Water Resources Management Plan 2024

Resource Options – Reservoirs Feasibility Report

Addendum

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Executive Summary

1 This report provides a summary of changes that have been made to the reservoir 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, Reservoir Feasibility Report, July 2017, Rev 01A. The updated WRMP24 feasibility assessment presents the WRMP19 options and WRMP24 backchecking results.

3 Review and backchecking of the WRMP19 options against the updated WRMP24 methodology concluded that five reservoir sites that were rejected at WRMP19 passed WRMP24 Stage 3 feasibility assessment (feasibility screening stage are detailed in Section 3):

- Marsh Gibbon Reservoir (30 Mm^3, 50 Mm^3, 75 Mm^3)
- Chinnor Reservoir (30 Mm^3)
- Aylesbury Reservoir (30 Mm^3, 50 Mm^3)
- Ludgershall Reservoir (30 Mm^3, 50 Mm^3)
- Haddenham Reservoir (30 Mm^3)

4 At WRMP19 the Marsh Gibbon and Chinnor sites were rejected at Fine Screening as they performed less well than the Abingdon[1] site across the environment & social, cost and deliverability dimensions and this position has not changed at WRMP24. The other three sites were rejected at feasibility Stage 3 at WRMP19, however all five sites have the potential to provide regional benefits.

5 The WRMP24 approach considers the regional need, rather than the Thames Water Utilities Limited (TWUL) need alone, through Water Resources South East (WRSE) regional planning. In the WRMP24 process, fine screening has been replaced by regional planning investment modelling output, which has informed screening for the WRMP24 Constrained List.

6 The WRMP19 Abingdon Reservoir option, also referred to as the South East Strategic Reservoir Option (SESRO), 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), Abingdon Reservoir is included in this report however it should be noted that further information on Abingdon Reservoir / SESRO can be found in the SRO Gate 1 and Gate 2 submissions.

7 The table below details the confirmed list of feasible reservoir options for WRMP24:

1 At WRMP19 the terminology Abingdon Reservoir was used, this has been further developed and is now referred to as South East Strategic Reservoir Option (SESRO). When referring to different reports and information it is necessary to refer to both these names. In reading the WRMP documents Abingdon Reservoir and SESRO are used interchangeably and refer to the same option.

	30Mm3	50Mm3	75Mm3	100Mm3	125Mm3	150Mm3
Abingdon	✓	✓	✓	✓	✓	✓
Marsh Gibbon	✓	✓	✓	✗	✗	✗
Chinnor	✓	✗	✗	✗	✗	✗
Aylesbury	✓	✓	✗	✗	✗	✗
Ludgershall	✓	✓	✗	✗	✗	✗
Haddenham	✓	✗	✗	✗	✗	✗

8 This report summarises the changes to the reservoir options up to the end of feasibility screening. However it should be noted that at WRMP24 the following options were rejected at Further Screening and are not included on the Constrained List of options for WRMP24:

- Abingdon Reservoir 30 Mm^3 and 50 Mm^3
- Ludgershall Reservoir
- Aylesbury Reservoir
- Haddenham Reservoir

9 At WRMP19 SESRO / Abingdon Reservoir 30 Mm^3 and 50 Mm^3 options were rejected as these options would limit development of larger capacity options on the same site. This rejection reasoning was backchecked at WRMP24 and found to remain valid. The investment model continues to select larger capacity SESRO/Abingdon Reservoir options confirming the reason for rejecting these options.

10 The options feeding into the upper Thames River are subject to a combined discharge limit of 600 Ml/d. This limit applies to STT, SESRO, Chinnor Reservoir, Marsh Gibbon Reservoir, Ludgershall Reservoir, Aylesbury Reservoir and Haddenham Reservoir. At Further Screening scenario runs of the investment model were undertaken to assess which options within the combined limit are selected. STT and SESRO were selected as preferred options and in combination reach the 600 Ml/d discharge limit.

11 Marsh Gibbon and Chinnor have been included on the Constrained List to provide reservoir options up to the discharge limit, in combination with SESRO, this is to allow the model maximum possible flexibility in option selection. These reservoirs were selected in preference to Ludgershall, Aylesbury and Haddenham as they perform better against Stage 3 Feasibility criteria.

12 For further details on rejection reasoning refer to WRMP24 Appendix Q – Scheme Rejection Register and for details on the Further Screening process detailed in WRMP24 Section 7 - Appraisal of Resource Options.

Introduction

13 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 reservoir options since WRMP19 and as part of WRMP24 development.

14 This report acts as an addendum to Thames Water WRMP19 Resource Options, Reservoir Feasibility Report, July 2017, Rev 01A. This report should be read alongside the WRMP19 report. Where there are inconsistencies information in this report supersedes information provided in the WRMP19 report.

15 Changes to the WRMP19 Reservoir Options have been detailed in Section 0. A backchecking exercise has been completed to assess if any changes are required as a result of identification of the new options or developments since WRMP19. Backchecking entails a review of options previously dismissed to see if they require reappraisal in the light of knowledge accumulated since they were dropped from consideration. 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 and environmental status of a site, changes in national and local planning policy and the emergence of viable technical solutions that were unavailable at the time the original assessment was undertaken.

16 The WRMP24 screening, option development and backchecking methodology is summarised in Section 7 - Appraisal of Resource Options and follows the Water Resources Planning Guideline, 4 April 2022. Further detail on the screening process can be found in WRMP19 Reservoirs Report.

17 This report summarises changes to the reservoir options up to the end of feasibility screening. Information on option development and investment modelling can be found in Section 7 - Appraisal of Resource Options.

18 At WRMP19 Abingdon Reservoir was identified as the preferred Reservoir Option. Abingdon Reservoir, now also referred to as the South East Strategic Reservoir Option (SESRO), 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 Abingdon Reservoir / SESRO can be found in the Gate 1 and Gate 2 submissions, available on the Thames Water website.

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 options and changes to Deployable Output (DO).
3	Updated feasibility assessment and backchecking	Provides a summary of the current feasibility assessment for all options including options identified at both WRMP19 and WRMP24.
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	Review of Reservoir Options	A summary of the further option development carried out on Marsh Gibbon and Chinnor reservoirs options for WRMP24 and how this applied to Ludgershall, Aylesbury and Haddenham reservoir options.
App C	SESRO Flood sequential and exception tests report	

Table 1: Structure of this report

19 Following the feasibility back checking, design development was undertaken for options that were rejected at WRMP19 but are passed WRMP24 Stage 3 feasibility assessment.

Updates since WRMP19

Option Identification

20 To ensure Thames Water is aligned with the 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, this takes into account the regional approach taken at WRMP24 to identify options which could have a regional need.
- 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.

21 As a result of the above review five reservoir sites that were rejected at WRMP19 have been reassessed and included on the WRMP24 Feasible List:

- Marsh Gibbon Reservoir (30 Mm^3, 50 Mm^3, 75 Mm^3)
- Chinnor Reservoir (30 Mm^3)
- Aylesbury Reservoir (30 Mm^3, 50 Mm^3)
- Ludgershall Reservoir (30 Mm^3, 50 Mm^3)
- Haddenham Reservoir (30 Mm^3)

22 At WRMP19 the Marsh Gibbon and Chinnor sites were rejected at Fine Screening[2] as they performed less well than the Abingdon site across the environment & social, cost and deliverability dimensions and this position has not changed at WRMP24. However, at WRMP24 the approach has changed to consider the regional need rather than the TWUL need alone through Water Resources South East (WRSE) regional planning. In the WRMP24 process fine screening has been replaced by regional planning investment modelling output (refer to Section 11 of the WRMP documents), which has informed screening for the WRMP24 Constrained Options list. Refer to WRMP24, Section 7 for details of the WRMP24 screening approach.

23 It is noted that Abingdon Reservoir is being developed as a Strategic Resource Option (SRO) under the title South East Strategic Reservoir Option (SESRO).

[2] Fine Screening Report Update, September 2018, revision 05b

Feasibility Screening Criteria

24 The following tables detail the criteria used for feasibility screening, which is further detailed in the WRMP19 Reservoirs 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

25 Stage 1 has two phases:

- Option identification – the criteria for which is detailed in Table 2
- Assessment of the options identified against absolute and other key constraints to the development of a new reservoirs - the criteria for which is detailed in Table 3 This is a pass fail assessment for each criterion

26 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

27 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 4 and the Stage 3 criteria are shown in Table 5.

Criteria
Step 1. Site must be located within the catchment of the River Thames
Step 2. Site must be located primarily on impermeable strata
Step 3. Site avoids areas of major built development
Step 4. Site to be located near to the River Thames upstream of Windsor or a main tributary river that flows into the River Thames upstream of Windsor

Table 2: Stage 1 Criteria to Identify Potential Reservoir Sites

Criteria
Planning, socio-economic & environmental criteria
National / International nature conservation sites (excludes pipelines)
National / International heritage sites (excludes pipelines)
Engineering criteria
Clay thickness of 10m or less underlying the site

Table 3: Criteria for Stage 1 Assessment of identified options

CRITERION TITLE	Stage 2 Criteria	Basis for assessment		
		Green	Amber	Red
Property & legal criteria				
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 any statutory agency's business affected in addition to agricultural land
Planning, socio-economic & environmental criteria				
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. 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)
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 recognised viewpoints	Important / recognised viewpoints may be affected. Site lies at a distance of between 3km and 5km from recognised viewpoints	Highly visible / panoramic views likely to be affected. Site lies at a distance less than 3km from recognised viewpoints
Nature conservation and biodiversity	Are any designated areas of nature conservation/biodiversity importance affected?	No national, regional or local 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 (County Wildlife Site, Local Nature Reserve)	Designation of national importance and/or Ancient Woodland likely to be adversely affected

CRITERION TITLE	Stage 2 Criteria	Basis for assessment		
		Green	Amber	Red
Archaeology and the historic environment	Are any heritage assets affected?	Heritage interest low. Site has heritage assets of low sensitivity or no records present	Designation of regional or local importance likely to be adversely affected. No statutory designated sites present but site contains known non designated heritage assets of high or moderate sensitivity	Nationally Designated Heritage Assets likely to be affected. Site includes an national heritage asset (Grade II*, Grade II Listed Building, Registered Historic Park or Garden, Listed battlefield site, conservation area)
Land use & land use quality	Will Best and Most Versatile Agricultural land be affected?	The site has less than 20% of Best and Most Versatile agricultural land affected	The site is likely to affect Best and Most Versatile agricultural land (20-60%)	Best and Most Versatile Agricultural land is affected (60%)
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
Recreational benefit	Will people benefit from recreational resource?	Less than 10,000 residential properties within 5km of the site	Between 10,000 and 29,999 residential properties likely within 5km of the site	Over 30,000 residential properties within 5km of the site
Flood plain encroachment	Percentage of the site covered by floodplain	Less than 25% of the site is within Flood Zones 2 or 3 or the site is solely located within Flood Zone 1	Between 25-50% of the site located within Flood Zones 2 or 3 or if greater than 50% the site benefits from existing flood protection measures	Over 50% of the site located within Flood Zones 2 or 3 and site does not benefit from existing flood protection measures
Non-traffic impact of construction on local residents.	Will construction activities (excluding traffic impacts) affect local residents?	Less than 100 residential properties likely to be affected by on-site construction activities	Between 100-299 residential properties likely to be affected by on-site construction activities	More than 300 residential properties likely to be affected by on-site construction activities

CRITERION TITLE	Stage 2 Criteria	Basis for assessment		
		Green	Amber	Red
Impact of construction 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
Impact on residential dwellings	Will construction activities result in loss of residential dwellings?	No residential dwellings located within the site	Up to 10 residential dwellings located within site	More than 10 residential dwellings located within the site
Water resources & water quality	Are there likely impacts on water resources and water quality, including Water Framework Directive objectives?	Minor adverse impacts likely; no risk to Water Framework Directive objectives	Moderate adverse impacts likely; low risk to Water Framework Directive objectives	Major adverse impacts likely; high risk to Water Framework Directive objectives
Engineering criteria				
Length of conveyance	Distance from intake/outfall point	Less than 5km from the potential intake/outfall location	Between 5km and 25km from potential intake/outfall location	More than 25km from potential intake/outfall location
Material use and local availability	What is the availability of clay on the site?	Clay thickness greater than 20m available on site	Clay thickness of between 10-20m available on site	Clay thickness of less than 10m available on site
Variation in topographical levels	What is the level of topographical variation across the site?	Very little topographical variation/all material can be used on site	Variation on site but not likely to create substantial additional movement of material	High level of topographical variation on site requiring substantial movement of material on site

CRITERION TITLE	Stage 2 Criteria	Basis for assessment		
		Green	Amber	Red
Access during construction and operation	Proximity to railways	Good means of suitable rail freight access. Less than 5km from operational railway with requirement for 3 or less significant structures over or under roads and waterways	Railway access can be achieved but compromise or significant mitigation required. Less than 5km from operational railway with requirement for more than 3 significant structures over or under roads and waterways	Significant difficulties anticipated to achieve suitable rail access. More than 5km from operational railway

Table 4: Criteria for Stage 2 and basis for assessment of site performance

CRITERION TITLE	Stage 3 Criteria	Basis for assessment		
		Green	Amber	Red
Planning, socio-economic & environmental criteria				
Planning policy and 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

CRITERION TITLE	Stage 3 Criteria	Basis for assessment		
		Green	Amber	Red
Flood plain encroachment	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 that appear to be used for agricultural purposes)	Loss of land anticipated to provide a high density of employment opportunities (for example, a business park)
Nature conservation and biodiversity	Are there likely effects on sites / habitats	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 with a watercourse and surrounding woodlands	Site with a watercourse or surrounding woodlands	Site without either a watercourse or surrounding woodlands
Archaeology and the historic environment	Are there likely effects on heritage assets,	No constraint posed	Issue or constraint can be overcome	Issue or constraint can be overcome, but will be very challenging

CRITERION TITLE	Stage 3 Criteria	Basis for assessment		
		Green	Amber	Red
	including overall setting			
Non-traffic impact of construction on local residents	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 objectives	No constraint posed	Issue or constraint may be overcome	Issue or constraint can be overcome, but will be very challenging
Engineering criteria				
Cost	£/m3 reservoir capacity	<£0.72/m^3	>£0.72/m^3	>£1.07/m^3
Construction Complexity	More detailed review of construction requirements	Construction complexity is low; it is not anticipated that the overall construction programme or cost will be impacted	Construction complexity is medium. There is a moderate risk that the construction programme and cost will increase; although it is anticipated that these risks can be managed / mitigated throughout the project	Construction complexity is high. There is a high risk that the construction programme and cost will increase. These risks are considered difficult to manage / mitigate throughout the project.

