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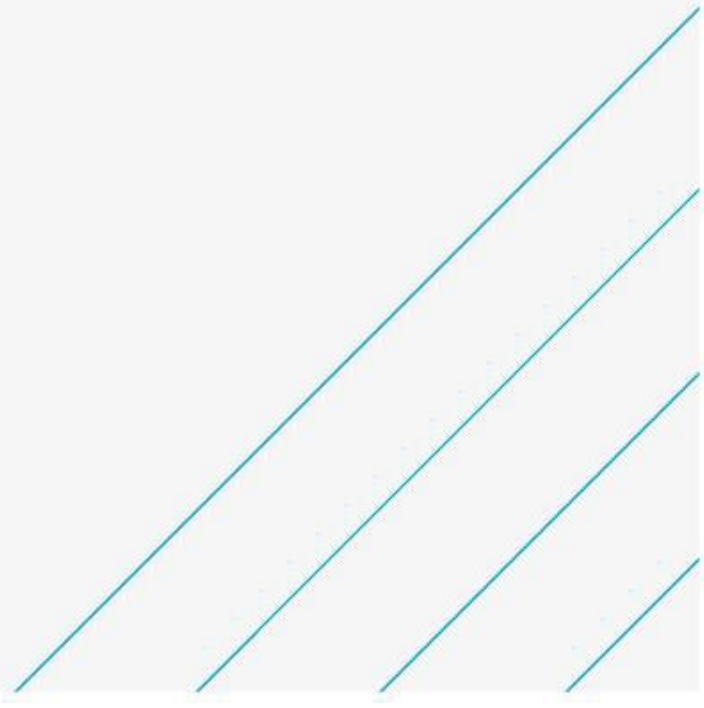
APPENDIX T
SST WRMP24 Support
Constrained Options Metrics Data

South Staffordshire Water PLC

2023

5209396-ATK-RP-7.2-005



Notice

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Document history

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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 describes the company's preparedness, and the actions required to maintain future water supply to customers. 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 WRMP is reviewed, updated, and published every five years, with the last round in 2019 resulting in South Staffs Water (SST) publishing their most recent WRMP in December 2019.

SST 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 SST means that it feeds into the activities of the Water Resources West (WRW) 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 prepared and 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 June 2021, SST approached Atkins for support in developing the details of some supply-side options to meet the needs of both WRMP24 and WRW assessments. SST had already progressed the preparation of an options list and a gap analysis of information that was unavailable for the options at that time. Through the course of summer 2021, Atkins reviewed the data gaps and presented a proposed approach for enhancing option information as noted in the Offer of Services (Ref: SN0240647/DG/002) provided in Appendix A. Atkins was appointed by SST to provide this service and during autumn 2021 Atkins prepared option information enhancements and responded to ad hoc requests from SST, drawing on Atkins previous experience of the supply-side option from involvement in WRMP19.

This report and its associated documentation provide the methodology and assumptions undertaken to enhance the option information (Section 2) and the individual option data outputs (Sections 3). The activities were limited to those specifically requested by SST to respond to the data gaps.

1.2. SST's supply-side options

Initially, SST provided Atkins with a list of 18Nr supply-side options with associated data gaps. These options had been developed during WRMP19 and carried forwards into WRMP24. Further information provided by SST (namely the option cost metrics) indicated that a level of option development or modification had been carried out since Atkins' support to SST's WRMP19.

During the course of this study, SST made variations to the supply-side options being considered. This resulted in removal of 3Nr options (1.1.12, 1.3.2 and 1.4.1), and introduction of 2Nr additional options (2.3.1 and 2.3.2) and 3Nr variations to option 7.5.1.5 (variants b, c and d).

Table 1-1 provides an overview of the supply-side option status and changes during this study.

As noted, the enhancement of option data was limited to the items specifically requested by SST. However, due to programme pressures the information gap analysis stage was not carried out by SST for the introduced options, and instead assumptions were made regarding the information enhancements that were required.

