



Revised Draft Water Resources Management Plan 2024

Resource Options – Raw Water Transfer Feasibility
Report Addendum



Contents

Executive Summary	1
Introduction	3
Structure of this report	3
Updates since WRMP19	5
Option Identification	5
Feasibility Screening Criteria	5
Feasibility Screening Updates	14
Strategic resource options	23
Updated Feasibility Assessment	25
Feasibility Assessment Approach	25
Stage 1 Assessment Results	25
Stage 2 assessment results	28
Stage 3 assessment results	31
Option Verification and Conclusion	36
Verification	36
Confirmation of feasible list of options:	37
Summary of Further Screening	37
A. Reference information	39
B. Extract from WRMP19 Raw Water Transfers Feasibility Report – Appendix B2	40

Tables

Table 1: Structure of this report	4
Table 2: Criteria for Stage 1	6
Table 3 Criteria for Stage 2 and basis for assessment of site performance	10
Table 4: Criteria for Stage 3 and basis for assessment of site performance	13
Table 5: Option changes since WRMP19	19
Table 6: Option DO changes since WRMP19	22
Table 7: Stage 1 assessment of all options	27
Table 8: Stage 2 assessment of all options (previous)	30
Table 9: Stage 3 assessment	34
Table 10: Potential Raw Water Transfer option combinations	36
Table 11: List of feasible raw water transfer options	37

Executive Summary

- 1 This report provides a summary of changes that have been made to the raw water transfer options since Thames Water's 2019 Water Resources Management Plan (WRMP19) as part of the 2024 Water Resources Management Plan (WRMP24) development.
- 2 This report acts as an addendum to [Thames Water WRMP19 Resource Options Raw Water Transfers Feasibility report, September 2018, Rev 03](#).
- 3 No new raw water transfer options have been identified at WRMP24, however the detail including Deployable Output (DO) has been updated for some of the WRMP19 options. The updated WRMP24 feasibility assessment presents the WRMP19 options and the updated WRMP24 options. The following list of options are the confirmed list of feasible raw water transfer options for WRMP24 (note that resource and conveyance options have been assessed separately):
 - 4 Resource options:
 - CRT BCN Surplus for SWOX
 - CRT BCN Surplus for London
 - Minworth STW effluent and a pipeline to the Avon
 - Mythe WTW unused part of licence
 - Lake Vyrnwy
 - Redeployment of ST Abstractions at Shrewsbury
 - Netheridge STW effluent
 - 5 Conveyance options:
 - Oxford Canal - Farmoor Reservoir
 - Deerhurst to Culham 300
 - Deerhurst to Culham 400
 - Deerhurst to Culham 500
 - Cotswold Canal 300
- 6 The feasibility assessment or screening of the following options has changed since WRMP19.
 - **River Wye to Deerhurst** was offered by Dwr Cymru Welsh Water (DCWW) at WRMP19 as a support option to the Severn Thames Transfer. Since WRMP19 DCWW have withdrawn this option and therefore the option is rejected at Stage 1 and not considered at Stages 2 and 3 feasibility assessments.
 - Following an assessment by Severn Trent Water and United Utilities, the quantity of water that can be made available from **Redeployment of ST Abstractions at Shrewsbury** has been reduced. Two mutually exclusive Redeployment of ST Abstractions at Shrewsbury options were included at WRMP19 with capacities of 12 MI/d or 30 MI/d, for WRMP24 this is offered as a single option of 25 MI/d.
 - WRMP19 considered the **Redeployment of ST Abstractions at Shrewsbury** (Shrewsbury) option to be mutually exclusive to Vyrnwy 180 MI/d. Further work by the Seven Thames Transfer has shown that 25 MI/d of water can be provided by the



Shrewsbury option in addition to 180 MI/d from the Vyrnwy option; therefore, Vyrnwy 180 MI/d and Shrewsbury 25 MI/d are not mutually exclusive in WRMP24.

- Cotswold Canal 300 was rejected at WRMP19, but it has been reconsidered at WRMP24 through the Severn to Thames Transfer Strategic Resource Option (SRO) investigations. These investigations concluded that a canal-based option would not provide best value and a direct pipeline option was preferred. To test this conclusion, across a range of different planning scenarios, the Cotswold Canal 300 MI/d option has been included on the Feasible List. The Cotswold Canal 300 MI/d option was subsequently rejected at Further Screening 1.

¹ Whilst this reflects the assessment and findings for Gate 2 and WRMP24, before any final decisions are made and as part of any future phases of the STT development, the preferred option and other alternatives considered would be subject to further engagement and consultation with stakeholders and also reaffirmation/back checking.

Introduction

- 7 Thames Water is developing options for the 2024 Water Resources Management Plan (WRMP24). These options build on options developed as part of Thames Water’s 2019 Water Resources Management Plan (WRMP19). This report provides a summary of changes that have been made to the Raw Water Transfers options since WRMP19 and as part of WRMP24 development. The report considers the resource and conveyance separately.
- 8 This report acts as an addendum to Thames Water WRMP19 Resource Options, Raw Water Transfers Feasibility Report, September 2018. This report should be read alongside the WRMP19 feasibility report. Information in this report supersedes information provided in the WRMP19 report.
- 9 Changes to the WRMP19 Raw Water Transfers Options have been detailed in Section 2. A backchecking exercise has been completed to assess if any changes are required to the WRMP19 assessment as a result of identification of the new options or developments since WRMP19. Backchecking also provides the opportunity to take into account any changes of circumstance that might affect how an option is considered. This might include a change in the planning or environmental status of a site, changes in national or local planning policy and the emergence of viable technical solutions that were unavailable at the time the original assessment was undertaken.
- 10 This report summarises changes to the Raw Water Transfers options up to the end of feasibility screening. Information on option development, investment modelling and back checking methodology can be found in WRMP24 Section 7 - Appraisal of Resource Options.
- 11 Severn Thames Transfer (STT), was identified by Ofwat as a strategic regional water resource solution (SRO) in the PR19 final determination ([PR19 final determinations: Strategic regional water resource solutions appendix - Ofwat](#)). SROs are being developed through a gated process overseen by the Regulators’ Alliance for Progressing Infrastructure Development (RAPID), further information on STT can be found in the Gate 1 and Gate 2 submissions.

Structure of this report

Table 1 summarises the structure of this report.

Section	Name	Description
	Executive summary	Summary of addendum report
1	Introduction	This section
2	Updates since WRMP19	Summary of the changes made to the options list since WRMP19, including changes to WRMP19 options, new WRMP24 phasing options and changes to Deployable Output (DO).
3	Updated feasibility assessment	Provides a summary of the current feasibility assessment for all options including options identified at both WRMP19 and WRMP24.



Section	Name	Description
4	Option verification and conclusion	Validation of risk and uncertainty for all options and the confirmation of the feasible list of options.
App A	Reference information	A list of useful links and references
App B	Extract from WRMP19 Raw Water Transfers Feasibility Report – Appendix B2	An extract from the WRMP19 Raw Water Transfers Feasibility Report that provides a summary of the promotability of STT options on the basis of their hydrological, water quality and/or ecological effects and risks.

Table 1: Structure of this report

Updates since WRMP19

Option Identification

- 12 To ensure Thames Water is aligned with the Water Resources South East (WRSE) approach, the following updates have been made to option identification for WRMP24:
- The WRMP19 rejection register has been revisited to ensure that the rejection reasoning remains robust for all rejected options.
 - Rejected options have been reviewed to identify any options which should be revisited due to potential for regional benefits, particularly in light of changes in requirements to plan for 1:500 drought resilience (previously 1:200 at WRMP19) and the need to plan for a long-term environmental destination that achieves and maintains a sustainable level of abstraction by 2050 (Section 2.2).
 - A review has been undertaken to identify new options to be considered in addition to the existing WRMP19 options, this did not identify any new Raw Water Transfer options.

Feasibility Screening Criteria

- 13 The following tables detail the criteria used for feasibility screening, which is further detailed in the WRMP19 Raw Water Transfer Feasibility Report. This is a 3 stage process:
- Stage 1 – Option identification and assessment of absolute and other key constraints
 - Stage 2 - Assessment of site performance and compilation of short list
 - Stage 3 - Further detailed assessment
- 14 Stage 1 has two phases:
- Option identification
 - Assessment of the options identified against absolute and other key constraints to the development of a new Raw Water Transfer - the criteria for which is detailed in Table 2. This is a pass / fail assessment for each criterion.
- 15 At stages 2 and 3 the assessed performance of each option is reviewed against a red / amber / green classification system, as
- **Red** – issue or constraint can be overcome, but will be very challenging
 - **Amber** – issue or constraint can be overcome
 - **Green** – no constraint posed
- 16 Additionally, Stage 3 allows for costing of each option to provide a comparison across all water resource options. The Stage 2 criteria are shown in Table 3 and the Stage 3 criteria are shown in Table 4.



Criteria	Meaning of pass or fail
Property/legal criteria	
Water rights (regulatory or legal barriers)	Are there any regulatory or legal barriers that would prevent Thames Water from utilising the resource?
Planning, socio-economic and environmental criteria	
National / international nature conservation sites	Is any part of the scheme likely to impact on an existing conservation site, including SSSI, Ramsar and Special Protection Areas?
National / international heritage sites	Is any part of the scheme likely to impact on an existing Heritage site?
Potential impact on Downstream abstractors	Would the abstraction significantly impact on downstream abstractors or related groundwater sources?
Water availability (CAMS)	Is the resource likely to be available in the short and long term?
Engineering criteria	
Drought resilience	Is the source considered to be particularly vulnerable to drought conditions?
Source quality (treatability)	Is the quality of the source currently treatable, within reasonable cost and technical feasibility?