Table 5: Criteria for Stage 3 and basis for assessment of site performance

Feasibility Screening Updates

28 The overall changes to options and approach since WRMP19 are described in WRMP24 Section 7 Appraisal of Resource Options. Specific changes applicable to reservoir options are detailed in Table 7. These tables should be read alongside the WRMP19 Reservoir Feasibility report[3].

[3] Reservoir Feasibility Report, July 2017, revision 01A

WRMP19 Option Reference and name	WRSE Option Reference and name	Changes to the Option	WRMP19 Feasibility Screening Outcome	WRMP24 Feasibility Screening Outcome[4]
Site 36 - Marsh Gibbon Reservoir 30 Mm^3	Marsh Gibbon Reservoir (30 Mm^3) TWU_STR_HI-RSR_RE1_CNO_res_marsh gibbon_3	In WRMP19 this option passed the feasibility stage but was not included on the constrained list following fine screening. Option design reviewed at WRMP24 taking into account greater regional need. Decision made to include options in WRMP24 investment model due to potential for regional benefit.	Included on Feasible List.	Passed screening, included on Feasible List.
Site 36 - Marsh Gibbon Reservoir 50 Mm^3	Marsh Gibbon Reservoir (50 Mm^3) TWU_STR_HI-RSR_RE1_CNO_res_marshgibbon_2	In WRMP19 this option passed the feasibility stage but was not included on the constrained list following fine screening. Option design reviewed at WRMP24 taking into account greater regional need. Decision made to include options in WRMP24 investment model due to potential for regional benefit	Included on Feasible List.	Passed screening, included on Feasible List.
Site 36 - Marsh Gibbon Reservoir 75 Mm^3	Marsh Gibbon Reservoir (75 Mm^3) TWU_STR_HI-RSR_RE1_ALL_res_marshgibbon	In WRMP19 this option passed the feasibility stage but was not included on the constrained list following fine screening. Option design reviewed at WRMP24 taking into account greater regional need. Decision made to	Included on Feasible List.	Passed screening, included on Feasible List.

[4] Note table summarises outcome of feasible screening, some options were subject to Further Screening and may have been rejected at this later screening stage. Details of Further Screening can be found in Section 7 - Appraisal of Resource Options.

WRMP19 Option Reference and name	WRSE Option Reference and name	Changes to the Option	WRMP19 Feasibility Screening Outcome	WRMP24 Feasibility Screening Outcome[4]
		include options in WRMP24 investment model due to potential for regional benefit		
Site 36 - Marsh Gibbon Reservoir 100 Mm^3	Marsh Gibbon Reservoir (100 Mm^3) TWU_LON_HI-RSR_RE1_ALL_res_marshgibbon_100	In WRMP19 this option passed the feasibility stage but was not included on the constrained list following fine screening. Option design reviewed at WRMP24 taking into account greater regional need. Decision made to reject option	Included on Feasible List.	Rejected following further development of the conceptual ground model for the site, and subsequent review of the earthworks cut fill balance, showed that it is not possible to obtain a storage capacity of 100Mm^3 within the available footprint.
Site 41 - Chinnor Reservoir 30Mm^3	Chinnor Reservoir (30 Mm^3) TWU_UTC_HI-RSR_RE1_ALL_res_chinnor	In WRMP19 this option passed the feasibility stage but was not included on the constrained list following fine screening. Option design reviewed at WRMP24 taking into account greater regional need. Decision made to include options in WRMP24 investment model due to potential for regional benefit	Included on Feasible List.	Passed screening, included on Feasible List.
Site 41 - Chinnor Reservoir 50Mm^3	Chinnor Reservoir (50 Mm^3) TWU_UTC_HI-RSR_RE1_ALL_res_chinnor_1	In WRMP19 this option passed the feasibility stage but was not included on the constrained list following fine screening. Option design reviewed at WRMP24 taking into account greater regional need. Decision made to reject option	Included on Feasible List.	Rejected following further development of the conceptual ground model for the site, and subsequent review of the earthworks cut fill balance, which indicated that the reservoir footprint would need to be approximately 50% larger than WRMP19 and the site is not able to accommodate the larger footprint

WRMP19 Option Reference and name	WRSE Option Reference and name	Changes to the Option	WRMP19 Feasibility Screening Outcome	WRMP24 Feasibility Screening Outcome[4]
Site 41 - Chinnor Reservoir 75Mm^3	Chinnor Reservoir (75 Mm^3) TWU_UTC_HI-RSR_RE1_ALL_res_chinnor_75	In WRMP19 this option passed the feasibility stage but was not included on the constrained list following fine screening. Option design reviewed at WRMP24 taking into account greater regional need. Decision made to reject option	Included on Feasible List.	Rejected at WRMP24 due to impacts on archaeology within site boundary (refer to Appendix Q for further detail).
Site 43 - Aylesbury 30 Mm^3	Aylesbury Reservoir (30 Mm^3) TWU_UTC_HI-RSR_RE1_CNO_res_aylesbury 30	Option design reviewed at WRMP24 taking into account greater regional need. Decision made to include options in WRMP24 investment model due to potential for regional benefit	Rejected at stage 3 due to proximity of new housing, impacts on visual amenity and construction complexity	Passed screening, included on Feasible List.
Site 43 - Aylesbury 50 Mm^3	Aylesbury Reservoir (50 Mm^3) TWU_UTC_HI-RSR_RE1_ALL_res_aylesbury	Option design reviewed at WRMP24 taking into account greater regional need. Decision made to include options in WRMP24 investment model due to potential for regional benefit	Rejected at stage 3 due to proximity of new housing, impacts on visual amenity and construction complexity	Passed screening, included on Feasible List.
Site 43 - Aylesbury 75 Mm^3	Aylesbury Reservoir (75 Mm^3) TWU_LON_HI-RSR_RE1_ALL_res_aylesbury 75	Option design reviewed at WRMP24 taking into account greater regional need. Decision made to reject option	Rejected at stage 3 due to proximity of new housing, impacts on visual amenity and construction complexity	Rejected at Screening due to a new development which is within the same area as the reservoir's footprint.
Site 37 - Ludgershall 30 Mm^3	Ludgershall Reservoir (30 Mm^3)	Option design reviewed at WRMP24 taking into account greater regional need. Decision made to include	Rejected at stage 3 due to poor performance across many criteria, including the likely need	Passed screening, included on Feasible List.

WRMP19 Option Reference and name	WRSE Option Reference and name	Changes to the Option	WRMP19 Feasibility Screening Outcome	WRMP24 Feasibility Screening Outcome[4]
	TWU_STR_HI-RSR_RE1_CNO_res_ludgershall 30	options in WRMP24 investment model due to potential for regional benefit	for off-site compensation storage for flood plain encroachment, landscape impacts and cost	
Site 37 - Ludgershall 50 Mm3	Ludgershall Reservoir (50 Mm^3) TWU_STR_HI-RSR_RE1_ALL_res_ludgershall	Option design reviewed at WRMP24 taking into account greater regional need. Decision made to include options in WRMP24 investment model due to potential for regional benefit	Rejected at stage 3 due to poor performance across many criteria, including the likely need for off-site compensation storage for flood plain encroachment, landscape impacts and cost	Passed screening, included on Feasible List.
Site 42 - Haddenham 30 Mm^3	Haddenham Reservoir (30 Mm^3) TWU_UTC_HI-RSR_RE1_ALL_res_haddenham 30	Option design reviewed at WRMP24 taking into account greater regional need. Decision made to include options in WRMP24 investment model due to potential for regional benefit	Rejected at stage 3 due to poor performance across many of the criteria, including landscape and visual impacts as well as complex construction requirements.	Passed screening, included on Feasible List.
New Abingdon Reservoir 75Mm^3 RES-RRR-ABI-75Mm3	Reservoir Abingdon 75 TWU_STR_HI-RSR_RE1_CNO_abingdon75(lon)	Option further developed as an SRO option. No change made to screening decisions made at WRMP19. Refer to SESRO Gate 2 submission for development of the engineering design and environmental assessment since WRMP19.	Passed feasibility assessment and included on Feasible List.	Included on Feasible List, developed as an SRO option
New Abingdon Reservoir (150Mm^3) RES-RRR-ABI-150Mm3	New Reservoir Abingdon 150 Mm^3 - 283 MLD	Option further developed as an SRO option. No change made to screening decisions made at WRMP19.	Passed feasibility assessment and included on Feasible List.	Included on Feasible List, developed as an SRO option

WRMP19 Option Reference and name	WRSE Option Reference and name	Changes to the Option	WRMP19 Feasibility Screening Outcome	WRMP24 Feasibility Screening Outcome[4]
	TWU_STR_HI-RSR_RE1_ALL_abingdon	Refer to SESRO Gate 2 submission for development of the engineering design and environmental assessment since WRMP19		
New Abingdon Reservoir 100 Mm^3 RES-RRR-ABI-100Mm3	Reservoir Abingdon 100 TWU_STR_HI-RSR_RE1_CNO_abingdon100(lon)	Option further developed as an SRO option. No change made to screening decisions made at WRMP19. Refer to SESRO Gate 2 submission for development of the engineering design and environmental assessment since WRMP19	Passed feasibility assessment and included on Feasible List.	Included on Feasible List, developed as an SRO option
New Abingdon Reservoir (125Mm^3) RES-RRR-ABI-125Mm3	Reservoir Abingdon 125 TWU_STR_HI-RSR_RE1_CNO_abingdon125(lon)	Option further developed as an SRO option. No change made to screening decisions made at WRMP19. Refer to SESRO Gate 2 submission for development of the engineering design and environmental assessment since WRMP19	Passed feasibility assessment and included on Feasible List.	Included on Feasible List, developed as an SRO option
New Abingdon Reservoir 30+100Mm^3 RES-RRR-ABI-30+100Mm3-P1 RES-RRR-ABI-30+100Mm3-P2	New Reservoir Abingdon 30 +100 Mm^3 Phased option TWU_STR_HI-RSR_RE1_CNO_abingdon30+100p1 TWU_STR_HI-RSR_RE2_ALL_abingdon30+100p2	Option further developed as an SRO option. No change made to screening decisions made at WRMP19. Refer to SESRO Gate 2 submission for development of the engineering design and environmental assessment since WRMP19	Passed feasibility assessment and included on Feasible List.	Included on Feasible List, developed as an SRO option

WRMP19 Option Reference and name	WRSE Option Reference and name	Changes to the Option	WRMP19 Feasibility Screening Outcome	WRMP24 Feasibility Screening Outcome[4]
New Abingdon Reservoir 80+42 Mm^3 RES-RRR-ABI-80+42Mm3-P1 RES-RRR-ABI-80+42Mm3-P2	New Reservoir Abingdon 80 + 42 Mm^3 Phased option TWU_STR_HI-RSR_RE2_ALL_abingdon80+42p2 TWU_STR_HI-RSR_RE1_CNO_abingdon80+42p1	Option further developed as an SRO option. No change made to screening decisions made at WRMP19. Refer to SESRO Gate 2 submission for development of the engineering design and environmental assessment since WRMP19	Passed feasibility assessment and included on Feasible List.	Included on Feasible List, developed as an SRO option
NA	STT-SESRO Link P1 TWU_STT_HI-TFR_STT_ALL_stt-sesro p1	New option to WRMP24 Option provides the ability for the STT pipeline transfer option to discharge into SESRO, Assessment of conjunctive use has been investigated by the SESRO SRO (P1 for pipeline and minimum DO increase) Refer to SESRO Gate 2 submissions, available on Thames Water Website for further information.	NA	Included in investment modelling, developed as an SRO option
NA	STT-SESRO Link P2 TWU_STT_HI-TFR_STT_ALL_stt-sesro p2	New option to WRMP24 Option provides the ability for the STT pipeline transfer option to discharge into SESRO, Assessment of conjunctive use has been investigated by the SESRO SRO (P2 for pipeline and maximum DO increase)	NA	Included in investment modelling, developed as an SRO option

WRMP19 Option Reference and name	WRSE Option Reference and name	Changes to the Option	WRMP19 Feasibility Screening Outcome	WRMP24 Feasibility Screening Outcome[4]
NA	STT-SESRO Link C1 TWU_STT_HI-TFR_STT_ALL_stt-sesro c1	New option to WRMP24 Option provides the ability for the STT canal transfer option to discharge into SESRO, Assessment of conjunctive use has been investigated by the SESRO SRO (C1 for canal and minimum DO increase)	NA	Included in investment modelling, developed as an SRO option
NA	STT-SESRO Link C2 TWU_STT_HI-TFR_STT_ALL_stt-sesro c2	New option to WRMP24 Option provides the ability for the STT canal transfer option to discharge into SESRO, Assessment of conjunctive use has been investigated by the SESRO SRO (C2 for canal and maximum DO increase)	NA	Included in investment modelling, developed as an SRO option

