

dWRMP24 Support

Supply-side Constrained Options Data Summary Report

Cambridge Water

31st May 2022

5211472-ATK-RP-7.7-015



Notice

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1. Introduction

1.1. Background and context

Water companies in England and Wales have a statutory duty to prepare a Water Resource Management Plan (WRMP). The WRMP sets out how the company intends to achieve a secure supply of water for customers and protect and enhance the environment. The preparation of the WRMP includes the progressive development (and where appropriate selection) of options that can enable the company to deliver their commitments to customers. Each company's WRMP is reviewed, updated, and published every five years, with the last round in 2019, resulting in Cambridge Water (CAM) publishing their most recent WRMP in December 2019.

CAM are currently in the process of preparing their next WRMP (WRMP24) and providing input to the Regional Plan, that is new to this round of water resource planning. The geography of CAM means that it feeds into the activities of the Water Resources East (WRE) regional group. A draft version of the regional plan and the company plan are expected to be published for consultation during summer 2022, ahead of a final plan being published for 2024.

The WRMP includes development and assessment of demand-side and supply-side options to maintain a positive supply / demand balance across the WRMP planning period. In August 2021, CAM approached Atkins for support in developing the details of supply-side options to meet the needs of both WRMP24 and WRE assessments. CAM had already progressed the initial preparation of an unconstrained options list. Atkins was appointed by CAM in December 2021 and undertook the initial option screening process in collaboration with CAM. Atkins undertook further iterative development of options and screening alongside CAM, drawing on Atkins previous experience of the supply-side options from involvement in WRMP19 and engineering experience for the new options proposed. The number of options under consideration was reduced from ~130 to 13 constrained options by May 2022. The remaining 13 options were progressed to option detail reporting, following the method summarised in this report. Atkins provided option details to the Ricardo environment team who were commissioned by CAM to undertake the environmental assessment of options.

This report and its associated documentation summarise the approach taken and assumptions made to provide the option information and outputs.

1.2. CAM supply-side options

Initially, CAM provided Atkins with a list of 106 supply-side options to be reviewed for feasibility. Some of these options had been developed during WRMP19 and carried forwards into WRMP24, others were new options proposed to be reviewed for feasibility as part of the WRMP24 process.

During the course of this project, the number of options being progressed fluctuated, with the introduction of 25 options to be reviewed in addition to the original 106, for feasibility and if suitable, to be progressed to option detail reporting for environmental assessment.

A detailed option screening spreadsheet (reference: 5211472-ATK-CA-9-011) was produced to demonstrate the reasoning for selection of the final constrained options as part of the WRPG requirements, subsection 8.1 - <https://www.gov.uk/government/publications/water-resources-planning-guideline/water-resources-planning-guideline>. This included setting screening criteria and reviewing each proposed option against it. Options that were deemed unsuitable against the proposed criteria were included in an option rejection log. This spreadsheet is provided as part of Appendix A. The 13 options progressed to the constrained list and option detail reporting for environmental assessment are included in Table 1-1 below.

The option detail reporting data were limited to the items specifically detailed in the engineering scope as agreed by CAM in a progress meeting (January 2022). Where required supporting data were unavailable, professional judgement was applied.

Table 1-1 – Constrained options

Ref	Option name and Short Description
CW24-1A	Combined Ouse gravel sources - Fenstanton to St Ives (01A). Recommissioning of the unused groundwater abstraction source (Ouse Gravels) at Fenstanton with connection to St Ives where the existing treatment and deployment will be used.
CW24-1B	Combined Ouse gravel sources - Fenstanton to St Ives (01B). Recommissioning of the unused groundwater abstraction source (gravels) at Fenstanton with connection to St Ives WTW which will require additional upgrade.
CW24-37A	Site-scale greywater re-use (Northstowe or similar growth). Site-scale greywater reuse scheme incorporated into large scale development (at full build out 10k properties).
CW24-38	Site-scale rainwater harvesting (Northstowe or similar growth). Site-scale rainwater harvesting scheme incorporated into large scale development (at full build out 10k properties).
CW24-57	River Cam abstraction & treatment works. Surface water abstraction from the River Cam utilising the HoF to provide additional raw water that will be stored in an embankment reservoir. This will then be treated in a new WTW and transferred to Cherry Hinton for deployment at a output of 7MI/d. This stretch of the River Cam is supplemented by effluent discharge from AWS owned Milton WWTW.
CW24-71	Milton WWTW Effluent re-use post effluent discharge. Effluent discharged from Anglian Water's Milton WWTW will be directly treated in a new WTW and transferred to Cherry Hinton for deployment into the CAM network.
CW24-73A	Fens Reservoir potable water transfer (Chatteris). The construction of a major new surface water reservoir in the Chatteris area, with associated WTW is proposed. This option is to pump the potable water along a pipeline allowing connection to Bluntisham and Madingley CAM distribution locations, which include additional storage at each location.
CW24-73B	Fens Reservoir potable water transfer (Ely). The construction of a major new surface water reservoir in the Ely area, with associated WTW is proposed. This option is to pump the potable water along a pipeline allowing connection to Bluntisham and Madingley CAM distribution locations, which include additional storage at each location.
CW24-73C	Fens Reservoir potable water transfer (Southery). The construction of a major new surface water reservoir in the Southery area, with associated WTW is proposed. This option is to pump the potable water along a pipeline allowing connection to Bluntisham and Madingley CAM distribution locations, which include additional storage at each location.
CW24-73D	Fens Reservoir potable water transfer (Burnt Fens). The construction of a major new surface water reservoir in the Burnt Fens area, with associated WTW is proposed. This option is to pump the potable water along a pipeline allowing connection to Bluntisham and Madingley CAM distribution locations, which include additional storage at each location.
CW24-75A	Potable transfer from AWS grid main crossing West to East through CAM area of supply (5MI). Cross-connection from AWS new strategic pipeline to Cambridge network north of Longstanton with a supply of 5MI/d.
CW24-75B	Potable transfer from AWS grid main crossing West to East through CAM area of supply (10MI). Cross-connection from AWS new strategic pipeline to Cambridge network north of Longstanton with a supply of 10MI/d.
CW24-75C	Potable transfer from AWS grid main crossing West to East through CAM area of supply (15MI). Cross-connection from AWS new strategic pipeline to Cambridge network north of Longstanton with a supply of 15MI/d.

