WRMP24, it is unlikely that this WSW would be running. Therefore, this scheme would not provide additional water in a drought. However, it could provide water under NYAA conditions.
SNZ	Production	Pulborough	Hythe Beds Managed Aquifer Recharge (MAR) investigation into the potential for abstraction from the underlying Hythe Beds aquifer either to be used: - New point of abstraction - Direct to treatment - For blending with storage at Pulborough/Arun water - For MAR for summer abstractions only - Recharge licence required to be negotiated - Will require extension of No Deterioration investigations if not covered by current scope.	4-5	Direct use 3 MAR 6	Medium to High	High to Very high	The re-application for BH10 licence – in Greensand 2-5Ml/d usage constraint driven by Natural England, undergoing investigations for Site of Specific Scientific Interest (SSSI) and snail – observation boreholes in place for this. Hythe Beds Aquifer Storage and Recovery (ASR) (5Ml/d) was rejected as an option in WRMP19as 'ASR is theoretically possible for the area, but the Pulborough basin would be very high risk due to interactions with shallow aquifers and surface waters. The uncertainties over yield, environmental impacts and engineering deliverability add to the complexity and lead in time of the MAR option.
SWZ	Resource	East Worthing	The site is currently running at 6Ml/d and has a licence of 7Ml/d. It is believed that the lower flow from East Worthing is due to a throttled valve as any increase in flow above 6Ml/d leads to an increase in turbidity which cannot be treated with the processes that are currently on site. It will therefore need bespoke turbidity removal treatment for the full 7Ml/d. Investigation required to understand water availability during droughts.	1	2	High	High	Apparent demand and treatment constraints. Recent testing was not able to yield 7Ml/d but has done historically. Ultra Violet (UV) treatment may require upgrading. Will require further option investigation as may not be able to provide additional water in a drought. The water quality issues that may come from increasing the flow at the site means that there is a great deal of uncertainty as to the potential benefit from the site. Turbidity is known to be an issue as the flow increases. However, given the presence of industrial pollution within the raw water, it is likely that increasing the flow would also lead to a deterioration of the water quality with respect to hydrocarbon contamination
SWZ	Resource	North Worthing Road	This is currently running at 7.2Ml/d, which is an increase over the historic output of 6Ml/d. The increase in flow was due to valving restrictions being rectified. The site has a licence of 11.4Ml/d, so an additional 4.2Ml/d is theoretically feasible. Disinfection unit restricts additional DO to 1.8 Ml/d. Changing the UV would allow for 4.2 Ml/d. It is not known whether the increased flow would result in water quality issues and whether the network would be able to cope with the additional water and any modifications that would need to be made. Additional investigations are needed to understand these potential constraints.	4.2	5	High	High	Need to confirm process constraint. Will require further option investigation as there are a large number of uncertainties with increasing the flow at this site, in terms of water quality and network capacity. There are a large number of uncertainties with increasing the flow at this site, in terms of water quality and network capacity. Continuing the current programme of incremental enhancements would be required before decisions can be made about further increase of the site output, and that would mean a longer timeframe for implementation.

WRZ	Type	Location	Option	Estimated DO Benefit (Ml/d)	Lead Time (Years)	Complexity to Deliver	Est. Expense	Comments / Key risks
SWZ	Resource	Littlehampton	The output of the site can be increased from 3Ml/d to 4Ml/d by increasing the size of the pumps. These should be capable of achieving 4Ml/d (each of the two boreholes has a pump nominally capable of achieving 2Ml/d). However, this has not been achieved for nearly 20 years. There are turbidity issues which are expected to increase as more water is abstracted from the ground. However, the filters on site were designed to treat 4Ml/d. It may not be able to provide additional water in a drought - more investigations needed.	1	2	Medium	High	This scheme is already being taken forward by the Southern Water operations team. However, it is believed that the pump size is not the flow constraint for this site; it is the lack of water in the borehole which is preventing the site from reaching its output. This is likely to be worse during drought conditions, so there is a need to determine whether any additional DO is expected and under which conditions.
SWZ	Resource	Worthing	Reinstatement of Sussex coast Lower Greensand ASR scheme previously removed due to land availability issues.	2-4	7	High	High	High lead in time due to the complexity of this scheme , the need to identify a suitable site, and undertake several cycles of testing.
SWZ	Network	Steyning	The current flow through the works is 1.8Ml/d, with the licence being 2.5Ml/d. The disinfection is sized for 5.9Ml/d. There are two boreholes with one pump in each, capable of producing 1.4Ml/d and 1.8Ml/d. These act as duty/standby, so new pumps would be required for an increase in flow. There are concerns over the nitrate levels at Steyning, although catchment management is currently considered a viable option. The main issue with this site is the demand constraint and a network solution is required to move the additional water.	0.7	tbc	Medium	High	This site is demand constrained so even if capacity is increased there is presently insufficient demand or network capacity to utilise this additional DO and therefore it would need to be delivered in concert with additional network enhancement.
SWZ	Network	Long Furlong A	The licence for the site is 4.5Ml/d but the site currently runs at 2.7Ml/d. There is one pump which can do a maximum of 3.3Ml/d and turbidity is an issue when the site output exceeds 2.7Ml/d, particularly within the winter period, when water quality is impacted by recharge. Filtration would be required to deal with the additional turbidity. However, there is a further concern with the capacity of the network. The site is unable to push more water into the local network, so changes to the distribution system would be required.	1.8	tbc	Medium	High	This site is demand constrained so even if capacity is increased there is presently insufficient demand or network capacity to utilise this additional DO and therefore it would need to be delivered in concert with additional network enhancement. Potential WFD ‘No Deterioration’/Licence Capping risk.
HAZ	Production	Chilbolton WSW	Returning Chilbolton to service – option requires new contact tank and new treatment and blending with Andover water to deal with the nitrate issue. The WSW is currently out of service. It has a nitrate issue, which could be mitigated through blending with Andover water.	0.5	3	High	High	This was examined as part of our WRMP24 resilience options for the Western Area but excluded because it was supplying the Andover WRZ rather than directly to HSE or HSW, which is where the need was. However, it can be kept as a contingency option for the Andover WRZ. This scheme is selected in WRMP24 in the 2070s.
HAZ	Network	Near Whitchurch	Rezoning of local network to allow additional abstraction for this source.	1	2	High	High to Very high	The source is currently under-utilised due to demand constraint. Complexity of solution to remove network restrictions unknown. WFD ‘No Deterioration’/Licence capping risks.
HSW	Resource	Test	Bring forward Test MAR scheme. Groundwater abstraction from the locally confined chalk aquifer below Test WSW during critical lower river flow periods. Existing distribution and treatment infrastructure is already in place.	5.5	6	High	Very high	A confined chalk MAR trial and feasibility scheme to initially investigate the aquifer potential for aquifer recharge. High uncertainty of scheme due to limited understanding of Chalk hydrogeology at this site. Close regulatory discussion and involvement will be required.

WRZ	Type	Location	Option	Estimated DO Benefit (Ml/d)	Lead Time (Years)	Complexity to Deliver	Est. Expense	Comments / Key risks
IOW	Resource	Newchurch / Sandown	There are currently 2 greensand boreholes running at 2Ml/d plus a chalk well at 6Ml/d. The greensand cannot run without chalk due to arsenic concerns, although there is aeration and filtration treatment in place for this. The aim of this scheme is provision of a new borehole and pump to increase yield from the greensand groundwater source. The existing treatment process would need enhancement with sand filters to accommodate this additional water and provide a DO benefit of 2Ml/d.	2	6	Medium	Medium	There are environmental concerns over drilling a new borehole due to the impact of removing more water from the environment. There is also a rick that a new borehole would impact the existing abstractions in terms of both quality and quantity. Surveying work would be required, which would cause a delay to the implementation of the scheme. Additionally, increasing the greensand proportion of the water has a known quality risk due to the amount of dissolved metals. A major treatment improvement would be required to enhance the removal of these substances, to ensure the water continued to meet the high standards required by the regulations.
KMW	Production	Near Rochester WSW	Near Rochester fed by Bewl. Option to provide support in peak demand periods.	10	2	High	High	There are process and hydraulics constraints. Site has ongoing works around replacing the high-lift pumps and HV control gear and new generator, surge vessel. AMP7 works to be complete for all 6 GACs and ozone and re-lift pumps working to achieve must be completed for option to be viable. Upgrade on the RGFs (concrete floor and nozzles) is also required.
KMW	Production	Longfield WSW	Install Amazon filters and carry out site modifications. Further work may be needed on duty/assist pumps.	3	1	Medium	High	Temporary measures in treatment system in place to reduce outage; Currently running duty/assist. Site is constrained by Process (Amazons) limit to 5.2Ml/d and network restrictions.
KMW	Resource	Northfleet	Northfleet Chalk and Northfleet Lower Greensand (LGS) boreholes. 1. VSD to improve water on startups. Contact main resize and look at permanent amazon filters. 2. Investigate MAR option for Chalk abstraction to recharge LGS – improve any water quality issues.	2	2 (MAR: 6)	Medium to High	High to Very high	Chalk licence is 20Ml/d and averaging 7Ml/d. The size of the contact main/no permanent amazon filters would be the limitation to abstraction. Previous bacteria and crypto (2016) issues. Only 1 of the 2 boreholes operational since amazon filters only on borehole 2, cannot treat borehole 1. Greensand licence is 4Ml/d but sources not in use. Hydrocarbons previously identified in LGS make MAR a particularly high-risk option.
KMW	Resource	Reculver	Old Reculver test boreholes (confined Chalk - North Kent). Investigate for option for a new source	1	5	High	Very high	Test/investigation on wells near Sheppey, but concerns over water quality and yield. Benefit scale unclear and previous abstraction licence revoked. Full scoping required to confirm potential for option.
KMW	Resource	Meopham LGS	1) Return LGS into service; or 2) investigate use as storage from chalk borehole (MAR) and LGS at Meopham. this would need iron removal plant renewed and new pumps for two boreholes.	1.3	3 or 6	Medium to High	High to Very high	Greensand groundwater source borehole 3 (1.3Ml/d) is currently out of service. This option not supported by Operations and Water Asset Strategy teams due to disproportionate costs and requirement to operate the source continuously. However, the source is licensed.
KME	Resource	Newington	Sittingbourne aggregation optimisation. Bring back into service with treatment at site - Add VSD for start-up on boreholes to reduce turbidity issues on start-up - Treatment may need a new chlorinator - Contact tank replacement required Newington is predicted to get close to nitrate trigger levels, options will be required for treatment. Alternative option: Drill a new point of abstraction to achieve improved water quality and more sustainable yield	2	5	High	Very high	There are turbidity issues on start-up, associated with the poor condition of the well. The AMP6 solution includes an opportunity for Sustainable Urban Drainage Systems (SuDS) run to waste. Historically seen to be constrained by 7 days sustained maximum yield. Scale of benefit needs further evaluation although the source has a large abstraction licence.
KME	Production	Chatham West	Chatham aggregation optimisation. Chatham West used to be 4Ml/d now at 3Ml/d. Has recently experienced turbidity turning	1	2	High	Very high	Under-utilised abstraction licence (11Ml/d). Raw water quality deteriorates at high flow

WRZ	Type	Location	Option	Estimated DO Benefit (Ml/d)	Lead Time (Years)	Complexity to Deliver	Est. Expense	Comments / Key risks
			flow up and has VSD to get more water there. Treatment needed to remove turbidity. Maybe need new borehole drilled (1 well and 2 pumps in a building) or if no new borehole, provide additional amazon filters.					
KME	Resource	Capstone	Recommission LGS borehole. Bigger pump option on one of the 2 existing boreholes or MAR option. Investigate for use of Chalk winter water for storage in LGS.	1-3	Rec: 1 MAR: 6	High	Very high	LGS boreholes not in service. Capstone LGS – 3 Ml/d licence
KME	Resource / Network	Hartlip Hill WSW / Rainham Mark WBS	Sittingbourne aggregation optimisation. Use of unused abstraction headroom at Hartlip Hill and remove constraint at Rainham Mark water booster station (WBS) and/or treat Newington (raw water transferred to Hartlip Hill – about 2 miles).	2	3	High	Very high	5Ml/d demand on Wigmore currently derived from Near Rochester WSW. Energy betwork modifications and source improvements to increase demand on Hartlip Hill WSW which is current demand constrained. 7Ml/d licence for Hartlip Hill, averaging under 2Ml/d but can do 4Ml/d on 2 boreholes and pumps.
KME/ KTZ	Network and Production	Faversham4 WSW / Faversham3 WSW	Blending with Faversham3 and Faversham4 sources through network to allow optimised use of available water. Turbidity issues at Faversham3 have potential to limit capacity of scheme to less than 8Ml/d.	7	3	High	Very high	Separating the Faversham4 raw and treated flow, 13Ml/d treated into the Thanet zone and 1Ml/d raw to Eastling. Investigation required to determine why current restrictions on water distribution. No apparent abstraction licence issues. Potential need for manual interventions. Recommissioning main into Faversham4. New UV plant on Faversham3 leg. Refurbish golf club valve junction. Recommissioning Calcott Hill WBS (3 pump arrangement). Booster at Faversham4 work would need further work. Monitoring of recommissioned leg from Faversham3 and treatment. Interface or separate shut down system at Faversham4 for Faversham3 and would something need to be done to reduce turbidity on the Faversham3 abstraction to get more than 8Ml/d
KTZ	Resource	Manston2 WSW	Return site back into service. Needs new treatment – possibly GAC and modification in network – blend in KME reservoir. (licence is 14.8Ml/d)	5-10	3	High	Very high	Site out of service long term. Borehole pump installed to meet peak Deployable Output (PDO) and HLP changed in AMP5 regarding nitrate blending requirements. There is an old nitrate removal plant on site. Refurbishment work required to bring site back in service.
KTZ	Resource	Commercial non potable water supply	Alternate supply to bulk user. Commercial non potable water supply for their growing season replacing 1Ml/d of supply by drilling borehole for their use.	1	2	Medium	High	Currently a WRMP24 rejected option as in an area of high nitrate sources in Thanet that may require blending with lower nitrate water for potable use. This option was not progressed in enough detail for inclusion in WRMP24. Early consideration for WRMP29 Option could be considered early AMP8 but third-party interest in the scheme not confirmed. Treatment may be required.
KTZ	Resource	Eastry WSW	Option to investigate an old WSW as a new source. Investigate if works is still owned by Southern Water and if licence exists.	TBC	4	High	Very high	Site believed to be out of service since 1980, initially due to Kent coalfields operations. Saline dewatering waters leaking from a discharge pipeline over a long period of time. History of chlorine contamination associated with the mine working.
KTZ	Network	North Deal/West Langdon/ Kingsdown	Maximise abstraction licences by removing network constraint	2	2	High	Very high	Combined works output restricted by the network. Individual source DO close to licence rates, but combined flow potential exceeds network capacity

WATER for LIFE from Southern Water

Appendix B: Scheme Level Adaptive Planning Decision Making Plots

This section contains the scheme level decision points for 29 options we have identified as being true ‘adaptive’ options rather than low or no regret. To define this, we have considered:

- Any option not selected in all 9 adaptive planning branches, or ‘situations’.
- Any option where there is a greater than 5-year (one planning cycle) difference in option selection timing.

The table below summarises each of these 29 adaptive options including which situation they are selected in and the year of first selection.

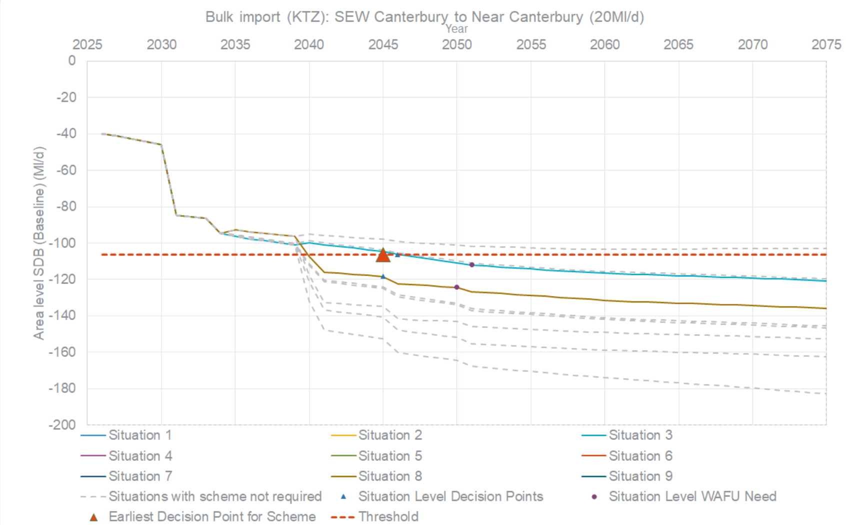
Supply option	Situation 1	Situation 2	Situation 3	Situation 4	Situation 5	Situation 6	Situation 7	Situation 8	Situation 9
Bulk import (KTZ): SEW Canterbury to Near Canterbury (20Ml/d)		2051						2050	
Bulk import (SNZ): Havant Thicket Reservoir to Pulborough (50Ml/d)	2040		2042	2041					
Bulk import (SNZ): Havant Thicket Reservoir to Pulborough (50Ml/d) Phase 2	2061		2056	2056					
Bulk import (HAZ): T2ST to Andover (20Ml/d)	2065			2048					
Bulk import (HKZ): T2ST to HKZ (5Ml/d)				2049					
Desalination (KTZ): East Thanet (20Ml/d)	2041		2070	2041					
Desalination (KTZ): East Thanet (20Ml/d) Phase 2	2051								
Desalination (KME): Isle of Sheppey (10Ml/d) Phase 2	2070			2065					
Desalination (KME): Isle of Sheppey (10Ml/d) Phase 2	2046			2046				2046	
Desalination (KMW) Thames estuary (10Ml/d)			2041						
Desalination (KMW): Thames Estuary (10Ml/d) Phase 2			2041						
Desalination (KMW) Thames estuary (20Ml/d)	2040			2040				2040	
Desalination (KMW): Thames Estuary (20Ml/d) Phase 2	2041			2040					
Desalination (SWZ): Tidal River Arun (10Ml/d)				2046					
Desalination (SWZ): Tidal River Arun (20Ml/d)	2041								
Desalination (SWZ): Tidal River Arun (20Ml/d) Phase 2	2050			2051					
Groundwater (SHZ): Reconfigure Rye Wells (1.5Ml/d)	2040		2040	2036				2041	
Groundwater (HSW): Test MAR (5.5Ml/d)	2036		2036	2036					
Recycling (SHZ): Hastings to Darwell (15.3Ml/d)	2057			2051					

Supply option	Situation 1	Situation 2	Situation 3	Situation 4	Situation 5	Situation 6	Situation 7	Situation 8	Situation 9
Recycling (SNZ): Horsham with storage at Pulborough (6.8Ml/d)	2063			2073					
Recycling (SHZ): Tonbridge to Bewl (5.7Ml/d)	2036		2036						
Interzonal transfer (SNZ-SWZ): Pulborough to Worthing (30Ml/d)	2040			2040					
Bulk import (SNZ): SEW RZ5 to Pulborough (10Ml/d)	2041			2040				2040	
Interzonal transfer (KME-KTZ): Utilise full existing transfer capacity (9Ml/d)	2050			2040					
Interzonal transfer (SWZ-SBZ): Pulborough winter transfer stage 2 (4Ml/d)	2041			2051					
Interzonal transfer (SBZ-SWZ): Brighton to Worthing	2041			2074					
Storage (SHZ): Raising Bewl Reservoir 0.4m (3Ml/d)	2068			2061					
Storage (SNZ): River Adur Offline Reservoir (19.5Ml/d)	2041		2070	2041					
Treatment capacity (SWZ): Pulborough winter transfer stage 1 (2Ml/d)	2046			2041					

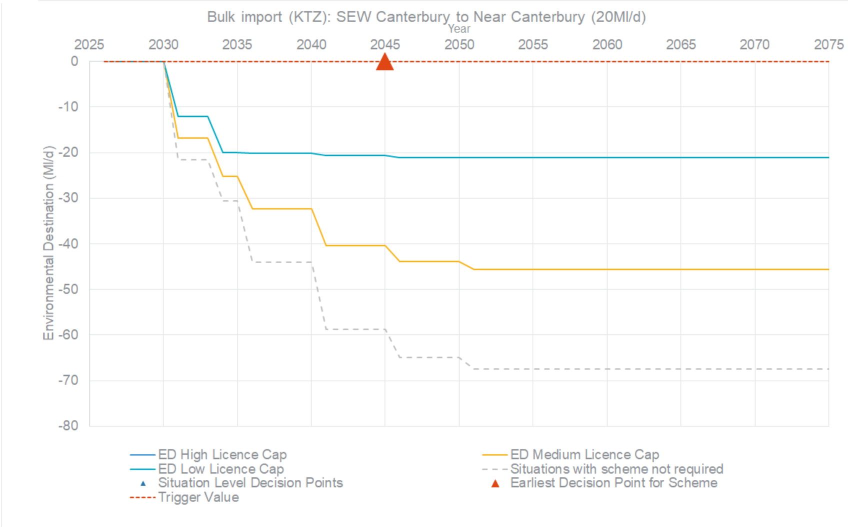
For each of the adaptive schemes the determined decision point and supply demand balance threshold at which the scheme should be triggered is summarised in the table below.

Supply option	Earliest decision	Supply Demand Balance Trigger (Ml/d)
Bulk import (KTZ): SEW Canterbury to Near Canterbury (20Ml/d)	2050	-106.3
Bulk import (SNZ): Havant Thicket Reservoir to Pulborough (50Ml/d)	2040	-52.9
Bulk import (SNZ): Havant Thicket Reservoir to Pulborough (50Ml/d) Phase 2	2056	-98.8
Bulk import (HAZ): T2ST to Andover (20Ml/d)	2048	-146.9
Bulk import (HKZ): T2ST to HKZ (5Ml/d)	2049	-59.0
Desalination (KTZ): East Thanet (20Ml/d)	2041	-57.7
Desalination (KTZ): East Thanet (20Ml/d) Phase 2	2051	-140.5
Desalination (KME): Isle of Sheppey (10Ml/d) Phase 2	2065	-166.0
Desalination (KME): Isle of Sheppey (10Ml/d) Phase 2	2046	-44.9
Desalination (KMW) Thames estuary (10Ml/d)	2041	-52.9
Desalination (KMW): Thames Estuary (10Ml/d) Phase 2	2041	-61.3
Desalination (KMW) Thames estuary (20Ml/d)	2040	-50.9
Desalination (KMW): Thames Estuary (20Ml/d) Phase 2	2040	-59.0
Desalination (SWZ): Tidal River Arun (10Ml/d)	2046	-57.7
Desalination (SWZ): Tidal River Arun (20Ml/d)	2041	-58.7
Desalination (SWZ): Tidal River Arun (20Ml/d) Phase 2	2050	-123.0
Groundwater (SHZ): Reconfigure Rye Wells (1.5Ml/d)	2036	-44.9
Groundwater (HSW): Test MAR (5.5Ml/d)	2036	-19.5
Recycling (SHZ): Hastings to Darwell (15.3Ml/d)	2051	-121.5
Recycling (SNZ): Horsham with storage at Pulborough (6.8Ml/d)	2063	-165.8
Recycling (SHZ): Tonbridge to Bewl (5.7Ml/d)	2036	-25.2
Interzonal transfer (SNZ-SWZ): Pulborough to Worthing (30Ml/d)	2040	-52.0
Bulk import (SNZ): SEW RZ5 to Pulborough (10Ml/d)	2040	-92.6
Interzonal transfer (KME-KTZ): Utilise full existing transfer capacity (9Ml/d)	2040	-60.2
Interzonal transfer (SWZ-SBZ): Pulborough winter transfer stage 2 (4Ml/d)	2041	-52.9
Interzonal transfer (SBZ-SWZ): Brighton to Worthing	2041	-58.7
Storage (SHZ): Raising Bewl Reservoir 0.4m (3Ml/d)	2061	-163.0
Storage (SNZ): River Adur Offline Reservoir (19.5Ml/d)	2041	-23.4
Treatment capacity (SWZ): Pulborough winter transfer stage 1 (2Ml/d)	2041	-60.2

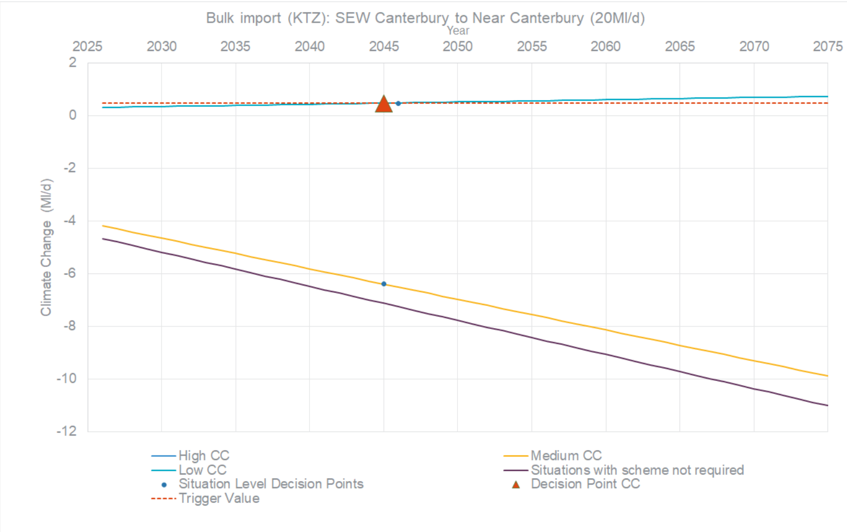
Bulk import (KTZ): SEW Canterbury to Near Canterbury (20Ml/d)



