Draft Water Resources Management Plan

Technical Appendix R – Scheme Dossiers

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Background and Introduction

Appendix R Scheme Dossiers provide:

- List of Constrained List options, these are options which passed:
  - Feasibility Assessment Stages 1, 2, 3, and Validation
  - Further Screening.
- A summary of each option on the Constrained List

All Constrained List options were included in the WRSE investment model

Structure of Appendix

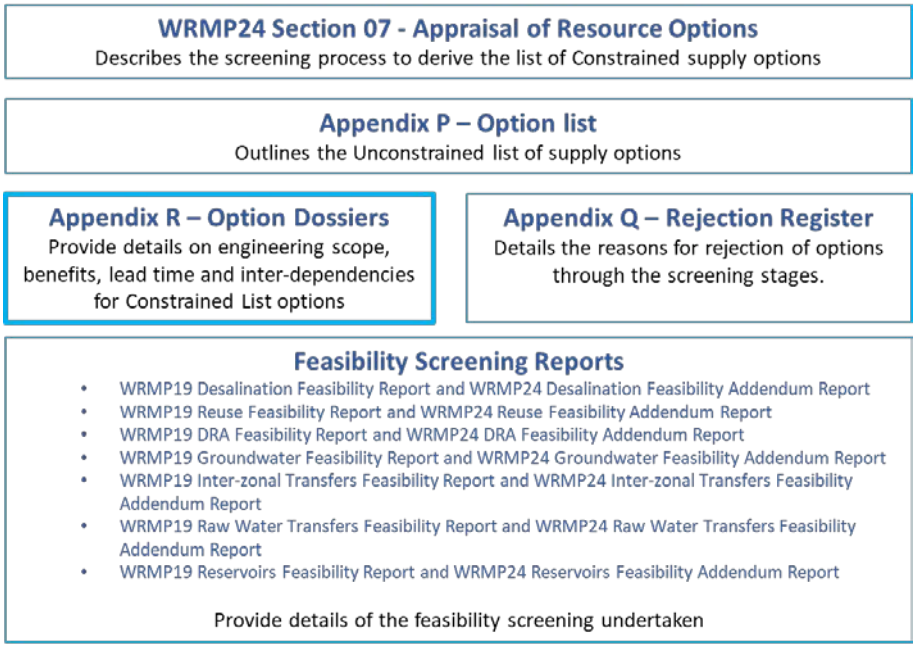
This appendix provides a high-level description of the options that have been included in the Constrained List for our 2024 Water Resources Management Plan. The appendix is in two sections; the first section describes our options to provide additional water resources and the second section describes our options to reduce demand for water.

Supply options: Scheme dossiers

Introduction

R.1 Appendix R – Scheme Dossiers should be read in conjunction with the following reports as detailed in Figure R - 1.

Figure R - 1: Overview of draft WRMP24 Supply options reports



R.2 This section provides a high level description of the elements that form our water resource options that have been included in the Constrained List for our draft Water Resources Management Plan 2024.

R.3 Firstly, resource elements are described, followed by the system elements that are required for delivering the additional resource into the distribution network. Following this introduction, the structure of this section is as follows:

- Overview of Constrained List Elements
- Desalination
- Raw water transfers
- Water reuse
- Direct River Abstraction
- Raw Water Purchase
- Inter-company transfers
- Inter-zonal transfers
- Groundwater
- Reservoirs

- Raw water conveyance
- Catchment management
- Water treatment works
- Network reinforcement

Overview of Constrained List Elements

R.4 An overview of the elements included in the Constrained List and how they can be combined to provide water resources options is shown in Table R - 1 for the London Water Resources Zone (WRZ). Table R - 2 and

R.5

R.6 Table R - 3 show the elements required for reinforcement of the London raw water system and the London transmission network depending upon whether resources are supplied from the east of London or the west of London.

The Thames Valley Constrained List elements are set out in

R.7 The network reinforcement requirements identified are:

1) Replace New River Head Pump 4
2) Replace Barrow Hill Pump 6
3) TWRM extension – Hampton to Battersea
4) TWRM level controlled by new header tank at Coppermills WTW and pumping station
5) TWRM extension – Coppermills to Honor Oak
6) Resolve issues with supply to Surbiton during TWRM outage

R.8 Additional network reinforcement elements have been identified that are specific for individual options. These include:

7) Tunnel from Beckton to Coppermills WTW for blending of water from Beckton and Crossness desalination options
8) Tunnel from Crossness desalination plant site to Beckton to extend the Beckton-Coppermills tunnel to Crossness so that it can transfer resource from the proposed desalination plant at Crossness
9) New shaft on the TWRM at Kempton is required the first phase of additional treatment

R.9 Table R - 4 covering:

- Guildford WRZ
- Henley WRZ
- Kennet Valley WRZ
- Slough Wycombe and Aylesbury (SWA) WRZ
- Swindon and Oxfordshire (SWOX) WRZ

R.10 Options included in the Best Value Plan are presented in draft WRMP24, Section 11.

Table R - 1: Constrained List Elements – London WRZ

Constrained List - London WRZ

Option Type	Resource Element		Conveyance Element		Raw Water System	Treatment Element	Network Element
	Location	DO DYAA Ml/d	Location	Nominal Capacity Ml/d		Location	
Water reuse	Deephams	42	Deephams to KGV	60	See raw water system matrix	East London	See network reinforcement matrix
			Deephams to TLT extension				
	Beckton 50 Ml/d	46	Beckton to Lockwood shaft	800		East London	
	Beckton 100 Ml/d	89					
	Beckton 150 Ml/d	130					
	Beckton 200 Ml/d	172					
	Beckton 300 Ml/d	252					
	Beckton 380 Ml/d	316					
	Reuse Mogden - 200 Ml/d	170	Mogden to Walton	200		Kempton	
	Reuse Mogden - 150 Ml/d	130					
	Reuse Mogden - 100 Ml/d	88					
	Reuse Mogden - 50 Ml/d	46					
	Reuse Mogden S Sewer	46				Kempton	
DRA	Teddington DRA – 50 Ml/d	46	Teddington Outfall	75	See raw water system matrix	Kempton & East London	See network reinforcement matrix
	Teddington DRA – 75 Ml/d	67	Teddington to Thames Lee Tunnel	75			
Raw Water Transfer	Vyrnwy	29/43/57/78/86/103	Deerhurst to Culham	300/400/500	See raw water system matrix	Kempton	See network reinforcement matrix
	Netheridge to River Severn	24					
	Minworth (Phase 1 and 2)	70					
	Oxford Canal	10.3					
Desalination	Beckton Desalination - 150 Ml/d	133	N/A		N/A	N/A	See matrix plus Beckton to Coppermills
	Beckton Desalination – 100 Ml/d	89					
	Beckton Desalination – 50 Ml/d	44					
	Crossness Desalination (Blended) – 300 Ml/d	267	N/A		Beckton-Crossness	N/A	As above plus Crossness to Beckton
	Crossness Desalination (Blended) – 250 Ml/d	222					
	Crossness Desalination (Blended) – 200 Ml/d	178					
	Crossness Desalination (Blended) – 150 Ml/d	133					
	Crossness Desalination (Blended) – 100 Ml/d	89					
	Crossness Desalination (Blended) –50 Ml/d	44					
New Reservoir	SESRO / Abingdon Reservoir - 150 Mm³	271	N/A		See raw water system matrix	Kempton	See network reinforcement matrix
	SESRO / Abingdon Reservoir - 125 Mm³	230					
	SESRO / Abingdon Reservoir - 100 Mm³	185					
	SESRO / Abingdon Reservoir - 75 Mm³	149					
	SESRO / Abingdon Reservoir Phased - 80 + 42 Mm³	224 Ml/d (155.1 + 68.9)					
	SESRO / Abingdon Reservoir Phased – 30 + 100 Mm³	238 Ml/d (65.5 + 173.1)					
	Chinnor Reservoir 30 Mm3	66				Kempton	
	Marsh Gibbon Reservoir - 75 Mm³	149				Kempton	
	Marsh Gibbon Reservoir - 50 Mm³	103					
	Marsh Gibbon Reservoir - 30 Mm³	66					
Aquifer Recharge	AR/SLARS - Kidbrooke (SLARS1)	8	N/A		N/A	N/A	N/A
	AR Merton (SLARS3)	6					
	AR Streatham (SLARS2)	7					
Aquifer Storage and Recovery	ASR South East London (Addington)	3	N/A		N/A	N/A	N/A
	ASR Thames Valley/Thames Central	3					
	ASR Horton Kirby	5					
Groundwater	GW - Addington	2.7	N/A		N/A	N/A	N/A
	GW - London Confined Chalk (north)	2					
	GW - Southfleet/Greenhithe (new WTW)	8.8					
	GW - Honor Oak	1.4					
	Honor Oak Increase DO	1.7					
Raw Water Purchase	Didcot Raw Water Purchase	22.6	N/A		N/A	N/A	N/A
Catchment Management	Bean Wellfield (Groundwater)	0.1	N/A		N/A	N/A	N/A
	Green Street Green (Groundwater)	0.3					
	Wilmington (Groundwater)	0.2					
Inter-co. transfers			Cheam to Murton	15	N/A	N/A	N/A

Table R - 2: Raw water system reinforcement requirements for additional water resources in East or West London

Additional Raw Water Resource in West (Ml/d)	Additional raw Water Resource in East (Ml/d)								
	0	100	200	300	400	500	600	700	800
0	-	3	1,3,5	1-3,5,6	1-3, 5, 6	1-3, 5, 6	1-3, 5, 6	1-3, 5, 6	1-3, 5, 6
100	-	3	1,3,5	1-3,5,6	1-3, 5, 6	1-3, 5, 6	1-3, 5, 6	1-3, 5, 6	
200		3	1,3,5	1-3,5,6	1-3, 5,6	1-3, 5, 6	1-3, 5, 6		
300		3	1,3,5	1-3,5,6	1-3, 5, 6	1-3, 5, 6			
400	7	3,7	1,3,5,7	1-3,5-7	1-3, 5-7				
500	7/8,10	3,7/8,10	1,3,5,7/8,10	1-3,5-7/8,10					
600	7/8,10	3, 7/8,10	1,3,5,7/8,10						
700	7/8,10	3, 7/8,10							
800	7/8,10								

East London

10) King George V Reservoir intake capacity increase
11) Chingford South (above Chingford Mill) intake capacity increase

12) TLT extension from Lockwood PS to King George V Reservoir intake
13) TLT upgrade to remove existing constraints to maximise transfer capacity (not shown in table)
14) Additional conveyance from King George V Reservoir to break tank
15) Second Spine Tunnel from break tank to Reservoir 5 upstream of Coppermills WTW

West London

16) Datchet intake capacity increase with transfer to Queen Mother and Wraysbury Reservoirs
17) Littleton intake capacity increase with transfer to Queen Mary
18) Surbiton intake capacity increase with transfer to Walton inlet channel, required for Teddington DRA option only (not shown in table)
19) Additional conveyance from Queen Mary Reservoir to Kempton WTW

Table R - 3: Network reinforcement requirements for additional water resources treated in East or West London

		East (Ml/d)								
		0	100	200	300	400	500	600	700	800
West (Ml/d)	0	-	-	5	4,5	4,5	4,5	4,5	1,4,5	1,4,5
	100	1	1	3,4,5	3,4,5	3,4,5	3,4,5	4,5	1,4,5	
	200	1,3	1,3	3,4	3,4,5	3,4,5	3,4,5	3,4,5		
	300	1,3	1,3	1,3,4	3,4,5	3,4,5	3,4,5			
	400	1,3	1,3	1,3,5	3,4,5	3,4,5				
	500	1,3,5,6	1,3,5,6	1,3,5	1,3,5					
	600	1,2,3,5,6	1,3,5,6	1,3,5,6						
	700	1,2,3,5,6	1,2,3,5,6							
	800	1,2,3,5,6								

R.11 The network reinforcement requirements identified are:

20) Replace New River Head Pump 4
21) Replace Barrow Hill Pump 6
22) TWRM extension – Hampton to Battersea
23) TWRM level controlled by new header tank at Coppermills WTW and pumping station
24) TWRM extension – Coppermills to Honor Oak
25) Resolve issues with supply to Surbiton during TWRM outage

R.12 Additional network reinforcement elements have been identified that are specific for individual options. These include:

26) Tunnel from Beckton to Coppermills WTW for blending of water from Beckton and Crossness desalination options
27) Tunnel from Crossness desalination plant site to Beckton to extend the Beckton-Coppermills tunnel to Crossness so that it can transfer resource from the proposed desalination plant at Crossness
28) New shaft on the TWRM at Kempton is required the first phase of additional treatment

Table R - 4: Constrained List Elements – Thames Valley WRZs

Preliminary Constrained List - Thames Valley

	Option Type	Resource Element Location	DO Ml/d ADPW	Conveyance Element Location	Nominal Capacity Ml/d	Raw Water System	Treatment Element Location	Network Element Location
Swindon & Oxfordshire (SWOX)	Raw Water Transfer	Severn Thames Transfer (See London WRZ for support elements)	See London Constrained list table	Deerhurst to Culham	300 400 500	N/A	Radcot WTW 24 Ml/d each phase	Transfers to service reservoir included in WTW elements
		Oxford Canal	12	Dukes Cut to Farmoor	15			
	New Reservoir	SESRO / Abingdon Reservoir - 150 Mm3 SESRO / Abingdon Reservoir - 125 Mm3 SESRO / Abingdon Reservoir - 100 Mm3 SESRO / Abingdon Reservoir - 75 Mm3 SESRO / Abingdon Reservoir Phased - 80 + 42 Mm3 SESRO / Abingdon Reservoir Phased – 30 + 100 Mm3	271 230 185 149 224 Ml/d (155.1 + 68.9) 238 Ml/d (65.5 + 173.1)	Abingdon to Farmoor Reservoir (if treatment capacity not required	24	N/A	Abingdon SWOX WTW (if treatment capacity rqd) 24 Ml/d each phase	Transfers to service reservoir included in WTW elements
		Chinnor Reservoir 30 Mm3 Marsh Gibbon Reservoir - 75 Mm3 Marsh Gibbon Reservoir - 50 Mm3 Marsh Gibbon Reservoir - 30 Mm3	66 149 103 66	N/A			TBC	TBC
	Groundwater	Woods Farm Increase DO GW - Moulsford 1	2.9 3.5	N/A N/A		N/A N/A	N/A N/A	N/A N/A
	Removal of constraints to DO	Ashton Keynes borehole pumps Britwell	2.04 1.3	N/A		N/A	N/A	N/A
	Inter-zonal transfers	GW - Mortimer disused source	4.5	Henley to SWOX Kennet Valley to SWOX	2.4 5 6.7 2.3	N/A	N/A	N/A
	Inter-company transfer		2.9	Wessex Water to SWOX (Flaxlands)	2.9	N/A	N/A	N/A
Slough, Wycombe & Aylesbury (SWA)	Raw Water Transfer	Severn Thames Transfer[#] (See London WRZ for support elements)	See London Constained list table	Deerhurst to Culham	300/400/500	N/A New intake 80 / 53	Abingdon SWA WTW Medmenham WTW	Abingdon to north SWA Transfers to service reservoir included in WTW elements
		Oxford Canal	12					
	New Reservoir[#]	SESRO / Abingdon Reservoir - 150 Mm3 SESRO / Abingdon Reservoir - 125 Mm3 SESRO / Abingdon Reservoir - 100 Mm3 SESRO / Abingdon Reservoir - 75 Mm3 SESRO / Abingdon Reservoir Phased - 80 + 42 Mm3 SESRO / Abingdon Reservoir Phased – 30 + 100 Mm3	271 230 185 149 224 Ml/d (155.1 + 68.9) 238 Ml/d (65.5 + 173.1)	N/A		N/A New intake 80 / 53	Abingdon SWA WTW Medmenham WTW	Abingdon to north SWA Transfers to service reservoir included in WTW elements
		Chinnor Reservoir 30 Mm3 Marsh Gibbon Reservoir - 75 Mm3 Marsh Gibbon Reservoir - 50 Mm3 Marsh Gibbon Reservoir - 30 Mm3	66 149 103 66	N/A N/A		New intake 80 / 53	Medmenham WTW	
	Raw Water Purchase	Didcot	22.6	N/A		New intake 80 / 53	Medmenham WTW	Transfers to service reservoir included in WTW elements
	Groundwater	Taplow Increase DO Datchet Increase DO Dorney Increase DO	5.7 6.2 4.3	N/A		N/A	N/A	N/A
	Inter-zonal transfers			Henley to SWA	2.4 / 5	N/A	N/A	N/A
Guildford	Groundwater	Dapdune licence disaggregation	2.2	N/A		N/A	N/A	N/A
	Removal of constraints to DO	Dapdune removal of constraints	1	N/A		N/A	N/A	N/A
	Inter-co. transfers			SouthEast Water to Guildford	10	N/A	N/A	N/A
Kennet Valley	Groundwater	GW - Mortimer disused source (recommission)	4.5	N/A		N/A	N/A	N/A
	Removal of constraints to DO	East Woodhay borehole pumps	2.1	N/A		N/A	N/A	N/A

Element references

R.13 At WRMP19 each resource element was allocated a unique reference. The element references comprised an element type, sub-type, location and size (where there is more than one size variant). Table R - 5 provides a list of WRMP19 abbreviations used for element references.

R.14 The option references have been updated for WRMP24 to align with the Water Resources South East (WRSE) naming convention. Table R - 6 summarises the abbreviations used for the element references for WRSE and WRMP24.

Table R - 5: Abbreviations used for element references (WRMP19)

Type	Sub-type	Location
RES (Resource)	DES (Desalination)	BEC (Beckton)
		CRO (Crossness)
	RWTS (Raw Water Transfer Support)	MIN (Minworth)
		MYT (Mythe)
		NTH (Netheridge)
		OXC-CRP (Oxford Canal to Cropredy)
		OXC-DKC (Oxford Canal to Duke's Cut)
		SHR (Shrewsbury)
		VYR (Vyrnwy)

Type	Sub-type	Location
		WYE (Wye)
	RU (Reuse)	BEC (Beckton)
		DPH (Deephams)
	WRP (Raw Water Purchase)	DID (Didcot)
		CHD (Chingford)
	ICT (Inter-Company Transfer)	SEW-GUI-MNT (South East Water to Guildford, Mount Service Reservoir)
		WSX-FLX (Wessex Water to SWOX, Flaxlands Service Reservoir)
	IZT (Inter-Zonal Transfers)	HEN-SWA-HAM (Henley to SWA, Hambleden WTW)
		HEN-SWX-NET (Henley to SWOX, Nettlebed)
		KEN-SWOX-CLV (Kennet Valley to SWOX, Cleeve)
	AR (Artificial Recharge)	SLARS (South London Artificial Recharge Scheme)
	ASR (Aquifer Storage and Recovery)	HTK (Horton Kirby)
		SEL (South East London)
		TV (Thames Valley)
	GW (Groundwater)	ADD (Addington)
		DAP (Dapdune)
		DAT (Datchet)
		HON (Honor Oak)
		LCC (London Confined Chalk)
		MOR (Mortimer)
		MOU (Moulsford)
		SOU (Southfleet/Greenhithe)
	RC (Removal of Constraints)	ASH (Ashton Keynes)
		BTW (Britwell)
		DAP (Dapdune)
		DAT (Datchet)
		EPS (Epsom)
		EWO (East Woodhay)
		LAD (Ladymead)
		MTN (Merton)
		NRV (New River Head)

Type	Sub-type	Location
	RRR (Reservoir)	ABI (Abingdon)
CON (Conveyance)	RU (Reuse)	BEC-LCK (Beckton to Lockwood)
		DPH-KGV (Deephams to King George V)
		DPH-TLTEX (Deephams to TLT extension)
	RWS (Raw Water Systems)	ABI-FMR (Abingdon to Farmoor)
		BEC-CRO (Beckton to Crossness)
		BT-COP (Break tank to Coppermills)
		CHS (Chingford South intake)
		DAT (Datchet intake)
		DKC-FMR (Duke's Cut to Farmoor)
		KGV (KGV Reservoir intake)
		LCK-KGV (Lockwood PS to KGV Intake)
		LTN (Littleton intake)
		MMM (Medmenham intake)
		QMR-KEM (Queen Mary Reservoir to Kempton WTW)
		SUR (Surbiton intake)
		TLT-UPG (Thames Lee Tunnel Upgrade)
	RWT (Raw Water Transfers)	DEH-CLM (Deerhurst to Culham)
WTW (Water Treatment Works)	LON (London)	COP (Coppermills)
		KEM (Kempton)
	SWA (Slough, Wycombe & Aylesbury)	MMM (Medmenham)
	SWOX (Swindon and Oxford)	ABI (Abingdon)
		ABI-SWA (Abingdon to SWA)
		RAD (Radcot)
NET (Network Reinforcement)	DES (Desalination)	BEC-COP (Beckton to Coppermills)
		CRO-BEC (Crossness to Beckton)
	GUI (Guildford)	SFD-NML (Shalford to Netley Mill)
	IZT (Inter-Zonal Transfers)	AB-LC (Abingdon to Long Crendon)
	TWRM (Thames Water Ring Main)	BAR-PUM (Barrow Hill Pump)
		COP-HEA (Coppermills Header Tank)
		COP-HON (Coppermills WTW to New Honor Oak SR)

Type	Sub-type	Location
		COP-PS (Coppermills Pumping Station)
		HAM-BAT (Hampton WTW to Battersea)
		KEM (Kempton WTW New shaft)
		NRV-PUM (New River Head Pump)

Table R - 6: Abbreviations used for water resource element references (WRMP24)

Company code	WRZ code	Option Type ID	Element	Real Options stage
TWU : Thames Water	GUI : Thames, Guildford	HI-GRW : Groundwater	RE1 : first resource phase	PLA : Planning
	HEN : Thames, Henley	HI-IMP : Water import (raw or potable)	RE2 : subsequent resource phase	DEV : Development
	KVZ : Thames, Kennet Valley	HI-TFR : Water transfer (raw or potable)	CON : raw water conveyance	CON : Construction
	LON : Thames, London	HI-LRE : Loss reduction	WT1 : first water treatment phase	OPN : Operation
	SWA : Thames, Slough, Wycombe and Aylesbury	HI-ROC : Removal of constraints	WT2 : subsequent water treatment phase	
	SWX : Thames, Swindon and Oxfordshire	HI-RSR : Reservoir	NET : network reinforcement	
		HI-REU : Reuse	ALL : integrated option	
		HI-RAB : River abstraction		
		HI-DES : Desalination		
		HI-OTH : Other		
		BG-CAT : Catchment management		
		BG-OTH : Other		

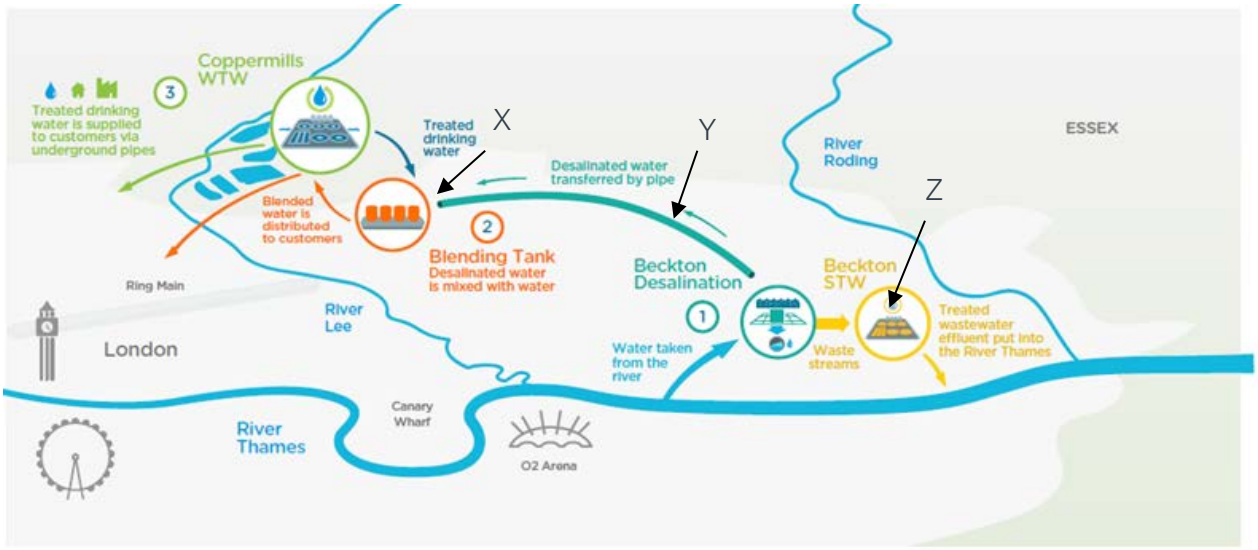
Desalination

Beckton Desalination treatment plant

Name	Desalination – Beckton Desalination treatment plant
WRSE ID	TWU_LON_HI-DES_ALL_ALL_beckton desal TWU_LON_HI-DES_ALL_CNO_beckton desal 100p1 TWU_LON_HI-DES_ALL_CNO_beckton desal 50 p1 TWU_LON_HI-DES_ALL_ALL_beckton desal 50p2a TWU_LON_HI-DES_ALL_ALL_beckton desal 50p2b
WRMP19 Reference	RES-DES-BEC-150
Element Type	Resource
WRZ	LONDON
Engineering Scope	Brackish estuarine water would be abstracted at low tide and used as raw water for the desalination plant. The new 150 Ml/d desalination plant will be located on land within the existing Beckton STW site. Treatment would include clarification, rapid gravity filters, ultrafiltration membranes, reverse osmosis, re-mineralisation, disinfection and final chemical treatment. The desalinated water would then be transferred via a tunnel to the Coppermills WTW Thames Water Ring Main (TWRM) shaft location and blended with potable treated water from Coppermills WTW prior to entering supply.
Engineering Components	Treatment works includes; • Water abstracted through eel screens • Storage reservoirs • Clarification, and rapid gravity filters (RGF) • Ultra-filtration (UF) membranes • Multistage reverse osmosis (RO) membranes • Water conditioning to add alkalinity and hardness • Disinfection and final water chemical addition • The waste streams from the clarifiers, RGF, UF membranes and the neutralised chemical cleaning wastewater would be pumped back to the Beckton STW inlet works for treatment • Brine waste stream from the RO would be returned to the final effluent channel for blending prior to discharge in the River Thames
Phases/benefits	Beckton desalination can be developed in phases of 50, 100 or 150 Ml/d up to a maximum capacity of 150 Ml/d

Capacity (Ml/d)	DO Benefits (Ml/d)
150	133
100	89
50	44

Name	Desalination – Beckton Desalination treatment plant
	DO benefits above apply for 1 in 2 average, 1 in 500 average and 1 in 500 peak
Lead times	The lead time for each phase is 11 years
Mutual Exclusivities	Deephams Reuse, Crossness Desalination, Beckton Desalination and Beckton Reuse are subject to a combined Tidal Thames Limit for desalination and reuse options of 366 Ml/d due to the impact on salinity in the river. [1]
Interdependencies/ Exclusivity	The Beckton desalination option is dependent on the following elements which would be constructed with the initial phase of Beckton desalination, with capacity for all phases: Beckton to Coppermills Tunnel (Conveyance of treated water to Coppermills WTW for blending and supply). New Header Tank and Pumping Station at Coppermills WTW To provide an additional resource to London WRZ the following system element may also be required: Additional capacity in the Thames Water ring main.



X	New Header Tank and Pumping Station at Coppermills WTW
Y	Beckton to Coppermills Tunnel
Z	Beckton Desalination

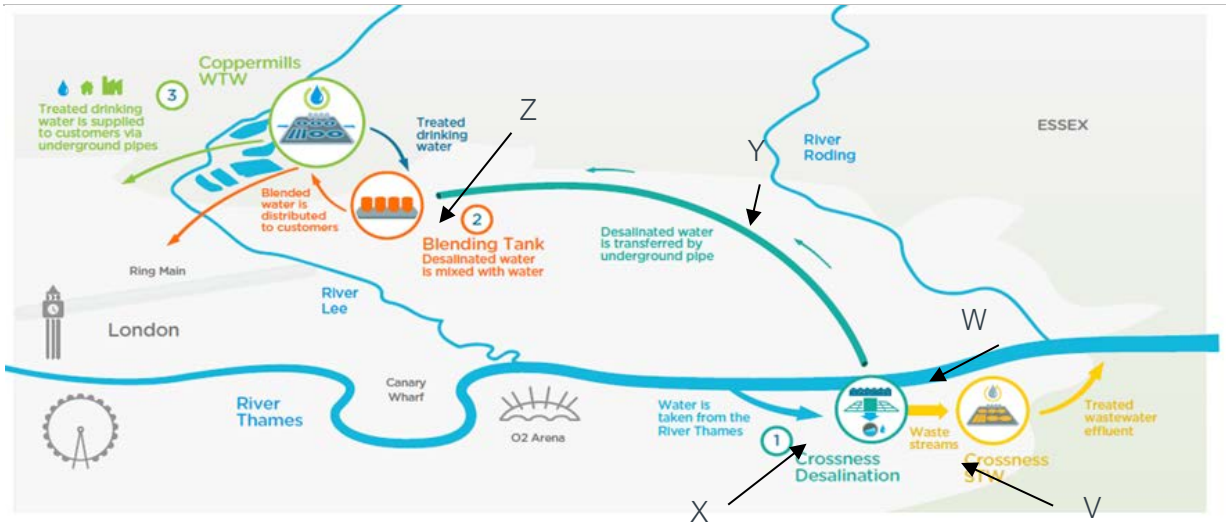
[1] Further work is ongoing to review the combined Tidal Thames Limit for desalination and reuse.

Crossness Desalination treatment plant

Name	Crossness desalination treatment plant
WRSE ID	TWU_LON_HI-DES_ALL_ALL_crossnessdesal TWU_LON_HI-DES_ALL_ALL_crossnessdesal100p2 TWU_LON_HI-DES_ALL_CNO_crossnessdesal50p1 TWU_LON_HI-DES_ALL_ALL_crossnessdesal50p2
WRMP19 Reference	RES-DES-CRO-100
Element Type	Resource
WRZ	LONDON
Engineering Scope	Brackish estuarine water shall be abstracted at low tide and used as raw water for the desalination plant. The new phased construction of the 300 Ml/d desalination plant will be located on land to the south of the existing Crossness STW site. Treatment includes clarification, rapid gravity filters, reverse osmosis re-mineralisation and disinfection. The desalinated water will then be transferred via a tunnel to Beckton to then be transferred to the Coppermills WTW Thames Water Ring Main (TWRM) shaft location and blended with potable treated water from Coppermills WTW prior to entering supply.
Engineering Components	Treatment works key engineering components: • Water abstracted through eel screens • Storage reservoirs • Clarification, and rapid gravity filters (RGF) • Ultra-filtration (UF) membranes • Multistage reverse osmosis (RO) membranes • Water conditioning to add alkalinity and hardness • Disinfection and final water chemical addition • The waste streams from the clarifiers, RGF, UF membranes and the neutralised chemical cleaning wastewater will be pumped back to the Crossness STW inlet works for treatment • Brine waste stream from the RO will be returned to the final effluent channel for blending prior to discharge in the River Thames
Phases/benefits	Crossness desalination can be developed in phases of 50 or 100 Ml/d up to a maximum capacity of 300 Ml/d

Capacity (Ml/d)	DO Benefits (Ml/d)
300	267
250	222
200	178
150	133
100	89
50	44

Name	Crossness desalination treatment plant
	DO benefits above apply for 1 in 2 average, 1 in 500 average and 1 in 500 peak.
Lead Time	The lead time for each phase is 11 years
Mutual exclusivities	Deephams Reuse, Crossness Desalination, Beckton Desalination and Beckton Reuse are subject to a combined Tidal Thames Limit for Desal and reuse options of 366 Ml/d due to the impact on salinity in the river.[2]
Interdependencies/ Exclusivity	The Crossness desalination option is dependent on the following elements: • Beckton to Crossness tunnel (would be constructed with the initial phase of Crossness desalination) • Crossness to Beckton Tunnel (would be constructed with the initial phase of Crossness desalination) • Beckton to Coppermills Tunnel (Conveyance of treated water to Coppermills for blending and supply) • New Header Tank and Pumping Station at Coppermills WTW The above elements are sized to have sufficient capacity for all phases of Crossness desalination and do not need to be duplicated for later phases. To provide an additional resource to London WRZ the following system elements may also be required: • Additional capacity in the Thames Water ring main.



V	Crossness Desalination
W	Crossness to Beckton Tunnel
X	Beckton to Crossness Tunnel
Y	Beckton to Coppermills Tunnel
Z	New Header Tank and Pumping Station at Coppermills WTW

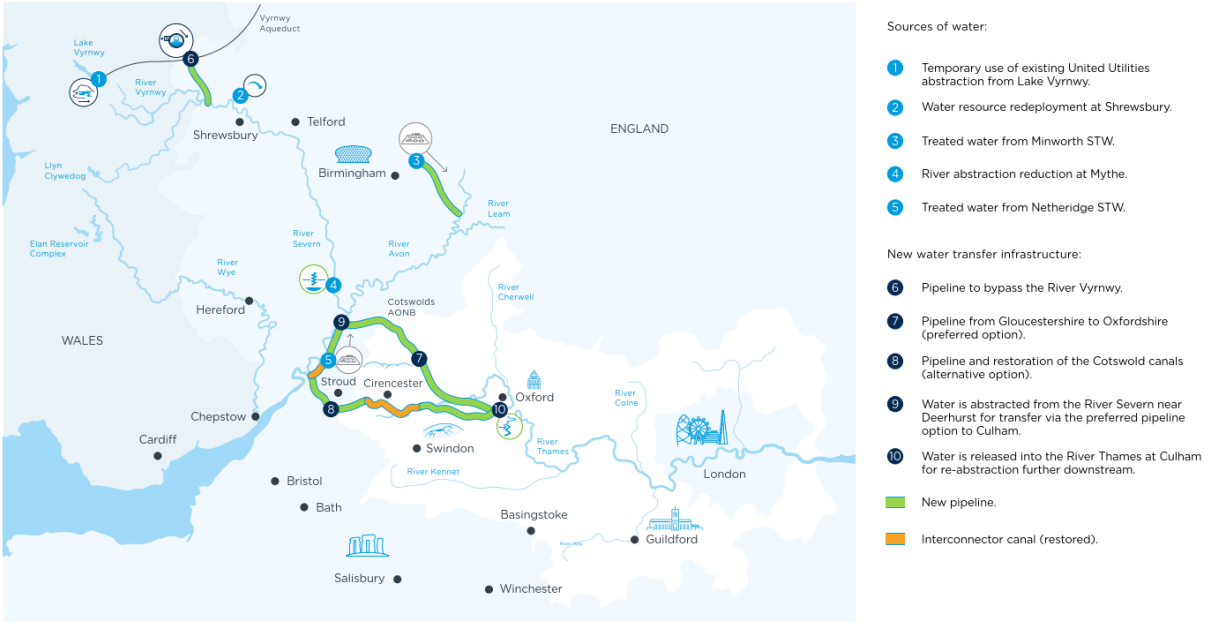
[2] Further work is ongoing to review the combined Tidal Thames Limit for desalination and reuse.

Raw Water Transfers

Minworth STW to River Avon 115 Ml/d

Name	Minworth STW to River Avon 115 Ml/d
WRSE ID	TWU_STT_HI-REU_RE1_ALL_p7-300-minworth_115 TWU_STT_HI-REU_RE1_ALL_p7-400-minworth_115 TWU_STT_HI-REU_RE1_ALL_p7-500-minworth_115
WRMP19 Reference	RES-RWTS-MIN
Element Type	Resource
WRZ	LONDON / SWOX / SWA
Engineering Scope	This option involves the construction of an advanced water treatment plant and laying of a new pipeline from Minworth WwTW to the river Avon near Stoneleigh to allow transfer of up to 115 Ml/d for abstraction in the lower Severn at Deerhurst. Water would then be transferred through the Severn Thames Transfer (STT) to the River Thames.
Engineering Components	The element is offered by Severn Trent Water and includes all engineering works required to deliver the flow to the River Avon • Tertiary treatment and intake after the treatment • Pumping station at Minworth WTW • Rising main • An outfall to the River Avon
Phases/Benefits	Maximum capacity delivered at the discharge to the River Avon is 115 Ml/d and can be implemented in two phases of 58 Ml/d and 57 Ml/d.
Lead Time	The lead time of the STT Deerhurst to Culham pipeline conveyance element is 10 years. Minworth can be delivered within this timescale.
Mutual exclusivities	None.
Interdependencies/ Exclusivity	Dependent on the provision of a conveyance i.e. – the Severn Thames Transfer pipeline. Deerhurst to Culham (300 Ml/d) pipeline Deerhurst to Culham (400 Ml/d) pipeline Deerhurst to Culham (500 Ml/d) pipeline

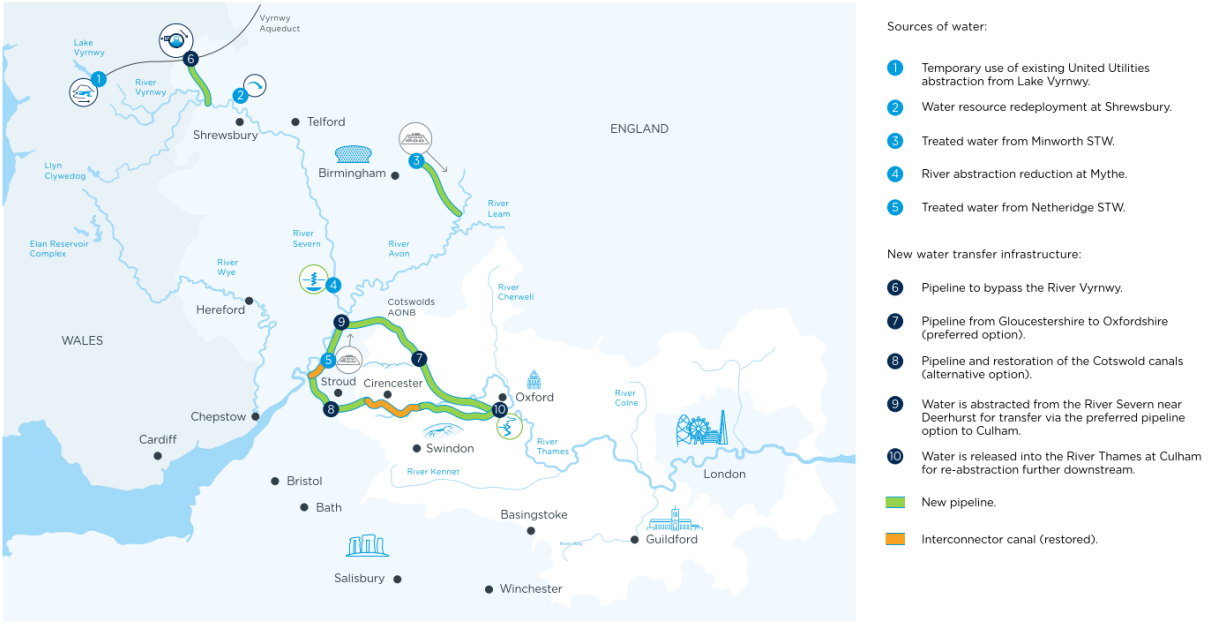
Capacity (Ml/d)	DO Benefits (Ml/d) 1 in 500 average	DO Benefits (Ml/d) 1 in 500 peak
115	70	99
58	35	49



Netheridge STW to River Severn 35 Ml/d

Name	Netheridge STW to River Severn 35 Ml/d
WRSE ID	TWU_STT_HI-REU_RE1_ALL_p5-300-neth_p35 TWU_STT_HI-REU_RE1_ALL_p5-400-neth_p35 TWU_STT_HI-REU_RE1_ALL_p5-500-neth_p35
WRMP19 Reference	RES-RWTS-NTH
Element Type	Resource
WRZ	LONDON / SWOX / SWA
Engineering Scope	Transfer of a 35 Ml/d of final effluent from Netheridge Sewage Treatment Works to the River Severn downstream of the proposed water intake at Deerhurst to replace water abstracted to the Severn Thames Transfer Deerhurst to Culham Pipeline.
Engineering Components	The element is offered by Severn Trent Water and includes all engineering works required to deliver the flow to the River Severn. • Tertiary treatment and an intake manhole to enable the required flow to be directed to the Netheridge FE pumping station • A pumping station which would pump the water from Netheridge STW to River Severn at Deerhurst; • A rising main; • An outfall to the River Severn. Netheridge has the potential to support the sweetening flows through the Deerhurst to Culham pipeline by augmenting flows in the River Severn when base flows are below the 'Hands off Flow'
Phases/Benefits	Maximum capacity delivered at the discharge to the River Severn is 35 Ml/d, which provides the following DO benefit: • 24 Ml/d (1 in 500 average)

Name	Netheridge STW to River Severn 35 Ml/d
	• 34 Ml/d (1 in 500 peak)
Lead Time	The lead time of the Severn Thames Transfer Deerhurst to Culham Pipeline conveyance element is 10 years, Netheridge can be delivered in this timescale
Mutual exclusivities	None.
Interdependencies/ Exclusivity	Dependent on the provision of a conveyance i.e., the Severn Thames Transfer pipeline. Deerhurst to Culham (300 Ml/d) pipeline Deerhurst to Culham (400 Ml/d) pipeline Deerhurst to Culham (500 Ml/d) pipeline



Oxford Canal - BCN Surplus – Raw Water Transfer Resource (Cropredy)

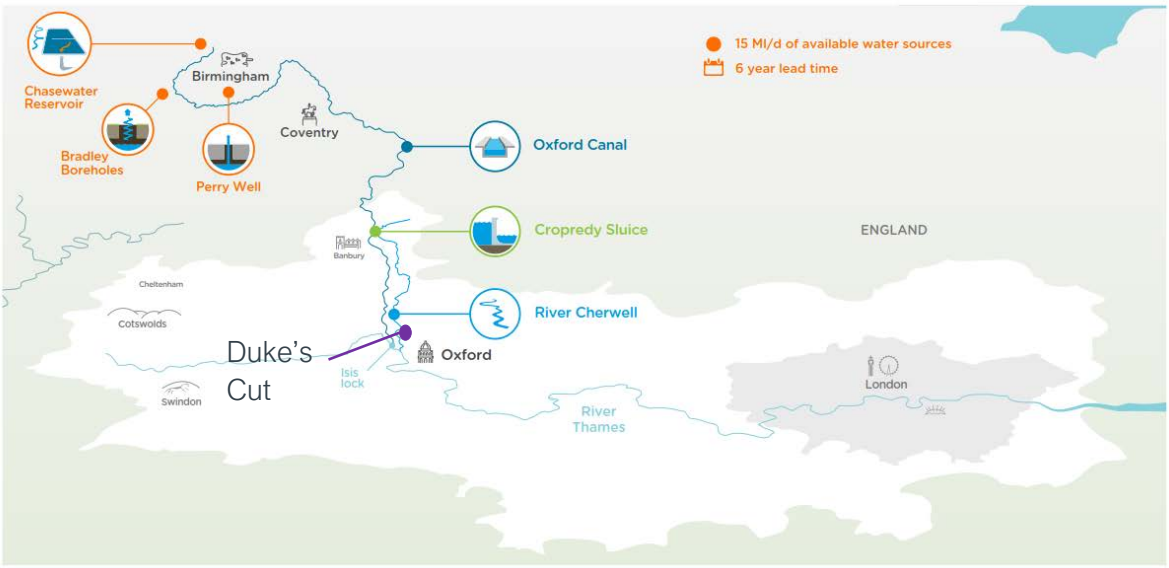
Name	Oxford Canal - BCN Surplus – Raw Water Transfer Resource (Cropredy)
WRSE ID	TWU_UTC_HI-IMP_UTC_ALL_oxcanal-cropredy
WRMP19 Reference	RES-RWTS-OXC-CRP-15
Element Type	Resource
WRZ	LON / SWA
Engineering Scope	This element includes upgrades to the canal network to transfer 15 Ml/d surplus from the Wolverhampton Levels to Cropredy, where it is discharged to the River Cherwell for onward transfer to the River Thames.
Engineering Components	All engineering works provided by others – the Canal and River Trust (CRT), key elements including • Three new Pump Stations

Name	Oxford Canal - BCN Surplus – Raw Water Transfer Resource (Cropredy)
	• Rebuild two Pump Stations • Bypass pipelines • Bypass weirs
Phasing/Benefits	DO benefits of: • 1 In 2 average: 10.3 Ml/d • 1 In 500 average: 10.3 Ml/d • 1 In 500 peak: 10.3 Ml/d
Lead Time	7 years
Mutual exclusivities	This element is mutually exclusive with the Oxford Canal to Duke's Cut
Interdependencies/ Exclusivity	This resource could support the following new WTWs: Medmenham WTW (72 Ml/d) Kempton WTW expansion (800 Ml/d)

Oxford Canal - BCN Surplus – Raw Water Transfer Resource (Duke's Cut)

Name	Oxford Canal - BCN Surplus – Raw Water Transfer Resource (Duke's Cut)
WRSE ID	TWU_SWX_HI-IMP_SWX_ALL_oxc-dukes cutswox
WRMP19 Reference	RES-RWTS-OXC-DKC-15
Element Type	Resource
WRZ	SWOX
Engineering Scope	This element includes upgrades to the canal network to transfer 15 Ml/d surplus from the Wolverhampton Levels to upstream of Duke's Cut. From that point, the water would be transferred to the River

Name	Oxford Canal - BCN Surplus – Raw Water Transfer Resource (Duke's Cut)
	Thames upstream of Farmoor Reservoir, in the Duke's Cut to Farmoor 15 Ml/d Pipeline.
Engineering Components	All engineering works provided by others – the Canal and River Trust (CRT), key elements including: • Three new Pump Stations • Rebuild two Pump Stations • Bypass pipelines • Bypass weirs
Phasing/Benefits	DO benefits of: • 1 In 2 average: 12 Ml/d • 1 In 500 average: 12 Ml/d • 1 In 500 peak: 12 Ml/d
Lead Time	7 Years
Mutual exclusivities	This element is mutually exclusive with Oxford Canal to Cropredy
Interdependencies/ Exclusivity	This element is interdependent with Duke's Cut to Farmoor 15 Ml/d Pipeline



Lake Vyrnwy (United Utilities) – 180 Ml/d

Name	Lake Vyrnwy (United Utilities) – 180 Ml/d
WRSE ID	TWU_STT_HI-RAB_RE1_ALL_p3-300-vyrnwy_50 TWU_STT_HI-RAB_RE1_ALL_p4-300-vyrnwy_75 TWU_STT_HI-RAB_RE1_ALL_p9-300-vyrnwy_100_b TWU_STT_HI-RAB_RE1_ALL_p7-300-vyrnwy_135_b TWU_STT_HI-RAB_RE1_ALL_p8-300-vyrnwy_155_b TWU_STT_HI-RAB_RE1_ALL_p10-300-vyrnwy_180_b

Name	Lake Vyrnwy (United Utilities) – 180 Ml/d
	TWU_STT_HI-RAB_RE1_ALL_p3-400-vyrnwy_50 TWU_STT_HI-RAB_RE1_ALL_p4-400-vyrnwy_75 TWU_STT_HI-RAB_RE1_ALL_p9-400-vyrnwy_100_b TWU_STT_HI-RAB_RE1_ALL_p7-400-vyrnwy_135_b TWU_STT_HI-RAB_RE1_ALL_p8-400-vyrnwy_155_b TWU_STT_HI-RAB_RE1_ALL_p10-400-vyrnwy_180_b TWU_STT_HI-RAB_RE1_ALL_p3-500-vyrnwy_50 TWU_STT_HI-RAB_RE1_ALL_p4-500-vyrnwy_75 TWU_STT_HI-RAB_RE1_ALL_p7-500-vyrnwy_135_b TWU_STT_HI-RAB_RE1_ALL_p8-500-vyrnwy_155_b TWU_STT_HI-RAB_RE1_ALL_p10-500-vyrnwy_180_b
WRMP19 Reference	RES-RWTS-VYR-60, RES-RWTS-VYR-148, RES-RWTS-VYR-180
Element Type	Resource
WRZ	LONDON / SWOX / SWA
Engineering Scope	A release of water from Lake Vyrnwy, which is an existing river regulation reservoir. The release will be a combination of a direct release into the River Vyrnwy (a tributary of the River Severn) and a bypass pipeline to discharge additional flows further downstream (to address environmental impacts). The combined release will be used for downstream abstraction and transfer into the Thames Water area. The reservoir is owned and operated by Hafren Dyfrdwy but supplies water to United Utilities, who have offered the water to Thames Water.
Engineering Components	It is assumed that water for direct release to the River Vyrnwy will be through existing dam pipework and valves with only minor works at that location. The bypass will work in combination with the Vyrnwy Aqueduct and Oswestry WTW to transfer flows by gravity further downstream.
Phases/Benefits	Maximum capacity delivered at the discharge to the River Vyrnwy is 180 Ml/d, which can be delivered in phases.
Lead Time	The lead time of the STT Deerhurst to Culham pipeline conveyance element is 10 years. Vyrnwy can be delivered within this timescale
Mutual exclusivities	None.

