Affinity Water

AFW146 Connect 2050 explainer

July 2024

Version v1.1

Contents

Executive summary

We are the largest water-only supply company in the UK, owning and managing the water assets and network in an area of approximately 4,500km² across three supply regions in the southeast of England. This includes our Central region which comprises 6 Water Resource Zones (WRZs) and is a highly water scarce region, vulnerable to climate change and has a fast-growing population. It also hosts precious, environmentally sensitive chalk streams.

At present we have sufficient water available for use (WAFU) and therefore acceptable headroom to supply our customers. However, due to a range of factors, this target headroom will be eroded (severely in certain WRZs) across the coming years. In the short term (by 2030), without intervention this erosion will cause a number of our WRZs to fall into a headroom deficit. The factors that cause this include the application of Sustainability Reductions in line with our Environmental Destination (supported by the Environment Agency) which will reduce the available deployable output (DO) within our Central region as we protect our chalk streams. Furthermore, significant population growth will stress the remaining DO and in the longer term this deficit will further be exacerbated if no interventions are put in place as we see further impacts of population growth and climate change on our local environment.

To ensure that we can provide our customers with clean and safe water whilst we also protect our precious local environment through our Sustainability Reduction programme, we have taken a systems-based solution approach and designed our Connect 2050 programme of work.

Whilst some of our wider supply-demand interventions (as detailed in our WRMP24) will improve this deficit position (including leakage improvement, metering deployment etc.), the Connect 2050 programme is necessary to be able to move the water that is coming from the new resource options to the areas where it can solve the remaining deficit. The Connect 2050 programme effectively balances cost and benefit through a comprehensive solution development and optioneering process accounting for the changes in the strategic supply network that are required to facilitate abstraction reductions and new supply side resources. We have ensured that options developed were all viable through a comprehensive understanding of the need which was assessed through extensive network modelling. We modelled the effect of each option with permutations (20,000 in total considering type and timing of intervention), to assess the impact on our network using a consistent set of measures to establish the best value option.

The chosen option that is proposed in AMP8 has been calculated as the best value for our Connect 2050 programme and comprises a series of interventions that use our ability to increase our DO in some of our more southerly WRZs and then use a combination of our existing infrastructure (where capacity permits) and new infrastructure to move water around our Central region to meet the WRMP24 target headroom in all WRZs. This forms the best value early development of the most cost effective upgrades that can then be used to support the changes in the system that will come into effect once the Strategic Resource Options (SROs) come online, starting in 2032. By taking this whole system view of balancing delivery of clean and safe water

across our network with our obligation to protect our natural environment, we have ensured best value outcome for our customers.

We must make these interventions in AMP8. Without making these interventions in AMP8, a number of our WRZs will fall into a deficit and we will not be able to guarantee clean and safe water to our customers from 2030 or be able to progress with our sustainability reduction programme in AMP8 and beyond.

1. Affinity Water's Central Region

Affinity Water is the largest water-only supply company in the UK, owning and managing the water assets and network in an area of approximately 4,500km² across three supply regions in the southeast of England and provided drinking water to over 3.8 million people. Figure 1 shows the eight Water Resource Zones (WRZs) across the company area. We operate in a water scarce region which is vulnerable to climate change and has a fast-growing population. It also hosts precious, environmentally sensitive chalk streams.

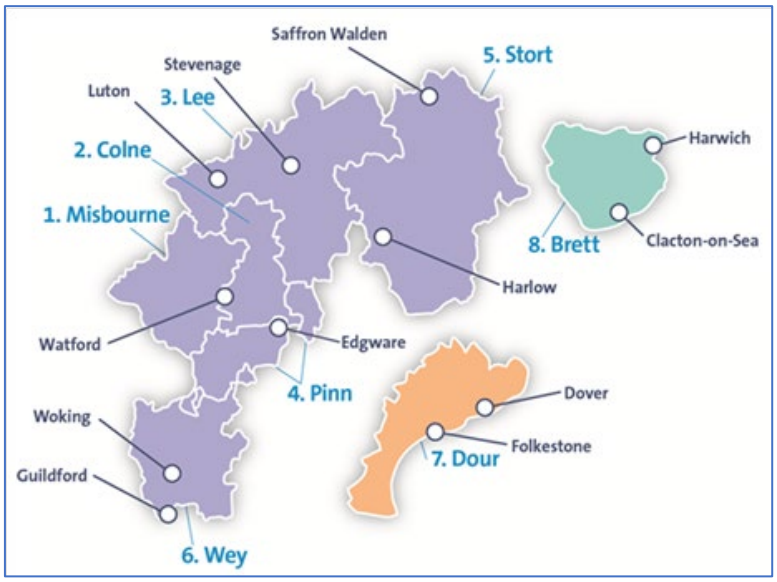

Figure 1: Map of Affinity Water Resource Zones (WRZs)

The Central Region (highlighted in purple in Figure 1) is split into six communities or WRZs; Misbourne (WRZ1), Colne (WRZ2), Lee (WRZ3), Pinn (WRZ4), Stort (WRZ5) and Wey (WRZ6).

The Central Region contains a large number of rare chalk streams which receive baseflow from the underlying chalk aquifer, from which we abstract groundwater for public supply. With the exception of four sources located in WRZ6 and WRZ4 in the south of the region (which take surface water from the River Thames), the rest of region is primarily fed by local chalk groundwater.

As part of our Environmental Destination strategy and supporting the ambitions of the Environment Agency's National Water Resources Framework, we have committed to ending unsustainable abstraction from chalk groundwater sources where this is identified, in order to protect our globally rare chalk streams which are predominantly in our Central Region. These Sustainability Reductions will decrease our groundwater abstraction from the chalk aquifer, to help restore the natural river flows in the upper reaches of rivers in the Chilterns.

These reductions will dramatically reduce the current supply/demand headroom in the zones where they will be implemented and along with other challenges such as population growth and climate change will necessitate significant changes to the

configuration of the strategic networks in the Central Region. The following section details these challenges, in particular the impact on supply/demand headroom.

2. The need to change: Impacts of sustainability reductions, growth and other factors

Baseline assessment

The baseline assessment for this enhancement case is centred around the existing network. The case enhances the network to ensure that future changes to existing and potentially new sources of water can be efficiently accommodated and subsequently transferred within the distribution network to serve customers. Therefore, the baseline position that has been modelled is the current network, including all funded AMP7 interventions.

The baseline assessment of the supply-demand balance is provided by the draft WRMP24. The draft WRMP24 (section 6) reports the baseline forecast supply-demand balance for Affinity Water. This represents the position in a 'Do Nothing' scenario. Figure 6.3 of the draft WRMP24 is reproduced in Figure 2 below, showing the forecast difference between available supply and projected demand for drinking water in Affinity water's Central Region (WRZ 1- 6).

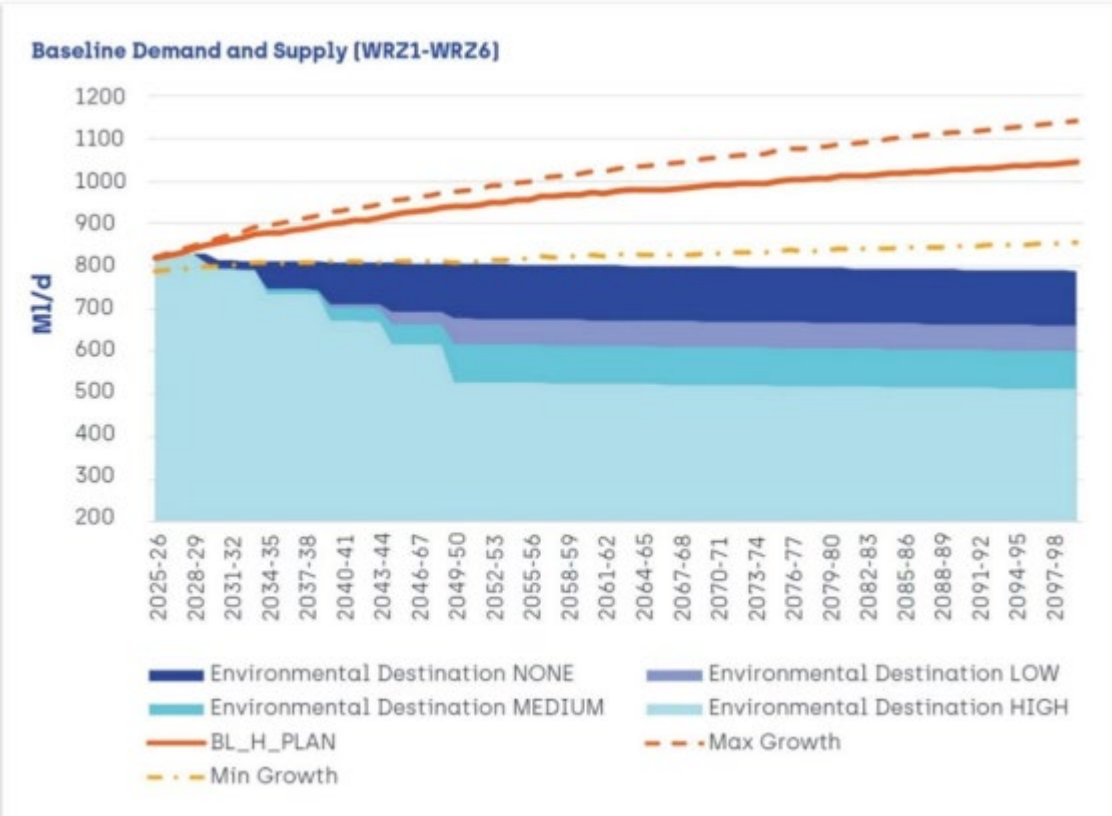

Figure 2 Baseline supply demand and supply for Affinity Water Central region (Figure 6.3 from draft WRMP24)[1]