Table 2: Criteria for Stage 1



CRITERION TITLE	Stage 2 Criteria	Basis for assessment		
		Green	Amber	Red
Ownership and Site Tenancies	<p>Is there sufficient space to build the facilities?</p> <p>Is there sufficient space to accommodate future growth and permit changes?</p>	Existing TW land is available and sufficient unconstrained space is available both for now and the future	Some TW land is available, additional land may also be acquired for treatment sites and / or pipelaying required in private land under Statutory Notice. Space is available but is constrained both now and for the future.	No TW land available. Private land will need to be acquired. Pipelaying required in land that cannot be served with Statutory Notice. No extra space for growth or there is not enough space for the maximum DO.
Estimated Land Acquisition Cost	Are land acquisition costs likely to be reasonable?	Land acquisition costs likely to be relatively low. Agricultural land and isolated properties only affected.	Land acquisition costs likely to be moderate. Local or regional business or other facilities affected in addition to agricultural land.	Land acquisition costs likely to be relatively high. National businesses or land required for statutory agency's business affected in addition to agricultural land
Land Use and Land Use Quality	<p>Can brownfield land be reused?</p> <p>Will Best and Most Versatile Agricultural land be affected?</p> <p>Will existing non-agricultural high value land-uses be affected?</p>	The site will reuse all brownfield land which appears to have low value use.	The site contains some brownfield land to be re-used and is currently occupied by existing business / commercial use.	The site is entirely greenfield or occupied by high value business.
Floodplain Encroachment (loss of floodplain / need for compensation storage)	Percentage of site covered by flood plain	Impact on floodplain likely to be minimal (less than 25% of area to be developed in flood zones 2 and 3) / temporary	Likely impact on floodplain (between 25-50% of area to be developed in flood zones 2 and 3) but impact not considered significant	Significant impact on floodplain (over 50% of the site to be developed within flood zones 2 and 3) considered likely
Landscape Character Sensitivity	Are any landscape designations affected?	No designations likely to be affected or effect likely to be positive. Site unlikely to affect a national landscape designation and not covered by a local landscape designation.	Designation of regional or local importance likely to be affected. The site lies within a locally designated landscape (e.g. Area of Great Landscape Value, Area of High Landscape Value, Strategic Landscape Area).	Designation of national importance likely to be affected. Site lies wholly or partly within or is likely to impact the setting of a national landscape designation (National Park or AONB).



CRITERION TITLE	Stage 2 Criteria	Basis for assessment		
		Green	Amber	Red
Views and Visual Amenity	Are any visually sensitive viewpoints affected?	Important / recognised viewpoints unlikely to be affected. Site lies at a distance greater than 5km from any recognised viewpoint.	Locally visible / locally important views likely to be affected. Site lies at a distance of between 3km and 5km from any recognised viewpoint.	Highly visible / Panoramic views likely to be affected. Site lies at a distance less than 3km from any recognised viewpoints
Nature Conservation and Biodiversity	Are any designated species and / or areas of nature conservation / biodiversity importance affected?	No international / national or regional designations likely to be adversely affected, or effect likely to be positive. Site does not contain sites of nature conservation importance.	Designation of regional or local importance likely to be adversely affected. Site includes or lies within a regionally designated site (Local Nature Reserve).	Designation of international / national importance likely to be adversely affected. Site includes or lies within an internationally or nationally statutory designated site (Special Protection Area, RAMSAR, Site of Special Scientific Interest) and / or site of Ancient Woodland.
Archaeology and Historic Environment	Are any heritage assets affected?	Heritage interest low or unknown.	Designation of regional or local importance likely to be adversely affected. No statutory designated sites present but site contains known non designated heritage assets.	Nationally Designated Heritage Assets likely to be affected. Site includes an international / national heritage asset (Grade II*, Grade II Listed Building), Registered Historic Park or Garden, Listed battlefield site, conservation area.
Non-traffic Impact of Construction on Local Residents	Will construction activities (excluding traffic impacts) affect local residents within a 350m radius of the site?	Less than 100 residential properties likely to be affected by construction.	Between 100 and 299 residential properties likely to be affected by construction.	More than 300 residential properties likely to be affected by construction.
Impact on Residential Dwellings	Will construction activities result in the loss of residential dwellings?	No residential dwellings located within the site.	Up to 10 residential dwellings located within the site.	More than 10 residential dwellings located within the site
Impact of Construction on Local Traffic	Will construction traffic affect local roads / built up areas?	Route largely not through built up areas and / or likely to have limited impacts on local traffic.	Route partly through built up areas and / or likely to have moderate impacts on local traffic.	Route predominantly through built up areas and / or likely to have substantial impacts on local traffic.
Recreational Benefit	Will people benefit from provision of a recreational resource?	New resource with potential to create additional recreational benefit	Maintain recreational benefit	No recreational benefit



CRITERION TITLE	Stage 2 Criteria	Basis for assessment		
		Green	Amber	Red
Impact on Recreation	Are recreational sites or rights of way affected?	No recreational resource / right of way disrupted or affected. Sites with no formal recreational activities	Recreational resource / right of way of local importance disrupted or affected. The site is likely to affect public rights of way.	Recreational resource / right of way of national or regional importance disrupted or affected. The site is likely to affect major recreational activities.
Water Resources & Water Quality	Are there likely impacts on water resources and water quality, including Water Framework Directive targets?	Minor adverse impacts likely; no deterioration to WFD status	Moderate adverse impacts likely; low risk of deterioration to WFD status	Major adverse impacts likely; high risk of deterioration to WFD status
Length of Conveyance	Total length of any pipe conveyance, as the crow flies.	Length of pipe conveyance is <50km	Length of pipe conveyance is in range 50 - 100km	Length of pipe conveyance is >100km and overall length of conveyance is >400km
Pumping Head	Pumping head - Is the pumping head significant?	The pumping head is <100m	The pumping head is between 101m-300m	The pumping head is in excess of 300m
Water Source and Availability	Uncertainty around deployable output from resource; Uncertainty around availability of recharge water (for AR / ASR)	Deployable output guaranteed in all scenarios	Deployable Output is affected by one or two issues that are expected to be resolved	Deployable Output is affected by more than two issues or one issue that is unlikely to be resolved
Access during Construction and Operation	Are the means of access suitable, both for construction and operation?	Existing access arrangements are available and suitable for both construction and operation	Existing access will be suitable for operations, temporary modifications will be needed for construction activities	Existing access will require significant modification to make it suitable for both construction and operation
Resilience	Is the resource scheme resilient to climate change and other external pressures?	Good resilience	Moderate resilience	Poor resilience
Connectivity to Waste System	Connectivity to wider infrastructure system including for any waste streams	The site is less than 5km from the discharge location. The site is located adjacent to the wider infrastructure (waste stream)	The site is between 10-25km from the discharge location. The site is located less than 5km of the wider infrastructure (Waste stream)	The site is greater than 25km from the discharge location. The site is located more than 5km from the wider infrastructure system (Waste stream)



CRITERION TITLE	Stage 2 Criteria	Basis for assessment		
		Green	Amber	Red
Construction Complexity	Are there adverse ground conditions / large number of major crossings?	No major crossings required or contaminated land risks identified	1-10 major crossings required or contaminated land risks identified	> 10 major crossings required or significant contaminated land risks identified.
Operational Complexity	Does the element require operational capabilities that are outside TW standard operating practices or outside TW supply area	No issues / Typical O&M procedures.	Operation of average complexity, with relatively complex processes / operations and requirement for relatively substantial O&M procedures.	Operation of high complexity, with complex processes / operations and requirement for major O&M procedures at regular intervals.

Table 3 Criteria for Stage 2 and basis for assessment of site performance



Criterion	Stage 3 criteria	Basis of assessment		
		Green	Amber	Red
Property and legal criteria				
Ownership of site and tenancies	Assessment of ownership and tenancy constraints to any development	Land involved is under a single freehold title	Land involved has between 1 and 5 titles	More than 5 land titles involved
Planning, socio-economic and environmental criteria				
Planning policy & history	Review of Local Plan planning policy designations and planning applications	The site is not allocated for significant development, there are no significant permissions or submitted applications, there are no policy constraints or the site benefits from positive policy support for reservoir development	The site has some policy constraints not considered significant and no significant permissions or applications. The site has significant permissions or applications but also benefits from positive policy support for reservoir development	The site or immediate area is allocated for significant development or has significant policy constraints. Extant planning permission or planning application has been submitted for significant development
Land use and land use quality	Extent of land take and land quality, greenfield vs brownfield mix	Construction is entirely within brownfield sites	Short term effects during construction phase only on greenfield sites	Permanent effects on greenfield sites as a result of reservoir development
Floodplain encroachment (loss of floodplain / need for compensation storage)	Are there likely effects on the floodplain?	No constraint posed	Issue or constraint can be overcome	Issue or constraint can be overcome, but will be very challenging
Landscape character sensitivity	Extent to which likely effects on landscape character & designations may be mitigated	No mitigation required	Mitigation may be employed to reduce impacts to an acceptable level	Adverse effects cannot be mitigated or constraint overcome resulting in adverse effects post mitigation
Views and visual amenity	Extent to which likely effects on visually sensitive receptors may be mitigated	No mitigation required	Mitigation may be employed to reduce impacts to an acceptable level	Adverse effects cannot be mitigated or constraint overcome resulting in adverse effects post mitigation
Employment and local economy	Extent of construction and operational effects on employment & local economy	No loss of employment	Loss of land anticipated to provide a low density of employment opportunities (for example, fields	Loss of land anticipated to provide a high density of employment



Criterion	Stage 3 criteria	Basis of assessment		
		Green	Amber	Red
			that appear to be used for agricultural purposes)	opportunities (for example, a business park)
Nature conservation and biodiversity	Are there likely effects on sites / habitats and protected species	No constraint posed	Issue or constraint can be overcome	Issue or constraint can be overcome, but will be very challenging
Opportunity for biodiversity improvement	Extent of any opportunities for biodiversity enhancement	Site has potential improvement opportunities for both watercourse and woodlands	Site has potential improvement opportunities for either a watercourse or woodlands	No potential for improvement is possible
Archaeology and historic environment	Are there likely effects on heritage assets, including overall setting	No constraint posed	Issue or constraint can be overcome	Issue or constraint can be overcome, but will be very challenging
Non-traffic impact of construction on local properties	Potential to mitigate non-traffic construction impacts on local properties	No constraint posed	Issue or constraint can be overcome	Issue or constraint can be overcome, but will be very challenging
Impact on recreation	Are there likely effects on recreational activities	No constraint posed	Issue or constraint can be overcome	Issue or constraint can be overcome, but will be very challenging
Water resources & water quality	Are there likely impacts on water resources and water quality, including Water Framework Directive targets?	No constraint posed	Issue or constraint can be overcome	Issue or constraint can be overcome, but will be very challenging
Engineering criteria				
Length of conveyance	Length of conveyance route (s) and scale (pipe diameter or equivalent)	Very limited need to transfer water in new conveyance (e.g. abstraction and treatment on the same site)	Moderately long or large diameter water transfer conveyance, making use of existing infrastructure where possible	Long water transfer conveyance which is comprised of entirely new infrastructure and / or large diameter and / or significant tunnelling
Normalised cost	£/m ³	< £1.00/m ³	> £1.00/m ³ , <£1.50/m ³	> £1.50/m ³