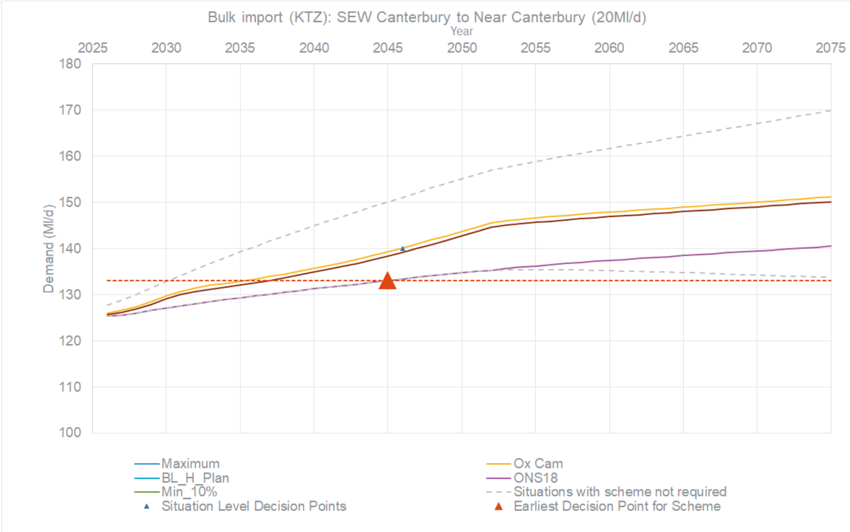
Supply-demand balance



Environmental Destination

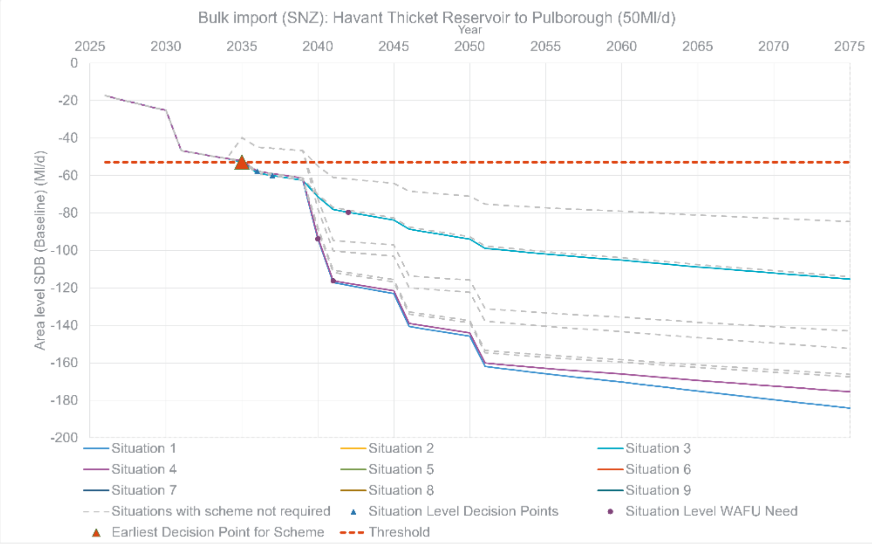


Climate change

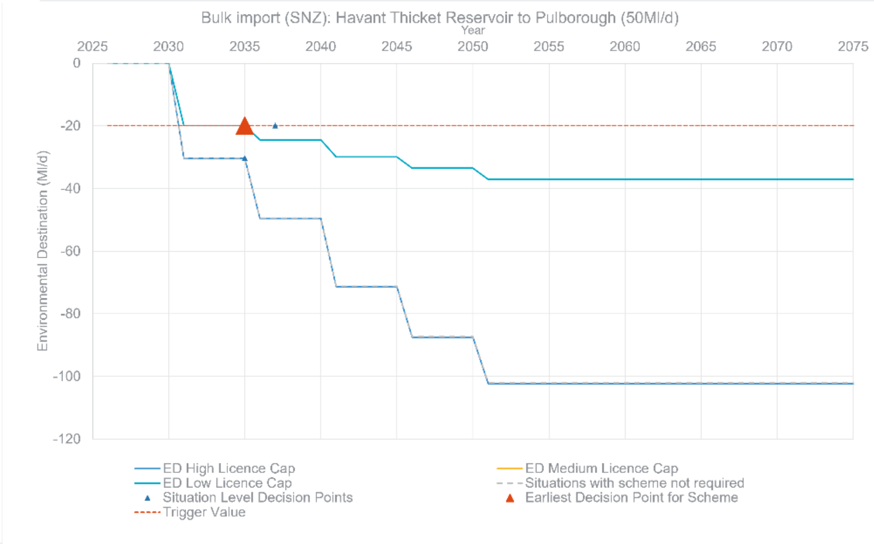


Demand (population growth)

Bulk import (SNZ): Havant Thicket Reservoir to Pulborough (50Ml/d)



Supply-demand balance



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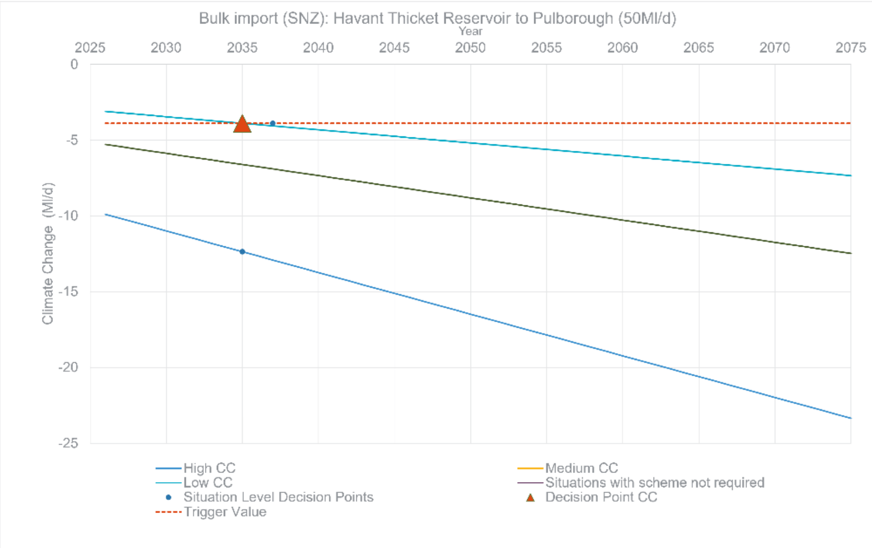

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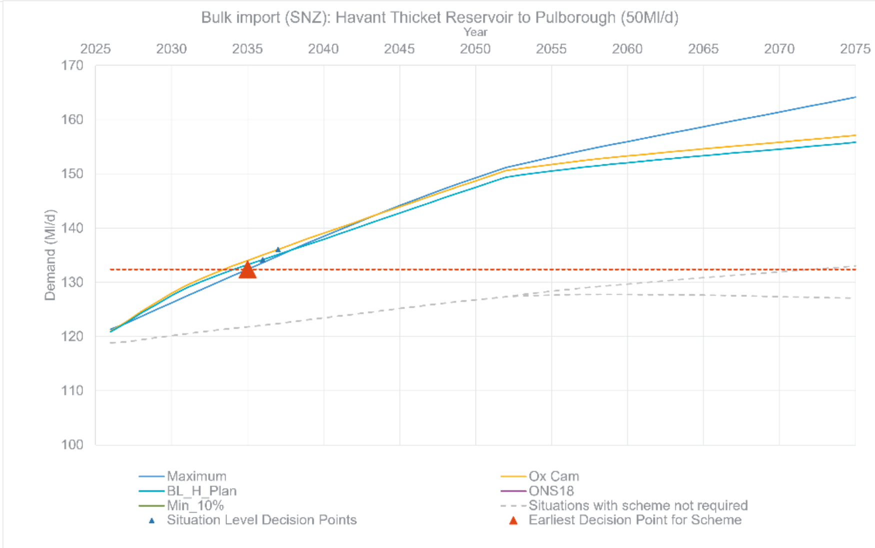
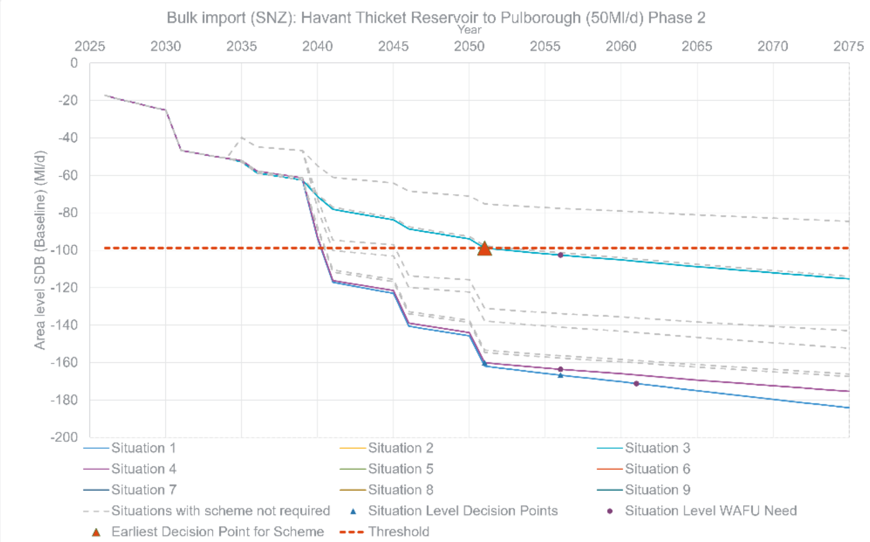
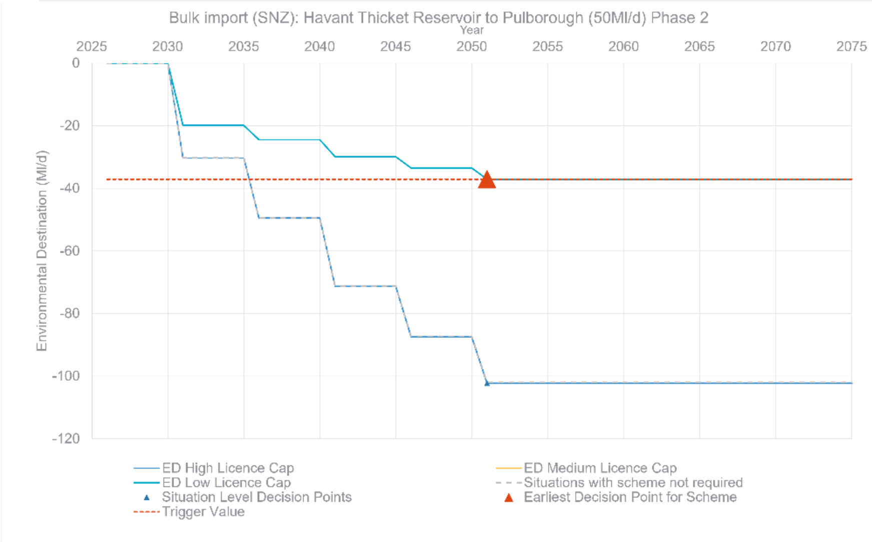


Demand (population growth)

Bulk import (SNZ): Havant Thicket Reservoir to Pulborough (50Ml/d) Phase 2



Supply-demand balance



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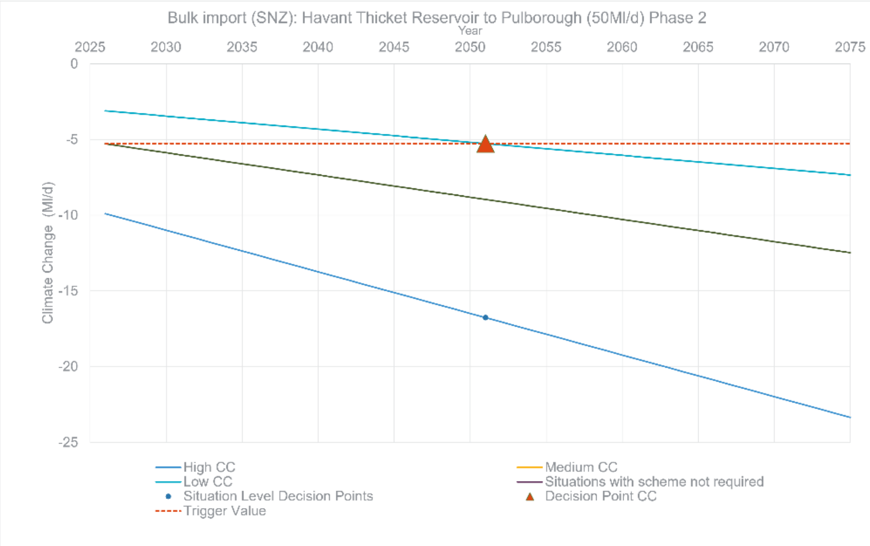

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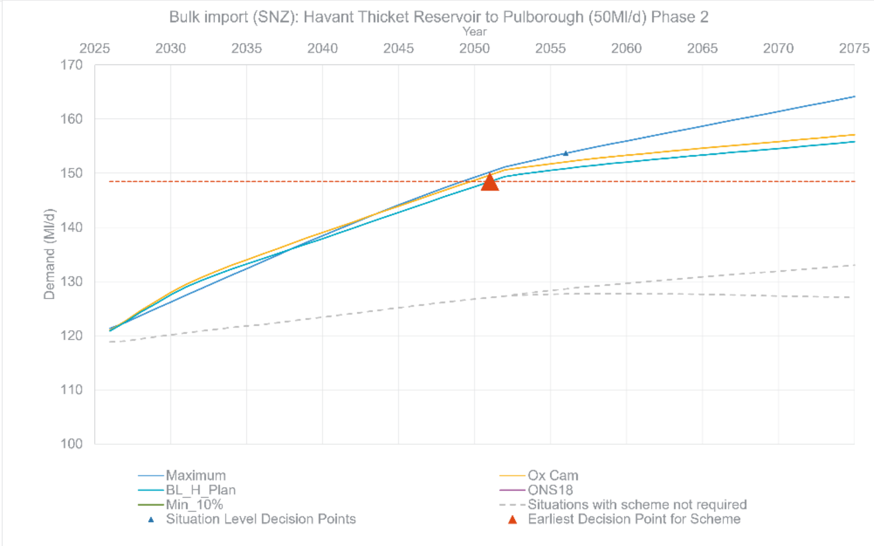
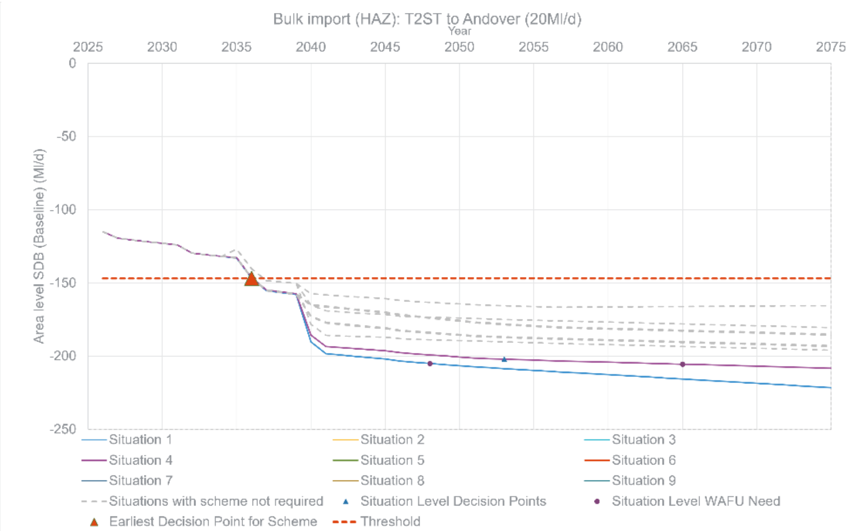
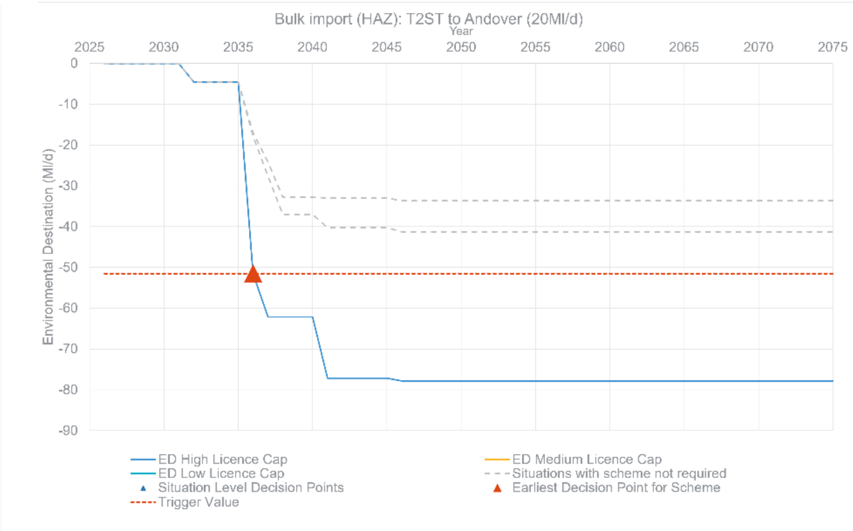


Demand (population growth)

Bulk import (HAZ): T2ST to Andover (20Ml/d)



Supply-demand balance



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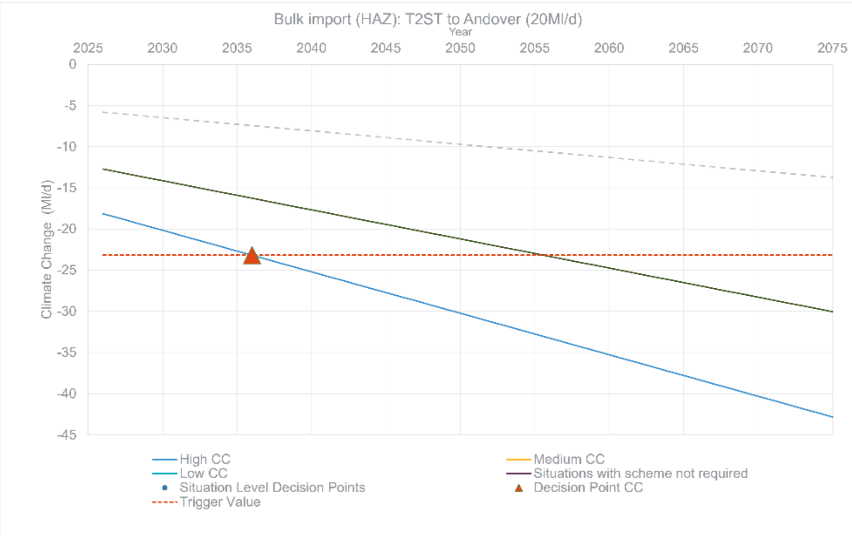

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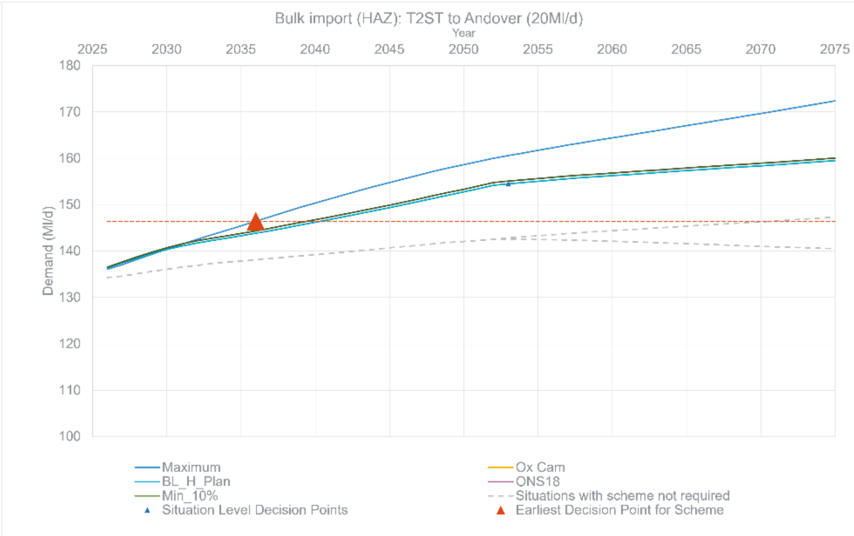
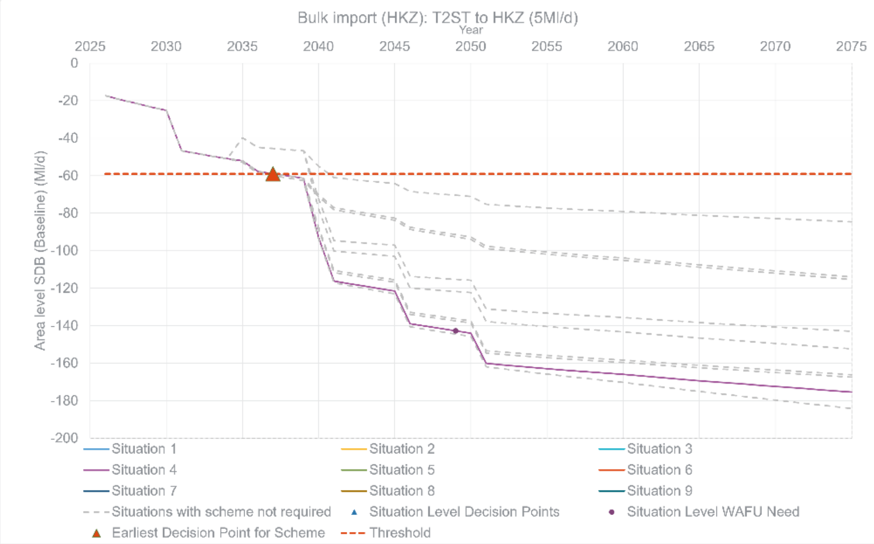
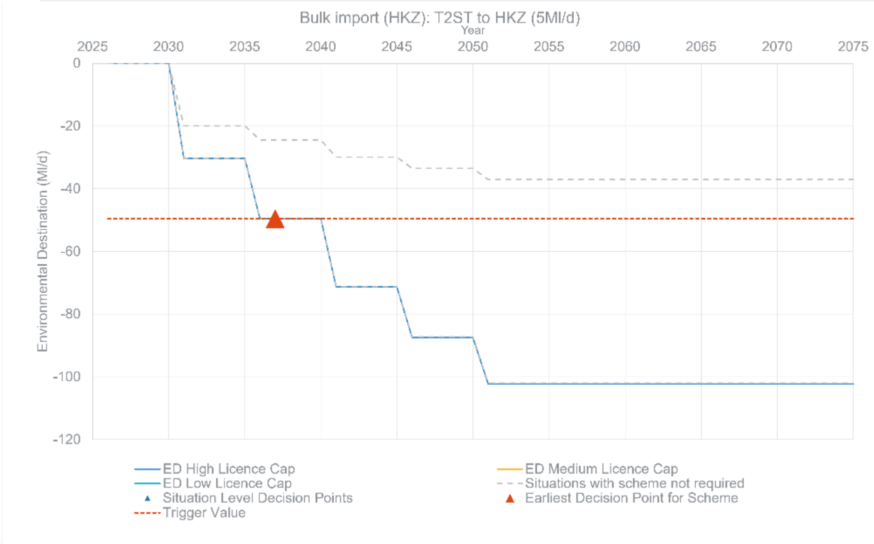


Demand (population growth)

Bulk import (HKZ): T2ST to HKZ (5Ml/d)



Supply-demand balance



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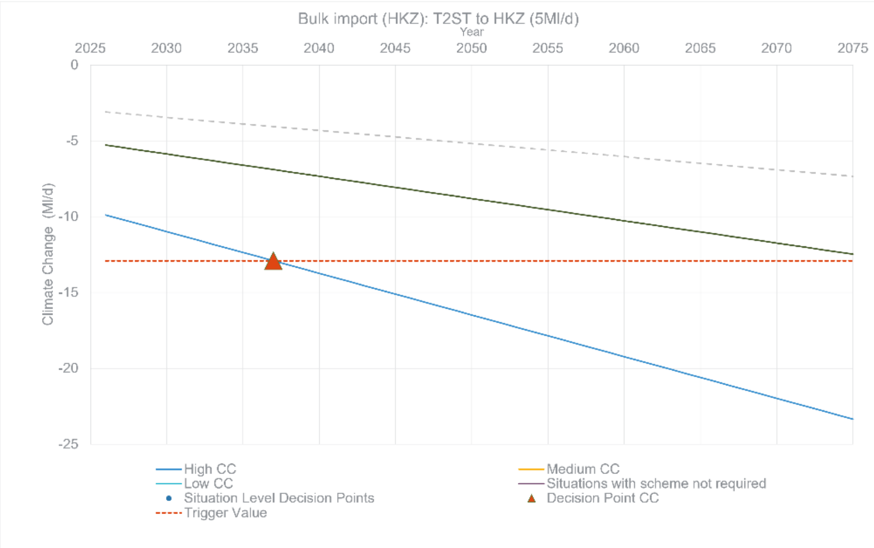