This is further quantified in the draft WRMP24 with a range of uncertainty, depending on the extent of future growth and future reductions in existing abstraction licences that

[1] Includes benefits with drought restrictions (i.e., Tubs and Neubs)

are required due to environmental pressures. Whilst Figure 2 demonstrates a supply demand imbalance by 2030 (i.e, at the end of AMP8), looking further into the future and again modelling uncertainty, this outlines a shortfall of potentially available supply of up to 450 Ml/d for Central communities by 2050.

This loss of supply (in both the short and longer term) needs to be met by a combination of new demand reduction and water efficiency measures and by new strategic supply-side options. It is not possible to compensate against the loss of supply through any single one of these intervention types. These new strategic resource options (SROs) are facilitated and enabled by the network enhancements and improvements proposed under Connect 2050.

There is a high level of uncertainty associated with the future demand for water and available supply of water for Affinity Water. below shows the range of uncertainty, showing that this is quantified as a loss of supply volume between 52 Ml/day and 149 Ml/day for Affinity Water's Central Region in 2050.

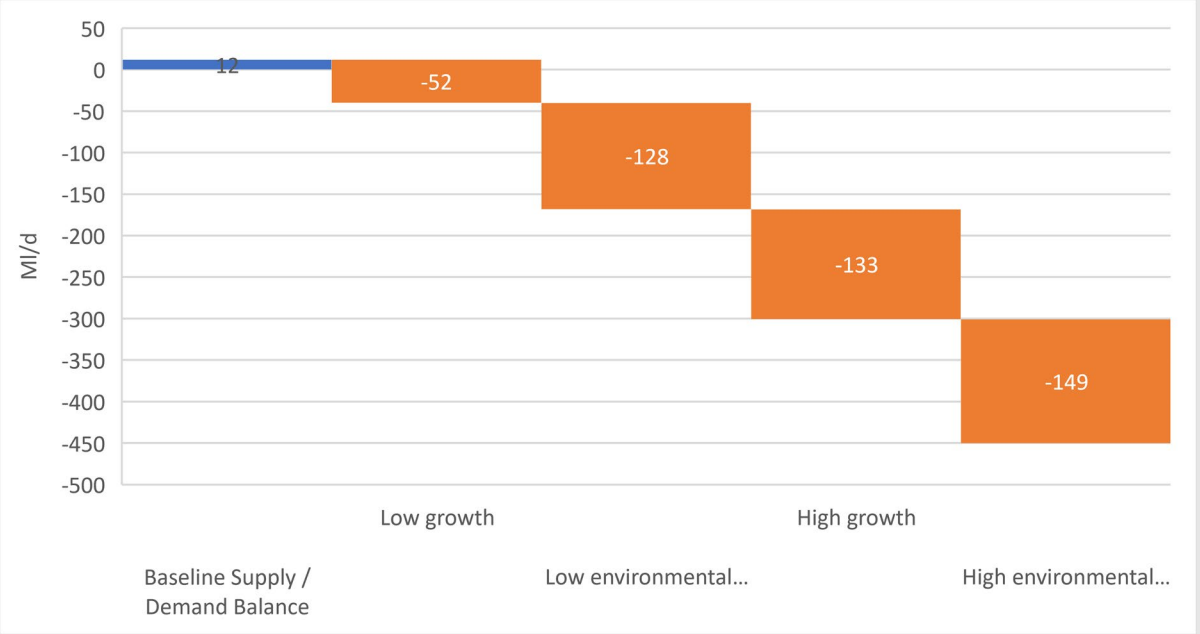

Figure 3: Supply and Demand Uncertainty Quantification for the Central Region in 2050[2]

What this means for our network in the Central Region

With current deployable output (DO), climate, statutory drought resilience and population figures, our current water resources position provides us with a positive

[2] Our Revised Draft WRMP provides further detail on this uncertainty- Figures 6.3 and 6.4 - https://affinitywater.uk.engagementhq.com/4398/widgets/76718/documents/46303

(target) headroom (Dry Year Annual Average 1 in 200 year planning scenario) position in each of our WRZs as described below in Figure 4.

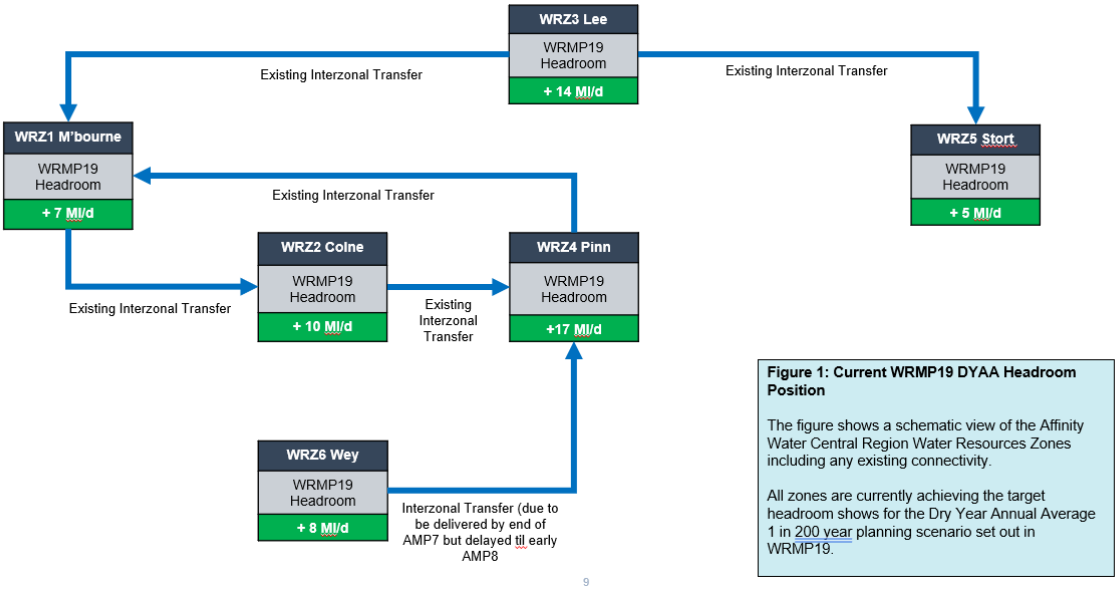

Figure 4 Current situation with target headroom

However, as Sustainability Reductions (SRs) are applied, the impacts of climate change become more acute, statutory drought resilience increases (to 1 in 500 year drought) and our population grows over the AMP8 and beyond, this target headroom is significantly depleted as outlined in Table 1 below.

Table 1 Headroom impacting factors in the Central Region

Target headroom impacting factor	Descriptor
Sustainability reductions	These SRs comprise a mixture of: - Cessations and reductions to average and peak DOs; - No Deterioration Licence capping, comprising reductions to average DOs to meet WFD No Deterioration requirements; and, - Average Deployable Output (ADO) Relocation, comprising a decrease in ADO in upper catchments and a concurrent increase in ADO in downstream catchments.
Climate change	Our region is among the lowest in the UK for total annual average rainfall per person, with climate change increasing the chances of significant and challenging events such as the prolonged summer demand of 2022.
Statutory drought resilience	The Environment Agency's National Framework for Water Resources requires companies to plan for a higher level of resilience to drought, so that restrictions such as rota cuts and standpipes will be needed no more than once every 500 years on average by the 2030s. Within WRSE, this is achieved using drought orders and drought permits up to 2040 but reducing reliance on these measures thereafter.
Population growth	A continued forecast of substantial population and housing growth, which will increase the demand for water within our region by around 10% by 2050.