Criterion	Stage 3 criteria	Basis of assessment		
		Green	Amber	Red
Water source and availability	Constraints on water source utilisation / availability	Availability of water is well understood and not dependent on other constraints	Availability of water is well understood but dependent on other constraints	Significant constraints on the water availability
Water treatability / process complexity	Water treatment risks and complexity of required water treatment	Sufficient water quality data is available. No concerns highlighted with respect to water quality, standard treatment process to be employed	Water quality data is available although may have some limitations in terms of duration / frequency / parameters. Some concerns with water quality although relatively simple to treat	Limited water quality data is available in terms of duration / frequency / parameters. Significant concerns regarding water quality, risks remain about ability to treat.
Power supply	Is sufficient power available to power the site?	Existing power supply to the site is adequate	Existing power supply is not adequate, power supply can be brought into the site relatively simply	New power supply required which would be very difficult to achieve
Construction complexity	More detailed review of construction requirements	Construction complexity is anticipated to have no significant impacts on construction programme and cost	Construction complexity is anticipated to have minor impacts on construction programme and cost	Construction complexity is anticipated to have major impacts on construction programme and cost

Table 4: Criteria for Stage 3 and basis for assessment of site performance



Feasibility Screening Updates

- 18 The overall changes to options and approach since WRMP19 are described in WRMP 24 Section 7 Appraisal of Resource Options. Specific changes applicable to Raw Water Transfers are detailed in Table 5 and Table 6. These tables should be read alongside the WRMP19 feasibility report.



WRMP19 Option Reference and name	WRSE ID Option Reference and name	Changes to the Option	WRMP19 feasibility outcome	WRMP24 feasibility outcome
STT – Raw Water Transfer Deerhurst to Culham 300 MI/d (Lon only) CON-RWT-DEH-CLM-300	STT – Raw Water Transfer Deerhurst to Culham 300 MI/d (Lon only) TWU_STT_HI-IMP_STT_CNO_sttpipe300(lon)	Through the SRO project the pipeline route has been further refined, this has not changed the screening decision. Refer to STT Gate 2 submission for development of the engineering design and environmental assessment since WRMP19.	Option passed screening and included on Feasible List	Option passed feasibility screening and is included on Feasible List
STT – Raw Water Transfer Deerhurst to Culham 400MI/d (Lon only) CON-RWT-DEH-CLM-400	STT – Raw Water Transfer Deerhurst to Culham 400MI/d (Lon only) TWU_STT_HI-IMP_STT_CNO_sttpipe400(lon)	Through the SRO project the pipeline route has been further refined, this has not changed the screening decision. Refer to STT Gate 2 submission for development of the engineering design and environmental assessment since WRMP19.	Option passed screening and included on Feasible List	Option passed feasibility screening and is included on Feasible List
STT – Raw Water Transfer Deerhurst to Culham 500MI/d (Lon only) CON-RWT-DEH-CLM-500	STT – Raw Water Transfer Deerhurst to Culham 500MI/d (Lon only) TWU_STT_HI-IMP_STT_ALL_sttpipe	Through the SRO project the pipeline route has been further refined, this has not changed the screening decision. Refer to STT Gate 2 submission for development of the engineering design and environmental assessment since WRMP19.	Option passed screening and included on Feasible List	Option passed feasibility screening and is included on Feasible List



WRMP19 Option Reference and name	WRSE ID Option Reference and name	Changes to the Option	WRMP19 feasibility outcome	WRMP24 feasibility outcome
Minworth STW to River Avon 115 MI/d Phase 2	<p>Minworth STW effluent diversion (115Mld)</p> <p>TWU_STT_HI-REU_RE1_ALL_c7-300-minworth_115</p> <p>TWU_STT_HI-REU_RE1_ALL_c11-300-min_115_p2</p> <p>TWU_STT_HI-REU_RE1_ALL_p7-300-minworth_115</p> <p>TWU_STT_HI-REU_RE1_ALL_p11-300-min_115_p2</p> <p>TWU_STT_HI-REU_RE1_ALL_p7-400-minworth_115</p> <p>TWU_STT_HI-REU_RE1_ALL_p11-400-min_115_p2</p> <p>TWU_STT_HI-REU_RE1_ALL_p7-500-minworth_115</p> <p>TWU_STT_HI-REU_RE1_ALL_p11-500-min_115_p2</p>	<p>At WRMP19 the option was a single phase of 115 MI/d. At WRMP24 option has been split into two Phases: Phase 1 58MI/d and Phase 2 57 MI/d. The option can either be delivered in phases or with the full capacity as a single phase.</p> <p>Refer to the Minworth SRO Gate 2 submission for development of the engineering design and environmental assessment since WRMP19.</p>	Option passed screening and included on Feasible List	Option passed feasibility screening and is included on Feasible List
Cotswold Canal 300 MI/d (Do Min) - with treatment	<p>Cotswold Canal 300 MI/d (Do Min) - with treatment</p> <p>TWU_STT_HI-IMP_STT_ALL_sttcanal</p>	Under the scope of works agreed with Ofwat for STT SRO option, Cotswold Canal has been reviewed as an option. At WRMP24 a number of different options have been considered for Cotswold Canal, further information on the Canal options can be found in the STT Gate 2 Report.	The Canal option was rejected at WRMP19 by comparison with the Deerhurst Pipeline STT	The SRO investigations concluded that a canal-based option would not provide best value and a direct pipeline option was preferred. To test this conclusion, across a range of different planning scenarios at Further Screening, the option has been included on the Feasible List.



WRMP19 Option Reference and name	WRSE ID Option Reference and name	Changes to the Option	WRMP19 feasibility outcome	WRMP24 feasibility outcome
Lake Vyrnwy (United Utilities) – 180 MI/d RES-RWTS-VYR-180	Raw Water Transfer Upper Severn Vyrnwy 180 MI/d (Lon only) ²	At WRMP19 Vyrnwy resource option supplied 180 MI/d through direct release to the river. Further investigations have shown that there are unacceptable environmental impacts associated with a direct release of 180 MI/d. WRMP24 therefore includes a maximum direct release to the River Vyrnwy of 25 MI/d with the rest of the flow being released through a bypass pipeline. Further details of investigations can be found in the STT SRO Gate 2 submission. Three capacity options were offered at WRMP19 (60, 148 or 180 MI/d), at WRMP24 this has increased to seven capacity options (25, 50, 80, 110,140, 160 or 180 MI/d).	Option passed screening and included on Feasible List	Option passed feasibility screening and is included on Feasible List

² Canal support

TWU_STT_HI-RAB_RE1_ALL_c4-300-vyrnwy_50 / TWU_STT_HI-RAB_RE1_ALL_c5-300-vyrnwy_75 / TWU_STT_HI-RAB_RE1_ALL_c9-300-vyrnwy_100_b / TWU_STT_HI-RAB_RE1_ALL_c7-300-vyrnwy_135_b / TWU_STT_HI-RAB_RE1_ALL_c8-300-vyrnwy_155_b / TWU_STT_HI-RAB_RE1_ALL_c10-300-vyrnwy_180_b
 300 MI/d pipeline
 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
 400 MI/d pipeline
 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
 500 MI/d pipeline
 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_p9-500-vyrnwy_100_b / 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 Option Reference and name	WRSE ID Option Reference and name	Changes to the Option	WRMP19 feasibility outcome	WRMP24 feasibility outcome
Netheridge STW to River Severn 35 MI/d RES-RWTS-NTH	Netheridge STW effluent diversion (35MI/d) - Deerhurst Pipeline TWU_STT_HI-REU_RE1_ALL_c3-300-neth_c35 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	The discharge locations for Netheridge resource option have been reviewed. At WRMP19 the discharge location was selected to suit a pipeline STT option. An alternative, additional discharge location has been identified for WRMP24 to suit a canal transfer STT option Further details of investigations can be found in the STT SRO Gate 2 submission. Netheridge is assumed to supply the sweetening flow for the STT interconnector and is therefore required to be implemented at the same time as the interconnector.	Option passed screening and included on Feasible List	Option passed feasibility screening and is included on Feasible List
Redeployment of Severn Trent Water Abstraction at Shrewsbury 12MI/d – RES-RWTS-SHR-12	River Vyrnwy Mitigation – Shrewsbury Redeployment (25MI/d) TWU_STT_HI-RAB_RE1_ALL_c6-300-shrewsbury_25 TWU_STT_HI-RAB_RE1_ALL_p6-300-shrewsbury_25 TWU_STT_HI-RAB_RE1_ALL_p6-400-shrewsbury_25 TWU_STT_HI-RAB_RE1_ALL_p6-500-shrewsbury_25	Shrewsbury resource option has been reviewed and maximum capacity reduced to 25 MI/d. This has been offered as a single option (12 MI/d and 30 MI/d options were offered at WRMP19). At WRMP19 Shrewsbury was mutually exclusive with a Vyrnwy 180 MI/d options, i.e. Vyrnwy and Shrewsbury were considered to have a combined limit of 180 MI/d. Further work has shown that 25 MI/d can be supplied in addition to 180 MI/d from Lake Vyrnwy. Further details of investigations can be found in the STT SRO Gate 2 submission.	Option passed screening and included on Feasible List	Option passed feasibility screening and is included on Feasible List



WRMP19 Option Reference and name	WRSE ID Option Reference and name	Changes to the Option	WRMP19 feasibility outcome	WRMP24 feasibility outcome
Oxford Canal - BCN Surplus – Raw Water Transfer Resource (Duke's Cut) RES-RWTS-OXC-DKC-15	Oxford Canal - Cropredy resource TWU_UTC_HI-IMP_UTC_ALL_oxcanal-cropredy	Further environmental investigations have been completed at WRMP24 and the option has been further developed however this has not resulted in any changes to the option screening.	Option passed screening and included on Feasible List	Option passed feasibility screening and is included on Feasible List
Oxford Canal - BCN Surplus – Raw Water Transfer Resource (Cropredy) RES-RWTS-OXC-CRP-15	Oxford Canal - Duke's Cut (SWOX) TWU_SWX_HI-IMP_SWX_ALL_oxc-dukes-cutswox	Further environmental investigations have been completed at WRMP24 and the option has been further developed however this has not resulted in any changes to the option screening.	Option passed screening and included on Feasible List	Option passed feasibility screening and is included on Feasible List