Capacity (Ml/d)	DO Benefits (Ml/d) 1 in 500 average	DO Benefits (Ml/d) 1 in 500 peak
180	103	146
155	86	122
135	77	110
100	57	81
75	43	61
50	29	41

Name	Lake Vyrnwy (United Utilities) – 180 Ml/d
Interdependencies/ Exclusivity	This option is enabled by the North West Transfer SRO which is being promoted by United Utilities. Dependent on the provision of a conveyance i.e. – the Severn Thames Transfer pipeline conveyance : Deerhurst to Culham (300 Ml/d) pipeline Deerhurst to Culham (400 Ml/d) pipeline Deerhurst to Culham (500 Ml/d) pipeline Vyrnwy options are being selected by both WRW and WRSE. Adaptive planning enables the use of 75 Ml/d from the North West Transfer by Severn Trent until the year the scheme is selected by WRSE

Sources of water:

1. Temporary use of existing United Utilities abstraction from Lake Vyrnwy.
2. Water resource redeployment at Shrewsbury.
3. Treated water from Minworth STW.
4. River abstraction reduction at Mythe.
5. Treated water from Netheridge STW.

New water transfer infrastructure:

6. Pipeline to bypass the River Vyrnwy.
7. Pipeline from Gloucestershire to Oxfordshire (preferred option).
8. Pipeline and restoration of the Cotswold canals (alternative option).
9. Water is abstracted from the River Severn near Deerhurst for transfer via the preferred pipeline option to Culham.
10. Water is released into the River Thames at Culham for re-abstraction further downstream.

New pipeline.

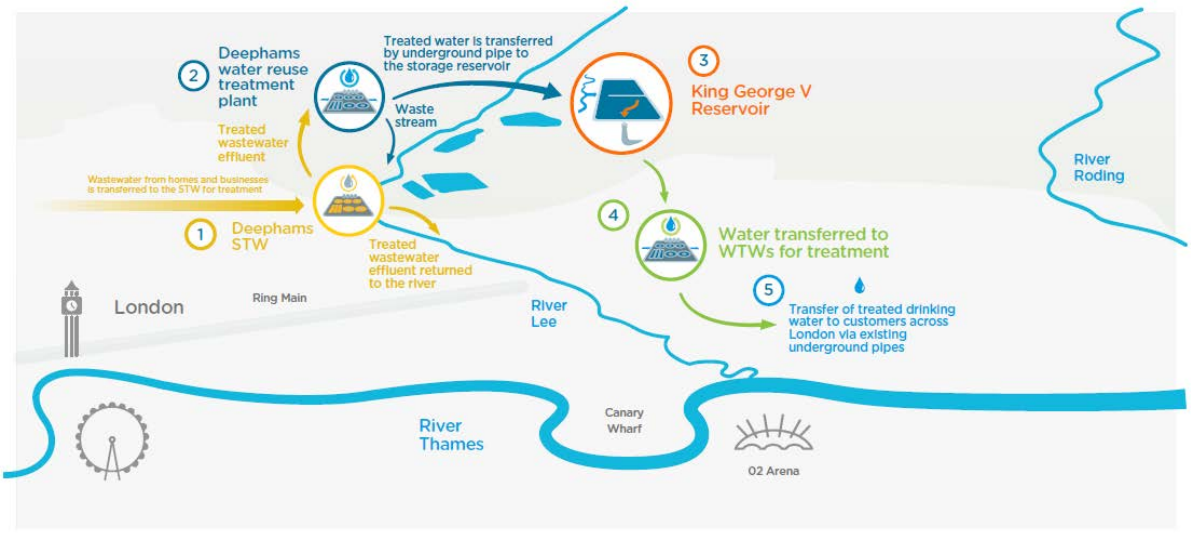
Interconnector canal (restored).

Water reuse

Deephams Reuse and conveyance to King George V Reservoir (46.5 Ml/d)

Name	Deephams Reuse (46.5 Ml/d)
WRSE ID	TWU_KGV_HI-REU_RE1_ALL_deephams reuse 46.5
WRMP19 Reference	RES-RU-DPH CON-RU-DPH-KGV
Element Type	Resource
WRZ	LONDON
Engineering Scope	46.5 Ml/d capacity Water Reuse Treatment Plant, located within the existing Deephams STW boundary and treating the STW effluent. The treated water will then be pumped to a proposed discharge location on the River Lee Diversion with the opportunity to discharge into the King George V Reservoir.
Engineering Components	46.5 Ml/d Water reuse treatment plant, consisting of the following treatment processes: • Duty/standby pressurised automatic backwash screens • Ferric addition • Ultrafiltration plant complete with filtrate pumps • Backwash, and clean in place (CIP) system • RO membrane plant • Hydrogen peroxide and UV treatment (AOP) • Remineralisation plant consisting of a lime and CO_2 dosing • Waste stream system returned to the Deephams STW inlet works for treatment • Conveyance from Deephams Reuse plant to King George V Reservoir (KGV)
Phases/Benefits	DO benefits of: • 1 In 2 average: 42 Ml/d • 1 In 500 average: 42 Ml/d • 1 In 500 peak: 42 Ml/d
Lead Time	7.5 years (earliest delivery date is 2060)
Mutual exclusivities	This option is mutually exclusive with Deephams Reuse and conveyance to Thames Lee Tunnel
Interdependencies/ Exclusivity	To provide an additional resource to London WRZ the following system elements may also be required: • Additional capacity in the raw water systems to allow the water to be abstracted from the Lee Valley Reservoirs and conveyed to a Water Treatment Works in east London; • Additional treatment in east London; • Additional capacity in the Thames Water ring main. Deephams Reuse, Crossness Desalination, Beckton Desalination and Beckton Effluent Reuse are subject to a combined Tidal

Name	Deephams Reuse (46.5 Ml/d)
	Thames Limit for Desal and reuse options of 366 Ml/d due to the impact on salinity in the river. [3]

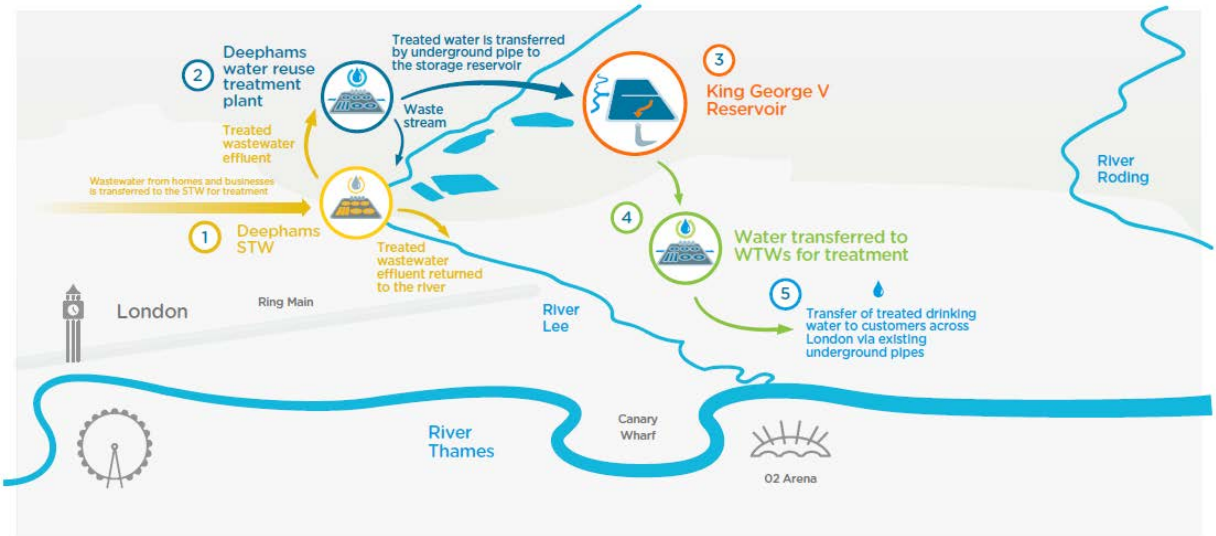


Deephams Reuse and conveyance to Thames Lee Tunnel (46.5 Ml/d)

Name	Deephams Reuse (46.5 Ml/d)
WRSE ID	TWU_KGV_HI-REU_RE1_ALL_deephams reuse 46.5b
WRMP19 Reference	RES-RU-DPH CON-RU-DPH-TLTEX
Element Type	Resource
WRZ	LONDON
Engineering Scope	46.5 Ml/d capacity Water Reuse Treatment Plant, located within the existing Deephams STW boundary and treating the STW effluent. The treated water would then be pumped to a proposed discharge location into a shaft the Thames Lee Tunnel extension.
Engineering Components	46.5 Ml/d Water reuse treatment plant, consisting of the following treatment processes: • Duty/standby pressurised automatic backwash screens. • Ferric addition. • Ultrafiltration plant with filtrate pumps. • Backwash, and clean in place (CIP) system. • RO membrane plant. • Hydrogen peroxide and UV treatment (AOP). • Remineralisation plant consisting of a lime and CO_2 dosing • Waste stream system, returned to the Deephams STW inlet works for treatment. • Conveyance from Deephams Reuse Plant to Thames Lee Tunnel Shaft
Phasing/Benefit	DO benefits of:

[3] Further work is ongoing to review the combined Tidal Thames Limit for desalination and reuse.

Name	Deephams Reuse (46.5 Ml/d)
	• 1 In 2 average: 42 Ml/d • 1 In 500 average: 42 Ml/d • 1 In 500 peak: 42 Ml/d
Lead Time	7.5 years (earliest delivery date is 2060)
Mutual exclusivities	This option is mutually exclusive with Deephams Reuse and conveyance to King George V Reservoir
Interdependencies/ Exclusivity	Dependent on the TLT extension from Lockwood PS to KGV reservoir intake To provide an additional resource to London WRZ the following system elements may also be required: • Additional capacity in the raw water systems to allow the water to be abstracted from the Lee Valley Reservoirs and conveyed to a Water Treatment Works in east London; • Additional treatment in east London; • Additional capacity in the Thames Water ring main. Deephams Reuse, Crossness Desalination, Beckton Desalination and Beckton Effluent Reuse are subject to a combined Tidal Thames Limit for Desal and reuse options of 366 Ml/d due to the impact on salinity in the river.



Mogden South Sewer – Reuse Treatment Plant - 50 Ml/d

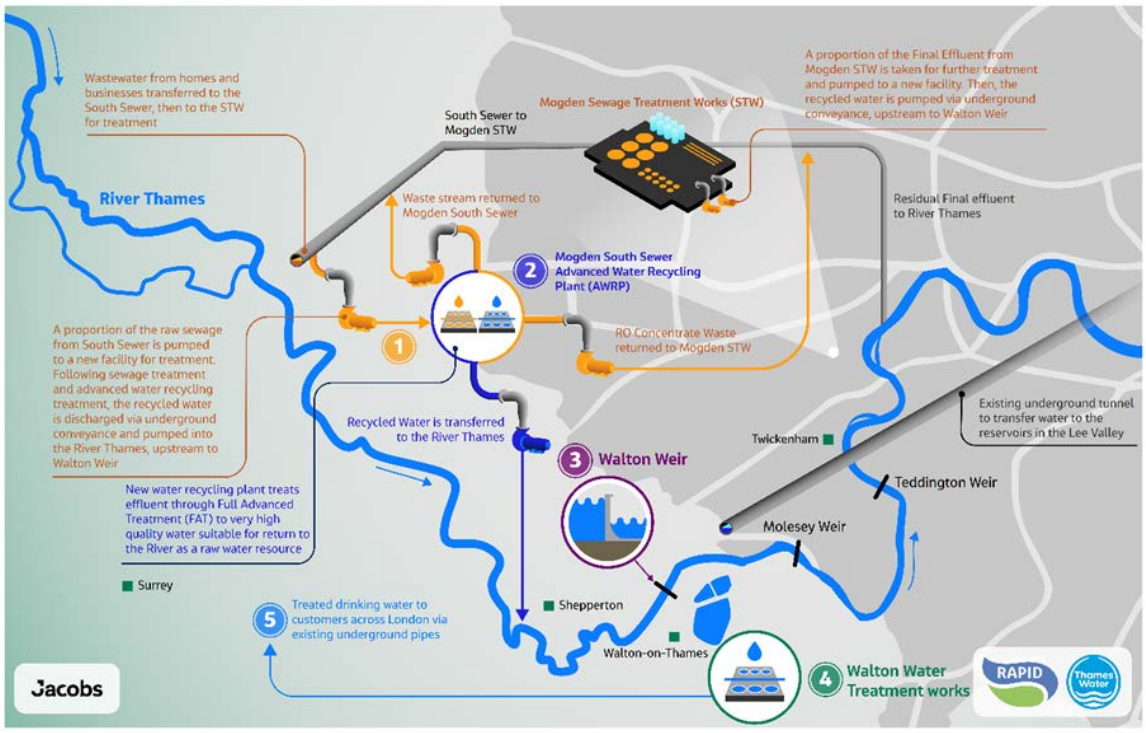
Name	Mogden South Sewer – Reuse Treatment Plant
WRSE ID	TWU_WLJ_HI-REU_RE1_ALL_reuse mogden s sewer
WRMP19 Reference	RES-RU-MSS-50; CON-RU-MSS-WAL-50
Element Type	Resource & Conveyance – Bulk Raw Water Transfer
WRZ	LONDON
Engineering Scope	Planned indirect potable reuse (IPR) is the process of actively managing returns of highly treated wastewater effluent to water courses above abstraction points. For the Mogden South Sewer

Name	Mogden South Sewer – Reuse Treatment Plant
	scheme, this has been combined with a traditional sewage treatment plant stage to allow raw sewage from the Mogden Sewage Treatment Works (STW) catchment to be transferred via a new pumping station to a new combined STW and Advanced Water Recycling Plant (AWRP) to produce a high purity water stream. The recycled water will then be pumped to a proposed discharge location on the River Thames at Walton to supplement the raw water supply to downstream WTWs. The AWRP can be built in a single phase for a maximum yield of 50 Ml/d total.
Engineering Components	The Advanced Water Recycling Plant can be constructed in a single phase of 50 Ml/d yield[4]. The treatment stages include; • Sewage Treatment Works – inlet works (screens and grit removal system); Primary Settlement; Fine screening; Activated Sludge Process, Membrane Bioreactor and odour control systems • AWRP stage – Ultrafiltration; Reverse Osmosis (RO); hydrogen peroxide dosing and UV treatment; remineralisation plant; and waste stream systems. • Incoming Transfer Pump Station • Recycled Water Pump Station • Wastewater Discharge Pump Station • The associated conveyance stages include: • Transfer pipeline from the South Sewer to the treatment works. • Waste return pipeline from the treatment works to the South Sewer. • Recycled water pipeline from the treatment works to the River Thames. • RO concentrate return pipeline from the treatment works to Mogden STW
Phases/Benefits	Mogden South Sewer would be developed in a single phase. DO benefits of: • 1 in 2 average: 46 Ml/d • 1 in 500 average: 46 Ml/d • 1 in 500 peak: 46 Ml/d
Lead Time	Alternative delivery programmes have been developed for London Effluent Reuse Gate 2 submission which show a lead time of 8 years and an earliest operational date of 2030.

[4] Following upload to WRSE investment model further work was completed to review the capacity and benefit from Mogden South Sewer. Dry Weather Flow (DWF) monitoring data was gathered during the London Effluent Reuse SRO Gate 2 stage, which showed DWF values of 33 to 36Ml/d. This is substantially below a DWF of 60 Ml/d required to support a 50Ml/d Mogden South Sewer scheme. As a result only a smaller DO c.25Ml/d is possible; however the option is retained while the additional wastewater benefits of the option are reviewed.

Name	Mogden South Sewer – Reuse Treatment Plant
Mutual Exclusivities	The combined yield of Mogden South Sewer, Teddington DRA and Mogden Effluent Reuse options is limited to 200 Ml/d because the three schemes use final effluent of Mogden STW or sewage from the Mogden STW catchment as a water source. Further considerations are being made regarding the impacts on the Middle Thames Tideway and mutual exclusivities between the options.
Interdependencies/ Exclusivity	To provide an additional resource to London WRZ, the following elements may also be required: • Upgrades to the west London raw water system • Additional treatment capacity at Kempton WTW • Network reinforcements, potentially including extensions to the London ring main. Mogden South Sewer has the potential to support the Thames to Affinity Transfer (T2AT) SRO as T2AT SRO may abstract raw water from the River Thames. Additional requirements to supply water to Affinity Water WRZs are described in the Thames to Affinity Water Transfer Gate 2 documents.

Mogden South Sewer Schematic



Mogden Effluent Reuse – Reuse Treatment Plant

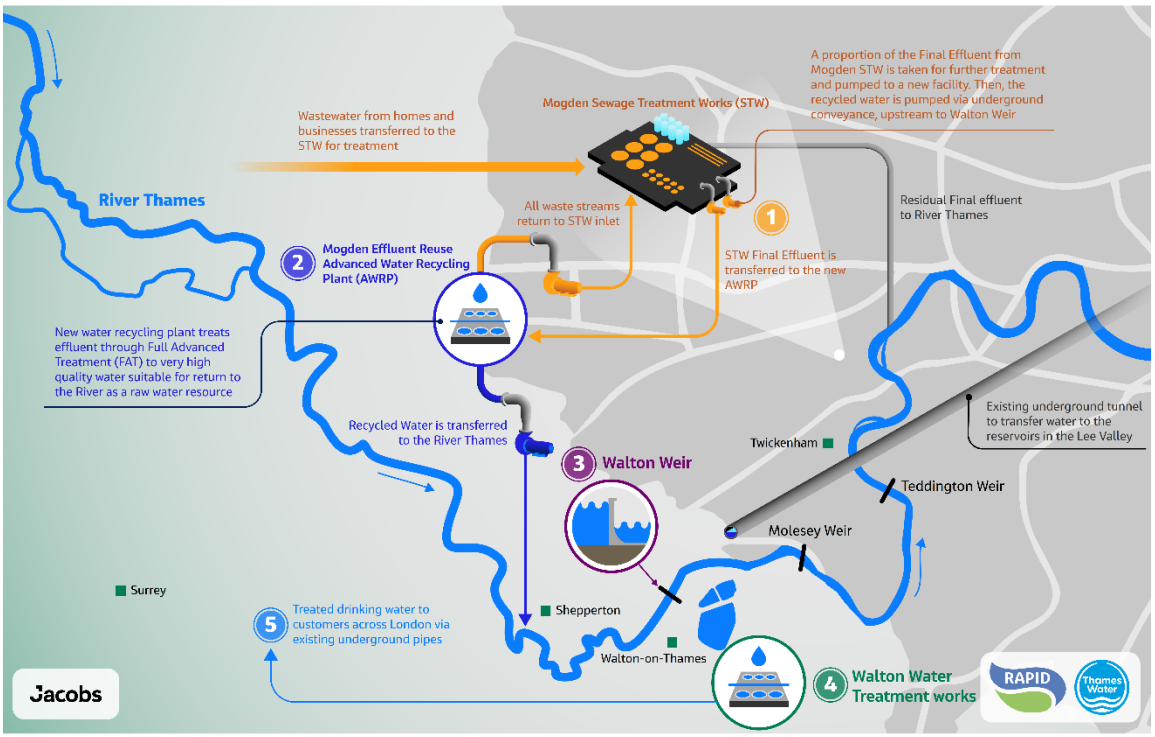
Name	Mogden Effluent Reuse – Reuse Treatment Plant
WRSE ID	TWU_WLJ_HI-REU_reuse mogden 50 TWU_WLJ_HI-REU_reuse mogden 100

Name	Mogden Effluent Reuse – Reuse Treatment Plant
WRMP19 Reference	RES-RU-MOG-50, RES-RU-MOG-100,
Element Type	Resource
WRZ	LONDON
Engineering Scope	Planned indirect potable reuse (IPR) is the process of actively managing returns of highly treated wastewater effluent to water courses above abstraction points. Final effluent from the Mogden Sewage Treatment Works (STW) is to be transferred via a new pumping station to a new Advanced Water Recycling Plant (AWRP) to produce a high purity water stream. The recycled water will then be pumped to a proposed discharge location on the River Thames at Walton to supplement the raw water supply to downstream WTWs. The AWRP can be built in up to three phases for a maximum yield of 200 Ml/d[5] total (based on available final effluent, physical space for the assets, etc).
Engineering Components	The Advanced Water Recycling Plant includes • Ultrafiltration plant • Reverse Osmosis (RO) membrane plant • Hydrogen peroxide dosing and UV treatment (UVAOP) • Remineralisation plant • Final effluent pumping station • Recycled water pumping station • Wastewater return pump station
Phases/Benefits	Mogden Reuse can be developed in phases of 50 or 100 Ml/d up to a maximum capacity of 200 Ml/d Capacity (Ml/d) / DO Benefits (Ml/d) 200 / 169 150 / 130 100 / 88 50 / 46 DO benefits above apply for 1 in 2 average, 1 in 500 average and 1 in 500 peak
Lead Time	Alternative delivery programmes have been developed for Gate 2 which show a lead time of 9 years (per phase) and an earliest operational date of 2031.
Mutual Exclusivities	The combined yield of Mogden Effluent Reuse scheme, Teddington DRA and Mogden South Sewer Reuse is limited to 200 Ml/d[4] because the three schemes use final effluent of Mogden STW or sewage from the Mogden STW catchment as a water source.

[5] Further modelling has shown that a maximum capacity of 200 Ml/d has a high risk of breaching Environment Agency guidance but does not risk breaching the Water Framework Directive (WFD) threshold, this option will therefore have a maximum of 150 Ml/d in the Gate 2 Report. Further work will continue to develop an operational philosophy to mitigate this risk this may result in further changes to the maximum capacity. Any changes will be reflected in the final WRMP documents.

Name	Mogden Effluent Reuse – Reuse Treatment Plant
Interdependencies/ Exclusivity	To provide an additional resource to London WRZ, the following elements may also be required: Upgrades to the west London raw water system Additional treatment capacity at Kempton WTW Network reinforcements, potentially including extensions to the London ring main. Mogden Reuse has the potential to support the Thames to Affinity Transfer (T2AT) SRO as T2AT SRO may abstract raw water from the River Thames. Additional requitements to supply water to Affinity Water WRZs are described in the Thames to Affinity Water Transfer Gate 2 documents

Mogden Effluent Reuse Schematic



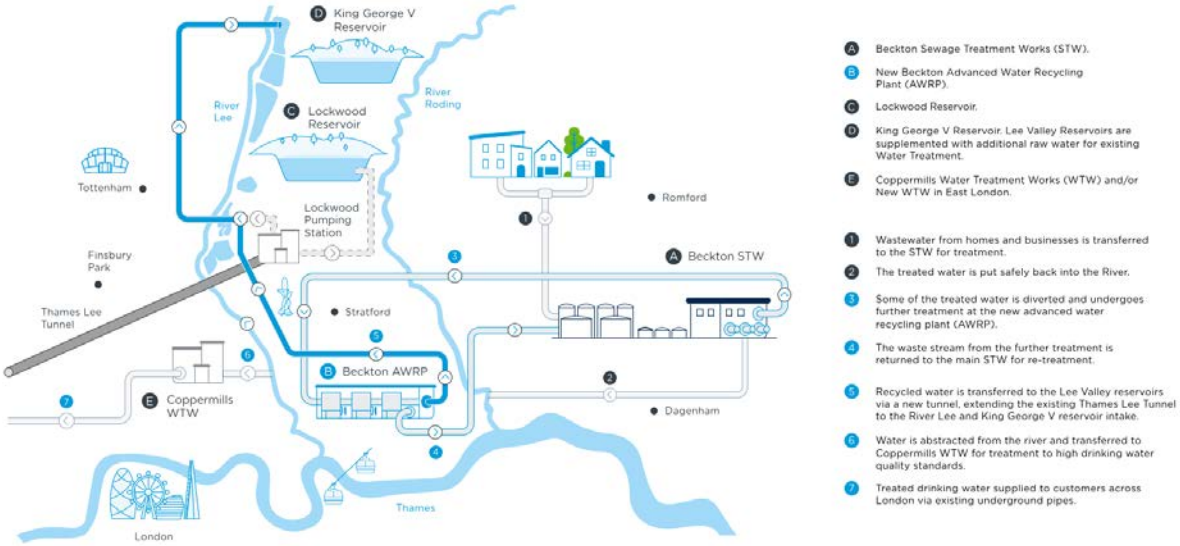
Beckton Effluent Reuse – Reuse Treatment Plant

Name	Beckton Effluent Reuse – Reuse Treatment Plant
WRSE ID	TWU_KGV_HI-REU_reuse beckton 50 TWU_KGV_HI-REU_reuse beckton 100 TWU_KGV_HI-REU_reuse beckton 150
WRMP19 Reference	RES-RU-BEC-50, RES-RU-BEC-100, RES-RU-BEC-150
Element Type	Resource
WRZ	LONDON
Engineering Scope	Planned indirect potable reuse (IPR) is the process of actively managing returns of highly treated wastewater effluent to water courses above abstraction points. Final effluent from the Beckton

Name	Beckton Effluent Reuse – Reuse Treatment Plant
	Sewage Treatment Works (STW) is to be subjected to an advanced treatment process to produce a high purity water stream. The recycled water will then be pumped to a proposed discharge location on the River Lee diversion to supplement the raw water supply to the Lee Valley reservoirs. The proposed site for the treatment plant will be within the Beckton STW boundary to the north of the operational area.
Engineering Components	The Advanced Water Recycling Plant includes : • Ultrafiltration plant • Reverse Osmosis (RO) membrane plant • Hydrogen peroxide dosing and UV treatment (UVAOP) • Remineralisation plant • Final effluent pumping station • Recycled water pumping station • Wastewater return pump station
Phases/Benefits	Beckton Effluent Reuse can be developed in phases of 50 or 100 Ml/d up to a maximum capacity of 300 Ml/d. Capacity (Ml/d) / DO Benefits (Ml/d) 300 / 252 200 / 172 150 / 130 100 / 89 50 / 46 DO benefits above apply for 1 in 2 average, 1 in 500 average and 1 in 500 peak.
Lead Time	Alternative delivery programmes have been developed for Gate 2 which show a lead time of 9 years (per phase) and an earliest operational date of 2031
Mutual Exclusivities	There are no other options or schemes that are mutually exclusive with the Beckton Effluent Reuse scheme. Deephams Reuse, Crossness Desalination, Beckton Desalination and Beckton Reuse are subject to a combined Tidal Thames Limit for desalination and reuse options of 366 Ml/d due to the impact on salinity in the river. [6]
Interdependencies/ Exclusivity	The first phase of Beckton Effluent Reuse is dependent on the following elements: Beckton to Lockwood Conveyance TLT extension from Lockwood PS to KG reservoir intake To provide an additional resource to London WRZ the following system elements may also be required:

[6] Further work is ongoing to review the combined Tidal Thames Limit for desalination and reuse.

Name	Beckton Effluent Reuse – Reuse Treatment Plant
	• Additional capacity in the raw water systems to allow the water to be abstracted from the River Lee Diversion into the Lee Valley Reservoirs and from there conveyed to a Water Treatment Works in east London; • Additional treatment capacity in east London. • Additional capacity in the Thames Water ring main. Beckton Reuse has the potential to support the Thames to Affinity Transfer (T2AT) SRO as T2AT SRO may abstract raw water from the River Lee. Additional requirements to supply water to Affinity Water WRZs are described in the Thames to Affinity Water Transfer Gate 2 documents.



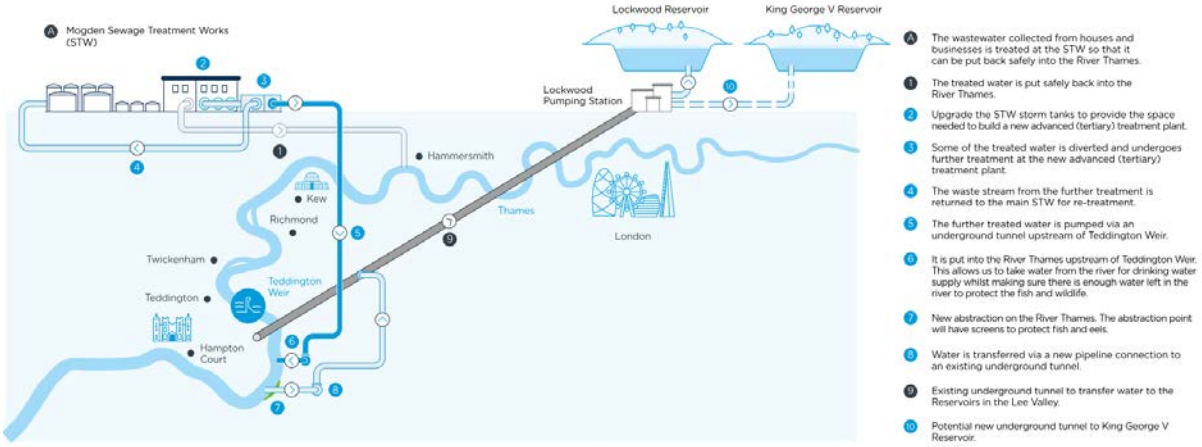
Direct River Abstraction

Teddington DRA Tertiary Treatment Plant

Name	Teddington DRA Tertiary Treatment Plant - 50 Ml/d output and 75 Ml/d output)
WRSE ID	TWU_KGV_HI-RAB_teddington dra 50 TWU_KGV_HI-RAB_teddington dra 75
WRMP19 Reference	RES-DRA-TED-50, RES-DRA-TED-75
Element Type	Resource
WRZ	LONDON
Engineering Scope	A portion of final effluent from Mogden STW would undergo treatment at a new Tertiary Treatment Plant, sized at a capacity of either 50 Ml/d or 75 Ml/d yield, within the Mogden STW boundary, sufficient to allow consented discharge into the river. The Treated Effluent will then be transferred to a new outfall location on the River Thames, upstream of Teddington Weir and the waste stream will be returned to Mogden STW. This option is part of the Teddington DRA scheme which also includes a new direct river abstraction from the River Thames, to supply the Thames Lee Tunnel with raw water. It is noted that at this stage, a maximum capacity for the Teddington DRA scheme has been set at 75 Ml/d, so no phased construction options are available. [7]
Engineering Components	Teddington DRA tertiary treatment plant (TTP) includes : • Coagulation dosing and mixing tank • Nitrifying Sand Filters • Mechanical Filters • Wastewater equalisation tank • Civil/structural works to deepen 2No. existing storm tanks to create extra storm capacity • Demolition and in-filling of 2No. existing storm tanks to make space for the new TTP • Upgrades to deepened storm tank equipment (pumps, mixers, etc) • Final Effluent Pumping Station • Treated Effluent Pumping Station • Wastewater Pumping Station
Phases/benefits	For capacities up to 75 Ml/d not phasing has been included. The TTP can be constructed with either 50 Ml/d or 75 Ml/d capacity

[7] Since the WRMP24 feasibility assessment London Effluent Reuse SRO has continued to undertake environmental investigations and river modelling; any changes to option feasibility as a result of this work will be reflected in the final WRMP24

Name	Teddington DRA Tertiary Treatment Plant - 50 Ml/d output and 75 Ml/d output)
	<table><tr><td>Capacity (Ml/d)</td><td>DO Benefit (Ml/d)</td></tr><tr><td>50</td><td>46</td></tr><tr><td>75</td><td>67</td></tr></table> DO benefits above apply for 1 in 2 average, 1 in 500 average and 1 in 500 peak
Lead Time	Alternative delivery programmes have been developed for Gate 2 which show a lead time of 9 years and an earliest operational date of 2031.
Mutual Exclusivities	The combined capacity of Teddington DRA, Mogden Effluent Reuse and Mogden South Sewer schemes is limited to 200 Ml/d because the three schemes use final effluent of Mogden STW or sewage from the Mogden STW catchment as a water source.
Interdependencies/ Exclusivity	The following elements are also required for the Teddington DRA option: • Teddington to Thames Lee Tunnel • Teddington Outfall Teddington DRA scheme does not have dependencies on other options. To provide an additional resource to London WRZ, the following elements may also be required: • Additional treatment capacity at Water Treatment Works (WTWs) in both east and west London • Sufficient available extra capacity in the Thames Water Ring Main • In order to provide raw water to all of the Lee Valley reservoirs, an additional transfer through TLT extension from Lockwood Shaft to the River Lee Diversion would be required. • Upgrades to raw water conveyance systems • Network reinforcements Teddington DRA scheme has the potential to support the Thames to Affinity Transfer (T2AT) SRO. Additional requirements to supply water to Affinity Water WRZs are described in the Thames to Affinity Water Transfer Gate 2 documents.


Lockwood Reservoir
King George V Reservoir
A Mogden Sewage Treatment Works (STW)
Lockwood Pumping Station
Hammersmith
Kew
Richmond
Thames
London
Twickenham
Teddington Weir
Teddington
Hampton Court
A The wastewater collected from houses and businesses is treated at the STW so that it can be put back safely into the River Thames.
1 The treated water is put safely back into the River Thames.
2 Upgrade the STW storm tanks to provide the space needed to build a new advanced (tertiary) treatment plant.
3 Some of the treated water is diverted and undergoes further treatment at the new advanced (tertiary) treatment plant.
4 The waste stream from the further treatment is returned to the main STW for re-treatment.
5 The further treated water is pumped via an underground tunnel upstream of Teddington Weir.
6 It is put into the River Thames upstream of Teddington Weir. This allows us to take water from the river for drinking water supply whilst making sure there is enough water left in the river to protect the fish and wildlife.
7 New abstraction on the River Thames. The abstraction point will have screens to protect fish and eels.
8 Water is transferred via a new pipeline connection to an existing underground tunnel.
9 Existing underground tunnel to transfer water to the Reservoirs in the Lee Valley.
10 Potential new underground tunnel to King George V Reservoir.

Raw Water Purchase

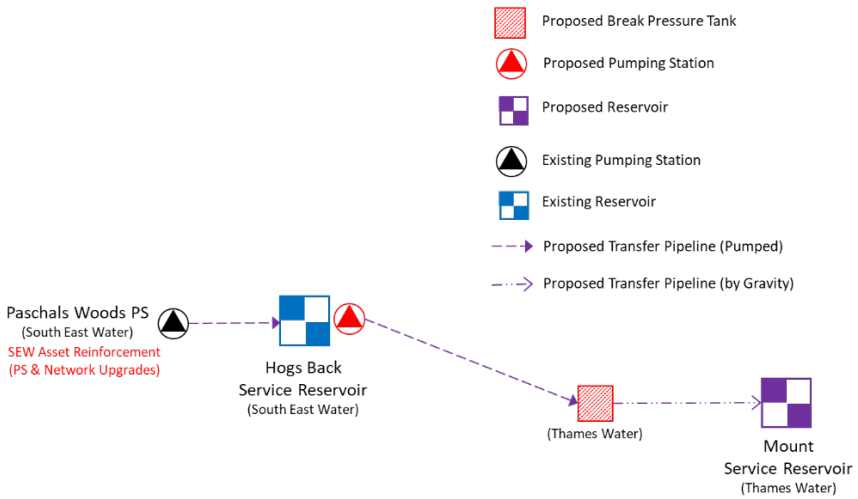
Didcot Raw Water Purchase

Name	Didcot Raw Water Purchase
WRSE ID	TWU_LON_HI-OTH_ALL_ALL_didcot purchase
WRMP19 Reference	RES-RWP-DID
Element Type	Resource
WRZ	LONDON / SWA
Engineering Scope	Agreement between Thames Water and RWE Generation UK that RWE will abstract less than the maximum amount of their abstraction licence at Didcot Power Station. This water would then be available downstream for abstraction at Thames Water intakes, subject to TW's existing abstraction licence for the Lower Thames, and the Lower Thames Operating Agreement.
Engineering Components	n/a
Phases/Benefits	DO benefits of: • 1 In 2 average: nil • 1 In 500 average: 22.6 Ml/d • 1 In 500 peak: 22.6 Ml/d
Lead Time	0 Years
Mutual exclusivities	none
Interdependencies/ Exclusivity	To provide a benefit to SWA, the additional elements required are: New Medmenham Intake Medmenham WTW To provide an additional resource to London WRZ, the following elements may also be required: • Upgrades to the west London raw water system • Additional treatment capacity at Kempton WTW • Network reinforcements, potentially including extensions to the London ring main.