1.3. Deliverables

Upon commencement of this project, Atkins and CAM agreed the required deliverables and outputs.

Initially there were four core deliverables, however as the project progressed the initial deliverables were refined, and additional items added. The final set of deliverables is summarised in Table 1-2.

Table 1-2 – Summary of deliverables

Deliverable	Components	Location
Technical report	Technical report to summarise: <ul style="list-style-type: none"> - Approach taken - Key project risks and assumptions made - Recommendations 	This report
Spreadsheet summary	Spreadsheet summarising option data and recording screening and rejection decisions	Appendix A
Individual preferred option proforma reports (in keeping with Appendix U of WRMP19)	Individual preferred option proforma reports summarising: <ul style="list-style-type: none"> - Short description of the proposed option concept, including engineering concept and high-level environmental appraisal. - Key option risks and assumptions made - Recommendations for further investigation that will help CAM to progress beyond the initial concept design stage. - Key figures such as schematics and option plans. - Summation of the option data developed during this study - Appendices of: <ul style="list-style-type: none"> • Operational carbon working dataset • The data inputted to TR61 and its outputs 	A table of the report documents is provided in Appendix B
GIS	GIS shapefiles and register spreadsheet for each option	Appendix C
Option proforma spreadsheets	Work in progress option proforma spreadsheets with engineering elements inputted - to be provided to the environmental team (Ricardo)	Appendix D
Fortnightly progress meetings	Record of client project meetings and associated discussion topics	Appendix E
Costing	Costing report and NPV/AIC spreadsheets which include: <ul style="list-style-type: none"> - assumptions regarding assets required for each option - data inputted to TR61 and its outputs - methodology for costs added as 'other costs' to TR61 - methodology used to produce the NPV and AICs for each option - associated workbooks to calculate the NPV and AIC for each option 	Appendix F

2. Approach

The option information required by this study and provided in the option detail reports (Appendix B) are broadly divided into 10 categories, as provided in Table 2-1, each with further sub-categories for specific data requirements.

Table 2-1 - Option detail reporting data categories

Section	Main category	Sub-categories
2.1	Option Information	Option name Option reference Option type Concept Links to other options Screening decision Option peak, drought and resilience status DO benefit Background information Option description Licensing and stakeholder feedback Key option assumptions Option risks and uncertainties
2.2	Option pricing and costs	Asset pricing breakdown Costing reporting
2.3	Environmental data	Option description
2.4	General data	Proforma WRMP19 status Option CAPEX (£k) Reuse of existing assets Environmental mitigation and benefits Relevant investigations (WINEP)
2.5	Abstractions	Abstraction type Abstraction status (new or existing) Name of abstraction source Location of abstraction (x/y) Timing data New abstraction data Groundwater specific data Seasonal variation regimes Hands off Flow (HoF)
2.6	Discharges	Quantity Quality Maximums Seasonal variation Timings
2.7	Construction - General data	Delivery period /duration of option construction Working width Area of compounds Area of option (ha) HGV movements requirements (+/- 10%) Embedded carbon emissions (tCO ²)

		Quantity of material Quantity of concrete Waste to landfill Power usage during construction
2.8	Construction - Pipeline and transfers	Pipeline length Pipeline size Option Deployable Output (DO) Max design pipeline capacity Quantity of water being transferred Quality of water being transferred Access routes Pipeline construction methods No. / type of crossings
2.9	Operations	Land take of completed option List of above ground structures Land take of completed scheme Operational carbon emissions (tCO ²) Waste to landfill Power usage (kWh/yr) Chemical usage / raw material use Vehicle movements (+/- 10%)
2.10	Option visualisations	GIS Construction access routes Schematics

The following sections describe the approach that has been taken by Atkins to provide the qualitative or quantitative information for each option detail report.