Table 6: Option changes since WRMP19

WRMP19 Option Reference and name	WRSE Option Reference and name	WRMP19 DO (Ml/d)[5]		WRMP24 DO (Ml/d)			Difference (Ml/d)		Impact on Feasibility Assessment Scoring
		Average	Peak	1 in 2 average	1 in 500 average	1 in 500 peak	Average	Peak	
Site 36 - Marsh Gibbon Reservoir 30 Mm^3	Marsh Gibbon Reservoir (30 Mm^3) TWU_STR_HI-RSR_RE1_CNO_res_marsh gibbon_3	48	68	66	66	66	+18	-2	Values as modelled for SESRO option adopted for other reservoir locations. As such, Tier 1 DO calculation undertaken using WRSE Pywr model, involving a 'full stochastic' DO assessment, and incorporating the impact of climate change as per the WRSE standard approach to climate change assessment. No impact on feasibility assessment scoring
Site 36 - Marsh Gibbon Reservoir 50 Mm^3	Marsh Gibbon Reservoir (50 Mm^3) TWU_STR_HI-RSR_RE1_CNO_res_marshgibbon_2	89	109	103	103	103	+13	-7	
Site 36 - Marsh Gibbon Reservoir 75 Mm^3	Marsh Gibbon Reservoir (75 Mm^3) TWU_STR_HI-RSR_RE1_ALL_res_marshgibbon	139	158	149	149	149	+10	-9	
Site 41 - Chinnor Reservoir 30Mm^3	Chinnor Reservoir (30 Mm^3)	48	68	66	66	66	+18	-2	Values as modelled for SESRO option adopted for other reservoir locations. As

[5] From WRMP19, Section 7, Table 7-3 Climate Change 2080s DO (Ml/d

WRMP19 Option Reference and name	WRSE Option Reference and name	WRMP19 DO (Ml/d)[5]		WRMP24 DO (Ml/d)			Difference (Ml/d)		Impact on Feasibility Assessment Scoring
		Average	Peak	1 in 2 average	1 in 500 average	1 in 500 peak	Average	Peak	
	TWU_UTC_HI-RSR_RE1_ALL_res_chinnor								such, Tier 1 DO calculation undertaken using WRSE Pywr model, involving a 'full stochastic' DO assessment, and incorporating the impact of climate change as per the WRSE standard approach to climate change assessment. No impact on feasibility assessment scoring
Site 41 - Chinnor Reservoir 50Mm^3	Chinnor Reservoir (50 Mm^3) TWU_UTC_HI-RSR_RE1_ALL_res_chinnor_1	89	109	Rejected at WRMP24			n/a	n/a	
Site 43 - Aylesbury 30 Mm^3	Aylesbury Reservoir (30 Mm^3) TWU_UTC_HI-RSR_RE1_CNO_res_aylesbury 30	48[6]	68[6]	66	66	66	+18	-2	Values as modelled for SESRO option adopted for other reservoir locations. As such, Tier 1 DO calculation undertaken using WRSE Pywr model, involving a 'full stochastic' DO assessment, and incorporating the impact of climate change as per the WRSE standard approach to climate change assessment. No impact on feasibility assessment scoring
Site 43 - Aylesbury 50 Mm^3	Aylesbury Reservoir (50 Mm^3) TWU_UTC_HI-RSR_RE1_ALL_res_aylesbury	89[6]	109[6]	103	103	103	+13	-7	

[6] For options not included in WRMP19, Section 7, Table 7-3, DOs are based on equivalent size Abingdon Reservoir

WRMP19 Option Reference and name	WRSE Option Reference and name	WRMP19 DO (Ml/d)[5]		WRMP24 DO (Ml/d)			Difference (Ml/d)		Impact on Feasibility Assessment Scoring
		Average	Peak	1 in 2 average	1 in 500 average	1 in 500 peak	Average	Peak	
Site 37 - Ludgershall 30 Mm^3	Ludgershall Reservoir (30 Mm^3) TWU_STR_HI-RSR_RE1_CNO_res_ludgershall 30	48[6]	68[6]	66	66	66	+18	-2	Values as modelled for SESRO option adopted for other reservoir locations. As such, Tier 1 DO calculation undertaken using WRSE Pywr model, involving a 'full stochastic' DO assessment, and incorporating the impact of climate change as per the WRSE standard approach to climate change assessment. No impact on feasibility assessment scoring
Site 37 - Ludgershall 50 Mm^3	Ludgershall Reservoir (50 Mm^3) TWU_STR_HI-RSR_RE1_ALL_res_ludgershall	89[6]	109[6]	103	103	103	+13	-7	
Site 42 - Haddenham 30 Mm^3	Haddenham Reservoir (30 Mm^3) TWU_UTC_HI-RSR_RE1_ALL_res_haddenham 30	48[6]	68[6]	66	66	66	+18	-2	Values as modelled for SESRO option adopted for other reservoir locations. As such, Tier 1 DO calculation undertaken using WRSE Pywr model, involving a 'full stochastic' DO assessment, and incorporating the impact of climate change as per the WRSE standard approach to climate change assessment. No impact on feasibility assessment scoring
New Abingdon Reservoir 75Mm^3 RES-RRR-ABI-75Mm3	Reservoir Abingdon 75	139	158	149	149	149	+10	-7	Tier 1 DO calculation undertaken using WRSE Pywr model, involving a 'full stochastic' DO assessment, and

WRMP19 Option Reference and name	WRSE Option Reference and name	WRMP19 DO (Ml/d)[5]		WRMP24 DO (Ml/d)			Difference (Ml/d)		Impact on Feasibility Assessment Scoring
		Average	Peak	1 in 2 average	1 in 500 average	1 in 500 peak	Average	Peak	
	TWU_STR_HI-RSR_RE1_CNO_abingdon75(Ion)								incorporating the impact of climate change as per the WRSE standard approach to climate change assessment.
New Abingdon Reservoir (150Mm^3) RES-RRR-ABI-150Mm3	New Reservoir Abingdon 150 Mm^3 TWU_STR_HI-RSR_RE1_ALL_abingdon	270	288	271	271	271	+1	-17	No impact on feasibility assessment scoring
New Abingdon Reservoir 100 Mm^3 RES-RRR-ABI-100Mm3	Reservoir Abingdon 100 TWU_STR_HI-RSR_RE1_CNO_abingdon100(Ion)	186	206	185	185	185	-1	-21	
New Abingdon Reservoir (125Mm^3) RES-RRR-ABI-125Mm3	Reservoir Abingdon 125 TWU_STR_HI-RSR_RE1_CNO_abingdon125(Ion)	230	248	230	230	230	0	-19	
New Abingdon Reservoir (50Mm^3) RES-RRR-ABI-50Mm3	Reservoir Abingdon 50 TWU_STR_HI-RSR_RE1_CNO_abingdon50(Ion)	89[2]	109[2]	103	103	103	+14	-6	No impact on feasibility assessment scoring

WRMP19 Option Reference and name	WRSE Option Reference and name	WRMP19 DO (Ml/d)[5]		WRMP24 DO (Ml/d)			Difference (Ml/d)		Impact on Feasibility Assessment Scoring
		Average	Peak	1 in 2 average	1 in 500 average	1 in 500 peak	Average	Peak	
New Abingdon Reservoir (30Mm^3) RES-RRR-ABI-30Mm3	Reservoir Abingdon 30 TWU_STR_HI-RSR_RE1_CNO_abingdon30(Ion)	48[2]	68[2]	66	66	66	+18	-2	No impact on feasibility assessment scoring
New Abingdon Reservoir 30+100Mm^3 RES-RRR-ABI-30+100Mm3-P1 RES-RRR-ABI-30+100Mm3-P2	New Reservoir Abingdon 30 +100 Mm^3 Phased option *TWU_STR_HI-RSR_RE1_CNO_abingdon30+100p1*	48 193	68 193	66 173.1	65.5 173.1	65.5 173.1	+18 -20	-2 26	Tier 1 DO calculation undertaken using WRSE Pywr model, involving a 'full stochastic' DO assessment, and incorporating the impact of climate change as per the WRSE standard approach to climate change assessment No impact on feasibility assessment scoring
New Abingdon Reservoir 80+42 Mm^3 RES-RRR-ABI-80+42Mm3-P1 RES-RRR-ABI-80+42Mm3-P2	New Reservoir Abingdon 80 + 42 Mm^3 Phased option TWU_STR_HI-RSR_RE1_CNO_abingdon80+42p1 TWU_STR_HI-RSR_RE2_ALL_abingdon80+42p2	148 81	167 81	155.1 68.9	155.1 68.9	155.1 68.9	+7 -12	-12 -12	

WRMP19 Option Reference and name	WRSE Option Reference and name	WRMP19 DO (Ml/d)[5]		WRMP24 DO (Ml/d)			Difference (Ml/d)		Impact on Feasibility Assessment Scoring
		Average	Peak	1 in 2 average	1 in 500 average	1 in 500 peak	Average	Peak	
NA [7]	SESRO / STT interconnector - Conjunctive Use Benefit TWU_STT_HI-TFR_STT_ALL_stt-sesro	0	0	DO for connection with STT (Deerhurst pipeline) is up to 3.6-10.8, depending on pipeline capacity and reservoir size.			0	0	NA

Table 7: Option Deployable Output (DO) changes since WRMP19

[7] 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

Strategic resource options

29 The conceptual design of the Abingdon reservoir has been developed since WRMP19 through the South East Strategic Reservoir Option (SESRO) SRO, however the proposed design of the major components of the SESRO scheme has not significantly changed.

30 The SRO work has focused on reducing uncertainty in the design information and ensuring the design concept responds to environmental and planning expectations for large scale infrastructure development. Further work has included reconfirming reservoir safety requirements, flood risk review, consideration of watercourse diversions and BNG requirements, road access, initial landscape design, scenarios for visitor and recreational facilities, realignment of the intake tunnel to avoid new developments, review of the auxiliary drawdown channel design, rail access for construction materials and mitigation for construction noise.

31 Latest information on the SESRO proposed design can be found in the SESRO Gate 2 submission published on the Thames Water Website.

32 The work undertaken by the SRO team since WRMP19 does not change the WRMP19 screening decision and SESRO is included on the WRMP24 Feasible List.

Updated Feasibility Assessment and Backchecking

Feasibility Assessment Approach

33 This section of the report outlines the updates made in WRMP24 to the WRMP19 feasibility assessment. This should be read alongside the WRMP19 reservoir feasibility report. Where options have been rejected through the screening process the rejection reason is recorded in the WRMP24 Appendix Q Scheme Rejection Register.

34 A three-stage feasibility screening approach was employed for WRMP24, this approach is unchanged from WRMP19, details of the approach can be found in the WRMP19 reservoir feasibility report.

35 The WRMP19 reservoir feasibility report assessed 55 reservoir sites, see Figure 1. Out of the 55 reservoir sites,

- 20 were rejected at Stage 1 assessment, on the basis of international/national nature conservation sites, heritage assets and thickness of impermeable strata
- 26 were rejected at Stage 2 assessment, on the basis of relative impact on land, socio-economic, environmental criteria and high-level design criteria (length of conveyance, material, topography)
- six were rejected at Stage 3 assessment, on the basis of planning policy, socio-economic, environmental criteria, cost and construction complexity
- three proceeded to fine screening

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 predicted water resources deficit of Thames Water and, where applicable, neighbouring companies. However, the predicted water resources need for the region at WRMP24[8] is significantly higher than at WRMP19, owing to:

- increased sustainability reductions
- a change to planning for water supply resilience for a 1 in 500 year drought from 1 in 200 at WRMP19[9]

37 Furthermore, potential new transfers identified by WRSE would allow new resource options in the Thames Water supply area to supply more of the WRSE region than was considered at WRMP19 (refer to WRSE regional plan for more information, published on the WRSE website). For these reasons, the potential resource need for Thames Water alone is not being used as a consideration in the screening process at WRMP24, allowing the investment model flexibility to select options based on regional need. 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

[8] https://wrse.uk.engagementhq.com/the-challenge

[9] A 1 in 500 year event explained: This does not refer to an event that will occur every 500 years, it is better considered an event where there is a 1 in 500 chance of the event occurring in a given year, or a 0.2% chance. The probability of it happening in one year remains the same in each of the following years.

use of the WRSE investment model to compare options against cost, environmental, and resilience criteria. Further information on WRSE investment modelling can be found in Section 11.

Stage 1 Assessment Results

38 The WRMP19 feasibility report assessed a total of 55 reservoir sites Figure 1, originally identified in the 2006[10] study, which was reviewed in 2012 as part of WRMP14.