Inter Company Transfers

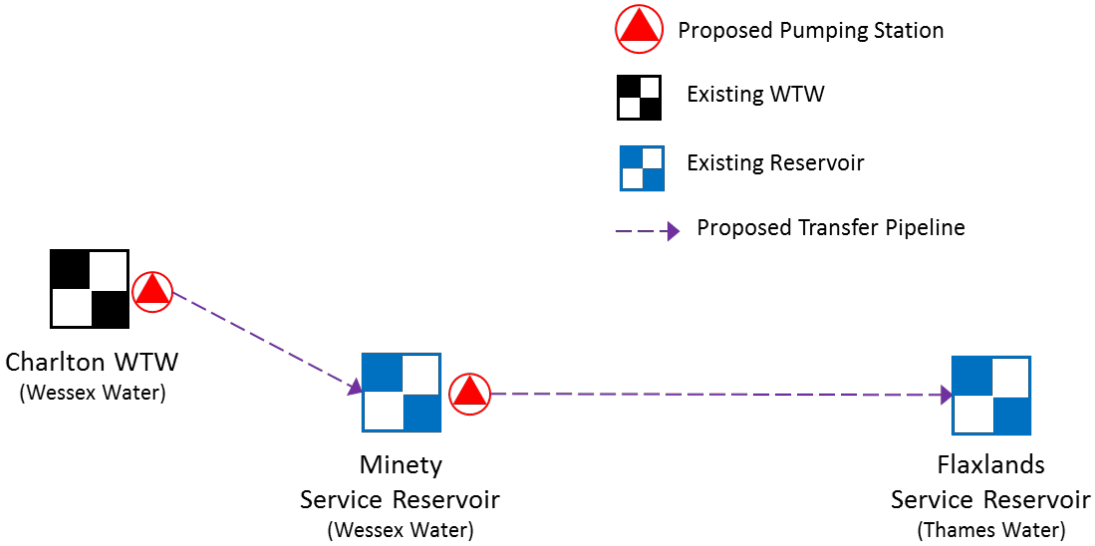
South East Water to Guildford Transfer

Name	South East Water to Guildford Inter-company transfer
WRSE ID	TWU_GUI_HI-TFR_RZ5_ALL_sewtogui
WRMP19 Reference	RES-ICT-SEW-GUI-MNT-10
Element Type	Resource
WRZ	Guildford
Engineering Scope	Inter-zonal (inter-company) transfer of 10Ml/d from Hogs Back Service Reservoir (SR) in South East Water (SEW) supply area to Mount SR in Guildford WRZ.
Engineering Components	Within SEW Supply area: • A new main from Colonels Gate to Mytchett Place, Keogh Barracks • A new main inlet to Hogs Back SR • New pumping station at Hogs Back • Booster upgrade (10Ml/d) requiring a new building/kiosk and new power supply. • Additional 8 Ml storage Within Guildford WRZ: • Treated water pipeline from Hogs Back SR (SEW) to Mount SR. • Break pressure tank.
Phases/Benefits	This option would be developed in a single phase. DO benefits of: • 1 in 2 average: 10Ml/d • 1 in 500 average: 10Ml/d • 1 in 500 peak: 10Ml/d
Lead Time	5 Years
Mutual exclusivities	None
Interdependencies/ Exclusivity	No interdependency with other WRMP elements



Wessex to SWOX (2.9Ml/d)

Name	Wessex to SWOX 2.9 Ml/d – Inter-zonal (inter-company) transfer
WRSE ID	TWU_SWX_HI-IMP_SWX_ALL_wessextoswoxflax
WRMP19 Reference	RES-ICT-WSX-FLX
Element Type	Resource
WRZ	SWOX
Engineering Scope	Inter-zonal (inter-company) transfer of 2.9 Ml/d from Wessex Water's Charlton WTW to Thames Water's Flaxlands Service Reservoir (SR).
Engineering Components	• A treated water pipeline from Charlton WTW to Minety SR • A treated water pipeline from Minety SR to Flaxlands SR • A new pump station and borehole pumps at Charlton WTW (Wessex Water). • A new pump station at Minety SR (Wessex Water).
Phases/Benefits	This option would be developed in a single phase. DO benefits : • 1 in 2 average: 2.9Ml/d • 1 in 500 average: 2.9Ml/d • 1 in 500 peak: 2.9Ml/d
Lead Time	5 Years with an earliest operational date of 2040
Mutual exclusivities	None
Interdependencies/ Exclusivity	No interdependency with other WRMP elements



Cheam to Merton Transfer (15Ml/d)

Name	Cheam to Merton Transfer (15Ml/d) – Inter-zonal (inter-company) transfer
WRSE ID	TWU_SES_HI-TFR_LON_ALL_r10
WRMP19 Reference	n/a new option at WRMP24
Element Type	Resource
WRZ	LON
Engineering Scope	Inter-zonal (inter-company) transfer of 15 Ml/d from SES at Cheam to Thames Water at Merton.
Engineering Components	• A treated water pipeline from Cheam to Merton • A new pump station.
Phases/Benefits	This option would be developed in a single phase. DO benefits : 15 Ml/d (TBC)
Lead Time	5 Years
Mutual exclusivities	None
Interdependencies/ Exclusivity	No interdependency with other WRMP elements

Reigate to Guildford Transfer (5Ml/d)

Name	Transfer - Reigate (SES) to Guildford 5Ml/d – Inter-zonal (inter-company) transfer
WRSE ID	TWU_GUI_HI-TFR_SES_ALL_reigatetoguildford5
WRMP19 Reference	n/a new option at WRMP24
Element Type	Resource
WRZ	Guildford
Engineering Scope	Inter-zonal (inter-company) transfer of 5 Ml/d from SES at Reigate to Thames Water Guildford WRZ.

Name	Transfer - Reigate (SES) to Guildford 5Ml/d – Inter-zonal (inter-company) transfer
Engineering Components	• A treated water pipeline from Reigate to Guildford • A new pump station.
Phases/Benefits	This option would be developed in a single phase. DO benefits : 5 Ml/d (TBC)
Lead Time	5 Years
Mutual exclusivities	None
Interdependencies/ Exclusivity	No interdependency with other WRMP elements

Thames to Affinity Transfer - Conjunctive Use Benefit

Name	Thames to Affinity Transfer
WRSE ID	AFW_AZ3_HI-TFR_KGV_CNO_beckton_conv100 AFW_RA4_HI-TFR_UTC_CNO_ltr_2a_conv100
WRMP19 Reference	Affinity Water Option
Element Type	Conjunctive Use
WRZ	NA
Engineering Scope	A modelling study carried out as part of the Thames to Affinity Transfer (T2AT) SRO scheme has shown that T2AT brings conjunctive use benefits to Thames Water. Refer to Thames to Affinity Transfer SRO Gate 1 and Gate 2 submissions for more information.
Engineering Components	None
Phases/Benefits	Conjunctive Use Benefit for Thames Water: 25 Ml/d per 50 Ml/d of transfer up to a maximum of 50 Ml/d
Lead Time	11 years. Delivery programmes have been developed for Gate 2 which show an earliest operational date of 2034/5; however this is dependent on the availability of resource to support the transfer.
Mutual exclusivities	None
Interdependencies/ Exclusivity	The LTR option is dependent on additional water resource being made available for abstraction from the River Thames. SESRO is a pre-requisite for the LTR scheme because without the new reservoir, the scheme would leave Thames Water with an unacceptable reduction in the volume of strategic raw water storage available to supply London. Should the supported STT option be implemented instead of or ahead of SESRO, then one of the alternative feasible configurations for T2AT from the River Thames could apply.

Name	Thames to Affinity Transfer
	The BRI option is dependent on additional water resource being made available for abstraction from the River Lee from Beckton Reuse.

SESRO / STT interconnector - Conjunctive Use Benefit

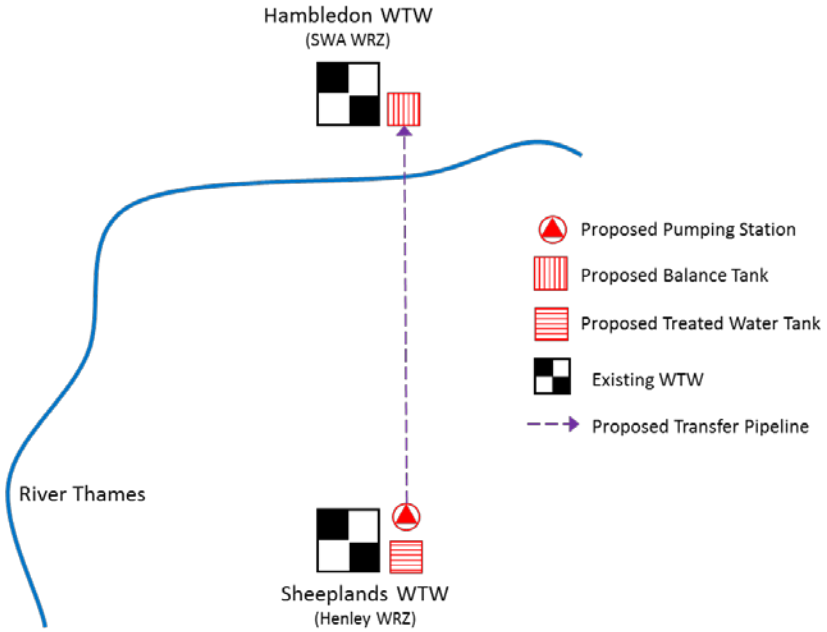
Name	SESRO / STT interconnector
WRSE ID	TWU_STT_HI-TFR_STT_ALL_stt-sesro c1 TWU_STT_HI-TFR_STT_ALL_stt-sesro c2 TWU_STT_HI-TFR_STT_ALL_stt-sesro p1 TWU_STT_HI-TFR_STT_ALL_stt-sesro p2
WRMP19 Reference	New option to WRMP24
Element Type	Conjunctive Use
WRZ	London
Engineering Scope	SESRO SRO has modelled the potential DO benefit that could be achieve by providing a link between SESRO and STT. Refer to SESRO SRO Gate 2 submission for more information.
Engineering Components	Provision for STT to be able to discharge into SESRO
Phases/Benefits	TBC[8]
Lead Time	TBC
Mutual exclusivities	None
Interdependencies/ Exclusivity	This option is dependent on both SESRO / Abingdon Reservoir and STT options being selected.

[8] At the time of uploading information to the WRSE investment model it was understood that there would be no DO benefit from the STT / SESRO link, however subsequent work has shown in that there is a small DO benefit of 11 Ml/d, this is further reported in Gate 2 Reports and will be included in the Final WRMP documents .

Inter Zonal Transfers

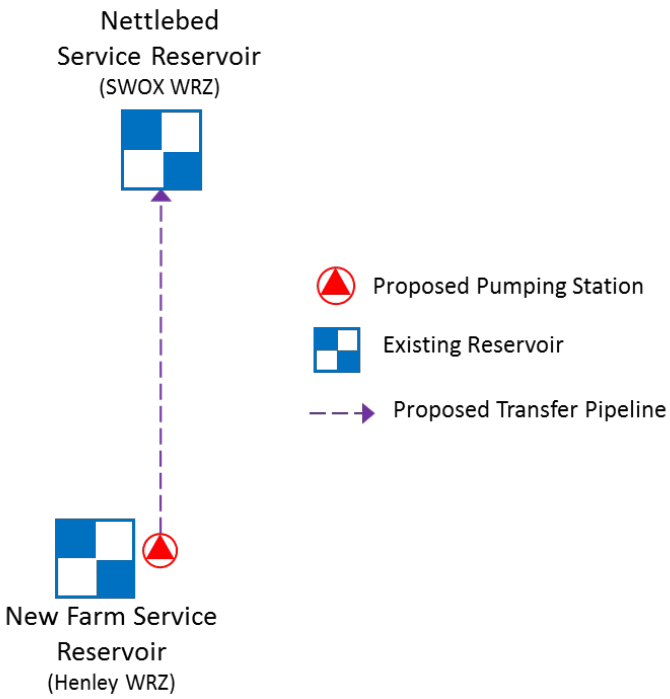
Henley to SWA Transfer (2.4 Ml/d or 5 Ml/d)

Name	Henley to SWA 2.4Ml/d – Inter-zonal transfer Henley to SWA 5Ml/d – Inter-zonal transfer
WRSE ID	TWU_SWA_HI-TFR_HEN_ALL_henley-swa2.4 TWU_SWA_HI-TFR_HEN_ALL_henley-swa5
WRMP19 Reference	RES-IZT-HEN-SWA-HAM- 2.37 RES-IZT-HEN-SWA-HAM-5
Element Type	Resource
WRZ	SWA
Engineering Scope	Inter-zonal transfer of 2.4Ml/d or 5Ml/d from Sheeplands WTW in Henley WRZ to Hambleden WTW in SWA WRZ.
Engineering Components	The components for this scope are as follows: • New treated water pipeline from Sheeplands WTW to Hambleden WTW. • Orthophosphate treatment at Hambleden WTW. • A treated water tank and pumping station at Sheeplands WTW. • A balance tank at Hambleden WTW.
Phases/Benefits	This option would be developed in a single phase. DO benefit: n/a
Lead Time	5 Years
Mutual Exclusivities	The transfer options are mutually exclusive to each other and also Henley to SWOX Transfer (2.4 Ml/d or 5 Ml/d). The transfer options are mutually exclusive to each other and also Henley to SWOX Transfer (2.4 Ml/d or 5 Ml/d).
Interdependencies/ Exclusivity	No interdependency with other WRMP elements



Henley to SWOX Transfer (2.4Ml/d or 5Ml/d)

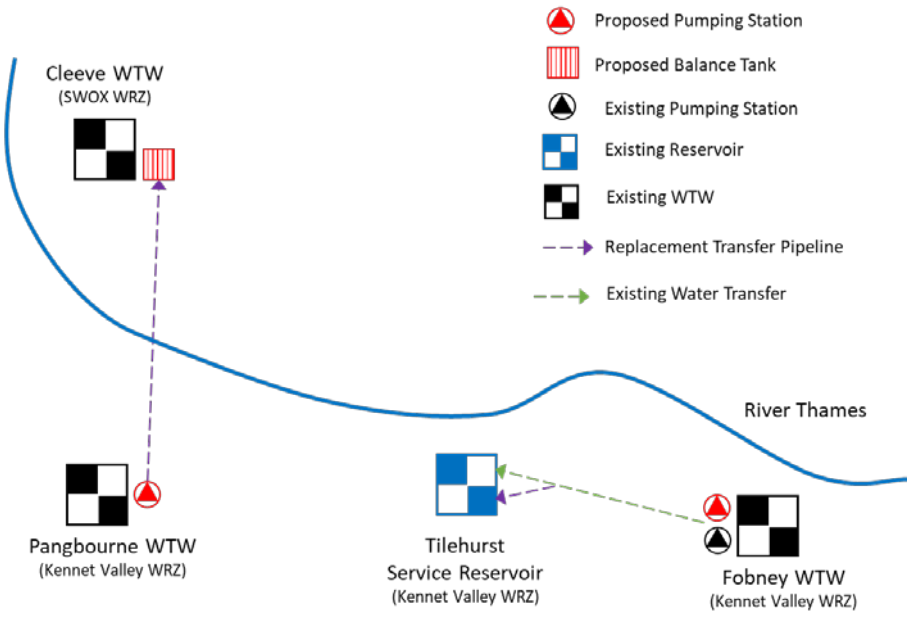
Name	Henley to SWOX 2.4Ml/d – Inter-zonal transfer Henley to SWOX 5Ml/d – Inter-zonal transfer
WRSE ID	TWU_SWX_HI-TFR_HEN_ALL_henley-swox2.4 TWU_SWX_HI-TFR_HEN_ALL_henley-swox5
WRMP19 Reference	RES-IZT-HEN-SWX-NET-2.37 RES-IZT-HEN-SWX-NET-5
Element Type	Resource
WRZ	SWOX
Engineering Scope	Inter-zonal transfer of 2.4Ml/d/5Ml/d from New Farm SR in Henley WRZ to Nettlebed SR in SWOX WRZ.
Engineering Components	The components for this scope are as follows: • A treated water pipeline to transfer water from New Farm SR to Nettlebed SR. • New pumping station at New Farm SR.
Phases/Benefits	This option would be developed in a single phase. DO benefit: n/a
Lead Time	5 Years
Mutual Exclusivities	Both transfer options are mutually exclusive to each other and also Henley to SWA Transfer (2.4 Ml/d or 5 Ml/d)
Interdependencies/ Exclusivity	No interdependency with other WRMP elements



Kennet Valley to SWOX Transfer (2.3Ml/d or 6.7Ml/d)

Name	Kennet Valley to SWOX 2.3 Ml/d – inter-zonal transfer Kennet Valley to SWOX 6.7 Ml/d – inter-zonal transfer
WRSE ID	TWU_SWX_HI-TFR_KVZ_ALL_kennet-swox2.3 TWU_SWX_HI-TFR_KVZ_ALL_kennet-swox6.7
WRMP19 Reference	RES-IZT-KEN-SWOX-CLV-2.3 RES-IZT-KEN-SWOX-CLV-6.7
Element Type	Resource
WRZ	SWOX
Engineering Scope	Phased construction of a new pipeline from Pangbourne WTW to Cleeve WTW to transfer 2.3Ml/d or 6.7Ml/d of treated water and a new pumping station at Pangbourne WTW. Additionally, a new potable water pipeline is required for the end section of the existing main from Fobney WTW to Tilehurst SR, to enable an increase in flow in the pipeline.
Engineering Components	The components for this scope are as follows: • New treated water pipeline from Pangbourne WTW to Cleeve WTW. • New treated water pipeline for the end section from Fobney WTW to Tilehurst SR. • New pumping station at Pangbourne WTW. • Balance tank at Cleeve WTW. • Additional pumps at the existing pumping station building at Fobney WTW.
Phasing/Benefits	This option would be developed in a single phase.

Name	Kennet Valley to SWOX 2.3 Ml/d – inter-zonal transfer Kennet Valley to SWOX 6.7 Ml/d – inter-zonal transfer
	DO benefit: n/a
Lead Time	5 Years
Mutual exclusivities	Both transfer options are mutually exclusive to each other.
Interdependencies/ Exclusivity	To provide an additional resource to SWOX WRZ the following system element is also required: An additional 4.5Ml/d from Mortimer Recommissioning to enable the release of 4.5Ml/d supply capacity from Fobney WTW.



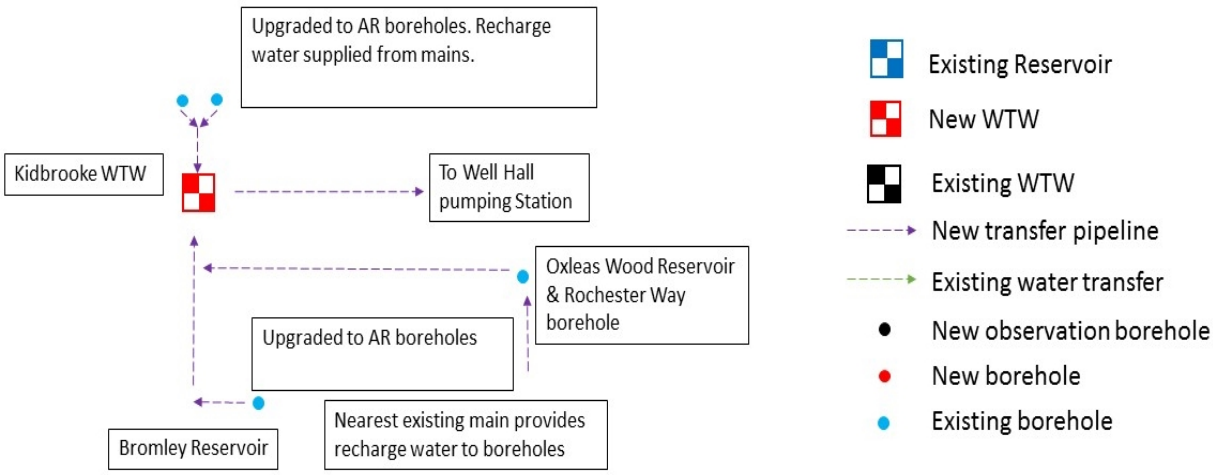
Groundwater[9]

South London Artificial Recharge Scheme Kidbrooke

Name	South London Artificial Recharge Scheme (SLARS) - Kidbrooke
WRSE ID	TWU_LON_HI-GRW_ALL_ALL_kidbrooke slars
WRMP19 Reference	RES-AR-SLARS1-7
Element Type	Resource
WRZ	LONDON
Engineering Scope	Upgrading four existing boreholes for Artificial Recharge (one at the Rochester Way site, two at Kidbrooke and another at the Bromley Reservoir site and construction of a new 8.1Ml/d WTW at the Kidbrooke borehole site to serve all the boreholes. Recharge water for the Kidbrooke boreholes will be provided from the local distribution main and will be recharged into the confined Chalk aquifer under mains pressure. Recharge water for Bromley Reservoir borehole and Rochester Way borehole will be provided via supply mains. Water abstracted from the AR boreholes will be treated at the new Kidbrooke WTW. Treated water from the Kidbrooke WTW will be returned to supply via the Well Hall Pumping station when an additional resource for the London Water Resource Zone is required. A discharge consent for recharge of the Chalk aquifer permit will be required from the Environment Agency for recharge of the Chalk aquifer.
Engineering Components	The components for this scope are as follows: • Construction of a new 8.1Ml/d treatment works at the Kidbrooke • New headworks and submersible abstraction pump with variable speed drives (VSD) for the existing Kidbrooke boreholes. • Existing Bromley reservoir borehole will have an abstraction pump installed • Existing Rochester Way borehole will have an abstraction pump installed. • A VSD booster pump will be installed at Oxleas Wood reservoir to pump recharge water to Rochester Way. • A new connection for recharge water to be constructed at the existing mains Bromley Reservoir site, transfer pipe will be constructed for raw water being pumped from Bromley to Kidbrooke WTW. • Construction of a main from Rochester Way borehole to transfer abstracted water to Kidbrooke WTW.

[9] New River Head groundwater scheme was included in the WRMP19 Preferred Programme for London for delivery in AMP7 (2020-25). This option is therefore not included in the Draft WRMP plan however since this decision the option has been deferred beyond the end of AMP7 as the supply demand balance in the London WRZ is in surplus. The option will therefore be included in the Final WRMP24 options list.

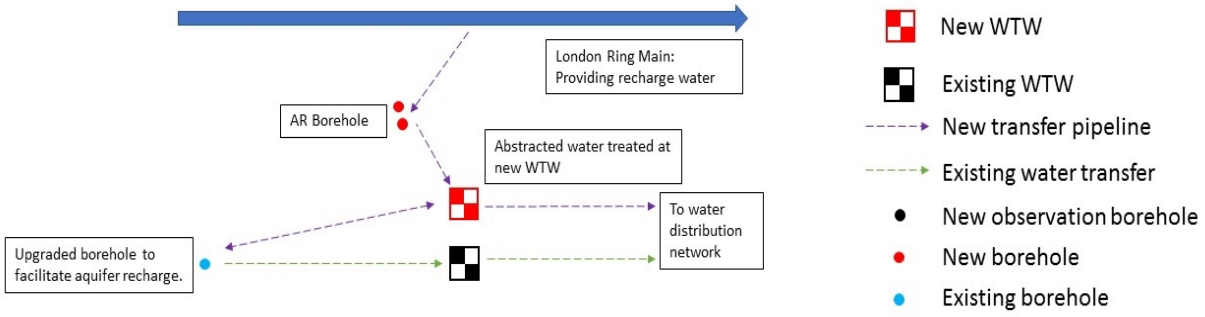
Name	South London Artificial Recharge Scheme (SLARS) - Kidbrooke
	• A main to be installed from Oxleas Wood to provide recharge water for Rochester Way.
Phases/Benefits	This option would be developed in a single phase. DO benefits of 8Ml/d.
Lead Time	6.5 Years
Mutual exclusivities	None.
Interdependencies/ Exclusivity	The scheme is independent of the other sub-components of the larger SLARS project: Streatham (SLARS) and Merton (SLARS)



South London Artificial Recharge Scheme Streatham

Name	South London Artificial Recharge Scheme (SLARS) - Streatham
WRSE ID	TWU_LON_HI-GRW_ALL_ALL_streatham ar
WRMP19 Reference	RES-AR-SLARS2
Element Type	Resource
WRZ	LONDON
Engineering Scope	Component of the larger SLARS project based on the development of boreholes for recharge/abstraction purposes in the confined Chalk. Upgrade of existing borehole at Streatham WTW and construction of new artificial recharge (AR) borehole on-site at the existing Streatham WTW. Construction of a new 17Ml/d WTW located on the existing WTW site. Recharged water is treated at the new WTW. A new licence and discharge consent will be required from the Environment Agency to allow abstraction/recharge from the Chalk. A winter licence from the River Thames will also be required to supply water during the recharge phase of the AR scheme.
Engineering Components	The components for this scope are as follows: • Construction of a new 17Ml/d treatment works on the existing site • New recharge / abstraction borehole

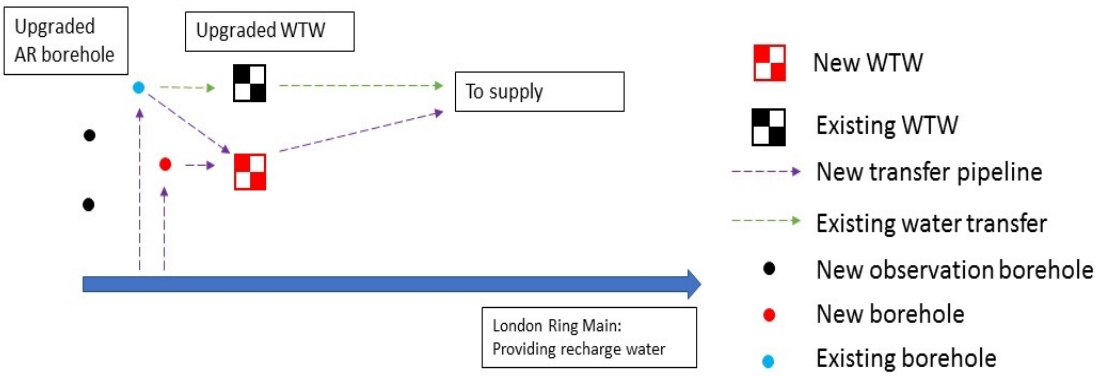
Name	South London Artificial Recharge Scheme (SLARS) - Streatham
	• Variable speed drive (VSD) pump for new borehole. • Redevelopment of existing borehole to become a recharge/abstraction borehole • New recharge water connection to the existing main in Conyers Rd. • Connection from treated water main to distribution network • New run-to-waste sewer connection
Phases/Benefits	This option would be developed in a single phase. DO benefits of: • 1 in 2 average: 5 Ml/d • 1 in 500 average: 5 Ml/d • 1 in 500 peak: 7 Ml/d
Lead Time	4 Years
Mutual exclusivities	None
Interdependencies/ Exclusivity	The scheme is independent of the other sub-components of the larger SLARS project: Kidbrooke (SLARS) and Merton (SLARS) .



South London Artificial Recharge Scheme Merton Abbey

Name	South London Artificial Recharge Scheme (SLARS) – Merton Abbey
WRSE ID	TWU_LON_HI-GRW_ALL_ALL_merton ar
WRMP19 Reference	RES-AR-SLARS3
Element Type	Resource
WRZ	LONDON
Engineering Scope	This option involves upgrading the existing well and adit system at the Merton Abbey Water Treatment Works (WTW) for artificial recharge (AR) and the construction of a new AR borehole with two observations boreholes. A new WTW will be constructed at Merton Abbey to serve the Byegrove Road AR borehole. Recharge water for the Merton Abbey and Byegrove Road AR boreholes will be provided via the London Ring Main and will be recharged to the confined Chalk aquifer. Abstracted water from the AR boreholes will be treated at the new and upgraded WTWs. Treated water from

Name	South London Artificial Recharge Scheme (SLARS) – Merton Abbey
	the Merton Abbey WTW will be returned to local distribution mains when an additional resource is needed for the London WRZ. A new licence and discharge consent will be required from the Environment Agency to allow abstraction/recharge from the Chalk. A winter licence from the River Thames will also be required to supply water during the recharge phase of the AR scheme.
Engineering Components	The components for this scope are as follows: • Installation of new submersible pump, in the existing abstraction well, at Merton Abbey WTW, capable of pumping 8Ml/d. • Construction of a new 4.5Ml/d treatment works at the Merton Abbey WTW site • Installation of a new submersible pump, in the existing abstraction well, at Merton Abbey WTW. • Construction of a connection to existing main in Fortescue Road, to provide recharge water • Construction of a new housing for the wellhead at Merton Abbey WTW. • Construction of a new WTW to treat water from the new AR borehole at the Byegrove Rd site. • Construction of a new connection from the new WTW to a local distribution main. A run to waste connection will be provided to the existing site drain. • Construction of an AR borehole at Byegrove road • Two observation boreholes for the AR borehole at Byegrove road. • Construction of a new connection pipeline to the distribution main in Byegrove road to provide recharge water. • Construction of pipeline for water transfer from Byegrove AR borehole to new WTW • Additional pumps are required at Byegrove Road AR borehole and the new WTW.
Phases/Benefits	This option would be developed in a single phase. DO benefits of: • 1 in 2 average: 6 Ml/d • 1 in 500 average: 6 Ml/d • 1 in 500 peak: 5 Ml/d
Lead Time	6.5 Years
Mutual exclusivities	None
Interdependencies/ Exclusivity	This option is independent of the other sub-components of the larger SLARS project: Kidbrooke (SLARS) and Streatham (SLARS) This option cannot be delivered without Merton Recommissioning

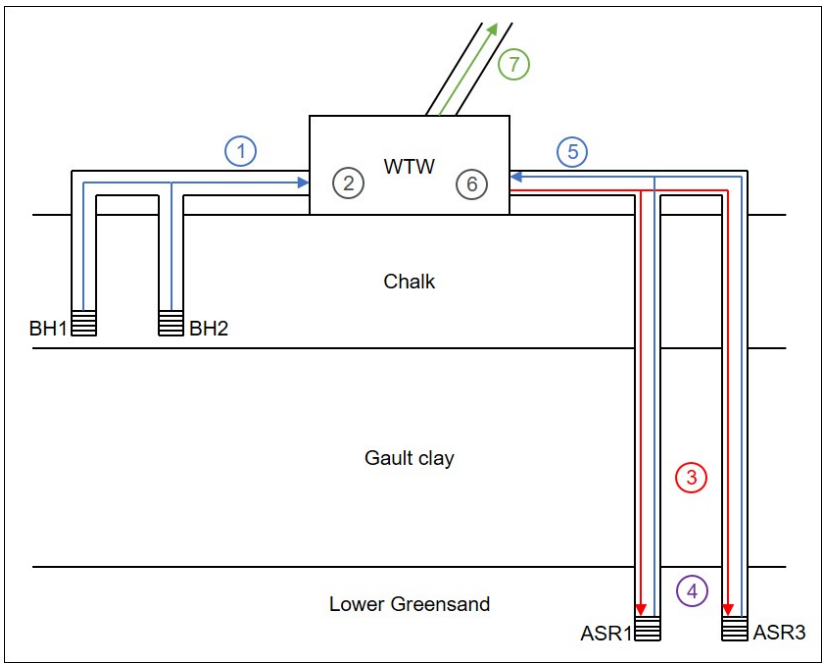


Horton Kirby Aquifer Storage and Recovery

Name	Horton Kirby Aquifer Storage and Recovery[10]
WRSE ID	TWU_LON_HI-GRW_RE1_ALL_asrhortonkirby
WRMP19 Reference	RES-ASR-HOR
Element Type	Resource
WRZ	LONDON
Engineering Scope	Construction of pipelines between two existing Aquifer Storage and Recovery (ASR) boreholes in the Lower Greensand aquifer to an existing WTW (water treatment works) at Horton Kirby in Kent. Water abstracted from existing Chalk aquifer boreholes (via the mains supply) will be recharged into the two ASR boreholes during periods of water surplus and abstracted when needed and treated at the WTW. A new licence and discharge consent will be required from the Environment Agency to allow abstraction/recharge from the Lower Greensand aquifer.
Engineering Components	The components for this scope are as follows: • Raw water pipeline to connect existing ASR3 borehole to existing Horton Kirby WTW • Upgrade to Horton Kirby WTW treatment. • New control infrastructure to recharge the aquifer. • New ASR borehole kiosk. • Two borehole abstraction pumps at the ASR boreholes • Two booster pumps for recharge to ASR boreholes • Two borehole pumps for abstraction from Chalk boreholes • Two force pumps to management control of Horton Kirby WTW output to Farningham storage reservoir • Install turbidity meters at ASR boreholes

[10] ASR Horton Kirby and Southfleet & Greenhithe Groundwater schemes were included in the WRMP19 Preferred Programme for London for delivery in AMP7 (2020-25). Since WRMP19 the delivery of these options has been deferred beyond the end of AMP7 as the supply demand balance in the London WRZ is in surplus. They are therefore included as WRMP24 Options

Name	Horton Kirby Aquifer Storage and Recovery[10]
	• New run-to-waste pipelines from ASR (1 and 3) boreholes to River Darent. New raw water pipelines between the existing ASR (1 and 3) boreholes and the WTW
Phases/benefits	This option would be developed in a single phase. DO benefits of 5Ml/d
Lead Time	5 Years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	This option is not dependent on other options.

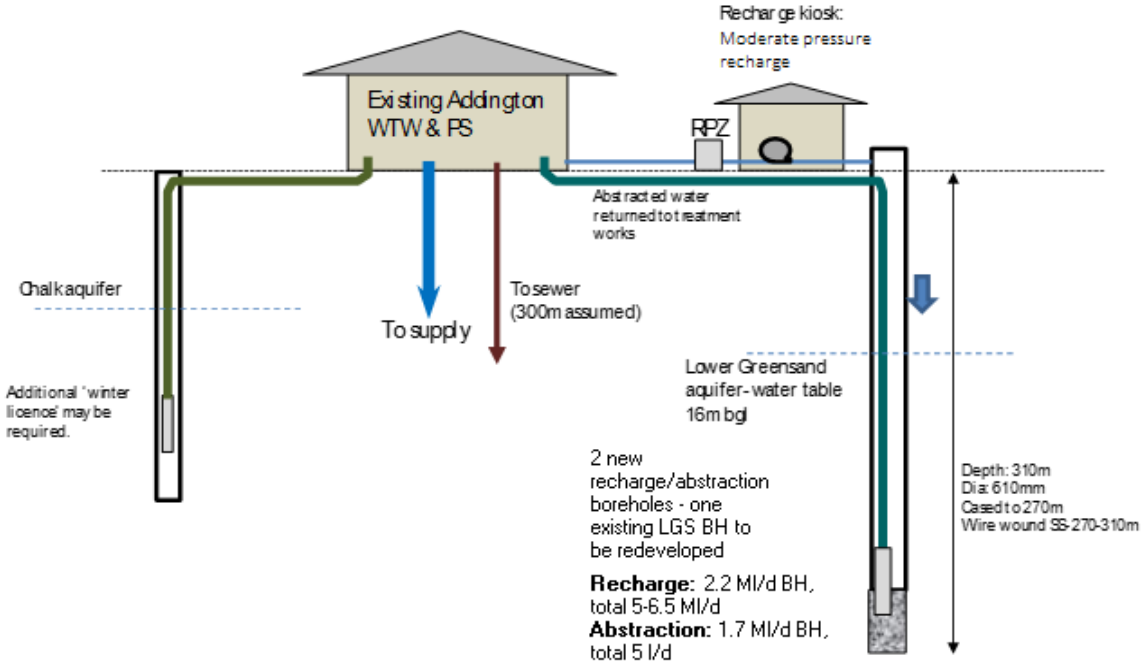


Additional abstraction from Chalk aquifer.
Treatment at WTW
Recharge of additional abstracted water to Lower Greensand Aquifer.
Storage in Lower Greensand aquifer.
Abstraction from storage, when required.
Treatment at WTW.
Distribution as potable water.

ASR South East London (Addington)

Name	ASR South-East London (Addington)
WRSE ID	TWU_LON_HI-GRW_ALL_ALL_addington asr
WRMP19 Reference	RES-ASR-SEL
Element Type	Resource
WRZ	LONDON
Engineering Scope	Development of the existing Lower Greensand (LGS) borehole for recharge/abstraction purposes. Construction of two new recharge/abstraction boreholes in the LGS aquifer to provide a total of three operational ASR boreholes. Recharge water will be provided via the Addington supply main and abstracted water will be treated at the existing WTW. Waste and sludge discharges drain to an existing sewer connection and treated water will be returned

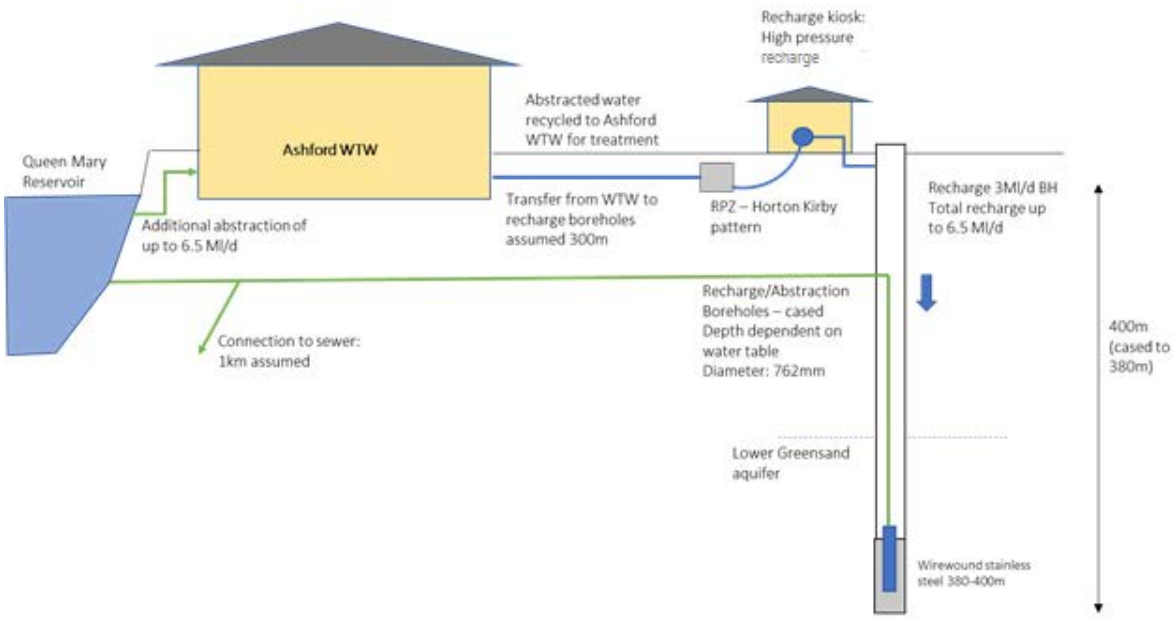
Name	ASR South-East London (Addington)
	to the Addington supply main when an additional resource for the London Water Resource Zone is required. A new licence and discharge consent will be required from the Environment Agency to allow abstraction/recharge from the Lower Greensand aquifer. As part of the application for consent, an understanding of potential impacts of the proposed option on water level (including nearby abstractors) and water quality will be prepared.
Engineering Components	The components for this scope are as follows • Two new abstraction /recharge boreholes, • Three new borehole pumps, • New moderate pressure recharge building • Upgrade of Addington WTW to treat additional peak supply • New pipelines from WTW to the two new off-site abstraction/recharge boreholes.
Phases/Benefits	This option would be developed in a single phase. DO benefits of: • 1 In 2 average: 3Ml/d • 1 In 500 average: 3Ml/d • 1 In 500 peak: 5Ml/d
Lead Time	10 Years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	Delivery of this option in addition to Addington (GW) will require a capacity upgrade of the Addington WTW to treat the additional peak supply. This is included in the Addington new borehole option Addington (GW).



Thames Valley Central ASR

Name	Thames Valley/Thames Central ASR
WRSE ID	TWU_LON_HI-GRW_ALL_ALL_thames valley asr
WRMP19 Reference	RES-ASR-TV
Element Type	Resource
WRZ	LONDON
Engineering Scope	Construction of two new recharge/abstraction boreholes in the Lower Greensand aquifer (LGS) on-site at the existing Ashford water treatment works. Recharge water will be provided via the transfer main from the existing WTW. Water abstracted from ASR boreholes will be pumped to the Queen Mary Reservoir adjacent to the WTW. All waste and sludge discharge will be pumped to the local sewer via a new sewer connection. Treated water will be returned to the supply main as an additional resource for the London Water Resource Zone, when required. A new licence and discharge consent will be required from the Environment Agency to allow abstraction/recharge from the Lower Greensand aquifer.
Engineering Components	The components for this scope are as follows: • Two new ASR boreholes to be developed. Initially, first borehole will be treated as pilot borehole to test yield and assess scheme viability. Second borehole will then be drilled if tests are successful. • One duty pump per borehole • New recharge pumping building. • New pipeline to sewer.

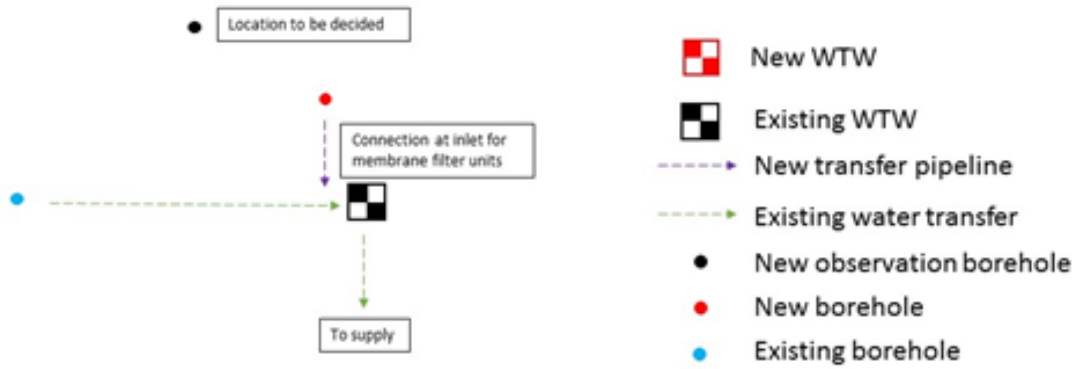
Name	Thames Valley/Thames Central ASR
	• Construction of pipe to return water to Queen Mary Reservoir. • Construction of pipe to transfer water under mains pressure to recharge building.
Phases/Benefits	This option would be developed in a single phase. DO benefits of: • 1 In 2 average: 3Ml/d • 1 In 500 average: 3Ml/d • 1 In 500 peak: 5Ml/d
Lead Time	10 Years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	This option is not dependant on other system elements.



Groundwater Addington

Name	Groundwater Addington
WRSE ID	TWU_LON_HI-GRW_ALL_ALL_addington gw
WRMP19 Reference	RES-GW-ADD
Element Type	Resource
WRZ	LONDON
Engineering Scope	The option comprises the construction of a new borehole at Addington WTW, the improvement of existing WTW capacity by additional sodium bisulphate and phosphoric acid dosing capacity and the development of a new run to waste connection. Treated

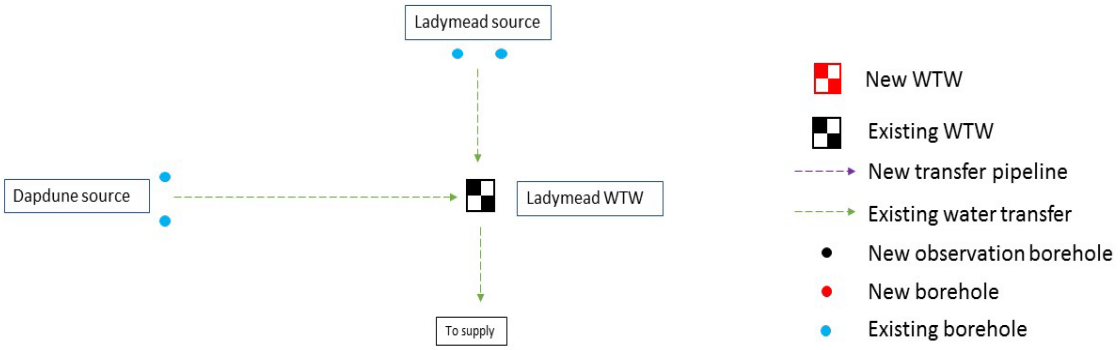
Name	Groundwater Addington
	water will be an additional resource for the London Water Resource Zone.
Engineering Components	The components for this scope are as follows • New abstraction borehole • Abstraction pipework • A new run-to-waste connection to the existing drain. • Upgrade of chemical dosing (sodium hypochlorite, sodium bisulphate and phosphoric acid) to provide an additional 5Ml/d treatment capacity. • New observation borehole
Phases/benefits	This option would be developed in a single phase. DO benefits of: • 1 In 2 average: 2.7Ml/d • 1 In 500 average: 2.7Ml/d • 1 In 500 peak: 5.7Ml/d
Lead Time	3 Years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	This option is not dependent on any other works. The Addington WTW does not have the capacity to treat the additional supply from the combined output of this option and the South East London ASR (Addington (ASR)) If the option Addington (ASR) is not taken forward then the proposed upgrades to Addington WTW will not be required.