2.1. Option information

2.1.1. Option name

The option names have been derived from the screening spreadsheet (WRMP24 Supply-side Option unconstrained list and rejection log, reference 5211472-ATK-CA-7.2-011) initially provided by CAM. Many of the names were brought forward from WRMP19 and therefore required update where option details had changed.

2.1.2. Option reference

The option references have been updated to refer to WRMP24, this was undertaken by adding CW24 to the start of the option reference. The later numbered part of the option reference allows the option to be used as unique identifier. Where the same option is being considered but with slight variations, an additional reference (a, b, c) has been included to represent sub-options.

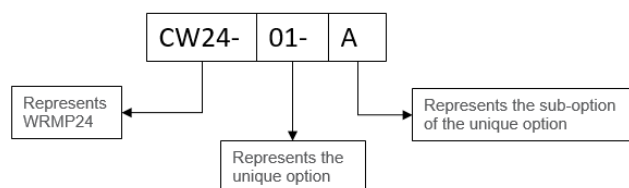


Figure 2-1 - Option reference construction

The options brought forward from WRMP19 were originally referenced to WRMP19 option references, where possible the same number for the unique identifier was used to prevent confusion when referencing WRMP19 proformas.

2.1.3. Option type

The option type have been derived from the screening spreadsheet (WRMP24 Supply-side Option unconstrained list and rejection log, reference 5211472-ATK-CA-7.2-011) and aligned with the WRPG option types.

2.1.4. Concept

The option concept provides a short synopsis of the option.

2.1.5. Links to other options

This section highlights any option dependencies or exclusivities with other options and details the reasoning if any have been identified.

2.1.6. Screening decision

The screening decision provides the current screening status for the option. All options that have been progressed to the option detail reporting stage have a screening status of 'Constrained list' at the time of writing (May 2022).

2.1.7. Option peak, drought, and resilience status

This section describes whether the option is being progressed as providing water during peak, drought, or resilience periods.

2.1.8. DO benefit

Where possible the DO benefit was initially brought forward from the WRMP19 proforma reporting. This was updated with further information from CAM. The assumed average and peak yield (MI/d) to be applied to the options for asset sizing purposes was also included.

Table 2-2 – Option DO

Option ref:	DYAA (MI/d)	NYAA (MI/d)	DYCP (MI/d)
CW24-1A	0.44	0.44	0.55
CW24-1B	2.0	2.0	4.0
CW24-37A	0.5	0.5	0.6
CW24-38	0.9	0.9	0.9
CW24-57	7.0	7.0	7.0
CW24-71	7.0	7.0	7.0
CW24-73A	50	50	50
CW24-73B	50	50	50
CW24-73C	50	50	50
CW24-73D	50	50	50
CW24-75A	5.0	5.0	5.0
CW24-75B	10	10	10
CW24-75C	15	15	15

2.1.9. Reasoning behind DO (MI/d) selection

This section provides the supporting reasoning behind the available DO (MI/d) assigned to each option.

2.1.10. Background information

This section provides any known information regarding the history of the option. This includes where the initial idea came from, any related ongoing works, and any supporting information as to the options progression to the constrained list.

2.1.11. Option description

This provides a detailed description of the proposed option and its associated assets.

2.1.12. Licensing and stakeholder feedback

This includes commentary from third party contributors to the WRMP24, such as neighbouring water companies and the Environment Agency. This section also includes any feedback received from correspondence and meetings as the options have been developed.

2.1.13. Key assumptions

This section provides a high-level bulleted list of key assumptions that have been taken in relation to the option and its feasibility.

2.1.14. Risks and uncertainties

This section provides a high-level bulleted list of key risks and uncertainties that have been identified to the option and its feasibility.

2.2. Option pricing and costs

2.2.1. Asset Pricing breakdown

This section provides a table breakdown of the option assets progressed to costing in raw water, transfer, distribution, land and power categories. The items listed in this section are included in the option CAPEX, OPEX, NPV and AIC. The table also provides the methods used for the pricing of each asset.

2.2.2. Option cost reporting

Option costs for CAPEX were requested at the onset of the project as part of the environmental data requirement. Atkins had planned to use the WRMP19 costing tool for the option cost data, however CAM requested that the WRC TR61 tool be utilised to align with CAMs PR24 costing. TR61 was made available to Atkins by CAM in May 2022 for use in undertaking the costing assessment.

TR61 data input is restricted to a select list of assets. Where TR61 was unable to represent an asset, its cost was calculated using WRMP19 costing information and professional judgement and inputted into TR61 as 'other costs'.

During option development, CAM further requested that Atkins undertake development of the constrained option list costs to NPV and AIC.

Due to the level of detail provided, the costing details are not included in the option detail reports. They are instead included in the cost report (reference 5211472-ATK-RP-9-074) provided in Appendix F (restricted circulation).

2.3. Environmental data

2.3.1. General data

2.3.1.1. Included in WRMP19

This section highlights if there was a proforma from WRMP19 available for this option or if it is a new option for WRMP24.