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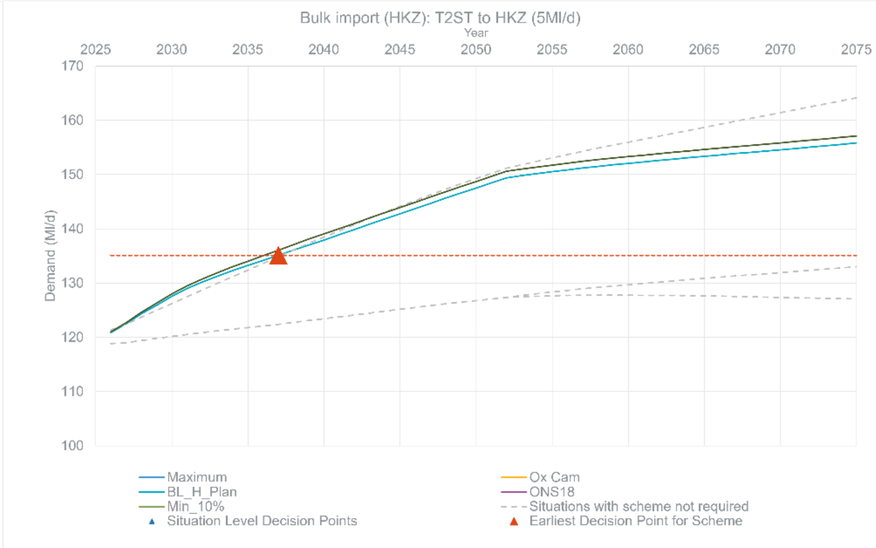
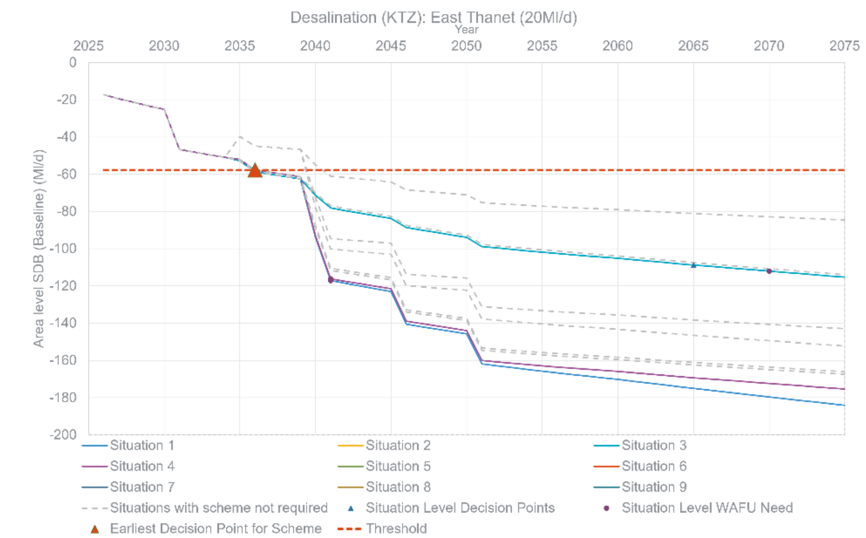
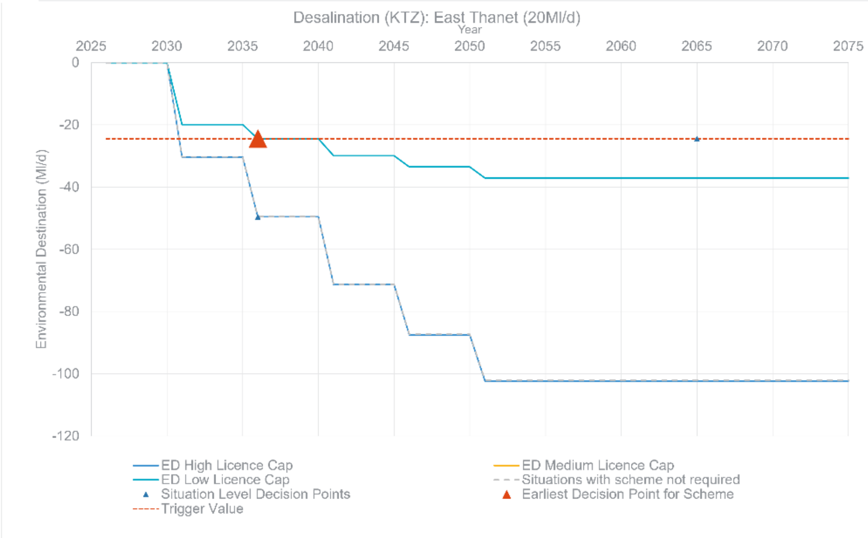


Demand (population growth)

Desalination (KTZ): East Thanet (20Ml/d)



Supply-demand balance



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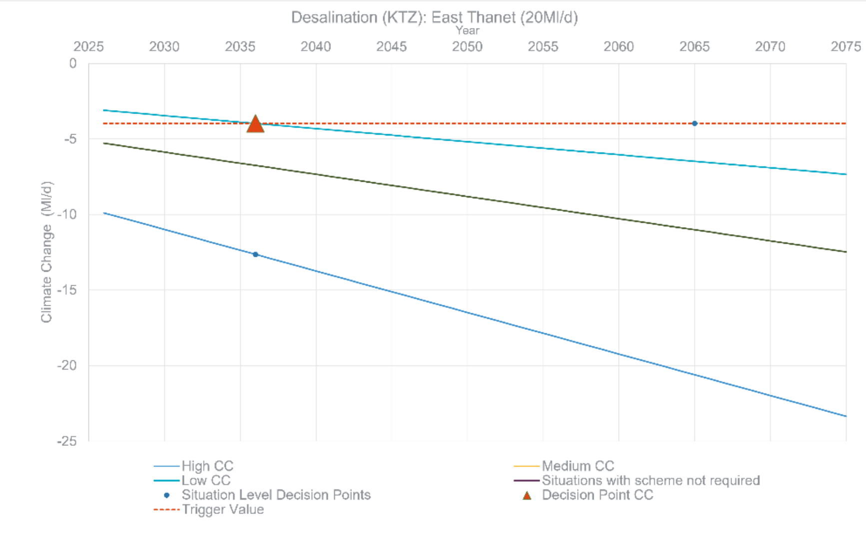

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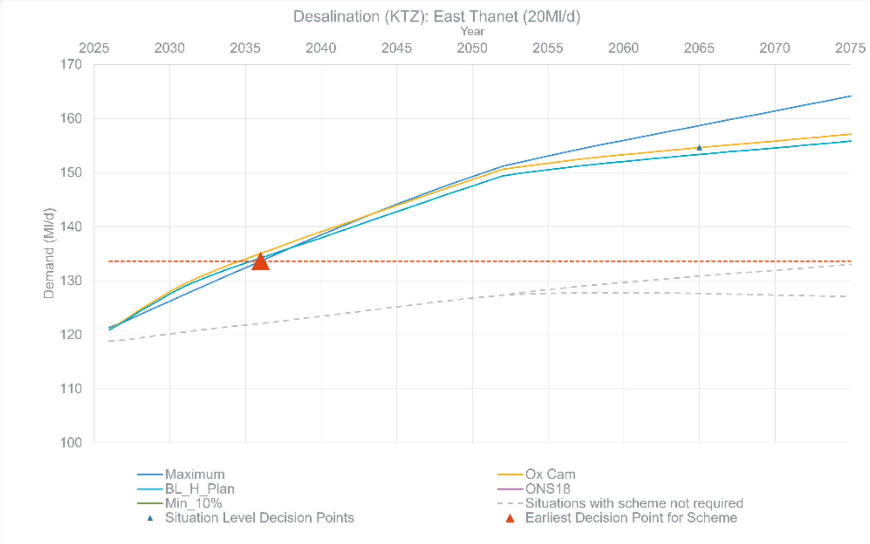
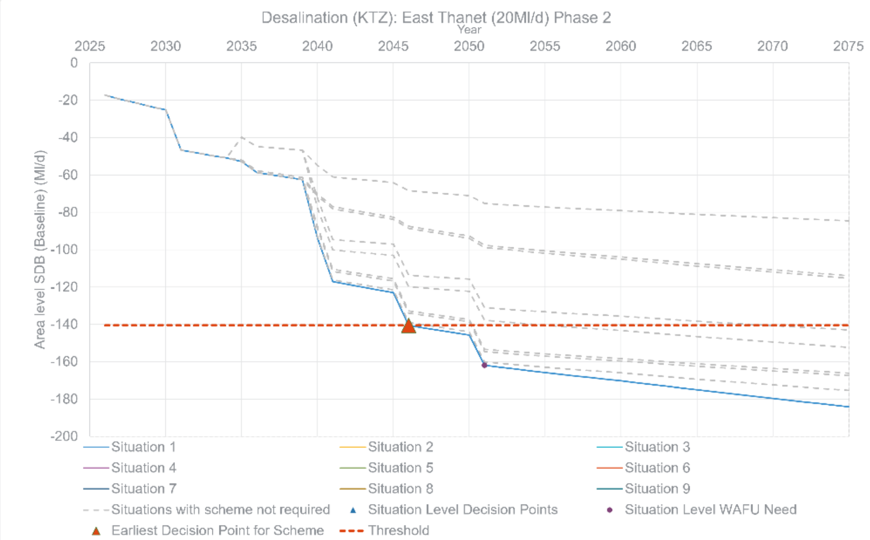
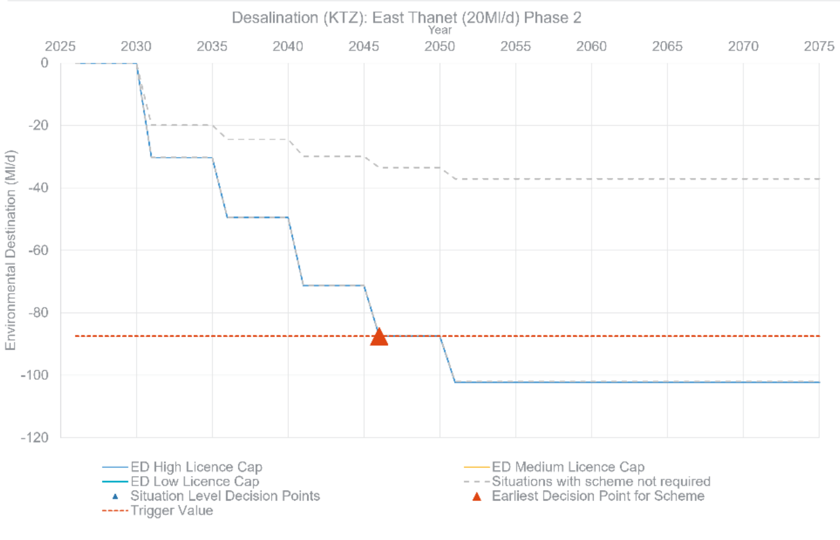


Demand (population growth)

Desalination (KTZ): East Thanet (20Ml/d) Phase 2



Supply-demand balance



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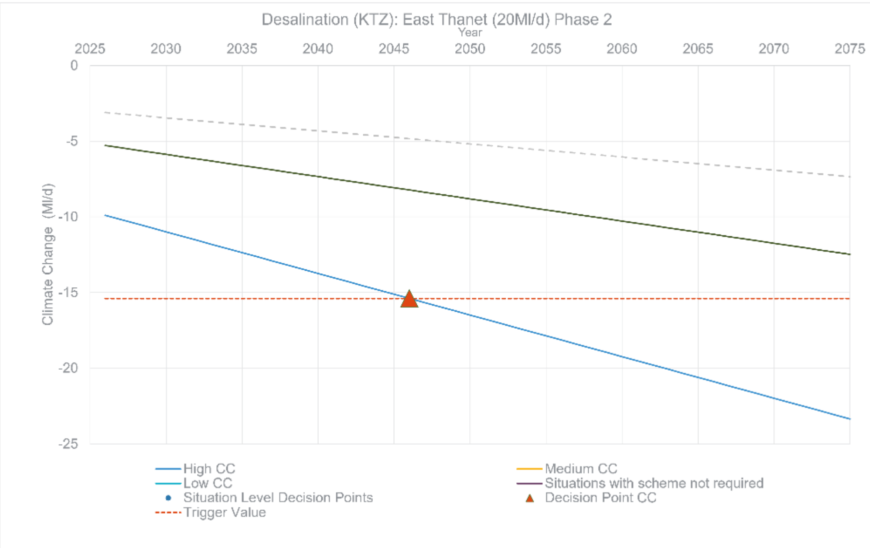

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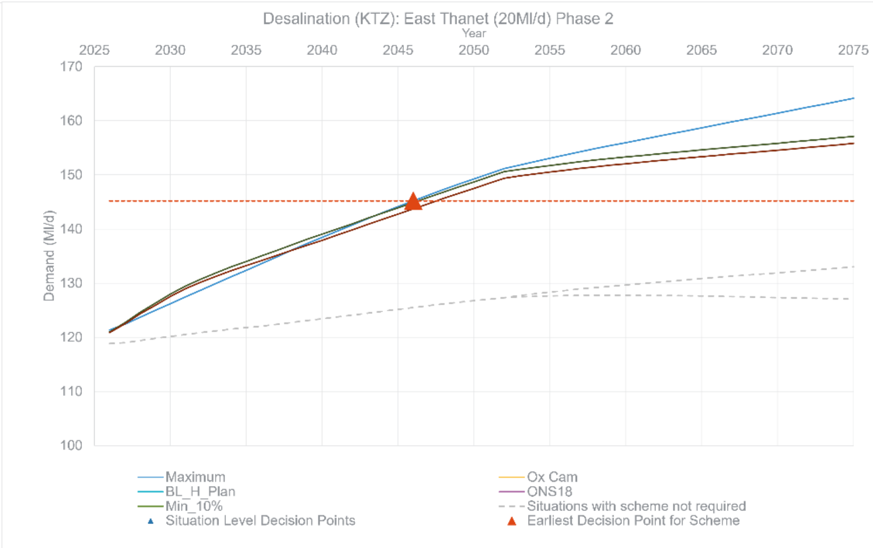
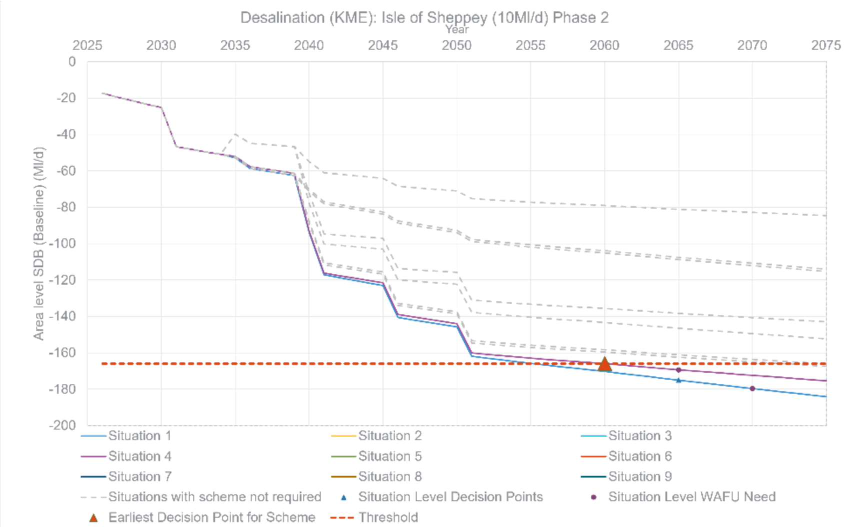
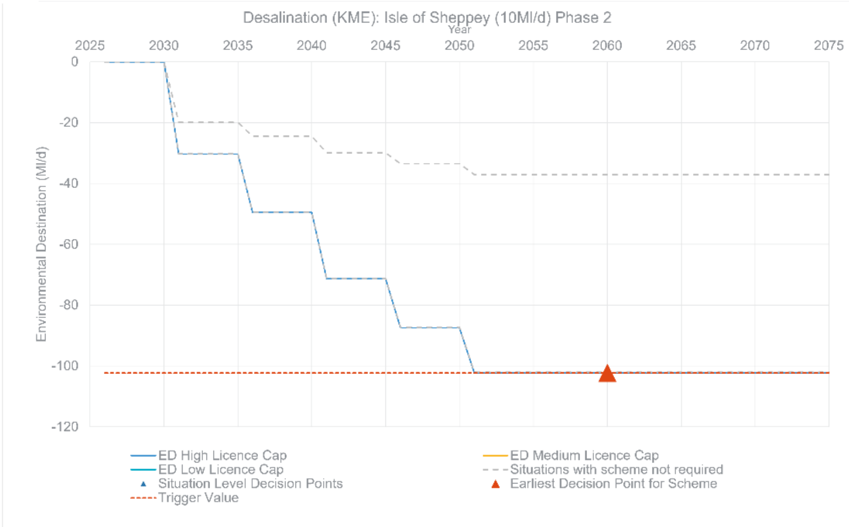


Demand (population growth)

Desalination (KME): Isle of Sheppey (10Ml/d) Phase 2



Supply-demand balance



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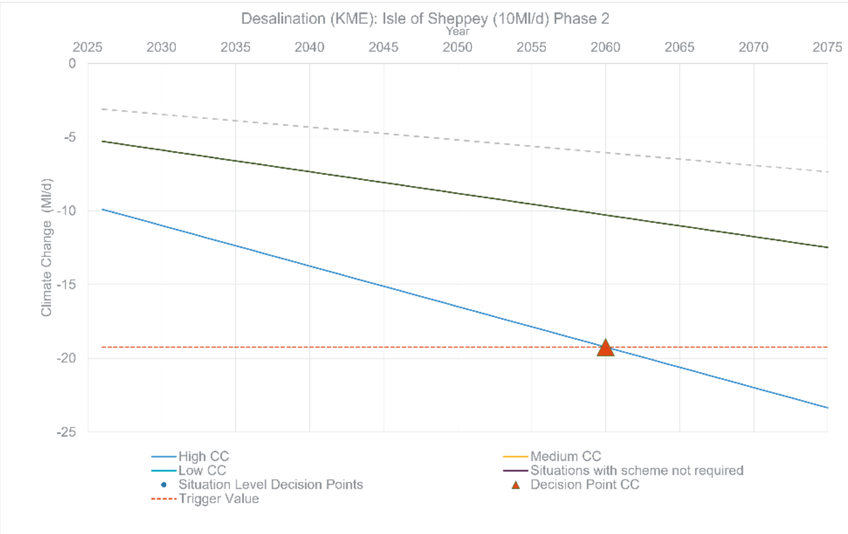

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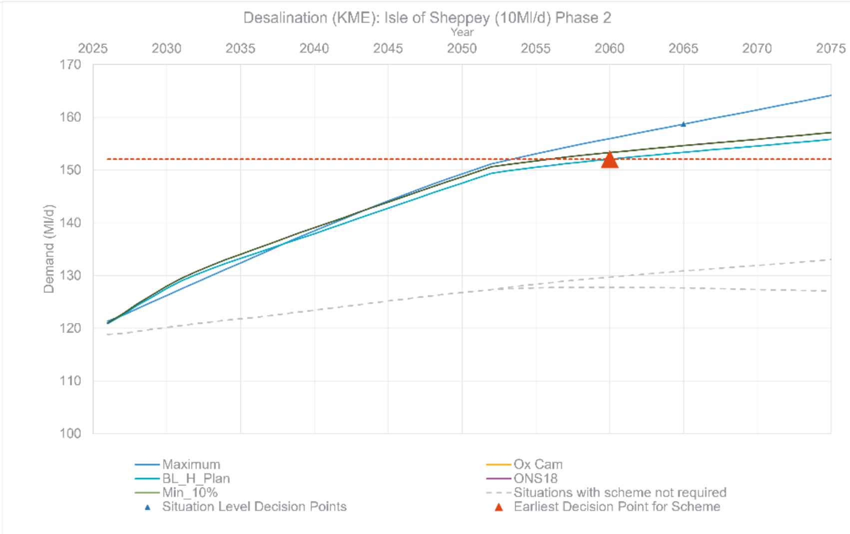
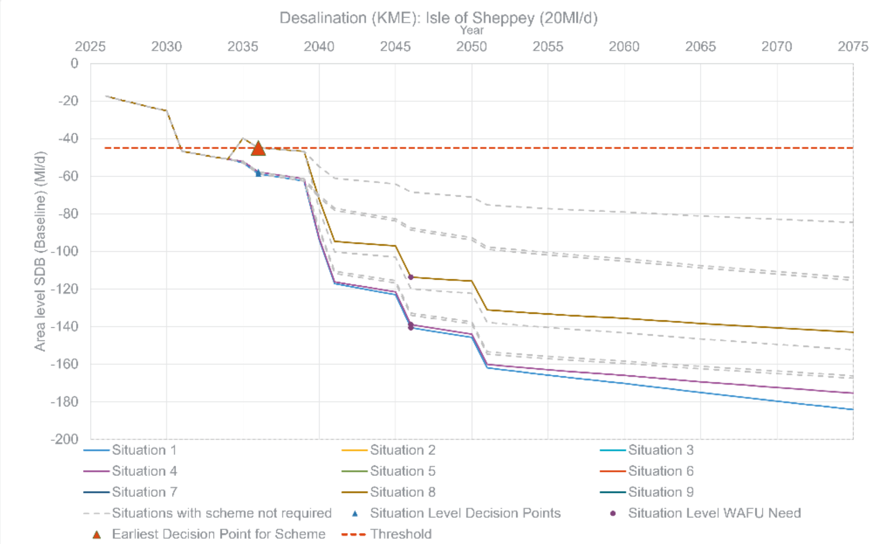
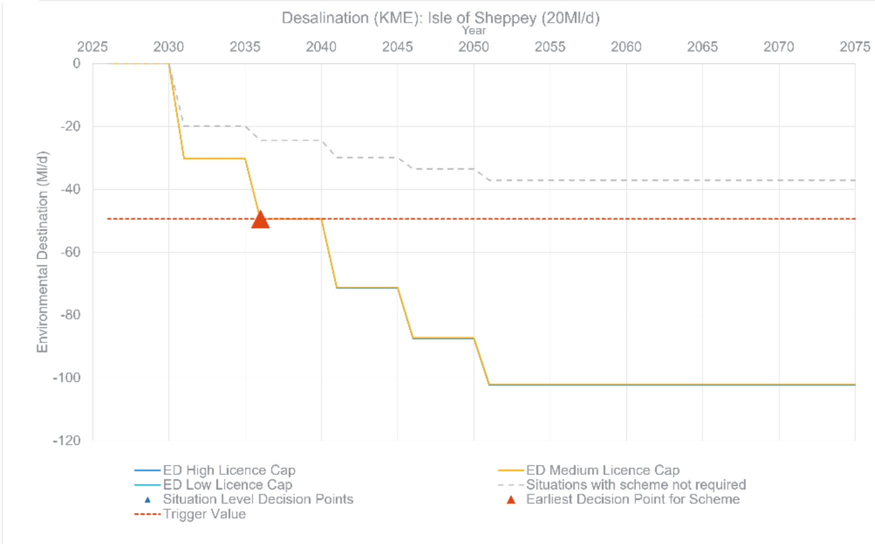


Demand (population growth)

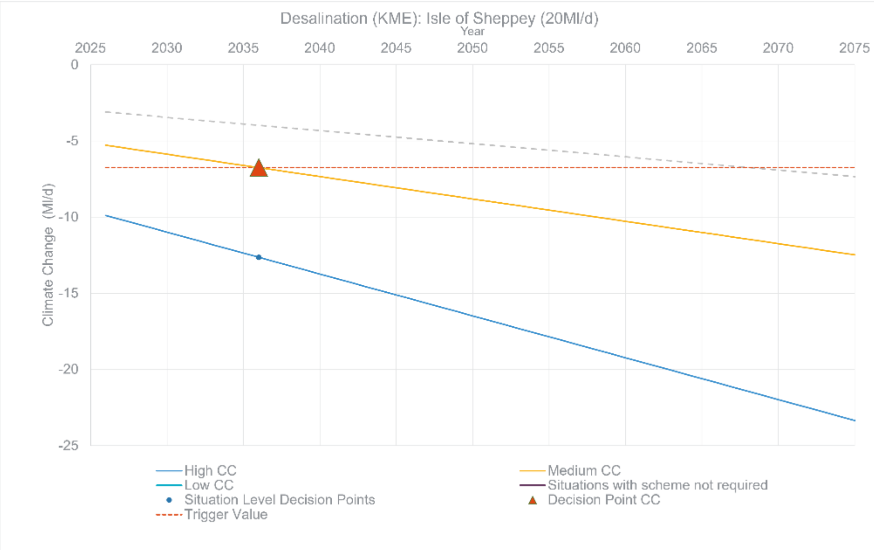
Desalination (KME): Isle of Sheppey (20Ml/d)