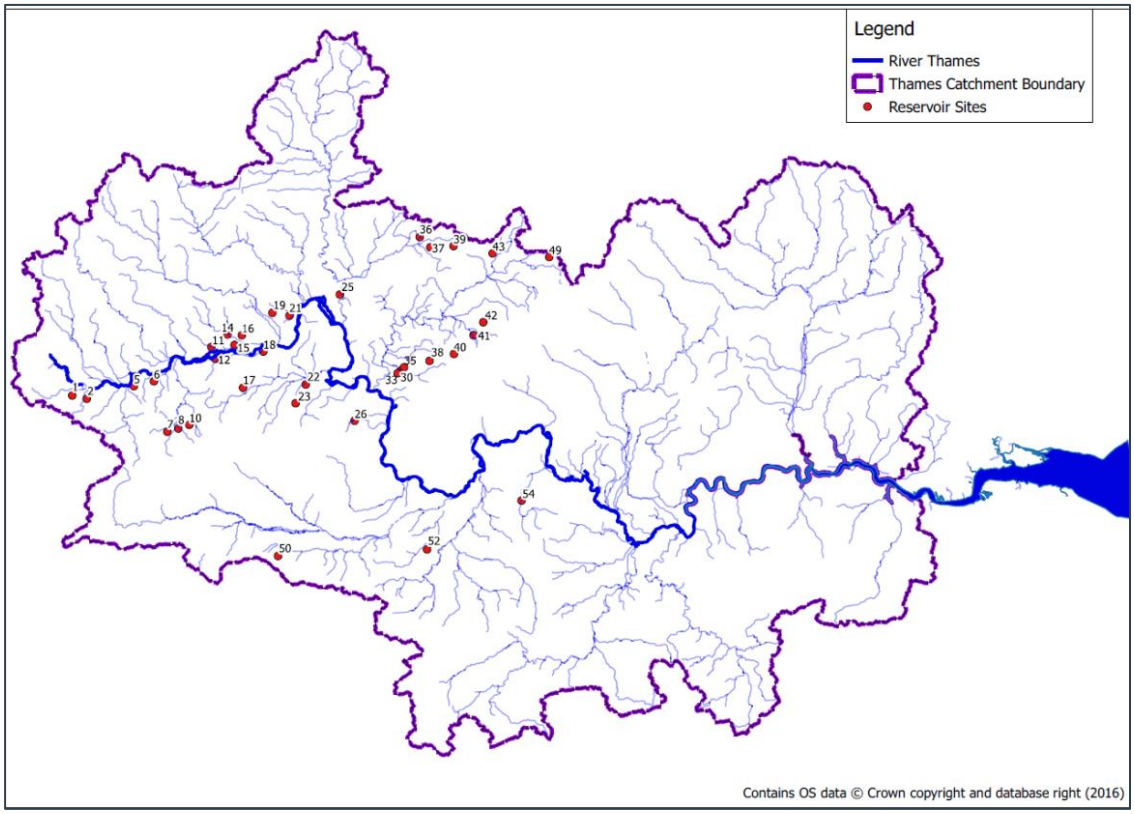


Figure 1: Reservoir sites assessed in WRMP 19

WRMP19 Stage 1 assessment was completed in 2 phases:

- Phase 1: Identification of potential reservoir site areas
- Phase 2: Review of absolute and other key constraints

39 New information was considered at this site identification stage (Phase 1) where relevent. Two sites from the list of the 55 sites were discounted in WRMP19 at Phase 1 on account of encroachment of further built development within these potential reservoir site areas. These were:

- Site 4 – Swindon
- Site 51 – Burghfield

[10] Thames Water (2006) The Upper Thames Major Resource Development: Reservoir Site Selection Report. 14 September 2006

41 Criteria	Site 3 Cricklade	Site 9 Lechade on Thames	Site 13 Uffington	Site 20 – West Hanney	Site 24 Kidlington	Site 27 Beckley	Site 28 Brightwell Cum Sotwell	Site 29 Ambrosden	Site 31 Wheatley	Site 32 Benson	Site 34 - Bicester	Site 44 Stone	Site 45 Whitchurch	Site 46 Stewkley
National/international nature conservation sites	✓	✓	✓	✓	✕	✕	✓	✓	✕	✓	✓	✓	✓	✓
National/international Heritage Assets	✕	✕	✓	✓	✕	✕	✕	✓	✓	✕	✓	✕	✓	✕
Clay thickness of 10m or less	✓	✓	✕	✕	✓	✓	✓	✕	✓	✓	✕	✓	✕	✕
OUTCOME	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL

40 Of the remaining 53 sites, 18 were rejected at WRMP19, Stage 1 - Phase 2 assessment, on the basis of international/national nature conservation sites, heritage assets and thickness of impermeable strata as shown in

42 . These are included in the Final WRMP19 Appendix Q - Scheme Rejection Register, further information can also be found in the WRMP19 Reservoirs Feasibility Report.

43 Stage 1 criteria are considered to still be valid for WRMP24 and therefore the study area is unchanged, as a result no new reservoir sites have been identified. There are no changes to the WRMP19 Stage 1 assessment of the 55 sites for WRMP24 and thirty-five options passed the Stage 1 assessment.

Criteria	Site 3 Cricklade	Site 9 Lechade on Thames	Site 13 Uffington	Site 20 – West Hanney	Site 24 Kidlington	Site 27 Beckley	Site 28 Brightwell Cum Sotwell	Site 29 Ambrosden	Site 31 Wheatley	Site 32 Benson	Site 34 - Bicester	Site 44 Stone	Site 45 Whitchurch	Site 46 Stewkley	Site 47 Bierton	Site 48 Wingrave	Site 53 Wokingham	Site 55 Maidenhead
National/international nature conservation sites	✓	✓	✓	✓	✗	✗	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓
National/international Heritage Assets	✗	✗	✓	✓	✗	✗	✗	✓	✓	✗	✓	✗	✓	✗	✓	✓	✗	✓
Clay thickness of 10m or less	✓	✓	✗	✗	✓	✓	✓	✗	✓	✓	✗	✓	✗	✗	✗	✗	✓	✗
OUTCOME	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL

Table 8: Stage 1 assessment

44 Further details regarding the Stage 1 assessments are included in the WRMP19 Reservoir Feasibility Report.

Stage 2 assessment results

45 The potential reservoir site areas taken through to Stage 2 at WRMP19 ranged in size from approximately 200 hectares to almost 1,500 hectares. Due to this wide range of land area, the WRMP19 feasibility report split these potential sites into "size bands". This was to allow comparison of similarly sized sites to be undertaken and for the best performing sites within each size band to be taken through to Stage 3 for more detailed assessment.

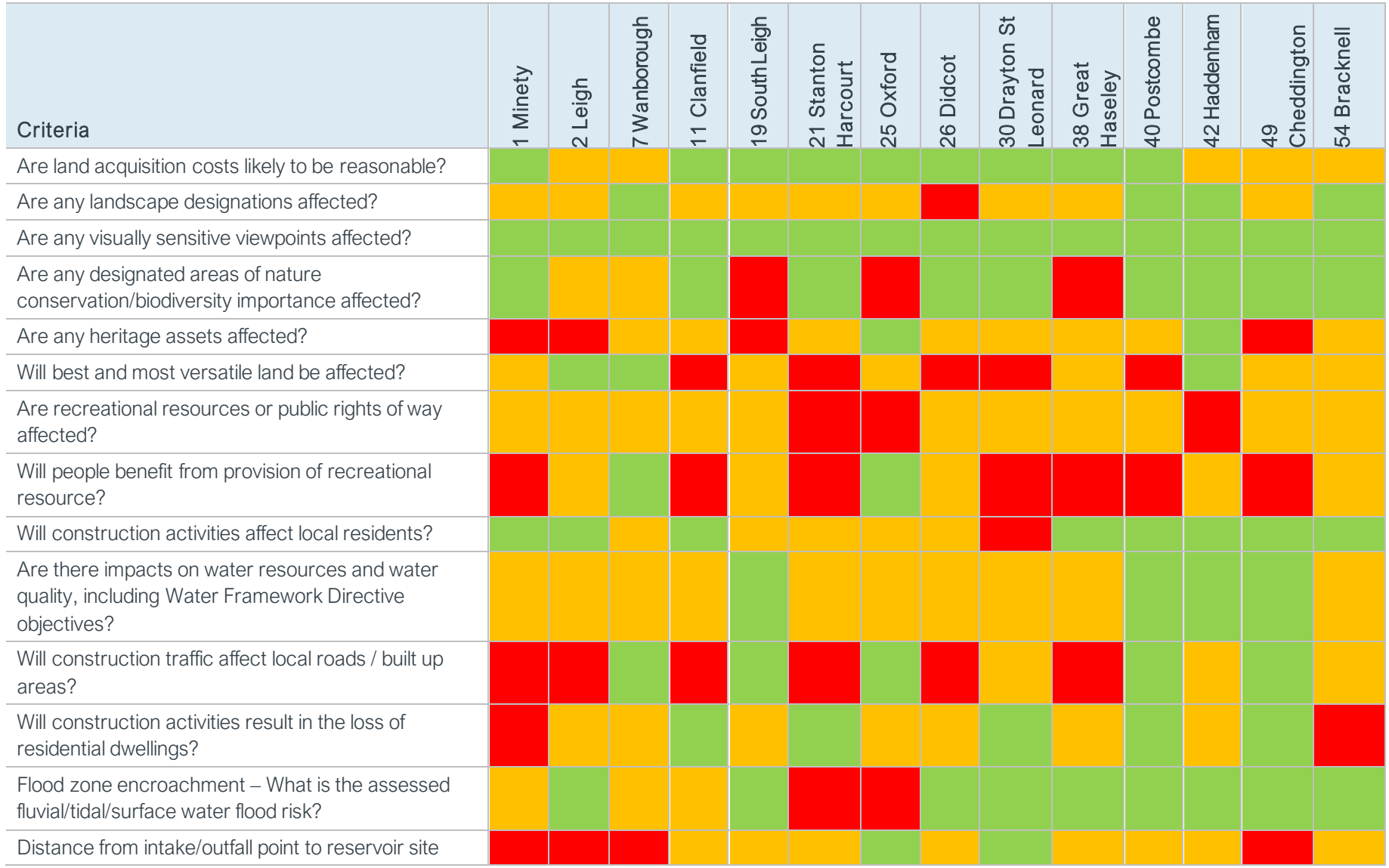
46 Following a review of the range of site sizes identified it was determined that the size bands would be:

- Band A: 200 – 399 hectares
- Band B: 400 – 699 hectares
- Band C: 700 hectares or larger

47 Band A sites are only likely to be able to accommodate reservoirs with a capacity of 30Mm^3, but those in Bands B and C, would be able to accommodate a wider range of reservoir capacities each of which was subject to assessment at Stage 3.

48 The Stage 2 assessment of the WRMP19 and WRMP24 options that passed Stage 1 is presented in Table 9 providing the Red, Amber, Green (RAG) assessment of the criteria described in the WRMP19 Reservoir Feasibility Report. Nine sites passed the Stage 2 assessment. Further details are included in the WRMP19 Reservoir Feasibility report.

49 Where changes have been made to WRMP19 RAG status this is indicated in Table 9 Appendix D of the WRMP19 feasibility report included Stage 2 summary assessments; these are unchanged at WRMP24 but the rationale for changes to the RAG assessment are noted in Table 9.


Criteria
1 Minety
2 Leigh
7 Wanborough
11 Clanfield
19 South Leigh
21 Stanton Harcourt
25 Oxford
26 Didcot
30 Drayton St Leonard
38 Great Haseley
40 Postcombe
42 Haddenham
49 Cheddington
54 Bracknell
Are land acquisition costs likely to be reasonable?
Are any landscape designations affected?
Are any visually sensitive viewpoints affected?
Are any designated areas of nature conservation/biodiversity importance affected?
Are any heritage assets affected?
Will best and most versatile land be affected?
Are recreational resources or public rights of way affected?
Will people benefit from provision of recreational resource?
Will construction activities affect local residents?
Are there impacts on water resources and water quality, including Water Framework Directive objectives?
Will construction traffic affect local roads / built up areas?
Will construction activities result in the loss of residential dwellings?
Flood zone encroachment – What is the assessed fluvial/tidal/surface water flood risk?
Distance from intake/outfall point to reservoir site

Criteria	1 Minety	2 Leigh	7 Wanborough	11 Clanfield	19 SouthLeigh	21 Stanton Harcourt	25 Oxford	26 Didcot	30 Drayton St Leonard	38 Great Haseley	40 Postcombe	42 Haddenham	49 Cheddington	54 Bracknell
Availability of construction materials on site?														
Variation in topographic levels across site?														
Opportunity for construction material transportation by rail – Are the means of access suitable, both for construction and operation?														
OUTCOME – Proceed to Stage 3	N	N	Y	N	N	N	N	N	N	N	Y	Y	N	Y

Table 9: Stage 2 assessment – Band A sites

50 There are no changes to the WRMP19 Stage 2 feasibility assessment outcome and the following Band A sites were therefore taken forward to Stage 3:

- Site 7 – Wanborough
- Site 40 – Postcombe
- Site 42 – Haddenham
- Site 54 – Bracknell

Criteria	6 Highworth	10 Shriven Heath	14 Brize Norton	15 Brampton	16 Witney	17 Stanford in the Vale	18 Longworth	23 Wantage	33 Chalgrove	35 Chargrove Airport	37 Ludgershall	39 Quainton	41 Chinnor	43 Aylesbury	50 Kintbury	52 Beech Hill
Are land acquisition costs likely to be reasonable?																
Are any landscape designations affected?																
Are any visually sensitive viewpoints affected?																
Are any designated areas of nature conservation/biodiversity importance affected?																
Are any heritage assets affected?																
Will best and most versatile land be affected?																
Are recreational resources or public rights of way affected?																
Will people benefit from provision of recreational resource?																
Will construction activities affect local residents?														WRMP24 UPDATE: Following a visual assessment, this site has		