2.3.1.2. Option CAPEX (£k)

This section includes the options CAPEX. These data are produced from the WRC TR61 tool where possible. Where asset information was unavailable, it has been produced through best engineering judgement and the

use of the WRMP19 costing methodology used for CAM WRMP19. These additional cost calculations have been included in a separate spreadsheet to the option details report, reference 5211472-ATK-CA-9-076.

2.3.1.3. Reuse of existing assets

This section describes any existing assets that are to be reused in the option. The assumed definition of reused assets is either:

- 1) Existing assets being enhanced by the option (upgrades to existing infrastructure that is currently in use), or;
- 2) Existing assets being renewed (assets that are currently not in use, and/or decommissioned that the option will bring back into supply).

2.3.1.4. Environmental mitigation and benefits

Prior to each option undergoing more detailed analysis, a high-level review of the environmental benefits and mitigation techniques available for each of the option types has been listed in the option detail reports (Appendix B).

Table 2-3 provides a breakdown of the categories that have been considered for each option in terms of environmental mitigation. Recommendations have been taken from engineering judgement and sources that include:

- CAM Environment and Sustainability Policy Commitments reference: <https://www.cambridge-water.co.uk/media/3245/environment-and-sustainability-policy-march-2021.pdf>
- The Considerate Constructors Scheme code of Considerate Practice reference: <https://www.ccoption.org.uk/ccs-ltd/code-of-considerate-practice-2/>

Table 2-3 - Categories of environmental consideration appraised

Category	Construction / Operation	Description
Best practice of construction	Construction	Application of Considerate Constructors code of practice to all aspects of the option construction.
Biodiversity and ecosystems	Both	Habitat creation, this could also allow for external partnerships with environmental bodies.
Protected sites and species	Both	If identified protected sites can't be avoided then specific construction methodology will be developed, e.g., Open cut will be the least favoured option, suggesting other methods such as directional drilling to reduce impact of groundworks on the sites. Further surveys before works are commenced are to be carried out if the option progresses further.
River levels/flows	Operational	Consideration of seasonal constraints and any Hands-off Flow agreements.
Vehicle movements	Construction	Assessment of the materials required to be transported to site to be sourced locally to reduce transportation needs. Assessment of the closest access routes to reduce unnecessary journey time.
Wider WFD No Deterioration benefits/disbenefits	Both	Ensuring compliance to licences for boreholes / stream / river abstraction.
Use of local suppliers	Construction	Application of sustainable principles. Particularly of relevance to sourcing materials required locally for both construction and ongoing operational processes e.g., WTW chemicals.
Water Quality	Both	Assessment of potential water quality concerns. This includes consideration of water transfer within options (mitigation such as built curtains across water courses, screens and treatment needs will be required to be installed during construction activities and maintained during option operation) and more generally in terms of water quality impact to groundwater and surface water bodies.

		Deployment of imported water into the network is to be assessed if the options progress further.
Archaeological Heritage	N/a	Ensure no archaeological sites are identified in close proximity to working areas. If they are identified, detailed methodology is to be applied.
Agriculture	N/a	Agricultural land classification for working areas and access routes to be undertaken at detailed design stage.
Informal recreation	Operational	Consideration to increase community engagement and the addition of informal recreation e.g., footpaths that would require ongoing management.
Noise	N/a	Any noise assessment required will be undertaken at detailed design stage.
Air quality	N/a	Impact from increases use of machinery and traffic during the construction work to be considered at design stage. Dust suppression techniques are advised.
CO ₂ emissions	Both	Increased CO ₂ emissions are expected during construction activities. Consideration of the CO ₂ emissions and reduction methodologies such as the use of upgraded pumps for the options with increased pumping or treatment processes. Assessment of the energy uses on site to reduce to minimum usage to support net zero commitments.
Sustainable management of water resources	Both	This aims to mitigate any impacts of future abstraction growth and does not offer any benefits in terms of reduced demand for water or improved water efficiency.
Other	Construction	Ensure there are no historic landfill sites near the proposed working areas.

2.3.1.5. Relevant investigations (WINEP)

WINEP information was not amalgamated into the option dataset presented at WRMP19. During this study Atkins have reviewed relevant investigations to CAM on the open source Environment Agency WINEP data tables (source: Water Industry National Environment Programme - data.gov.uk) and provided any that appear relevant to the options specifics. Further engagement with the CAM environment and catchment team is recommended.

2.3.2. Abstractions

2.3.2.1. Abstraction type

This provides information on the type of abstraction that is being undertaken, varying from borehole to river intake.

2.3.2.2. Abstraction status

The abstraction status provides details on whether the abstraction is a new or an existing licence.

2.3.2.3. Name of abstraction source

This section provides the abstraction source name details.

2.3.2.4. Location of abstraction

The location data have been provided for the abstraction point(s).

2.3.2.5. Timings

The abstraction timings were not provided as part of the WRMP19 option information. It has been assumed that the abstractions will be affected by seasonal variation, and therefore the timing data provided represents each option's abstraction data for Dry Year Annual Average (DYAA), Normal Year Annual Average (NYAA) and Dry Year Critical Peak (DYCP) which have been provided as a table.

2.3.2.6. New abstraction data

The data provided in this section refers only to new abstractions being proposed, this includes the existing abstraction licence (if applicable) and the new abstraction rate required.