Supply-demand balance



Environmental Destination



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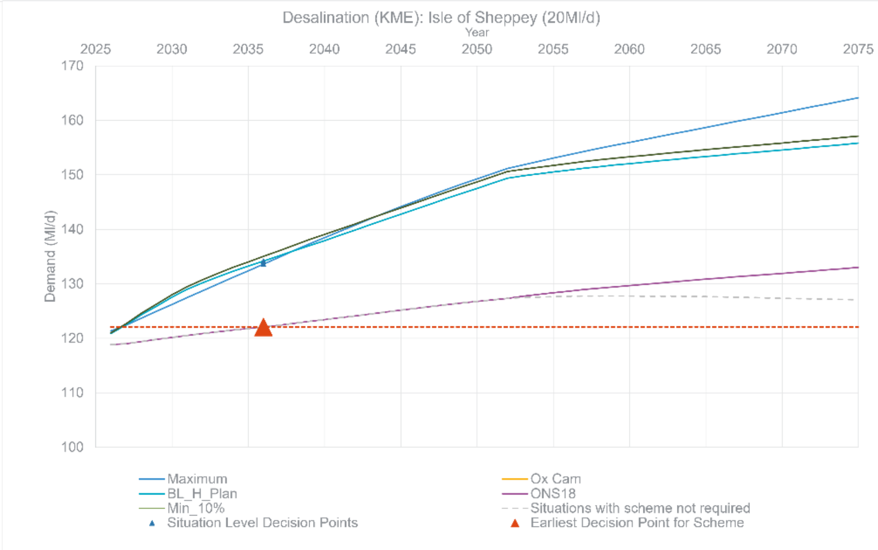
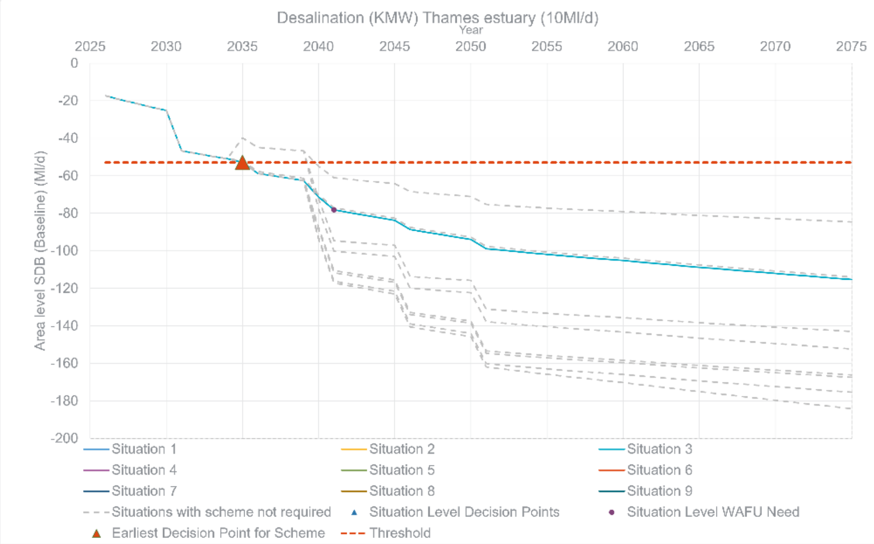
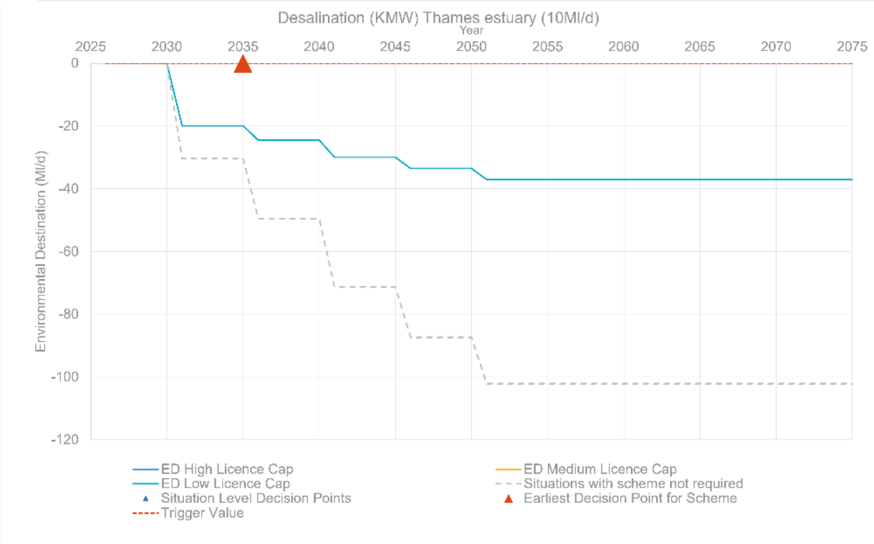


Demand (population growth)

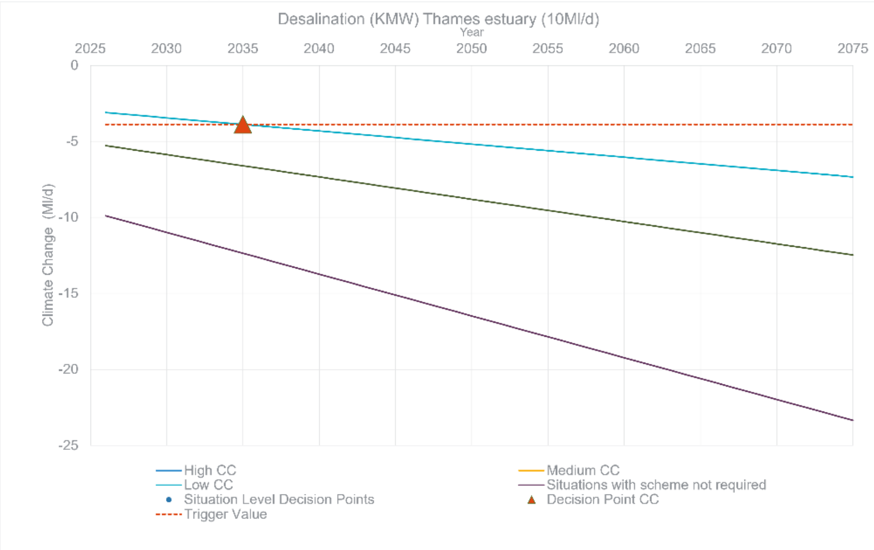
Desalination (KMW) Thames estuary (10Ml/d)



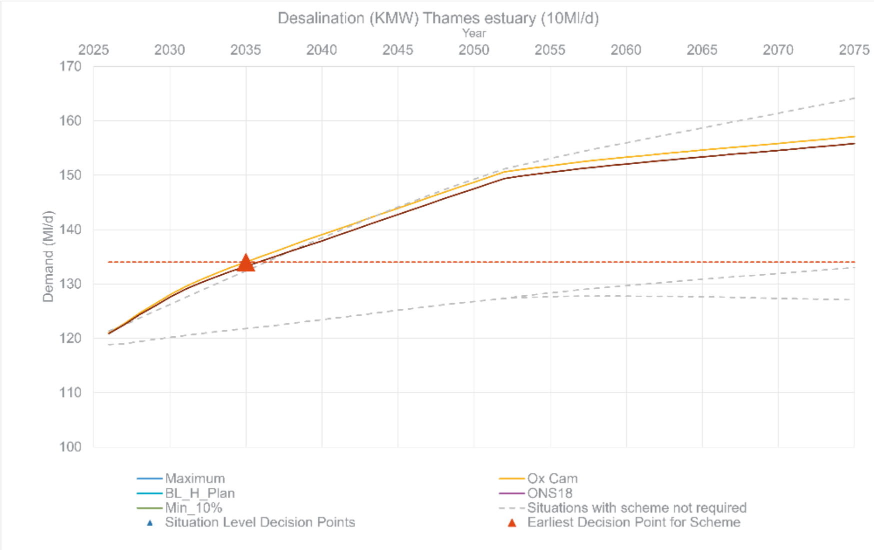
Supply-demand balance



Environmental Destination

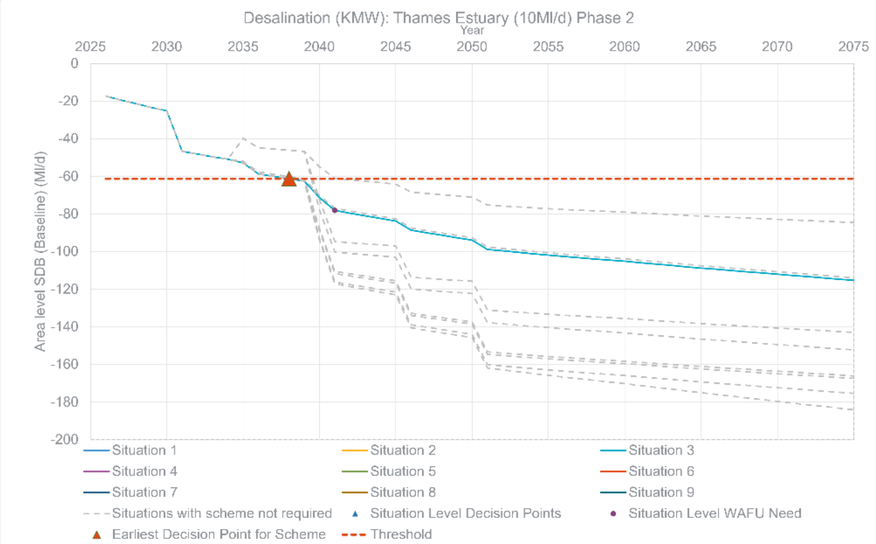


Climate change

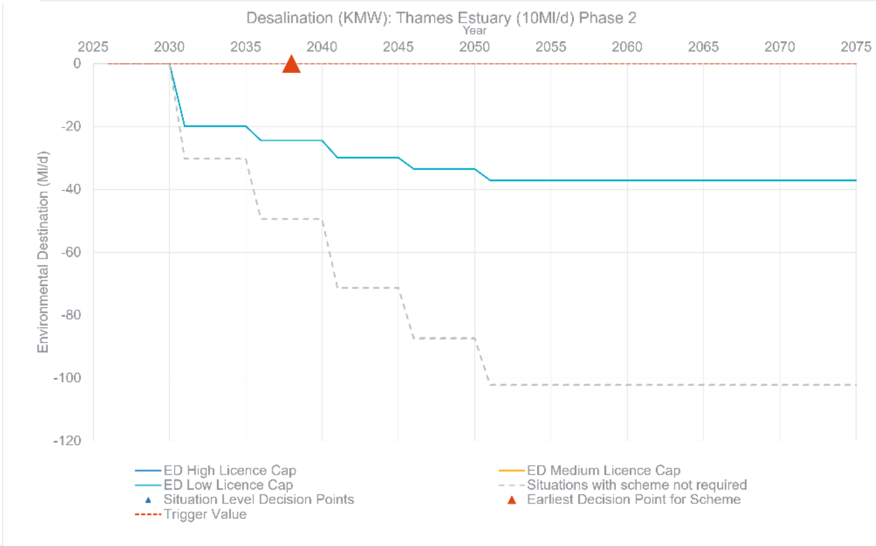


Demand (population growth)

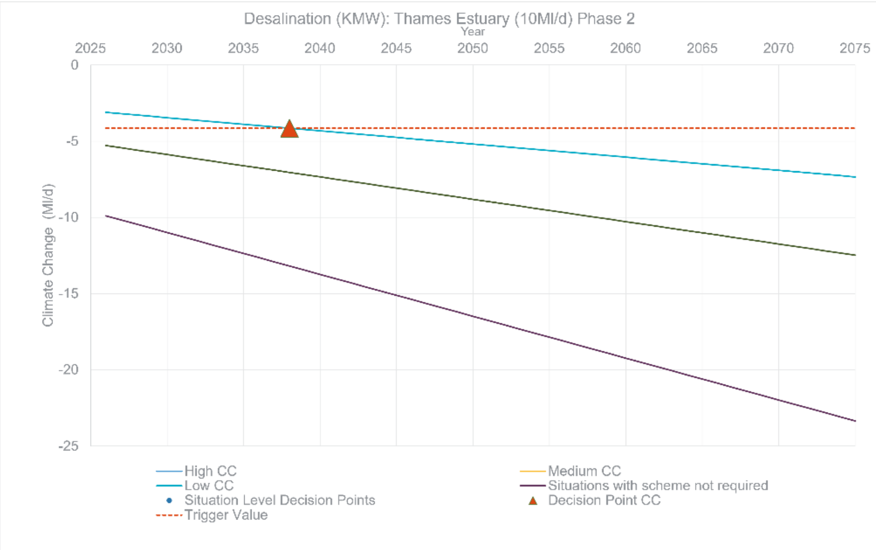
Desalination (KMW): Thames Estuary (10Ml/d) Phase 2



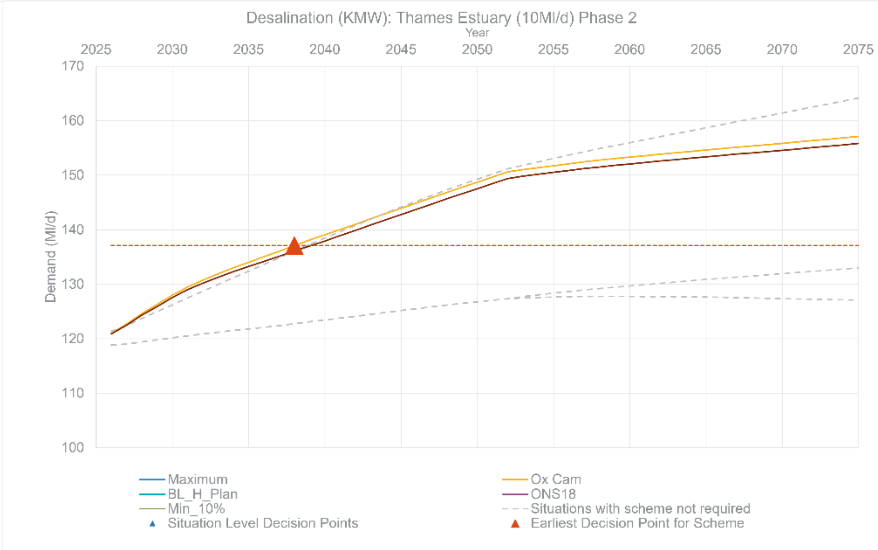
Supply-demand balance



Environmental Destination

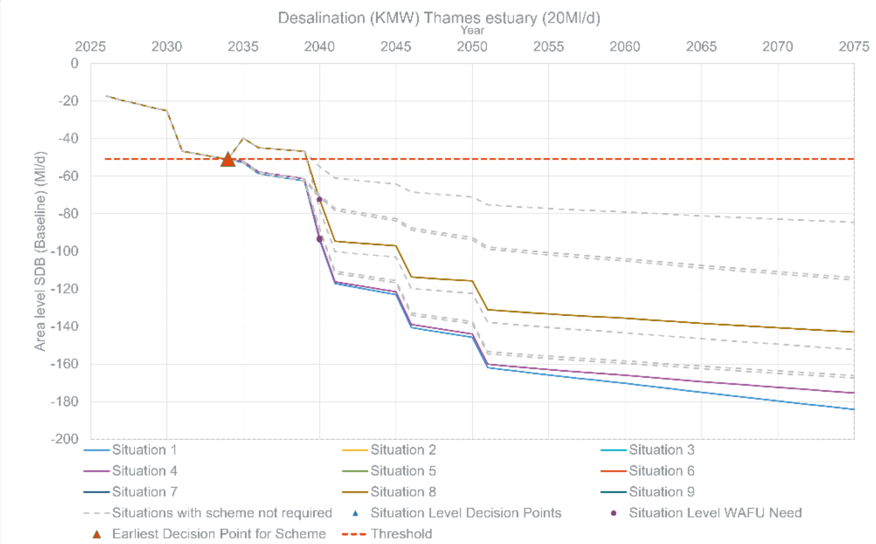


Climate change

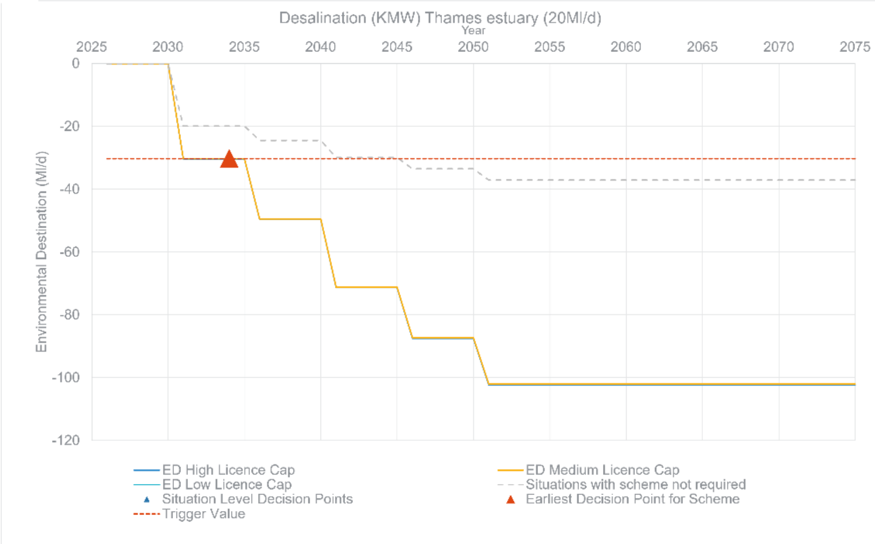


Demand (population growth)

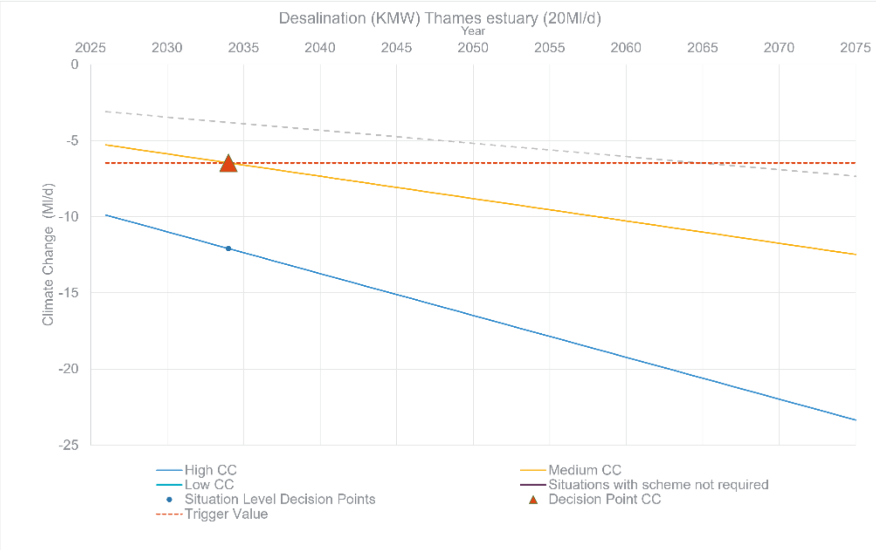
Desalination (KMW) Thames estuary (20Ml/d)



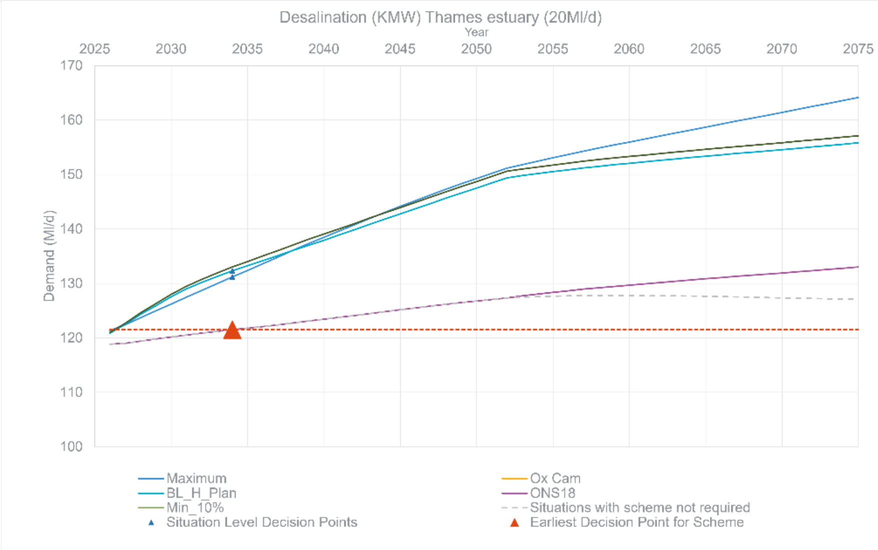
Supply-demand balance



Environmental Destination

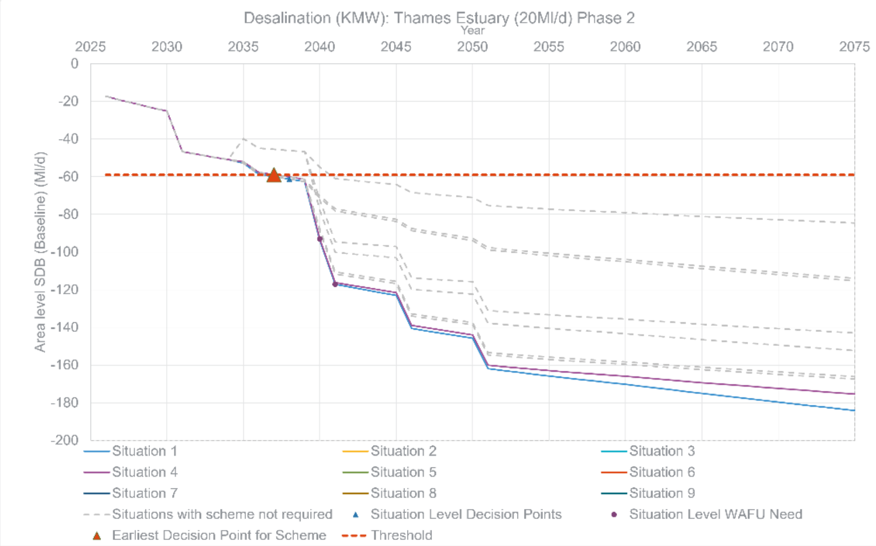


Climate change

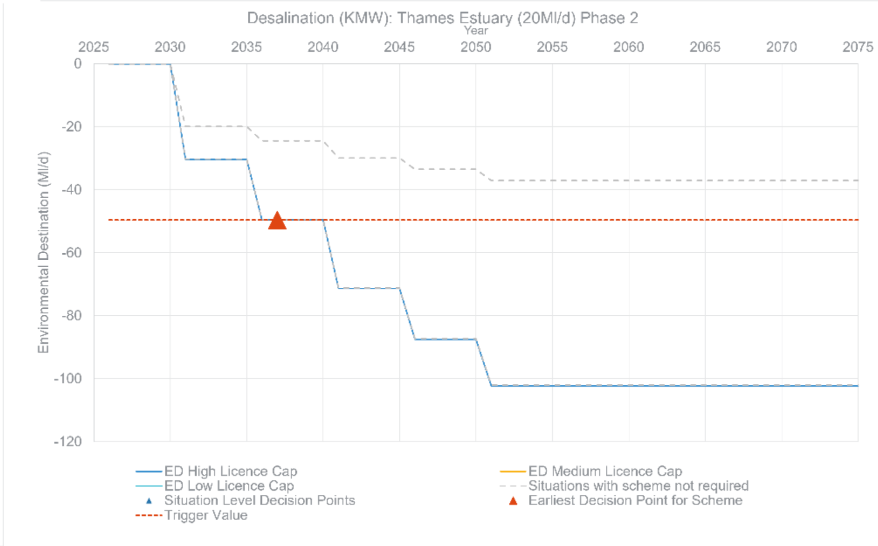


Demand (population growth)

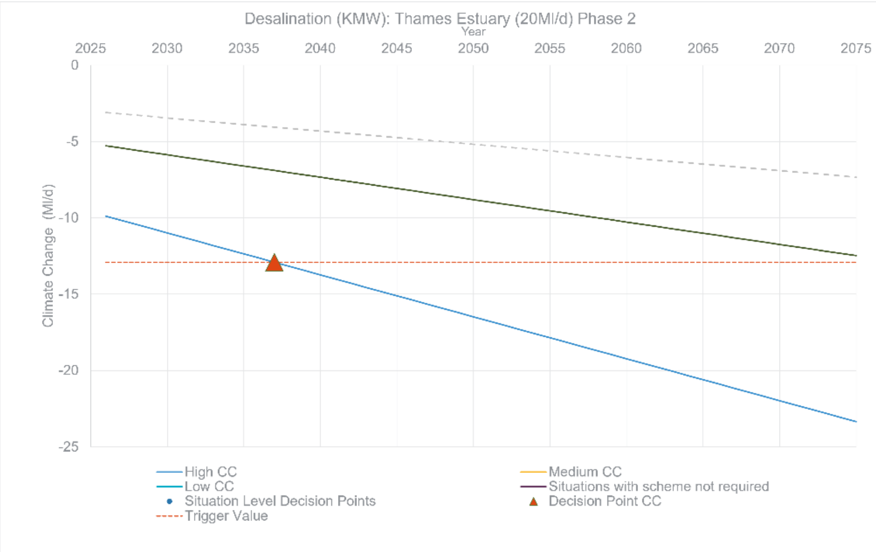
Desalination (KMW): Thames Estuary (20Ml/d) Phase 2