Criteria	6 Highworth	10 Shriven Heath	14 Brize Norton	15 Brampton	16 Witney	17 Stanford in the Vale	18 Longworth	23 Wantage	33 Chalgrove	35 Chargrove Airport	37 Ludgershall	39 Quainton	41 Chinnor	43 Aylesbury	50 Kintbury	52 Beech Hill
														been updated from Amber to Green because less than 100 residential properties are likely to be affected		
Are there likely impacts on water resources and water quality, including Water Framework Directive objectives?																
Will construction activities result in the loss of residential dwellings?																
Flood zone encroachment – What is the assessed fluvial/tidal/surface water flood risk?											WRMP24 UPDATE: Scoring changed from Amber to Red as review concluded		WRMP24 UPDATE: Scoring changed from Green to Amber as review			

Criteria	6 Highworth	10 Shriven Heath	14 Brize Norton	15 Brampton	16 Witney	17 Stanford in the Vale	18 Longworth	23 Wantage	33 Chalgrove	35 Chargrove Airport	37 Ludgershall	39 Quainton	41 Chinnor	43 Aylesbury	50 Kintbury	52 Beech Hill
											>50% of site located within FZ2/3[11]		concluded 25-50% of site within FZ2/3.			
Distance from intake/outfall point to reservoir site																
Availability of construction materials on site?																
Variation in topographic levels across site?																
Opportunity for construction material transportation by rail – Are the means of access suitable, both for construction and operation?																
OUTCOME – Proceed to Stage 3	N	N	N	N	N	N	N	N	N	N	Y	N	Y	Y	N	N

Table 10: Stage 2 assessment – Band B sites

[11] There are no changes to the previous mapping which is included in the WRMP 19 Reservoir Feasibility Report Appendix M

51 There are no changes to the WRMP19 Stage 2 feasibility assessment outcome and the following Band B sites were therefore taken forward to Stage 3:

- Site 37 – Ludgershall
- Site 41 – Chinnor
- Site 43 – Aylesbury

Criteria	5 Broad Blunsdon	8 Bishopstone	12 Farringdon	22 Abingdon	36 Marsh Gibbon
Are land acquisition costs likely to be reasonable?					
Are any landscape designations affected?					
Are any visually sensitive viewpoints affected?					
Are any designated areas of nature conservation/biodiversity importance affected?					
Are any heritage assets affected?					
Will best and most versatile land be affected?					
Are recreational resources or public rights of way affected?					
Will people benefit from provision of recreational resource?					
Will construction activities affect local residents?					
Are there likely impacts on water resources and water quality, including Water Framework Directive objectives?					
Will construction traffic affect local roads / built up areas?					
Will construction activities result in the loss of residential dwellings?					
Flood zone encroachment – What is the assessed fluvial/tidal/surface water flood risk?					
Distance from intake/outfall point to reservoir site					
Availability of construction materials on site?					
Variation in topographic levels across site?					
Opportunity for construction material transportation by rail – Are the means of access suitable, both for construction and operation?					
OUTCOME – Proceed to Stage 3	N	N	N	Y	Y

WRMP19 assessment shown for information, option has now been developed through SRO Gate process

Table 11: Stage 2 assessment – Band C sites

52 There are no changes to the WRMP19 Stage 2 feasibility assessment outcome and the following Band C sites were therefore taken forward to Stage 3:

- Site 22 – Abingdon
- Site 36 – Marsh Gibbon

53 Ten Band A sites, thirteen Band B sites and three Band C sites were rejected at Stage 2; the reasons for rejection are included in the WRMP24 Appendix Q - Scheme Rejection Register.

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 12 to Table 17 providing the red, amber, green assessment of the criteria described in WRMP19 Reservoir Feasibility report. Six sites passed the Stage 3 assessment for reservoir capacities of 30 Mm^3, five sites for 50 Mm^3, two for 75 Mm^3 and 100 Mm^3, and one site for 125 Mm^3 and 150 Mm^3. Further details are included in the WRMP19 Reservoir Feasibility report and Section 3 of this report.

56 Where changes have been made to WRMP19 RAG status this is indicated **Error! Reference source not found.** to **Error! Reference source not found.**. Appendices O to T of the WRMP19 feasibility report included Stage 3 summary assessments; these are still considered appropriate and have therefore not been updated for WRMP24 but the rationale for changes to the RAG assessment are noted in **Error! Reference source not found.** to **Error! Reference source not found.**.

	7 Wanborough	22 Abingdon	36 Marsh Gibbon 3	37 Ludgershall	41 Chinnor	42 Haddenham	43 Aylesbury
Criteria: Sustainability measures							
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							
Opportunities for Biodiversity Enhancement							

	7 Wanborough	22 Abingdon	36 Marsh Gibbon 3	37 Ludgershall	41 Chinnor	42 Haddenham	43 Aylesbury
Archaeology and Historic Environment							
Non- traffic impact of construction on residents							
Impact on recreation							
Impact on Water Resources and Water Quality							
Cost (regulating only reservoir)			WRMP24 UPDATE: AIC reassessed based on WRMP24 information.				
Cost (dual function reservoir)							
Construction Complexity					WRMP24 UPDATE: Change from Amber to Red Construction complexity reviewed taking account of		

	7 Wanborough	22 Abingdon	36 Marsh Gibbon 3	37 Ludgershall	41 Chinnor	42 Haddenham	43 Aylesbury
					WRMP24 design development and risk associated with geology, pipeline route and distance from main river (emergency drawdown).		

Table 12: Stage 3 assessment - Summary of 30Mm^3 option

57 The planning review of the Wanborough site indicates that there has been approved planning for 370 new dwellings, with a further two planning applications for developments near the site submitted for approval. These planning applications are within the potential reservoir site, thereby reducing the area of land available. This does not change the Stage 3 RAG assessment as the site was already assessed as RED for Planning Policy and History.

58 The following 30Mm^3 sites passed Stage 3 feasibility assessment and were taken forward for further consideration:

- Site 22 Abingdon
- Site 36 Marsh Gibbon
- Site 37 Ludgershall (rejected at WRMP19)
- Site 41 Chinnor
- Site 42 Haddenham (rejected at WRMP19)
- Site 43 Aylesbury (rejected at WRMP19)

Criteria	22 Abingdon	36 Marsh Gibbon	37 Ludgershall	41 Chinnor	43 - Aylesbury
Sustainability measures					
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					
Opportunities for Biodiversity Enhancement			WRMP24 UPDATE: More detailed review identified that the 50Mm^3 has both woodland and watercourse adjacent to the site, therefore	WRMP24 UPDATE: More detailed review identified that the 50Mm^3 has both woodland and watercourse adjacent to the site, therefore	WRMP24 UPDATE: More detailed review for WRMP24 identified that the 50Mm^3 has no woodland adjacent to site, therefore change from Green to Amber.

Criteria	22 Abingdon	36 Marsh Gibbon	37 Ludgershall	41 Chinnor	43 - Aylesbury
			change from Amber to Green.	change from Amber to Green.	
Archaeology and Historic Environment					
Non- traffic impact of construction on local residents					
Impact on recreation					
Impact on Water Resources and Water Quality					
Cost (regulating only reservoir)		WRMP24 UPDATE: AIC reassessed based on WRMP24 information			
Cost (dual function reservoir)					
Construction Complexity				WRMP24 UPDATE: Change from Amber to Red Construction complexity reviewed taking account of WRMP24 design development and risk associated with geology, pipeline route and distance from	

Criteria	22 Abingdon	36 Marsh Gibbon	37 Ludgershall	41 Chinnor	43 - Aylesbury
				main river (emergency drawdown).	

Table 13: Stage 3 assessment - Summary of 50Mm^3 option

59 The following 50Mm^3 sites passed Stage 3 feasibility assessment and were taken forward for further consideration:

- Site 22 Abingdon
- Site 36 Marsh Gibbon
- Site 37 Ludgershall (previously rejected at WRMP19 – reconsidered due to potential for regional benefit)
- Site 41 Chinnor
- Site 43 Aylesbury (previously rejected at WRMP19 WRMP19 – reconsidered due to potential for regional benefit)

Criteria	22 Abingdon	36 Marsh Gibbon	[illegible]	43-Aylesbury
Sustainability measures				
Planning Policy and History				
Land Use and Land Use Quality				
Floodplain Encroachment		WRMP24 UPDATE: On review, the floodplain encroachment can be overcome, therefore change from Red to Amber.		
Landscape Character Sensitivity				
Views and Visual Amenity				
Employment and Local Economy				
Nature Conservation and Biodiversity				
Opportunities for Biodiversity Enhancement				
Archaeology and Historic Environment				
Non- traffic impact of construction on local residents				
Impact on recreation				
Impact on Water Resources and Water Quality				
Cost (regulating only reservoir)		WRMP24 UPDATE: AIC reassessed based on WRMP24 information		
Cost (dual function reservoir)				

Criteria	22 Abingdon	36 Marsh Gibbon	WRMP24 UPDATE: Change from Arber	43-Aylesbury
Construction Complexity				

Criteria	22 Abingdon	36 Marsh Gibbon	to Red Construction complexity	43-Aylesbury

Criteria	22 Abingdon	36 Marsh Gibbon	[illegible]	43-Aylesbury
			eviewed talking account of WRMP24	

Criteria	22 Abingdon	36 Marsh Gibbon	43-Aylesbury
			design development and risk asso

Criteria	22 Abingdon	36 Marsh Gibbon	[illegible]	43-Aylesbury
			ciated with geology, pipeline ro	

Criteria	22 Abingdon	36 Marsh Gibbon	[illegible]	43-Aylesbury
			u t e a n d i s t a n c e f r o m r a i n r i v e r (	

Criteria	22 Abingdon	36 Marsh Gibbon	43-Aylesbury

Table 14: Stage 3 assessment - Summary of 75Mm^3 option

60 The following 75Mm^3 sites passed Stage 3 feasibility assessment and were taken forward for further consideration:

- Site 22 Abingdon
- Site 36 Marsh Gibbon

Criteria	22 Abingdon	36 Marsh Gibbon
Sustainability measures		
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		
Opportunities for Biodiversity Enhancement		
Archaeology and Historic Environment		
Non- traffic impact of construction on local residents		
Impact on recreation		
Impact on Water Resources and Water Quality		
Cost (regulating only reservoir)		WRMP24 UPDATE: AIC reassessed based on WRMP24 information
Cost (dual function reservoir)		
Construction Complexity		

Table 15: Stage 3 assessment - Summary of 100Mm^3 option

61 The following 100Mm^3 sites passed Stage 3 feasibility assessment and were taken forward for further consideration:

- Site 22 Abingdon
- Site 36 Marsh Gibbon

Criteria	22 Abingdon
WRSE ID	
WRMP 19 ID	
Sustainability measures	
Planning Policy and History	

Criteria	22 Abingdon
Land Use and Land Use Quality	
Floodplain Encroachment	
Landscape Character Sensitivity	
Views and Visual Amenity	
Employment and Local Economy	
Nature Conservation and Biodiversity	
Opportunities for Biodiversity Enhancement	
Archaeology and Historic Environment	
Non- traffic impact of construction on local residents	
Impact on recreation	
Impact on Water Resources and Water Quality	
Cost (regulating only reservoir)	
Cost (dual function only reservoir)	
Construction Complexity	

Table 16: Stage 3 assessment - Summary of 125Mm^3 option

62 The following 125Mm^3 site passed Stage 3 feasibility assessment and was taken forward for further consideration:

- Site 22 Abingdon

Criteria	22 Abingdon
WRSE ID	
WRMP 19 ID	
Sustainability measures	
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	
Opportunities for Biodiversity Enhancement	

Criteria	22 Abingdon
Archaeology and Historic Environment	
Non- traffic impact of construction on local residents	
Impact on recreation	
Impact on Water Resources and Water Quality	
Cost (regulating only reservoir)	
Cost (dual function reservoir)	
Construction Complexity	

Table 17: Stage 3 assessment - Summary of 150Mm^3 option

63 The following 150Mm^3 site passed Stage 3 feasibility assessment and was taken forward for further consideration:

- Site 22 Abingdon

Option Verification and Conclusion

64 The review and backchecking of the WRMP19 Feasibility assessment concluded that the WRMP19 assessment criteria and study area remain valid for WRMP24.

65 Taking into account the regional need five reservoir sites that were rejected at WRMP19 have been reassessed and passed Stage 3 feasibility assessment:

- Marsh Gibbon Reservoir (30 Mm^3, 50 Mm^3, 75 Mm^3, 100Mm^3)
- Chinnor Reservoir (30 Mm^3, 50 Mm^3)
- Aylesbury Reservoir (30 Mm^3, 50 Mm^3)
- Ludgershall Reservoir (30 Mm^3, 50 Mm^3)
- Haddenham Reservoir (30 Mm^3)

Validation

66 Following the feasibility review, the concept designs for the Marsh Gibbon and Chinnor options were developed further to gain additional cost confidence (see Appendix B). These two sites were chosen for further development as they were the best performing non-SESRO reservoir options at Stage 1, 2 and 3. No update was made to the concept design of the Ludgershall, Aylesbury and Haddenham options; however, the costs were updated using the updated Chinnor and Marsh Gibbon costs as benchmarks, conceptual design were developed for the better performing options.

67 Multiple reservoir sizes were included in the design development. As a result of the concept design development, Marsh Gibbon (100Mm^3) and Chinnor (50Mm^3) are rejected due to ground conditions and revised embankment and borrow pit design. For both sites, the geotechnical review undertaken indicated that the clay volume that would be won from the borrow pit was significantly smaller than that assumed in WRMP19. This was due to shallower borrow pit excavation than originally assumed, therefore a larger footprint reservoir is required to achieve the same storage volume leading to more clay required for construction of the longer reservoir embankments.