2.3.2.7. Groundwater specific data

This section provides groundwater specific data for those options where the abstraction type has been defined as a groundwater source.

2.3.2.8. Seasonal variation regimes

Where applicable, identified seasonal variation regimes of abstraction locations have been included. For example, where an option is available at Q30 we have the full amount of water available for 30% of the time, we don't allow for any ramping up of the water available to the scheme design. These data have been sourced from a search on the Environment Agency webpage¹

Further engagement with the CAM Environment and Catchment team is recommended.

2.3.2.9. Hands off Flow (HoF)

Where applicable Hands off Flow (HoF) constraints have been summarised and provided in the option detail reports (Appendix C). This has been sourced from a search on the Environment Agency webpage¹.

Further engagement with the CAM Environment and Catchment team is recommended.

2.3.3. Discharges

There are no discharges in any of the 13 options progressed at this stage, therefore these sections have been deemed not applicable and the methodology not included.

2.3.3.1. Quantity

Not applicable.

2.3.3.2. Quality

Not applicable.

2.3.3.3. Maximums

Not applicable.

2.3.3.4. Seasonal variation

Not applicable.

2.3.3.5. Timings

Not applicable.

2.3.4. Construction: general data

2.3.4.1. Delivery period - duration of option construction

The delivery period for each option has been assessed using professional judgement of the option requirements and has been reported as the spend profile. The delivery period of all options has been clearly stated as this has a direct influence on the costing estimation of NPV values.

The duration and spend profiling have been applied to the costs following the same approach used in WRMP19 as shown in Figure 2-2.

¹ <https://www.gov.uk/government/publications/cam-and-ely-ouse-abstraction-licensing-strategy/cam-and-ely-ouse-abstraction-licensing-strategy>).

Spend Profile	Description
Profile A:	<u>5 year spend profile – generic</u> Generic one AMP scheme comprising feasibility, outline and detailed design carried out within the first two years, followed by construction spend across the remainder of the AMP.
Profile B:	<u>10 year spend profile – generic</u> Generic two AMP scheme typically comprising of only design and planning activities in the first AMP following by construction in the second AMP. Used for all schemes considered undeliverable within a 1 AMP timescale.
Profile C:	<u>10 year spend profile – complex scheme</u> Used for major new water treatment works schemes with a longer construction period than Profile B.
Profile D:	<u>10 year spend profile – significant scheme</u> Used for dams and reservoir associated schemes where proportionally low cost activities (such as planning, investigation and consultation) is required at early stages before design can commence.
Profile E:	<u>5 year spend profile – expedited complex scheme</u> Scheme which would be expected to be within Profile B-D but can be expedited due to known existing information or prior design knowledge. Typically used for schemes involving increasing outputs at borehole sites.

Year	Profile A % of Capex	Profile B % of Capex	Profile C % of Capex	Profile D % of Capex	Profile E % of Capex
1	5 %	2 %	1 %	1 %	10 %
2	10 %	3 %	2 %	1 %	15 %
3	20 %	5 %	3 %	3 %	25 %
4	30 %	5 %	4 %	5 %	25 %
5	35 %	5 %	5 %	7 %	25 %
6	-	5 %	10 %	8 %	-
7	-	10 %	10 %	15 %	-
8	-	15 %	20 %	20 %	-
9	-	25 %	25 %	20 %	-
10	-	25 %	20 %	20 %	-

Figure 2-2 – Spend profile

2.3.4.2. Working area of pipeline (m²)

The construction working width provided is based on an engineering assumption of a 15m width for all pipelines. This is assumed from a 5m trench corridor width, 5m width for the excavator and 5m for vehicles to pass the excavator. The data are provided as meters squared.

2.3.4.3. Area of compounds (ha)

The area of the compounds within the option construction area have been assumed based on option type, see Table 2-4 for assumed applied area sizes based on engineering judgement. The data are provided in hectares.

Table 2-4 - Option compound areas

Option Type	Assumed area of compound (ha)
Groundwater options	50 x 50 = 2,500m ² (0.25ha)
Dams and reservoirs options	200 x 50 = 10,000m ² (1ha)
Import options	50 x 50 = 2,500m ² (0.25ha)

2.3.4.4. Area for option (ha)

Option area data have been estimated by aggregating the working area of pipeline linear sections (as a function of working width and length) and the area of site compounds during the construction phase.

It should be noted that the footprint of a finished option may not be the same as the construction phase working area. For example, on linear pipeline options, the easement or sterilised strip of land associated with the pipeline may be less than a 15m wide working area used during construction. The data are provided in hectares.

2.3.4.5. Construction HGV movements

Production of data for HGV movements was discussed with CAM, these data are to be progressed at option design stage.

2.3.4.6. Access routes

All options are located by public highways, therefore they are expected to be used for the proposed access routes. Further confirmation will be required at design stage.

2.3.4.7. Embedded carbon emissions (tonnes)

These data are provided as an output from the WRC TR61 tool in tonnes. The data methodology is included in the TR61 manuals.