Table 5: Option changes since WRMP19



WRMP19 Option Name	WRMP24 Option Name	WRMP19 DO (MI/d) ³		WRMP24 DO (MI/d)			Difference (MI/d)		Impact on Feasibility Assessment Scoring
		Average	Peak	1 in 2 average	1 in 500 average	1 in 500 peak	Average	Peak	
Lake Vyrnwy (United Utilities) – 180 MI/d	Lake Vyrnwy – 180 MI/d – STT resource	89/101/101		0	112	160	14	14	No impact on feasibility assessment Note : DO is cumulative
n/a	Lake Vyrnwy - 160 MI/d – STT resource	n/a	n/a	0	100	141	n/a	n/a	No impact on feasibility assessment Note : DO is cumulative
Lake Vyrnwy (United Utilities) – 148 MI/d	n/a	73/83/83		n/a	n/a	n/a	n/a	n/a	
n/a	Lake Vyrnwy - 140 MI/d – STT resource	n/a	n/a	0	87	123	n/a	n/a	No impact on feasibility assessment Note : DO is cumulative
n/a	Lake Vyrnwy - 110 MI/d – STT resource	n/a	n/a	0	68	96	n/a	n/a	No impact on feasibility assessment Note : DO is cumulative
n/a	Lake Vyrnwy - 80 MI/d – STT resource	n/a	n/a	0	48	68	n/a	n/a	No impact on feasibility assessment Note : DO is cumulative
Lake Vyrnwy (United Utilities) – 60 MI/d	n/a	30/34/34		n/a	n/a	n/a	n/a	n/a	No impact on feasibility assessment
n/a	Lake Vyrnwy - 50 MI/d – STT resource	n/a	n/a	0	29	41	n/a	n/a	No impact on feasibility assessment

³ From WRMP19, Section 7, Table 7.3



WRMP19 Option Name	WRMP24 Option Name	WRMP19 DO (MI/d) ³		WRMP24 DO (MI/d)			Difference (MI/d)		Impact on Feasibility Assessment Scoring
		Average	Peak	1 in 2 average	1 in 500 average	1 in 500 peak	Average	Peak	
n/a	Lake Vyrnwy - 25 MI/d – STT resource	n/a	n/a	0	13	18	n/a	n/a	No impact on feasibility assessment
Minworth STW to River Avon 115 MI/d	Minworth STW effluent diversion (58MI/d) – phase 1	58/64/64		37	37	53	n/a	n/a	No impact on feasibility assessment
	Minworth STW effluent diversion (115MI/d) – Phase 2 (cumulative)			74	74	103	n/a	n/a	No impact on feasibility assessment Note : DO is cumulative
Netheridge STW to River Severn 35 MI/d	Netheridge STW effluent diversion (35MI/d)	23/24/24		24	24	34	11	11	No impact on feasibility assessment
Redeployment of Severn Trent Water Abstraction at Shrewsbury 12MI/d	River Vyrnwy Mitigation – Shrewsbury Redeployment (25MI/d)	6/7/7		14	14	19	n/a	n/a	Note DO from WRMP19 and WRMP24 cannot be directly compared as the capacity of the option has changed
Redeployment of Severn Trent Water Abstraction at Shrewsbury 30MI/d		15/17/17							No impact on feasibility assessment
Mythe WTW – unused part of licence (Severn Trent Water)	Raw Water Transfer Mythe 15 MI/d Deerhurst to Culham	12	12	10	10	14	-2	-2	No impact on feasibility assessment



WRMP19 Option Name	WRMP24 Option Name	WRMP19 DO (MI/d) ³		WRMP24 DO (MI/d)			Difference (MI/d)		Impact on Feasibility Assessment Scoring
		Average	Peak	1 in 2 average	1 in 500 average	1 in 500 peak	Average	Peak	
Oxford Canal - BCN Surplus – Raw Water Transfer Resource (Duke’s Cut	Oxford Canal - Duke's Cut (SWOX)	12	12	12	12	12	-	-	
Oxford Canal - BCN Surplus – Raw Water Transfer Resource (Croppedy)	Oxford Canal - Croppedy resource	11	11	10.3	10.3	10.3	-0.7	-0.7	No impact on feasibility assessment

DO = Deployable Output

Table 6: Option DO changes since WRMP19

21 For WRMP24 as part of the STT scheme, Lake Vyrnwy support water has been defined as available for drought conditions only with the assumption that this support would be needed up to approximately 15% of the time. The North West Transfer SRO, including the Vyrnwy enabling works and backfill options, was designed to be utilised under these conditions. It has not been offered to WRSE at utilisation levels equivalent to a 1:2 year event. Future assessments could potentially explore the availability of Lake Vyrnwy water in different amounts at higher utilisation levels, for different drought return periods.

Strategic resource options

22 The Severn to Thames Transfer (STT) was identified as a strategic resource option (SRO) by Ofwat. Alongside WRMP24 work STT is being developed through the Ofwat Gate process. Details of option development can be found in the STT Gate 1 and Gate 2 Reports.

23 This section provides a high level summary of the key changes made in WRMP24.

Cotswold Canal 300 MI/d

24 Cotswold Canal was rejected at Stage 3 in WRMP19. In WRMP24, under the scope of works agreed with Ofwat for STT SRO option, the Cotswold Canal has been reviewed. At WRMP24 a number of different options have been considered for Cotswold Canal, further information on the Canal options can be found in the STT Gate 2 submission.

25 These investigations concluded that a canal-based option would not provide best value and a direct pipeline option was preferred. To test this conclusion, across a range of different planning scenarios, the option has been included on the Feasible List

Lake Vyrnwy (United Utilities) – 180 MI/d

26 At WRMP19 Vyrnwy resource option supplied 180 MI/d through direct release to the river. Further investigations have shown that there are unacceptable environmental impacts associated with a direct release of 180 MI/d. WRMP24 therefore includes a maximum direct release to the River Vyrnwy of 25 MI/d with the rest of the flow being released through a bypass pipeline.

27 Three capacity options were offered at WRMP19 (60, 148 or 180 MI/d), at WRMP24 this has increased to seven capacity options (25, 50, 80, 110, 140, 160 or 180 MI/d).

28 Further details of investigations can be found in the STT SRO Gate 2 submission⁴.

Netheridge STW to River Severn - 35 MI/d

29 The discharge locations for Netheridge resource option have been reviewed. At WRMP19 the discharge location was selected to suit a pipeline STT option. An alternative, additional discharge location has been identified for WRMP24 to suit a canal transfer STT option Further details of investigations can be found in the STT SRO Gate 1 and 2 submissions.

30 Netheridge is assumed to supply the sweetening flow for the STT interconnector and is therefore required to be implemented at the same time as the interconnector.

River Vyrnwy Mitigation – Shrewsbury Redeployment (25MI/d)

31 Shrewsbury resource option has been reviewed and maximum capacity reduced to 25 MI/d. This has been offered as a single option (12 MI/d and 30 MI/d options were offered at WRMP19).

32 At WRMP19 Shrewsbury was mutually exclusive with a Vyrnwy 180 MI/d options, i.e. Vyrnwy and Shrewsbury were considered to have a combined limit of 180 MI/d. Further work has shown that 25 MI/d can be supplied from Shrewsbury in addition to 180 MI/d from Lake Vyrnwy.

⁴ <https://www.thameswater.co.uk/about-us/regulation/strategic-water-resource-solutions/water-transfer-from-the-river-severn-to-the-river-thames>



33 Further details of investigations can be found in the STT SRO Gate 2 submission.

Updated Feasibility Assessment

Feasibility Assessment Approach

- 34 This section of the report outlines the updates made in WRMP24 to the WRMP19 feasibility assessment. This should be read alongside the WRMP19 Raw Water Transfers feasibility report. Where options have been rejected through the screening process the rejection reason is recorded in the WRMP24 Appendix Q - Scheme rejection register.
- 35 A three-stage feasibility screening approach was taken at WRMP24, this approach is unchanged from WRMP19, details of the approach can be found in the WRMP19 Raw Water Transfers feasibility report.
- 36 At WRMP19, fine screening was undertaken for all options which passed the feasibility screening. The WRMP19 fine screening took account of the estimated volume of water resource needed by Thames Water and, where applicable, neighbouring companies. However, the potential water resources need for the region at WRMP24 is significantly higher than at WRMP19, owing to increased sustainability reduction assumptions as well as a shift to 1:500 level of drought resilience. Furthermore, new transfers identified by WRSE would potentially allow new resource options in the Thames Water supply area to supply more WRSE WRZs than were considered at WRMP19 when estimating potential resource needs. For these reasons, the forecast resource need is not being used as a consideration in the screening process at WRMP24. This is to avoid rejecting options based on Thames Water's need where there could be a regional benefit. At WRMP24 the fine screening stage has therefore been replaced by use of the WRSE investment model to compare options against cost, environmental, and resilience criteria.
- 37 At WRMP19 the raw water transfer options were split into elements: Water Resource / Support elements and Conveyance elements. The water resource and conveyance elements were assessed separately and the Stage 1 assessment focused on the resource options, with Conveyance elements first considered in Stage 2.

Stage 1 Assessment Results

- 38 At WRMP19 a total of 16 water resource options were identified through the top-down and bottom-up investigations for assessment at Stage 1.
- 39 Where changes have been made to WRMP19 RAG status this is indicated in Table 7.
- 40 River Wye to Deerhurst has not been reviewed at WRMP24 as Dwr Cymru Welsh Water have withdrawn the offer of water. This option is therefore not included in WRMP24.
- 41 The Stage 1 assessment of all options is presented in Table 7 according to the assessment of the criteria described in the WRMP19 Raw Water Transfer feasibility report. Nine water resource options passed the Stage 1 assessment.