The application of these factors causes significant negative headroom impacts across each of our six WRZs in the Central Region, putting five of the six WRZs into a deficit by 2030 as outlined in Figure 5 below:

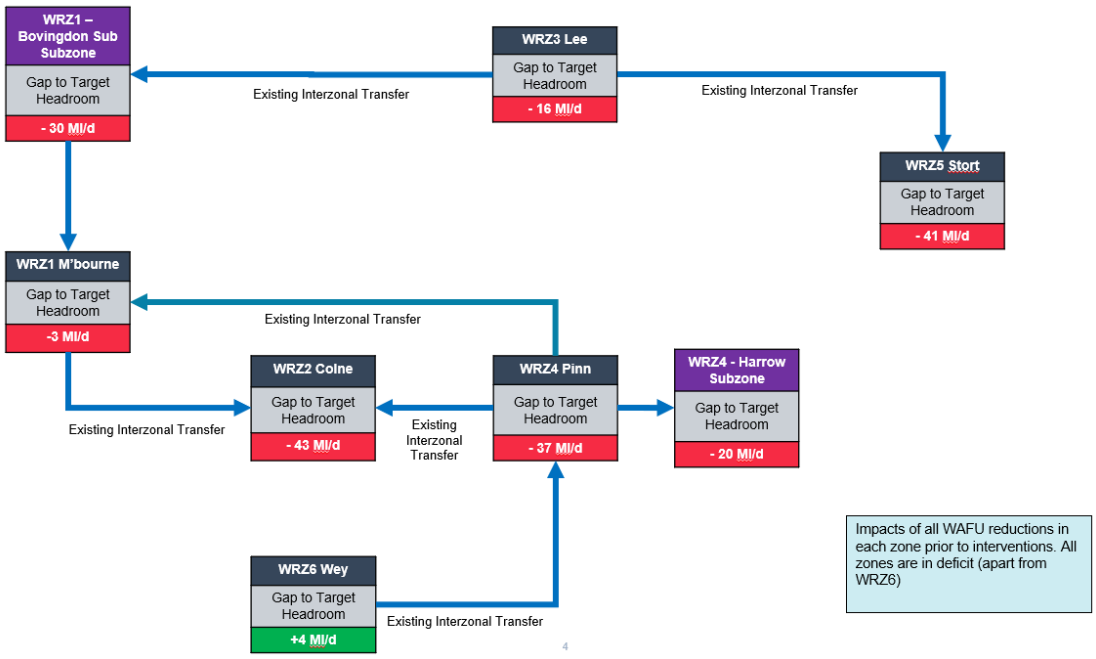

Figure 5 Impacts of all WAFU reductions prior to interventions

However, as described in our WRMP24 we are proposing a number of demand measures (such as leakage interventions and metering deployment) to lessen the impact of these factors. Nevertheless, these interventions alone will not provide us with target headroom as described in Figure 6.

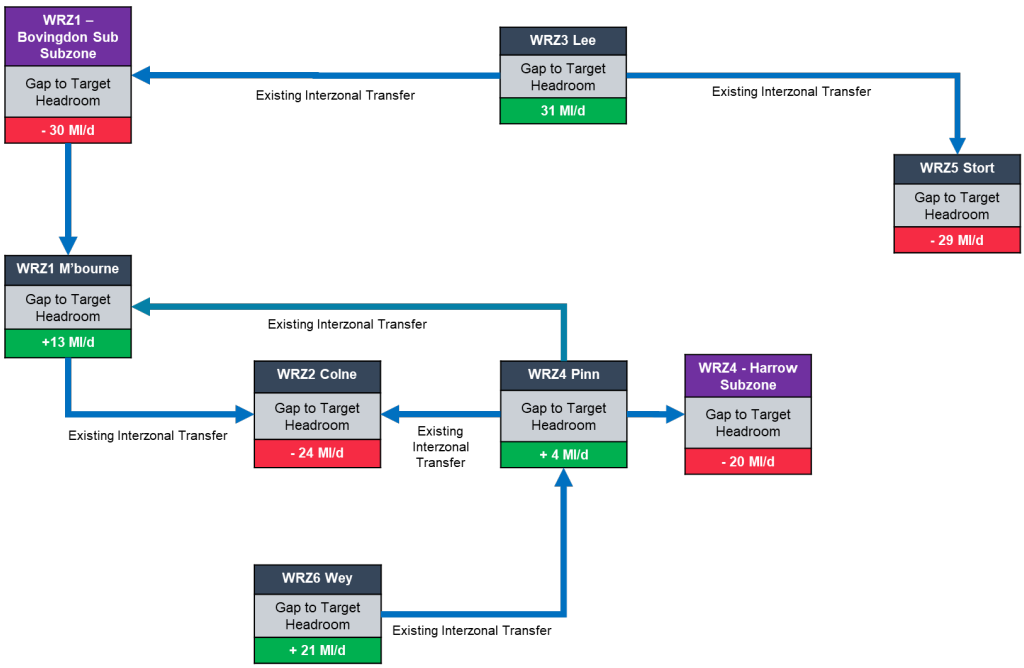

Figure 6 Modelled gaps to target headroom (WRMP24 DYAA in 2030)

Specifically, this will mean for our WRZs over AMP8 (without Connect 2050 interventions) that:

- WRZ 1 will see a significant reduction in target headroom focused in the north of the zone (Bovingdon Subzone) as a result of SRs (the Environment Agency has requested prioritisation of SRs here due to the Colne and its tributaries showing greater deficit to the Environmental Flow Indicator - EFI) and raw water deterioration (notably Iron, Manganese and PFAS). Furthermore, WRZ 1 is projected to see significant population growth putting an even greater strain on the supply demand balance. Whilst the south of the zone benefits from wider supply demand interventions (causing it to achieve target headroom), this is not the case for the Bovingdon Subzone in the north which remains in deficit and cannot benefit from the surplus position in the south of the zone, as the current infrastructure does not support the transfer of water from the south to the north of the zone where there is deficit due to "bottlenecks" in the network.

- WRZ 2 will also see a significant reduction in target headroom as a result of SRs as per our Environmental Destination programme. It will also see a significant impact of climate change due to sources being hydrogeologically constrained and will experience a moderate degree of growth. Drought orders will significantly lessen the impact of these measures against target headroom as will, to a lesser degree, metering and leakage reduction schemes. Nevertheless, despite these supply-demand options, WRZ 2 will remain in a deficit at 2030 unless Connect 2050 interventions are implemented.

- Although WRZ3 is subject to significant SRs and is projected to face significant climate change impacts which would otherwise cause a deficit, substantial wider WRMP24 supply-demand interventions such as the application of drought permits, the impact of the Sundon conditioning plant (described further below) and demand management interventions, ensure that the zone remains in surplus (at target headroom) at 2030, however this surplus is not large enough to offset the deficits in the adjacent WRZs (namely the Bovingdon Subzone in WRZ 1 and WRZ 5).

- WRZ5 will also see a significant reduction in target headroom causing a deficit in the zone. WRZ 5 had a relatively low surplus initially, however, after the application of the multiple No Deterioration Licence capping schemes and the projected population increase, WRZ 5 falls into a deficit and creates several single points of failure (SPOFs) as some parts of zone become dependent on only one source. The wider supply-demand interventions planned for this WRZ reduce the deficit but do not result in achieving target headroom.

- WRZ 4 will also see a reduction in target headroom. This is as a result of projected population growth and feeding zones that are significantly in deficit to which it is already connected, namely WRZ 1 and WRZ 3. Although significant, this reduction is not as severe as some other WRZs as a result of a licence relocation scheme in this WRZ.

- WRZ 6 is the only WRZ within our network that is forecast to remain in surplus during AMP8 with no Connect 2050 interventions. This is primarily as a result of lower population growth and licence headroom (ADO trading). However, this surplus is not great enough to offset deficits seen elsewhere across the network and cannot be effectively moved

to areas of need as we do not have sufficient transfer capacity with our existing infrastructure.

Whilst the increase in the Grafham transfer (through the Sundon conditioning plant implemented at the end of AMP7) may alleviate some of our deficit challenges across our Central Region, it will not provide any additional benefit by 2030 as it will only address the AMP7 SRs. Moreover, the Grand Union Canal (GUC) SRO scheme is currently planned for implementation in 2032/33 and is also dependent on the Connect 2050 scheme to allow this water to be transferred downstream of the point of entry to Affinity Water's supply system (Chaul End Service Reservoir). Therefore, to provide wholesome and resilient water supplies to our customers in both the short and the long-term, we must make a number of key interventions in AMP8 in order to remove these potential deficits (gaps to target headroom).