2.3.4.8. Quantity of material

No data on materials are available at this stage of the option design; therefore, impact status provided by Ricardo (shown below in Figure 2-3) has been applied to each option based on the CAPEX data output.

A review of each impact status has been undertaken and the most suitable description for each option has been provided in the option detail report.

15. To minimise waste, promote resource efficiency and move towards a	<ul style="list-style-type: none"> Will it make use of existing infrastructure? Will it promote the re-use and recycling of waste materials and reduce the proportion of waste sent to landfill? 	+++	Major/Significant Positive	The option would make extensive reuse of existing built assets and infrastructure. The option will re-use or recycle substantial quantities of waste materials and any new infrastructure will incorporate substantial sustainable design measures and materials.
		++	Moderate Positive	The option would make reuse of existing built assets and infrastructure. The option would re-use or recycle moderate quantities of waste materials and any new infrastructure would incorporate some sustainable design measures and materials.
circular economy.	<ul style="list-style-type: none"> Will it help to encourage sustainable design or use of sustainable materials (e.g., supplied from local resources)? 	+	Minor Positive	The option would re-use or recycle limited quantities of waste materials and any new infrastructure would incorporate limited sustainable design measures and materials.
		0	Neutral	The option would largely rely on existing infrastructure and only require small quantities of additional materials to realise design capacity.
		-	Minor Negative	The option would require new infrastructure. The option would have limited opportunities for the re-use or recycling of waste materials. There would be limited opportunities for sustainable design or the use of sustainable materials.
		--	Moderate Negative	The option would require new infrastructure. The option would have limited opportunities for the re-use or recycling of waste materials.
		---	Major/Significant Negative	The option would require significant new infrastructure that cannot be provided through the re-use or recycling of waste materials. There are no opportunities for sustainable design or the use of sustainable materials.
		?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain

Figure 2-3 – Assessment of materials³

2.3.4.9. Quantity of concrete

No data relating to concrete are available at this stage of the option design; therefore information provided by Ricardo (shown below in Figure 2-4), has been applied to each option. The impact of construction from the quantity of the concrete is recorded in the option detail report and the associated CAPEX cost from WRC’s TR61 tool for each option is included.

³ SEA threshold criteria

15 – waste and resource use	<p>Main impacts likely to be <u>Negative construction impacts</u></p> <p>Neutral = <100t concrete</p> <p>Minor negative = 100t - <1,000t concrete</p> <p>Mod negative = 1,000t - <15,000t concrete</p> <p>Major neg = >15,000t concrete</p> <p>Where no concrete data – can adopt capital spend</p> <ul style="list-style-type: none"> • minor negative = less than £5 mill capex • moderate negative = £5mil to £25 mill capex • Major negative => £25 mill capex
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Figure 2-4 – Assessment of resource use⁴

2.3.4.10. Waste to landfill

Construction wastes arising from each option can occur from many different activities. When options are developed in the design stages, it is likely that a Materials Waste Management Plan and Site Waste Management Plan will be developed. There is insufficient option definition at this stage to provide detail on construction waste, therefore it is assumed that the same outputs (shown above in Figure 2-3) for the quantity of material impact criteria are applied.

2.3.4.11. Power usage during construction

No data on power usage during construction are available at this stage of the option design; therefore, information provided by Ricardo (shown below in Figure 2-5), has been applied to each option from the carbon outputs provided by WRC’s TR61 tool.

9. To reduce greenhouse gas emissions.	<ul style="list-style-type: none"> • Will it reduce or minimise greenhouse gas emissions? • Will it have a low level of embodied carbon? • Will it provide new infrastructure that is energy efficient and/or minimises the use of energy? • Will it provide new infrastructure that could contribute or make use of renewable energy sources? • Will the option affect carbon sequestration? 	+++	Major/Significant Positive	The option would reduce operational carbon emissions by more than 1,000 tonnes CO2e/year e.g. it would provide new infrastructure/assets that maximise the use of renewable energy sources. The option would result in a major increase in carbon sequestration.
		++	Moderate Positive	The option will reduce operational carbon emissions by between 100 and <1,000 tonnes CO2e/year. The option will result in a moderate increase in carbon sequestration
		+	Minor Positive	The option will reduce operational carbon emissions by less than 100 tonnes CO2e/year
		0	Neutral	The option would have no discernible effect on greenhouse gas emissions.
		-	Minor Negative	The construction of the option would use of materials with a minor amount of embodied carbon (100 to <1,000 tonnes CO2e). The option would result in a minor or temporary increase in operational carbon emissions (100 to <500 tonnes CO2e).
		--	Moderate Negative	The construction of the option would use of materials with a moderate amount of embodied carbon (1,000 to 7,500 tonnes CO2e). The option would result in a moderate increase in operational carbon emissions (500-2,000 tonnes CO2e). The option will result in a moderate release of previously sequestered carbon.
		---	Major/Significant Negative	The construction of the option would use of materials with a major amount of embodied carbon (>7,500 tonnes CO2e). The option would result in major or long term increases in operational carbon emissions (>2,000 tonnes CO2e). The option would result in a major release of previously sequestered carbon.
		?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain

Figure 2-5 – Assessment of power use⁵

⁴ SEA Threshold criteria

⁵ SEA Threshold criteria with additional information regarding cost provided from the environmental team (Jan 2022)

2.3.5. Construction: pipeline and transfers

2.3.5.1. Pipe size and length

The pipe length (m) and size (mm) data have been provided for each pipe within the option, for both the treated and raw water pipelines.