Ref	Water Resource	WRSE ID	WRMP 19 ID	Water Rights	National / International Nature Conservation Sites	National / International Heritage Sites	Potential Impact on Downstream Abstractors	Water Availability (CAMS status)	Resilience to Drought	Source Water Quality (Treatability)	Pass / Fail
R1	Kielder Reservoir	TWU_LON_HI-IMP_NES_ALL_kielder reservoir	N/A								Pass
R2	River Wye to Deerhurst	TWU_STT_HI-IMP_STT_ALL_welshwaterwy valley	RES-RWTS-WYE-60.3	Offer withdrawn by DCWW and not assessed							
R3	Great Spring	N/A	N/A		Insufficient information available	Insufficient information available	Insufficient information available	Insufficient information available	Insufficient information available		Fail
R4	Craig Goch Reservoir expansion (Based on historical option)	N/A	N/A								Fail
R5	CRT Bradley groundwater abstraction	TWU_LON_HI-IMP_SVE_ALL_crt bradley-gw	N/A								Fail
R6	River Severn (independent unsupported River Severn resource option, without support options)	TWU_LON_HI-IMP_SVE_ALL_rivsevern(unsupp)	N/A								Pass
R7	Minworth STW effluent to River Avon	TWU_STT_HI-REU_RE1_ALL_c7-300-minworth_115	RES-RWTS-MIN								Pass
R8	Netheridge STW Effluent Transfer	TWU_STT_HI-REU_RE1_ALL_p5-300-neth_p35	RES-RWT-NTH								Pass
R9	Mythe	TWU_STT_HI-RAB_RE1_ALL_c2-300-mythe_15	RES-RWT-MYT-15								Pass
R10	Lake Vyrnwy	TWU_STT_HI-RAB_RE1_ALL_c4-300-vyrnwy_50 TWU_STT_HI-RAB_RE1_ALL_c5-300-vyrnwy_75 TWU_STT_HI-RAB_RE1_ALL_c7-300-vyrnwy_135_b TWU_STT_HI-RAB_RE1_ALL_c8-300-vyrnwy_155_b	RES-RWT-VYR180-180								Pass
R11	Longdon Marsh reservoir to support River Severn abstraction	N/A	N/A								Pass
R12	Use of a new Thames reservoir if successfully promoted to support River Severn abstraction	N/A	N/A		Specific site to be assessed at Stage 2	Specific site to be assessed at Stage 2					Fail
R13	Use of Farmoor Reservoir to enable benefit from a River Severn transfer	N/A	N/A								Fail



Ref	Water Resource	WRSE ID	WRMP 19 ID	Water Rights	National / International Nature Conservation Sites	National / International Heritage Sites	Potential Impact on Downstream Abstractors	Water Availability (CAMS status)	Resilience to Drought	Source Water Quality (Treatability)	Pass / Fail
R14	CRT BCN surplus	TWU_SWX_RE-DRP_ALL_ALL_dp-oxford canal-swox	RES-RWTS-OXC-CRP-15 CON-RWS-DKC-FMR								Pass
R15	Minworth Canal Transfer	TWU_LON_HI-TFR_SVE_ALL_canalminworth-thames	N/A		Specific site to be assessed at Stage 2	Specific site to be assessed at Stage 2					Fail
R16-1	Redeployment of ST Abstractions at Shrewsbury (25)	TWU_STT_HI-RAB_RE1_ALL_c6-300-shrewsbury_25)	RES-RWTS-SHR-12 RES-RWTS-SHR-30								Pass

Table 7: Stage 1 assessment of all options

- 42 There is no change to the WRMP19 screening of the remaining 15 water resource options, with six options failing the Stage1 at WRMP24. Further information regarding the reasons for the option rejection are included in the WRMP24 Appendix Q - Scheme Rejection Register.
- 43 Further investigation of the Shrewsbury option has been completed by the STT SRO which has concluded that the maximum capacity of the option is 25 MI/d. A single 25 MI/d Shrewsbury option is therefore included for WRMP24 to replace the 12 MI/d and 30 MI/d Shrewsbury options included in WRMP19.
- 44 During WRMP19 the Shrewsbury option was considered to be mutually exclusive to Vyrnwy 180 MI/d as this option is centred around Vyrnwy water being redeployed to serve Shrewsbury. Further investigation by United Utilities (UU) and Severn Trent Water (STWL) has concluded that 25 MI/d can be provided from Shrewsbury in addition to 180 MI/d from Lake Vyrnwy, therefore these options are not mutually exclusive in WRMP24.
- 45 Further details regarding the Stage 1 assessments of the options at WRMP19 are included in the WRMP19 Raw Water Transfers Feasibility Report.
- 46 The options that pass Stage 1 are:
- R1 : Kielder Reservoir
 - R6 : River Severn (independent unsupported River Severn resource option, without support options)
 - R7 : Minworth STW effluent and a pipe to the River Avon
 - R8 : Netheridge STW Effluent
 - R9 : Mythe WTW unused part of the license
 - R10 : Lake Vyrnwy
 - R11 : Longdon Marsh reservoir to support River Severn abstraction
 - R14a/b : CRT BCN Surplus (SWOX) / (LON)
 - R16 : Redeployment of ST Abstractions at Shrewsbury (12)

Stage 2 assessment results

- 47 Each water resource option requires a conveyance element to transfer it from the point of abstraction to the point of discharge, Conveyance elements are identified at Stage 2 for water resource options that pass Stage 1.
- 48 The Stage 2 assessment of the WRMP19 and WRMP24 water resource options that passed Stage 1, and the associated conveyance elements, is presented in Table 8 providing the red, amber, green assessment of the criteria described in the WRMP19 Raw Water Transfers Feasibility Report. The RAG assessment has been split into conveyance and resource. Eight resource options and eight conveyance options passed the Stage 2 assessment. Further details are included in the WRMP19 Raw Water Transfers Feasibility report.
- 49 No changes have been made to RAG assessment at WRMP24.



	Criterion	Ownership and Site Tenancies	Estimated Land Acquisition Cost	Land Use and Land Use Quality	Floodplain Encroachment	Landscape Character Sensitivity	Views and Visual Amenity	Nature Conservation and Biodiversity	Archaeology and Historic Environment	Non-traffic Impact of Construction on Local Residents	Impact on Residential Dwellings	Impact of Construction on Local Traffic	Recreational Benefit	Impact on Recreation	Water Resources and Water Quality	Length of Conveyance	Pumping Head	Water Source and Availability	Access during Construction and Operation	Resilience	Connectivity to Waste System	Construction Complexity	Operational Complexity	Stage 2
Ref	Resource/ Support	1	2	4	5	6	7	9	11	12	13	14	15	16	17	18	20	22	25	26	28	29	30	Outcome
R14-1	CRT BCN Surplus for SWOX	g	g	g	g	g	g	g	g	g	g	g	a	g	a	g	a	a	a	a	g	g	g	Pass
R14-2	CRT BCN Surplus for London	g	g	g	g	g	g	g	g	g	g	g	a	g	a	g	a	a	a	a	g	g	g	Pass
R1	Kielder Reservoir	g	g	g	g	g	g	g	g	g	g	g	a	g	g	g	g	a	g	g	g	g	g	Fail
R6	River Severn (independent unsupported River Severn resource option, without support options)	g	g	g	g	g	g	g	g	g	g	g	a	g	a	g	g	a	g	a	g	g	g	Pass
R7	Minworth STW effluent and a pipeline to the Avon	g	g	g	g	g	g	r	a	g	g	g	r	a	a	g	g	A	G	a	g	a	a	Pass
R9	Mythe WTW unused part of licence	g	g	g	g	g	g	g	g	g	g	g	a	g	g	g	g	g	g	g	g	g	g	Pass
R10	Lake Vyrnwy	g	g	g	g	g	g	g	g	g	g	g	a	g	a	g	g	a	g	g	g	g	g	Pass
R11	Longdon Marsh reservoir to support River Severn transfer	a	r	a	r	g	a	g	r	g	r	g	g	a	a	g	g	g	a	g	g	a	a	Fail
R16	Redeployment of ST Abstractions at Shrewsbury (25)	g	g	g	g	g	g	g	g	g	g	g	a	g	g	g	g	a	g	g	g	g	g	Pass
R8	Netheridge STW effluent	g	g	g	r	g	a	a	a	g	g	a	r	a	g	g	g	a	g	a	g	a	a	Pass
Ref	Conveyance	1	2	4	5	6	7	9	11	12	13	14	15	16	17	18	20	22	25	26	28	29	30	
C2-2	Oxford Canal - Farmoor Reservoir	a	g	g	g	g	g	g	g	g	g	g	a	r	g	g	g	N/A	g	N/A	g	a	a	Pass
C4	Pipeline from Kielder Reservoir	a	g	g	g	r	g	r	r	g	g	g	r	r	a	r	r	N/A	g	N/A	g	r	r	Fail
C5	Canals from Kielder Reservoir	a	g	g	g	g	g	g	g	g	g	g	a	g	a	r	a	N/A	g	N/A	g	a	r	Fail
C6-1	Deerhurst to Culham 100	a	g	g	g	r	g	r	r	g	g	g	r	r	a	a	a	N/A	g	N/A	g	a	a	Fail
C6-2	Deerhurst to Culham 300	a	g	g	g	r	g	r	r	g	g	g	r	r	a	a	a	N/A	g	N/A	g	a	a	Pass
C6-3	Deerhurst to Culham 600	a	g	g	g	r	g	r	r	g	g	g	r	r	a	a	a	N/A	g	N/A	g	a	a	Pass
C6-4	Deerhurst to Lechlade (was Cricklade) 100	a	g	g	g	r	g	r	r	g	g	g	r	r	a	g	a	N/A	g	N/A	g	a	a	Pass
C6-6	Deerhurst to Radcot 300	a	g	g	g	r	g	r	r	g	g	g	r	r	a	a	a	N/A	g	N/A	g	a	a	Fail
C6-7	Deerhurst to Radcot 600	a	g	g	g	r	g	r	r	g	g	g	r	r	a	a	a	N/A	g	N/A	g	a	a	Fail
C6-10	Deerhurst to Culham 400	a	g	g	g	r	g	r	r	g	g	g	r	r	a	a	a	N/A	g	N/A	g	a	a	Pass



C6-11	Deerhurst to Culham 500	a	g	g	g	r	g	r	r	g	g	g	r	r	a	a	a	N/A	g	N/A	g	a	a	Pass
C7-1	Cotswold Canal 100	a	g	g	g	r	g	r	g	a	g	g	g	a	g	a	N/A	g	N/A	g	a	r	Pass	
C7-2	Cotswold Canal 300	a	g	g	g	r	g	r	g	a	g	g	g	a	a	a	N/A	g	N/A	g	a	r	Pass	