Dapdune Licence Disaggregation

Name	Dapdune licence disaggregation
WRSE ID	TWU_GUI_HI-GRW_ALL_ALL_dapdune lic disagg
WRMP19 Reference	RES-GW-DAP
Element Type	Resource

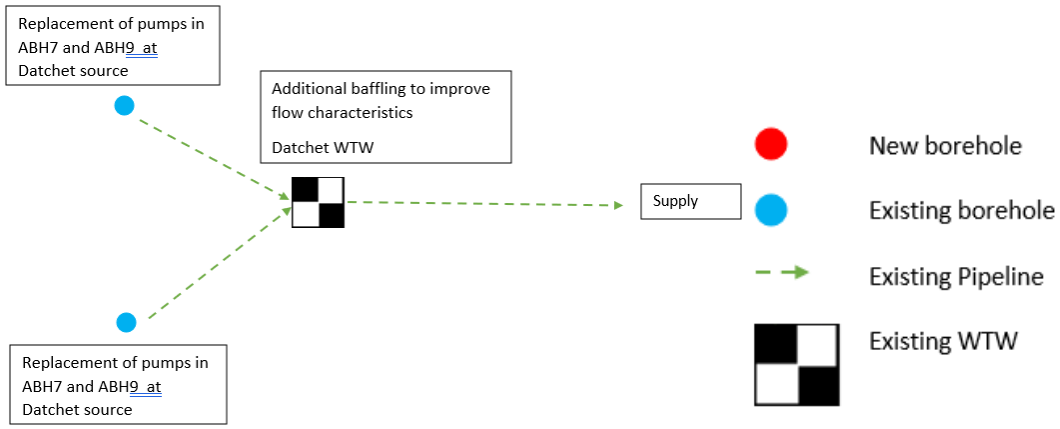
Name	Dapdune licence disaggregation
WRZ	Guildford
Engineering Scope	This option comprises the disaggregation of the group Dapdune – Ladymead – Millmead borehole abstraction licence group for peak licensed quantities only. No change to the average aggregate licence is proposed. The benefit from this option will provide an additional resource to the Guildford water resource zone.
Engineering Components	No additional works will need to be performed. This option will require approval from the Environment Agency (EA).
Phases/benefits	This option would be developed in a single phase. DO benefits of: • 1 in 2 average: 0Ml/d • 1 in 500 average: 0Ml/d • 1 in 500 peak: 2.2Ml/d
Lead Time	1 Year
Mutual Exclusivities	none
Interdependencies/ Exclusivity	This option is dependent on the delivery of the Dapdune (ROC) option and Ladymead removal of constraints option (ROC) which has been progressed in AMP7.



Datchet Increase DO

Name	Datchet Increase Do
WRSE ID	TWU_SWA_HI-GRW_ALL_ALL_datchet do
WRMP19 Reference	New option to WRMP24
Element Type	Resource
WRZ	Slough, Wycombe & Aylesbury (SWA)
Engineering Scope	The WRMP24 Datchet increase DO option aims to increase current DO limited by pump capacity to the annual average licence limit. This would be an increase of 1.6Ml/d.
Engineering Components	The components for this scope are as follows: • Installation of additional baffling to improve the plug flow characteristics of the Datchet WTW contact tank

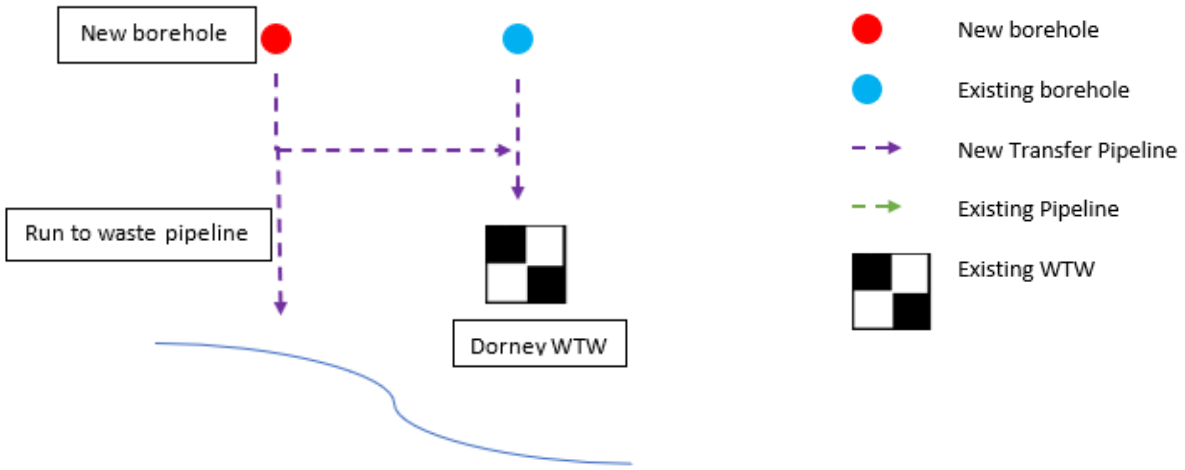
	• 1 no. new borehole pump for ABH7 • 1 no. new borehole pump for ABH9 installed at a deeper level • Main MCC with busbar • Cable trenches/ducting between the old and new MCC, communications link to be established with existing ICA panel • Replacement transformer • Temporary works – Duty/standby diesel generators and ICA panel
Phases/benefits	This option would be developed in a single phase. DO benefits of: • 1 in 2 average: 1.6 Ml/d • 1 in 500 average: 1.6 Ml/d • 1 in 500 peak: 6.2 1Ml/d
Lead Time	3.5 Year
Mutual Exclusivities	None
Interdependencies/ Exclusivity	This option is not dependent on any other works.



Dorney Increase DO

Name	Dorney increase DO
WRSE ID	TWU_SWA_HI-GRW_ALL_ALL_dorney DO
WRMP19 Reference	n/a – new option to WRMP24
Element Type	Resource
WRZ	Slough, Wycombe & Aylesbury (SWA)
Engineering Scope	Increase abstraction to peak license at Dorney WTW by constructing a new abstraction borehole in the gravel aquifer at the existing Dorney Reach raw water site. The borehole will be operated within the existing abstraction licence. The water

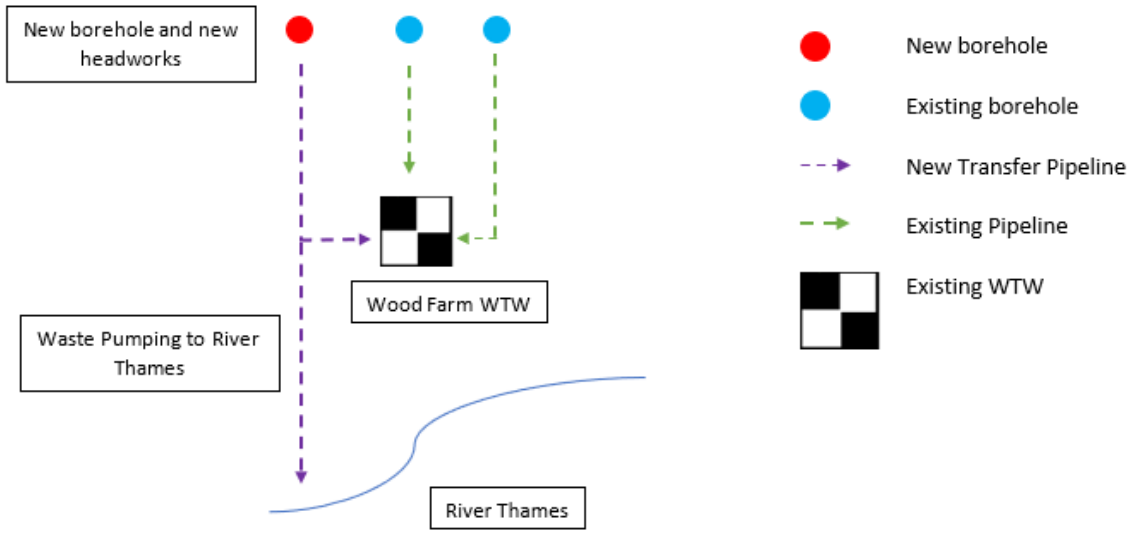
	abstracted from the proposed borehole will be treated at the existing Dorney WTW site.
Engineering Components	The components for this scope are as follows: • New borehole to be drilled at the Dorney Reach • Two pumps (duty and standby) • New pipeline connecting raw feed to WTW • New run-to-waste pipeline
Phases/benefits	DO benefits of: • 1 in 2 average: 0Ml/d • 1 in 500 average: 0Ml/d • 1 in 500 peak: 4.3Ml/d
Lead Time	4 Years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	The size of the disinfection upgrade in the Taplow Increase DO scheme is dependent on whether the Dorney Increase DO option is selected.



Wood Farm Increase DO

Name	Woods Farm increase DO
WRSE ID	TWU_SWX_HI-GRW_ALL_ALL_woods farm do
WRMP19 Reference	n/a – new option to WRMP24
Element Type	Resource
WRZ	Swindon and Oxford (SWOX)
Engineering Scope	Increase abstraction to peak license and the average DO at Woods Farm WTW. The objective is to recover DO to licensed quantity by drilling a new borehole to make up for the lost output due to turbidity in ABH3.

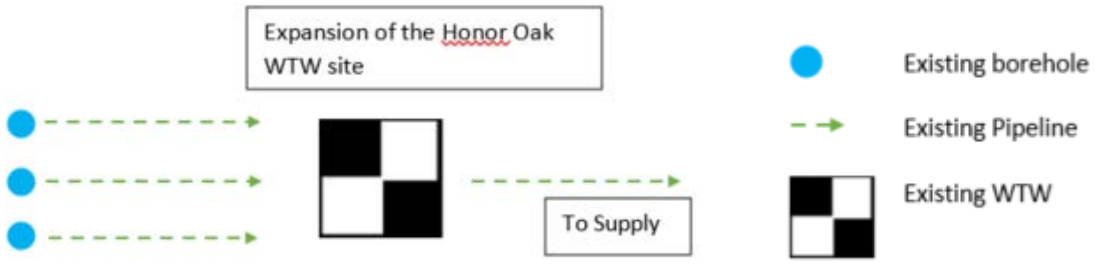
Engineering Components	The components are as follows: • One new borehole in the Chalk aquifer outside existing site. • One duty pump • New raw water pipeline from borehole to WTW • New waste from Wood Farm WTW to the River Thames. This includes three minor crossings.
Phases/benefits	DO benefits of: • 1 in 2 average: 2.4Ml/d • 1 in 500 average: 2.4Ml/d • 1 in 500 peak: 2.9Ml/d
Lead Time	4 Years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	This option is not dependent on any other works.



Honor Oak Increase DO

Name	Honor Oak increase DO
WRSE ID	TWU_LON_HI-GRW_ALL_ALL_honoroak do
WRMP19 Reference	n/a – new option to WRMP24
Element Type	Resource
WRZ	London
Engineering Scope	Restore Honor Oak well and WTW back into service by refurbishing the treatment works and replacing the pump. This option would utilise the existing license.

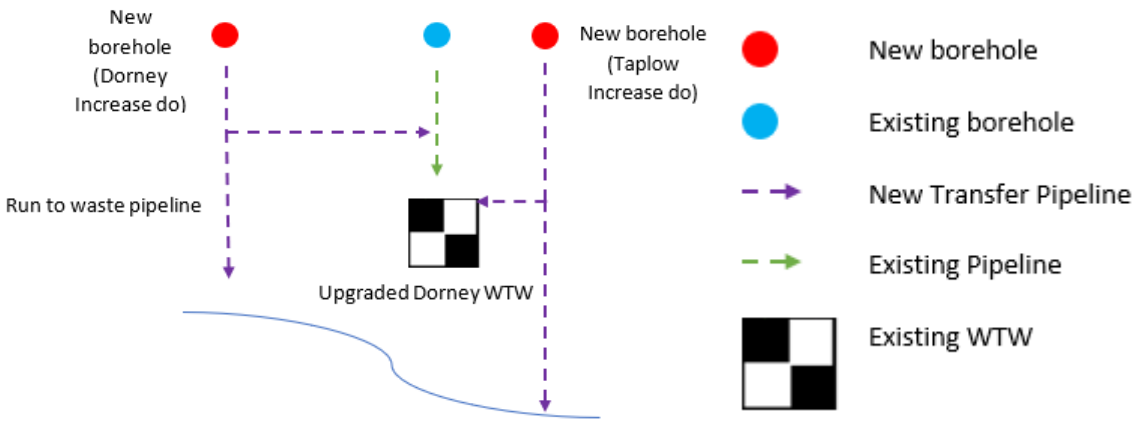
Name	Honor Oak increase DO
Engineering Components	The components for this scope are as follows: • Well refurbishment; including replacement well pump • Coagulation and flocculation system including re-lift pumping station • Re-lift pumps from new flocculation tank to downstream process units • Replacement of sand filters • Replacement of disinfection + dichlorination equipment • Ammonisation • Orthophosphoric acid
Phases/benefits	This option would be developed in a single phase. DO benefits of: • 1 in 2 average: 1.7 Ml/d • 1 in 500 average: 1.7 Ml/d • 1 in 500 peak: 1.7 Ml/d
Lead Time	5 Years
Mutual exclusivities	None
Interdependencies/ Exclusivity	Work on this option must be completed before the Honor Oak (GW) option work can take place.



Taplow Increase DO

Name	Taplow increase DO
WRSE ID	TWU_SWA_HI-GRW_ALL_ALL_taplowincreasedo
WRMP19 Reference	n/a – new option to WRMP24
Element Type	Resource
WRZ	Slough, Wycombe & Aylesbury (SWA)
Engineering Scope	The WRMP24 Taplow option aims to increase DO up to the licenced quantities. The option includes new chalk abstraction borehole including pumps and variable speed drives (VSD's) at Dorney WTW site but added to the Taplow abstraction licence. Upgrade at Dorney WTW is required if both Taplow Increase DO and Dorney Increase DO options are selected.

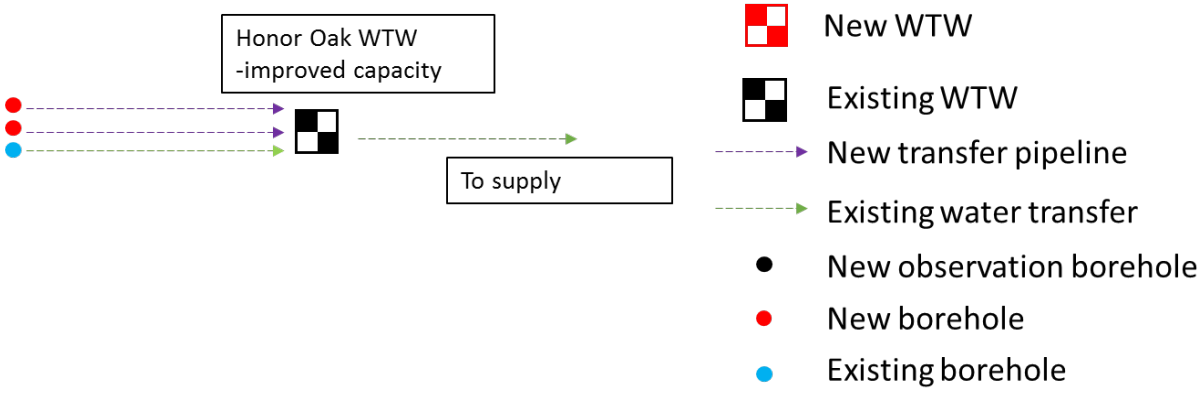
Name	Taplow increase DO
Engineering Components	The components for the scope are as follows: • New chalk abstraction borehole at the Dorney WTW site. • New duty pump • New rising main and a run to waste pipeline. • Disinfection upgrade at Dorney WTW is required to increase treatment capacity to 77Ml/d. (See Interdependencies).
Phases/benefits	This option would be developed in a single phase. DO benefits of: • 1 in 2 average: 0Ml/d • 1 in 500 average: 0Ml/d • 1 in 500 peak: 5.7Ml/d
Lead Time	4 Years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	The disinfection upgrade scope will only be included if –Dorney Increase DO option is selected as well as Taplow increase DO.



Groundwater Honor Oak

Name	Groundwater Honor Oak
WRSE ID	TWU_LON_HI-GRW_ALL_ALL_honor oak gw
WRMP19 Reference	RES-GW-HON
Element Type	Resource
WRZ	LONDON
Engineering Scope	This option comprises construction of one or two new abstraction boreholes close to the existing Honor Oak site to increase output within existing licence limits. The option also includes associated headworks and abstraction pumps, and the installation of a new pipeline to transfer the water from the new borehole(s) to the existing WTW. The water abstracted from the proposed borehole(s) will be treated at the existing WTW.

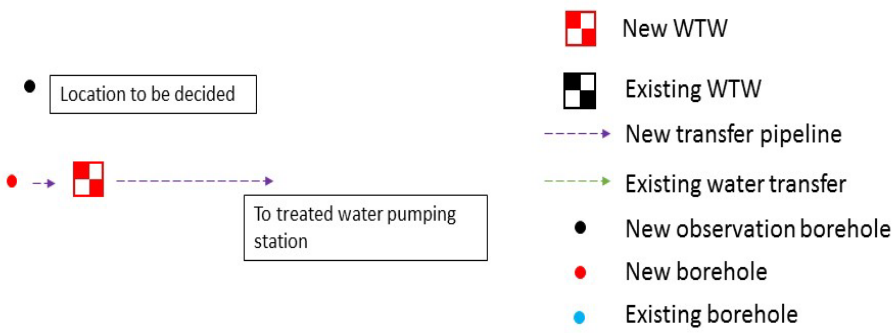
Name	Groundwater Honor Oak
	The capacity of the existing WTW will be improved by installing new pressure sand filters for iron and manganese removal, and new GAC adsorbers for pesticide removal. The existing contact tanks have sufficient capacity to treat the total abstraction volume. The treated water will be used to provide additional resource for the London Water Resource Zone (WRZ).
Engineering Components	The components for this scope are as follows: • New abstraction boreholes with associated headwords near the existing WTW site • Run to waste facility for boreholes • Two new pipelines to transfer water from the new boreholes to the existing WTW • New abstraction pump in each new borehole • Transfer from the new boreholes to the existing WTW • New pressure sand filter and new GAC absorbers at Honor Oak WTW
Phases/benefits	This option would be developed in a single phase. DO benefits of: • 1 in 2 average: 1.4 Ml/d • 1 in 500 average: 1.4 Ml/d • 1 in 500 peak: 2.7 Ml/d
Lead Time	3 Years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	This option is not dependent on any other works.



London Confined Chalk (north)

Name	London Confined Chalk (north)
WRSE ID	TWU_LON_HI-GRW_ALL_ALL_london conchalk
WRMP19 Reference	RES-GW-LCC
Element Type	Resource

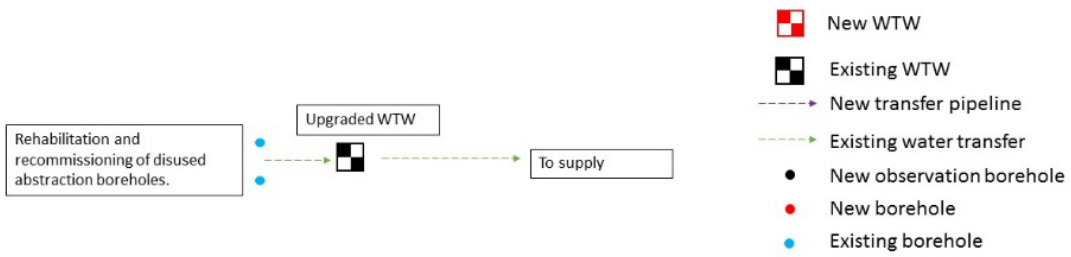
Name	London Confined Chalk (north)
WRZ	LONDON
Engineering Scope	Construction of one new abstraction borehole in the confined Chalk aquifer in London and one new water treatment works (WTW). Treatment assumed to include ultrafiltration, reverse osmosis, super-chlorination and dichlorination. Test pumping will be required to support the application for a new abstraction licence.
Engineering Components	The components for this scope are as follows: • A new abstraction borehole, • Observation borehole • New WTW containing; Ultrafiltration, reverse osmosis, super-chlorination, dichlorination.
Phases/benefits	This option would be developed in a single phase. DO benefits of: • 1 in 2 average: 2Ml/d • 1 in 500 average: 2Ml/d • 1 in 500 peak: 2Ml/d
Lead Time	5 Years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	This option is not dependent on any other option.



Mortimer Disused Source Recommissioning

Name	Mortimer Disused Source Recommissioning
WRSE ID	TWU_KVZ_HI-GRW_ALL_ALL_mortimer recomm
WRMP19 Reference	RES-GW-MOR1
Element Type	Resource
WRZ	Kennet Valley
Engineering Scope	Rehabilitation and recommissioning of two abstraction boreholes (Borehole A and Borehole B) on the disused Mortimer water treatment works (WTW). The WTW will be upgraded to include

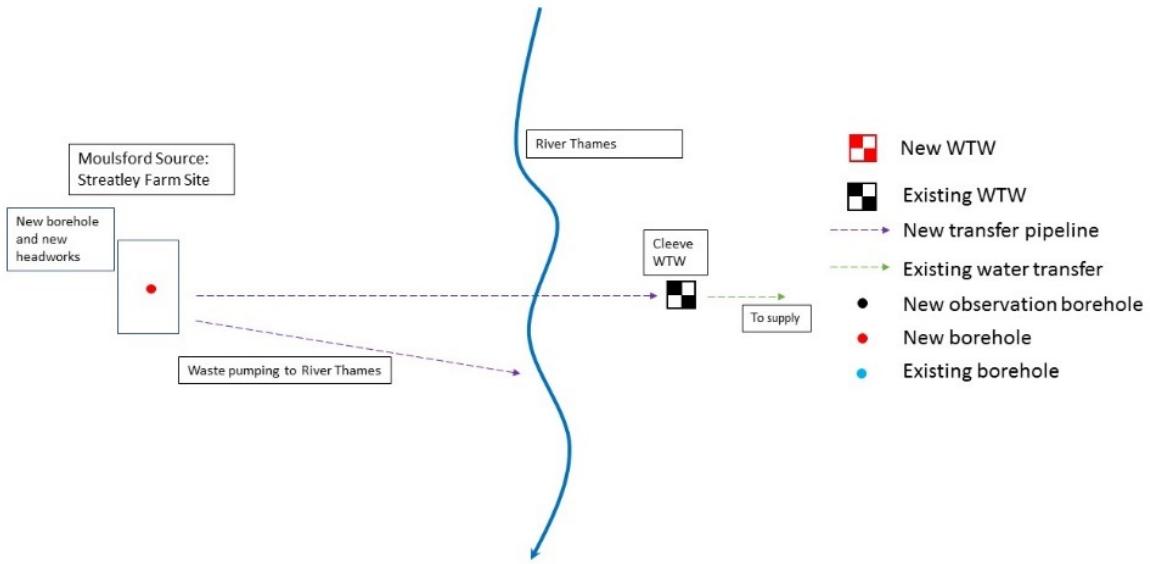
Name	Mortimer Disused Source Recommissioning
	treatment for ammonia and iron removal. Test pumping of the boreholes will be required to confirm groundwater quality. Treated water will provide an additional resource for the Kennet Valley Water Resource Zone. An investigation to understand the potential impacts of the proposed option on the Water Framework Directive status of the water body will be carried out in AMP7.
Engineering Components	The components for this scope are as follows: • Refurbishment of the existing boreholes • Upgrading the existing WTW for ammonia and iron removal.
Phases/benefits	This option would be developed in a single phase. DO benefits of: • 1 in 2 average: 4.5Ml/d • 1 in 500 average: 4.5Ml/d • 1 in 500 peak: 4.5Ml/d
Lead Time	2 Years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	This option is not dependent on other options.



Moulsford 1 groundwater option

Name	Moulsford 1 groundwater option
WRSE ID	TWU_SWX_HI-GRW_ALL_ALL_moulsford gw
WRMP19 Reference	RES-GW-MOU
Element Type	Resource
WRZ	SWOX
Engineering Scope	Construction of an abstraction borehole in the unconfined Chalk north of Streatley, on the west bank of River Thames. Abstracted water will be treated at existing Cleeve WTW. Test pumping to support the new abstraction licence will be carried out. Treated water will provide an additional resource for the Swindon and Oxford Water Resource Zone.

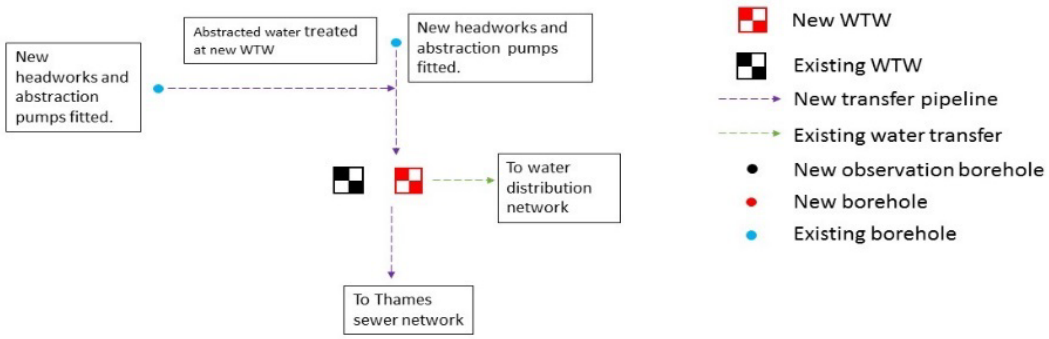
Name	Moulsford 1 groundwater option
	An abstraction licence will be required. The potential impact of the Moulsford abstraction will be reviewed as part of any licence application, including a review of the impact of the Chiltrey Warren sustainability reduction in AMP7.
Engineering Components	The components for this scope are as follows: • A new abstraction borehole and associated headworks, • Installation of pumps • Potential of a new observation borehole, • A new transfer pipeline between the abstraction borehole and the WTW. A new raw water run to waste pipeline.
Phases/benefits	This option would be developed in a single phase. DO benefits of: • 1 in 2 average: 2Ml/d • 1 in 500 average: 2Ml/d • 1 in 500 peak: 3.5Ml/d
Lead Time	3 Years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	This option is not dependent on other options.



Southfleet/Greenhithe Licence Disaggregation

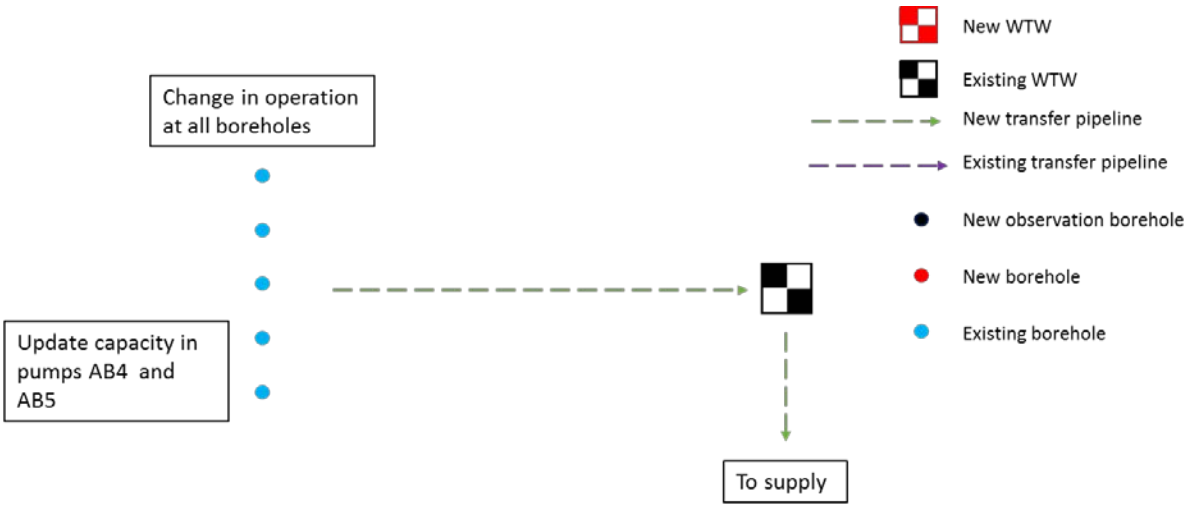
Name	Southfleet-Greenhithe Licence Disaggregation[11]
WRSE ID	TWU_LON_HI-GRW_ALL_ALL_s'fleet lic disagg
WRMP19 Reference	RES-GW-SOU
Element Type	Resource
WRZ	LONDON
Engineering Scope	This option comprises the disaggregation of the group Bean-Southfleet-Greenhithe borehole abstraction licence to a group Southfleet-Greenhithe abstraction licence to allow operation of both sources as per their combined licence amounts. A new water treatment works (WTW) will be constructed at the existing Southfleet WTW. Abstracted water from the two boreholes (one at Southfleet and one at Greenhithe) will be treated at the new WTW. Treated water will provide an additional resource for the London Water Resource Zone. An investigation into potential water quality issues in the catchment will be carried out as part of the delivery of the option and the feasibility of mitigation measures such as catchment management will be investigated.
Engineering Components	The components for this scope are as follows: • New headworks and pumps for the existing boreholes • Replacement of borehole buildings at Southfleet and Greenhithe EPM borehole location, • Construction of a new WTW in land adjacent to the existing Southfleet WTW. • Raw water transfer mains will be constructed from Greenhithe borehole and Southfleet borehole • New pipeline connecting Southfleet EPM WTW to local TWUL sewer network.
Phases/benefits	This option would be developed in a single phase. DO benefits of: • 1 in 2 average: 8.8Ml/d • 1 in 500 average: 8.8Ml/d • 1 in 500 peak: 8.8Ml/d
Lead Time	4 Years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	This option is not dependent on other elements.

[11] ASR Horton Kirby and Southfleet & Greenhithe Groundwater schemes were included in the WRMP19 Preferred Programme for London for delivery in AMP7 (2020-25). Since WRMP19 the delivery of these options has been deferred beyond the end of AMP7 as the supply demand balance in the London WRZ is in surplus. They are therefore included as WRMP24 Options



Ashton Keynes borehole pumps Removal of Constraints

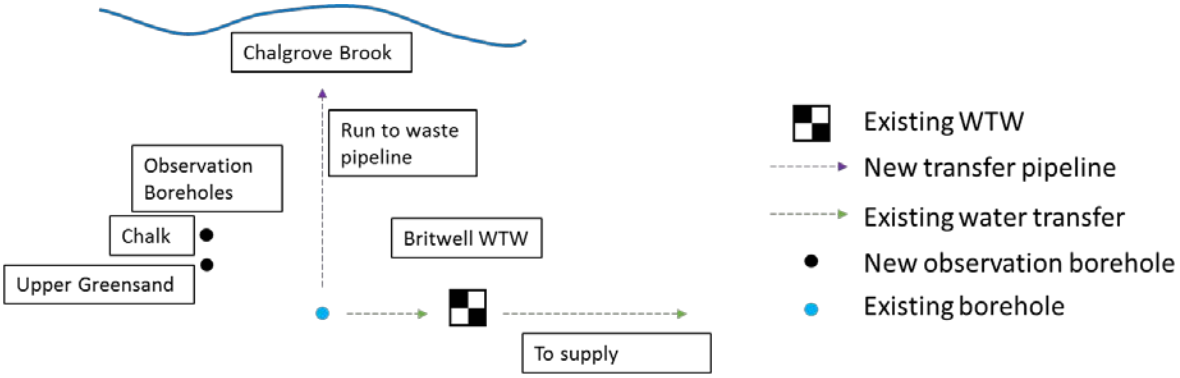
Name	Ashton Keynes borehole pumps Removal of Constraints
WRSE ID	TWU_SWX_HI-GRW_ALL_ALL_ashton keynes roc
WRMP19 Reference	RES-RC-ASH
Element Type	Resource
WRZ	SWOX
Engineering Scope	To replace two existing borehole pumps (ABH4 and ABH5) at Ashton Keynes with higher capacity pumps at a lower intake level to increase the peak abstraction. Change in operational abstraction philosophy to spread abstraction across the 5 boreholes to increase the peak abstraction to the licensed quantity of 11.6Ml/d. An investigation to understand the potential impacts of the proposed option on the Water Framework Directive status of the water body will be carried out in AMP7.
Engineering Components	The components for this scope are as follows: • New pump for existing abstraction borehole ABH4 and ABH5
Phases/benefits	This option would be developed in a single phase. DO benefits of: • 1 in 2 average: 0Ml/d • 1 in 500 average: 0Ml/d • 1 in 500 peak: 2.04Ml/d
Lead Time	1 Year
Mutual Exclusivities	None
Interdependencies/ Exclusivity	This option is not dependent on any other options.



Britwell Removal of Constraints

Name	Britwell Removal of Constraints
WRSE ID	TWU_SWX_HI-GRW_RE1_ALL_britwell roc
WRMP19 Reference	RES-RC-BTW
Element Type	Resource
WRZ	SWOX
Engineering Scope	This option comprises of the construction of a new run to waste pipeline from the existing Britwell borehole to the Chalgrove Brook. In addition, new borehole and booster pumps will be installed at the site. The borehole will be operated within the existing abstraction licence. The option includes the construction of two new observation boreholes, one in the Chalk and one in the Upper Greensand; and a low flows investigation to improve the understanding of the hydrogeology of the source. The capacity of the existing WTW will be improved by additional sodium hypochlorite and sodium bisulphate dosing capacity, along with addition of internal baffle walls to the contact tank to increase capacity.
Engineering Components	The components for this scope are as follows: • New run to waste pipeline from Britwell borehole site to Chalgrove Brook • Installation of new borehole pump at Britwell • Installation of booster pump from Britwell borehole WTW to Wallington Reservoir • Replacement of chlorine and sodium bisulphite dosing at Britwell WTW • Construction of two observation boreholes
Phases/benefits	This option would be developed in a single phase. DO benefits of: • 1 in 2 average: 1.3Ml/d • 1 in 500 average: 1.3Ml/d

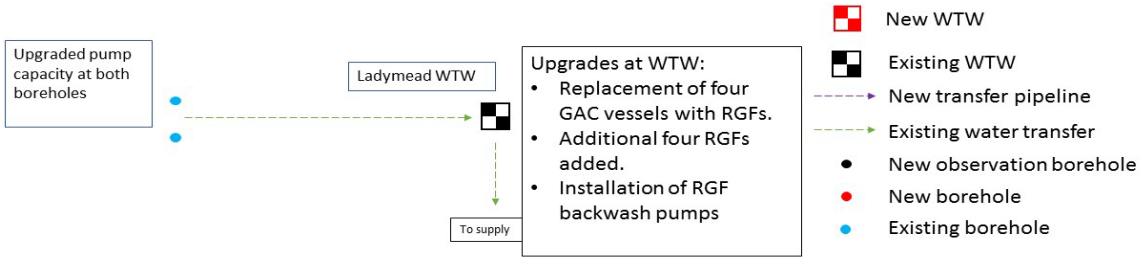
Name	Britwell Removal of Constraints
	• 1 in 500 peak: 1.3Ml/d
Benefit	5 Years
Mutual exclusivities	None
Interdependencies/ Exclusivity	This option is not dependent on any other option.



Dapdune removal of constraints to DO

Name	Dapdune removal of constraints to DO
WRSE ID	TWU_GUI_HI-GRW_ALL_ALL_dapdune roc
WRMP19 Reference	RES-RC-DAP
Element Type	Resource
WRZ	Guildford
Engineering Scope	This option consists of the removal of the current constraints on the DO at the Dapdune source. This groundwater source consists of two operational boreholes which abstract from a confined Chalk aquifer. Raw water is treated at Ladymead WTW. To remove the DO constraints pump capacity will be increased at the Dapdune boreholes and rapid gravity filters (RGF) will be used to treat the periodic microbial contamination at Ladymead WTW. Treated water will provide an additional resource for the Guildford Water Resource Zone.
Engineering Components	The components for this scope are as follows: • Replacement of both borehole pumps at Dapdune • Replacement of four GAC vessels with RGFs by filling GAC vessels with pumice media • Additional four RGF vessels to meet TWUL standard • Installation of RGF backwash pumps • One standby generator required at Dapdune site
Phases/benefits	This option would be developed in a single phase. DO benefits of: • 1 in 2 average: 0Ml/d • 1 in 500 average: 0Ml/d

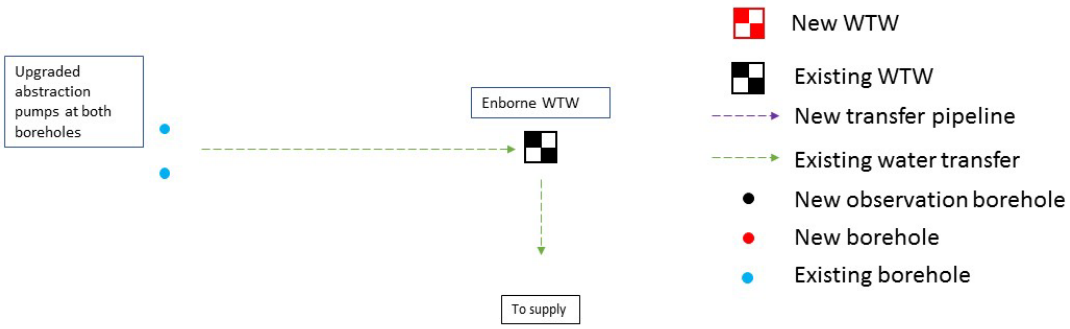
Name	Dapdune removal of constraints to DO
	• 1 in 500 peak: 1Ml/d
Lead Time	2 Years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	Delivery of the Dapdune removal of constraints option is dependent on the delivery of the Ladymead ROC which has been progressed in AMP7. Additionally, the delivery of the Dapdune Lic (DISAGG) is dependent on the delivery of both the Ladymead ROC and Dapdune (ROC) options.



East Woodhay borehole pumps Removal of Constraints to DO

Name	East Woodhay borehole pumps Removal of Constraints to DO
WRSE ID	TWU_KVZ_HI-GRW_ALL_ALL_east woodhay roc
WRMP19 Reference	RES-RC-EWO
Element Type	Resource
WRZ	Kennet Valley
Engineering Scope	Upgrade of the two borehole abstraction pumps to increase the peak abstraction within the existing licence.
Engineering Components	The components for this scope are as follows: • Replacement of both existing borehole pumps with larger units • Potential upgrade of mains power distribution system after new pumps are installed
Phases/benefits	This option would be developed in a single phase. DO benefits of: • 1 in 2 average: 0Ml/d • 1 in 500 average: 0Ml/d • 1 in 500 peak: 2.1Ml/d
Lead Time	2 Years
Mutual Exclusivities	None

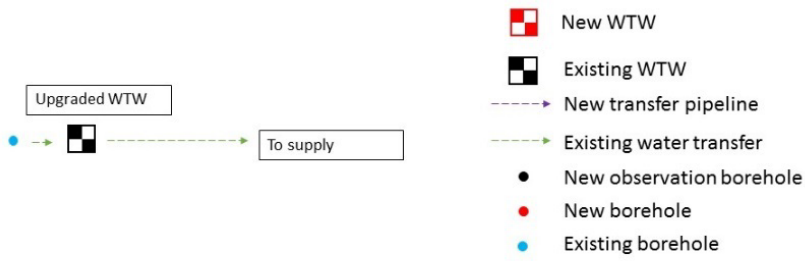
Name	East Woodhay borehole pumps Removal of Constraints to DO
Interdependencies/ Exclusivity	This option is not dependent on any other option.



Merton Recommissioning

Name	Merton Recommissioning
WRSE ID	TWU_LON_HI-GRW_ALL_ALL_merton recommission
WRMP19 Reference	RES-RC-MTN
Element Type	Resource
WRZ	LONDON
Engineering Scope	This option consists of the recommissioning of the currently disused Merton Abbey groundwater source and water treatment works (WTW) to address water quality issues.
Engineering Components	Providing that the Merton Abbey well and the WTW are operational the components for this scope are to make the following upgrades at the WTW: • Removal of existing GAC adsorbers • Installation of the coagulant dosing plant and flocculation retention tanks in the location of the removed GAC plant • Replacement of the four existing pressure sand filter vessels with six new dual media filter vessels • Replacement of the chlorine contact tanks with larger units • Replacement of the dosing plant for sodium hypochlorite • Replacement of the dosing plant for sodium bisulphate and orthophosphoric acid • Replacement of the chemical storage facilities • Upgrade of the electrical, motoring and control systems • Upgrade of treated water pump station to pump into the local distribution mains
Phases/benefits	This option would be developed in a single phase. DO benefits of: • 1 in 2 average: 2Ml/d • 1 in 500 average: 2Ml/d

Name	Merton Recommissioning
	• 1 in 500 peak: 6Ml/d
Lead Time	2 Years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	The Merton (SLARS) option is dependent on the delivery of this option as the former includes the adaptation of the well and WTW for a recharge and abstraction scheme. If the Merton Recommissioning option is deemed unfeasible, then the SLARS Merton option cannot go ahead.



Reservoirs

South East Strategic Reservoir Option (SESRO)

Name	South East Strategic Reservoir Option (SESRO)
WRSE ID	TWU_STR_HI-RSR_RE1_CNO_abingdon150 TWU_STR_HI-RSR_RE1_CNO_abingdon125 TWU_STR_HI-RSR_RE1_CNO_abingdon100 TWU_STR_HI-RSR_RE1_CNO_abingdon75 TWU_STR_HI-RSR_RE1_CNO_abingdon30+100p1 & p2 TWU_STR_HI-RSR_RE1_CNO_abingdon80+42p1 & p2
WRMP19 Reference	RES-RRR-ABI-150Mm3, RES-RRR-ABI-125Mm3, RES-RRR-ABI-100Mm3, RES-RRR-ABI-30+100Mm3, RES-RRR-ABI-75Mm3, RES-RRR-ABI-80+42Mm3
Element Type	Resource
WRZ	London/SWOX/SWA
Engineering Scope	Provision of a new fully bunded reservoir with live capacity of: 150Mm^3, 125Mm^3, 100Mm^3, 75Mm^3, 30Mm^3 (phase 1) with 100Mm^3 (phase 2), or 80Mm^3 (phase 1) with 42Mm^3 (phase 2). Associated conveyance tunnel and intake / discharge structure at Culham on the River Thames to (i) fill reservoir by abstracting raw water from the River Thames, and (ii) support flows in River Thames by discharging water stored in the reservoir.
Engineering Components	• Provision of a fully bunded reservoir with storage capacity between 75Mm^3 and 150Mm^3. • Pumping station for filling the reservoir, including turbines for energy recovery during periods when water is released to the River Thames. • A conveyance tunnel to transfer flows via the pumping station to / from an intake / outfall structure on the bank of the River Thames. • Auxiliary drawdown channel aligned with a proposed alignment of the Wilts & Berks Canal to allow release of water from the reservoir in emergency scenarios. • Main access road (from A415) and a road diversion to the south of the reservoir. • Rail siding to facilitate delivery of construction materials by freight train. • Recreation facilities, landscaping and creation of aquatic / grassland habitats.