2.3.5.2. Option Deployable Output (DO)

As discussed in section 2.1.8, the expected deployable output has been provided.

2.3.5.3. Max design pipeline capacity

Maximum design pipeline capacity has been assumed to be required to meet the peak DO.

2.3.5.4. Quantity of water being transferred

The quantity of transfer has been estimated by adjusting the option peak DO to represent an annual volume (i.e. multiplying the peak DO in MI/d by 365).

2.3.5.5. Quality of water being transferred

Pipeline water quality has been categorised by the pipeline type i.e. raw water or potable water.

2.3.5.6. Pipeline construction method

Construction methods have been assessed at a high level, and it is proposed that all pipelines will be installed using open-cut methods unless specific conditions require otherwise. Major crossings can be made by open cut or trenchless installation (for example directional drilling, tunnelling, or pipe jacking). If passing environmental sensitive areas, trenchless techniques may be used. A specific construction methodology is expected to be developed once an option reaches later design stages.

2.3.5.7. No. / type of crossings

The number of each type of crossing have been assessed by review of the GIS data and background mapping.

Table 2-5 provides a breakdown of the expected variation of typical lengths to guide the length of trenchless pipeline installation required for the different crossing types.

Table 2-5 - Crossing type and distance

Crossing Type	Estimated length of crossing (m)
Canal Crossings	30
Major Road (A/B classification ⁶) crossings	50
Major Road (Motorways) crossings	75
Minor Road (unclassified) crossings	20
Railway line crossings (Private)	100
Railway line crossings (Public)	100
Watercourse crossings	25
Major River Crossings	100

⁶ [Guidance on road classification and the primary route network - GOV.UK \(www.gov.uk\)](https://www.gov.uk/guidance/guidance-on-road-classification-and-the-primary-route-network)

2.3.6. Operations

2.3.6.1. List of permanent above ground structures once operational

This provides a list of all new assets that will permanent above ground.

2.3.6.2. Total new land take of completed option

Subject to CAM design standards for pipeline easement, it has been assumed that pipelines will have a 6m easement, which has been applied to each options pipeline length. Additional to the pipeline length multiplied by 6m, the footprint of any permanent compounds included in the option have been included to provide a high-level assumption of land take per option.

2.3.6.3. Carbon Total tonnes of carbon over lifespan (80 years)

The total tonnes of carbon over the option's lifespan (80 years) have been produced using:

- option delivery period from WRMP19
- outputs of the operational power (kWh/yr) calculation undertaken in this scope of works
- the grid carbon factor, taken from 'Greenbook supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal'⁷, data tables 1 to 19 for the next 80 years.

Table 1 of the government tables 1-19 was used with the long-run marginal estimates for commercial consumption base selected as appropriate to CAM. This was selected due to the relatively small change from the overall CAM usage, it therefore provides a more conservative case for the operational carbon estimation.

The government-advised grid carbon factor is provided in kgCO₂e/kWh over 76 years. As there are no data for years 77-80, assumptions have been made that they will be consistent with that of year 76's data. These data have been converted to tonnes, and then multiplied by the option's power (kWh/yr) to provide the tonnes of carbon per individual year, over the 80-year period; this has then been summed to produce the total tonnes of carbon over the option's lifespan (80 years).

It has been assumed that year 1 will start in after the construction spend profile periods for each option (reported in section 2.3.4.1 – Delivery period). It has also been assumed that no operational carbon will be produced during the option's construction periods, these have been zero valued until the delivery period has lapsed.

2.3.6.4. Waste to landfill

Operational waste is deemed to be negligible at this stage as it cannot be quantified without detailed design. It is recommended that this is reviewed and updated at the options detailed design stage as the Site Waste Management Plan will provide estimates of outputs, particularly associated with the water treatment processes and sludge disposal.

2.3.6.5. Power usage during operation (kWh/yr)

An estimate of the option power usage during operation has been provided based on the required power inputs to WRC TR61 for assets requiring power e.g. pumps and/or WTW.

The data were adjusted to an annual power need for each option by multiplying the option assets power kW rating by 365 to represent an annual usage, ensuring where options have been scaled for utilisation this has been taken into account.

2.3.6.6. Chemical usage

The chemicals data were taken from the WRMP19 workbook, which provided the types of chemical at each option's WTW and the assumed concentration used by CAM (as a percentage). This allowed for a high-level assessment of pro-rata assumptions using *Twort Water Supply 7th edition* data to be applied to the chemical usage of tonnes per year.

The assumption that Sodium Hypochlorite concentration will not increase where a UV plant is being added as part of the option has also been applied.

⁷ source: <https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal>

2.3.6.7. Operational vehicle movements (+/- 10%)

Production of data for HGV movements was discussed with CAM, this data is to be progressed at option design stage.