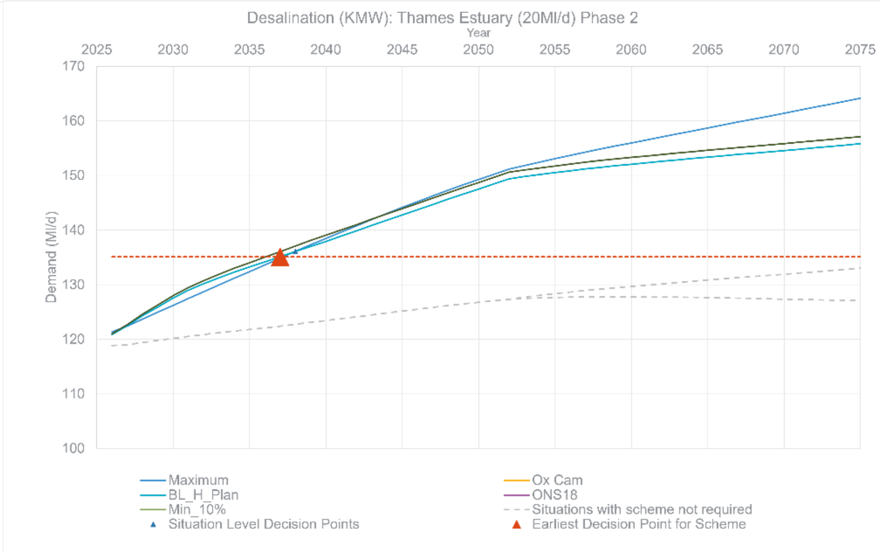
Supply-demand balance



Environmental Destination

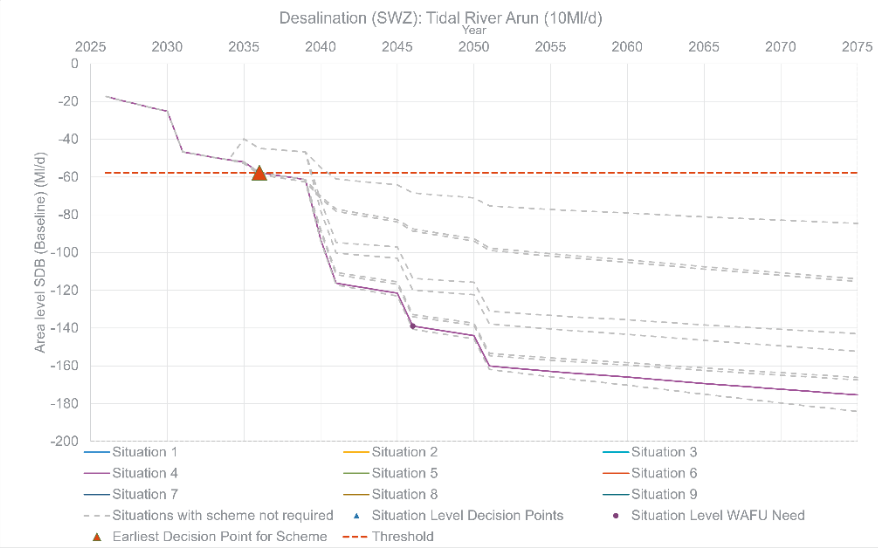


Climate change

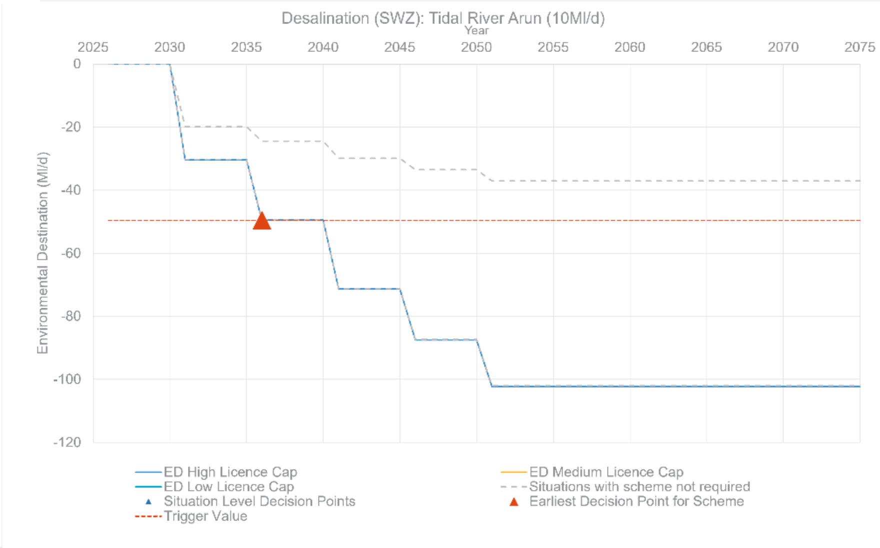


Demand (population growth)

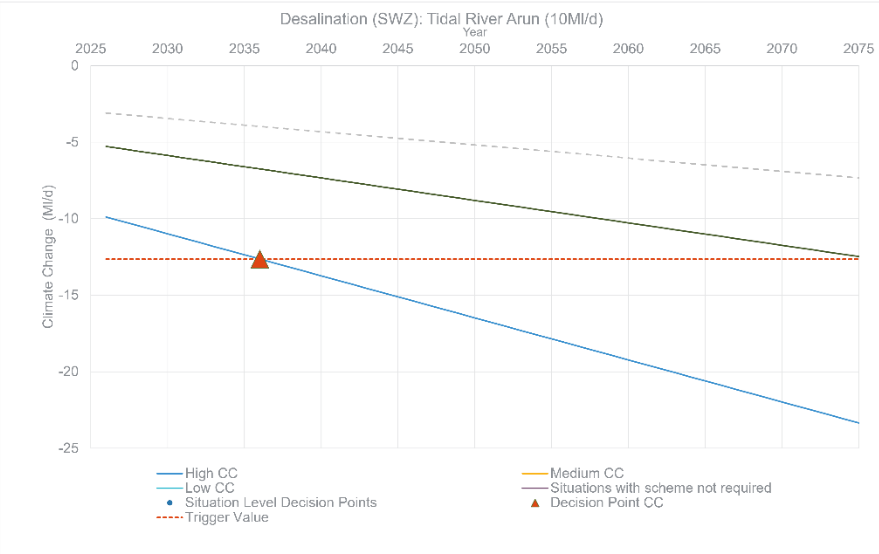
Desalination (SWZ): Tidal River Arun (10Ml/d)



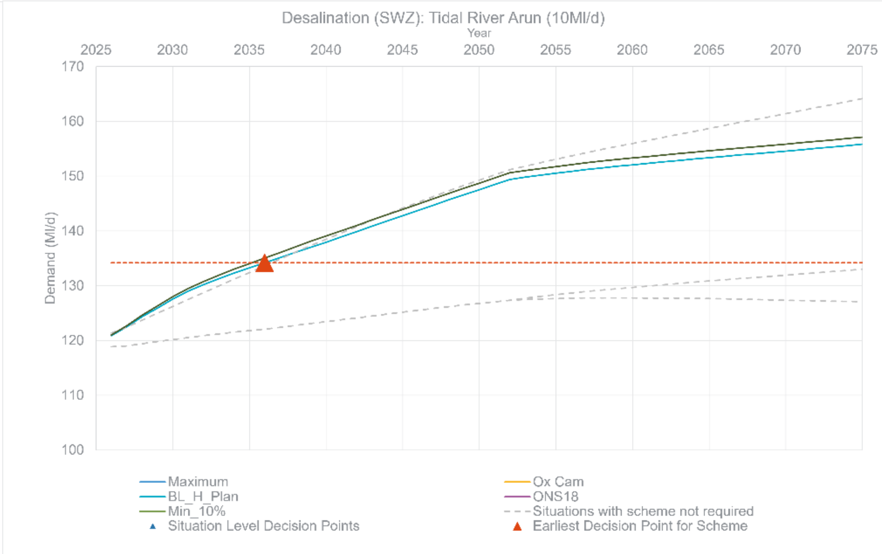
Supply-demand balance



Environmental Destination

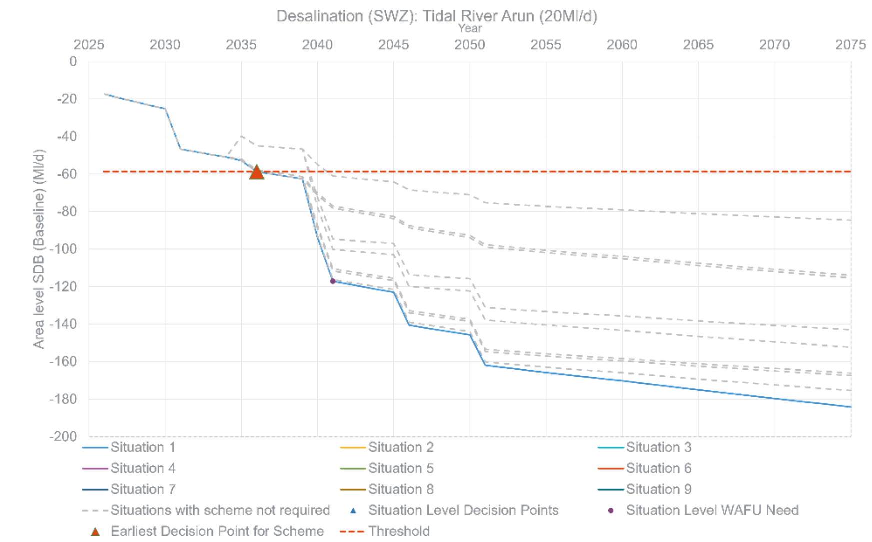


Climate change

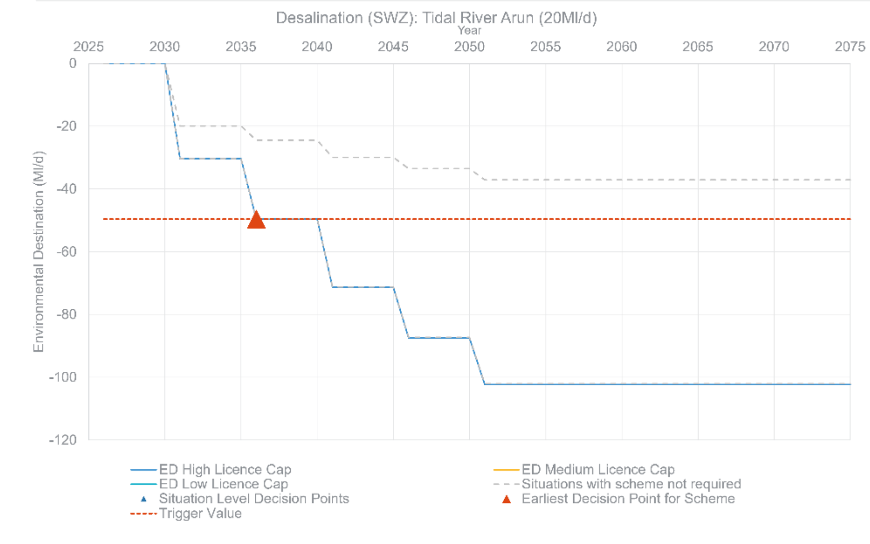


Demand (population growth)

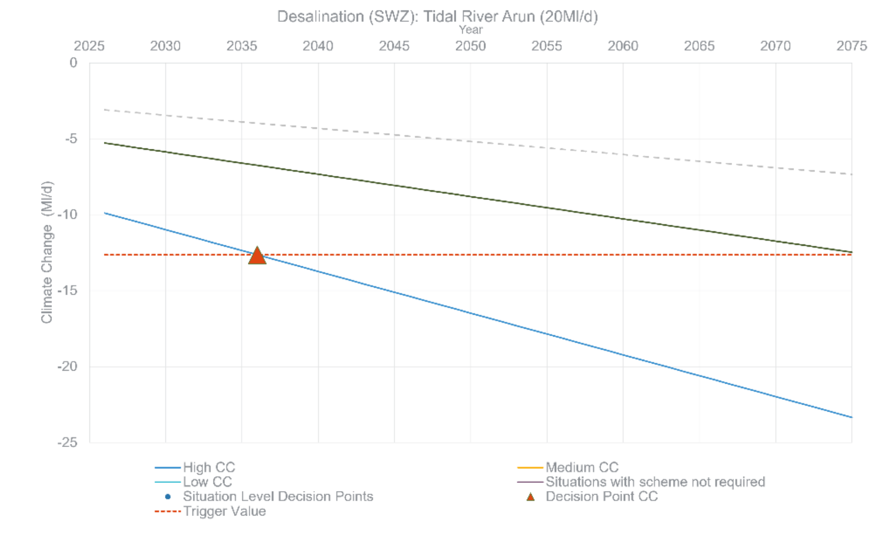
Desalination (SWZ): Tidal River Arun (20Ml/d)



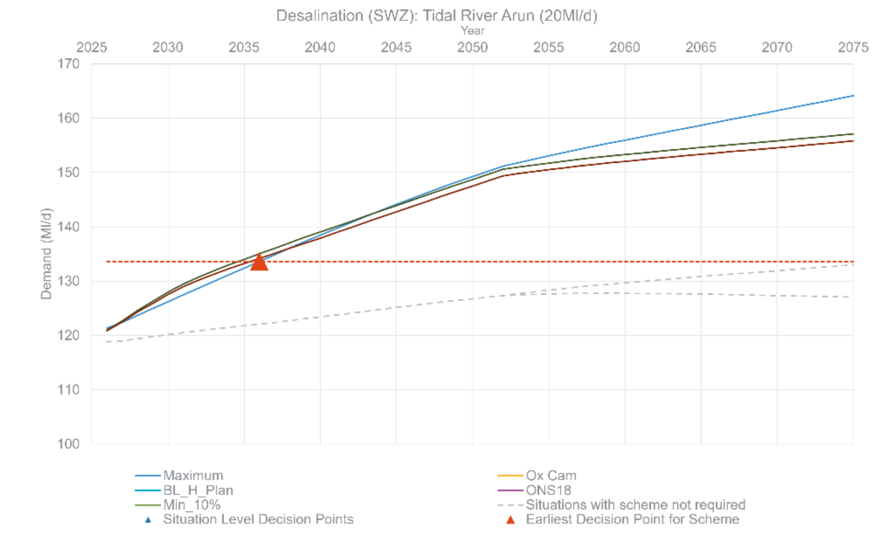
Supply-demand balance



Environmental Destination

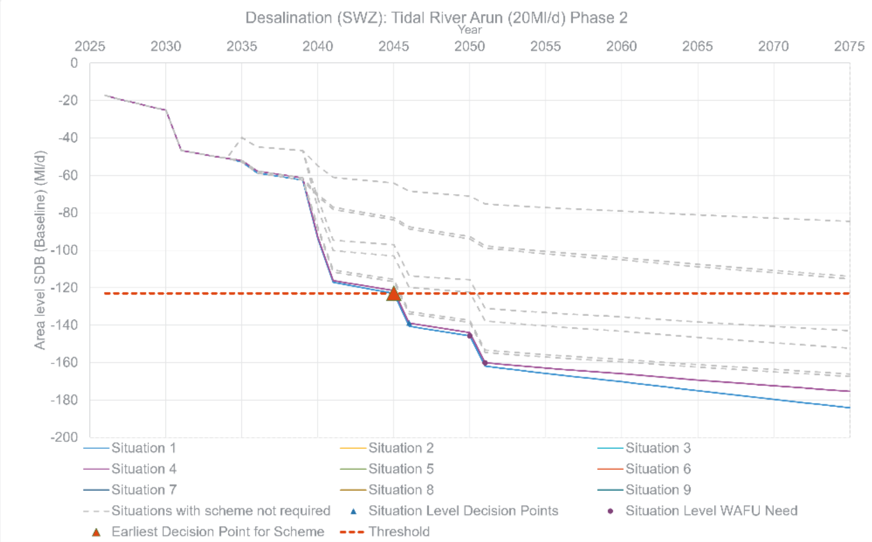


Climate change

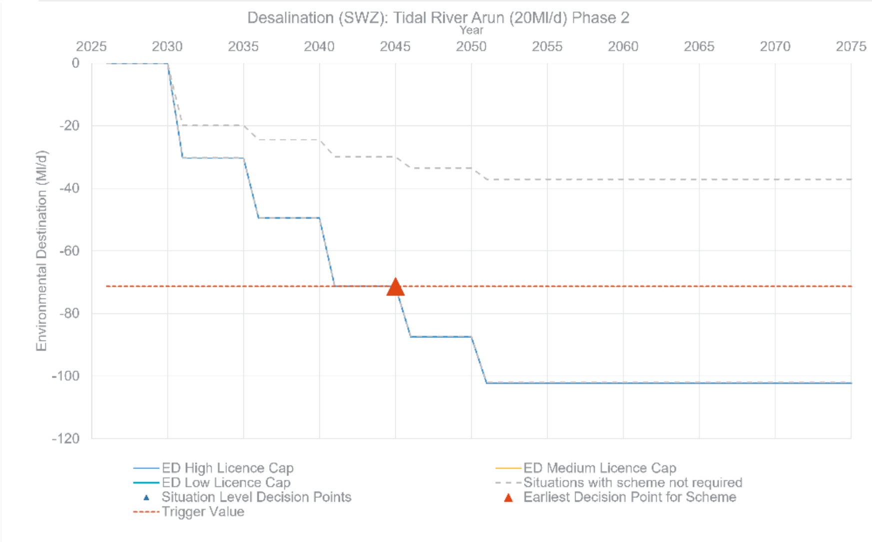


Demand (population growth)

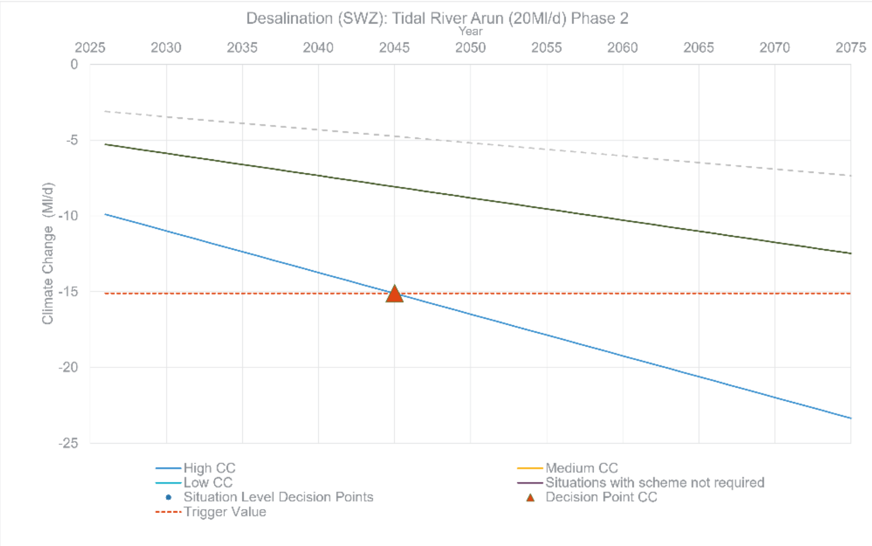
Desalination (SWZ): Tidal River Arun (20Ml/d) Phase 2



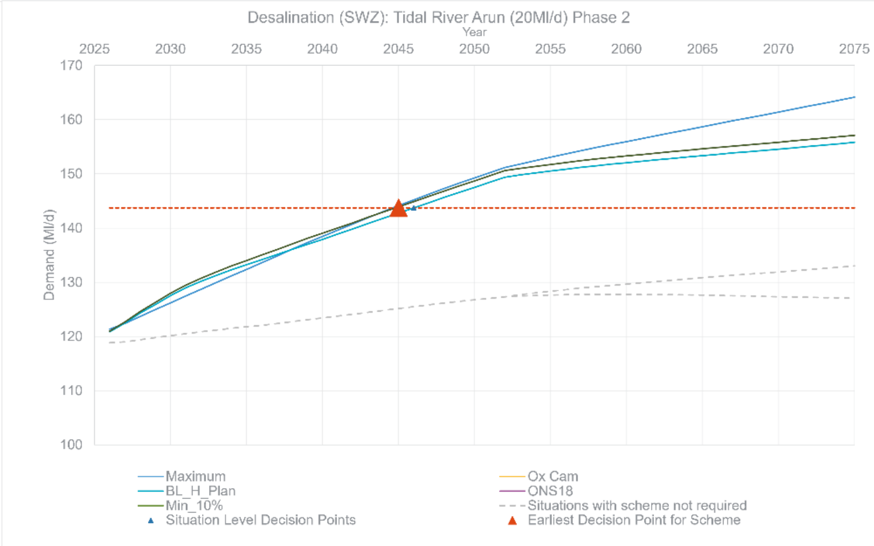
Supply-demand balance



Environmental Destination

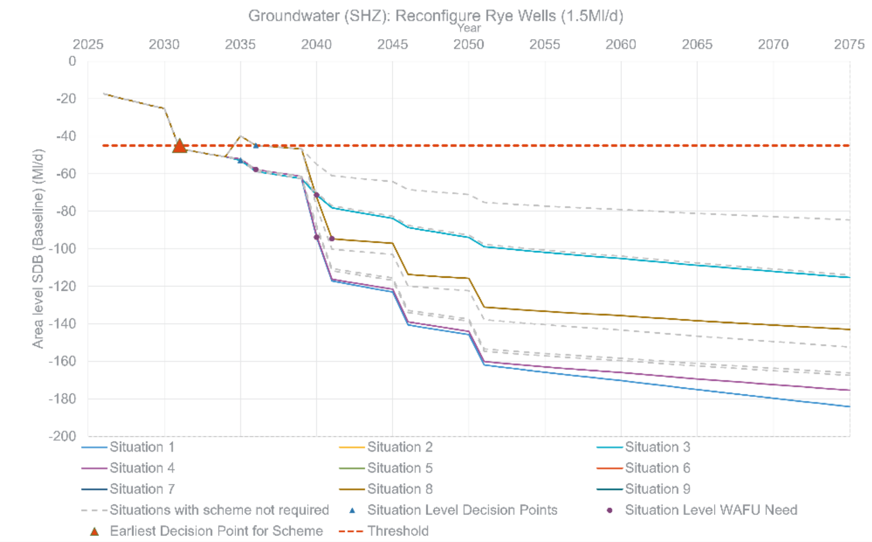


Climate change

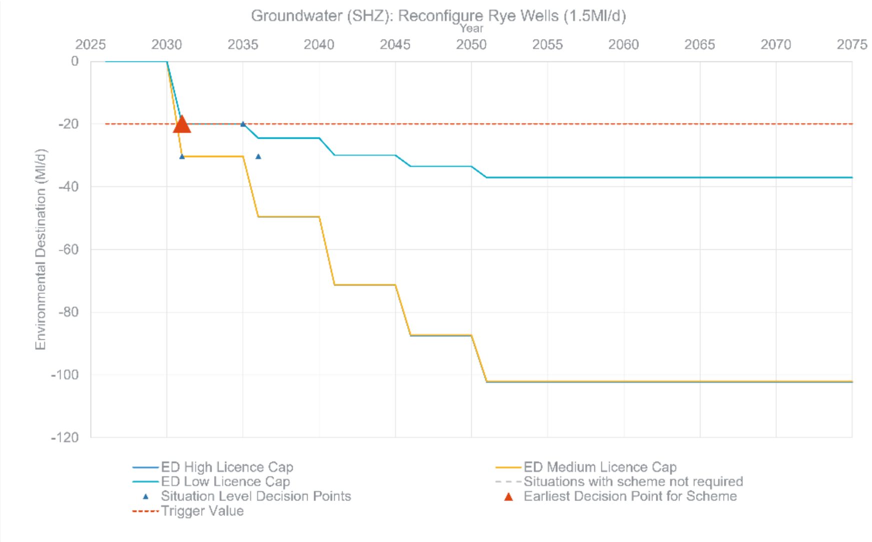


Demand (population growth)

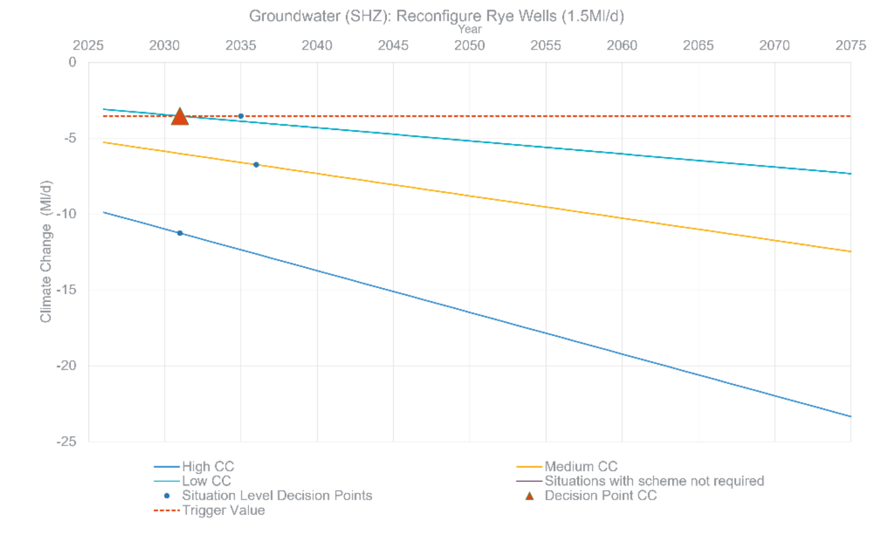
Groundwater (SHZ): Reconfigure Rye Wells (1.5Ml/d)