68 This clay shortage from the borrow pit required an increase of reservoir footprint to provide the same useable volume. The consequence was that the largest options – Marsh Gibbon (100Mm^3) and Chinnor (50Mm^3) became unfeasible as:

- the updated Marsh Gibbon 100 Mm^3 option now has a footprint that is approximately 50% larger than assumed at WRMP19 and cannot be accommodated within the site boundary
- the updated Chinnor 50 Mm^3 option now has a footprint that is similar to that assumed for the Chinnor 75 Mm^3 option at WRMP19 and is therefore rejected for the same reason as Chinnor 75 Mm^3 (due to impacts on archaeology within site boundary)

Confirmation of feasible list of options

69 The reservoir sites and capacities included in the WRMP24 Feasible List are summarised in Table 18 below.

	30Mm³	50Mm³	75Mm³	100Mm³	125Mm³	150Mm³
Abingdon	✓	✓	✓	✓	✓	✓
Marsh Gibbon	✓	✓	✓	✗	✗	✗
Chinnor	✓	✗	✗	✗	✗	✗
Aylesbury	✓	✓	✗	✗	✗	✗
Ludgershall	✓	✓	✗	✗	✗	✗
Haddenham	✓	✗	✗	✗	✗	✗

Table 18 - Reservoir sites and capacities included in the WRMP24 Feasible List

Summary of Further Screening

70 The options feeding into the upper Thames River are subject to a combined discharge limit of 600 Ml/d. This limit applies to STT, SESRO, Chinnor Reservoir, Marsh Gibbon Reservoir, Ludgershall Reservoir, Aylesbury Reservoir and Haddenham Reservoir. At Further Screening scenario runs of the investment model were undertaken to assess which options within the combined limit are selected. STT and SESRO were selected as preferred options and in combination reach the 600 Ml/d discharge limit.

71 Marsh Gibbon and Chinnor have been included on the Constrained List to provide reservoir options up to the discharge limit, in combination with SESRO. This is to allow the model maximum possible flexibility in option selection. These reservoirs were selected in preference to Ludgershall, Aylesbury and Haddenham as they perform better against Stage 3 Feasibility criteria. Ludgershall, Aylesbury and Haddenham reservoirs have therefore been rejected at Further Screening and are not included on the Constrained List of options.

72 At WRMP19 SESRO / Abingdon Reservoir 30 Mm^3 and 50 Mm^3 options were rejected as these options would limit development of larger capacity options on the same site. This rejection reasoning was backchecked at WRMP24 and found to remain valid. The investment model continues to select larger capacity SESRO / Abingdon Reservoir options confirming the reason for rejecting these options.

73 For further details on rejection reasoning refer to WRMP24 Appendix Q – Scheme Rejection Register and details on the Further Screening process are provided in WRMP24 Section 7 - Appraisal of Resource Options.

A. Reference information

- The 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 throughout this report can be found on the Thames Water website at:
Regional water resources | Regulation | About us | Thames Water

B. Review of Reservoir Options

Following rescreening, the concept designs for the Marsh Gibbon and Chinnor options were developed further to gain additional cost confidence. These two sites were chosen for further development as they were the best performing non-SESRO reservoir options. No update was made to the concept design of the Ludgershall, Aylesbury and Haddenham options; however the costs were updated using the updated Chinnor and Marsh Gibbon costs as benchmarks. The concept designs for Marsh Gibbon and Chinnor were developed further, considering further refinement of:

- Site geology (conceptual ground model)
- Embankment and borrow pit design (cut / fill balance)
- Transfer pipe alignment and length.

Concept design developments since WRMP19

The proposed conceptual designs for Marsh Gibbon and Chinnor are similar to Abingdon/SESRO. They are fully bunded, non-impounding reservoirs that are filled from the River Thames when flows are high and release back to the River Thames under low flow conditions. Clay is excavated from and on-site borrow pit and used to construct the embankments that form the reservoir and the borrow pit forms part of the reservoir storage volume. Additional materials will need to be imported to the site and opportunities for delivery by rail have been considered.
The WRMP24 design developments focussed on the following aspects:

- Ground model and borrow pit design: The data from the British Geological Society (BGS) were re-assessed to refine the WRMP19 ground model with the aim of estimating the maximum excavation depth for the borrow pit.
- Embankment plan and cross section: The cross section was modified to be the same as SESRO, scaled down in height. The embankment plan was re-designed to optimise the cut/fill balance. The change of the embankment plan required an update of:
  - Road diversions
  - River diversion and Replacement Flood Storage (RFS) areas
  - Transfer pipes within the reservoir
  - Intake tower(s) location
  - Site external boundaries
- Revised pipeline design: potential pipeline routes, from the River Thames to the reservoir site, were identified which avoid key environmental, land and heritage constraints but full optimisation has not been undertaken at this time.

Site 36: Marsh Gibbon - Developments since WRMP19

The Marsh Gibbon site is situated on the Oxford/Buckinghamshire border, 6km east of Bicester. The topography is relatively flat with levels averaging at 65mAOD across the reservoir footprint. The concept design was developed for four reservoir sizes (100 Mm³, 75 Mm³, 50 Mm³, 30 Mm³).
The updated conceptual ground model indicates that, due to the updated data on the depth of clay in the area, the borrow pit needs to be shallower than was assumed in WRMP19, in order to maintain adequate factors of safety against base uplift. As a result of this, there is less clay material won from the borrow pit, and in order to achieve the cut/fill balance the reservoir

embankments must be lower, resulting in an increase in reservoir surface area (and hence overall footprint) for a given storage volume. As a consequence, the updated Marsh Gibbon 100 Mm³ option has a footprint that is approximately 50% larger than assumed at WRMP19 and cannot be accommodated within the site boundary, which is limited by proximity to other developments. The conceptual design of the 100 Mm^3 option has therefore not been developed further.

For all capacities of reservoir at the Marsh Gibbon site, the new reservoir scheme is proposed to comprise:

- A borrow pit with a base level of between 59 to 60 mAOD. The excavation follows a dip towards the south east, with shallowest area being to the north west. This allows for approximately an average of 5m depth of excavation across the whole site, rather than the 15m assumed in WRMP19
- The reservoir would be filled by pumping from an abstraction intake located on the River Thames upstream of the Oxford sewage works. Discharges back to the River Thames would be made at the same location. The combined intake and outfall structure would comprise inlet orifice with screens, connection culvert to the intake pumping station and outfall weir
- A new pumping station will be required at the intake, to pump flows to a break pressure tank, located at the transfer pipeline high point, north of Horspath. From the break pressure tank flows will gravitate to the reservoir. A drawdown pumping station will be required at the reservoir site to pump flows to the break pressure tank. Flows will then pass via gravity back to the abstraction/discharge point in the River Thames
- A main water draw off tower and secondary draw off tower. Multiple towers have been specified to allow flexibility regarding the draw off location for water quality purposes, as well as providing a backup system during periods of maintenance
- For Marsh Gibbon 75Mm^3 and 50Mm^3 options, 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. For Marsh Gibbon 30Mm^3 and 50Mm^3 a single diversion is required
- All the options have part of the embankment located in the floodplain south of the site, therefore for all three options, suitable land for replacement flood storage was identified
- Rail access is possible at this site if new sidings can be constructed to the east of the Euston-Birmingham line immediately north of the A41 just north of Blackthorn. Road access to the site would be provided by a new access road from the A41 Bicester-Aylesbury trunk road, or from the road to the north that runs from Marsh Gibbon to Edgcott
- Emergency drawdown is provided via syphons over the embankment, discharging directly into River Ray immediately downstream of the reservoir

The summary data for the Marsh Gibbon reservoir options are shown in the following table:

Option	Marsh Gibbon 75Mm³	Marsh Gibbon 50 Mm³	Marsh Gibbon 30 Mm³
Embankment Top Level*:	+78mAOD	+80.1mAOD	+78mAOD
Embankment Height:	17.3m - 8.6m	15.6m - 8.8m	15.1m - 9.6m
Embankment Length:	10,500m	7,180m	5,600m

Option	Marsh Gibbon 75Mm³	Marsh Gibbon 50 Mm³	Marsh Gibbon 30 Mm³
Drawoff pipe lengths:	27.6km total 1200 – 1400 mm dia Steel	27.6km total 1200 – 1400 mm dia Steel	27.6km total 1000 – 1100 mm dia Steel
Drawdown Flow (Ml/d)	165	108	63
Site area:	1034ha	710ha	450ha

Table 19: Marsh Gibbon reservoir summary data

* Embankment Top Level is calculated based on cut and fill analysis and varies based on reservoir footprint and ground level. This is an initial estimate and is dependent on assumptions which could change in the future.

Site: 46 Chinnor - Developments since WRMP19

The Chinnor site is situated in Oxfordshire 5km south-east of Thame. The site is relatively steep with levels varying from 69mAOD to 83mAOD. The concept design was developed for a 30 Mm^3 and 50 Mm^3 reservoir.
The updated conceptual ground model indicates that the borrow pit needs to be shallower than was assumed in WRMP19 in order to maintain adequate factors of safety against base uplift. As a result of this, there is less clay material won from the borrow pit, and in order to achieve the cut/fill balance, the reservoir embankments must be lower, resulting in an increase in reservoir surface area (and hence overall footprint) for a given storage volume. As a consequence, the updated Chinnor 50 Mm³ option now has a footprint that is similar to that assumed for the Chinnor 75 Mm³ option at WRMP19 and similar impacts on archaeology within site boundary. The conceptual design of the 50 Mm^3 option has therefore not been developed further.
The new reservoir scheme is proposed to comprise:

- A borrow pit with a base level between 66.4 to 63.1 mAOD. The excavation follows a dip towards the south, with shallowest area being to the north. This allows for excavation depths approximately 6-10m below ground, (with largest excavation towards the south of the site), significantly shallower than the 15m assumed in the WRMP19.
- The reservoir would be filled by pumping from an abstraction intake on the River Thames at Benson. Discharges back to the River Thames would be made at the same location. The combined intake and outfall structure comprises inlet orifice with screens, connection culvert to the intake pumping station and outfall weir.
- A new pumping station will be required at the intake, to pump flows directly to the new reservoir.
- A main water draw off tower and secondary draw off tower would be required. Multiple towers have been specified to allow flexibility regarding the draw off location for water quality purposes, as well as providing a backup system during periods of maintenance.
- A diversion of the National Cycle Route 57.
- River diversion works for the Cattle Brook and a drain running north of the site.
- A significant part of the reservoir (approx. 50%) would be located in Zone 2 floodplain from the Cattle Brook. To compensate for the loss of flood storage volume, three potential areas for replacement flood storge were identified.
- Railway access is available at this site – a temporary siding could be constructed from the London-Bicester railway line.

- Emergency drawdown is provided via syphons over the embankment, discharging downstream of Thame in a location downstream of the A418 bridge over River Thame.

The summary data for the Chinnor reservoir option are shown in the following table:

Option	Chinnor 30Mm³
Embankment Top Level*:	+85mAOD
Embankment Height:	16.1m - 2.4m
Embankment Length:	5,690m
Drawoff pipe lengths:	19.8km, 1000 dia Steel
Drawdown Flow (Ml/d)	63
Site area:	762ha

Table 20: Chinnor Reservoir Summary Data

* Embankment Top Level is calculated based on cut and fill analysis and varies based on reservoir footprint and ground level. This is an initial estimate and is dependent on assumptions which could change in the future.

Aylesbury, Ludgershall and Haddenham Reservoir Options

- The Aylesbury site is located 5km north-west of Aylesbury and 1km west of Hardwick
- The Ludgershall site is located in Buckinghamshire approximately 8km south-east of Bicester and 20km south of the Marsh Gibbon reservoir site
- The Haddenham site is located approximately 3km north and 5km east of Thame, between the A418 and the A4129

The concept designs for the Aylesbury, Ludgershall and Haddenham reservoir options have not been developed further since WRMP19 as these are less favourable options.

General Design Assumptions

In order to develop the options further, a number of assumptions have been made for all the options. These are detailed in the following sections.

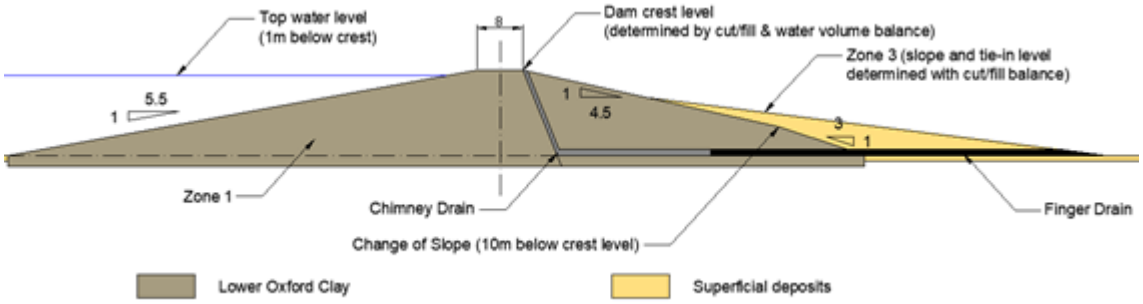
Emergency Drawdown Assumptions

Emergency Drawdown flows were estimated using Thames Water standard requirements for 1m/day drawdown capacity.
For all the options, it was assumed that the emergency drawdown is provided by multiple syphons, discharging to the closest watercourse downstream of the dam. This choice was made for easier construction and to facilitate the emergency drawdown testing.
The emergency drawdown discharge was then compared with the available flow data from the closest hydrometric stations, as a preliminary assessment of whether drawdown flows may result in flooding of properties.
It should be noted that for all 5 sites, the estimated drawdown flows are larger than the recent historic gauging data from the receiving watercourse. In the next stage of option development, this will therefore need to be assessed further so that requirements for mitigation or an

alternative discharge location can be identified. Such measures are not defined at this stage but are noted.