Table 8: Stage 2 assessment of all options (previous)

- 50 Seven options were rejected at Stage 2; the reasons for the option rejection are included in the WRMP24 Appendix Q - Scheme Rejection Register.
- 51 Further information regarding the investigations into the options is included in the WRMP19 Raw Water Transfers Feasibility report.
- 52 The water resource options that pass Stage 2 are:
- R6 : River Severn (independent unsupported River Severn resource option, without support options)
 - R7 : Minworth STW effluent and a pipe to the River Avon
 - R8 : Netheridge STW Effluent
 - R9 : Mythe WTW unused part of the license
 - R10 : Lake Vyrnwy
 - R14-1 : CRT BCN Surplus (SWOX)
 - R14-2 : CRT BCN Surplus (LON)
 - R16 : Redeployment of ST Abstractions at Shrewsbury
- 53 The conveyance elements that pass Stage 2 are:
- C2-2 Oxford Canal – Farmoor Reservoir
 - C6-2 Deerhurst to Culham 300
 - C6-3 Deerhurst to Culham 600
 - C6-4 Deerhurst to Lechlade 100
 - C6-10 Deerhurst to Culham 400
 - C6-11 Deerhurst to Culham 500
 - C7-1 Cotswold Canal 100
 - C7-2 Cotswold Canal 300

Stage 3 assessment results

- 54 Assessment against Stage 3 criteria of options has been undertaken for all options that passed Stage 2.
- 55 The Stage 3 assessment of the WRMP19 and WRMP24 options that passed Stage 2 is presented in Table 9 providing the red, amber, green assessment of the criteria described in WRMP19 Raw Water Transfers Feasibility report.
- 56 Eight resource options and six conveyance options passed the Stage 3 assessment. Further details are included in the WRMP19 Raw Water Transfers Feasibility report and Section 3 of this report.
- 57 Two changes have been made to RAG assessment at WRMP24:
- River Wye to Deerhurst was rejected at Stage 1 and is therefore not included in the Stage 2 or 3 assessment.
 - Cotswold Canal 300 MI/d option has been taken forward
- 58 The STT SRO has undertaken further assessment of the Deerhurst to Culham and Cotswold Canal conveyance options and concluded that that selecting a canal-based option for water transfer would not provide best value, when compared with a direct pipeline option as the pipeline was shown to:



- perform better overall against a range of environmental and resilience criteria
- have the lowest Net Present Cost (including monetised social, natural capital and carbon impacts and benefits), being approximately 25% cheaper than other options

59 A further assessment was also undertaken to assess the potential opportunities for tourism and recreation that could be realised with the full restoration of the canal. This concluded that the additional benefits gained by integrating canal restoration with a water transfer are outweighed by the impacts and costs.

60 To test this conclusion, across a range of different planning scenarios, the Cotswold Canal 300 MI/d has been included on the Feasible List.



Criterion	Ownership and Site Tenancies	Estimated Land Acquisition Cost - Stage 2 only	Planning Policy and History	Land Use and Land Use Quality	Floodplain Encroachment	Landscape Character Sensitivity	Views and Visual Amenity	Employment and Local Economy	Nature Conservation and Biodiversity	Opportunity for biodiversity improvement	Archaeology and Historic Environment	Non-Traffic Impact of Construction on Local Residents	Impact on Residential Dwellings - Stage 2 only	Impact of Construction on Local Traffic - Stage 2 only	Recreational Benefit - Stage 2 only	Impact on Recreation	Water Resources and Water Quality	Length of Conveyance	Normalised cost	Pumping Head - Stage 2 only	Water Source and Availability	Water treatability/process complexity	Access during Construction and Operation - Stage 2 only	Resilience - Stage 2 only	Power supply	Connectivity to Waste System - Stage 2 only	Construction Complexity	Operational Complexity - Stage 2 only	Stage 3
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	22	24	25	26	27	28	29	30	Outcome
CRT BCN Surplus for SWOX	g	g	g	g	g	g	g	g	g	a	g	a	g	g	a	g	a	g	g	a	a	a	a	a	g	g	g	g	Pass
CRT BCN Surplus for London	g	g	g	g	g	g	g	g	g	a	g	a	g	g	a	g	a	g	g	a	a	a	a	a	g	g	g	g	Pass
River Severn (unsupported)	g	g	g	g	g	g	g	g	g	a	g	g	g	g	a	g	a	g	g	g	a	g	g	a	g	g	g	g	Pass
Minworth STW Effluent and a Pipeline to the Avon	g	g	g	g	a	g	a	g	a	a	a	a	g	g	a	a	a	g	g	g	a	a	g	a	g	g	a	a	Pass
Mythe WTW unused part of Licence	g	g	g	g	g	g	g	g	g	a	g	g	g	g	a	g	g	g	g	g	g	g	g	g	g	g	g	g	Pass
Lake Vyrnwy	g	g	g	g	g	g	g	g	g	a	g	g	g	g	a	g	a	g	g	g	a	a	g	g	g	g	g	g	Pass
Redeployment of ST Abstractions at Shrewsbury (12)	g	g	g	g	g	g	g	g	g	a	g	g	g	g	a	g	g	g	g	g	g	g	g	a	g	g	g	g	Pass
Redeployment of ST Abstractions at Shrewsbury (30)	g	g	g	g	g	g	g	g	g	a	g	g	g	g	a	g	g	g	g	g	g	g	g	a	g	g	g	g	Pass
Netheridge STW effluent	g	g	g	g	a	g	g	g	a	a	a	a	g	a	a	a	g	g	g	g	a	g	g	a	g	g	a	a	Pass
Conveyance	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	22	24	25	26	27	28	29	30	
Oxford Canal - Farmoor Reservoir	a	g	g	a	a	g	a	a	g	a	a	a	g	g	a	a	g	g	g	g	n/a	g	g	n/a	g	g	a	a	Pass
Deerhurst to Culham 300	a	g	a	r	g	a	a	a	r	a	a	a	g	g	r	a	a	a	g	a	n/a	a	g	n/a	r	g	a	a	Pass
Deerhurst to Culham 600	a	g	a	r	g	a	a	a	r	a	a	a	g	g	r	a	r	r	g	a	n/a	a	g	n/a	r	g	r	a	Fail
Deerhurst to Lechlade 100	a	g	a	r	g	a	a	a	r	a	a	a	g	g	r	a	a	a	g	a	n/a	a	g	n/a	g	g	g	a	Pass



Deerhurst to Culham 400	a	g	a	r	g	a	a	a	r	a	a	a	g	g	r	a	a	a	g	a	n/a	a	g	n/a	r	g	a	a	Pass
Deerhurst to Culham 500	a	g	a	r	g	a	a	a	r	a	a	a	g	g	r	a	a	r	g	a	n/a	a	g	n/a	r	g	r	a	Pass
Cotswold Canal 100	r	g	a	r	a	a	a	a	a	g	a	a	a	g	g	a	r	g	g	a	n/a	r	g	n/a	a	g	r	r	Fail
Cotswold Canal 300	r	g	a	r	a	a	a	a	a	g	a	a	a	g	g	a	r	a	g	a	n/a	r	g	n/a	a	g	r	r	Pass

Table 9: Stage 3 assessment

- 61 Two conveyance elements were rejected at Stage 3 screening; Deerhurst to Culham 600 and Cotswold Canal 100. These options were also rejected at WRMP19 Stage 3.
- 62 The water resource options that pass Stage 3 are:
- R6 : River Severn (independent unsupported River Severn resource option, without support options)
 - R7 : Minworth STW effluent and a pipe to the River Avon
 - R8 : Netheridge STW Effluent
 - R9 : Mythe WTW unused part of the license
 - R10 : Lake Vyrnwy
 - R14-1 : CRT BCN Surplus (SWOX)
 - R14-2 : CRT BCN Surplus (LON)
 - R16 : Redeployment of ST Abstractions at Shrewsbury
- 63 The conveyance elements that pass Stage 3 are:
- C2-2 Oxford Canal – Farmoor Reservoir
 - C6-2 Deerhurst to Culham 300
 - C6-4 Deerhurst to Lechlade 100
 - C6-10 Deerhurst to Culham 400
 - C6-11 Deerhurst to Culham 500
 - C7-2 Cotswold Canal 300
- 64 Further information regarding the investigations into the options is included in the WRMP19 Raw Water Transfer Feasibility report.

Option Verification and Conclusion

66 The validation discussion of risk and uncertainty in Section 7 of the WRMP19 Raw Water Transfer feasibility report remains unchanged. Where options have been rejected through the screening process the rejection reason is recorded in WRMP24 Appendix Q Scheme Rejection Register.

Verification

67 The resource and conveyance elements have been assessed separately at Stages 1 to 3. To create complete raw water transfer options, the two elements need to be combined and the potential combinations are given in Table 10.

Conveyance	Resource	Supply Zone	Capacity (Ml/d)	Comments
Oxford Canal – Farmoor Reservoir (C2-2)	CRT BCN Surplus (R14-1)	SWOX	15	
None – Oxford Canal discharges into River Cherwell for transfer to River Thames	CRT BCN Surplus (R14-2)	LON/SWA	15	
Deerhurst to Lechlade Pipeline element (C6-4)	Unsupported River Severn (R6), Mythe (R9), Vyrnwy (R10), Shrewsbury (R16)	LON / SWOX / SWA	100	Several combinations of support options were assessed against this pipe size.*
Deerhurst to Culham Pipeline element (C6-2,10,11)	Unsupported River Severn (R6), Mythe (R9), Vyrnwy (R10), Shrewsbury (R16), Minworth (R7), Netheridge (R8)	LON / SWOX / SWA	300, 400 or 500	Several combinations of support options were assessed against this pipe size.*
Cotswold Canal 300 (C7-2)	Unsupported River Severn (R6), Mythe (R9), Vyrnwy (R10), Shrewsbury (R16), Minworth (R7), Netheridge (R8)	LON / SWOX / SWA	300	

Table 10: Potential Raw Water Transfer option combinations

* This combination of resource and conveyance was identified at WRMP19 and has not been updated for WRMP24.