Phases/benefits

Phase 1	Phase 2	DO benefit (Ml/d)	
150Mm^3	N/A	271	
125Mm^3	N/A	230	
100Mm^3	N/A	185	
75Mm^3	N/A	149	
30Mm^3	100Mm^3	66 (p1)	173 (p2)
80Mm^3	42Mm^3	155 (p1)	69 (p2)

DO benefits above apply for 1 in 2 average, 1 in 500 average and 1 in 500 peak values?

Lead Times

Phase 1	Phase 2	Lead Time (years)	
150Mm^3	N/A	15	
125Mm^3	N/A	15	
100Mm^3	N/A	14	
75Mm^3	N/A	14	
30Mm^3	100Mm^3	14	14
80Mm^3	42Mm^3	14	13

Mutual exclusivities

The SESRO size variants are mutually exclusive (only one could be taken forward).

There is a limit on the amount of additional water that can be discharged into River Thames. This limit will apply to options discharging into the River Thames, including new reservoirs and Severn Thames Transfer (STT).[12]

Interdependencies

For SESRO to deliver a benefit, the water that is released into the River Thames will need to be re-abstracted. There are other water resource options being considered in WRMP24 and/or WRSE regional planning that would either benefit, or be dependent on, water supply from SESRO directly or from water provided into, and conveyed by, the River Thames (whether this be via SESRO, STT or a combination of both), these include:

- Thames to Affinity Transfer (T2AT) SRO
- Thames to Southern Transfer (T2ST) SRO
- Thames Water non-SRO options to supply the SWOX or SWA Water Resource Zones

To provide an additional resource to London WRZ the following system elements may also be required:

- Additional capacity in the raw water systems to allow the water to be abstracted from the River Thames into the west London reservoirs and from there conveyed to Kempton WTW;

[12] Further work is ongoing to review the limit on the amount of additional water that can be discharged into River Thames

- Additional treatment capacity in Kempton WTW expansion (800 Ml/d)
- Additional capacity in the Thames Water ring main.

To provide an additional resource to SWOX WRZ the following system elements are required:

- Abingdon WTW new 24 Ml/d (SWOX)
- Abingdon to Farmoor Transfer

To provide an additional resource to SWA WRZ the following system elements may also be required:

- Abingdon WTW new 24 Ml/d (SWOX) and SWOX to SWA (48/72) Ml/d or
- Raw Water System – New Medmenham Intake and Medmenham WTW (72 Ml/d)

Additional requirements to supply water to Affinity Water WRZs are described in the Thames to Affinity Water Transfer Gate 2 documents and requirements to supply Southern Water WRZs are described in the Thames to Southern Water Transfer Gate 2 documents.

Marsh Gibbon Reservoir – 75 Mm^3/ 50 Mm^3 / 30 Mm^3

Name	Marsh Gibbon Reservoir - 75Mm3
WRSE ID	TWU_STR_HI-RSR_RE1_ALL_res_marshgibbon TWU_STR_HI-RSR_RE1_CNO_res_marshgibbon_2 TWU_STR_HI-RSR_RE1_CNO_res_marsh gibbon_3
WRMP19 Reference	RES-RRR-MAR-75Mm3 RES-RRR-MAR-50Mm3 RES-RRR-MAR-30Mm3

Name	Marsh Gibbon Reservoir - 75Mm3
Element Type	Resource
WRZ	LONDON / SWOX / SWA
Engineering Scope	Provision of a new 75 Mm^3 / 50 Mm^3 / 30 Mm^3 non-impounding bunded reservoir located near the Oxford/Buckinghamshire border. Associated conveyance and intake / discharge structure upstream of the Oxford sewage works (i) fill reservoir by abstracting raw water from the River Thames, and (ii) support flows in River Thames by discharging water stored within the reservoir.
Engineering Components	The components for this scope are as follows: • New 75 Mm^3 / 50 Mm^3 / 30 Mm^3 storage reservoir located in Oxford / Buckinghamshire border. • River intake and outfall Structure. • Inlet and outlet tower • Conveyance from river to Marsh Gibson Reservoir • A new pumping station • A main water draw off tower and secondary draw off tower. For Marsh Gibbon 75Mm^3 and 50Mm^3, two minor local access roads would need to be diverted around the site. Marsh Gibbon 30Mm^3 would require just a single road to be diverted. For Marsh Gibbon 75Mm^3 two watercourses would need to be diverted around the site.
Phases/benefits	<table><tr><th>Capacity</th><th>DO Benefits (Ml/d)</th></tr><tr><td>75Mm^3</td><td>149</td></tr><tr><td>50Mm^3</td><td>103</td></tr><tr><td>30Mm^3</td><td>66</td></tr></table> DO benefits above apply for 1 in 2 average, 1 in 500 average and 1 in 500 peak values
Lead Time	14 – 15 Years (varies based on capacity)
Mutual exclusivities	The three reservoir capacities are mutually exclusive with each other, however there is a limit on the amount of additional water that can be discharged into River Thames. This limit will apply to options discharging into the River Thames, including new reservoirs and Severn Thames Transfer (STT).[13]
Interdependencies/ Exclusivity	This option is not dependent on any other option. For the reservoir to deliver a benefit, the water that is released into the River Thames will need to be re-abstracted. There are other water resource options being considered in WRMP24 and/or WRSE regional planning that could benefit water supply from

[13] Further work is ongoing to review the limit on the amount of additional water that can be discharged into River Thames

Name	Marsh Gibbon Reservoir - 75Mm3
	Marsh Gibbon Reservoir or water provided into and conveyed by River Thames, these include: • Thames to Affinity Transfer (T2AT) SRO • Thames to Southern Transfer (T2ST) SRO • London WRZ To provide an additional resource to London WRZ the following system elements may also required: Additional capacity in the raw water systems to allow the water to be abstracted from the River Thames into the west London reservoirs and from there conveyed to a Water Treatment Works in west London; • Additional treatment capacity in west London. • Additional capacity in the Thames Water ring main

Chinnor Reservoir – 30 Mm^3

Name	Chinnor Reservoir - 30Mm^3
WRSE ID	TWU_UTC_HI-RSR_RE1_ALL_res_chinnor
WRMP19 Reference	RES-RRR-CHI-30Mm3
Element Type	Resource
WRZ	LONDON / SWOX / SWA
Engineering Scope	Provision of a new 30 Mm3 non-impounding bunded reservoir located in Oxfordshire 5km south-east of Thame. Associated conveyance and intake / discharge structure to (i) fill reservoir by abstracting raw water from the River Thames, and (ii) support

	flows in River Thames by discharging water stored within the reservoir.
Engineering Components	The components for this scope are as follows: • New 30 Mm3 storage reservoir located in Oxfordshire • A borrow pit • An abstraction intake on the River Thames. Flow regulation discharges back to the River Thames for the regulating reservoir option at the same location. • Combined intake and outfall structure situated on the River Thames just upstream of Benson Weir. • A new pumping station at the intake, to pump flows directly to the new reservoir. • A main water draw off tower and secondary draw off tower. • Diversion of the National Cycle Route 57. • River diversion works for the Cattle Brook and a drain running north of the site. • Emergency drawdown via syphons
Phases/benefits	DO benefits of: • 1 in 2 average: 66Ml/d • 1 in 500 average: 66Ml/d • 1 in 500 peak: 66Ml/d
Lead Time	14 – 15 Years (varies based on capacities)
Mutual exclusivities	No other options on the constrained list are mutually exclusive with this option; however there is a limit on the amount of additional water that can be discharged into River Thames. This limit will apply to options discharging into the River Thames, including new reservoirs and Severn Thames Transfer (STT).[14]
Interdependencies/ Exclusivity	This option is not dependent on any other option. For the reservoir to deliver a benefit, the water that is released into the River Thames will need to be re-abstracted. There are other water resource options being considered in WRMP24 and/or WRSE regional planning that would either benefit, or be dependent on, water supply from water supply from Chinnor Reservoir or water provided into and conveyed by River Thames, these include: • Thames to Affinity Transfer (T2AT) SRO • Thames to Southern Transfer (T2ST) SRO • London WRZ To provide an additional resource to London WRZ the following system elements may also required: • Additional capacity in the raw water systems to allow the water to be abstracted from the River Thames into the west

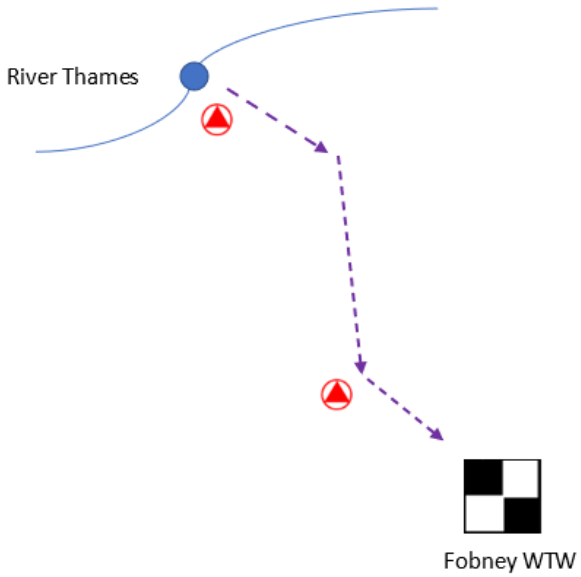
[14] Further work is ongoing to review the limit on the amount of additional water that can be discharged into River Thames

	London reservoirs and from there conveyed to a Water Treatment Works in west London; • Additional treatment capacity in west London. • Additional capacity in the Thames Water ring main

Raw Water Conveyance

Raw Water System Conveyance - Thames to Fobney 40Ml/d

Name	Thames to Fobney
WRSE ID	TWU_KVZ_HI-TFR_UTC_ALL_thamestofobney
WRMP19 Reference	n/a – new option to WRMP24
Element Type	Resource
WRZ	Kennet Valley
Engineering Scope	40Ml/d raw water transfer option from River Thames to Fobney WTW to supply Kennet Valley WRZ.
Engineering Components	The components for this scope are as follows: • New Raw water conveyance to Fobney WTW • New Intake at River Thames • New Pumping stations
Phasing /benefit	n/a
Lead Time	5 Years
Mutual exclusivities	None.
Interdependencies/ Exclusivity	This option is not dependent on any other option.



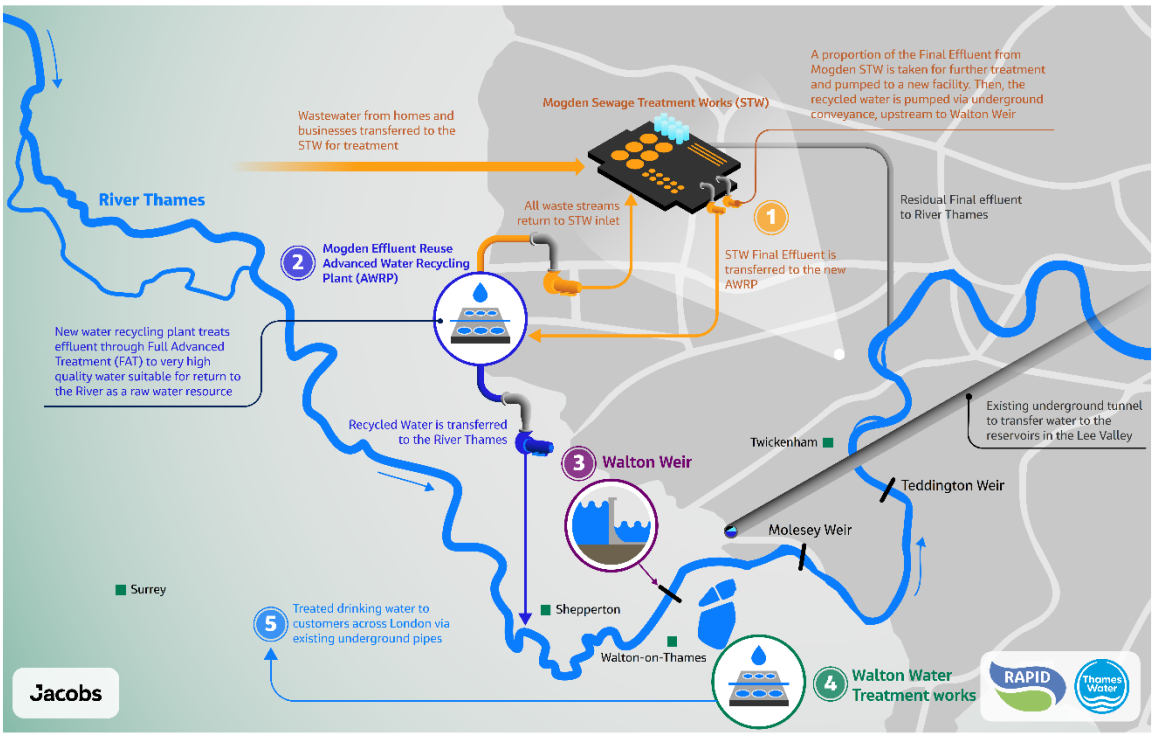
Reuse Mogden to Walton 200Ml/d - Conveyance for Mogden Effluent Reuse Treatment

Name	Reuse Mogden to Walton 200Ml/d - Conveyance for Mogden Effluent Reuse Treatment
WRSE ID	TWU_WLJ_HI-TFR_WLJ_ALL_reuse mogden/walton
WRMP19 Reference	CON-RU-MOG-WAL-200

Name	Reuse Mogden to Walton 200Ml/d - Conveyance for Mogden Effluent Reuse Treatment
Element Type	Conveyance – Raw water bulk transfer
WRZ	LONDON
Engineering Scope	All conveyancing scope for the proposed Mogden Effluent Reuse scheme, consisting of four transfers: Final Effluent transfer (1), RO Concentrate return (4) and waste streams return (2) from Mogden STW to AWRP treatment site & Recycled Water from the AWRP treatment site to River Thames at Walton (3): (1), (2) & (4): 2No pipe jacked tunnels in parallel. Pipes (2) & (4) to be pressurised pipes inside one of the pipe jack tunnels. (3): Recycled Water pipeline is largely open-cut with 2 major trenchless crossings.
Engineering Components	• Pipeline, pipe-jacking and all associated conveyancing scope for the four transfers noted above for the Mogden Effluent Reuse scheme. • Pipe-jacked tunnel to transfer final effluent (FE) from Mogden STW to the treatment site, suitable for the maximum capacity of all phases of treatment. • Pipe-jacked tunnel from the treatment site to Mogden STW to return the waste streams and RO concentrate. 2No. internal pressurised pipes within the pipejack tunnel. • Pipe-jack tunnel shafts for the 2No. pipejacks above between Mogden STW and the treatment site. • Trenched pipeline from the treatment site to the River Thames at Walton for the recycled water transfer, including trenchless crossings and associated shafts. • New river outfall consisting of below ground velocity-reduction chamber, weir, discharge chamber and piping to river.
Phases/Benefits	The above conveyance elements are sized to have sufficient capacity for all phasing options of Mogden Effluent Reuse and do not need to be duplicated for phase 2 or phase 3.
Lead Time	Alternative delivery programmes have been developed for Gate 2 which show a lead time of 9 years (per phase) and an earliest operational date of 2031.
Mutual Exclusivities	n/a
Interdependencies/ Exclusivity	To provide an additional resource to London WRZ, the following elements may also be required: • Upgrades to the west London raw water system • Additional treatment capacity at Kempton WTW • Network reinforcements, potentially including extensions to the London ring main Mogden Effluent Reuse has the potential to support the Thames to Affinity Transfer (T2AT) SRO as T2AT SRO may abstract raw water

Name	Reuse Mogden to Walton 200Ml/d - Conveyance for Mogden Effluent Reuse Treatment
	from the River Thames. Additional requitements to supply water to Affinity Water WRZs are described in the Thames to Affinity Water Transfer Gate 2 documents

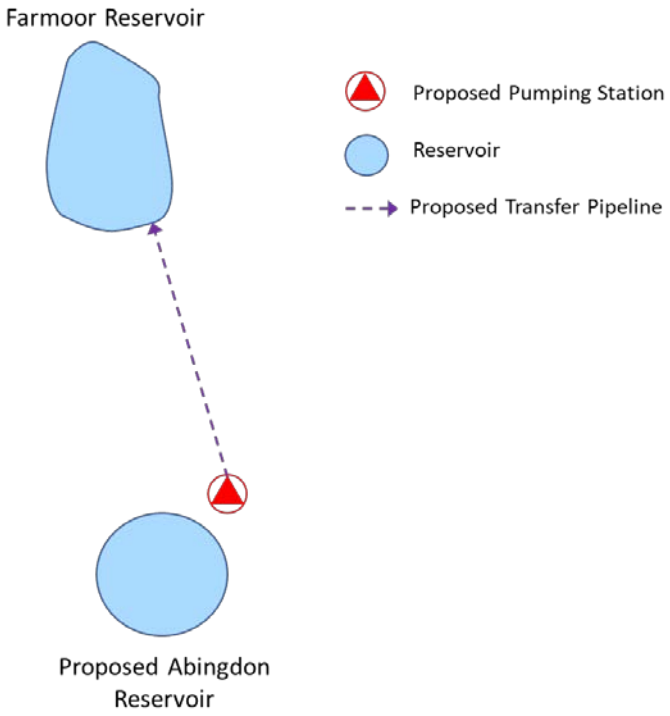
Mogden Effluent Reuse Schematic



Abingdon to Farmoor Transfer

Name	Abingdon to Farmoor Transfer
WRSE ID	TWU_SWX_HI-TFR_STR_ALL_abing-farmoor pipe
WRMP19 Reference	CON-RWS-ABI-FMR
Element Type	Conveyance
WRZ	SWOX
Engineering Scope	Construction of a transfer pipeline to convey 24Ml/d of raw water between a proposed reservoir at Abingdon and the existing Farmoor reservoir, in the SWOX WRZ. The engineering scope includes the provision of a booster pump station at the proposed Abingdon Reservoir site to facilitate the transfer.
Engineering Component	The components for this scope are as follows: • Raw water pipeline from proposed reservoir at Abingdon to Farmoor Reservoir • Raw water pumping station. • Raw water screens at Abingdon Reservoir intake.

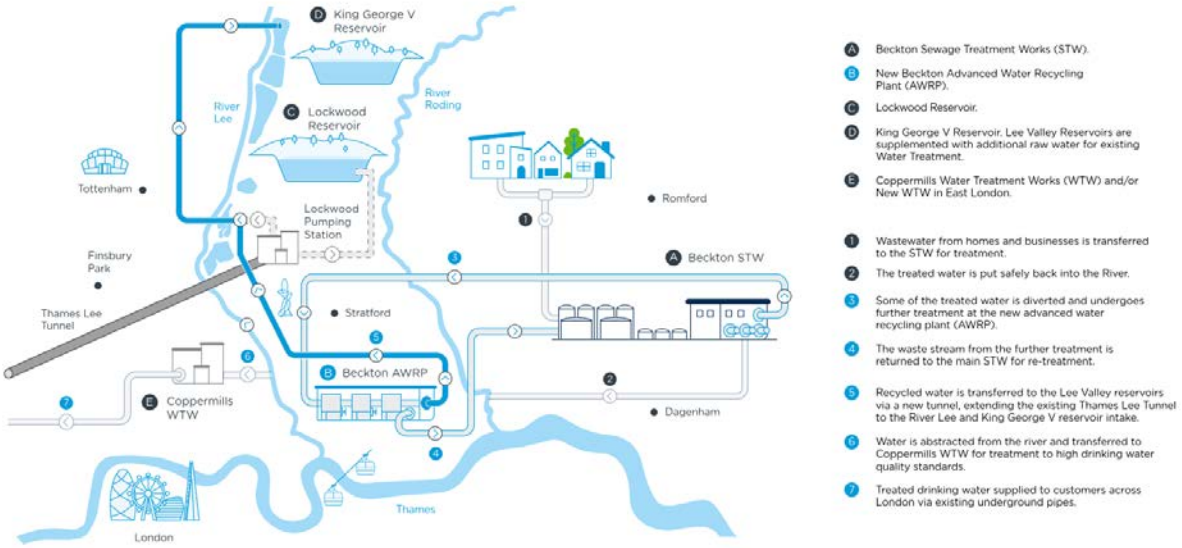
Name	Abingdon to Farmoor Transfer
	• New break pressure tank at or near high point of transfer route.
Phases/benefits	n/a
Lead Time	5 Years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	This element would transfer raw water from the new Abingdon Reservoir resource elements to the existing Farmoor reservoir. Treatment would be provided at the existing WTW.



Beckton to Lockwood Conveyance

Name	Beckton to Lockwood Tunnel Conveyance
WRSE ID	TWU_KGV_HI-TFR_beckton to lockwood
WRMP19 Reference	CON-RU-BEC-LCK-300
Element Type	Conveyance – Raw water bulk transfer
WRZ	LONDON
Engineering Scope	Conveyance of recycled water from Beckton to Lockwood pumping station, as part of the Beckton Effluent Reuse scheme. A portion of the Beckton STW final effluent is to be subjected to a full advanced treatment process and pumped to location next to Lockwood Reservoir for onward conveyance to the River Lee diversion through TLT extension from Lockwood PS to King George V Reservoir intake to supplement raw water supply to the Lee Valley reservoirs. Conveyance will be via a new raw water tunnel from Beckton to Lockwood.

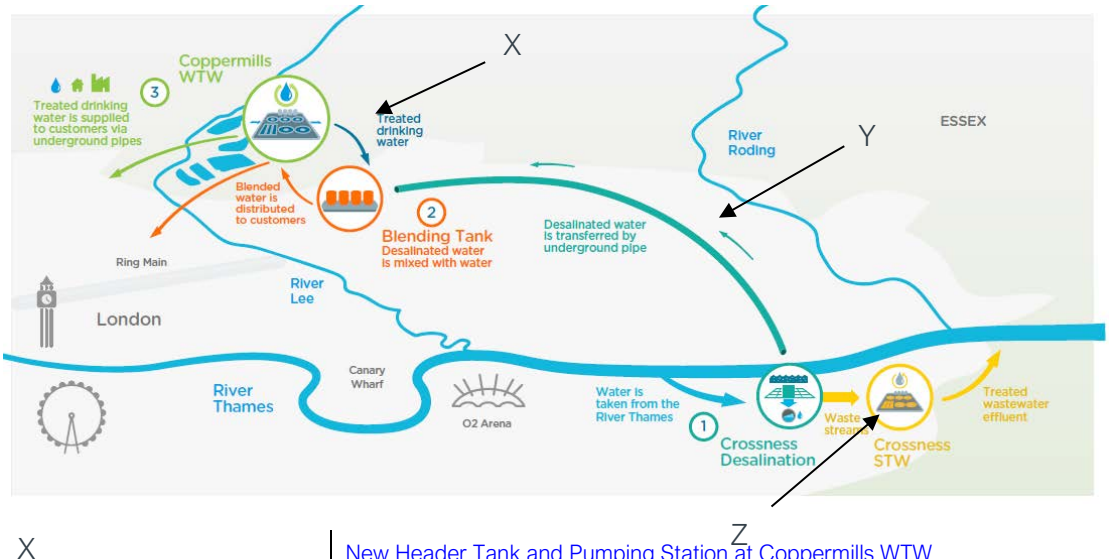
Name	Beckton to Lockwood Tunnel Conveyance
Engineering Components	• Bulk raw water transfer tunnel for a connection from Beckton STW to the Thames Lee Tunnel (TLT) termination at Lockwood Pump Station. • Tunnel from north of Beckton STW to Lockwood pumping station. • 7No. tunnel shafts for the tunnel construction. • Submersible pumps within final shaft to discharge the water. • Connection between the final shaft of this tunnel and the first shaft of the TLT extension from Lockwood PS to King George V Reservoir intake .
Phases/benefits	The above conveyance elements are sized to have sufficient capacity for all phasing options of Beckton Effluent Reuse and do not need to be duplicated for phase 2 or phase 3.
Lead Time	Alternative delivery programmes have been developed for Gate 2 which show a lead time of 9 years and an earliest operational date of 2031.
Mutual Exclusivities	n/a
Interdependencies/ Exclusivity	The Beckton Effluent Reuse option comprises treatment and conveyance elements. The conveyance elements include: Beckton to Lockwood Conveyance); and the TLT extension from Lockwood PS to KG reservoir intake . Treatment can be phased via all three capacities under Beckton Effluent Reuse option. To provide an additional resource to London WRZ the following system elements are may also be required: • Additional capacity in the raw water systems to allow the water to be abstracted from the River Lee Diversion into the Lee Valley Reservoirs and from there conveyed to a Water Treatment Works in east London. • Additional treatment capacity in East London • Additional capacity in the Thames Water ring main Beckton Reuse has the potential to support the Thames to Affinity Transfer (T2AT) SRO as T2AT SRO may abstract raw water from the River Lee. Additional requirements to supply water to Affinity Water WRZs are described in the Thames to Affinity Water Transfer Gate 2 documents.



Desalination – Beckton to Crossness tunnel

Name	Desalination – Beckton to Crossness tunnel
WRSE ID	TWU_LON_HI-TFR_LON_ALL_beckton-crossness
WRMP19 Reference	CON-RWS-BEC-CRO-300
Element Type	Conveyance
WRZ	LONDON
Engineering Scope	Raw estuarine Thames River water is to be abstracted at Beckton for Crossness desalination treatment plant. The estuarine water is to be conveyed under the River Thames via a tunnel to the Crossness desalination treatment site.
Engineering Components	The components for this scope are as follows: • The tunnel under the River Thames to the Crossness desalination plant • 1 No drive shaft • 1 No intermediate shaft • 1 No reception shaft • High Integrity Gate valve
Phases/benefits	n/a
Lead Time	10.5 Years
Mutual Exclusivities	No other options on the constrained list are mutually exclusive with this option.
Interdependencies/ Exclusivity	The Crossness Desalination option comprises conveyance, treatment and treated water network reinforcement. Treatment is phased in 50Ml/d or 100Ml/d increments) The conveyance elements (required for first phase of desalination) include: • Beckton to Crossness Tunnel

Name	Desalination – Beckton to Crossness tunnel
	• Crossness to Beckton Tunnel Beckton to Coppermills Tunnel To provide an additional resource to London WRZ the following system elements are also required: • Additional blending capacity at Coppermills WTW and capacity to discharge into the local water supply network or into the TWRM, • New Header Tank and Pumping Station at Coppermills WTW • Additional capacity in the Thames Water ring main.

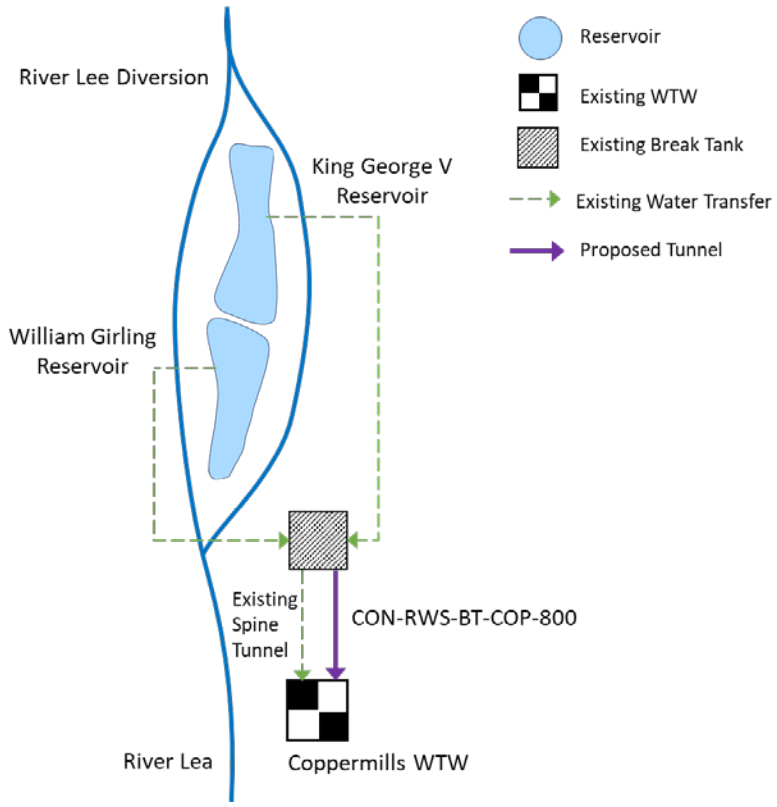


X	New Header Tank and Pumping Station at Coppermills WTW
Y	Beckton to Coppermills Tunnel
Z	Crossness to Beckton Tunnel

Raw Water System – Conveyance from Break Tank to Coppermills

Name	Raw Water System – Conveyance from Break Tank to Coppermills
WRSE ID	TWU_LON_HI-TFR_LON_ALL_second spine tunnel
WRMP19 Reference	CON-RWS-BT-COP-800
Element Type	Conveyance
WRZ	LONDON
Engineering Scope	Transfer of raw water from the break tank in the east London raw water system to Coppermills WTW.
Engineering Components	The components for this scope are as follows: • Tunnel from Break Tank to Coppermills WTW via Reservoir 5 • 1 No drive shaft • 1 No diameter intermediate shaft

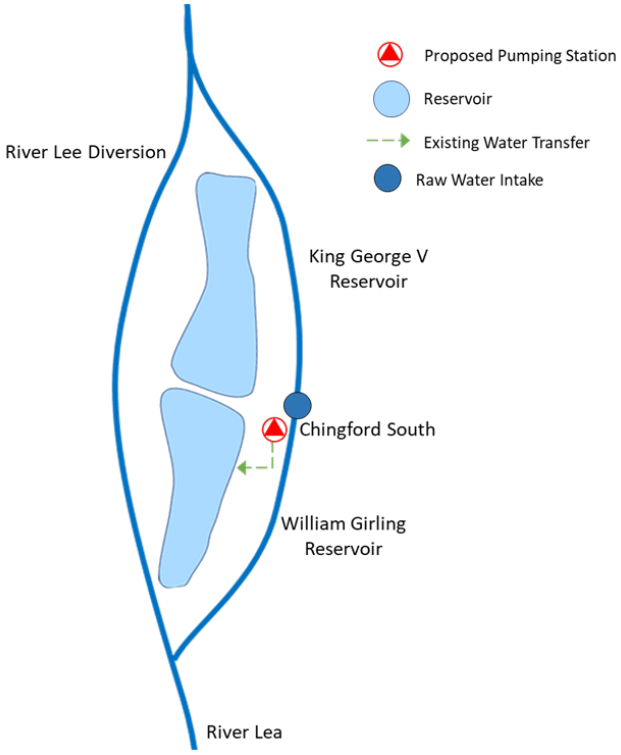
Name	Raw Water System – Conveyance from Break Tank to Coppermills
WRSE ID	TWU_LON_HI-TFR_LON_ALL_second spine tunnel
	• 1 No reception shaft • High Integrity Gate Valves
Phases/benefits	n/a
Lead Time	8 Years
Mutual exclusivities	No other options on the constrained list are mutually exclusive with this option.
Interdependencies/ Exclusivity	May be required to support additional raw water resources in East London: • Beckton Effluent Reuse • Deephams Reuse (46.5) - deephams reuse 46.5 • Deephams Reuse (46.5b) - deephams_reuse_46.5b



Raw Water System – Chingford South intake increase

Name	Raw Water System – Chingford South intake increase
WRSE ID	TWU_LON_HI-TFR_LON_ALL_ch'ford s intake
WRMP19 Reference	CON-RWS-CHS-100
Element Type	Conveyance
WRZ	LONDON
Engineering Scope	Increase capacity of the Chingford south intake by 100Ml/d This option is limited to providing benefit up to 2060.

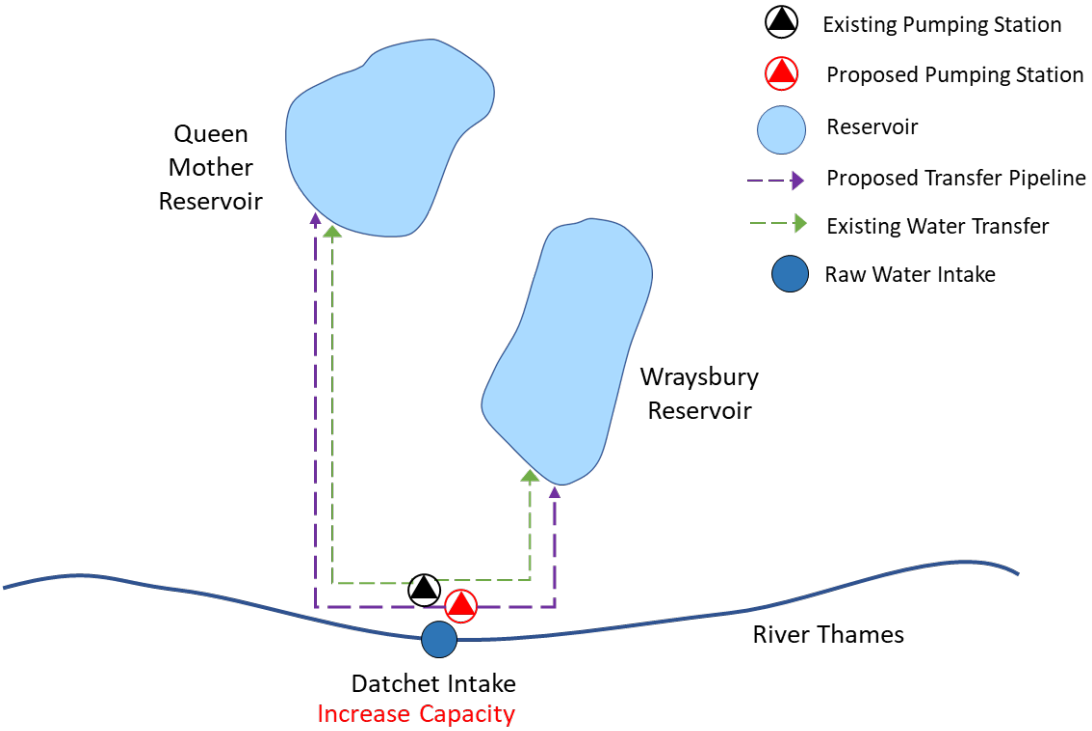
Name	Raw Water System – Chingford South intake increase
Engineering Components	The components for this scope are as follows: • New pumping station • Two new pumps • Screens
Phases/benefits	n/a
Benefit	n/a
Lead Time	4 Years
Mutual Exclusivities	No other options on the constrained list are mutually exclusive with this option.
Interdependencies/ Exclusivity	May be required to support additional raw water resources in East London: • Beckton Effluent Reuse • Deephams Reuse (46.5) - deephams reuse 46.5 • Deephams Reuse (46.5b) - deephams_reuse_46.5b



Raw Water System – Datchet intake increase

Name	Raw Water System – Datchet intake increase
WRSE ID	TWU_LON_HI-TFR_LON_ALL_datchet int-qm
WRMP19 Reference	CON-RWS-DAT-300
Element Type	Conveyance
WRZ	LONDON
Engineering Scope	Increase capacity of the existing River Thames Datchet intake.

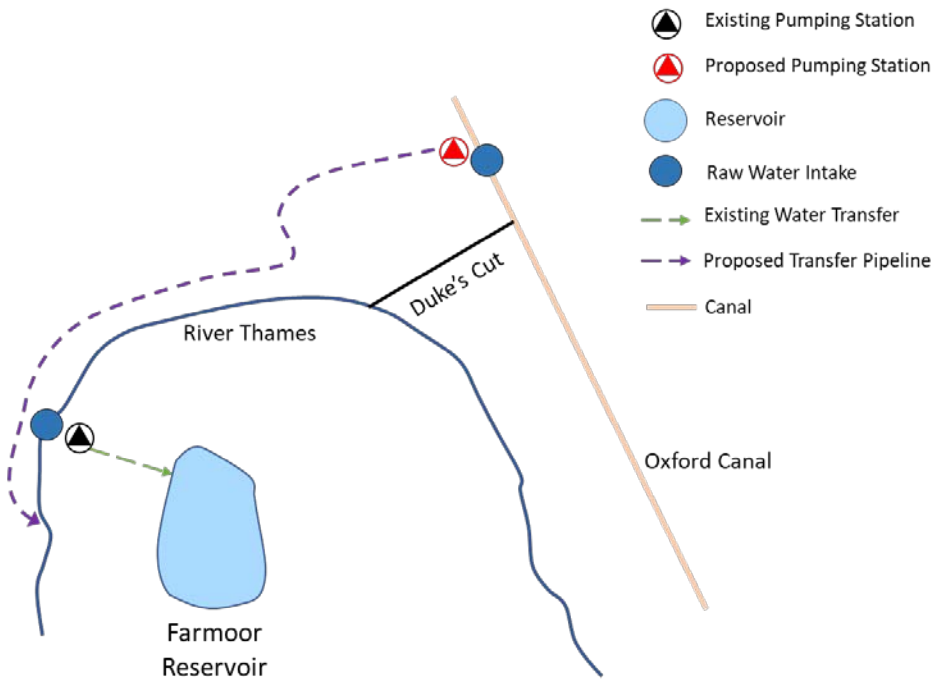
Name	Raw Water System – Datchet intake increase
Engineering Components	The components for this scope are as follows: • New Pumping Station. • New Ductile Iron (DI) pipe to Queen Mother • New DI pipe to Wraysbury • Above ground pipelines to feed into Wraysbury and Queen Mother - twin pipes at each reservoir.
Phases/benefits	n/a
Benefit	n/a
Lead Time	5 Years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	Required to support additional raw water resources in West London All reservoir sizes under SESRO, Marsh Gibbon Reservoir, Chinnor Reservoir, Ludgershall Reservoir, Aylesbury Reservoir Haddenham Reservoir , Deerhurst to Culham pipeline and transfer additional water to new treatment at Kempton WTW



Raw Water System- Oxford Canal – Duke's Cut to Farmoor 15Ml/d Pipeline

Name	Oxford Canal – Duke's Cut to Farmoor 15Ml/d Pipeline
WRSE ID	TWU_SWX_HI-TFR_SVE_ALL_dukescut-farmoor
WRMP19 Reference	CON-RWS-DKC-FMR
Element Type	Conveyance
WRZ	SWOX

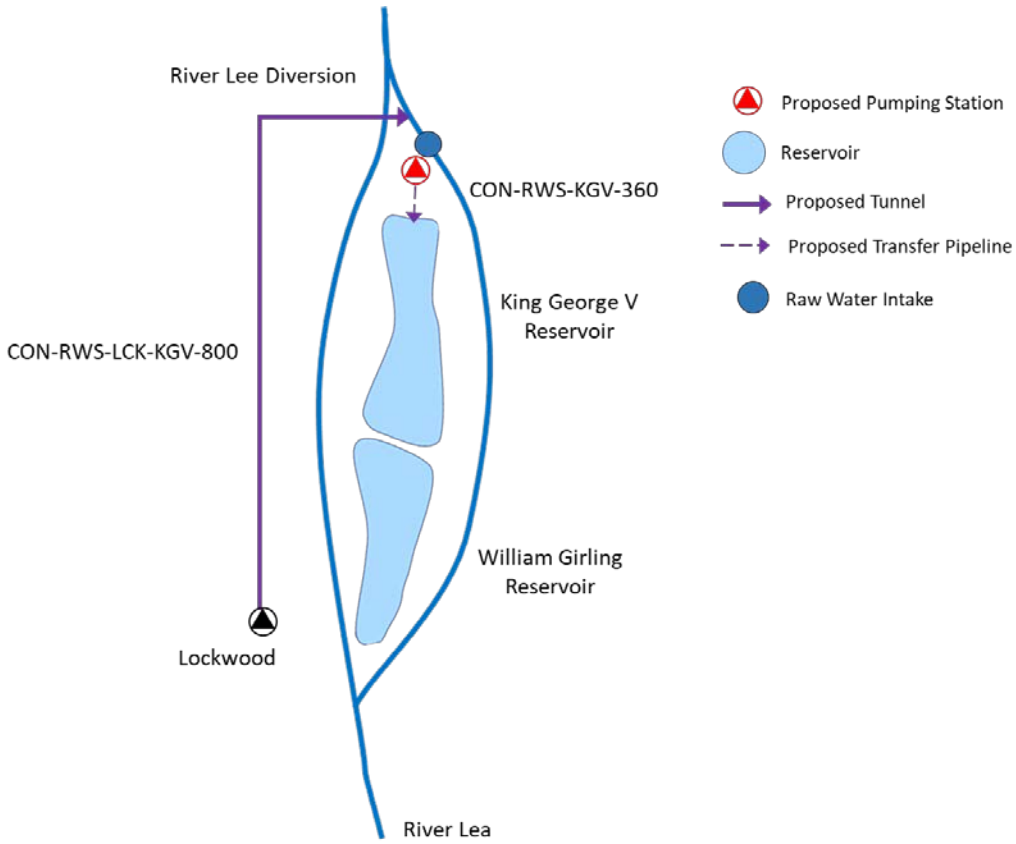
Name	Oxford Canal – Duke's Cut to Farmoor 15Ml/d Pipeline
Engineering Scope	A supported conveyance pipeline option from Duke's Cut on the Oxford Canal to the River Thames upstream of the existing Farmoor intake. The element includes all engineering works required to transfer the flow to the River Thames.
Engineering Components	The components for this scope are as follows: • A river intake structure at Duke's Cut with inlet screens. • A raw water low lift pump station. • Rising main. • Outfall to the River Thames just upstream of the existing Farmoor intake.
Phases/benefits	n/a
Benefit	n/a
Lead Time	5 Years
Mutual Exclusivities	This option is mutually exclusive with Oxford Canal to Cropredy option
Interdependencies/ Exclusivity	This element is dependent on surplus in the canal network that will be provided by 3rd parties (Canal and River Trust) as well as Oxford Canal to Duke's Cut element.