Given the interdependence of these factors and their impacts, we have taken a full systems-based approach to our solution optioneering and development. By taking this systems approach, we are ensuring our network solution optimises environmental benefits and impacts, whole life costs, resilience that fits with the Water Resources in SouthEast (WRSE) regional plan and addresses the specific WRMP, Sustainable Abstraction Reduction and resilience needs.

Without the interventions proposed within our Connect 2050 business case, we would have to defer our AMP8 and beyond abstraction reductions under our Environmental Destination, otherwise our customers would suffer loss of supply, particularly during times of higher demand in the summer.

3. Solution to meet these challenges: Connect 2050

In order to efficiently restore the target headroom in WRZs 1, 2, 3 and 5, over 20,000 options were tested in the MISER water resources model (see Section 5 for an overview of the optioneering process) and best value (where best value is defined in Table 3 in Section 5). Option 5 was identified which comprised of the following interventions in AMP8 outlined in Table 2 below. These interventions have been analysed as "no regret" even with the GUC scheme coming online after 2030 (planned for 2032/33):

Table 2 AMP8 interventions to restore target headroom in the Central Region

ID	Intervention Name	Type	Description
1	Build 40 Ml/d of additional treatment capacity in WRZ6	Additional DO	Installation of GAC at Chertsey and Walton WTWs in WR6 to create additional treatment capacity and surplus for onward transfer
2	2a: WRZ6 to WRZ4: Egham to Iver Interconnector	New Strategic Interconnector between zones	Improving connectivity from WRZ6 to WRZ4 (beyond the strategic interconnector already planned for delivery) to deploy the 40 Ml/d of surplus water (described in Intervention 1) in WRZ6 to the rest of the region. This includes maximising the capacity of the existing transfer (interconnector) and a new pipeline
	2b: Upgrade to existing booster on existing interconnector from WRZ6 to WRZ4	Upgrade of existing Interconnector	
3	WRZ4 Internal Interconnector: Harefield to Harrow interconnector	New Strategic Interconnector within a zone	Interconnector within WRZ4 - Booster and trunk main to increase transfer capacity between Harefield to Harrow to release water cascaded from WRZ6 via Iver and to reduce the deficit only seen in the Harrow subzone in WRZ4.
4	WRZ2 to WRZ1: Watford Grove to Heronsgate Interconnector	Upgraded Strategic Interconnector between zones	Upgrade of an existing interconnector from WRZ2 to WRZ1: The Surplus from WRZ4 (not Harrow subzone) is transferred to WRZ2 via existing transfers to put WRZ2 into surplus and for onward cascade from WRZ1 via an upgraded booster station in WRZ2.
5	WRZ1 Internal Interconnector: Heronsgate to Bovingdon interconnector	New Strategic Interconnector within a zone	In order to resolve the target headroom gap in WRZ1, an internal interconnector is required to deploy the water transferred from WRZ2 from the south of WRZ1 to the north of WRZ1. With the WRZ1 headroom target now met, the transfer from WRZ3 is no longer required. Allowing the surplus in WRZ3 to address the deficit in WRZ5.

6	Local Reinforcement Schemes in WRZ3	Local Interconnectors within a zone	Due to the loss of source DO through SRs, we are planning the delivery of schemes to remove Single Point of Failure (SPoF) risks that are now present. These also permit a more efficient transfer of water in the zone to allow an increase in the transfer of water to WRZ5 (increasing the existing transfers by 30 Ml/d).
7	New Reservoir in WRZ5 to reinstate resilience lost due to DO loss from SRs	Additional Strategic Storage in the zone	New strategic storage is required to restore resilience lost from SRs which remove available DO during drought and so more storage required to mitigate outages at the remaining sources.

Figures 7 & 8 further illustrate the cascade of additional DO from WRZ6 to address the headroom gaps in the rest of the Central Region.

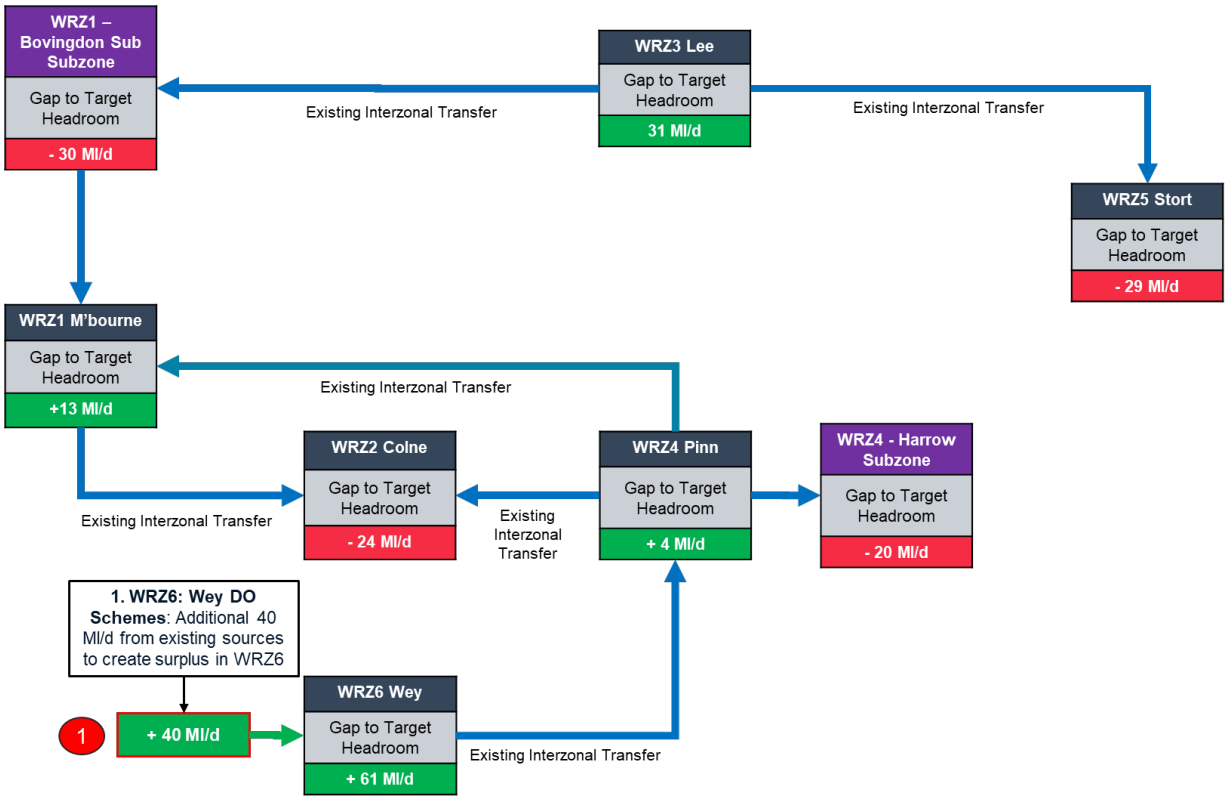

Figure 7 Intervention1: 40 Ml/d of additional DO generates a surplus in WRZ6

Figure 7 - Intervention 1 - Increase DO within WRZ6: Since WRZ6 is not subject to the SRs seen in other WRZs (as it does not utilise chalk groundwater sources in sensitive catchments), we are planning to build treatment capacity at Chertsey and Walton WTWs (in WRZ6). This will create an additional 40 Ml/d in treatment capacity and

resultant DO and this surplus will then be transferred onwards to the other WRZs in the Central Region that are in deficit. Specifically, Intervention 1 will include:

- The installation of two GAC absorbers at Chertsey (to treat an additional 25 Ml/d)
- The installation of one GAC absorber at Walton (to treat an additional 15 Ml/d)
- Utilising the infrastructure within WRZ6 to transfer this additional DO to Egham WTW, where there is a transfer (strategic interconnector) to WRZ4 already scoped for delivery in AMP7, but delayed until early AMP8.

Intervention 2 is then required to transfer the additional 40 Ml/d to WRZ4.