Embankment and borrow pit assumptions

The embankment cross-section was scaled down from SESRO, maintaining the same crest width, slopes and filter size and type. Being a non-impounding reservoir, a 1m freeboard from the embankment crest was deemed appropriate.



The borrow pit excavation was designed to have a 1 in 7 slope, with a 100m minimum buffer from the upstream toe of the embankment. Borrow pit excavation depths were defined depending on ground stratigraphy and groundwater levels, as the risk of uplift of the base is a key limiting factor for the excavation depth. Other key issues found by the geotechnical desk study were:

- The presence of fault lines surrounding the reservoir sites
- The presence of a 1m thick superficial deposit across all sites
- A risk posed by hydraulic uplift failure due to artesian pressure building up on the bottom of the clay layer

Watercourse Diversion and Replacement Flood Storage assumptions

Watercourse diversions have been designed to divert all the rivers impacted by the presence of the reservoir. A 50m buffer on both sides of the watercourse was allowed. Where the watercourse was assessed to be a land drain for the surrounding crops, no diversion was introduced, as it was assumed that it can be discontinued. This would need to be confirmed in the future stages of design development.
A high level assessment of replacement flood storage requirements was made by assessing the area of Zone 2 floodplain that would be obstructed by the reservoir footprint. Areas adjacent to the watercourse diversion were then identified to provide replacement flood storage (on the basis of providing level for level mitigation).

Road diversions, Haul roads and site boundaries.

Minor roads have diverted around the reservoirs, maintaining a 25m buffer on each side to allow for construction of the works. Two haul roads for the embankment construction were incorporated, one running along the upstream toe of the embankment and one running along the downstream toe. A buffer of 50m from the downstream toe of the embankment dam was included to allow space for haul roads, fencing, landscaping and environmental mitigation.

Inlet and outlet towers

For each reservoir, the number of inlet/outlet towers was taken from the WRMP19 site plans for the respective footprint. The design of the towers was based on the SESRO design, which was

reviewed by the WRMP team deemed appropriate for these reservoirs and provides has been developed inline with best practice.

Pipelines and Pumping stations

A single, bi-directional pipeline is proposed to be used for both filling the reservoirs and for discharge back to the River Thames, using suitable valving arrangements. Potential pipeline routes have been identified but full optimisation has not been undertaken at this time. A nominal, possible route has been provided which avoids key environmental, land and heritage constraints. Pumping stations were located where appropriate.

General Costing Assumptions

Cost estimates have been developed to reflect the WRMP24 conceptual designs using a similar approach to WRMP19. These costs have been used in the WRSE investment modelling and also to provide updated AICs which have been fed back into the Stage 3 feasibility assessment.
A number of assumptions have been made in calculating costs for Marsh Gibbon and Chinnor Reservoirs.

Marsh Gibbon and Chinnor CAPEX updates

For all Marsh Gibbon and Chinnor options, the capex rates were developed using:

- Thames Water cost models where components are within the range of the models
- Similar reservoir rates, which have been derived from industry data and benchmarked against similar schemes

The majority of CAPEX rates used are the same as in WRMP19, uplifted to allow for inflation. The CAPEX item rates were taken from the SESRO 150Mm³ option, which has a more developed design and is therefore considered suitable for use as a basis for Marsh Gibbon and Chinnor cost rates.
CAPEX quantities were updated for WRMP24 to take account of the revised conceptual designs.

Marsh Gibbon and Chinnor OPEX

A review was carried out of the OPEX costs aligned with the WRMP24 methodology developed by the All Company Working Group.
As part of the review of Marsh Gibbon and Chinnor the inflow/outflow pipeline size and length, intake pumping station capacity and reservoir pumping station (PS) capacity and associated operational power requirements were estimated.
Maximum Pumping Power

- The maximum pumping power required in a year was estimated by calculating the time and power required to undertake a full fill/empty cycle pro-rata to 365 days

Minimum Pumping Power

- The minimum power required was assumed to be for a year in which no DO benefit was required, and that the only flows would be sweetening flows. These sweetening flows were calculated based on the assumption that the requirement would be to clear the volume of water within the pipeline once a week. It was assumed flows would be pumped in and then pumped out/released in consecutive weeks. The annual power was then calculated as a proportion of the maximum power

- The equivalent annual flows were very small and did not represent a net DO benefit, as the assumptions mean flow is pumped both in and out without any reference to river levels and flow requirements
- It is noted that it may be possible for the pipelines to be largely emptied by gravity following pumping operations, but further work would be required to assess the effect of the retention of flow in localised low points

Mixers are included in the reservoir design to promote circulation of the water within the reservoir. The mixer power usage for Chinnor and Marsh Gibbon was pro-rated based on the number of mixers estimated for each option compared to SESRO.
An allowance has been made for miscellaneous power for intake screens and other ancillaries, as well as reservoir power requirements including potential visitors centres etc.
The abstraction license costs have been included based on the standard EA formula.

Marsh Gibbon and Chinnor Quantitative Risk Assessment and Optimism Bias

The reservoir risk assessments were developed based on the WRMP19 risk assessment for Abingdon Reservoir and updated to reflect WRMP24 methodology. In general, the risk items were split between the reservoir-related and the pipeline-related risks.
Common risks included archaeological screening, environmental screening, and existing infrastructure diversions. Option specific risks included geology, faults, clay thickness, flooding area.
Optimism Bias (OB) has also been assessed for Marsh Gibbon and Chinnor, following WRMP24 methodology.

Costing for Aylesbury, Haddenham and Ludgershall

Costs for Aylesbury, Haddenham and Ludgershall were developed based on Marsh Gibbon and Chinnor costs to ensure consistency between the options. A summary of the CAPEX and OPEX options used for the reservoirs are as follows:

- Aylesbury 30 Mm³ assumed to be equal to Marsh Gibbon 30 Mm³ costs
- Aylesbury 50 Mm³ assumed to be equal to Marsh Gibbon 50 Mm³ costs
- Ludgershall 50 Mm³ assumed to be equal to Marsh Gibbon 50 Mm³ costs
- Ludgershall 30 Mm³ assumed to be equal to Marsh Gibbon 30 Mm³ costs
- Haddenham 30 Mm³ assumed to be equal to Chinnor 30 Mm³ costs
-
- This approach is based on the location of the reservoirs.

Deployable Output (DO)

Deployable output is assumed to be independent of reservoir location (i.e. varies only with useable capacity).

Lead Times

Lead times were estimated assuming a similar programme to the WRMP19 SESRO 75Mm³ and SESRO 100Mm³ options for the Marsh Gibbon 50 Mm³ and 75Mm³ options respectively, as the footprint for Marsh Gibbon 50 Mm³ and 75 Mm³ are similar to the WRMP19 footprint for Marsh Gibbon 75 Mm³ and 100 Mm³ respectively. The duration for the 30Mm³ options was then estimated by linearly extrapolating the data available for the SESRO 75 Mm³ and 100 Mm³ options. The results are shown in the following table:

	30Mm³	50Mm³	75Mm³
Pre-Construction activities	6.2 yrs	6.2 yrs	6.2 yrs
Construction Activities	7.9 yrs	8.3 yrs	8.7 yrs
Total lead time	14 yrs	14.5 yrs	15 yrs

Table 21: Summary of option lead times

Next Steps

The next steps for in developing these reservoir options would be:

- For Ludgerhall, Aylesbury or Haddenham, to develop the design to the same level of detail as Marsh Gibbon and Chinnor, as follows:
- Develop conceptual ground model
- Carry out updated earthworks cut/fill balance
- Review road & watercourse diversions etc based on updated footprint
- Carry out pipeline routing and initial hydraulic design to size pipes and pumping stations
- Update cost estimate and costed risk
- For all options, continue to develop the concept design, with particular focus on:
- Emergency drawdown requirements and conveyance capacity of receiving watercourse/requirements for mitigation works to address flood risk from release of drawdown flows
- Requirements for flood plain compensatory storage
- Rail access review
- Requirements for diversions of utilities, roads, watercourses etc.
- Local construction traffic

C. SESRO Flood sequential and exception tests report

Introduction

The National Policy Statement for Water Resources Infrastructure (NPS) was published in draft in November 2018 and a consultation was held between November 2018 and January 2019. Following the consultation, the government laid before Parliament on 17 April 2023 the published NPS. The published NPS contains the following:

> 4.7.16. Where flood risk is a factor in determining an application for development consent, the Secretary of State will need to be satisfied that, where relevant: the application is supported by an appropriate flood risk assessment, the Sequential Test has been applied as part of site selection and, if required, the Exception Test
> 4.7.17. When determining an application, the Secretary of State will need to be satisfied that flood risk will not be increased elsewhere, and will only consider development appropriate in areas at risk of flooding where, informed by a flood risk assessment, following the Sequential Test and, if required, the Exception Test, it can be demonstrated that:

- within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location
- the development is appropriately flood resistant and resilient
- it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate
- any residual risk can be safely managed
- safe access and escape routes are included where appropriate, as part of an agreed emergency plan

For the South East Strategic Reservoir Option (SESRO), consideration of site selection criteria and alternatives forms part of the options selection for the statutory Thames Water Resources Management Plan (WRMP) and the regional Water Resources South East (WRSE) planning process. A consultation on Thames Water's draft WRMP24 was held between 13 December 2022 and 21 March 2023 and a revised draft is currently being prepared. The results of the flood sequential and exception tests will be published in this Annex to the revised draft WRMP24 reservoir Feasibility Addendum.

Context and guidance

The WRSE and WRMP24 processes have consistently selected the SESRO option with a volume between 100Mm^3 and 150Mm^3. It is very unlikely that a reservoir with a volume smaller than 100 Mm^3 will be selected in the final WRMP24 and therefore the Flood Sequential Test and Exception Tests focus on alternative sites and the preferred site for reservoir volumes in this range. Further information to support this assumption can be found in the revised draft Water Resources Management Plan to which this document is an Annex to the revised draft WRMP24 reservoir Feasibility Addendum which is published at the same time as this document.

The flood sequential test and exception test is described in the National Planning Policy Framework and set out in more detail on the government website.

Thames Water has undertaken fluvial and initial groundwater modelling to assess the flood risk of SESRO. This modelling has shown that we can be confident that both the sequential and exception tests are passed for SESRO at the preferred site.

Thames Water has also published a Terrestrial Environmental Appraisal which shows that SESRO will provide wider sustainability benefits to the community that outweigh the flood risk.

Flood sequential and exception tests

The flood sequential test is described in the National Planning Policy Framework (as revised in 2021) which states at paragraph 162 in part that "the aim of the sequential test is to steer new development to areas with the lowest risk of flooding from any source. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding."

The option and site selection process for SESRO has been undertaken as part of the WRSE and Thames Water WRMP processes. A long list of possible locations has been narrowed to a single site suitable for a reservoir in the range 100Mm^3 to 150Mm^3 when the various factors are considered. The evidence for this can be found in the revised draft WRMP24 reservoir Feasibility Addendum to which this report is an Annex. Locations have been identified for smaller reservoirs but these cannot be made larger and combinations of smaller reservoirs are not selected in the water resources planning process in preference to a large reservoir at SESRO.

There are no reasonably available sites appropriate for a reservoir in an area with a lower risk of flooding.

Thames Water therefore consider the sequential test to have been passed.

The exception test is set out in the National Planning Policy Framework at paragraphs 163 to 164 where it states:

> 163. If it is not possible for development to be located in areas with a lower risk of flooding (taking into account wider sustainable development objectives), the exception test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the

development proposed, in line with the Flood Risk Vulnerability Classification set out in Annex 3.

164. The application of the exception test should be informed by a strategic or site-specific flood risk assessment, depending on whether it is being applied during plan production or at the application stage. To pass the exception test it should be demonstrated that:

(a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and

(b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

The flood risk vulnerability classification from Annex 3 is 'Essential infrastructure'.

The NPS refers to further guidance here: https://www.gov.uk/guidance/flood-risk-and-coastal-change

The guidance at this link contains Table 2 that sets out flood risk vulnerability and flood zone 'incompatibility'. This table is repeated below, refer to Table C1 below, and shows when the exception test is required. SESRO is located in flood zones 1, 2, 3a and 3b. For essential infrastructure in flood zone 3a and 3b the exception test is required. It is also noted that essential infrastructure in zone 3a should be designed and constructed to remain operational and safe in times of flood. Essential infrastructure in Flood Zone 3b should be designed and constructed to:

- remain operational and safe for users in times of flood
- result in no net loss of floodplain storage
- not impede water flows and not increase flood risk elsewhere

Table C1 – Table C2: Flood risk vulnerability and flood zone 'incompatibility'

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	**X**	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	**X**	**X**	**X**	✓ *

Key:

✓ Exception test is not required

X Development should not be permitted

This is an extract from https://www.gov.uk/guidance/flood-risk-and-coastal-change#the-exception-test and is Table 2 from this link not this report

Notes to table - 2:

- This table does not show the application of the Sequential Test which should be applied first to guide development to the lowest flood risk areas; nor does it reflect the need to avoid flood risk from sources other than rivers and the sea;
- The Sequential and Exception Tests do not need to be applied to those developments set out in National Planning Policy Framework footnote 56. The Sequential and Exception Tests should be applied to 'major' and 'non major' development;
- Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.

"†" In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.
"*" In Flood Zone 3b (functional floodplain) essential infrastructure that has passed the Exception Test, and water-compatible uses, should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows and not increase flood risk elsewhere.