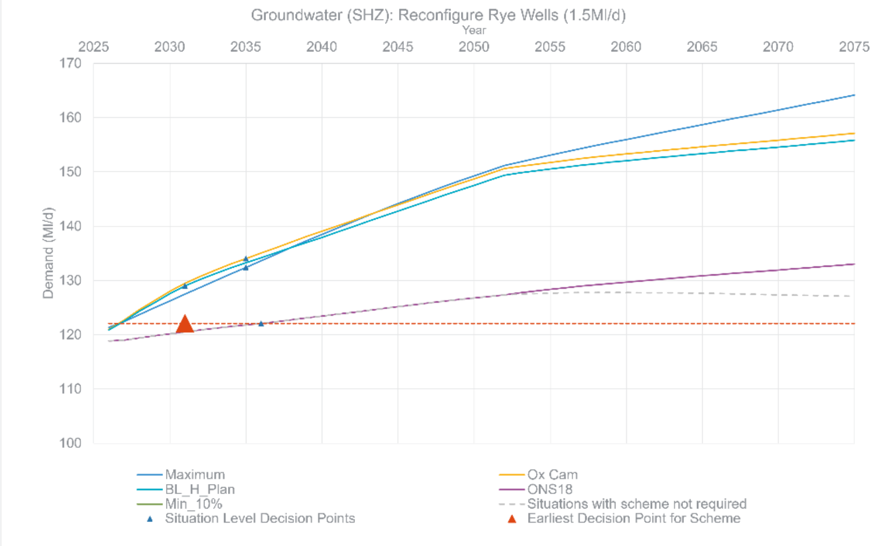
Supply-demand balance



Environmental Destination

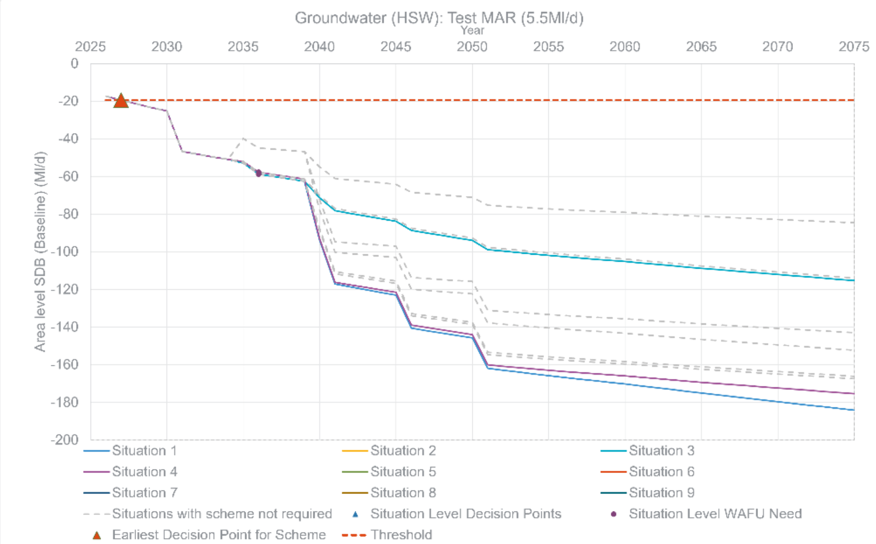


Climate change

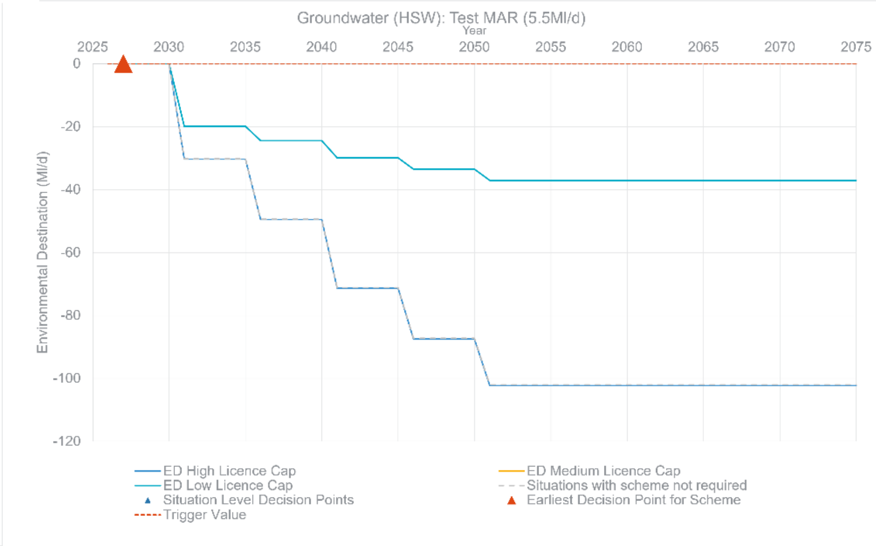


Demand (population growth)

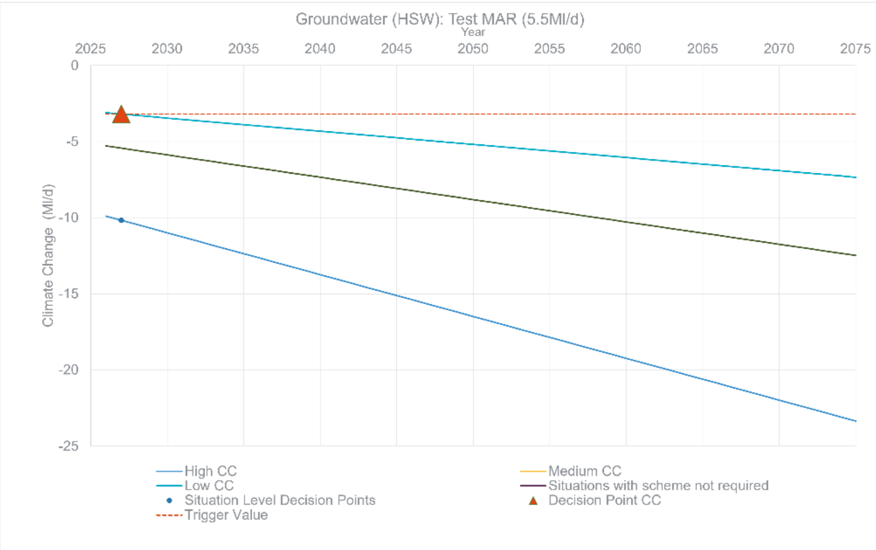
Groundwater (HSW): Test MAR (5.5Ml/d)



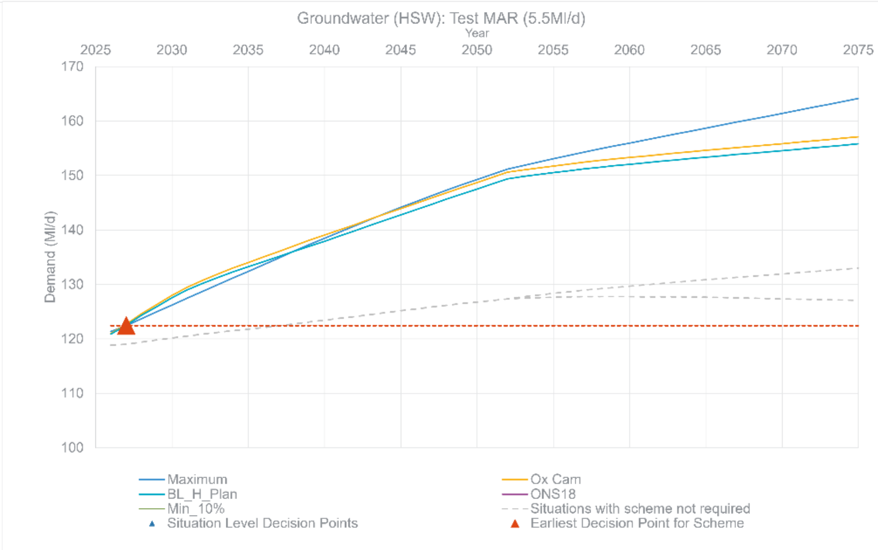
Supply-demand balance



Environmental Destination

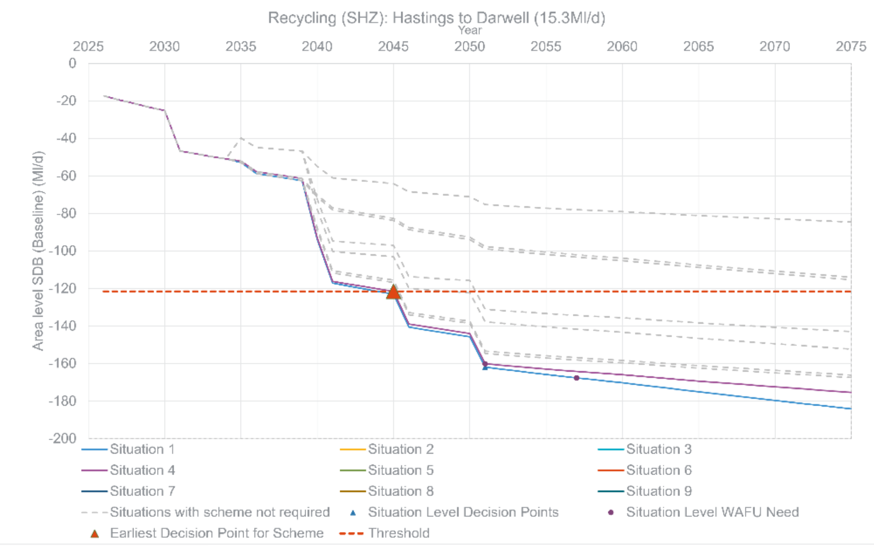


Climate change

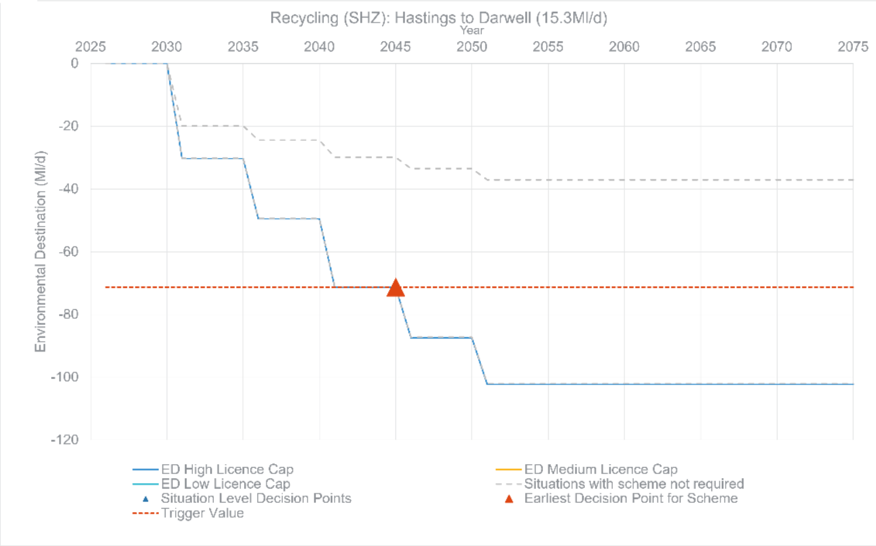


Demand (population growth)

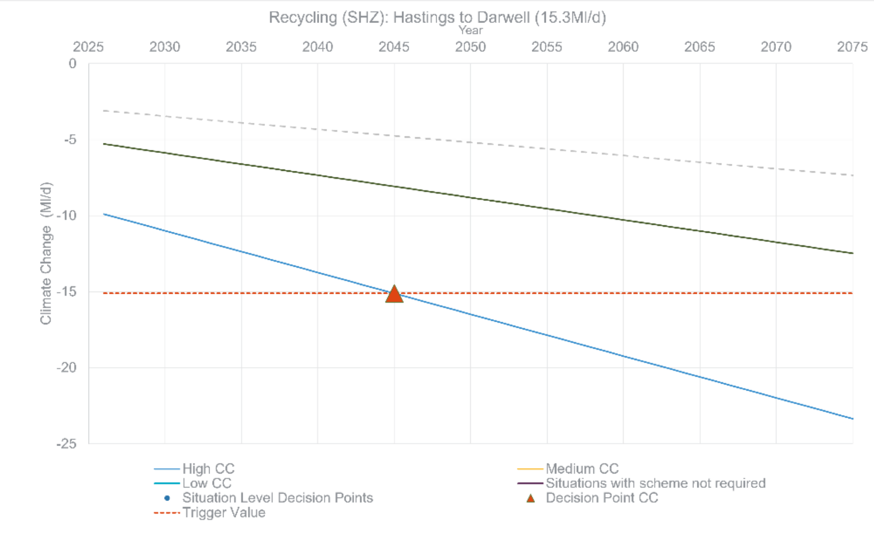
Recycling (SHZ): Hastings to Darwell (15.3Ml/d)



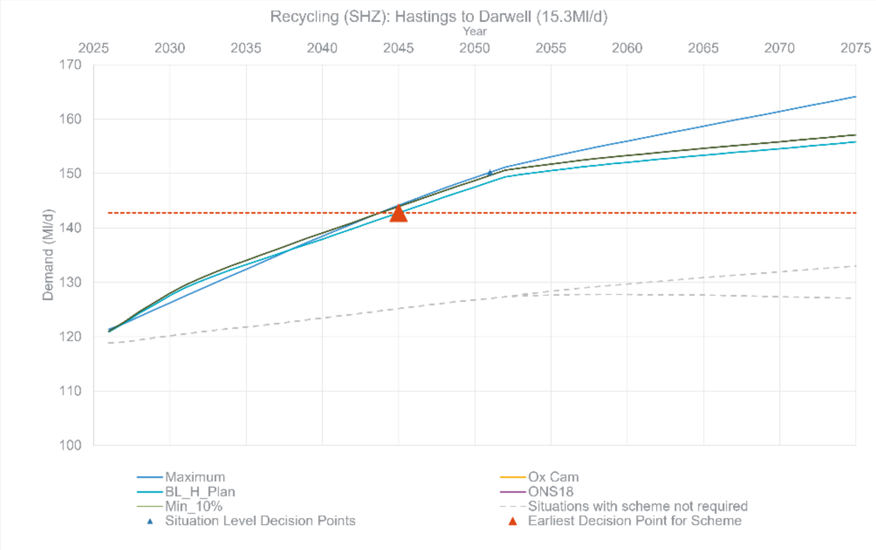
Supply-demand balance



Environmental Destination

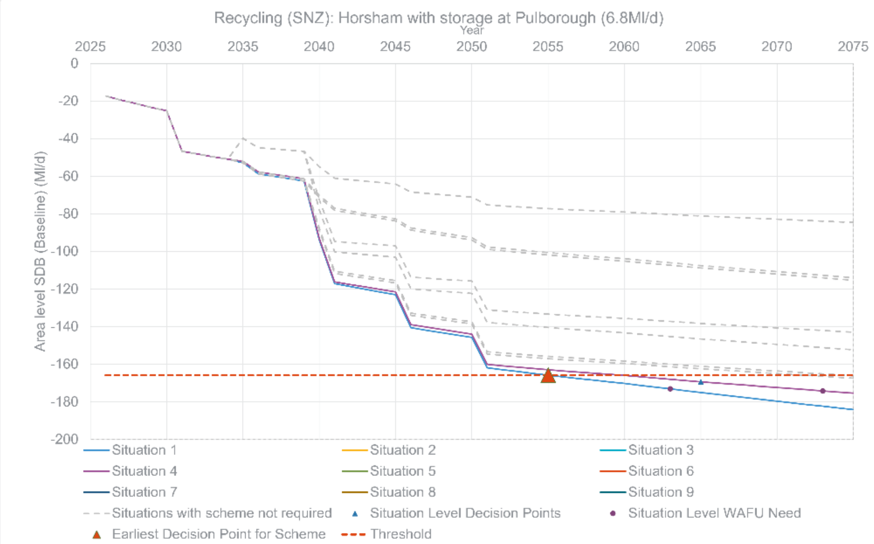


Climate change

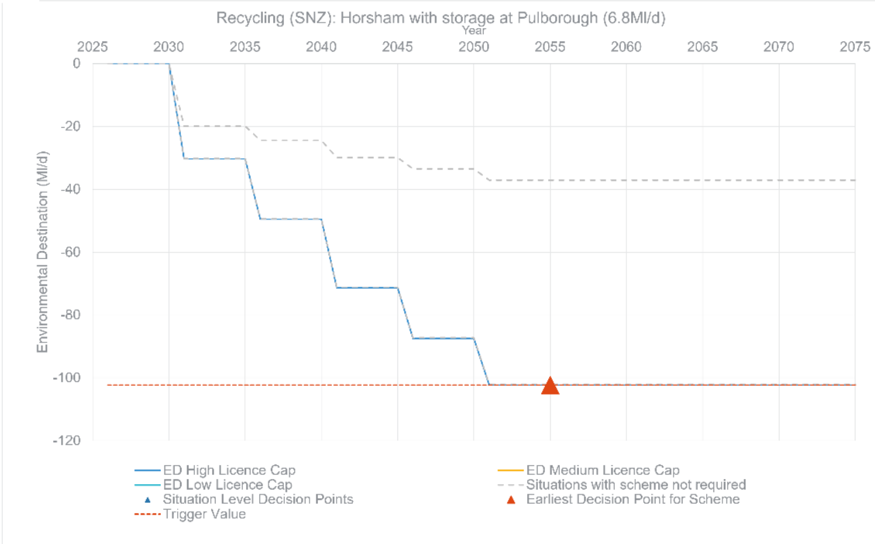


Demand (population growth)

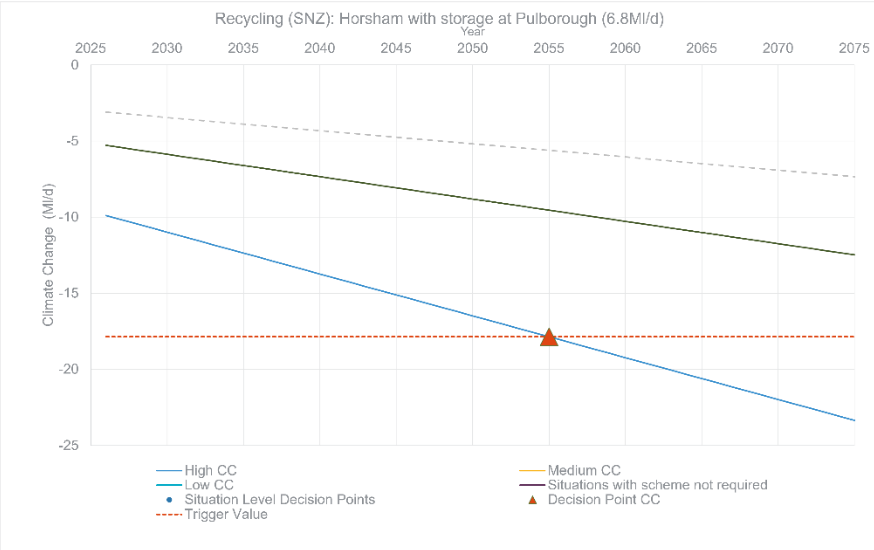
Recycling (SNZ): Horsham with storage at Pulborough (6.8Ml/d)



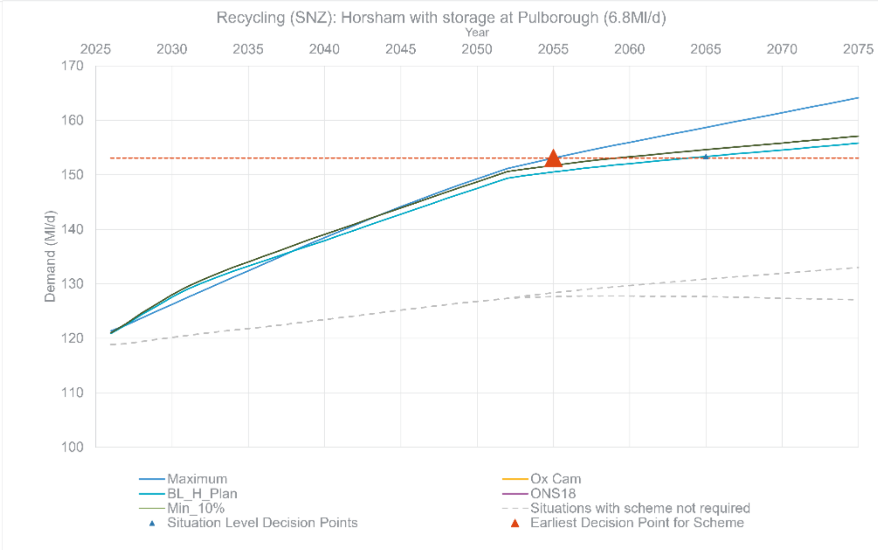
Supply-demand balance



Environmental Destination

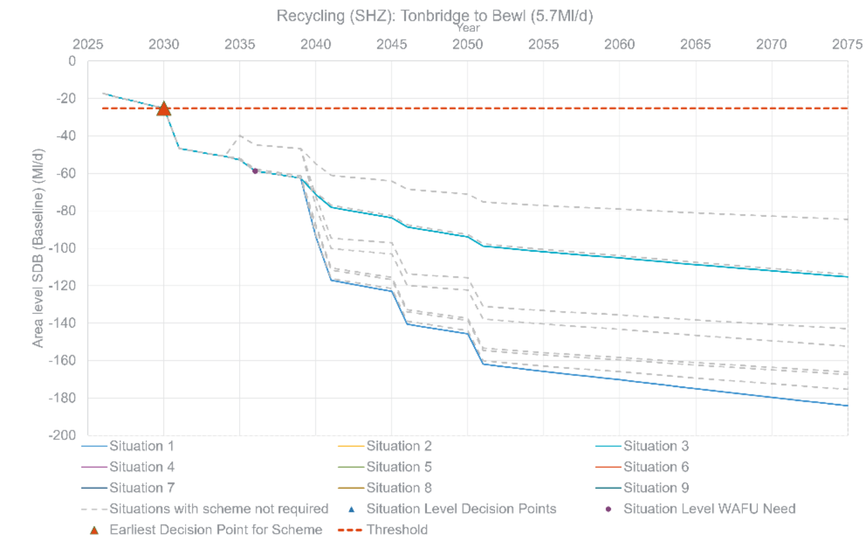


Climate change

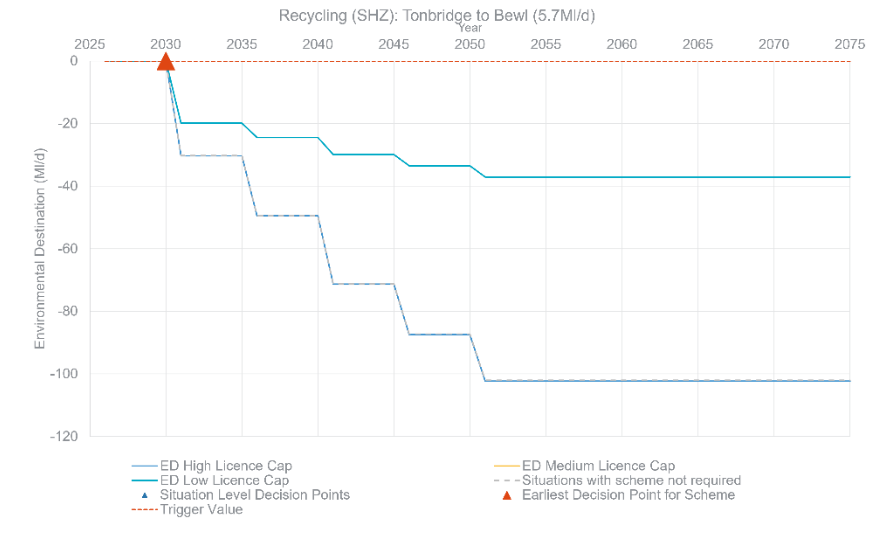


Demand (population growth)

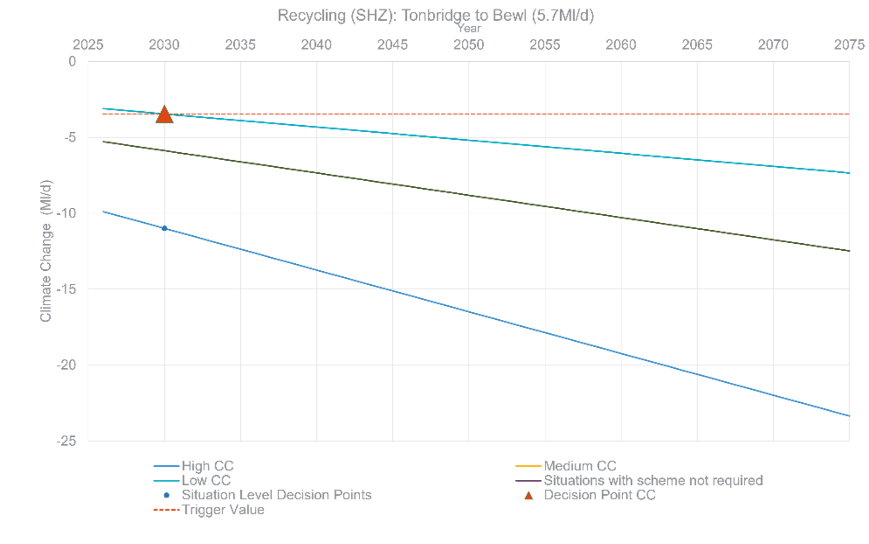
Recycling (SHZ): Tonbridge to Bewl (5.7Ml/d)