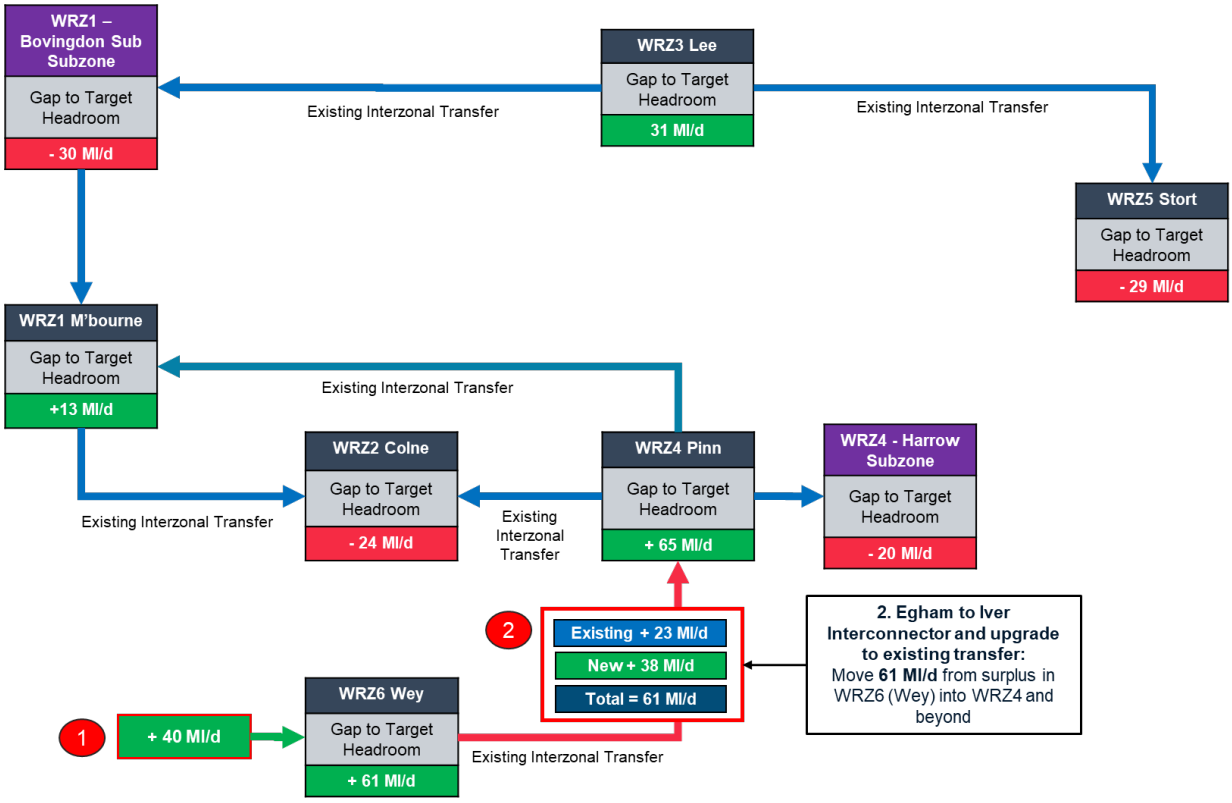

Figure 8 Intervention 2: Building additional connectivity to transfer the additional 40 Ml/d from WRZ6 to the rest of the Central Region[3]

Figure 8- Intervention 2 – Infrastructure to transfer of the 40 Ml/d from WRZ6 to WRZ4:

Since WRZ6 does not require the additional DO created by Intervention 1, we plan to improve connectivity from WRZ6 to WRZ4 to deploy the 40 Ml/d of new resources in WRZ6 to the rest of the region. Whilst we have already scoped an interzonal transfer from WRZ6 to WRZ4 (originally planned for AMP7 delivery but now due for delivery early AMP8), this does not have sufficient capacity to transfer the 40Ml/d created from Intervention 1. Therefore, we will maximise the capacity of the already scoped

[3] Where 'existing' describes strategic interconnector already scoped (originally due for delivery end of AMP7, but now expected to be delivered beginning of AMP8)

strategic transfer infrastructure as far as possible before building a new main to transfer the remainder of the 40Ml/d.

More specifically, Intervention 2 will include:

- Upgrade of the Stanwell Moor Booster Pumping Station (due in early AMP8) from 17Ml/d to 23Ml/day, providing an additional 6 Ml/d of transfer capacity to the existing WRZ6 to WZR4 interzonal transfer.

- Building of a new booster station and new 10.7km potable water transfer main (interzonal transfer) to provide an additional 38 Ml/d of transfer capacity from WRZ6 to WRZ4.

In total, Intervention 2, provides an additional 44 Ml/d of transfer capacity between WRZ6 and WRZ4. This permits the transfer of the 61 Ml/d of additional DO to WRZ4 with additional headroom for future demand growth in the design lifetime of the transfer.

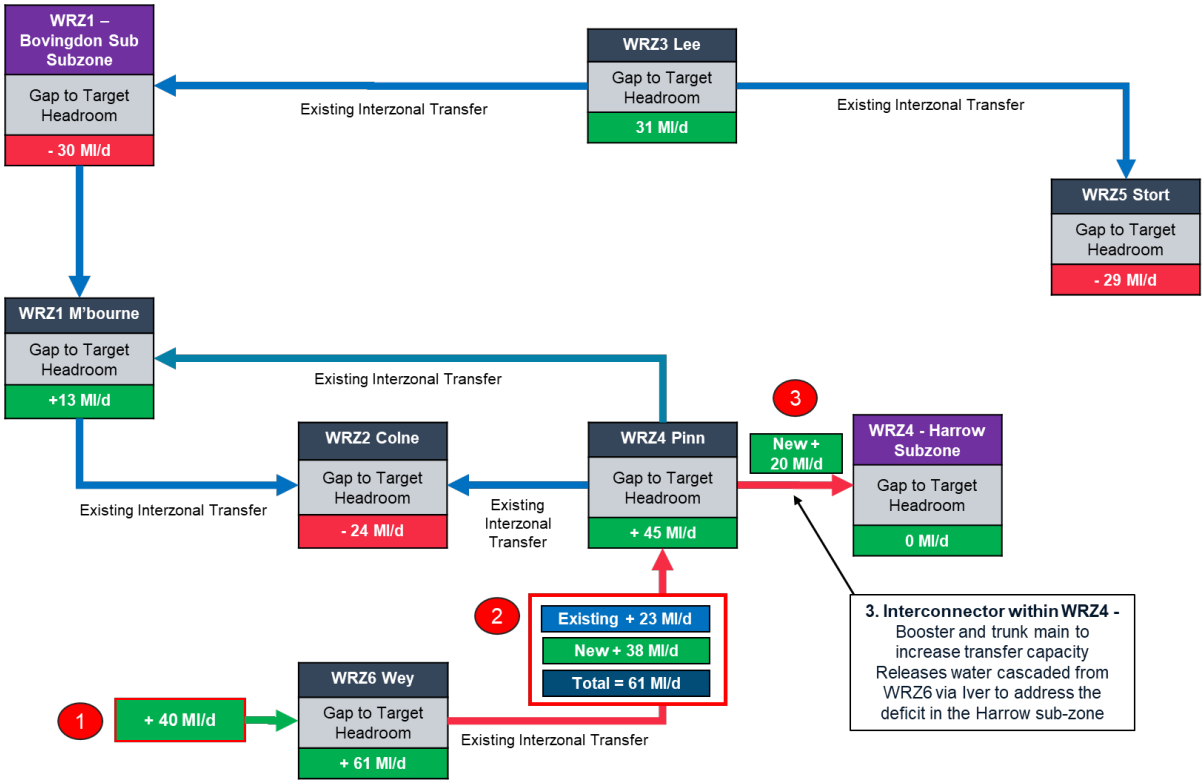

Figure 9 Intervention 3: WRZ4 Internal Interconnector: Harefield to Harrow interconnector

Figure 9 - Intervention 3 – WRZ4 Internal Interconnector to the Harrow Subzone: Harefield to Harrow: A new transfer is required to release the water cascaded from WRZ6 to WRZ4 into the Harrow subzone. This area has limited existing connectivity and has a gap to target headroom of 20 Ml/d. Intervention 3 will comprise of:

- A new Trunk Main of an approximate length of 10.7km of 650mm running from New BPS at Ickenham site to Harrow Service Reservoir.

- A new 30 Ml/d booster station at Ickenham Service Reservoir (this has been sized for future growth and resilience requirements).