68 These combined options were assessed at WRMP19 validation stage to confirm those to be carried forward to fine screening and the following elements were rejected at Validation stage:

- R6: River Severn (independent unsupported River Severn resource option, without support options)

- C6-4 Deerhurst to Lechlade 100
- 69 The WRMP19 rejection reasoning for these two elements has been reviewed and confirmed at WRMP24.

Confirmation of feasible list of options:

- 70 The confirmed list of feasible raw water transfer options for WRMP24 is shown in Table 11.

Conveyance	Resource	Supply Zone	Capacity (MI/d)
C2-2 : Oxford Canal to Farmoor Reservoir	R14-1 : CRT BCN Surplus	SWOX	15
n/a	R14-2 : CRT BCN Surplus	LON/SWA	15
C6-2 : Deerhurst to Culham 300	Unsupported River Severn*	LON / SWOX / SWA	300, 400 or 500
C6-10 : Deerhurst to Culham 400	R7 : Minworth STW		
C6-11 : Deerhurst to Culham 500	R8 : Netheridge STW Effluent		
	R9 : Mythe WTW		
	R10 : Lake Vyrnwy		
	R16 : Shrewsbury		
C7-2 : Cotswold Canal 300	Unsupported River Severn*	LON / SWOX / SWA	300
	R7 : Minworth STW		
	R8 : Netheridge STW Effluent		
	R9 : Mythe WTW		
	R10 : Lake Vyrnwy		
	R16 : Shrewsbury		

Table 11: List of feasible raw water transfer options

* R6 unsupported River Severn is rejected as an option without additional support but the unsupported benefit will be accounted for in all STT supported combinations.

- 71 This report summarises changes to the raw water resource options up to the end of feasibility screening. The reasoning for rejection of options can be found in the WRMP24 Appendix Q - Scheme rejection register.

Summary of Further Screening

- 72 The Cotswold Canal 300, Shrewsbury and Mythe were rejected at Further Screening, for more information see WRMP24 Section 7 and WRMP24 Appendix Q - Scheme rejection register.
- 73 Reasons for rejection are summarised below:
- 74 **Cotswold Canal 300:** The investment model consistently selects the pipeline interconnector in preference to the canal interconnector. Furthermore, the draft WRSE best value regional plan selects a 400 or 500 MI/d capacity pipeline transfer in many scenarios including the WRSE preferred plan (options incorporating sections of canal



would be limited to 300 MI/d maximum capacity). The Cotswold Canal is therefore rejected at Further Screening and is not on our Constrained List.

- 75 Note: Whilst this reflects the assessment and findings for Gate 2 and WRMP24, before any final decisions are made and as part of any future phases of the STT development, the preferred option and other alternatives considered would be subject to further engagement and consultation with stakeholders and also reaffirmation/back checking.
- 76 **Mythe and Shrewsbury:** A backchecking exercise was carried out following reconciliation of the regional plans. Mythe and Shrewsbury are required to meet the needs of Water Resources West and are therefore not available to WRSE. These options are therefore rejected at further screening and are not on our Constrained List.



A. Reference information

The draft WRMP24 and Technical Appendices can be found on the Thames Water website at:
[Water resources](#) | [Regulation](#) | [About us](#) | [Thames Water](#)

Please contact consultation@thames-wrmp.co.uk for access to WRMP19 reports

SRO documents referenced in report can be found on the Thames Water website at:
[Regional water resources](#) | [Regulation](#) | [About us](#) | [Thames Water](#)

B. Extract from WRMP19 Raw Water Transfers Feasibility Report – Appendix B2

The following pages are an extract from the WRMP19 Raw Water Transfers Feasibility Report and provides a summary of the promotability of STT options on the basis of their hydrological, water quality and/or ecological effects and risks.

Promotability of STT Options

This appendix provides a summary of the promotability of STT options on the basis of their hydrological, water quality and/or ecological effects and risks.

Introduction

This appendix discusses the promotability of a number of Severn-Thames Transfer (STT) water supply options based on their potential hydrological, water quality and/or ecological risks and benefits to the various receptor environments. The selected options are a sub-set of those set out in the Raw Water Transfer Feasibility Report (September 2016) Stage 3 feasibility assessment. The initial transfer volume options for pipeline transfers included 300 and 600MI/d maximum transfer rates (defined as the pipeline capacity). For these volumes, the amount of water available to support transfer is potentially up to 279MI/d (equating to 308MI/d prior to losses upstream of the Deerhurst intake).

However, the achievement of these volumes is critically dependent on a number of third party options, the feasibility of which remain unproven at this stage. The balance for options requiring higher transfer volumes would be from an unsupported abstraction from the River Severn when it was available, which must not compromise the abstraction licence hands-off flow (HOF) conditions proposed by the Environment Agency. The HOF is required to protect the hydro-morphology and hydro-ecology of the Severn Estuary SAC/SPA/Ramsar and the hydrology at the interface between the freshwater and estuarine systems, the maintenance of which is important for the passage of migratory fish, which are an important feature underpinning the international nature conservation designations.

This appendix considers first the appropriateness of release locations on the River Thames for the transferred water, followed by an assessment of the potential risks and impacts of the range of transfer volumes at the most suitable location. The appendix then summarises the risks to promotability from hydrological, water quality and ecological effects, with options ranked from green (most promotable) to red (least promotable).

Consideration of release locations

A number of locations on the River Thames have been assessed for their suitability to receive transferred water from the River Severn. These range from locations in the vicinity of Cricklade, Lechlade (later considered slightly downstream at Radcot) or Culham. Through a review of large-scale transfers (≥ 300 MI/d) with the Environment Agency, it was identified that any transfer greater than 200MI/d would prove to be difficult to promote upstream of Farmoor. This would be on the basis that the River Thames from the release location as far as Farmoor would change

from a natural or semi-natural flow rate to a regulated river. It is noted that the river upstream of Farmoor as far as Lechlade is already subject to human intervention linked predominantly to navigation; however, there would be adverse ecological effects from an introduced regulation regime. These would be most notable in the hydraulic effects on fisheries in the network of high quality weir pool habitats downstream of weirs in the reach Lechlade-Farmoor. In the River Thames between Farmoor and the confluence with the River Evenlode a transfer could discharge relatively large volumes of River Severn water into low flow conditions in the River Thames (albeit treated to ensure no deterioration in WFD quality) such that the River Thames would take on the water quality characteristics of the River Severn. These modifications could have consequential adverse ecological effects on fish communities in these upper reaches.

Further downstream, a review of the weir pool habitat quality and sensitivity at Sandford Weir (upstream of Culham) identified that supported or part supported options of $\geq 300\text{MI/d}$ would be promotable, although release downstream of the flow contribution from Sandford (Oxford) STW and the River Ock, would be preferred. The River Thames at Culham (and downstream) is therefore considered the most suitable of the locations assessed for receipt of the River Severn transfers.

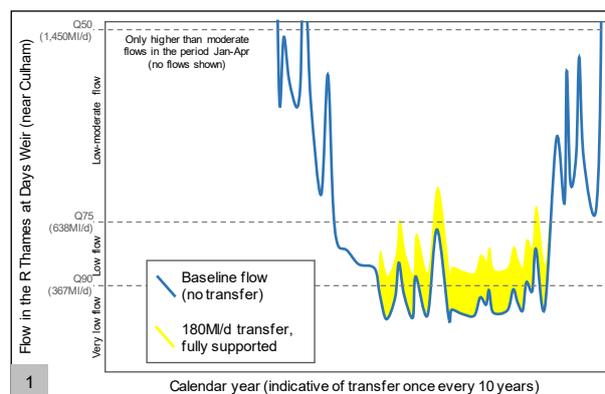
The remainder of this summary therefore focusses on supported or part supported options of $\geq 300\text{MI/d}$ releasing transferred water at Culham.

Key hydrology, water quality and ecology effects of the transfer options assessed

There are five key issues that could significantly affect the hydrology, water quality and/or ecology of the Rivers Severn and/or Thames should supported or part supported 300-600MI/d transfer options be adopted. The detailed analysis is contained in the Severn Thames Transfer: Water Quality and Ecology Assessment - Phase 2 (September 2016), although it is noted that the Phase 2 report only assessed fully supported (e.g. 200MI/d, 300MI/d and 600MI/d) and fully unsupported (e.g. 200MI/d, 300MI/d) options and not the partially supported options considered here. The following assessment is therefore underpinned by additional studies of the 300-600MI/d variants, which include hydrological evidence gathered from water resources modelling by Thames Water for specific options. The five key issues are:

1. Raising the baseflow of the River Thames through supported components of transfer

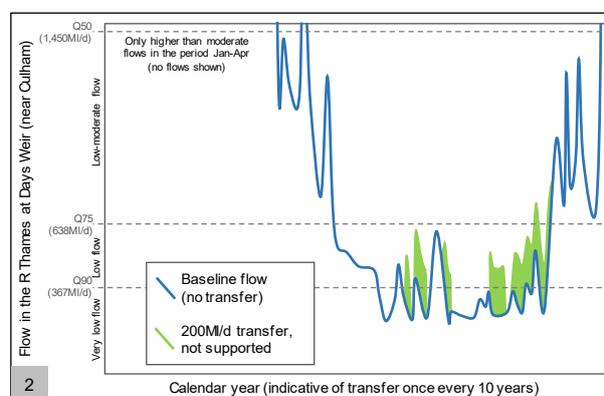
The supported component of a River Severn transfer can be in continuous operation for long periods, typically covering the entire period of moderate and prolonged low flow periods in the River Thames. These existing lower flow periods are a typical feature of the River Thames. In extreme circumstances (e.g. 1976) the low flow regime of the River Thames can be ecologically detrimental and some base flow elevation can be beneficial to most fish. A 180MI/d fully supported transfer option is illustrated in Graph 1. There is a point above which the increase in base flow removes the normal low flow regime of the River Thames in all dry and average flow years, with low flows then modifying to resemble those of wet years only. This effect is most notable in weir pools where the loss of shallows and low velocities can reduce habitat availability for the full range of



fish, invertebrates and plants. At Culham, this tipping point is considered to lie between a fully supported transfer of 500-600MI/d.