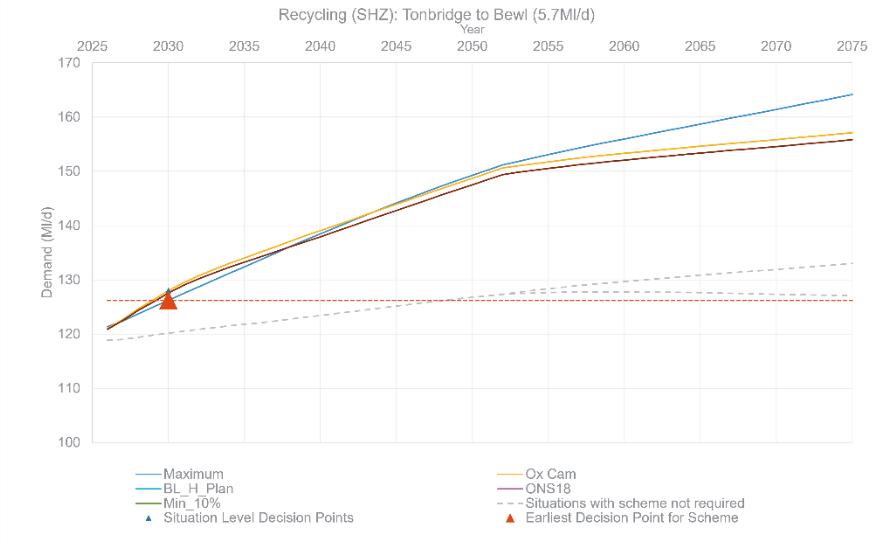
Supply-demand balance



Environmental Destination

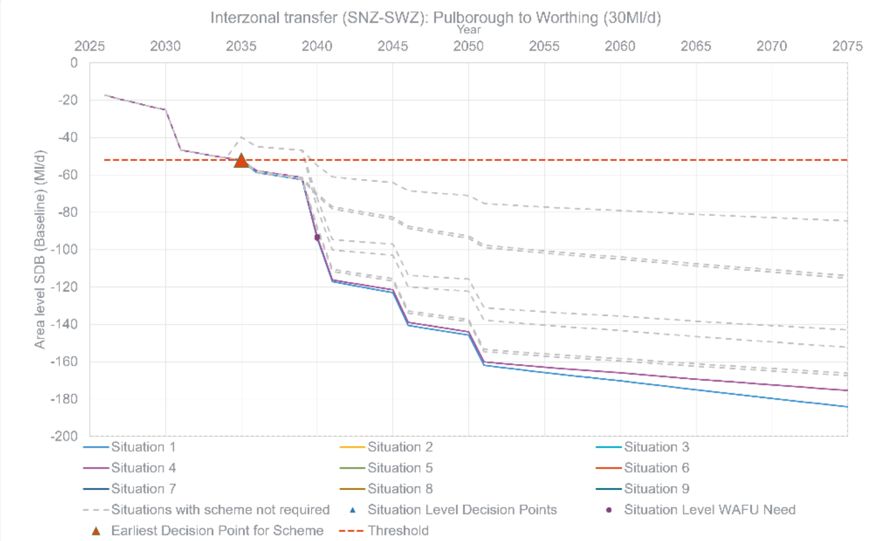


Climate change

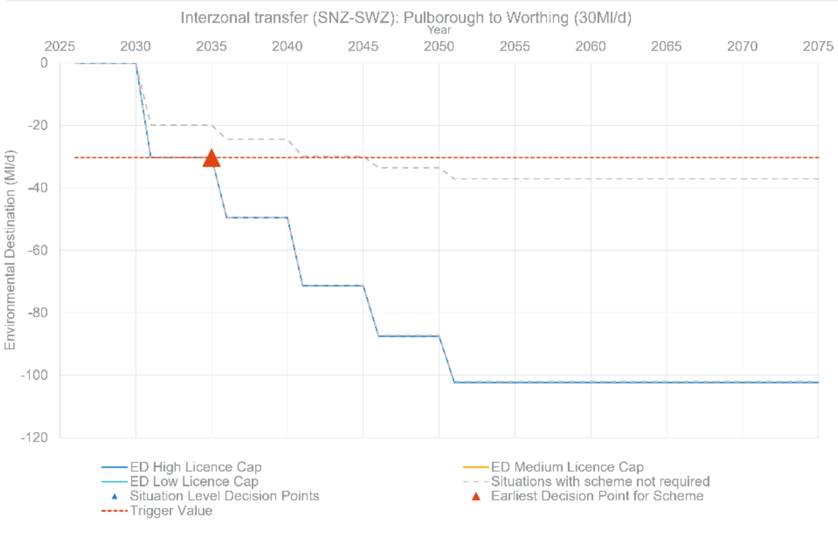


Demand (population growth)

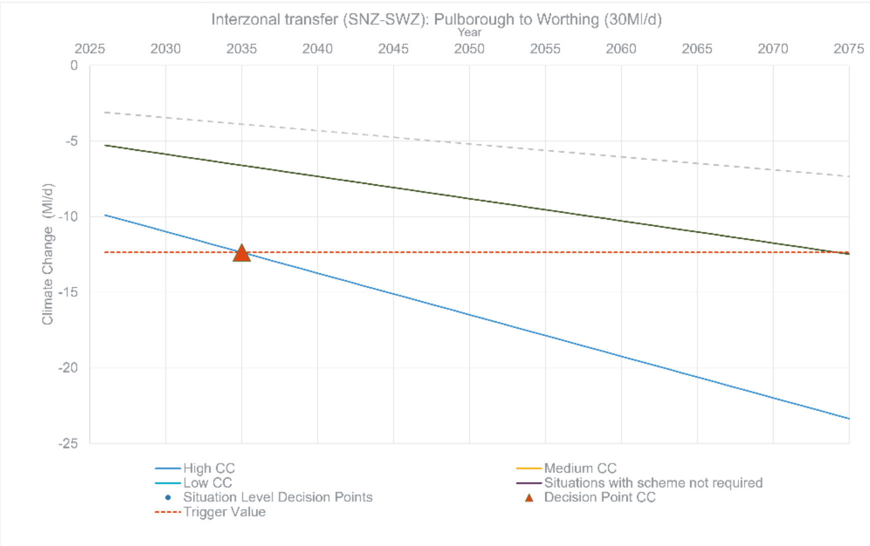
Interzonal transfer (SNZ-SWZ): Pulborough to Worthing (30Ml/d)



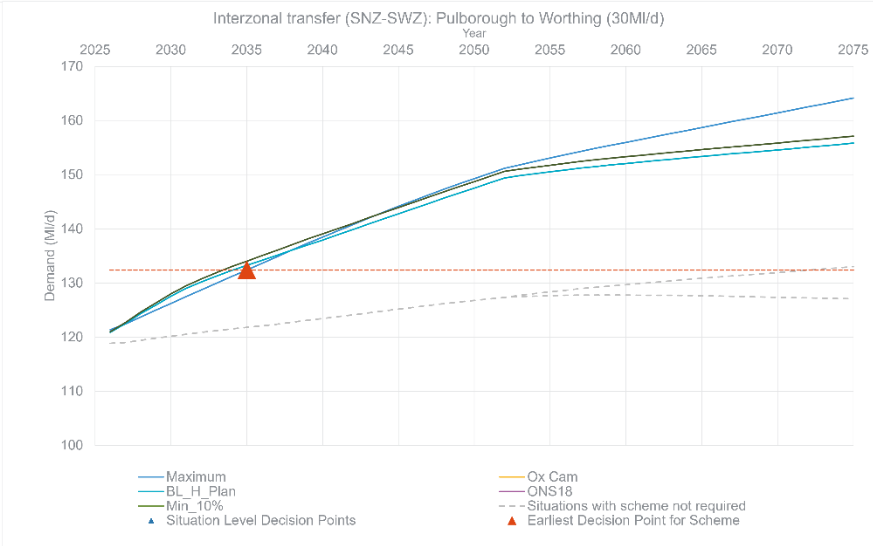
Supply-demand balance



Environmental Destination

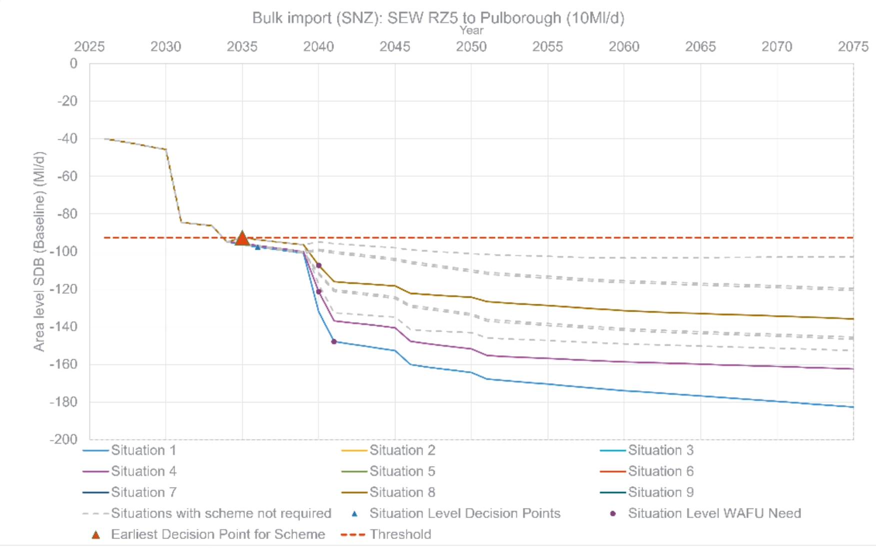


Climate change

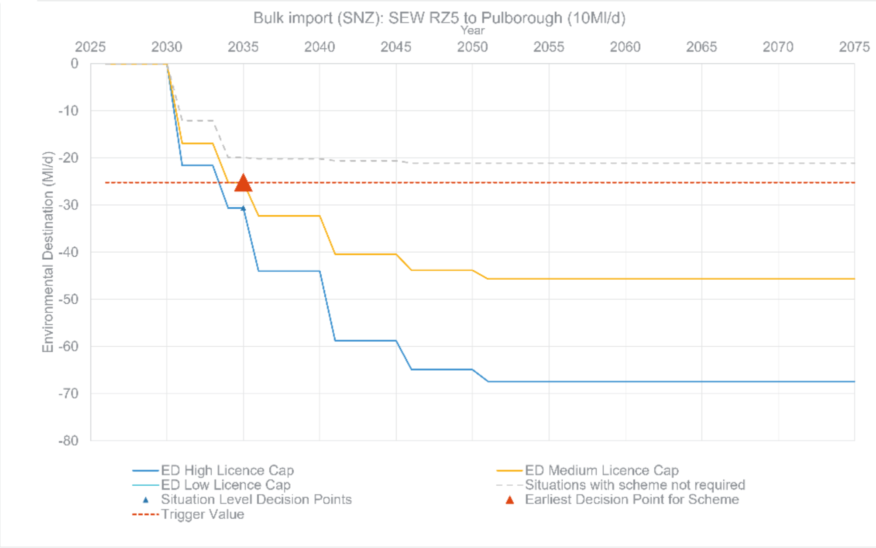


Demand (population growth)

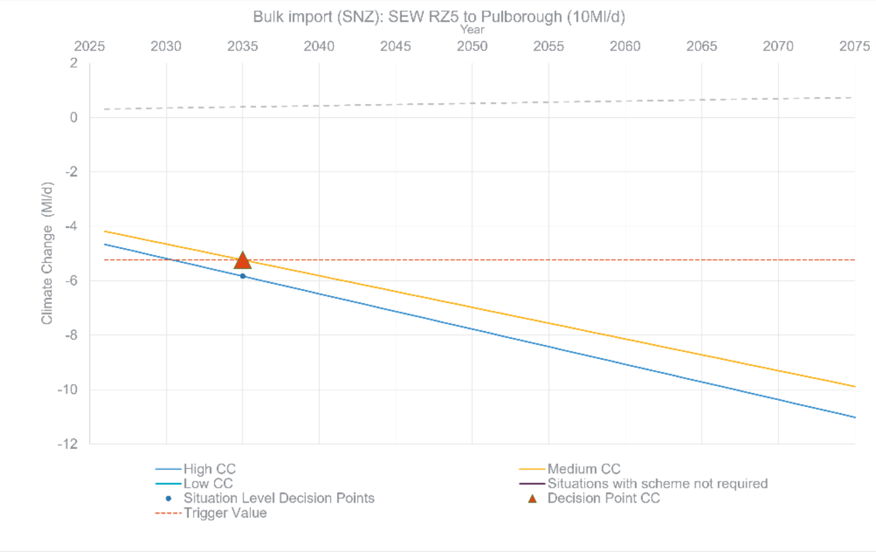
Bulk import (SNZ): SEW RZ5 to Pulborough (10Ml/d)



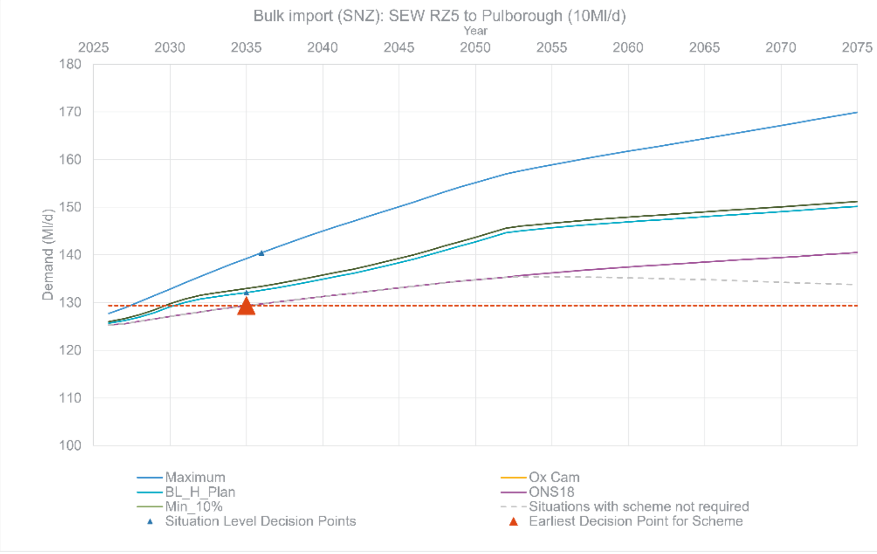
Supply-demand balance



Environmental Destination

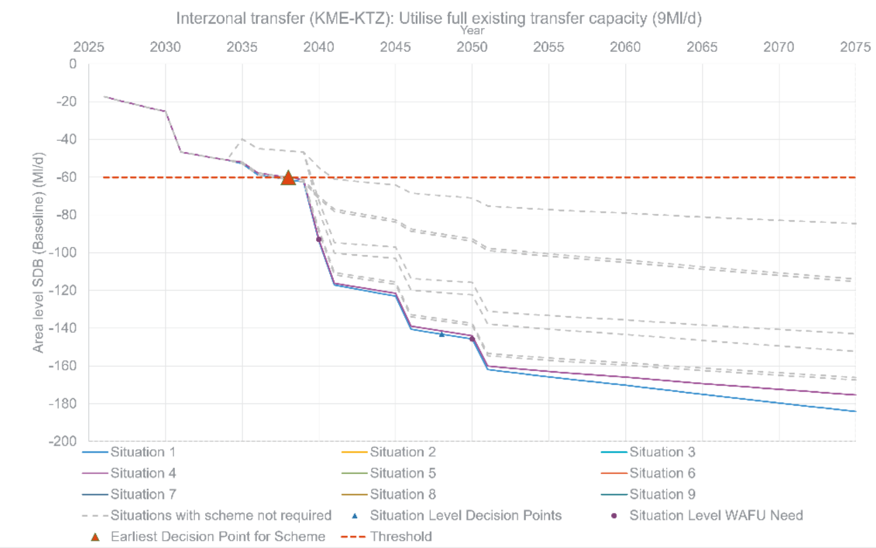


Climate change

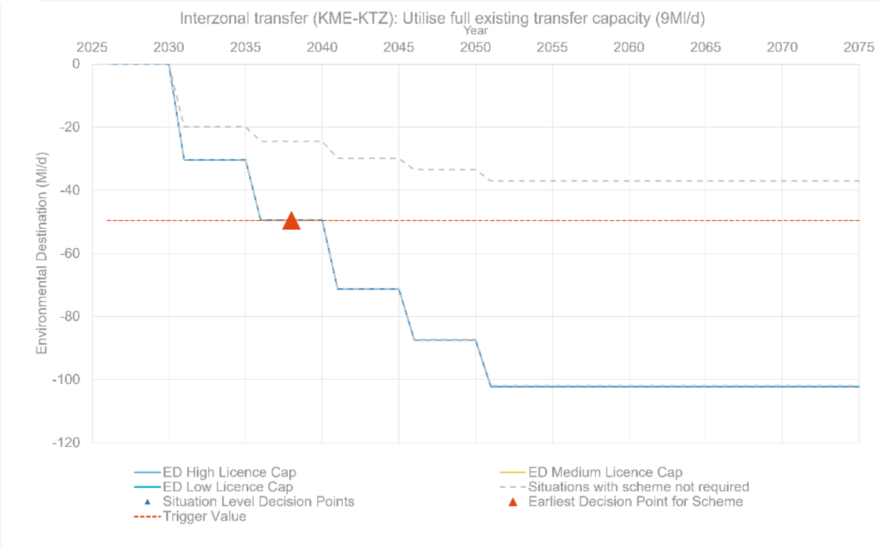


Demand (population growth)

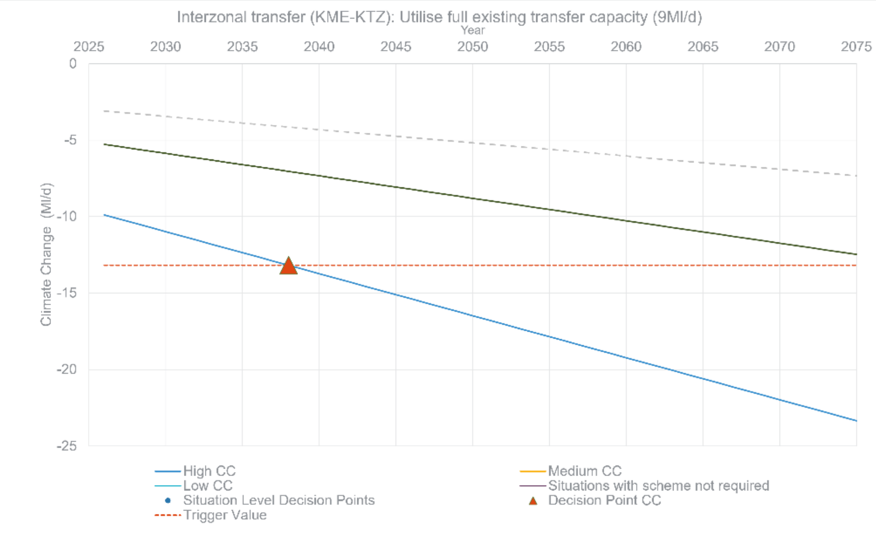
Interzonal transfer (KME-KTZ): Utilise full existing transfer capacity (9Ml/d)



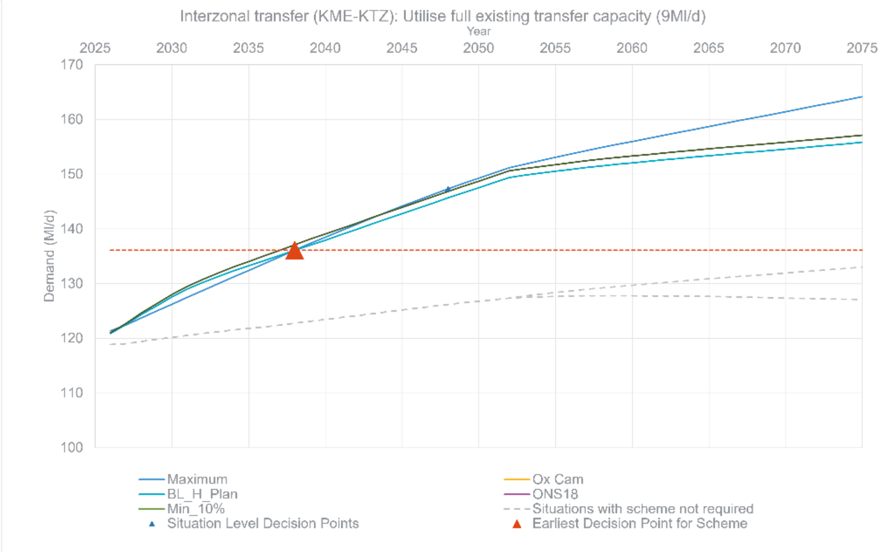
Supply-demand balance



Environmental Destination

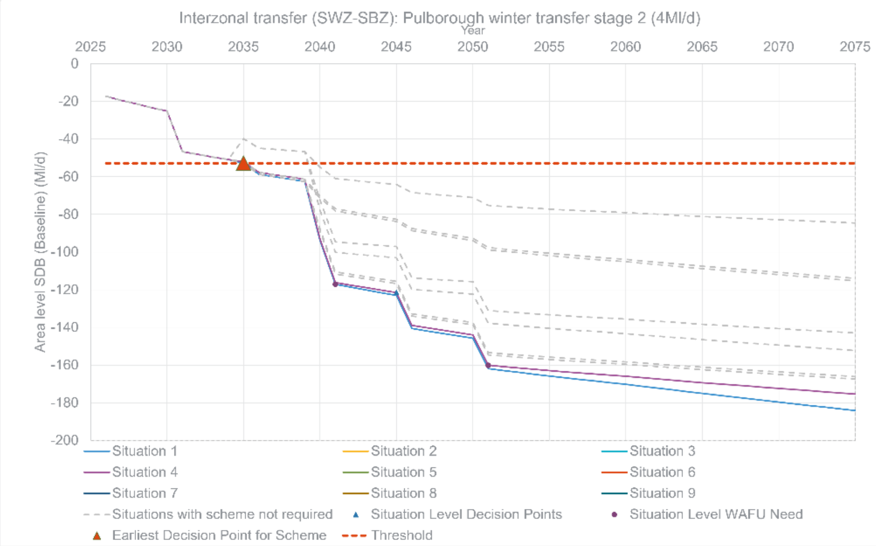


Climate change

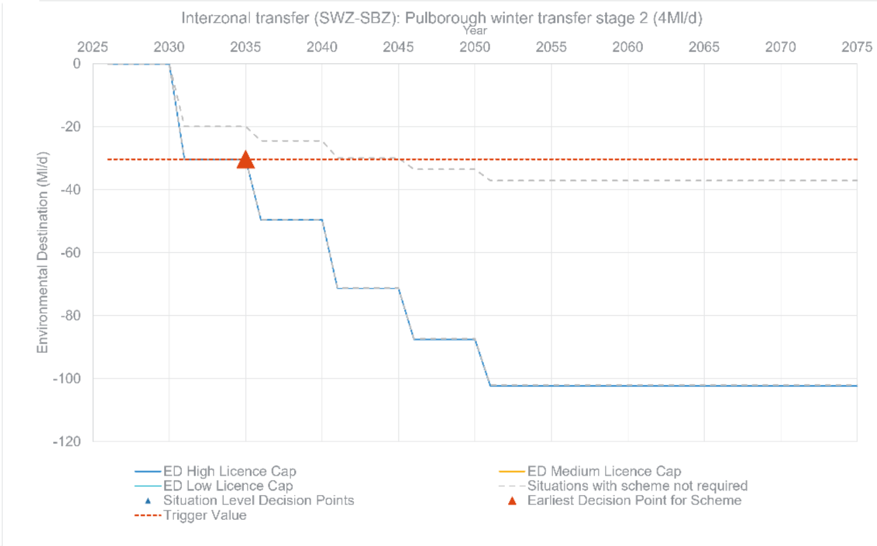


Demand (population growth)

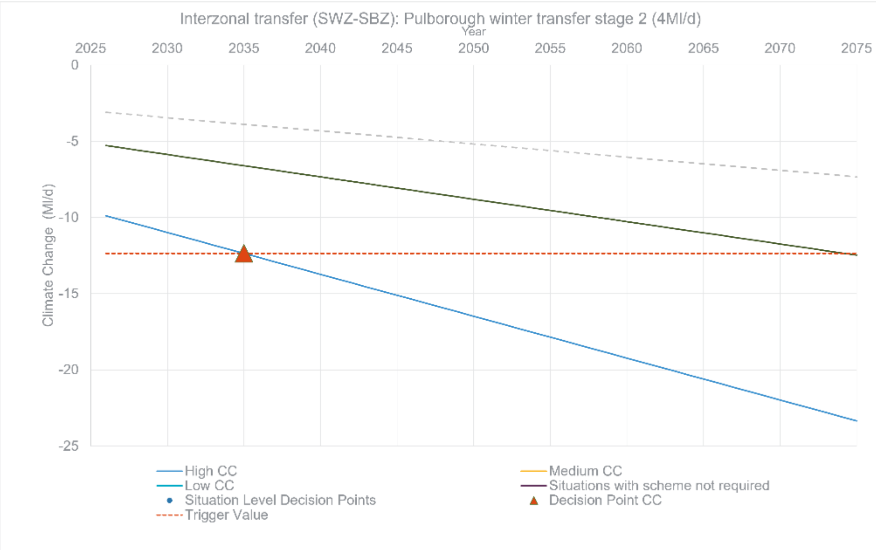
Interzonal transfer (SWZ-SBZ): Pulborough winter transfer stage 2 (4Ml/d)