2.3.7. Option visualisations

2.3.7.1. Schematics

An outline schematic of each option has been produced using option concept information, these are condensed to focus on the specific requirements of each option.

2.3.7.2. GIS data

A GIS representation of options has been prepared by Atkins. The GIS files from the WRMP19 study have been collated and the alignment with the current WRMP24 option descriptions reviewed and updated where necessary. For new options, GIS representation has been produced using best engineering judgement.

GIS is provided in digital form as ESRI shapefiles in Appendix C. An accompanying file register (5209396-ATK-CA-9-037) is provided that includes version control.

3. Recommendations

Recommended next steps include:

- A review of the costing report by CAM is recommended to ensure that option assets have been represented to CAM's satisfaction. In particular, this should focus on options with assets that could not be simply represented in TR61.
- Certain parameters such as the environmental benefits and timescales have been estimated at a level commensurate with the concept stage of the options. As an option is developed further and the screening stages progress, it is recommended that those parameters are updated to reflect any additional information that is established.
- Where there are future scope changes to options as a result of the WRMP process, the reasons for these changes should be collated by CAM and included in the option rejection log for WRMP24.
- Further engagement with the Environment Agency, to enable seasonal variations and HoF data to be reviewed and updated if required.

Appendices



Appendix A. Screening and Rejection Log

A.1. Option screening and rejection log

The detailed option screening spreadsheet (reference: 5211472-ATK-CA-9-011) has been included for CAM assurance purposes, as part of the Water Resource Planning Guidance (WRPG) WRMP24 need to include evidence of an unconstrained list of options and demonstration of the reason for selection of the constrained options (WRPG requirement subsection 8.1 - <https://www.gov.uk/government/publications/water-resources-planning-guideline/water-resources-planning-guideline>).

This spreadsheet includes:

- Screening methodology
- Screening workbook
- Rejection log

Appendix B. Option detail reports

An option detail report has been produced for each option progressed to the constrained list, the below table provides the breakdown of the report references included:

Option	Report document reference
CW24-01A	5211472-ATK-RP-9-033 CAM WRMP24 CW24-01A Option Details
CW24-01B	5211472-ATK-RP-7.7-015 CAM WRMP24 CW24-01B Option Details
CW24-37A	5211472-ATK-RP-9-036 CAM WRMP24 CW24-37A Option Details
CW24-38	5211472-ATK-RP-9-071 CAM WRMP24 CW24-38 Option Details
CW24-57	5211472-ATK-RP-9-064 CAM WRMP24 CW24-57 Option Details
CW24-71	5211472-ATK-RP-9-065 CAM WRMP24 CW24-71 Option Details
CW24-73A	5211472-ATK-RP-9-040 CAM WRMP24 CW24-73A Option Details
CW24-73B	5211472-ATK-RP-9-041 CAM WRMP24 CW24-73B Option Details
CW24-73C	5211472-ATK-RP-9-042 CAM WRMP24 CW24-73C Option Details
CW24-73D	5211472-ATK-RP-9-043 CAM WRMP24 CW24-73D Option Details
CW24-75A	5211472-ATK-RP-9-051 CAM WRMP24 CW24-75A Option Details
CW24-75B	5211472-ATK-RP-9-052 CAM WRMP24 CW24-75B Option Details
CW24-75C	5211472-ATK-RP-9-053 CAM WRMP24 CW24-75C Option Details

Each option detail report includes an appendix that holds the option engineering data input documentation, operational carbon workings and costing assumptions input reports.

Appendix C. GIS files

GIS shapefiles for each option have been provided as part of the option data files. For specific details please refer to the included register spreadsheet, reference 5211472-ATK-CA-9-037.

Appendix D. Option proformas

An option proforma spreadsheet has been produced for each option progressed to the constrained list. It is expected that the proforma is progressed by all parties, Atkins, the environmental team and CAM, with the sections to be inputted as discussed in progress meetings (March 2022). The below table provides each documents reference details:

Option	Proforma document reference
CW24-01A	5211472-ATK-CA-9-034
CW24-01B	5211472-ATK-CA-9-066
CW24-37A	5211472-ATK-CA-9-077
CW24-38	5211472-ATK-CA-9-078
CW24-57	5211472-ATK-CA-9-067
CW24-71	5211472-ATK-CA-9-068
CW24-73A	5211472-ATK-CA-9-047
CW24-73B	5211472-ATK-CA-9-048
CW24-73C	5211472-ATK-CA-9-049
CW24-73D	5211472-ATK-CA-9-050
CW24-75A	5211472-ATK-CA-9-057
CW24-75B	5211472-ATK-CA-9-058
CW24-75C	5211472-ATK-CA-9-059

Appendix E. Meetings log

A log of the project meetings and the associated discussion topics and outcomes has been provided in the spreadsheet CAM WRMP24 Meeting Log, reference 5211472-ATK-RP-9-079.

Appendix F. Costing report

A costing report, reference 5211472-ATK-RP-9-074 has been produced to highlight the methodology undertaken to produce the options CAPEX, OPEX, NPV and AIC for the options progressed to the constrained list.

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