Raw Water System – KGV Reservoir intake increase

Name	Raw Water System – KGV Reservoir intake increase
WRSE ID	TWU_KGV_HI-TFR_KGV_ALL_kgv res intake
WRMP19 Reference	CON-RWS-KGV-360
Element Type	Conveyance

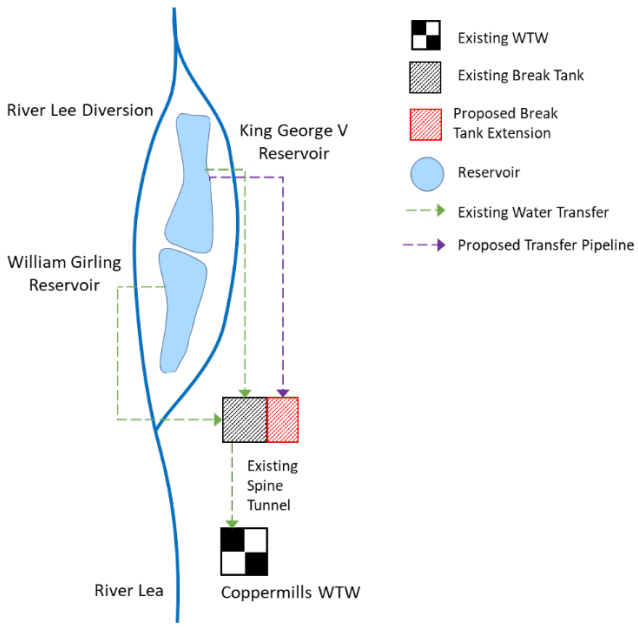
Name	Raw Water System – KGV Reservoir intake increase
WRZ	LONDON
Engineering Scope	360Ml/d increase of capacity at existing King George V reservoir intake.
Engineering Components	The components for this scope are as follows: • New Pumping Station. • Above ground pipelines to KGV
Phases/benefits	n/a
Benefit	n/a
Lead Time	5 Years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	May be required to support additional raw water resources in East London: All sizes under Beckton Reuse, Deephams Reuse and transfer additional water to new treatment at a East London WTW



Raw Water System – KGV Reservoir to Break Tank

Name	Raw Water System – KGV Reservoir to Break Tank
WRSE ID	TWU_KGV_HI-TFR_KGV_ALL_kgv res to bt
WRMP19 Reference	CON-RWS-KGV-BT-300

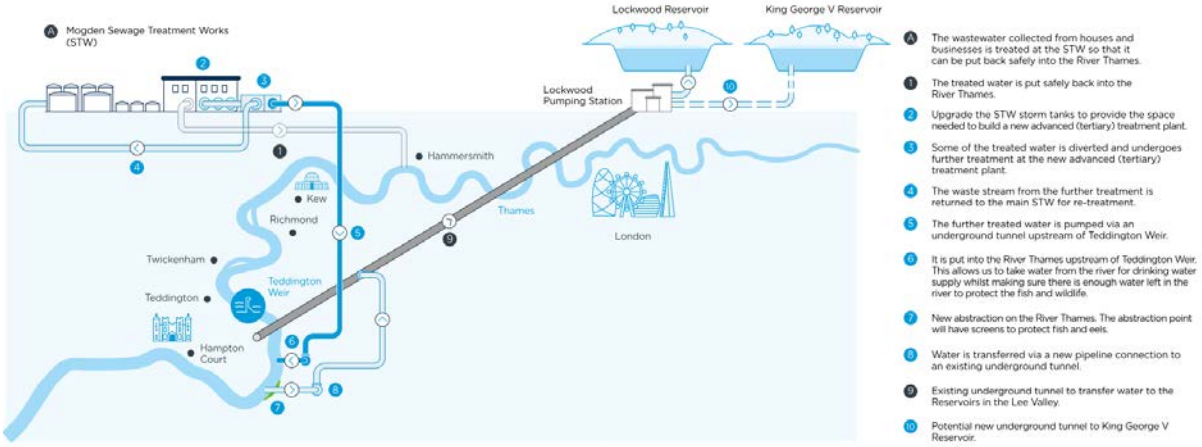
Name	Raw Water System – KGV Reservoir to Break Tank
Element Type	Conveyance
WRZ	LONDON
Engineering Scope	New 300Ml/d capacity pipeline to allow transfer or raw water from King George V reservoir to the existing break tank at the south of William Girling reservoir.
Engineering Components	The components for the scope are as follows: • Pipeline from KGV reservoir to the break tank at the south of William Girling reservoir • New/increased capacity of the break tank include valves and fittings • New break tank.
Phases/benefits	n/a
Benefit	n/a
Lead Time	5 Years
Mutual Exclusivities	No other options on the constrained list are mutually exclusive with this option.
Interdependencies/ Exclusivity	May be required to support additional raw water resources in East London: • Beckton Effluent Reuse • Deephams Reuse • Transfer additional water to new treatment at an East London WTW



Direct River Abstraction - Teddington to Thames Lee Tunnel

Name	Direct River Abstraction - Teddington to Thames Lee Tunnel
WRSE ID	TWU_KGV_HI-TFR_teddingtondrated/tlt
WRMP19 Reference	CON-RA-TED-TLT
Element Type	Conveyance – Direct River Abstraction
WRZ	LONDON
Engineering Scope	Raw water from the River Thames at Teddington is abstracted for transfer into the Thames Lee Tunnel to supplement raw water flows in the tunnel. The capacity of the abstraction will match an input of water to River Thames from the Teddington DRA Tertiary Treatment Plant.
Engineering Components	Abstraction intake, pump station, pipeline and TLT connection scope for abstracting raw water from the River Thames at Teddington into the TLT. • Abstraction intake structure incl. coarse screens, eel-friendly band screens, settling chamber & pipeline to pump station • Abstraction Pump Station, including inline flowmeter • Transfer pipeline to TLT and connection shaft / adit • Power supply / transformer for pump station
Phases	n/a
Benefits	n/a – the DO benefits are included within Teddington DRA Tertiary Treatment Plant .
Lead Time	Alternative delivery programmes have been developed for Gate 2 which show a lead time of 9 years and an earliest operational date of 2031.
Mutual Exclusivities	None
Interdependencies/ Exclusivity	The following elements are also required for the Teddington DRA option: • Teddington DRA Tertiary Treatment Plant • Teddington Outfall Teddington DRA scheme does not have dependencies on other options. To provide an additional resource to London WRZ, the following elements may also be required: • Raw water system upgrades in east and west London • Additional treatment capacity at Water Treatment Works (WTWs) in both east and west London • Network reinforcements, potentially including extensions to the London ring main In order to provide raw water to the full Lee Valley reservoirs, an additional transfer through TLT extension from Lockwood PS to King George V Reservoir Intake would be required. Teddington DRA scheme has the potential to support the Thames to Affinity Transfer (T2AT) SRO as T2AT SRO may abstract raw water

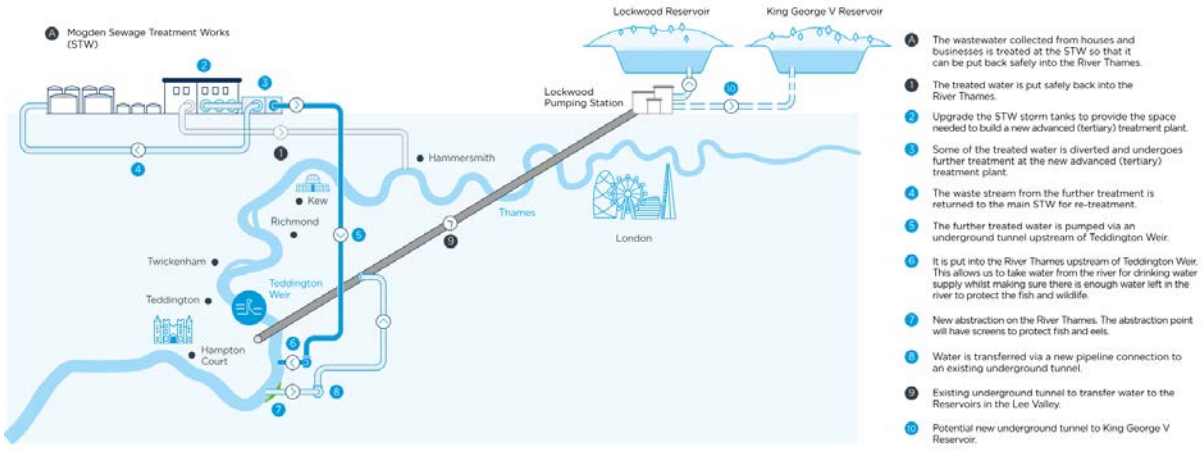
Name	Direct River Abstraction - Teddington to Thames Lee Tunnel
	from the River Thames. Additional requirements to supply water to Affinity Water WRZs are described in the Thames to Affinity Water Transfer Gate 2 documents.



Teddington DRA Conveyance from Mogden to River Thames (Teddington Outfall)

Name	Teddington DRA Conveyance from Mogden to River Thames (Teddington Outfall)
WRSE ID	TWU_WLJ_HI-TFR_teddingtondramog/ted
WRMP19 Reference	CON-RA-MOG-TED
Element Type	Conveyance – Raw water bulk transfer
WRZ	LONDON
Engineering Scope	Pipeline for transporting treated effluent from the Teddington DRA Tertiary Treatment Plant at Mogden STW to the River Thames at Teddington.
Engineering Components	• Pipeline for transporting treated effluent from the Teddington DRA Tertiary Treatment Plant at Mogden STW to the River Thames at Teddington. • Pipe-jacked tunnel, with shafts, from Mogden STW to River Thames (Teddington). • Pipe for connection between the final shaft and the outfall structure. • New river outfall consisting of below ground velocity-reduction chamber, weir, discharge chamber and piping to river.
Phases	n/a
Benefits	n/a – the DO benefits are included within Teddington DRA Tertiary Treatment Plant.

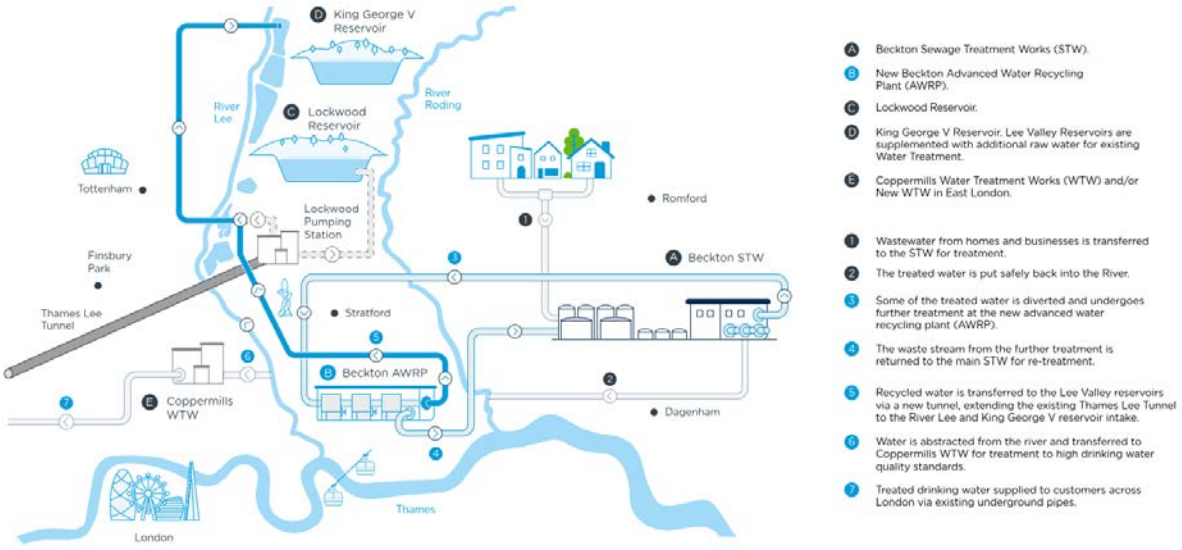
Name	Teddington DRA Conveyance from Mogden to River Thames (Teddington Outfall)
Lead Time	Alternative delivery programmes have been developed for Gate 2 which show a lead time of 9 years and an earliest operational date of 2031.
Mutual Exclusivities	n/a
Interdependencies/ Exclusivity	Teddington DRA scheme does not have dependencies on other options. • To provide an additional resource to London WRZ, the following elements may also be required: • Upgrades to raw water conveyance systems in both east and west London • Additional treatment capacity at Water Treatment Works (WTWs) in both east and west London • Network reinforcements, potentially including extensions to the London ring main In order to provide raw water to the full Lee Valley reservoirs, an additional transfer through TLT extension from Lockwood PS to King George V Reservoir Intake would be required. Teddington DRA scheme has the potential to support the Thames to Affinity Transfer (T2AT) SRO as T2AT SRO may abstract raw water from the River Thames. Additional requirements to supply water to Affinity Water WRZs are described in the Thames to Affinity Water Transfer Gate 2 documents.



TLT extension from Lockwood PS to King George V Reservoir intake

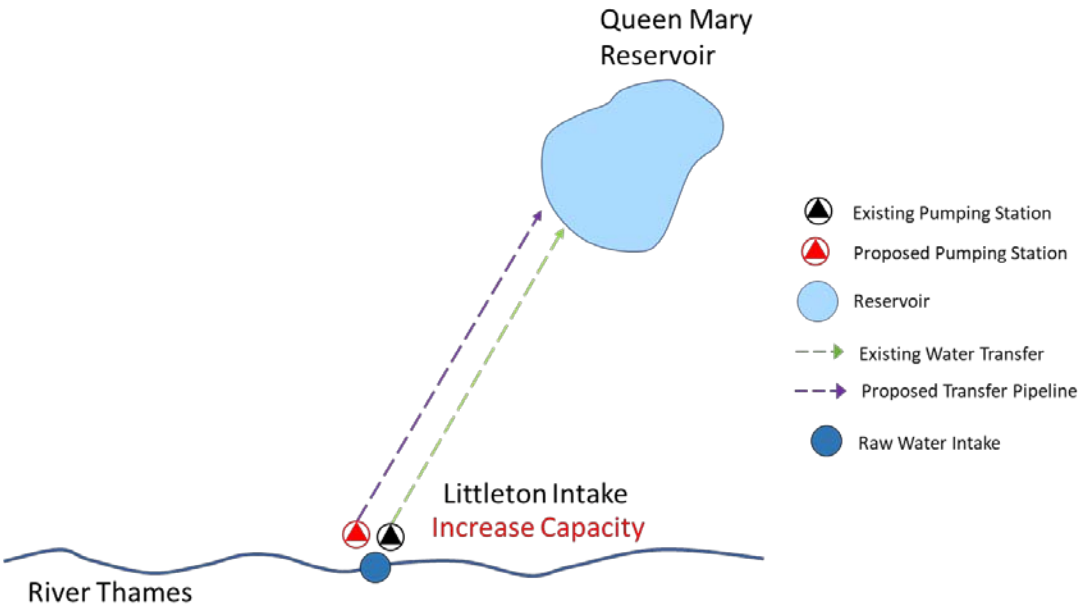
Name	TLT extension from Lockwood PS to King George V Reservoir intake
WRSE ID	TWU_KGV_HI-TFR_lockwood ps-kgv res
WRMP19 Reference	CON-RWS-LCK-KGV-800
Element Type	Conveyance – Raw water bulk transfer
WRZ	LONDON

Name	TLT extension from Lockwood PS to King George V Reservoir intake
Engineering Scope	A raw water tunnel from the existing Lockwood pumping station (end of Thames Lee Tunnel – TLT) to River Lee Diversion upstream of the King George V Reservoir intake. New connection from Lockwood PS to the new tunnel as well as provision for future connections.
Engineering Components	• Bulk raw water transfer tunnel for an extension of the Thames Lee Tunnel (TLT) to take raw water and recycled water (from Beckton Effluent Reuse and other options) from Lockwood Pump Station to the River Lee Diversion near King George V reservoir: • Tunnel from Lockwood to KGV. ` • 5No. tunnel shafts for the tunnel construction. • Submersible pumps within final shaft to discharge the water to the River Lee Diversion outfall. • Pipework, control valving arrangement and ancillaries for the connection to the existing TLT Lockwood Pumping Station. • Sub-structures and in-river works for the outfall to River Lee diversion, upstream of KGV.
Phases/Benefits	n/a. The tunnel would have sufficient capacity for the maximum flow from Beckton Effluent Reuse and additional capacity for other options if required.
Benefits	n/a
Lead Time	Alternative delivery programmes have been developed for Gate 2 which show a lead time of 9 years and an earliest operational date of 2031.
Mutual Exclusivities	n/a
Interdependencies/ Exclusivity	This option is required as part of the Beckton Effluent Reuse option To provide an additional resource to London WRZ the following system elements may also be required: • Additional capacity in the raw water systems to allow the water to be abstracted from the River Lee Diversion into the Lee Valley Reservoirs and from there conveyed to a Water Treatment Works in east London; • Additional treatment capacity in east London. • Additional capacity in the Thames Water ring main Beckton Reuse has the potential to support the Thames to Affinity Transfer (T2AT) SRO as T2AT SRO may abstract raw water from the River Lee. Additional requirements to supply water to Affinity Water WRZs are described in the Thames to Affinity Water Transfer Gate 2 documents



Raw Water System – Increase capacity of Littleton intake PS

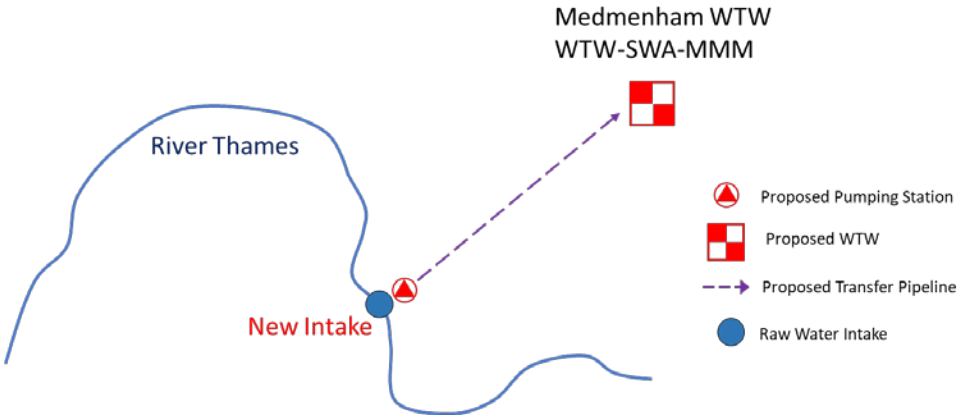
Name	Raw Water System – Increase capacity of Littleton intake PS
WRSE ID	TWU_LON_HI-TFR_LON_ALL_littleton int-qm
WRMP19 Reference	CON-RWS-LTN-300
Element Type	Conveyance
WRZ	LONDON
Engineering Scope	Capacity increase of existing River Thames Littleton intake to 300Ml/d
Engineering Components	The components for this scope are as follows: • New Pumping station located at Littleton intake. • Above ground pipelines to reservoir.
Phases/benefits	n/a
Benefit	n/a
Lead Time	5 Years
Mutual exclusivities	No other options on the constrained list are mutually exclusive with this option.
Interdependencies/ Exclusivity	May be required in order to deliver the benefit from the increase in raw water within the west London system from resource options.



Raw Water System – New Medmenham Intake

Name	Medmenham Intake – 80Ml/d
WRSE ID	TWU_SWA_HI-TFR_UTC_ALL_medmenham intake 53 TWU_SWA_HI-TFR_UTC_ALL_medmenham intake 80
WRMP19 Reference	CON-RWS-MMM-53 CON-RWS-MMM-80
Element Type	Conveyance
WRZ	SWA
Engineering Scope	Construction of 53Ml/d or 80Ml/d intake near Medmenham to abstract water from the River Thames including a 53Ml/d or 80Ml/d raw water pumping station to the new Medmenham WTW and raw water pipeline to transfer the water from the intake to the WTW.
Engineering Components	The components for this scope are as follows: • New 53Ml/d / 80Ml/d raw water intake and screens. • New gravity pipeline between intake and raw water pumping station. • Raw water pumping station. • Raw water pipeline from abstraction point to new Medmenham WTW.
Phases/benefits	n/a
Benefit	n/a
Lead Time	5 Years
Mutual Exclusivities	The 53 Ml/d and 80 Ml/d capacity options are mutually exclusive to each other.
Interdependencies/ Exclusivity	Dependent on new Medmenham WTW and treated water pipeline to new Widdenton SR Medmenham WTW (72Ml/d).

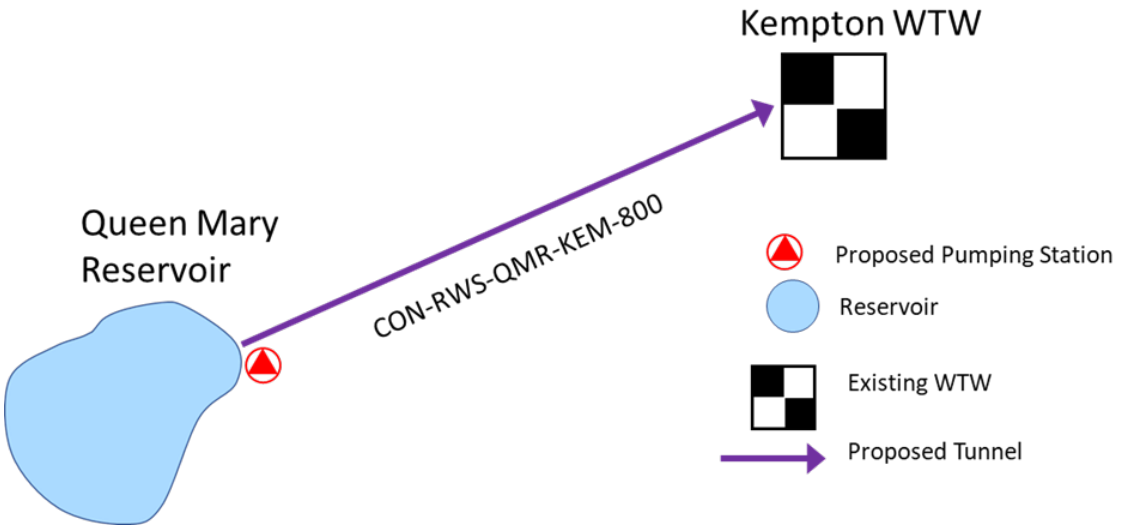
Name	Medmenham Intake – 80Ml/d
	The intake will abstract from the River Thames, supported by one or more of the following options: • Didcot Raw Water Purchase • SESRO • Marsh Gibbon Reservoir • Chinnor Reservoir • Deerhurst to Culham (300Ml/d) pipeline Deerhurst to Culham (400Ml/d) pipeline Deerhurst to Culham (500Ml/d) pipeline • Oxford Canal to Cropredy



Raw Water System – Queen Mary Reservoir to Kempton WTW site

Name	Raw Water System – Queen Mary Reservoir to Kempton WTW site
WRSE ID	TWU_WLJ_HI-TFR_WLJ_ALL_qm res-kempton wtw
WRMP19 Reference	CON-RWS-QMR-KEM-800
Element Type	Conveyance
WRZ	LONDON
Engineering Scope	New conveyance of raw water from Queen Mary Reservoir to new Kempton WTW.
Engineering Components	The components for this scope are as follows: • Tunnel from Queen Mary to Kempton • 1 No drive shaft • 1 No intermediate shaft • 1 No reception shaft • High Integrity Gate Valve; 2 at the intermediate shaft. • Installation of jetty • Pumps installed in the reservoir including housing and control room for the pumps.
Phases/benefits	n/a
Benefit	n/a

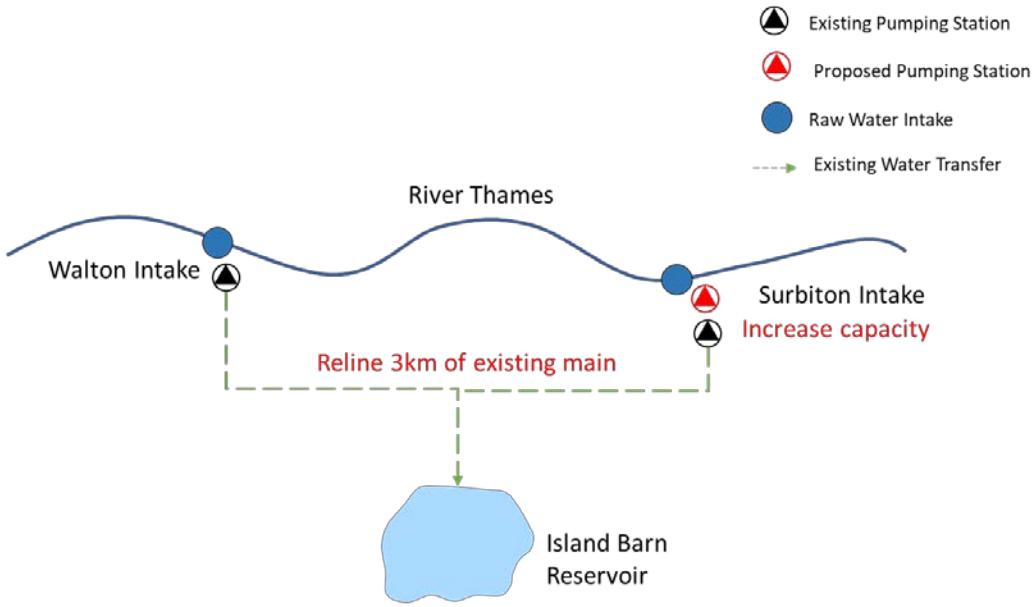
Name	Raw Water System – Queen Mary Reservoir to Kempton WTW site
Lead Time	8 Years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	May be required to support additional raw water resources in West London: • SESRO, • Marsh Gibbon Reservoir • Chinnor Reservoir • Deerhurst to Culham (300Ml/d) pipeline, Deerhurst to Culham (400Ml/d) pipeline, Deerhurst to Culham (500Ml/d) pipeline • Oxford Canal to Cropredy • and transfer additional water to new treatment at Kempton WTW expansion .



Raw Water System – Increase capacity of Surbiton intake

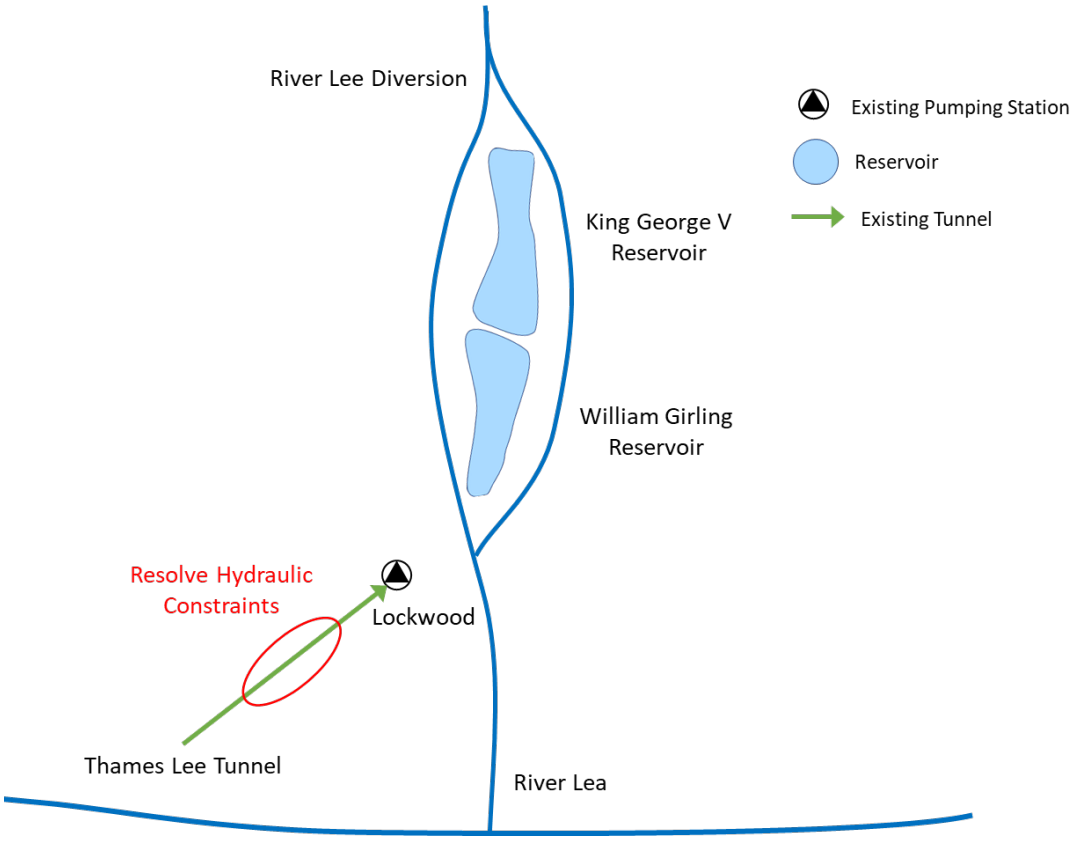
Name	Raw Water System – Increase capacity of Surbiton intake
WRSE ID	TWU_LON_HI-TFR_LON_ALL_surbiton int-walton
WRMP19 Reference	CON-RWS-SUR-100
Element Type	Conveyance
WRZ	LONDON
Engineering Scope	Increase capacity of existing River Thames Surbiton intake by 100Ml/d. Includes additional pump at the intake and relining a section of the existing main between Surbiton and Walton intakes and Island Barn Reservoir.
Engineering Components	The components for this scope are as follows: • Installation of an extra pump within the Surbiton Pumping station intake • Upgrade screens at Surbiton. • Reline section of an existing main.

Name	Raw Water System – Increase capacity of Surbiton intake
Phases/benefits	n/a
Benefit	n/a
Lead Time	6 Years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	Required to support Teddington DRA scheme. .



Raw Water System - TLT upgrade

Name	Raw Water System – TLT upgrade
WRSE ID	TWU_LON_HI-TFR_LON_ALL_tlt upgrade - roc
WRMP19 Reference	CON-RWS-TLT-UPG-450
Element Type	Conveyance
WRZ	LONDON
Engineering Scope	Nominal 450Ml/d upgrade to the Thames Lee Tunnel to remove existing constraints.
Engineering Components	The components for this scope are as follows: • Reinforcing section of the tunnel. • New shaft. • New air valve.
Phases/benefits	n/a
Benefit	n/a
Lead Time	6 Years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	Not dependent on other elements

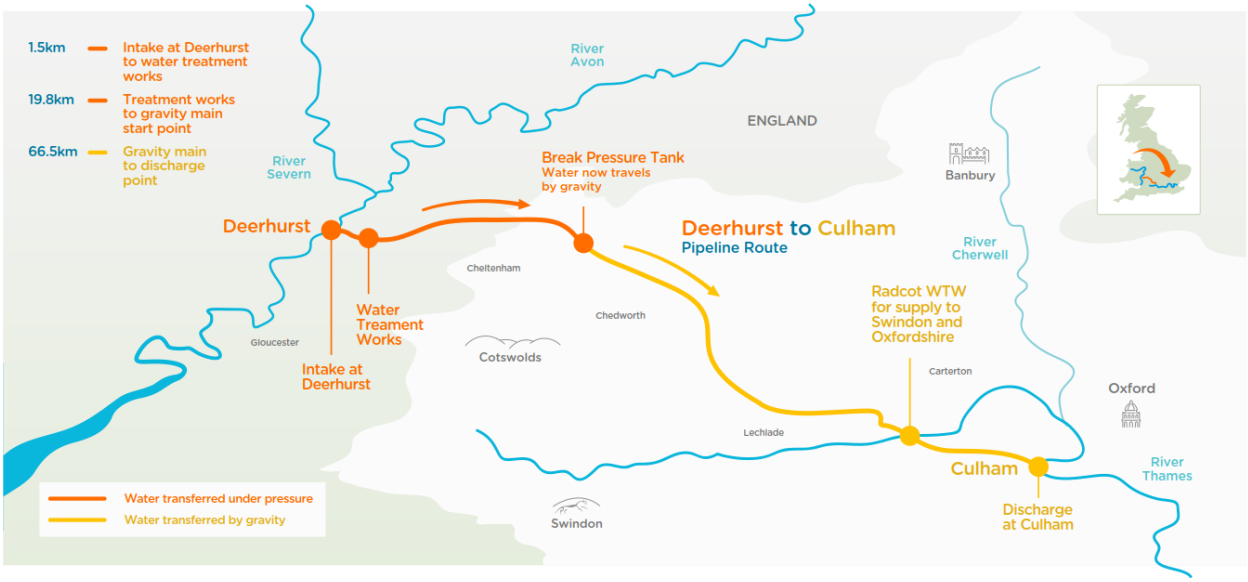


Severn Thames Transfer – Deerhurst to Culham (300Ml/d) pipeline

Name	STT – Raw Water Transfer Deerhurst to Culham 300Ml/d
WRSE ID	TWU_STT_HI-IMP_STT_CNO_sttpipe300(lon)
WRMP19 Reference	CON-RWT-DEH-CLM-300
Element Type	Conveyance
WRZ	LONDON / SWOX / SWA
Engineering Scope	A supported conveyance pipeline option from Deerhurst on the River Severn to Culham on the River Thames with a 300Ml/d capacity and a total length circa 88km. The element includes all engineering works required to transfer the flow to the River Thames.
Engineering Components	A river intake structure at Deerhurst including inlet screens and a twin pipeline to a low lift pump station; • A raw water low lift pump station and a twin pipeline to treatment works; • Treatment works including inlet screens, coagulation and lamella clarifiers, rapid gravity filtration and sludge and washwater treatment; • A treated water high lift pump station • A single rising main to a break pressure tank; • A break pressure tank at the high point;

Name	STT – Raw Water Transfer Deerhurst to Culham 300Ml/d
	• A single gravity main to the outfall location; • An outfall at Culham with an actuated valve and an aeration cascade
Phases/Benefit	The independent unsupported River Severn resource option, without support options was rejected at feasibility stage and is not included in the Constrained List; however unsupported River Severn water will be abstracted for transfer in the Deerhurst pipeline when available. Stochastic modelling allowing for climate change and other abstractors indicates a benefit of 80 Ml/d for the 300Ml/d pipeline option, from the unsupported flow in the River Severn.
Lead Time	10 Years (to supply unsupported flow). The full SRO project delivery programme allows for an Earliest Operational Date of 2033
Mutual exclusivities	Mutually exclusive with Deerhurst to Culham (400Ml/d) pipeline and Deerhurst to Culham (500Ml/d) pipeline
Interdependencies/ Exclusivity	This element is dependent on River Severn support elements that will be provided by 3rd parties (Severn Trent Water and United Utilities): • Minworth STW to River Avon 115Ml/d • Netheridge STW to River Severn 35Ml/d • Lake Vyrnwy (United Utilities) – 180Ml/d Not all support options may be required, depending on the capacity of the STT that is selected. For STT to deliver a benefit, the water that is released into the River Thames will need to be re-abstracted. There are other water resource options being considered in WRMP24 and/or WRSE regional planning that would either benefit, or be dependent on, water supply from SESRO directly or from water provided into, and conveyed by, the River Thames (whether this be via SESRO, STT or a combination of both), these include: • Thames to Affinity Transfer (T2AT) SRO • Thames to Southern Transfer (T2ST) SRO • Thames Water non-SRO options to supply the SWOX or SWA Water Resource Zones Additional requirements to supply water to Affinity Water WRZs are described in the Thames to Affinity Water Transfer Gate 2 documents and requirements to supply Southern Water WRZs are described in the Thames to Southern Water Transfer Gate 2 documents. To provide an additional resource to London WRZ the following system elements may also required: • Additional capacity in the raw water systems to allow the water to be abstracted from the River Thames into the west London reservoirs and from there conveyed to a Water Treatment Works in west London;

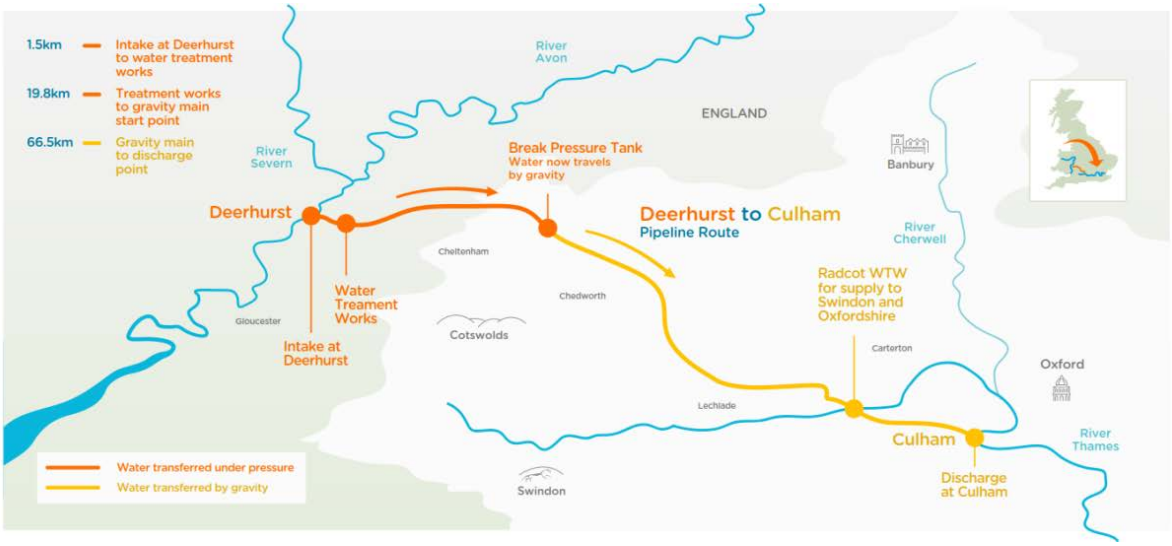
Name	STT – Raw Water Transfer Deerhurst to Culham 300Ml/d
	• Additional treatment capacity in west London. • Additional capacity in the Thames Water ring main.



Severn Thames Transfer – Deerhurst to Culham (400Ml/d) pipeline

Name	STT – Raw Water Transfer Deerhurst to Culham 400Ml/d
WRSE ID	TWU_STT_HI-IMP_STT_CNO_sttpipe400(lon)
WRMP19 Reference	CON-RWT-DEH-CLM-400
Element Type	Conveyance
WRZ	LONDON / SWOX / SWA
Engineering Scope	A supported conveyance pipeline option from Deerhurst on the River Severn to Culham on the River Thames with a 400 Ml/d capacity and a total length circa 88km. The element includes all engineering works required to transfer the flow to the River Thames.
Engineering Components	• A river intake structure at Deerhurst including inlet screens and a twin pipeline to a low lift pump station; • A raw water low lift pump and a twin pipeline to treatment works; • Treatment works including inlet screens, coagulation and lamella clarifiers, rapid gravity filtration and sludge and washwater treatment; • A treated water high lift pump station; • A single rising main to a break pressure tank; • A break pressure tank at the high point; • A single gravity main to the outfall location; • An outfall at Culham with an actuated valve and an aeration cascade
Phases/Benefits	The independent unsupported River Severn resource option, without support options was rejected at feasibility stage and is not included

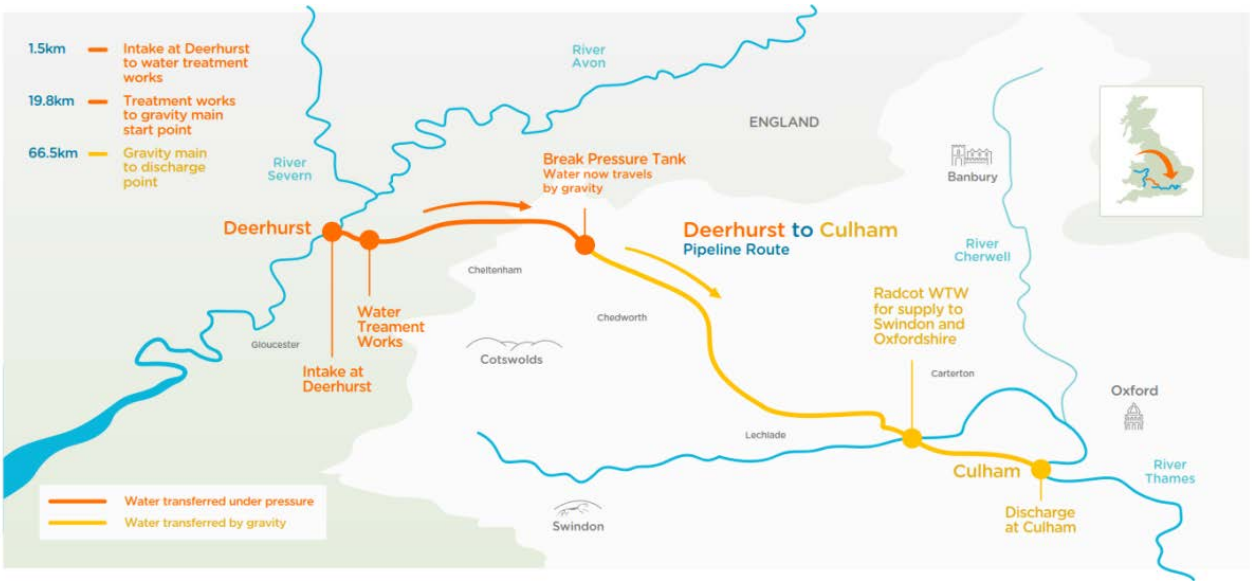
Name	STT – Raw Water Transfer Deerhurst to Culham 400Ml/d
	in the Constrained List; however unsupported River Severn water will be abstracted for transfer in the Deerhurst pipeline when available. Stochastic modelling allowing for climate change and other abstractors indicates a benefit of 107 Ml/d from the River Severn for the 400Ml/d pipeline option, from the unsupported flow in the River Severn.
Mutual exclusivities	Mutually exclusive with Deerhurst to Culham (300Ml/d) pipeline and Deerhurst to Culham (500Ml/d) pipeline
Lead Time	10 Years. The full SRO project delivery programme allows for an Earliest Operational Date of 2033.
Interdependencies/ Exclusivity	This element is dependent on River Severn support elements that will be provided by 3rd parties (Severn Trent Water and United Utilities). • Minworth STW to River Avon 115Ml/d • Netheridge STW to River Severn 35Ml/d • Lake Vyrnwy (United Utilities) – 180Ml/d Not all support options may be required, depending on the capacity of the STT that is selected For STT to deliver a benefit, the water that is released into the River Thames will need to be re-abstracted. There are other water resource options being considered in WRMP24 and/or WRSE regional planning that would either benefit, or be dependent on, water supply from SESRO directly or from water provided into, and conveyed by, the River Thames (whether this be via SESRO, STT or a combination of both), these include: • Thames to Affinity Transfer (T2AT) SRO • Thames to Southern Transfer (T2ST) SRO • Thames Water non-SRO options to supply the SWOX or SWA Water Resource Zones Additional requirements to supply water to Affinity Water WRZs are described in the Thames to Affinity Water Transfer Gate 2 documents and requirements to supply Southern Water WRZs are described in the Thames to Southern Water Transfer Gate 2 documents. To provide an additional resource to London WRZ the following system elements may also required: • Additional capacity in the raw water systems to allow the water to be abstracted from the River Thames into the west London reservoirs and from there conveyed to a Water Treatment Works in west London; • Additional treatment capacity in west London. • Additional capacity in the Thames Water ring main.



Severn Thames Transfer – Deerhurst to Culham (500Ml/d) pipeline

Name	STT – Raw Water Transfer Deerhurst to Culham 500 Ml/d
WRSE ID	TWU_STT_HI-IMP_STT_ALL_sttpipe500(lon)
WRMP19 Reference	CON-RWT-DEH-CLM-500
Element Type	Conveyance
WRZ	LONDON / SWOX / SWA
Engineering Scope	A supported conveyance pipeline option from Deerhurst on the River Severn to Culham on the River Thames with a 500Ml/d capacity and a total length circa 88km. The element includes all engineering works required to transfer the flow to the River Thames.
Engineering Components	• A river intake structure at Deerhurst including inlet screens and a twin pipeline to a low lift pump station; • A raw water low lift pump station and a twin pipeline to treatment works; • Treatment works including inlet screens, coagulation and lamella clarifiers, rapid gravity filtration and sludge and washwater treatment; • A treated water high lift pump station • A single rising main to a break pressure tank; • A break pressure tank at the high point; • A single gravity main to the outfall location; • An outfall at Culham with an actuated valve and an aeration cascade;
Phases/Benefit	The independent unsupported River Severn resource option, without support options was rejected at feasibility stage and is not included in the Constrained List; however unsupported River Severn water will be abstracted for transfer in the Deerhurst pipeline when available. Stochastic modelling allowing for climate change and other abstractors indicates a benefit of 134Ml/d from the River Severn for

Name	STT – Raw Water Transfer Deerhurst to Culham 500 Ml/d
	the 500Ml/d pipeline option, from the unsupported flow in the River Severn.
Mutual exclusivities	Mutually exclusive with Deerhurst to Culham (300Ml/d) and pipelineDeerhurst to Culham (400Ml/d) pipeline
Lead Time	10 Years. The full SRO project delivery programme allows for an Earliest Operational Date of 2033.
Interdependencies/ Exclusivity	This element is dependent on River Severn support elements that will be provided by 3rd parties (Severn Trent Water and United Utilities): • Minworth STW to River Avon 115Ml/d • Netheridge STW to River Severn 35Ml/d • Lake Vyrnwy (United Utilities) – 180Ml/d Not all support options may be required, depending on the capacity of the STT that is selected For STT to deliver a benefit, the water that is released into the River Thames will need to be re-abstracted. There are other water resource options being considered in WRMP24 and/or WRSE regional planning that would either benefit, or be dependent on, water supply from SESRO directly or from water provided into, and conveyed by, the River Thames (whether this be via SESRO, STT or a combination of both), these include: • Thames to Affinity Transfer (T2AT) SRO • Thames to Southern Transfer (T2ST) SRO • Thames Water non-SRO options to supply the SWOX or SWA Water Resource Zones Additional requirements to supply water to Affinity Water WRZs are described in the Thames to Affinity Water Transfer Gate 2 documents and requirements to supply Southern Water WRZs are described in the Thames to Southern Water Transfer Gate 2 documents To provide an additional resource to London WRZ the following system elements may also required: Additional capacity in the raw water systems to allow the water to be abstracted from the River Thames into the west London reservoirs and from there conveyed to a Water Treatment Works in west London; • Additional treatment capacity in west London. • Additional capacity in the Thames Water ring main.