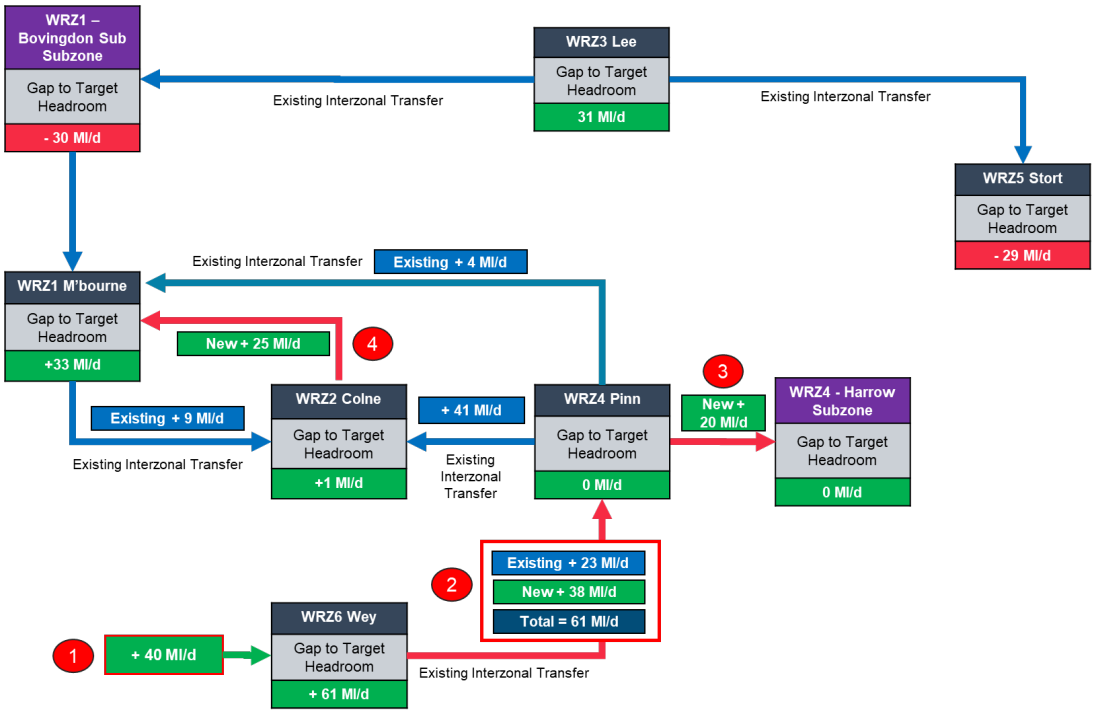

Figure 10 Intervention 4: WRZ2 to WRZ1: Watford Grove to Heronsgate Interconnector Upgrade

Figure 10 - Intervention 4 – Upgrade of the existing interconnector from WRZ2 to WRZ1: The Surplus from WRZ4 is transferred to WRZ2 via existing transfers to put WRZ2 into surplus and for onward cascade to WRZ1 via an upgraded booster station in WRZ2. This puts the southern part of WRZ1 in surplus and allows onward cascade to the northern part of the zone (the Bovingdon subzone). Intervention 4 consist of anew 25 Ml/d Booster station at Grove Park in WRZ2.

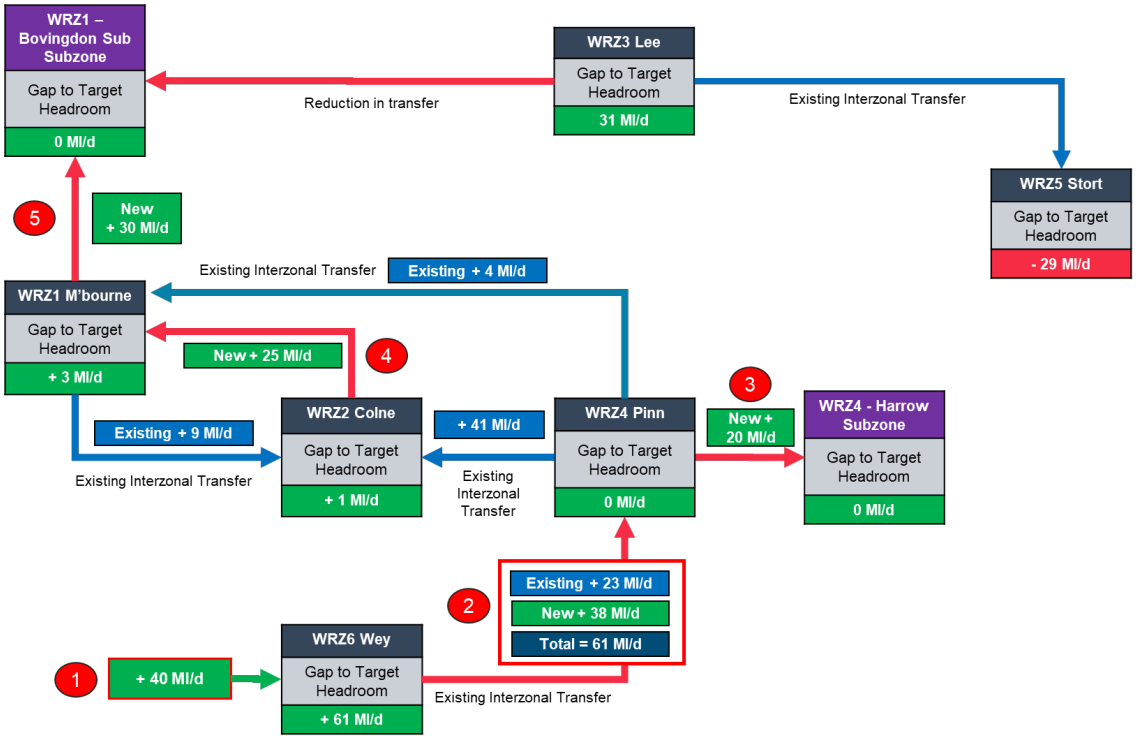

Figure 11 Intervention 5 - Interconnector within WRZ1

Figure 11 - Intervention 5: In order to resolve the target headroom gap in the Bovingdon Sub-Zone, a new WRZ1 internal interconnector is required to deploy the water transferred from WRZ2 from the south of WRZ1 to the north of WRZ1 (the Bovingdon subzone) with a new 30 Ml/d transfer, this will include:

- A new 650mm Trunk Main of an approximate length of 12.8km from the Heronsgate Service Reservoir to the Bovingdon Service Reservoir.
- A new 40Ml/day BPS (this has been sized for future growth and resilience requirements).

With the WRZ1 headroom target now met, the existing transfer from WRZ3 is no longer required and this reduces the gap to target headroom in WRZ3 and allows WRZ3 to cascade a surplus to WRZ5 with two further enabling interventions (interventions 6 and 7).

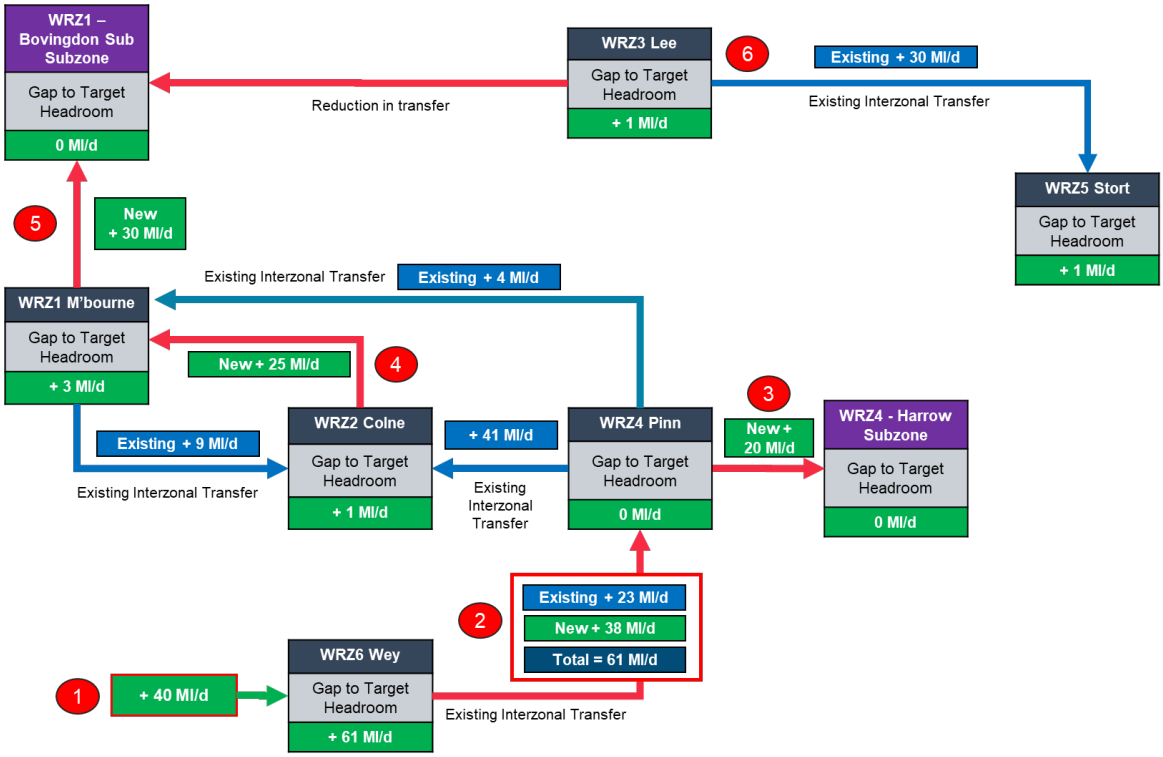

Figure 12 Intervention 6: Local Reinforcement Schemes in WRZ3

Figure 12 - Intervention 6 – Local Reinforcement Schemes in WRZ3: Due to the loss of source DO through Sustainability Reductions (SRs), we are planning the delivery of schemes to remove Single Point of Failure (SPoF) risks that will be present due to the SR implementation. These also permit a more efficient transfer of water in the zone to balance the deficit (gap to target headroom). Specifically, this will include:

- 5 x small diameter trunk mains to cross connect the zones existing strategic mains to maximise distribution within WRZ3.
- 3 x water booster stations to increase the ability to transfer water across the zone via the new trunk mains and remove any single points of failure.