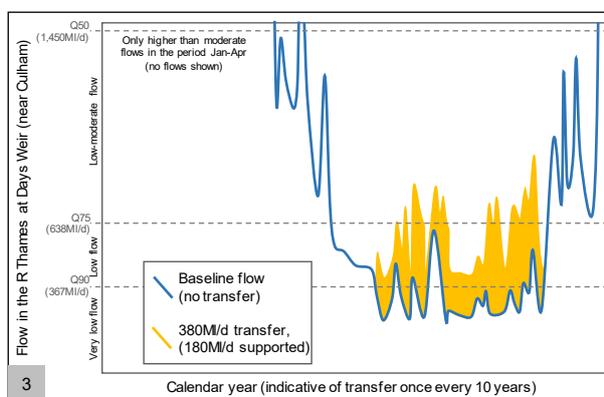
2. Making the River Thames flow regime more variable through release of unsupported components of transfer

2a. The unsupported component of transfer (up to 300MI/d fully unsupported) has previously been noted to be reasonably acceptable for water quality and ecology effects in the River Thames at Culham. This is on the basis that abstraction from the River Severn stops for moderate to prolonged periods such that much of the low flow regime of the River Thames is retained, albeit with increase in flows for short blocks of time, typically around 10 consecutive days. A 200MI/d unsupported option is stylised in Graph 2.



However, several of the options now considered have unsupported elements greater than 300MI/d. This is observed to increase the variability and peakiness of the transfer, as illustrated in Graph 2. This results in a highly variable flow regime at times of low and low-moderate flow in the River Thames during summer and autumn, which is not the existing characteristic for the River Thames.

2b. Several of the options assessed here have substantial baseflow elevation combined with increased variability. A 380MI/d transfer (supported to 180MI/d) option is illustrated in Graph 3. The combined effect moves the summer and autumn flow regime further away from that expected for the River Thames.



Both the increased variability (2a) and the cumulative effect with increased baseflow (2b) represent deviation from the norm and are considered to have potentially significant adverse effects on the fisheries and other ecological characteristics of the River Thames, including both the main channel and the more sensitive and ecologically valuable weir pools.

3. Effectiveness of the water quality and ecology mitigation measures package for the unsupported components of transfer.

Options that include the potential for regular change in the transfer rate from the River Severn, particularly with smaller supported volumes and greater unsupported contribution, increase the complexity of the water quality and ecology mitigation package. Regular variability in flow through complex treatment systems makes water treatment more difficult. The promotability of transfer options will be influenced by the ability to demonstrate they have no adverse effects on Water Framework Directive (WFD) risk for phosphorus status and the appropriate management

of invasive non-native species risk. Further, wide ranges in the flow rates between the supported and total transfer rates may lead to regular lower velocities in the transfer pipelines, enhancing the risk of adherence of mussel larvae and subsequent fouling.

4. Increasing the frequency of low flows in the River Severn from the unsupported components of transfer.

Where an option includes a higher proportion of unsupported abstraction to achieve a high overall abstraction total there will be an elevated risk of increased frequency or duration of lower flows in the River Severn downstream of the abstraction. Typically, without transfer (median from scheme operational data prepared by water resource modelling) there are in the order of 64 days a year with flows lower than the proposed Tier 1 HOF limit in the River Severn of 2,490MI/d and 14 days a year lower than the Tier 2 limit of 1,800MI/d. With transfer this increases by ~20% for the Tier 1 and ~70% for the Tier 2, a substantial increase in low flow days. In low flow years, which would commonly coincide with the need for greater transfers, the baseline number of low flow days is much higher such that there is already additional hydrological stress on the River Severn system. This may have implications for environmental effects due to the sensitivity of the downstream Severn Estuary SAC/SPA/Ramsar. Promotability may be impaired when taking account of the probability of regulatory challenge and the concerns of salmon fishery interest groups.

Further, Natural England has noted that at high abstraction transfer volumes there could be a significant step change in flow at the point of abstraction which could adversely impact upon migratory fish behaviour depending on local factors.

5. Other river systems affected as a result of transfer options

The supported options currently set out in the WRMP19 Feasibility Report for Raw Water Transfers include licence transfer in the lower Severn (15MI/d); additional regulation of much of the River Severn using Vyrnwy Reservoir (either 60MI/d or 180MI/d released); transfer of treated effluent from Minworth STW into the River Avon catchment, with concurrent flow loss in the River Tame (88MI/d transferred); and regulation of the Rivers Leam and Avon using Draycote Reservoir (25MI/d released). Each of these options would need to be demonstrated to be environmentally acceptable for them to be considered valid support options in Thames Water's WRMP19, and any such difficulties could lead to amendment or withdrawal of the options currently set out.

Of these support options, as currently set out there are likely to be significant impacts on the flow regime of the River Avon system from either, or both, of the options releasing there (Minworth and Draycote). Currently the River Avon and its tributaries do not have a regulated flow rate, noting that; from just upstream of Stratford-upon-Avon, somewhat downstream of the release points, the river is managed for navigation, but not as extensively as the River Thames. In the River Leam the regulated release volume would be greater than the receiving river flow for 26% of the days on which releases would be made. Regulation would likely amend the flow regime of the River Leam at least to the River Avon confluence ~3km downstream.

In the River Avon at the potential release point for the Minworth STW support, the receiving river flow would always be greater than the regulation itself, but not substantially. Regulation releases would amend the flow regime of the River Avon at least to the River Leam confluence ~11km downstream.



When operated in combination the two River Avon regulation options would retain effects at least 50km downstream to the next gauge at Evesham. Here, combined regulation would increase very low flow (Q95) by ~71%, low-moderate flow (Q75) by 44% and average flow (Q50) by 33%.

Promotability of the River Severn transfer options when considering the hydrological, water quality and/or ecological effects

The option combinations of supported and unsupported volumes are set out in Table E.1 below. The combined supported and unsupported variants can be identified by reference to the total volumes shown in the top row, 300 to 600MI/d. The supported element is shown in the left hand column, ranging from 69 to 279MI/d, with the shortfall against the volume being taken up by the unsupported element. A three-point promotability scale is used: green most promotable; amber with promotional issues to overcome; red considered difficult to promote. A guide to relevant aspects of the key issues discussed above is set out after the table using the table referencing a-h. The transfer discharge location to the River Thames is assumed to be in the Culham reach downstream of the River Ock.

		Total transfer rate (as abstraction from Deerhurst)			
		300MI/d	400MI/d	500MI/d	600MI/d
Extent of support (as available at Deerhurst)	69MI/d (licence transfer and Vyrnwy Reservoir regulation)	a	b	c	c
	177MI/d (licence transfer and Vyrnwy Reservoir regulation)	a	a	d	e
	279MI/d (licence transfer, Vyrnwy Reservoir regulation, both R Avon regulations)	f	f	g	h

Table B.1: Promotability of Option Combinations

- a. Total abstractions made up of reasonably manageable supported flow volumes, and unsupported flows of sufficiently modest volumes that the River Thames is not subject to undue variability beyond its characteristic flow regime.
- b. A high rate of unsupported transfer relative to the total transfer rate which may promote unsuitable flow variability in the River Thames (key issue 2a), with additional treatment complexity for mitigation measures (key issue 3). The option presents promotional challenges when taking into account impacts on hydrology, water quality and ecology in the River Thames.
- c. Very high rates of unsupported transfer relative to the total transfer rate which would result in modification to the flow regime in the River Thames (key issue 2a) and additional treatment complexity for mitigation measures (key issue 3). The options would also increase the low flows in the River Severn (key issue 4). These options are considered difficult to promote on hydrology, water quality and ecology grounds in the River Thames and on ecological grounds in the River Severn.
- d. This option would promote moderate to large increases in baseflow in the River Thames (key issue 1), although probably below the tipping point in terms of non-promotability. It does however demonstrate a high rate of unsupported transfer relative to the total transfer rate (key issue 2a). It may also exhibit an adverse cumulative effect with increased baseflow and

- flow variability (key issue 2b) that could trigger additional treatment complexity for mitigation measures (key issue 3) and lead to increased periods of low flows in the River Severn (key issue 4). The option represents the largest of the combined supported - unsupported transfer variants that has at least, a moderate promotability potential, given the various and increasingly problematic environmental implications of water transfer.
- e. The option has a very high rate of unsupported transfer relative to the total transfer rate, which would induce significant changes in flow variability in the River Thames (key issue 2a), with additional treatment complexity for mitigation measures (key issue 3). The abstractions from the River Severn would result in an increase in low flow days in the River Severn (key issue 4). The option would also lead to a significant cumulative adverse effect to fisheries from increased baseflow and variability (key issue 2b). This option is considered difficult to promote on hydrological, water quality and ecological grounds in the River Thames and on ecology grounds in the River Severn.
 - f. These options would lead to increased baseflow in the River Thames (key issue 1), but less than that considered problematic from an environmental perspective. At present, from publicly available information, operation of the third party support options (Severn Trent Water Minworth and Draycote support options) is likely to demonstrate significant adverse effects on the flow regime of the River Avon (key issue 5), with potential for consequential adverse water quality and ecology effects. These effects would require further quantification and consideration given to their mitigation, if possible, before their environmental acceptability could be assessed. These options therefore have a number of promotional issues that would need to be overcome relating to hydrology, water quality and ecology in the River Thames and hydrology in the River Avon catchment.
 - g. This option would result in a large increase in the baseflow of the River Thames (key issue 1), although probably not giving rise to a change in flow beyond the tipping point in terms of promotability. It would also result in a very large adverse cumulative effect to fisheries from increased baseflow and increased flow variability (key issue 2b). At present, from publicly available information, it can be concluded that operation of the third party support options is likely to result in significant adverse effects on the flow regime of the River Avon (key issue 5), with potential for consequential adverse water quality and ecology effects that would require further assessment including the possibility of their mitigation before it could be demonstrated that they were environmentally acceptable. For these reasons this option is considered very difficult to promote on hydrological, water quality and ecological grounds in the River Thames and on hydrology grounds in the River Avon catchment.
 - h. This option gives rise to the same negative issues as the 500MI/d (279MI/s supported option, reference g. but they are more pronounced, reflecting the greater transfer rate. In addition, it has a higher proportion of unsupported water transfer relative to the total transfer volume (key issue 2a) resulting in greater flow variability. Additional risks would include more likelihood of the difficulty of treatability complexity arising by reason of the transfer variability (key issue 3) and an increase in low flows in the River Severn (key issue 4). Of the options considered, this is the most problematic from a promotability perspective, triggering all of the environmental concerns outlined above.