1.5km
Intake at Deerhurst to water treatment works
19.8km
Treatment works to gravity main start point
66.5km
Gravity main to discharge point
River Avon
ENGLAND
River Severn
Break Pressure Tank
Water now travels by gravity
Deerhurst
Deerhurst to Culham
Pipeline Route
Banbury
River Cherwell
Cheltenham
Chedworth
Radcot WTW for supply to Swindon and Oxfordshire
Water Treament Works
Gloucester
Cotswolds
Intake at Deerhurst
Carterton
Oxford
Lechlade
Culham
River Thames
Discharge at Culham
Swindon
Water transferred under pressure
Water transferred by gravity

Catchment Management

R.15 Catchment options were compiled into catchment portfolios to compare the proposed options with regards to their contribution to current and future catchment challenges, targeting catchment deficits, catchment issues, problem characterisation and future problems. Standard options (Portfolio 1) were those identified to address the deficit issues and environmental need, both now and with any predicted changes in the future, and these portfolios of options were inputted into WRSE's investment model to develop to regional plan.

R.16 We have identified three schemes (below) within our nature-based solutions programmes that may offer a deployable output benefit over the longer term. These schemes involve working with farmers to provide support and advice to implement environmental interventions, including measures to reduce the potential for nitrate to leach into groundwater. These schemes have been included within our catchment options longlist to be screened and modelled by WRSE to develop the draft Regional Plan. As with the other catchment options on our longlist, the information for these options is less mature and the option type itself generates less certain water resources benefits. This means that a high degree of uncertainty remains around the deliverability of the estimated deployable output benefits from these options. Through our existing programmes to improve the environment and our WINEP and PR24 process we are working as a business to better understand the benefits of these options and support their implementation.

Bean Wellfield (Groundwater)

Name	
WRSE ID	CM_TWU_3
WRMP 19 Reference	n/a
Element Type	Catchment Management
WRZ	London
Engineering Scope	To carry out a programme of catchment management measures to reduce seasonal and long term trend in nitrate.
Engineering Components	To be delivered as part of Portfolio 1 (Standard) Darent and Cray – see above
Phases/benefits	0.1 Ml/d
Time Lead	To be delivered as part of a portfolio
Mutual exclusivities	n/a
Interdependencies/ Exclusivity	n/a

Green Street Green (Groundwater)

Name	
WRSE ID	CM_TWU_14
WRMP 19 Reference	n/a
Element Type	Catchment Management
WRZ	London

Name	
Engineering Scope	To carry out a programme of catchment management measures to reduce seasonal and long term trend in nitrate.
Engineering Components	To be delivered as part of Portfolio 1 (Standard) Darent and Cray – see above
Phases/benefits	0.3 Ml/d
Time Lead	To be delivered as part of a portfolio
Mutual exclusivities	n/a
Interdependencies/ Exclusivity	n/a

Wilmington (Groundwater)

Name	
WRSE ID	CM_TWU_36
WRMP 19 Reference	n/a
Element Type	Catchment Management
WRZ	London
Engineering Scope	To carry out a programme of catchment management measures to reduce seasonal and long term trend in nitrate.
Engineering Components	To be delivered as part of Portfolio 1 (Standard) Darent and Cray – see above
Phases/benefits	0.2 Ml/d
Time Lead	To be delivered as part of a portfolio
Mutual exclusivities	n/a
Interdependencies/ Exclusivity	n/a

Water Treatment Works

East London (600Ml/d)

<table>
<tr><th>Name</th><th>East London Water Treatment Works extension</th></tr>
<tr><td>WRSE ID</td><td>TWU_LON_HI-ROC_WT1_ALL_eastlondonwtw
TWU_LON_HI-ROC_WT2_ALL_eastlondonwtw100p2
TWU_LON_HI-ROC_WT1_CNO_eastlondonwtw150
TWU_LON_HI-ROC_WT1_CNO_eastlondonwtw200
TWU_LON_HI-ROC_WT1_CNO_eastlondonwtw300</td></tr>
<tr><td>WRMP 19 Reference</td><td>WTW-LON-COP-100
WTW-LON-COP-150</td></tr>
<tr><td>Element Type</td><td>Water Treatment</td></tr>
<tr><td>WRZ</td><td>LONDON</td></tr>
<tr><td>Engineering Scope</td><td>New WTW in East London to treat water from various water resource options such as: reuse and transfer.</td></tr>
<tr><td>Engineering Components</td><td>The components for this scope are as follows:
New WTW to support required capacities
Inter-stage pumping station
Land purchase
New abstraction and conveyance pipelines</td></tr>
<tr><td>Phases/benefits</td><td>Option has a maximum capacity of 600 Ml/d which can be achieved through phase options as set out below:
<table>
<tr><th>Phase 1 Ml/d</th><th>Phase 2 Ml/d</th><th>Phase 3 Ml/d</th><th>Phase 4 Ml/d</th><th>Phase 5 Ml/d</th><th>Phase 6 Ml/d</th><th>Total Ml/d</th></tr>
<tr><td>100</td><td>100</td><td>100</td><td>100</td><td>100</td><td>100</td><td>600</td></tr>
<tr><td>150</td><td>100</td><td>100</td><td>100</td><td>100</td><td></td><td>550</td></tr>
<tr><td>200</td><td>100</td><td>100</td><td>100</td><td>100</td><td></td><td>600</td></tr>
<tr><td>300</td><td>100</td><td>100</td><td>100</td><td></td><td></td><td>600</td></tr>
</table></td></tr>
<tr><td>Time Lead</td><td>9 Years for Phase 1 elements and 7 Years for subsequent phases</td></tr>
<tr><td>Mutual exclusivities</td><td>Phase 1 elements are mutually exclusive with each other.</td></tr>
<tr><td>Interdependencies/ Exclusivity</td><td>This WTW would treat new raw water resources in East London including from:
Beckton Effluent Reuse
Deephams Reuse
To provide an additional resource to London WRZ the following system elements may also be required:
Raw water system upgrades will be required to convey the raw water to the new WTW.
Additional capacity in the Thames Water ring main.</td></tr>
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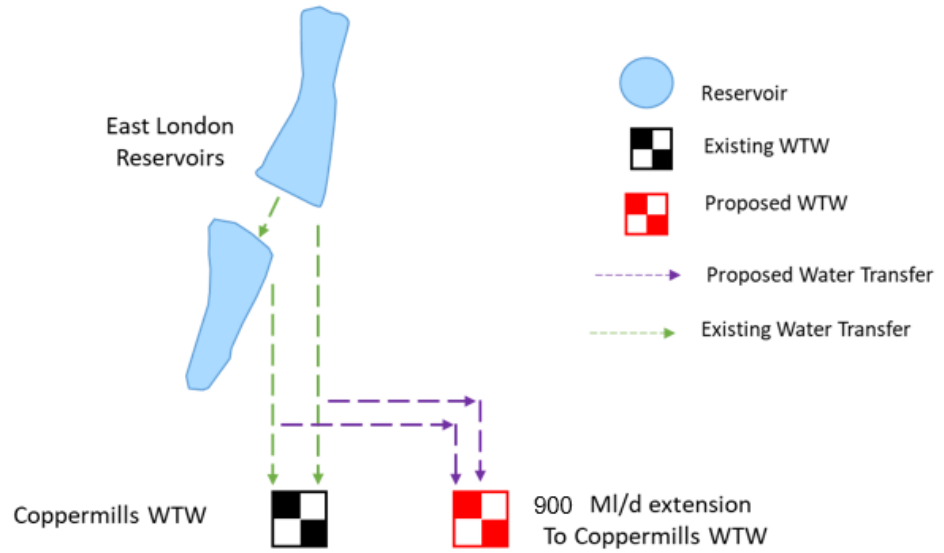
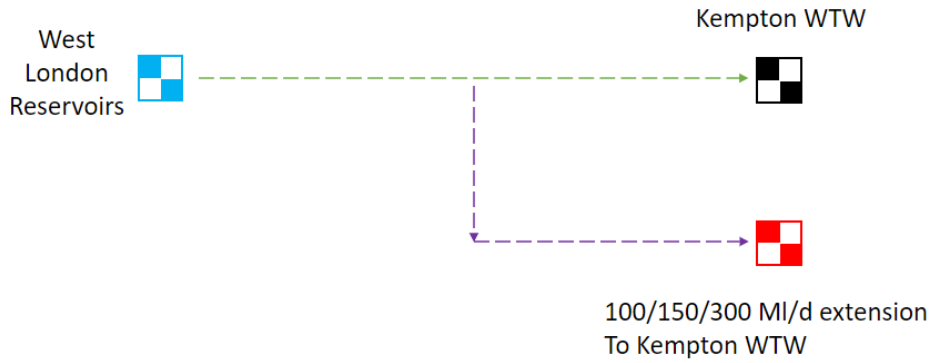


Kempton WTW expansion (800Ml/d)

Name	Kempton Water Treatment Works expansion 800Ml/d
WRSE ID	TWU_LON_HI-ROC_WT1_CNO_kemptonwtw300 TWU_LON_HI-ROC_WT1_ALL_kemptonwtw TWU_LON_HI-ROC_WT2_ALL_kemptonwtw100 p2 TWU_LON_HI-ROC_WT1_CNO_kemptonwtw150
WRMP19 Reference	WTW-LON-KEM-300 WTW-LON-KEM-100 WTW-LON-KEM-150
Element Type	Water Treatment
WRZ	LONDON
Engineering Scope	Phased construction of new WTW with maximum capacity of 800Ml/d located at the existing Kempton WTW site to treat water from West London reservoirs. This could originate from various raw water option types including reservoir, reuse, and raw water transfers.
Engineering Components	The components for this scope are as follows: • Raw water pumping station • New Water Treatment Works • Interstage pumping station • Treated water pumping station
Phases/benefits	Option is a phased option up to a maximum capacity of 800Ml/d. Phased elements are as below:

Phase 1 Ml/d	Phase 2 Ml/d	Phase 3 Ml/d	Phase 3 Ml/d	Phase 4 Ml/d	Phase 5 Ml/d	Phase 6 Ml/d	Phase 7 Ml/d	Total Ml/d
100	100	100	100	100	100	100	100	800
150	100	100	100	100	100	100		750

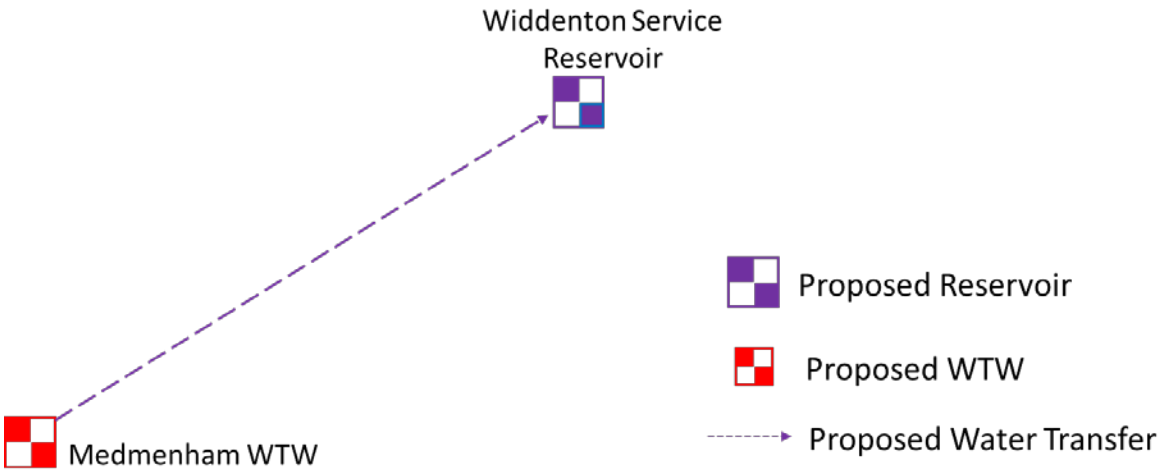
Name	Kempton Water Treatment Works expansion 800Ml/d								
	300	100	100	100	100	100			800
Time Lead	8 Years for Phase 1 elements and 6 Years for subsequent phases								
Mutual Exclusivities	Phase 1 elements are mutually exclusive with each other.								
Interdependencies/ Exclusivity	Dependent on Kempton WTW New shaft which would be constructed with Phase 1 This WTW would treat new water resources in west London including from: • Abingdon Reservoir(SESRO), • Marsh Gibbon Reservoir, • Chinnor Reservoir, Severn Thames Transfer – Deerhurst to Culham 300Ml/D, Deerhurst to Culham 400Ml/d, Deerhurst to Culham 500Ml/d). To provide an additional resource to London WRZ the following system elements may also be required: • Raw water system upgrades will be required to convey the raw water to the new WTW. • Additional capacity in the Thames Water ring main								



Medmenham WTW (72Ml/d)

Name	Medmenham Water Treatment Works
WRSE ID	TWU_SWA_HI-ROC_WT1_ALL_medmenhamwtw ph1 TWU_SWA_HI-ROC_WT2_ALL_medmenhamwtw ph2
WRMP19 Reference	WTW-SWA-MMM
Element Type	Water Treatment
WRZ	SWA
Engineering Scope	Construction of a new WTW, up to 72 Ml/d capacity, near Medmenham to treat water abstracted from the River Thames.
Engineering Components	The components for this scope are as follows: • New Water Treatment Works

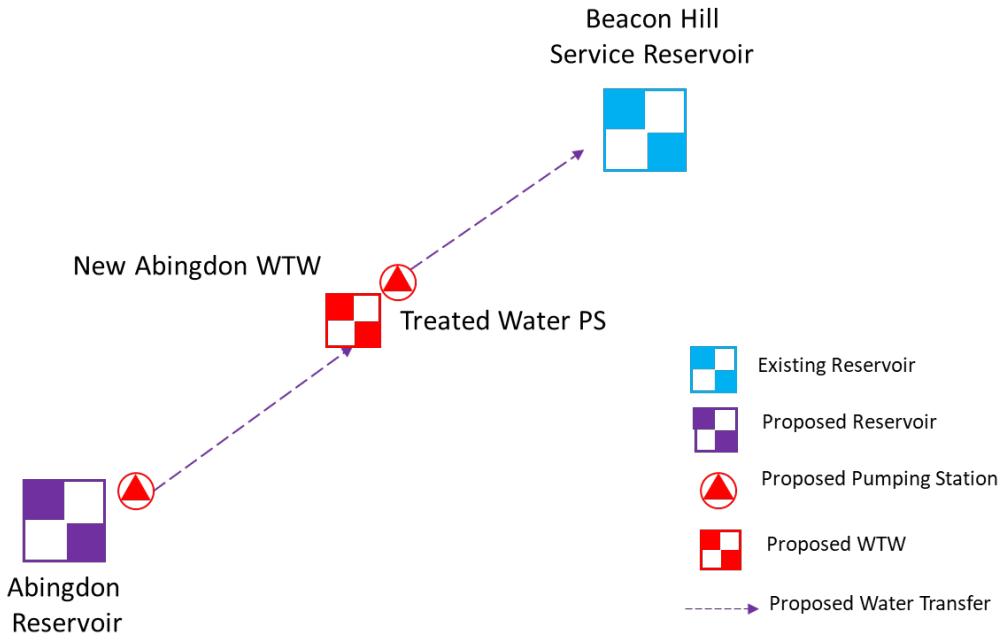
Name	Medmenham Water Treatment Works
	• Interstage pumping station • Treated water pumping station • New Service Reservoir near Widdenton • Treated water pipeline from WTW to new Widdenton Service Reservoir.
Phases/benefits	Option has a maximum capacity of 72Ml/d which can be achieved through 3 phases for 24Ml/d
Lead Time	5 Years (each phase)
Mutual Exclusivities	None
Interdependencies/ Exclusivity	Dependent on New Medmenham Intake and raw water pipeline This WTW would treat water abstracted from the River Thames, supported by one or more of the following elements: • Didcot Raw Water Purchase • SESRO • Marsh Gibbon Reservoir • Chinnor Reservoir • Deerhurst to Culham (300Ml/d) pipeline, Deerhurst to Culham (400Ml/d) pipeline or Deerhurst to Culham (500Ml/d) pipeline • Oxford Canal to Cropredy



Abingdon WTW new 24 Ml/d (SWOX)

Name	Abingdon Water Treatment Works
WRSE ID	TWU_SWX_HI-ROC_WT1_ALL_abingdon wtw ph1 TWU_SWX_HI-ROC_WT2_ALL_abingdon wtw ph2
WRMP19 Reference	WTW-SWOX-ABI WTW-SWOX-ABI-SWA
Element Type	Water Treatment

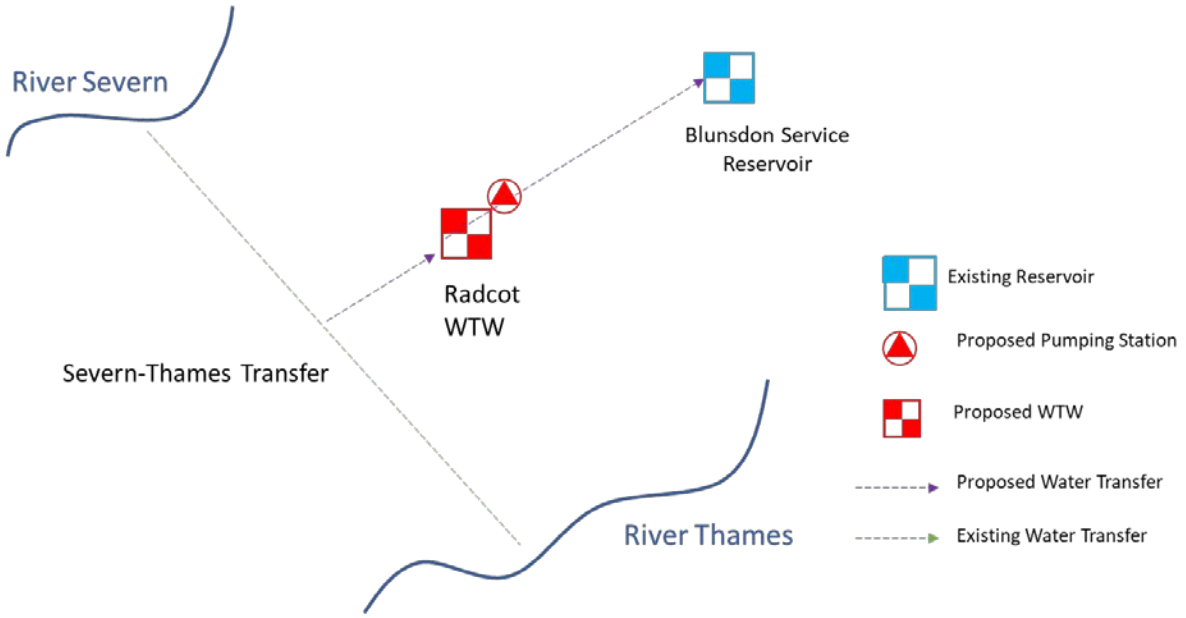
Name	Abingdon Water Treatment Works
WRZ	SWOX
Engineering Scope	Construction of a WTW with maximum capacity of up to 72Ml/d adjacent to, and supplied by the new Abingdon reservoir, to supply parts of the SWOX WRZ. The Engineering scope includes the raw water pipeline from the reservoir to the treatment works and the treated water pipeline from the treatment works to Beacon Hill Service Reservoir.
Engineering Components	The components for this scope are as follows: • Raw water pipeline from reservoir to water treatment works. • Raw water pumping station. • New 72Ml/d Water Treatment Works comprising of multiple treatment steps (for more details please refer to the relevant CDR report). • Interstage pumping station • Treated water pumping station • Treated water pipeline from WTW to Beacon Hill Service Reservoir.
Phases/benefits	Option has a maximum capacity of 72Ml/d which can be achieved through 3 phases for 24Ml/d
Time Lead	5 Years (each phase)
Mutual exclusivities	This element is not mutually exclusive with the Radcot WTW (72Ml/d) element as they serve two different options that may both be implemented. If both options were to be implemented including the treatment elements, then consideration would be needed around the timeframe in which the two treatment works would be built and this timeframe would mainly be driven by the SWOX WRZ supply/demand balance.
Interdependencies/ Exclusivity	This WTW would treat water from options provided under SESRO to supply the SWOX WRZ. Water can also be supplied to SWA through the SWOX to SWA (48 Ml/d and 72 Ml/d).



Radcot WTW (72 Ml/d)

Name	Radcot Water Treatment Works
WRSE ID	TWU_SWX_HI-ROC_WT1_ALL_radcotwtw TWU_SWX_HI-ROC_WT2_ALL_radcotwtwenhanced
WRMP19 Reference	WTW-SWOX-RAD
Element Type	Water Treatment
WRZ	SWOX
Engineering Scope	Phased construction of up to 72Ml/d water treatment works adjacent to the new main Severn Thames Transfer pipeline to supply parts of the SWOX WRZ. The Engineering scope includes the branch pipeline from the STT pipeline to the treatment works and the treated water pipeline from the treatment works to Blunsdon Service Reservoir.
Engineering Components	The components for this scope are as follows: • Raw water pipeline from the Deerhurst to Culham pipeline to water treatment works • New Water Treatment Works • Interstage pumping station • Treated water pumping station • Treated water pipeline
Phases/benefits	Option has a maximum capacity of 72Ml/d which can be achieved through 3 phases for 24Ml/d
Time Lead	5 years (Each phase)
Mutual exclusivities	This element is not mutually exclusive with the Abingdon WTW element as they serve two different options that may both be implemented. If both options were to be implemented including the treatment elements, then consideration would be needed around

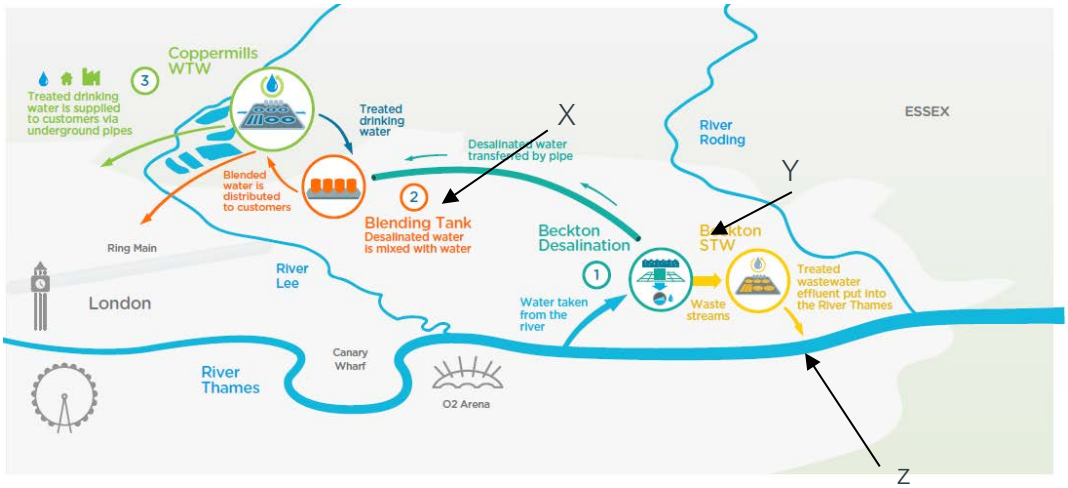
Name	Radcot Water Treatment Works
	the timeframe in which the two treatment works would be built and this timeframe would mainly be driven by the SWOX WRZ supply/demand balance.
Interdependencies/ Exclusivity	To supply the SWOX WRZ this WTW would treat water from the Severn Thames Transfer: • Deerhurst to Culham (300Ml/d) pipeline • Deerhurst to Culham (400Ml/d) pipeline • Deerhurst to Culham (500Ml/d) pipeline



Network reinforcement

Desalination Beckton to Coppermills tunnel

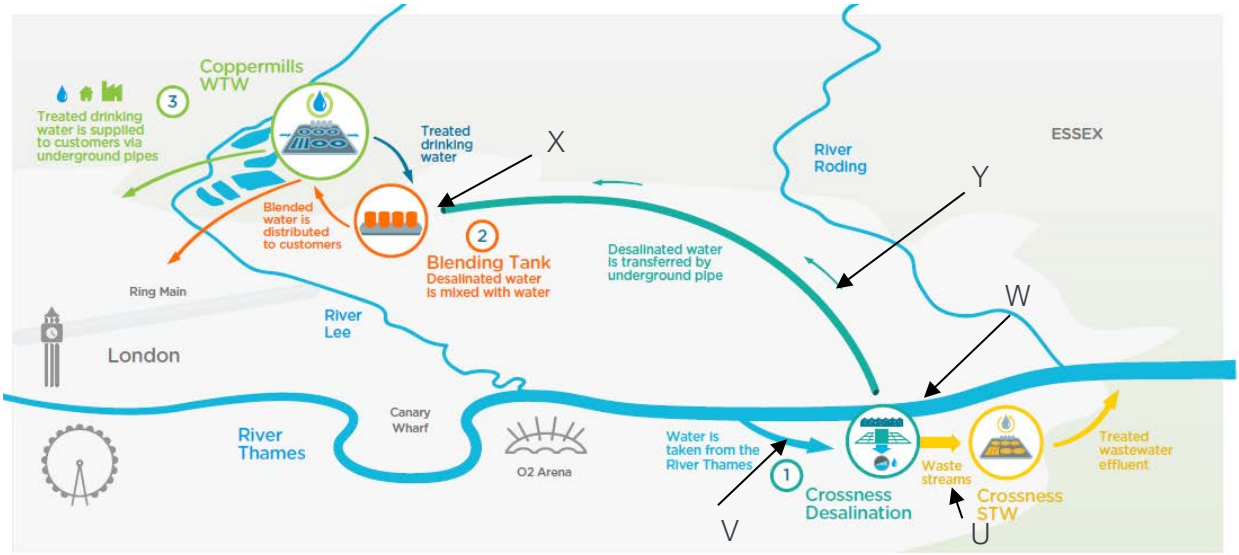
Name	Desalination – Beckton to Coppermills tunnel
WRSE ID	TWU_LON_HI-TFR_LON_ALL_beckton-coppermills
WRMP19 Reference	NET-DES-BEC-COP
Element Type	Network Reinforcement
WRZ	LONDON
Engineering Scope	Desalination plants at Beckton and Crossness are included on the Constrained List. The treated desalination water would be conveyed via tunnel from both Beckton and Crossness desalination works to Coppermills WTW for blending and distribution. This tunnel conveyance between Beckton desalination plant and Coppermills WTW has the capacity of over 450Ml/d (the combined Beckton and Crossness desalination plants output).
Engineering Components	The components for this scope are as follows: • The treated water will be conveyed via a tunnel from Beckton STW site to Coppermills site. • 6 shaft locations. • Paths / access for the permanent area for the 6 shafts.
Phases/benefits	n/a
Lead Time	11 Years
Mutual exclusivities	none
Interdependencies/ Exclusivity	This is the treated water conveyance for Beckton Desalination. Additional blending capacity at Coppermills WTW New Header Tank and Pumping Station at Coppermills WTW) To provide an additional resource to London WRZ the following system elements may also be required: • Capacity to discharge into the local water supply network or into the Thames Water Ring Main.



X	New Header Tank and Pumping Station at Coppermills WTW`
Y	Beckton to Coppermills Tunnel
Z	Beckton Desalination

Desalination – Crossness to Beckton tunnel

Name	Desalination – Crossness to Beckton tunnel
WRSE ID	TWU_LON_HI-ROC_NET_ALL_crossness-beckton
WRMP19 Reference	NET-DES-CRO-BEC
Element Type	Network Reinforcement
WRZ	LONDON
Engineering Scope	A desalination plant at Crossness. The treated desalination water would be conveyed via tunnel from the Crossness plant to the Beckton desalination plant and then via the Beckton to Coppermills tunnel for blending and distribution at Coppermills WTW.
Engineering Components	The components for this scope are as follows: • The treated water will be conveyed via a tunnel from the Crossness desalination site to Beckton • 3 shaft locations. • Paths /access for the permanent area for the 3 shafts.
Phases/benefits	n/a
Lead Time	10.5 Years
Mutual Exclusivities	none
Interdependencies/ Exclusivity	This tunnel combined with Beckton to Crossness tunnel form the treated water conveyance for Crossness Desalination plant. Additional blending capacity at Coppermills WT provided through New Header Tank and Pumping Station at Coppermills WTW To provide an additional resource to London WRZ the following system elements may also be required: • Capacity to discharge into the local water supply network or into the TWRM.

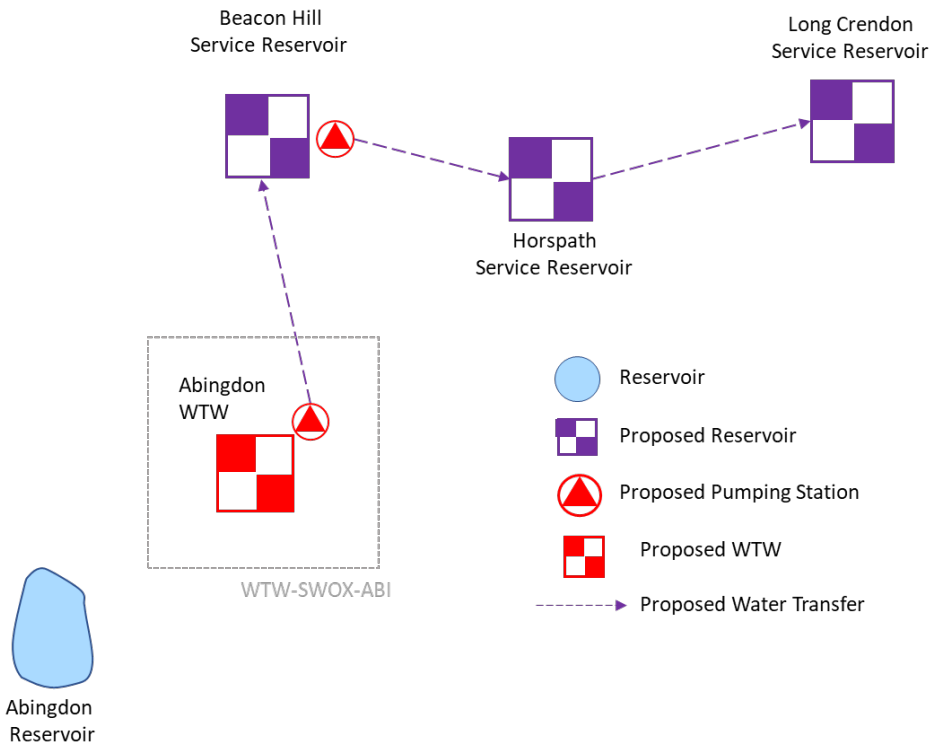


X	New Header Tank and Pumping Station at Coppermills WTW
Y	Beckton to Coppermills Tunnel
Z	Beckton Desalination
W	Crossness to Beckton tunnel
V	Beckton to Crossness tunnel
U	Crossness Desalination

SWOX to SWA (48/72)Ml/d

Name	SWOX to SWA
WRSE ID	TWU_SWA_HI-TFR_SWX_ALL_swoxswa72 TWU_SWA_HI-TFR_SWX_ALL_swoxswa48
WRMP19 Reference	NET-IZT-AB-LC-72 NET-IZT-AB-BS-48
Element Type	Network Reinforcement
WRZ	SWA
Engineering Scope	The engineering scope includes either a 72Ml/d or 48Ml/d treated water pipeline from the new Abingdon WTW first to Beacon Hill, then to Horspath and finally to Long Crendon Service Reservoirs
Engineering Components	The components for this scope are as follows: • New treated water pipeline from the new Abingdon WTW to new Beacon Hill Service Reservoir. • New treated water pipeline from new Beacon Hill Service Reservoir to new Horspath Service Reservoir • New treated water pipeline from new Horspath Service Reservoir to new Long Crendon Service Reservoir. • New treated water pumping station for pumping water from Beacon Hill SR to Horspath SR.

Name	SWOX to SWA
	• A new service reservoir at each of Beacon Hill, Horspath and Long Crendon.
Phases/benefits	n/a
Lead Time	5 Years
Mutual Exclusivities	The 48 Ml/d and 72 Ml/d options are mutually exclusive to each other.
Interdependencies/ Exclusivity	This element is interdependent with the Abingdon WTW new 24Ml/d which would treat water from Abingdon Reservoir[15]



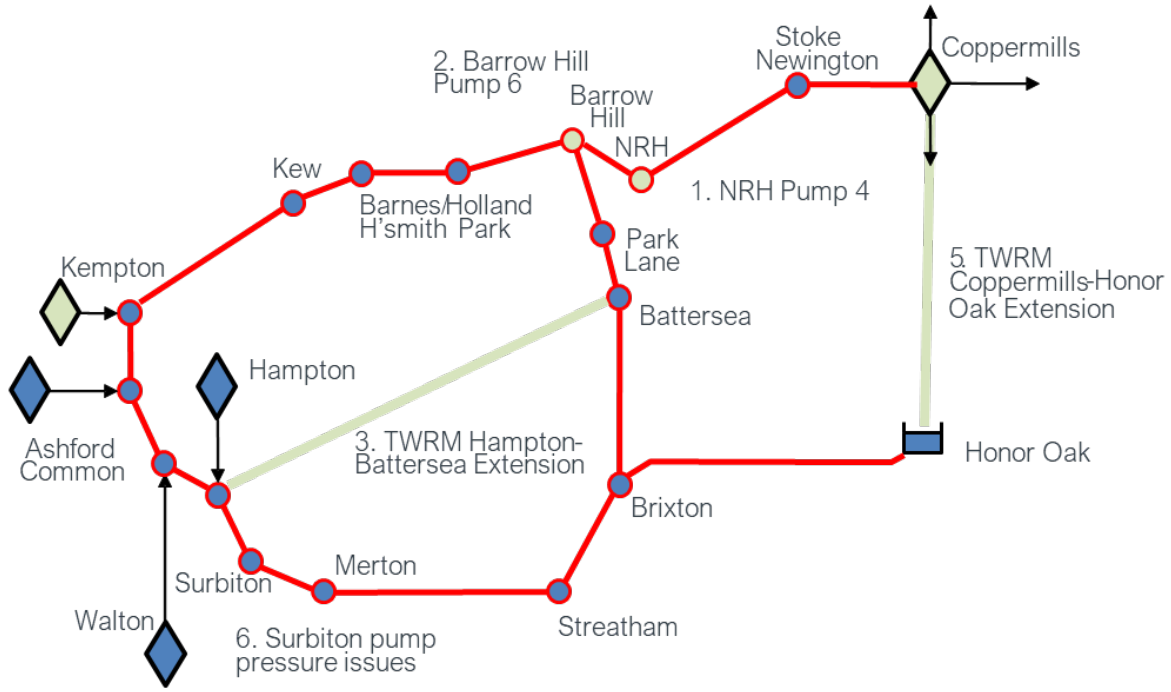
Network Reinforcement – Barrow Hill Pump 6 replacement

Name	Network Reinforcement - Barrow Hill Pump 6 replacement
WRSE ID	TWU_LON_HI-ROC_NET_ALL_barrowhillpump
WRMP19 Reference	NET-TWRM-BAR-PUM
Element Type	Network Reinforcement
WRZ	LONDON
Engineering Scope	Replacement of pump at Barrow Hill Shaft on the Thames Water Ring Main. The element will be required when additional resources from the west and/or east of the London water resource zone (WRZ) are increased reach a trigger value.

[15] The works could also treat water from the Severn Thames transfer option. In this case a different raw water connection would be needed. There may also be differences in the treatment process.

Name	Network Reinforcement - Barrow Hill Pump 6 replacement
Engineering Components	The components for this scope are as follows: • Replacement of existing pump with a larger pump.
Phases/benefits	n/a
Lead Time	1 Year
Mutual exclusivities	None
Interdependencies/ Exclusivity	The network reinforcement is required as new water resources are developed and treated for delivery into the London WRZ to meet demand growth. Additional treated water will be supplied from new WTW at East London and/or Kempton, depending on the resource options developed

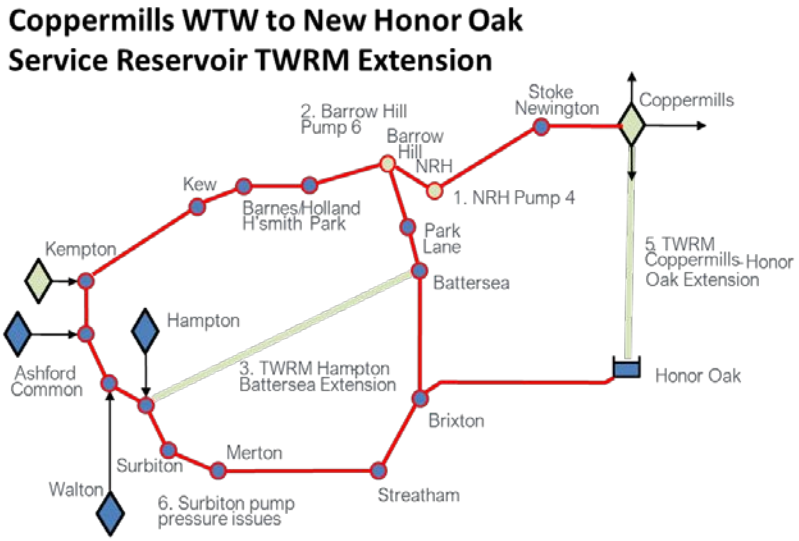
Network Reinforcement - Barrow Hill Pump 6 replacement



Coppermills WTW to New Honor Oak Service Reservoir TWRM Extension

Name	Coppermills WTW to New Honor Oak Service Reservoir TWRM Extension
WRSE ID	TWU_HON_HI-ROC_NET_ALL_cop'mills-honoroak
WRMP19 Reference	NET-TWRM-COP-HON
Element Type	Network Reinforcement
WRZ	LONDON

Name	Coppermills WTW to New Honor Oak Service Reservoir TWRM Extension
Engineering Scope	Thames Ring Main extension tunnel connecting existing shafts at Coppermills and Honor Oak. The Coppermills to Honor Oak TWRM extension will be required when additional resources from the west and/or east of the London water resource zone (WRZ) are increased reach a trigger value.
Engineering Components	The components for this scope are as follows: • New Tunnel from Coppermills to Honor Oak. • 2 No drive shafts. • 5 No intermediate shafts. • Tunnel connections to existing TW Ring Main at Coppermills and Honor Oak. • High Integrity Gate Valves (2 per intermediate shaft).
Phases/benefits	n/a
Lead Time	8 Years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	The network reinforcement is required as new water resources are developed and treated for delivery into the London WRZ to meet demand growth. Additional treated water will be supplied from new WTW at East London and/or Kempton, depending on the resource options developed.