The interventions will also allow an increase in the existing transfer to WRZ5 to close the gap to target headroom in this zone.

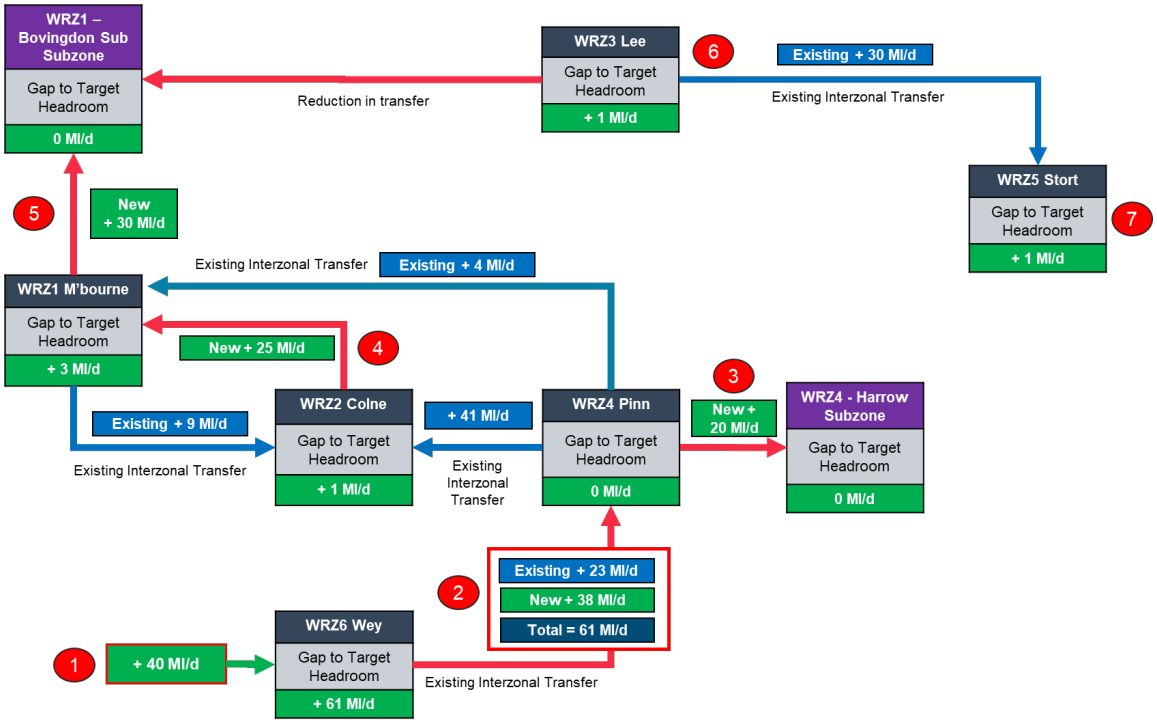

Figure 13 Intervention 7: Local Reinforcement Schemes in WRZ5

Figure 13 - Intervention 7 – Local Reinforcement Schemes in WRZ5: New strategic storage is required to restore resilience lost from Sustainability Reductions, which remove available DO especially during drought conditions and so more storage is required to mitigate outages at the remaining sources. These schemes do not provide additional resilience, rather they reinstate resilience lost due to SRs.

This will include 2 x New 10 Ml/d Service Reservoir cells at Hadham Mill Service Reservoir to restore resilience lost in the zone.

Deliverability and practicality of implementing the chosen solution option

The Connect 2050 programme option described above, utilises our existing infrastructure as far as possible before the consideration of construction of new assets. All transfer elements utilise the shortest practicable distances where interconnectors are required to minimise costs (both financial and less tangible environmental impacts). All elements will be constructed in parallel and commissioned on a rolling sequential programme to allow for flow through the network.

4. System level optioneering

The Connect 2050 programme has been derived using a holistic, system level approach of extensive modelling and options appraisal. This is illustrated in Figure 14 below.

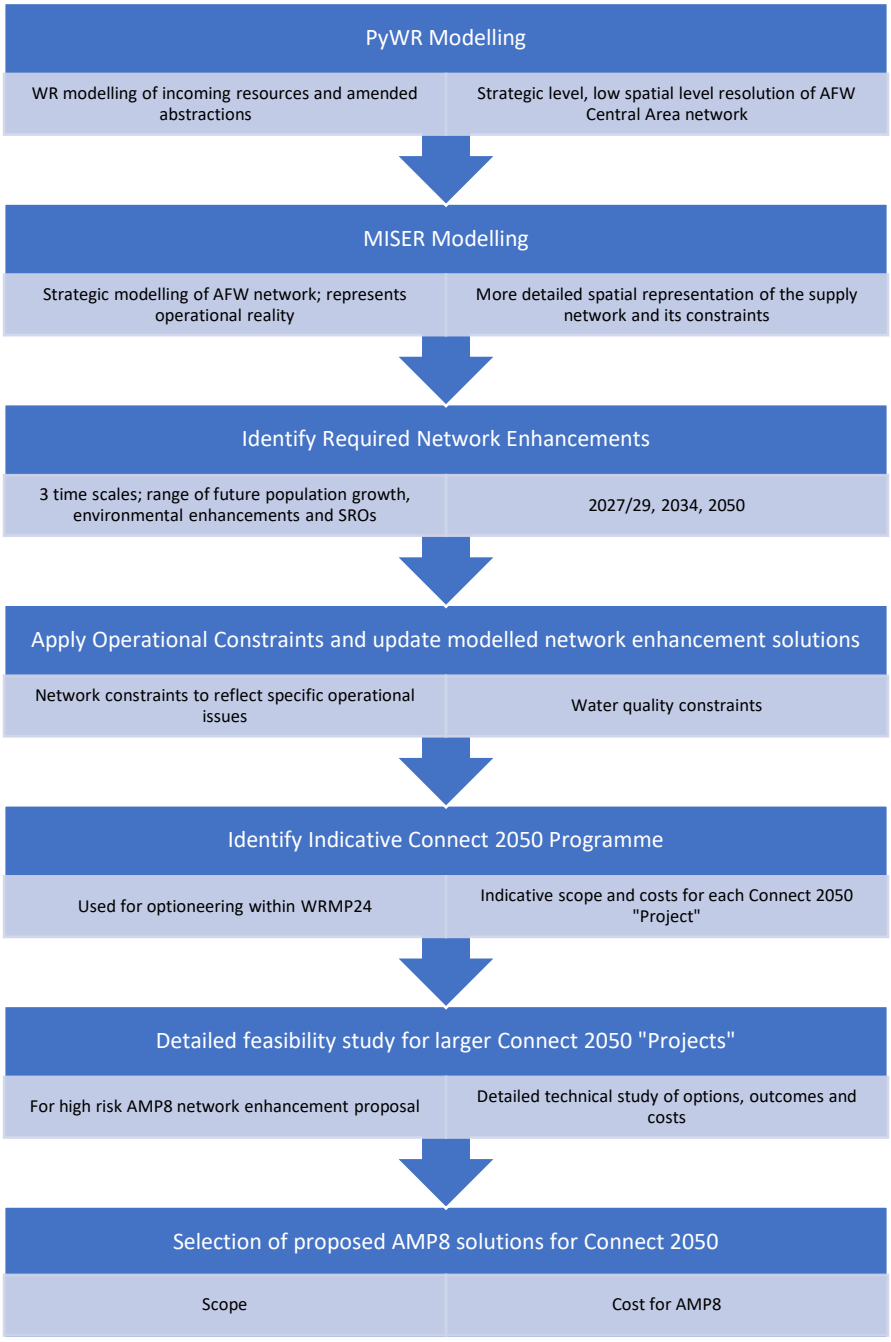

Figure 14 Connect 2050 System Level Approach

The PyWR model at the Water Resources in the South East (WRSE) level, served to identify existing supply capability during the summer stress periods under the different scenarios that were tested, and the potential for inter-company transfers at a WRZ level, while the MISER model operates at the intra-company level at a Hydraulic