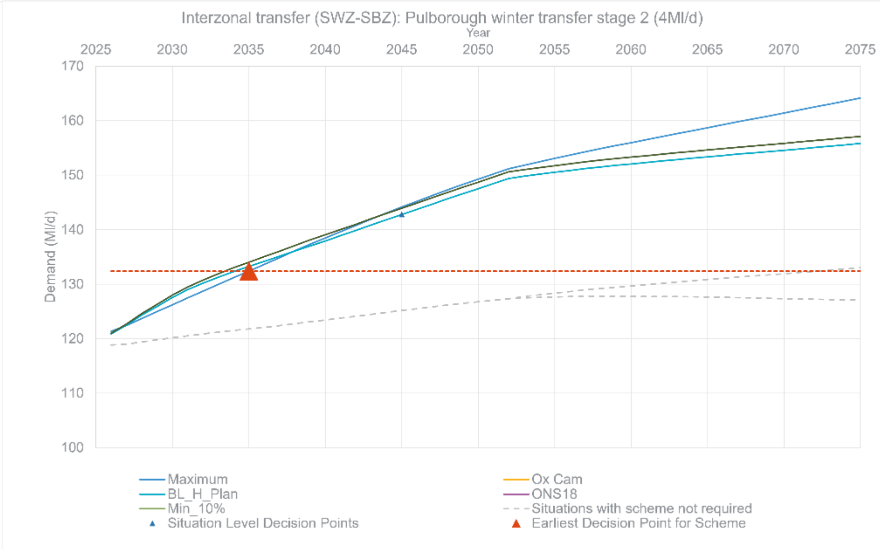
Supply-demand balance



Environmental Destination

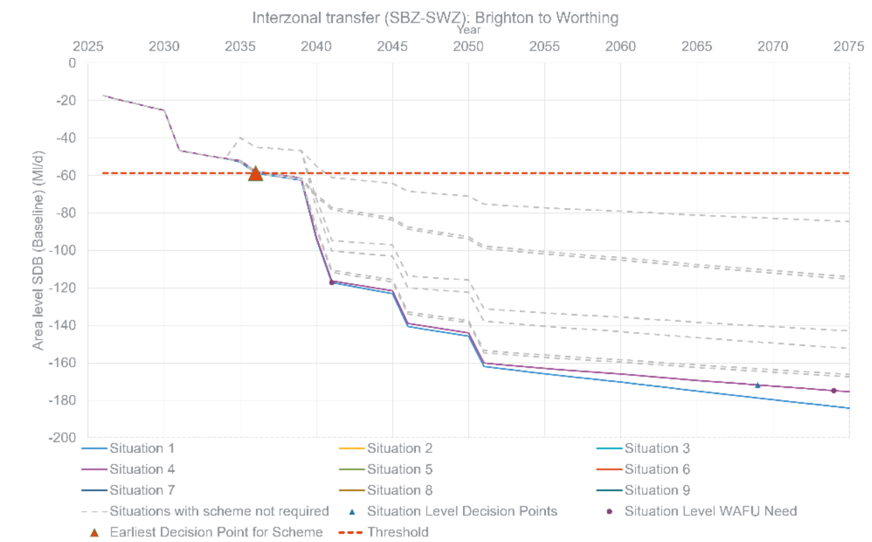


Climate change

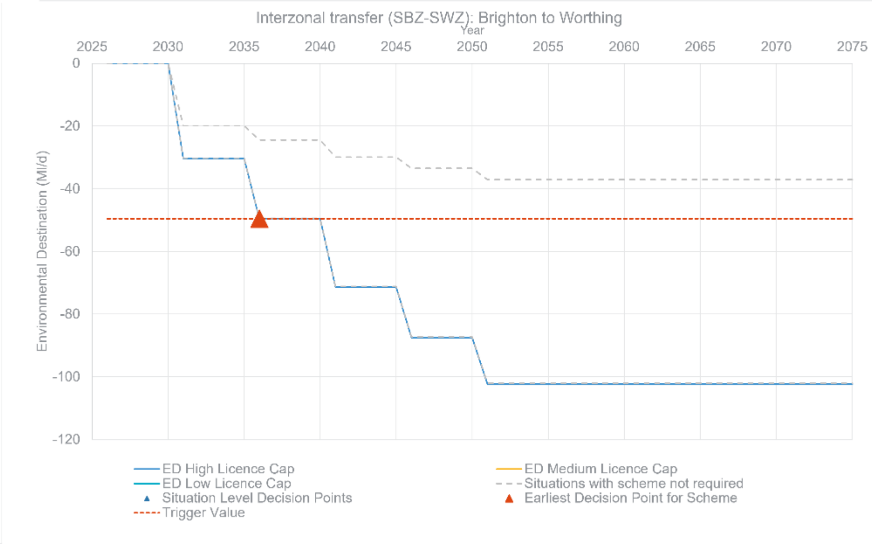


Demand (population growth)

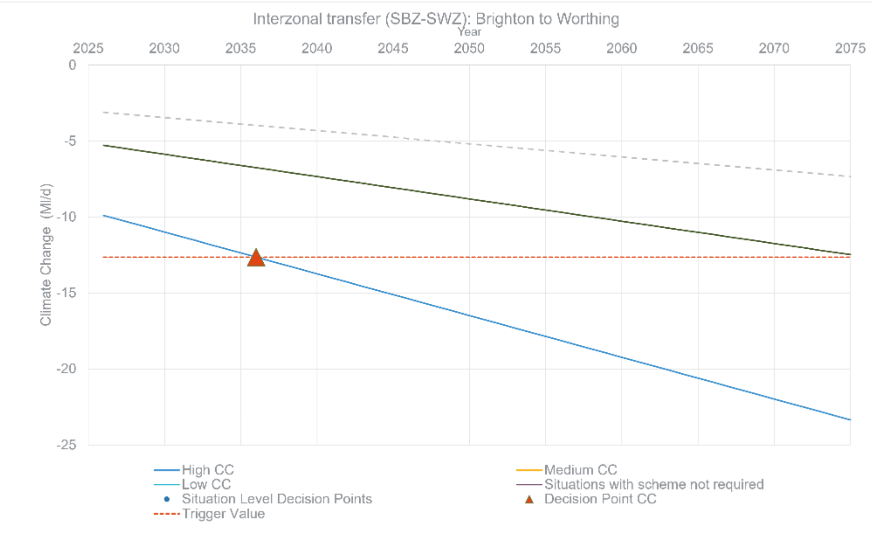
Interzonal transfer (SBZ-SWZ): Brighton to Worthing



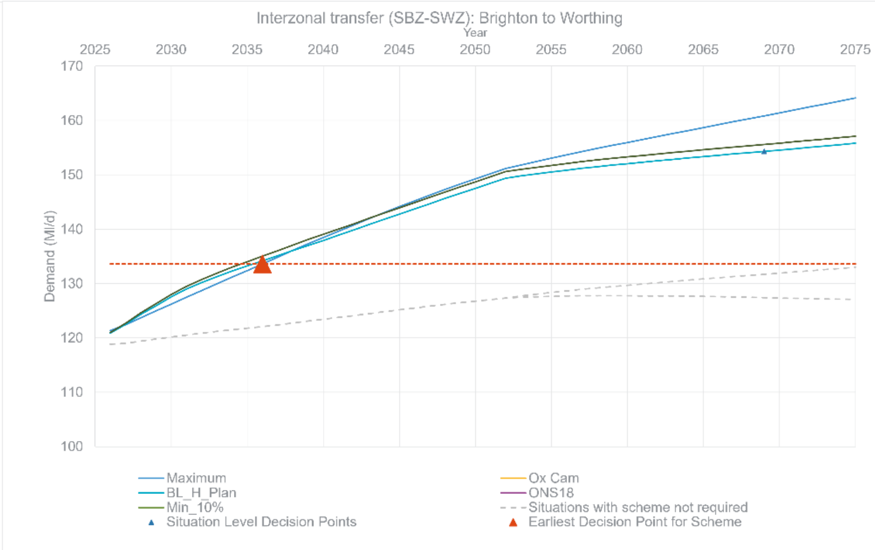
Supply-demand balance



Environmental Destination

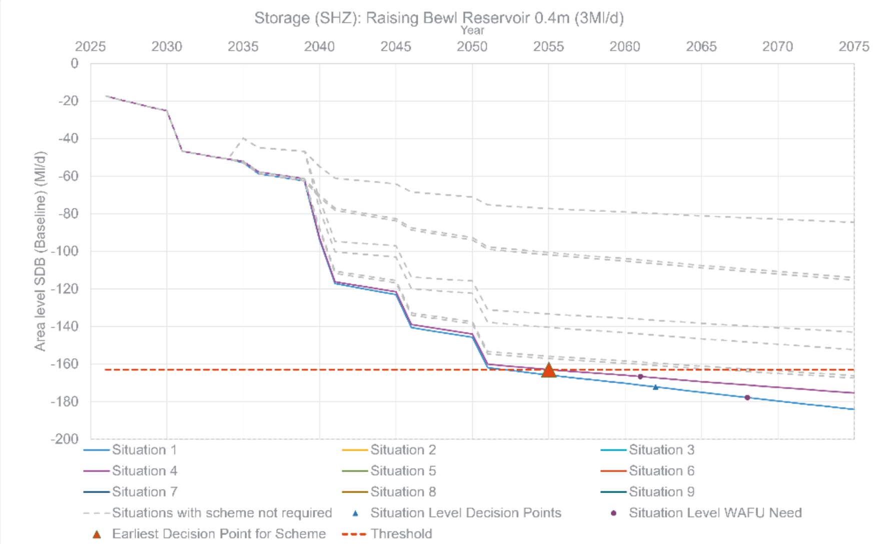


Climate change

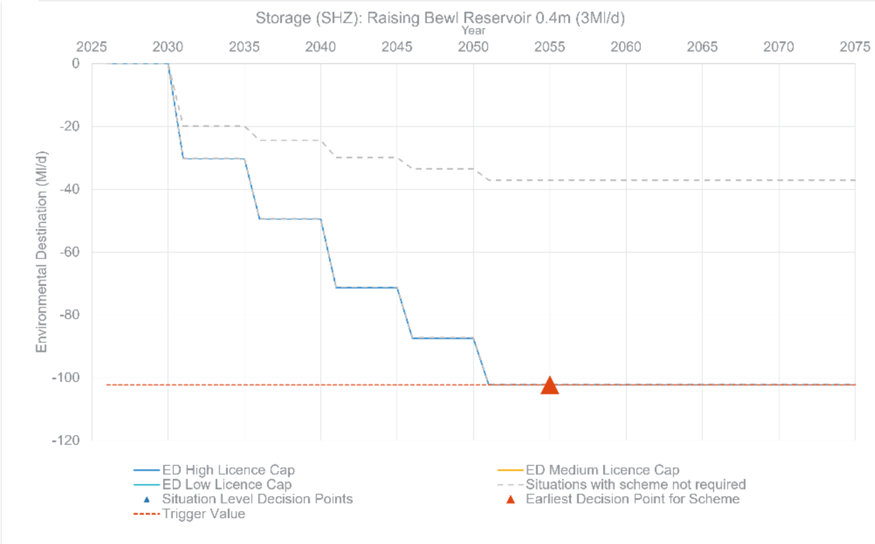


Demand (population growth)

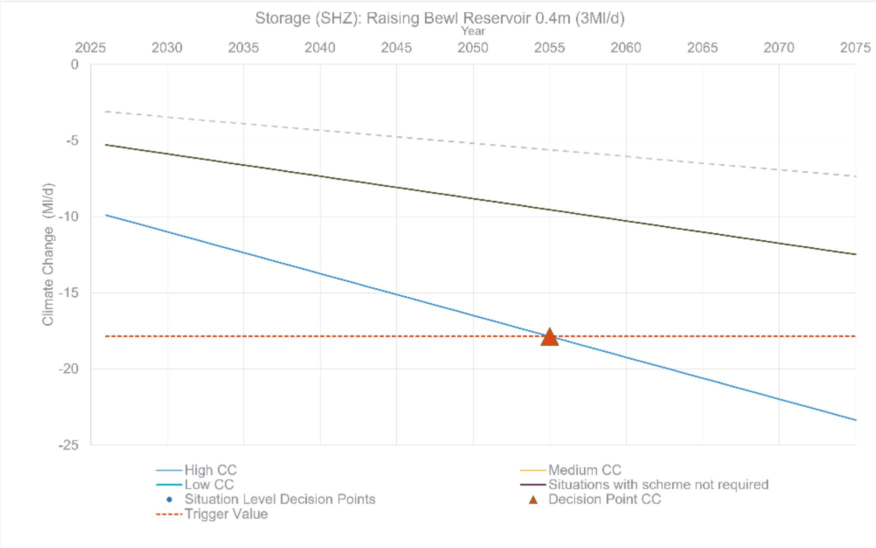
Storage (SHZ): Raising Bewl Reservoir 0.4m (3Ml/d)



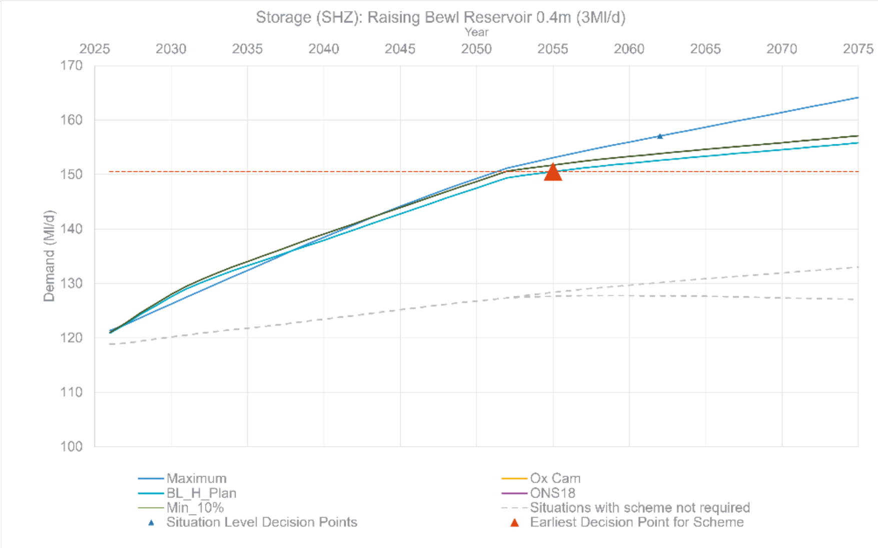
Supply-demand balance



Environmental Destination

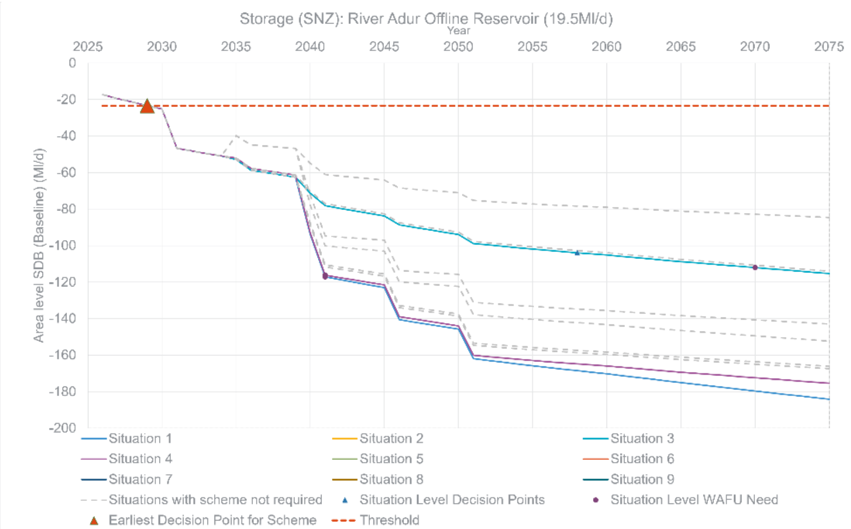


Climate change

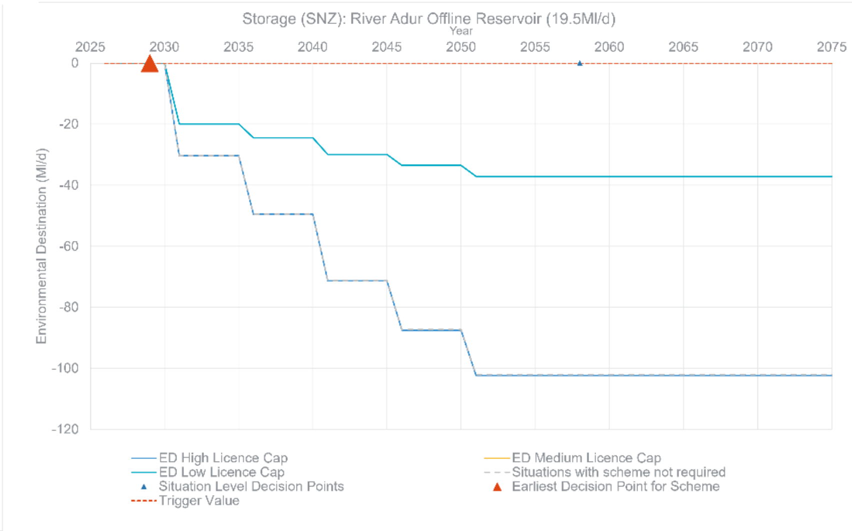


Demand (population growth)

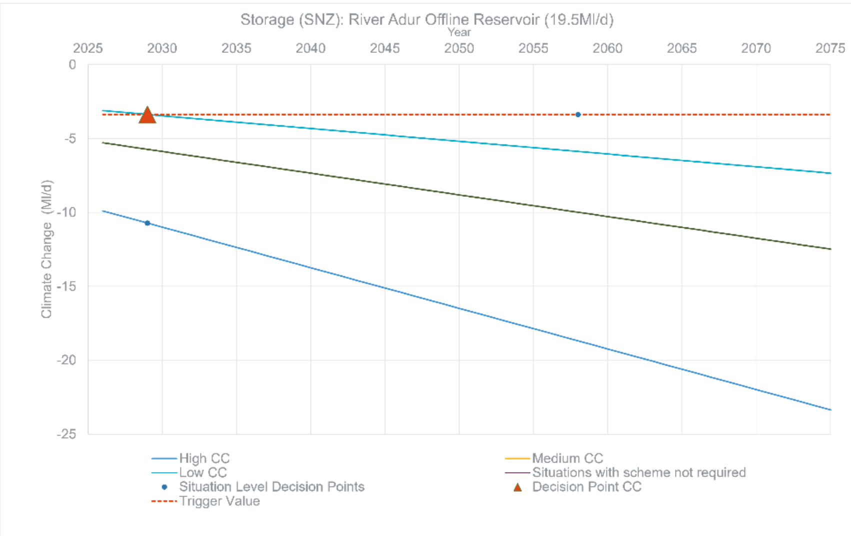
Storage (SNZ): River Adur Offline Reservoir (19.5Ml/d)



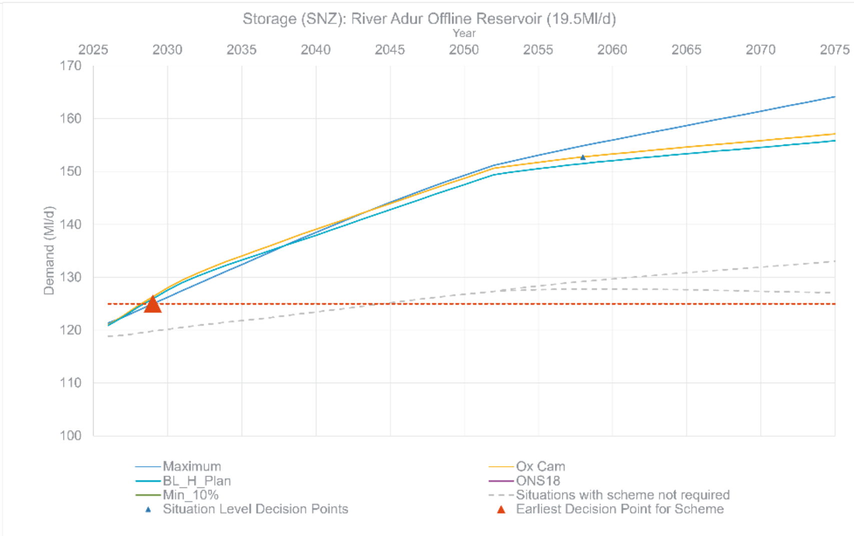
Supply-demand balance



Environmental Destination

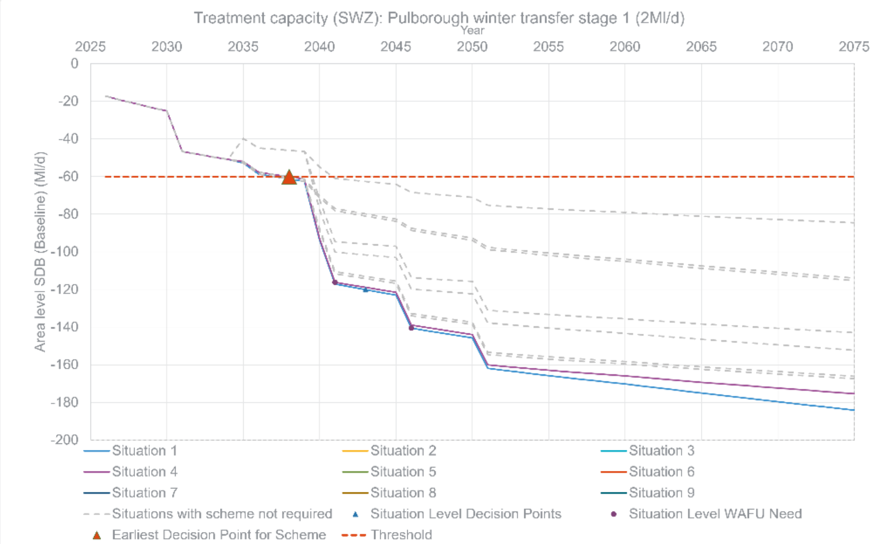


Climate change

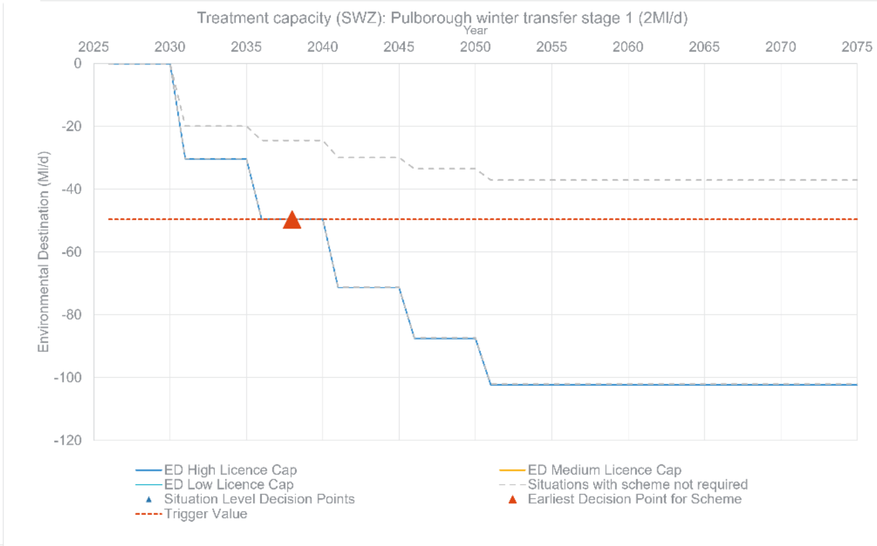


Demand (population growth)

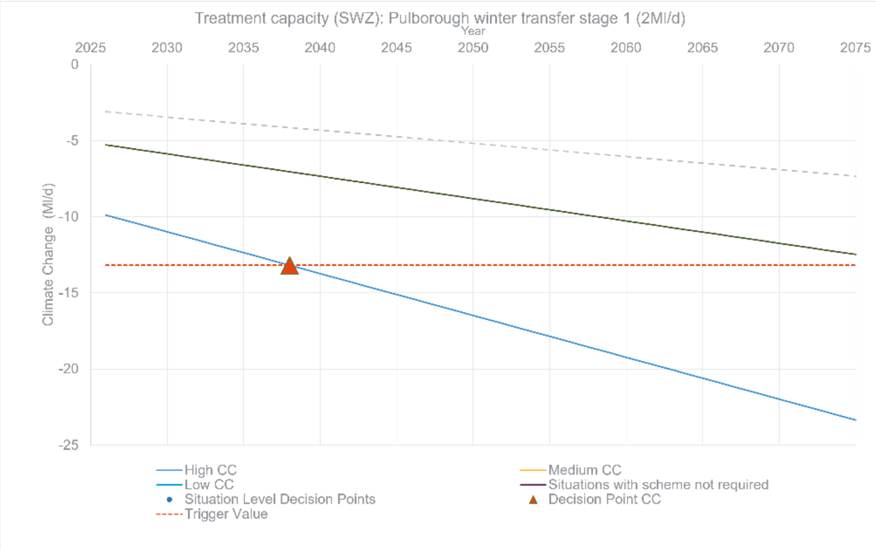
Treatment capacity (SWZ): Pulborough winter transfer stage 1 (2Ml/d)



Supply-demand balance



Environmental Destination



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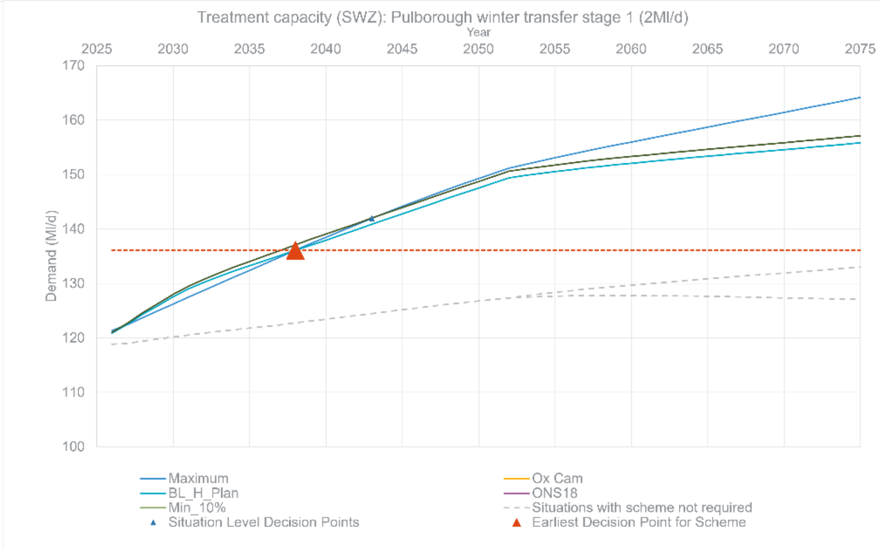

Demand (population growth)