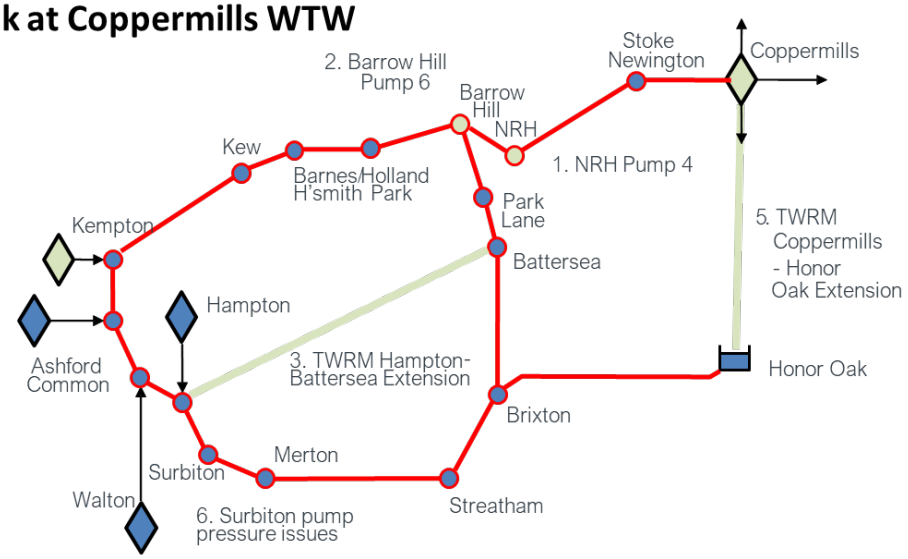


Network Reinforcement New Header tank and Pumping Station at Coppermills WTW

Name	Network Reinforcement - New header tank at Coppermills WTW
WRSE ID	TWU_LON_HI-ROC_NET_ALL_twrm ht-coppermills
WRMP19 Reference	NET-TWRM-COP-HEA NET-TWRM-COP-PS

Name	Network Reinforcement - New header tank at Coppermills WTW
Element Type	Network Reinforcement
WRZ	LONDON
Engineering Scope	The element will be required when additional resources from the west and/or east of the London water resource zone (WRZ) are increased reach a trigger value and/or when desalination options are developed. New low lift pump station to pump treated water from the existing Coppermills WTW contact tanks to the new blending / header tank and new header tank at Coppermills WTW to control the water levels in the Thames Water Ring Main.
Engineering Components	The components for this scope are as follows: • New header tank • New pumping station
Phases/benefits	n/a
Lead Time	5 Years
Mutual Exclusivities	none
Interdependencies/ Exclusivity	The network reinforcement is required as new water resources are developed and treated for delivery into the London WRZ to meet demand growth. Additional treated water will be supplied from new WTW at East London and/or Kempton, depending on the resource options developed

Network Reinforcement - New header tank at Coppermills WTW

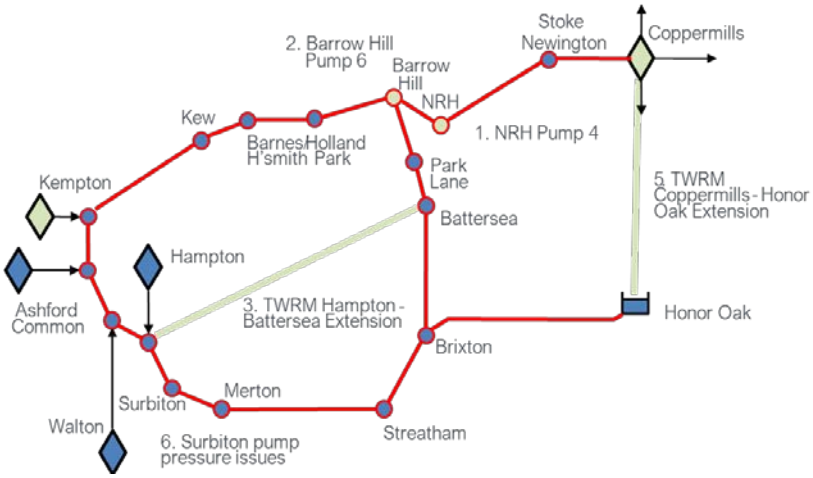


Hampton WTW to Battersea Extension

Name	Hampton WTW to Battersea Extension
WRSE ID	TWU_LON_HI-ROC_NET_ALL_hampton-battersea

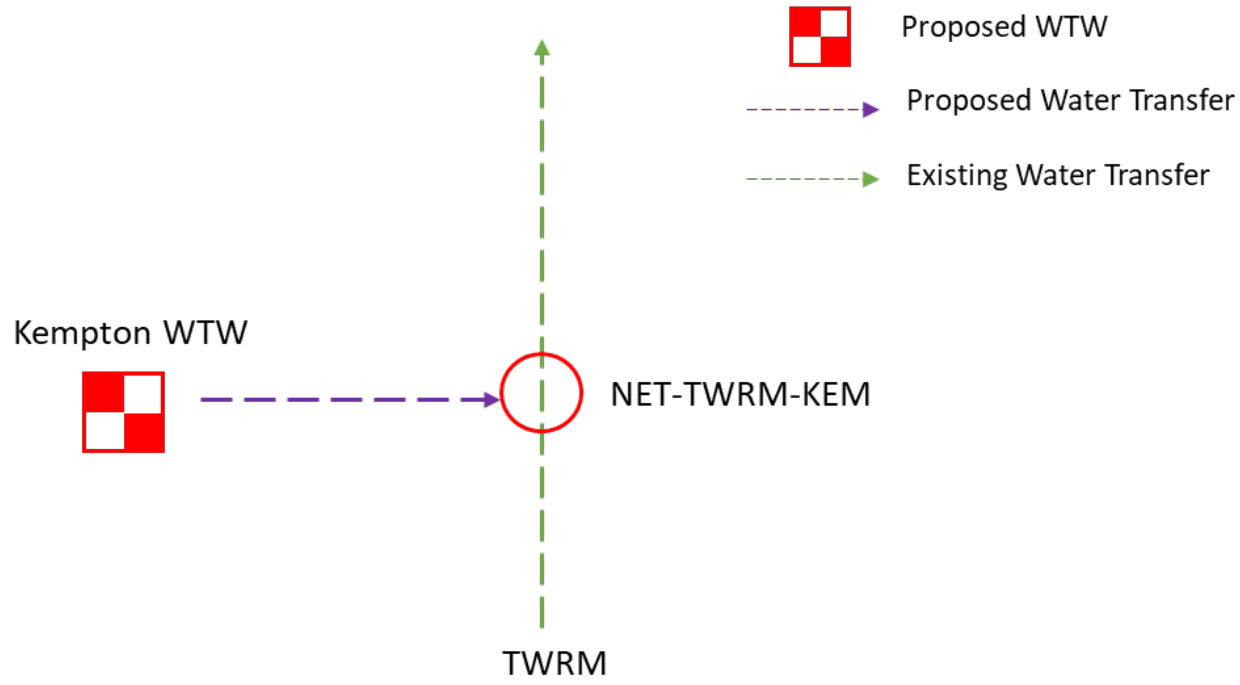
Name	Hampton WTW to Battersea Extension
WRMP19 Reference	NET-TWRM-HAM-BAT
Element Type	Network Reinforcement
WRZ	LONDON
Engineering Scope	Thames Ring Main extension tunnel joining existing shafts at Hampton WTW and Battersea. The Hampton Battersea TWRM extension will be required when additional resources from the west and/or east of the London water resource zone (WRZ) are increased reach a trigger value.
Engineering Components	The components for this scope are as follows: • New Tunnel from Hampton to Battersea. • 2 No drive shafts. • 8 No intermediate shafts. • Tunnel connections to existing TW Ring Main at Hampton and Battersea. • High Integrity Gate Valves.
Phases/benefits	n/a
Lead Time	9 Years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	The network reinforcement is required as new water resources are developed and treated for delivery into the London WRZ to meet demand growth. Additional treated water will be supplied from new WTW at Coppermills and/or Kempton, depending on the resource options developed

Hampton WTW to Battersea Extension



Network Reinforcement – Kempton WTW New shaft

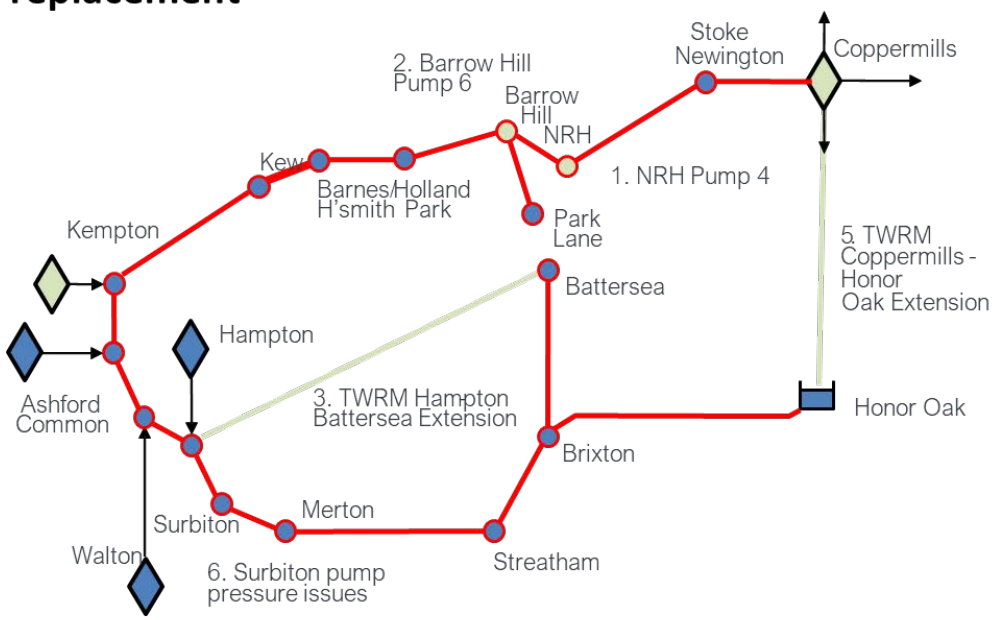
Name	Network Reinforcement – Kempton WTW New shaft
WRSE ID	TWU_WLJ_HI-ROC_NET_ALL_twrm shaft kempton
WRMP19 Reference	NET-TWRM-KEM
Element Type	Network Reinforcement
WRZ	LONDON
Engineering Scope	New shaft on the Thames Water Ring Main to accommodate up to 800Ml/d of treated water flow from the expanded Kempton WTW expansion (800Ml/d).
Engineering Components	The components for this scope are as follows: New shaft on TWRM shaft
Phases/benefits	n/a
Lead Time	7 Years
Mutual exclusivities	No other options on the constrained list are mutually exclusive with this option.
Interdependencies/ Exclusivity	This element is interdependent with the new WTW at Kempton (Kempton WTW expansion) and will be required at the time that the first additional treatment at Kempton is provided.



Network Reinforcement – New River Head Pump 4 replacement

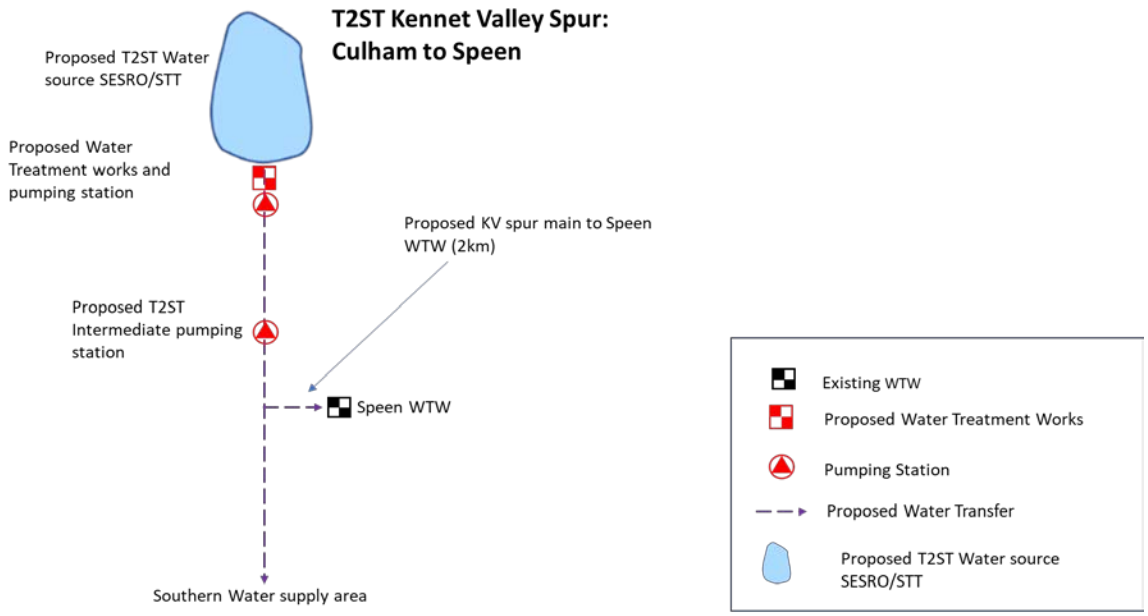
Name	Network Reinforcement - New River Head Pump 4 replacement
WRSE ID	TWU_LON_HI-TFR_LON_ALL_newriverhead pump 4
WRMP19 Reference	NET-TWRM-NRV-PUM
Element Type	Network Reinforcement
WRZ	LONDON
Engineering Scope	Replacement of a pump at the New River Head Shaft on the Thames Water Ring Main with a larger and a suitable pump. The element will be required when additional resources from the west and/or east of the London water resource zone (WRZ) are increased reach a trigger value.
Engineering Components	The components for this scope are as follows: Replacement of the old pump with a larger pump.
Phases/benefits	n/a
Lead Time	5 years
Mutual Exclusivities	None
Interdependencies/ Exclusivity	The network reinforcement is required as new water resources are developed and treated for delivery into the London WRZ to meet demand growth. Additional treated water will be supplied from new WTW at East London and/or Kempton, depending on the resource options developed.

Network Reinforcement – New River Head Pump 4 replacement



T2ST KV Spur: Culham to Newbury (Potable)

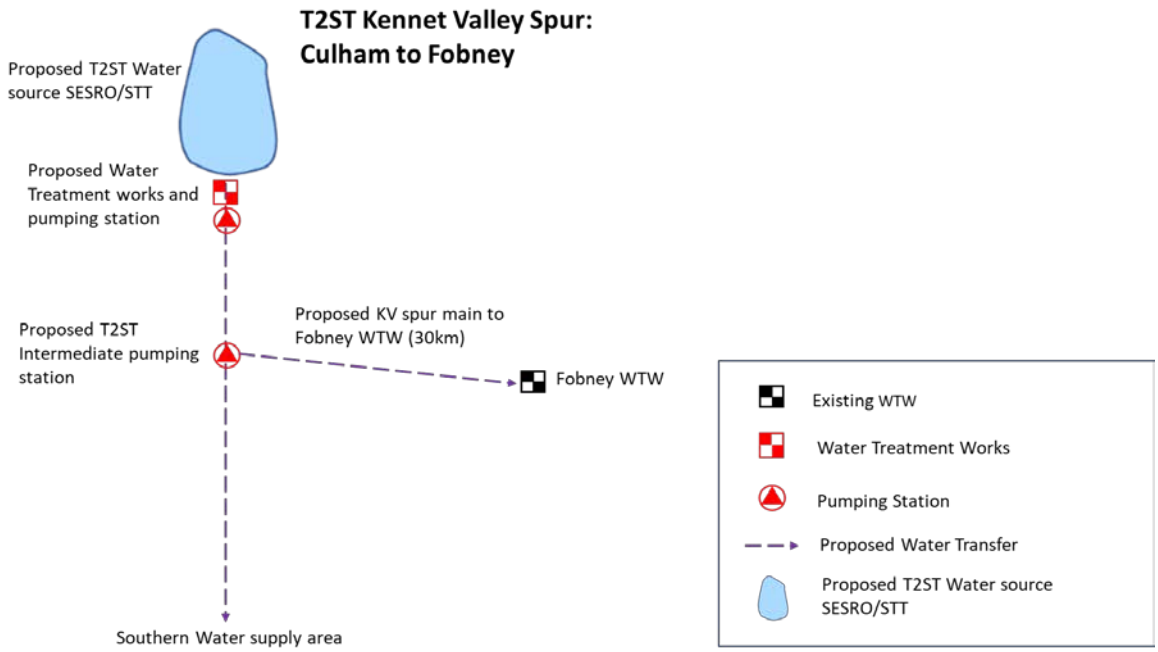
Name	T2ST KV Spur: Culham to Newbury (Potable)
WRSE ID	TWU_KVZ_HI-TFR_T2S_ALL_t2st cul to speen
WRMP19 Reference	n/a option new to WRMP24
Element Type	Network Reinforcement
WRZ	Kennet Valley
Engineering Scope	Treated water spur 10 Ml/d connection from Thames to Southern Transfer (T2ST) pipeline to Speen WTW within the Kennet Valley water resource zone. Pumping head is provided by T2ST pumping station.
Engineering Components	The components for this scope are as follows: • 2km long potable spur connection from T2ST pipeline to Speen WTW.
Phases/benefits	n/a
Lead Time	12 Years (as lead time for T2ST scheme)
Mutual exclusivities	None
Interdependencies/ Exclusivity	This option is dependent on Thames to Southern Transfer being selected.



T2ST KV Spur: Culham to Fobney (Potable)

Name	T2ST KV Spur: Culham to Fobney (Potable)
WRSE ID	TWU_KVZ_HI-TFR_T2S_ALL_t2st cul to fobney
WRMP19 Reference	n/a option new to WRMP24
Element Type	Network Reinforcement
WRZ	Kennet Valley

Name	T2ST KV Spur: Culham to Fobney (Potable)
Engineering Scope	Treated water spur 40 Ml/d connection from Thames to Southern Transfer (T2ST) pipeline to Fobney WTW within the Kennet Valley water resource zone. Pumping head is provided by T2ST pumping station.
Engineering Components	The components for this scope are as follows: • 30km long potable spur connection from T2ST pipeline to Fobney WTW.
Phases/benefits	n/a
Lead Time	12 Years (as lead time for T2ST scheme)
Mutual exclusivities	No other options on the constrained list are mutually exclusive with this option.
Interdependencies/ Exclusivity	This option is dependent on Thames to Southern Transfer being selected.



Demand options: Scheme dossiers

R.17 This section provides the demand options dossiers for options included in the WRSE investment modelling.

R.18 These options were included in the optimisation stage, which resulted in development of demand reduction programmes; this is further described in Section 8 of our dWRMP24, Creating Demand Reduction Programmes.

Metering - Progressive Metering Programme (PMP)

Name	Progressive Metering Programme (PMP)
WRZ	All WRZs
Option Scope	PMP is a compulsory programme of proactive meter installation for unmeasured household customers (customers who do not currently have a water meter). The PMP seeks to install a digital smart meter, which is either: • Advanced Metering Infrastructure (AMI): commonly referred to as a 'smart meter', which sends readings automatically using a secure wireless network when Local Communication Equipment (LCE) and Wide Area Network (WAN) systems are available; or • An Automatic Meter Reading (AMR): these meters are equipped with a short-range radio that communicates with a meter reading device, enabling a 'walk by' or 'drive by' reading. Referred to as 'smart enabled', they have the capability to be switched into AMI mode when LCE and a WAN are available. When a new smart meter is installed it will either be installed: • Externally - a meter is fitted in the pavement at the stop tap position. This has the benefit that the meter will record leakage on the customer's supply pipe aiding quicker pipe repair and the meters are easier to install: • Where there is an existing sufficient sized standard boundary box a screw in meter can be installed. • Where there is not a suitable boundary box, one must be excavated. • Internally - a meter is fitted at the first stop tap inside the property. This location is used if the property does not have an individual supply pipe.
Technical application	Households – all property types including detached, semi-detached and terraced houses and individual dwellings in Mini Bulk (small blocks of flats) and Bulk (large blocks of flats) properties.
Benefit	Reduction in per capita consumption (PCC) through: • Behavioural use change. Previously unmetered customers change water use behaviour after a meter is installed.

Name	Progressive Metering Programme (PMP)
	• Wastage reduction. Metering a previously unmeasured property makes it easier to identify any internal wastage (e.g. leaking toilets or taps.
Option Programme	The meter installation programme will be completed by 2025 (end of AMP8). There will be ongoing maintenance through AMP9 and AMP10 to sustain the level of demand reduction.
Constraints	Meter installation is generally constrained by the location of the meter and the feasibility of installing one. • Location of meter. The ratio of external/internal meter locations varies by property type. Internal meters will usually be installed where a property does not have an individual supply, e.g. dwellings in blocks of flats. • Survey to fit ratio. Prior to meter any meter installation a survey is required to ascertain the most appropriate meter type and location for a property. It is not possible to install meters at all properties for variety of technical, economic and safety reasons.

Metering - Progressive Smart Upgrade Programme Household (HH PSUP)

Name	Progressive Smart Upgrade Programme Household (HH PSUP)
WRZ	All WRZs
Option Scope	The Progressive Smart Upgrade Programme Household (HH PSUP) is a proactive replacement/upgrade from basic meters to smart meters to reduce the total number of basic meters in the Thames Water area (basic meters are meters which require physical access and visual recording of the reading). The basic meters are replaced with smart (AMI) technology meters. When a new smart meter is installed, it will either be installed: • Externally - a meter is fitted in the pavement at the stop tap position. This has the benefit that the meter will record leakage on the customer's supply pipe aiding quicker pipe repair and the meters are easier to install: • Where there is an existing sufficient sized standard boundary box a screw in meter can be installed. • Where there is not a suitable boundary box, one must be excavated. • Internally - a meter is fitted at the first stop tap inside the property. This location is used if the property does not have an individual supply pipe.
Technical application	Households – all property types which contain a basic meter including detached, semi-detached and terraced houses and individual dwellings in Mini Bulk (small blocks of flats) and Bulk (large blocks of flats) properties.

Name	Progressive Smart Upgrade Programme Household (HH PSUP)
Benefit	Leakage reduction through reduced Customer Side Leakage (CSL) reduction. This only applies to externally fitted meters. An externally fitted meter can identify leakage of the supply pipe within a customer's property boundary.
Option Programme	The meter upgrade programme will be completed by 2030 (end of AMP9). There will be ongoing operational activity through AMP10 to sustain the level of demand reduction.
Constraints	The number of basic meters which can be upgraded is dependent on: • The number of existing basic meters and their location, broken down into internal and external meters. • The year of reaching the end of their useful life for basic meters grouped into two categories: • Due in AMP8. Includes both meters that will expire within AMP8 and those which have already expired such as basic meters that were installed more than 10 – 15 years ago • Due in AMP9 to 10 • Survey to fit ratio. The number of properties which are likely to have a successful exchange from a basic to AMI meter • The assumed progress of the HH PSUP meter installations

Metering - Bulk Metered Area (BMA)

Name	Bulk Metered Area (BMA)
WRZ	All WRZs
Option Scope	Bulk Metered Area (BMA) may include a mix of household and non-household customers and: • Feeds 25 or more properties • Can supply multiple buildings • Can have multiple supplies to the BMA • Involves longer and/or more complex pipework (>20m of pipe in London, >50m of pipe in Thames Valley) • Can include metered and unmeasured properties within the BMA The meter fitted to a Bulk Metered Area (BMA) is non-revenue which means it will measure the water supplied but will not be used for billing. Individual premises within a BMA may have individual meters on which they are billed. A Bulk Metered Area (BMA) cannot be created if supplies into the area are already metered with meters used for billing or if the area is fed from more than one District Meter Area (DMA).
Technical application	Bulks – 25 or more properties within multiple buildings and multiple sources. Includes metered, unmeasured, household and non-household.

Name	Bulk Metered Area (BMA)
Benefit	Leakage reduction through reduced Customer Side Leakage (CSL).
Option Programme	The meter installation programme will be completed by the end of AMP9. There will be ongoing operational activity through AMP10 to sustain the level of demand reduction.
Constraints	Bulk meter installation is constrained by the technical limitations of installing such meters.

Metering - Mini Bulk Metered Area (mBMA)

Name	Mini Bulk Metered Area (mBMA)
WRZ	All WRZs
Option Scope	Mini Bulk Metered Area (mBMA) includes a mix of household and non-household customers (particularly sites with flats over a business premises) and; • Feeds up to 25 properties • Supplies one building only • Has a single supply to the mBMA only • Has simple pipe work feeding multiple dwellings in one building (<20m of pipe in London, <50m of pipe in Thames Valley) Can include metered and unmeasured properties within the mBMA The meter fitted to a Mini Bulk Metered Area (mBMA) is non-revenue which means it will measure the water supplied but will not be used for billing. Individual premises within a mBMA may have individual meters on which they are billed. A Mini Bulk Metered Area (mBMA) cannot be created if supplies into the area are already metered with meters used for billing or if the area is fed from more than one DMA.
Technical application	Mini Bulks – a single building with up to 25 properties within, with only a single supply to the mBMA. This includes metered, unmeasured household and non-household properties.
Benefit	Leakage reduction through reduced Customer Side Leakage (CSL).
Option Programme	The meter installation programme is ongoing through AMP8, AMP9 and AMP10.
Constraints	Mini Bulk meter installation is constrained by the technical limitations of installing such meters.

Metering - Progressive Smart Upgrade Programme Non-Household (NHH PSUP)

Name	Progressive Smart Upgrade Programme Non-Household (NHH PSUP)
WRZ	All WRZs
Option Scope	Proactive programme to upgrade basic meters with smart or AMI technology meters.

Name	Progressive Smart Upgrade Programme Non-Household (NHH PSUP)
	Where the Wide Area Network (WAN) is unavailable for non-household properties, an AMI meter shall be fitted.
Technical application	Non-household properties
Benefit	Non Household Consumption (NHH Consumption) reduction and Customer Side Leakage (CSL) reduction.
Option Programme	The meter upgrade programme will be completed by the end of AMP9. There will be ongoing operational activity through AMP10 to sustain the level of demand reduction.
Constraints	Age of meter. Less than 14 years old, 71.58% are basic and should be upgraded. 100% of meters older than 14 years, both internal and external, will be upgraded in AMP8. Location of external meters. It is assumed 10% will require digs to install.

Metering - Metering Innovation - PMP

Name	Metering Innovation - PMP
WRZ	All WRZs
Option Scope	Metering Innovation has two workstreams; Metering Innovation - PMP for properties that have not been metered following PMP and Metering Innovation - PSUP for properties that have not been metered following PSUP. Meter installations are constrained in two areas: • No Access: properties where the customer is not available or will not provide permission for access to install a meter (either internally or externally). • Unmeterable: properties where it is impractical, too expensive or a health and safety risk to provide an installation. Metering Innovation will reduce the number of No Access and Unmeterable properties in the TW area by: • No Access: Metering properties when customers vacate or move into a property • Extend access to customer support for making meter installation appointments • Extend operating hours to customers for meter installation appointments i.e., evenings and weekends • Cover a portion of costs of reinstatement works where external meter impacts a customer drive or garden • Investigate use of higher tariff for ‘no access’ customers Unmeterable Innovation:

Name	Metering Innovation - PMP
	• Use innovative and emerging technologies, such as smaller meters. • Seek funding from regulators to increase limit for meter installs deemed to be expensive.
Technical application	Households – all property types which contain a basic meter including detached, semi-detached and terraced houses and individual dwellings in Mini Bulk (small blocks of flats) and Bulk (large blocks of flats) properties.
Benefit	Reduction in per capita consumption (PCC) through: • Behavioural use change. Previously unmetered customers change water use behaviour after a meter is installed. • Wastage reduction. Metering a previously unmeasured property makes it easier to identify any internal wastage (e.g. leaking toilets or taps). Leakage reduction through reduced Customer Side Leakage (CSL). This only applies to externally fitted meters. An externally fitted meter can identify leakage of the supply pipe within a customer's property boundary.
Option Programme	The programme is ongoing through AMP8, AMP9 and AMP10.
Constraints	The number of total properties, which cannot be metered under the PMP programme, which are either unmeterable due to technical/safety constraints or no access which can be successfully metered under the Metering Innovation - PMP programme.

Metering - Metering Innovation - PSUP

Name	Metering Innovation - PSUP
WRZ	All WRZs
Option Scope	Metering Innovation has two workstreams; Metering Innovation - PMP for properties that have not been metered following PMP and Metering Innovation - PSUP for properties that have not been metered following PSUP. Meter installations are constrained in two areas: • No Access: properties where the customer is not available or will not provide permission for access to install a meter (either internally or externally). • Unmeterable: properties where it is impractical, too expensive or a health and safety risk to provide an installation for upgrading a meter. Metering Innovation will reduce the number of No Access and unmeterable properties in the TW area by: No Access:

Name	Metering Innovation - PSUP
	• Metering properties when customers vacate or move into a property • Extend access to customers for making meter installation appointments • Extend operating hours to customers for meter installation appointments i.e. evenings and weekends • Cover a portion of costs of reinstatement works where external meter impacts a customer drive or garden • Investigate use of higher tariff for 'no access' customers Unmeterable Innovation: • Use innovative and emerging technologies, such as smaller meters. • Seek funding from regulators to increase limit for meter installs deemed to be expensive.
Technical application	Households – all property types which contain a basic meter including detached, semi-detached and terraced houses and individual dwellings in Mini Bulk (small blocks of flats) and Bulk (large blocks of flats) properties.
Benefit	Reduction in per capita consumption (PCC) through: • Behavioural use change • Wastage reduction
Option Programme	Programme is planned to start in AMP9 and continue throughout AMP10.
Constraints	The number of currently considered no access installs (properties currently considered to be unsuitable for installation of a smart meter) that can have a smart meter installed due to innovations.

Water Efficiency - Digital Engagement

Name	Digital Engagement
WRZ	All WRZs
Option Scope	Through digital engagement, smart metered customers will have continuous access to their own water consumption data. Digital Engagement has two parts: **Digital Engagement Portal** • Enables customers to log on and access their smart meter data at their convenience. • Allows customers to track both their water consumption and cost throughout each day. • Allows customers to identify areas where they could save water or money on their bills. **Digital Engagement Advice**

Name	Digital Engagement
	• Assists customers with the interpretation of their smart meter data, including: • Identifying which proportion of consumption may be a leak or internal wastage issue • Identifying peak periods of behavioural usage and recommend water saving tips • Providing context of a customer's consumption impact on the environment and context for the environmental benefits for water saved • Providing advice to find and fix leakage or wastage issues within the home • Encouraging customers to maintain their previous water savings by highlighting any subsequent increase • Alerting customers when they are entering the 'high use' category of consumption
Technical application	Households – all property types including detached, semi-detached and terraced houses and individual dwellings in Mini Bulk (small blocks of flats) and Bulk (large blocks of flats) properties.
Benefit	Reduction in Household Consumption (HH consumption) which includes HH behavioural use reduction and HH wastage reduction.
Option Programme	Programme to be completed by the end of AMP9 and will become a component of the household innovation and tariffs option from AMP10.
Constraints	Number of customers who engage with digital engagement. Digital Engagement will build upon the benefits provided by smart metering (Progressive Metering Programme, Progressive Smart Upgrade Programme and those customers who have opted to have a meter installed). The access to continuous water consumption data is an improvement on what is currently available for customers. The Digital Engagement programme will become a component of the household innovation and tariffs option.

Water Efficiency - Household Innovation and Tariffs

Name	Household Innovation and Tariffs
WRZ	All WRZs
Option Scope	Household Innovation and Tariffs encompasses innovative household activity and future tariffs. From all the options, the critical solution is AMP8 Water Efficiency Innovation Trials as the viability and practicality of other solutions depends on AMP8 investment in trials. **AMP8 Water Efficiency Innovation Trials (new)** Investment in trials of emerging approaches and technology to establish the most cost efficient and viable solutions to achieve long term, sustainable reductions in household Per Capita Consumption

Name	Household Innovation and Tariffs
	(PCC). Specific investment will be made in a trial of non-potable solutions. **Eliminate Wastage (new)** Smart meter data from Progressive Metering Programme (PMP) shows that a greater proportion of consumption is wastage compared with the volume assumed in WRMP19. Even after Progressive Metering Programme (PMP), Smarter Home Visits (SHVs), Wastage Fixes and conducted Digital Engagement programs are completed, some customers will still have internal wastage issues. This option will explore innovative ways to understand and approach the customers to repair any remaining internal wastage issues. **Non-Potable Water Supplies** Non-potable water is water that is not of drinking water quality, but that can be used for other purposes such as toilet flushing, laundry and garden watering to reduce the total demand on potable supply. Schemes which are a combination of rainwater harvesting, stormwater harvesting, and greywater recycling are considered here. **Water Efficiency on Bulk Metered Areas (BMAs) and Mini Bulk Metered Areas (mBMAs) (new)** Bulk Metered Areas (BMAs) and Mini Bulk Metered Areas (mBMAs) may be non-revenue or revenue. Non-revenue Bulk Metered Areas (BMAs) are smart metered for leakage detection and may include individually metered dwellings within the Bulk Metered Area (BMA). Revenue Bulk Metered Areas (BMAs) meter the supply to a multi occupancy building for the purposes of billing the building landlord or managing agent and do not have meters installed on individual premises within that building. This solution involves conducting a smarter home visit and, where required, a wastage repair on dwellings within revenue and non-revenue Bulk Metered Areas (BMAs). This solution will specifically focus on those dwellings without a meter. **Media campaigns** Media campaigns will be designed with overarching messages to provide more focus to link water savings with environmental value and protection in the local area and include the promotion of local activities to help save water. Media campaigns in the shorter term will raise awareness of all Water Efficiency activities and assist to increase the take up of specific water saving initiatives. **New Water Efficiency Innovation** Although there are indications of the types of future household innovation, there are solutions that are yet to be conceptualised. The New Water Efficiency Innovation category includes these solutions and makes an allowance for solutions that will be discovered and developed in the future.

Name	Household Innovation and Tariffs
	Tariffs Tariff charging to encourage water conservation can be implemented by reforming water rates, introducing surcharges, or establishing penalties to deter high water or wasteful water practices. Tariffs are planned to be introduced in 2035, once meter penetration is sufficiently high to ensure fairness in billing to customers.
Technical application	Households – all property types including detached, semi-detached and terraced houses and individual dwellings in Mini Bulk (small blocks of flats) and Bulk (large blocks of flats) properties.
Benefit	Reduction in Household Consumption (HH consumption) which includes HH behavioural use reduction and HH wastage reduction.
Option Programme	Innovate solution trials to take place throughout AMP8. Tariffs are planned to be introduced from 2035, once meter penetration is sufficiently high to ensure fairness in billing to customers.
Constraints	All of the innovation methods are constrained by the types of and success of the innovative methods that are trialled. Some of these are not yet conceptualised. Tariffs are constrained by meter penetration being sufficiently high to ensure fairness in billing to customers.

Water Efficiency - Smarter Home Visit - Progressive Metering Programme (PMP)

Name	Smarter Home Visit - Progressive Metering Programme (PMP)
WRZ	All WRZs
Option Scope	This option offers a Smarter Home Visit (SHV) to customers who are newly smart metered through the Progressive Metering Programme (PMP). Smarter Home Visits offered to those who have requested a smart meter from Thames Water (Optants) and those who have been metered through the Progressive Smart Upgrade Programme Household (HH PSUP) programme are separate options. A Smarter Home Visit (SHV) includes a free home visit by qualified staff to install water saving devices and provide personalised water saving advice to households. It includes an App which is used to produce a tailored water savings report for every customer. This report helps customers to quantify their potential water, energy, and money savings from changing their water use behaviour in the home.
Technical application	Households – all property types including detached, semi-detached and terraced houses and individual dwellings in Mini Bulk (small blocks of flats) and Bulk (large blocks of flats) properties.
Benefit	Reduction in per capita consumption (PCC) through behavioural use change. Smarter Home Visits can also identify wastage fixes, the benefits of which are described in Wastage Fix Demand Option.

Name	Smarter Home Visit - Progressive Metering Programme (PMP)
Option Programme	The Smarter Home Visits be completed by the end of AMP8. There will be ongoing maintenance through AMP9 and AMP10 to sustain the level of demand reduction achieved from the visits.
Constraints	• The Smarter Home Visit - Progressive Metering Programme (PMP) builds upon the Progressive Metering Programme (PMP) • The ratio of high (more than 500l/d) and normal (less than 500l/d) households. Higher use households are particularly targeted as part of the programme • The uptake rate of Smarter Home Visits among eligible households

Water Efficiency - Smarter Home Visit – Optants

Name	Smarter Home Visit – Optants
WRZ	All WRZs
Option Scope	This option offers a Smarter Home Visit (SHV) to customers who are newly smart metered after requesting a meter from Thames Water. Optants are customers who request a meter from Thames Water. Smarter Home Visits offered to those who have been metered through the Progressive Metering Programme (PMP) and Progressive Smart Upgrade Programme Household (HH PSUP) programme are separate options. A Smarter Home Visit (SHV) includes a free home visit by qualified staff to install water saving devices and provide personalised water saving advice to households. It includes an App which is used to produce a tailored water savings report for every customer. This report helps customers to quantify their potential water, energy, and money savings from changing their water use behaviour in the home.
Technical application	Households – all property types including detached, semi-detached and terraced houses and individual dwellings in Mini Bulk (small blocks of flats) and Bulk (large blocks of flats) properties.
Benefit	Reduction in per capita consumption (PCC) through behavioural use change. Smarter Home Visits can also identify wastage fixes, the benefits of which are described in Wastage Fix Demand Option.
Option Programme	The Smarter Home Visits be completed by the end of AMP8. There will be ongoing maintenance through AMP9 and AMP10 to sustain the level of demand reduction achieved from the visits.
Constraints	The Smarter Home Visit – Optants builds upon the base of customers who have requested a meter from Thames Water (Optants).

Water Efficiency - Smarter Home Visit – Progressive Smart Upgrade Programme (PSUP)

Name	Smarter Home Visit – Progressive Smart Upgrade Programme (PSUP)
WRZ	All WRZs
Option Scope	This option offers a Smarter Home Visit (SHV) to customers who are newly smart metered through the Progressive Metering Programme (PSUP). Smarter Home Visits offered to those who have requested a smart meter from Thames Water (Optants) and those who have been metered through the Progressive Metering Programme (PMP) are separate options. A Smarter Home Visit (SHV) includes a free home visit by qualified staff to install water saving devices and provide personalised water saving advice to households. It includes an App which is used to produce a tailored water savings report for every customer. This report helps customers to quantify their potential water, energy, and money savings from changing their water use behaviour in the home.
Technical application	Households – all property types including detached, semi-detached and terraced houses and individual dwellings in Mini Bulk (small blocks of flats) and Bulk (large blocks of flats) properties.
Benefit	Reduction in per capita consumption (PCC) through behavioural use change. Smarter Home Visits can also identify wastage fixes, the benefits of which are described in Wastage Fix Demand Option.
Option Programme	The Smarter Home Visits be completed by the end of AMP9. There will be ongoing maintenance through AMP10 to sustain the level of demand reduction achieved from the visits.
Constraints	The Smarter Home Visit – Progressive Smart Upgrade Programme (PSUP) builds upon the Progressive Smart Upgrade Programme Household (HH PSUP) Metering Option.

Water Efficiency - Wastage Fix

Name	Wastage Fix
WRZ	All WRZs
Option Scope	Wastage Fixes are offered to customers following a Smarter Home Visit (SHV) if they are found to have a leaking toilet or tap.
Technical application	Households – all property types including detached, semi-detached and terraced houses and individual dwellings in Mini Bulk (small blocks of flats) and Bulk (large blocks of flats) properties.
Benefit	Reduction in Household Consumption (HH Consumption) through wastage reductions.
Option Programme	The Wastage fixes be completed by the end of AMP9. There will be ongoing maintenance through AMP10 to sustain the level of demand reduction achieved from the fixes.

Name	Wastage Fix
Constraints	Wastage Fixes result from repairs of leaks on toilets and taps identified through Smarter Home Visits and dependent on the number of Smarter Home Visits through the following Water Efficiency options: • Smarter Home Visit – Progressive Metering Programme (PMP) • Smarter Home Visit - Optants • Smarter Home Visit – Progressive Smart Upgrade Programme (PSUP)

Water Efficiency - Green Redeem

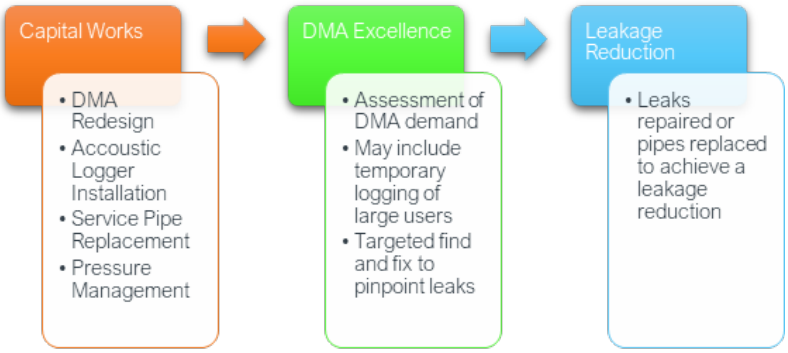
Name	Green Redeem
WRZ	All WRZs
Option Scope	Customers are incentivised to use less water through awarding points that can be exchanged for money off vouchers, charity donations, prize draw entries and days out. Customers are given water reduction targets based on their current usage and are awarded points if they can reach their water saving target, sustain the reduction in water usage and if they exceed their reduction targets.
Technical application	Households – all property types including detached, semi-detached and terraced houses and individual dwellings in Mini Bulk (small blocks of flats) and Bulk (large blocks of flats) properties.
Benefit	Reduction in per capita consumption (PCC) through behavioural use change resulting in lower water consumption.
Option Programme	The programme will be completed by the end of AMP9. There will be ongoing operational activity through AMP10 to sustain the level of demand reduction.
Constraints	Green Redeem is offered to customers who have had a Smarter Home Visit and/or a Smart Meter installed and is therefore dependent on the following other Water Efficiency options: • Smarter Home Visit – Progressive Metering Programme (PMP) • Smarter Home Visit - Optants • Smarter Home Visit – Progressive Smart Upgrade Programme (PSUP) And the following metering options (as well as those who have requested a meter from Thames Water (Optants)): • Progressive Metering Programme (PMP) • Progressive Smart Upgrade Programme Household (HH PSUP)

Water Efficiency - Smarter Business Visits (SBVs)

Name	Smarter Business Visits (SBVs)
WRZ	All WRZs
Option Scope	A free visit by a qualified member of staff to install water saving devices and provide personalised water saving advice to non-households.
Technical application	Non-household properties (businesses)
Benefit	Reduction in non-household consumption (NHH consumption) which is the sum of two subcomponents which includes NHH behavioural use reduction and NHH wastage reduction.
Option Programme	The Smarter Business Visits be completed by the end of AMP8. There will be ongoing operational through AMP9 and AMP10 to sustain the level of demand reduction achieved from the visits.
Constraints	Smarter Business Visits are offered to businesses both through lettering and more targeted groundwork by Thames Water.

Leakage Reduction - Advanced District Metered Area Intervention (DMAi)

Name	Advanced District Metered Area Intervention (DMAi)
WRZ	All WRZs excl. Henley WRZ as the network is in a good condition such that it is possible to detect and understand where leakage is occurring.
Option Scope	Advanced DMAi – Capital Works: • DMA Redesign – involves splitting and reconfiguring DMAs to make it more efficient to pinpoint leaks i.e., ensure there is an appropriate property count, length of pipework and number of meters in each DMA. This will help resolve longstanding network issues and ensure leakage detection and repair can be undertaken. • Acoustic logger installation • Service pipe replacement • Pressure Management: install new pressure management schemes within individual DMAs at sub-DMA level. Advanced DMAi – Operational Works/DMA Excellence: • DMA Excellence: operational component of the work following DMA Redesign. • This includes an assessment of demand in the DMA that looks at the assets, properties, and customer water demand. This may include temporary logging of large customers. • Traditional or innovative find and fix activity is employed to pinpoint leaks. Advanced DMAi – Final Works/Leakage Reduction: • The final stage of Advanced DMAi is to fix the leaks identified to realise the leakage reduction.

Name	Advanced District Metered Area Intervention (DMAi)
	
Technical application	Network
Benefit	Reduction in leakage
Option Programme	The capital programme will be completed throughout AMP8-AMP10. There will be ongoing maintenance and operational activity through AMP11 and AMP12 to sustain the level of leakage reduction achieved.
Constraints	The Advanced DMAi option involves a range of measures which are closely interlinked to create holistic strategies specific to individual DMAs. The availability and suitability of measures in particular DMAs will affect the implementation of others. The three high level work streams of Capital Works, DMA Excellence and Leakage Reduction, all influence and are dependent upon each other.

Leakage Reduction - Leakage Innovation

Name	Leakage Innovation
WRZ	All WRZs
Option Scope	Leakage Innovation includes: • Advanced technologies for precise and accurate leakage detection – artificial intelligence and machine learning applied to pattern recognition • Adoption of keyhole repair techniques • Advanced technologies for precise and accurate leak location – acoustics • Advanced technologies for precise and accurate leakage location – tracer gases • New quality or design of joints so they are leak free – product development • Using technologies for repairing pipes from the inside • Enhanced detection equipment or innovation in detection • Enhanced repair methods or innovation in repair methods

Name	Leakage Innovation
	AMP8 Investment in Innovation Trials In AMP8, investment in trials of innovative technology and leakage reduction and repair trials are foreseen. This investment is crucial to test and demonstrate the most cost-effective innovative solutions prior to their full implementation in later AMPs. • The technology and approach to achieve long term leakage reduction ambitions is either emerging or is yet to be developed. • It is therefore critical to understand the emerging technology and approaches to ensure the deliverability of Leakage innovation.
Technical application	Network
Benefit	Reduction in leakage
Option Programme	The programme is expected to capital works only (which will have a life of greater than 60 years). The programme will run through AMP8 to AMP12. There are no operational maintenance costs associated with this option.
Constraints	The technology and approach required to achieve the long-term leakage reduction ambition is either emerging or is yet to be developed. • The success of innovative techniques that we are currently aware of but have not yet implemented. • The successful development of new innovative techniques that we are currently not aware of and the degree of leakage reduction benefit that they return once implemented.

Leakage Reduction - Mains Rehabilitation

Name	Mains Rehabilitation
WRZ	All WRZs
Option Scope	Water mains rehabilitation is a traditional and long-term sustainable option to reduce leakage from the distribution mains network - which includes over 31,000km of water mains across London and Thames Valley. A lot of London's water mains are between 100 and 150 years old and more likely to leak or burst than modern water supplies, due to increase in road traffic, corrosive soil conditions and ground movement. This option focuses on water mains rehabilitation of the 100–150-year-old Victorian mains in a phased manner. This includes mains replacement, relining and repair.
Technical application	Network
Benefit	Reduction in leakage volume from mains
Option Programme	The programme will run through AMP8-AMP12.

Name	Mains Rehabilitation
Constraints	Particular rehabilitation methods are specific to the situation in each DMA Appropriate where water mains that require either renovating or replacement where leakage issues cannot be addressed by either Advanced DMAi or Leakage Innovation.


Thames
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