For the first part of the exception test, Thames Water needs to demonstrate that the development would provide wider sustainability benefits to the community that outweigh the flood risk.

Thames Water has published a Terrestrial Environmental Appraisal (TEA) Report as part of the SESRO SRO RAPID Gate 2 submission which sets out the wider sustainability benefits that SESRO will deliver. The report is linked here.
https://www.thameswater.co.uk/media-library/home/about-us/regulation/regional-water-resources/south-east-strategic-reservoir/gate-2-reports/B-2---SESRO-EAR-Terrestrial.pdf

SESRO would provide a broad range of long term benefits in Oxfordshire, providing opportunities to improve physical health, access to science, technology, engineering, arts and mathematics (STEAM) learning opportunities, provide employment and grow the local economy.

The Gate 2 TEA Report states that employment provided by SESRO during the construction and operation would lead to further benefits for the economy through more jobs being created. In addition to the 4,297 employment years created by SESRO's construction a further 2,741 are estimated to be created through further economic activity. During operation, an estimated 30 SESRO jobs would create an additional 26 within the wider economy for the foreseeable future, therefore 56 jobs created in total due to SESRO's operation. An estimated £252m of GVA over 10 years construction is significant given the size of Berkshire, Buckinghamshire and Oxfordshire's construction sector. The project has been further developed but these estimates remain valid.

The increased range of physical activities at SESRO would propose significant health benefits to the visiting population locally and in Oxfordshire. Not only would more people use SESRO than the existing site for physical activities but the range of hobbies would create a more inclusive and accessible environment to exercise.

The education value of SESRO has been quantified in terms of the potential annual willingness to pay by educators to visit the facility with school children for STEAM field trips. This value should not be considered solely indicative of the total benefits of education, a much greater economic value would be felt with the long-term economy.

Furthermore, as the area has low levels of deprivation it is likely that only a small proportion of the population would be significantly affected by a change in cost of living. Further work has been undertaken since this was published but this remains valid.

It is possible that SESRO would generate some disbenefits for local communities including disturbance to local businesses, but this impact is limited to 19 businesses and would be short term. Potential long term disbenefit of an increase to customer bills may affect Thames Water customers as part of securing future water supply. This work remains valid following further work undertaken since.

Ultimately, the Gate 2 report concludes opportunities created at SESRO should lead to long-term benefits of a far greater magnitude than the short-term disbenefits. There would be significant employment, economic activity, education, and health benefits as a result of SESRO's construction and operation.

Thames Water concludes from this work that SESRO will provide wider sustainability benefits to the community that outweigh the flood risk.

For the second part of the exception test, we need to demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall. We also need to demonstrate that the development will:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows and not increase flood risk elsewhere.

Thames Water has undertaken preliminary fluvial flood risk assessment modelling for SESRO. This is reported in the Gate 2 Concept Design Report. Here is a link. https://www.thameswater.co.uk/media-library/home/about-us/regulation/regional-water-resources/south-east-strategic-reservoir/gate-2-reports/A-1---SESRO-Concept-Design-Report.pdf. Further hydraulic modelling has been undertaken since this report was published but the conclusions of this report remain valid.

The outputs from the current modelling demonstrate that the construction of SESRO would have minimal impact on fluvial flood risk. The inclusion of the reservoir in the model, without inclusion of replacement flood storage (RFS), is predicted to result in slightly lower peak flows along the watercourses that pass below the A34 and flow towards Abingdon; this indicates that construction of SESRO could reduce the risk of fluvial flooding in Abingdon. Watercourses that currently flow through the SESRO site would be diverted around the reservoir, however, based on the largest reservoir option, there would be a 6.5km^2 reduction in the upstream catchment area for the reservoir surface. The rain that would fall directly onto the reservoir surface would be captured, stored and discharged to the River Thames, thereby removing it from the River Ock catchment. This is considered to cause the reduction in modelled peak flows.

There are some localised changes in flood extents within the project area which will require further design to resolve. It is however considered very likely that changes to the dimensions of the watercourse diversions, adjustments to watercourse alignments and changes to culvert dimensions would reduce flood extents in these areas and this will be further investigated in Gate 3 work.

As SESRO would be partially constructed on existing floodplain the size of RFS that would be required to achieve level-for-level replacement of the floodplain flood storage has been calculated based on the area that would be taken up by the scheme (without taking account of the rainwater capture effect of the reservoir described above). The volume of the RFS has been determined by calculating the flood depth for every elevation band for the area of displaced floodplain volume and the RFS is designed to provide replacement storage for the volume lost through implementation of the scheme, in a 1%AEP+70%CC flood event (ie. a 1 in 100 return period flood event + 70% increase for climate change). In the Gate 2 concept design, the majority of RFS is located to the west of the reservoir, while the remainder is proposed to be located to the north-east of the reservoir adjacent to the Auxiliary Drawdown Channel. Comparison of floodplain volume from pre-scheme and post-scheme models indicates that the designed RFS provides sufficient volumes for the majority of the 200mm elevation bands. Adjustments are required during the next stage of design development at the southern extent of the RFS as well as for four other elevation bands to resolve localised changes to predicted flood extents, however, it is considered very likely that suitable adjustments can be made.

It is also noted that the climate change flow increase allowances have been updated since this work was done. The climate change flow increase allowance now required is 41% and not 70%. This improves our already very high confidence that SESRO will not increase flood risk elsewhere and is likely to reduce flood risk overall.

For surface water flood risk, the whole catchment is included in the fluvial model with many of the ditches included and the drainage deals with run off from the reservoir bank. The surface water flood risk is therefore considered as part of the fluvial and drainage assessments. Thames Water can conclude that there is no increase in surface water flood risk elsewhere as this will be managed through the surface water and drainage design proposals. Drainage design may need to include attenuation ponds for example.

Thames Water will also consider construction and flood risk and will ensure that flood risk does not increase elsewhere.

Thames Water has undertaken preliminary groundwater flood risk modelling which concluded:

- Baseline groundwater levels are controlled by surface and near surface drainage.
- Introduction of the reservoir footprint leads to an increase in groundwater levels in some areas of the study area. Groundwater levels are widely still controlled by existing surface and subsurface drainage.
- Groundwater levels are reduced by the presence in the concept design of the toe drain, flood storage area and watercourse diversions.
- Further reductions in groundwater levels are simulated to occur through inclusion of a groundwater drain in the concept design.

- Limited impacts on groundwater levels are modelled. This initial model output has identified that further investigation into the impacts is required as the model is developed and more data becomes available. The refined model will be used to develop the drainage design
- Thames Water is confident that further modifications to the proposed groundwater drainage will be able to ensure that there is no increase in groundwater flood risk. An indicative layout plan for 150Mm^3 reservoir is included as Figure C3.1. This remains the latest plan available.

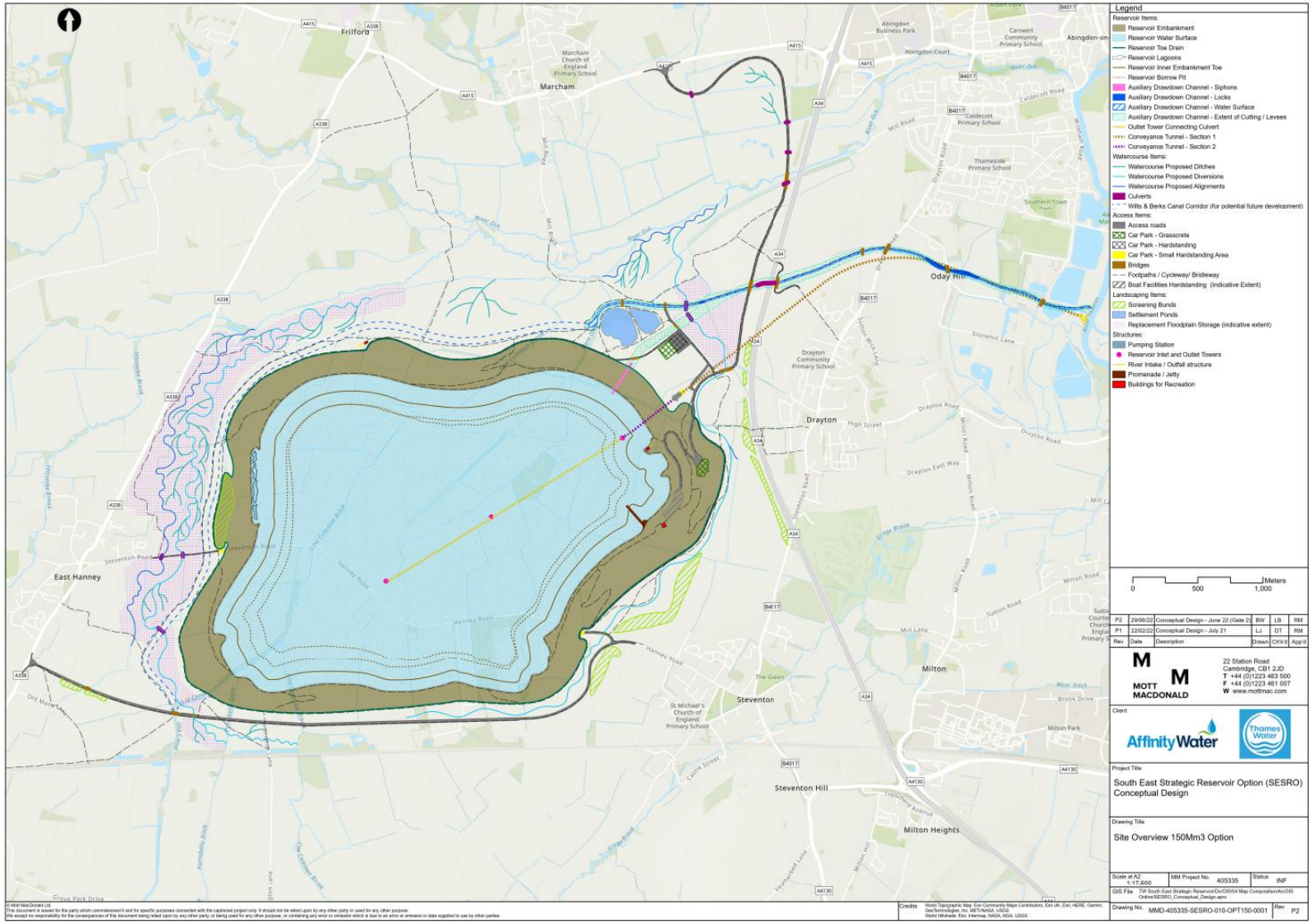


Figure C.1 – Figure C.3.1 – Indicative layout pan for 150Mm^3 reservoir

Work is ongoing on the design of the Auxiliary Drawdown Channel (ADC) which runs from the reservoir to the River Thames and crosses the flood plain. The ADC would prevent flow across the flood plain unless mitigation is provided. A solution may include the provision of siphons under the ADC. If this proves not to work after further modelling, then the ADC could be changed to one or more tunnels below the flood plain which would avoid any impact on the operation of the flood plain.

The work described above has been undertaken for a reservoir volume of 150Mm^3. The flood risk impacts of a reservoir with a volume of 100Mm^3 would be easier to mitigate than for a 150Mm^3 reservoir because less flood volume would be displaced with a smaller footprint. The conclusions are therefore valid for any reservoir volume between 100Mm^3 and 150Mm^3.

Thames Water has examined all sources of flood risk, fluvial, surface water and groundwater. We conclude that we have demonstrated that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Thames Water concludes that we have also demonstrated that the reservoir will:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows and not increase flood risk elsewhere.
- The exception tests are therefore passed.

Conclusions

Thames Water has examined the flood sequential test and exception test for SESRO.

The sequential test requires that we need to demonstrate that there are no reasonably available sites appropriate for the reservoir in an area with a lower risk of flooding.

Thames Water has demonstrated that only one site within the Thames Water area is suitable for the location of a reservoir with a volume between 100Mm^3 and 150Mm^3. A combination of smaller reservoirs was less favourable. The WRSE and Thames Water WRMP24 processes have consistently selected the SESRO option and site with a capacity in this range. There are no reasonably available sites appropriate for the reservoir in an area with a lower risk of flooding. We therefore consider the sequential test to have been passed.

Parts of the reservoir are located in flood zones 3a and 3b. The reservoir is essential infrastructure, and the exception test is therefore required.

For the first part of the exception test, we need to demonstrate that the development would provide wider sustainability benefits to the community that outweigh the flood risk. Thames Water has shown in our Terrestrial Environmental Appraisal Report https://www.thameswater.co.uk/media-library/home/about-us/regulation/regional-water-resources/south-east-strategic-reservoir/gate-2-reports/B-2---SESRO-EAR-Terrestrial.pdf that SESRO would provide a broad range of long term benefits in Oxfordshire, providing opportunities to improve physical health, access to STEAM learning opportunities, provide employment and grow the local economy.
Thames Water concludes from this work that SESRO will provide wider sustainability benefits to the community that outweigh the flood risk.

For the second part of the exception test, we need to demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall. We also need to demonstrate that the reservoir will:

- remain operational and safe for users in times of flood
- result in no net loss of floodplain storage
- not impede water flows and not increase flood risk elsewhere

Thames Water has examined all sources of flood risk, fluvial, surface water and groundwater. We conclude that we have demonstrated that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Thames Water concludes that we have also demonstrated that the development will:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows and not increase flood risk elsewhere

The exception tests are therefore passed.

Thames Water concludes that the sequential and exception tests are passed. The Sequential Test and Exception Test have been applied as part of the option and site selection during the WRSE and Thames Water WRMP processes.

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