Demand Zone (HDZ) level, facilitating transfer capabilities across various scenarios and at a more granular scale. An additional stage of hydraulic modelling was conducted using Optimizer to consider hydraulic performance. The output from Optimizer aimed to find the best value solution for our complex network reinforcement needs by leveraging AI technology and advanced asset planning techniques. Alternative options for each section of the interconnector, points of connection, routes, and pipe diameters were evaluated to build the necessary infrastructure for the Water Resources Management Plan (WRMP) and Water Framework Directive (WFD), Water Industry National Environment Programme (WINEP) sustainability reduction needs, implementing the best value and sustainable investment proposal. Together, these models enable a comprehensive assessment of water resources management, encompassing both transfers between different companies at a WRZ scale and transfers within the same company at a HDZ scale. This integrated approach allows for a thorough analysis of diverse scenarios, ensuring effective water resource planning and utilisation across the region.

The approach was designed to identify the optimum combination of solutions that resolved the full range of scenarios. Ultimately, the MISER modelling, which provides an operationally realistic representation of the AFW network, was used to determine if any of AFW's supply zones are showing deficits of supply under any of the scenarios at the HDZ scale. Enhancement solutions could then be developed to address any such supply shortfalls. If other zones are in surplus but the existing supply network is at capacity, then infrastructure can be identified to link up the areas of surplus water with those which are in deficit. The outcomes considered in developing this optimum solution set included:

- Population Growth
- Sustainability Reductions
- Strategic Resource Options (SROs) and Different Long Term Supply Strategies (SROs)

Table 3 below describes a at a summary level the type of solutions considered against each of the outcomes:

Table 3 Best Value Solutions

Option ID	Option Name	Target Head Room	SRs	Growth	SROs	Totex (£m)	Comments
1	Do Nothing	Need not met	Need not met	Need not met	Need not met	N/A	Costing not provided as option is not viable since we would not meet our licence requirements
2	Import from neighbouring companies	Need not met	Need not met	Need not met	Need not met	N/A	Not feasible – neighbouring companies do not have sufficient headroom

3	Import surplus from Wey and create a ring main	Need met	Need met	Need not met	Need met	£789	
4	Import surplus and create dedicated trunk mains to SR affected areas	Need met	Need met	Need met	Need met	£257	Does not resolve the Harrow sub-zone deficit issue
5	Import surplus from Wey (WRZ6) and make use of the existing spare capacity in the network and reinforce where necessary to cascade from Wey (WRZ6) where it is needed	Need met	Need met	Need met	Need met	£240	Preferred solution

On this basis Option 5 was selected as it met all WRMP, WINEP and Resilience requirements at the lowest Totex Cost, whilst also providing a strong benefit against our six capitals framework:

Six Capitals					
Natural	Social	Financial	Manufact.	Human	Intellectual
	★ ★ ★	★	★ ★		★

5. Totex cost of solution

The costs for each component of the programme have been determined using Affinity Water's PR24 cost curves (2002/23 cost base) with an additional 10% contingency to account for Biodiversity Net Gain and risks inherent in large infrastructure projects within urban agglomerations. These risks include factors like traffic management, lane rental, engineering challenges such as railway crossings and motorway crossings (e.g., M25, M1 and M4), and are based on estimated pipeline length and diameter or expected capacity for booster pumping stations and water treatment upgrades.

Table 4 Totex cost for all Connect 2050 elements

ID	Intervention Name	AMP8	AMP9	AMP10	Totex Cost (£m)
1	Build 40 Ml/d of additional water resources in WRZ6	7.7	2.8	2.8	13.3
2	2a: WRZ6 to WRZ4: Egham to Iver Interconnector	62.2	2.2	2.2	68.5
	2b: Upgrade to existing booster on existing interconnector from WRZ6 to WRZ4	1.9			
3	WRZ4 Internal Interconnector: Harefield to Harrow interconnector	42.3	3.7	3.7	49.7
4	WRZ2 to WRZ1: Watford Grove to Heronsgate Interconnector	3.0	3.1	3.1	9.2
5	WRZ1 Internal Interconnector: Heronsgate to Bovingdon interconnector	32.5	4.9	4.9	42.3
6	Local Reinforcement Schemes in WRZ3	23.9	4.2	4.2	32.3
7	New Reservoir in WRZ5 to replace resilience lost due to source loss from SRs	6.8	-	-	6.8
Total (£m)		180.3	20.9	20.9	222.1

6. Driver allocation

To provide further clarity with regards to the drivers allocated to Connect 2050 in our previous submission, please see Table 5 below which sets out driver allocation and rationale.

Table 5 Connect 2050 interventions – driver allocation

ID	Intervention Name	Driver Allocation	Rationale	AMP8 Totex (£m)
1	Build 40 Ml/d of additional water resources in WRZ6	WRMP	Intervention required to restore Supply/Demand (WRMP).	7.7
2	2a: WRZ6 to WRZ4: Egham to Iver Interconnector	WRMP	Intervention required to restore Supply/Demand (WRMP).	62.2
	2b: Upgrade to existing booster on existing interconnector from WRZ6 to WRZ4	WRMP		1.9
3	WRZ4 Internal Interconnector: Harefield to Harrow interconnector	WINEP (Sustainability Reductions)	Intervention required to restore Supply/Demand balance (WRMP), however the WRMP24 methodology provides guidance that transfers within a zone (interconnectors) should not be included with a WRMP driver. Therefore, this scheme is classified with a WINEP driver as the scheme is required in order to achieve the sustainability reductions. In addition, this will also allow a more realistic assessment of the cost of WINEP/Sustainability Reduction schemes.	42.3
4	WRZ2 to WRZ1: Watford Grove to Heronsgate Interconnector	WRMP	Intervention required to restore Supply/Demand (WRMP).	3.0
5	WRZ1 Internal Interconnector: Heronsgate to Bovingdon interconnector	WINEP (Sustainability Reductions)	Intervention required to restore Supply/Demand (WRMP), however the WRMP24 methodology provides guidance that transfers within a zone (interconnectors) should not be included with a WRMP driver. Therefore, this scheme is classified with a WINEP driver as the scheme is required in order to achieve the sustainability reductions. In addition, this will also allow a more realistic assessment of the cost of WINEP/Sustainability Reduction schemes.	32.5
5	Local Reinforcement Schemes in WRZ3	WINEP (Sustainability Reductions)		23.9
6	New Reservoir in WRZ5 to replace resilience lost due to source loss from SRs	WINEP (Sustainability Reductions)		6.8

Table 6: Connect 2050 interventions – AMP8 totex by driver

Driver	AMP8 Totex (£m)
WRMP	74.8
WINEP	105.5
Total (£m)	180.3

Appendix A – Alignment to existing enhancement business case and wider documentation

This summary document has been developed using information already presented within our existing PR24 enhancement September business plan submission. It also draws upon information from, and aligns to, our wider statutory instruments including our WRMP19 and our WRMP24.

The table below describes where, for the purposes of this summary document, we have made simplifications and assumptions:

	Element	Description and explanation
1	Zonal Connectivity	Some of the WRZ connectivity has been simplified to show only the changes to strategic transfers which are required to achieve the DYAA target headroom in each WRZ. Inter zonal connections which are less than 5 Ml/d or where there is no change to the current operation (in terms of direction of flow or volume) are not shown for clarity.
2	Volumetric Rounding	In most cases the volumetric figures shown have been rounded to the nearest 1 Ml/d and so there maybe minor discrepancies between the figures stated and those in the WRMP and Business Plan tables.
3	WRMP24 Tables	The draft final WRMP24 tables have been used to generate the figures shown in all the simplified schematics. To generate Figure 5, the stated DYAA baseline deficit for each zone was taken from FY29/30 as stated in the Table 3 (WRZs). For Figure 6, this baseline was updated to include all the interventions in the core pathway from Table 5 except for the internal transfers benefits and showing the impacts of all other interventions before implementation of the Connect 2050 solution.
4	Scheme Details	All scheme details were taken from the August 2023 Delivery Pack presented for Red Team review, this included: • Asset Location • Pipeline length • Pipeline Diameter • Pump Capacity • Reservoir Storage Capacity