Table 1-1 - Option status and description

Ref	Short Description
1.1.1	Drill new boreholes in Stour Valley: Upgrade Kinver BH
1.1.3a	Drill new boreholes in Stour Valley: New borehole at Hinksford BH site - Blending

1.1.3b	Drill new boreholes in Stour Valley: New borehole at Hinksford BH site - Nitrate Treatment
1.1.7	Reinstate Shenstone BH
1.1.9	New groundwater source and treatment works in Warton Unit: New source and infrastructure.
1.1.10	Reinstate Sandhills BH for potable supply including CRT releases from Chasewater
1.1.12	Treat SO BH water in isolation from SH.
1.3.2	Drill a new borehole at TV: New borehole and headworks, transfer to Central WTW.
1.4.1	Improve and enhance SH and SO outputs
1.4.5	New groundwater source and treatment works in Coven Unit as an extension of Option 1.4.1
2.1.1.1	40 Ml/d capacity raw water abstraction from the Trent to Blithfield
2.2.1.1	Increase storage at Blithfield: Increase dam height by 1m
2.2.2.1	Increase storage at Blithfield: Increase dam height by 2m
2.3.1	Chelmarsh Reservoir 15 Ml/d - <2m raising
2.3.2	Chelmarsh Reservoir 30 Ml/d - up to 2m raising
6.1.1	40 Ml/d capacity treatment works on the Trent, with 6-month bankside storage. 40Ml/d intake on the River Trent between Rugeley and Yoxall
6.1.3	70 Ml/d capacity treatment works on the Trent, with 6-month bankside storage. 70Ml/d intake on the River Trent between Alrewas and Burton.
7.1.2.1	Third Party Option: Canal & River Trust: Birmingham Blithfield surplus
7.1.5	Canal & Rivers Trust: Chasewater options
7.5.1.5a	UU Vyrnwy reservoir raw water release 30 Ml/d to River Severn to support SSW
7.5.1.5b	UU Vyrnwy reservoir raw water release 15 Ml/d to River Severn to support SSW
7.5.1.5c	UU Vyrnwy reservoir raw water release 45 Ml/d to River Severn to support SSW
7.5.1.5d	UU Vyrnwy reservoir raw water release 75 Ml/d to River Severn to support SSW
8.1.1	Utilise third-party boreholes and a new potable import in the Burton-upon-Trent area.
8.1.5	Utilise a third-party abstraction licence(s) and develop as a new groundwater source in the Burton-upon-Trent area.
8.3.1	Construct a new raw water storage reservoir close to the River Trent in the Burton-upon-Trent area and utilise third-party abstraction licence(s) to fill it.

1.3. Deliverables

Upon commencement of this study, Atkins and SST agreed the required deliverables and outputs. There were four core deliverables as follows:

- Technical report (this document), comprising:
  - Approach taken (Section 2)

- Key project assumptions (Section 2)
- Key project risks and limitations (Section 3)
- Recommendations for further investigation that will help SST to progress beyond this initial concept design stage (Section 4)
- Offer of services (Appendix A)

  - Schematics (Appendix B)
  - GIS data (Appendix C & electronic data pack)
  - Cost NPV methodology (Appendix D)
- Data workbook
  - Summarising the option data developed during this study (Appendix E)
- Fortnightly progress meetings
  - Record of client project meetings and associated discussion topics (Appendix F)
- Option concept information
  - Description of the proposed option concept, including engineering concept and high-level environmental appraisal. (Appendix G)

During the period of the study, SST also requested additional option costs data that was provided separately. Reference should also be made to the following outputs:

- Interim cost NPV metrics (ref: 5209396-JT-CA-0.1.4-002-1-S1)

2. Approach

The option information and data enhancements required by this study are broadly divided into 12 categories, each with further sub-divisions for specific data requirements. For clarity the categories are shown in Table 2-1.

Table 2-1 - Information categories / sub-categories and output locations

Section	Main category	Sub-categories	Output location(s)
2.1	Option visualisations	Schematics GIS	Appendix B Appendix C
2.2	Option costs	-	Appendix E – Section 1
2.3	Re-use of existing assets	-	Appendix E – Section 1
2.4	Environmental mitigation and benefits	-	Appendix E – Section 1
2.5	Relevant investigations (WINEP)	-	Appendix E – Section 1
2.6	Abstractions	Timing Hands Off Flow	Appendix E – Section 2
2.7	Discharges	Quantity Quality Timing	Appendix E – Section 3
2.8	Construction - General data	Duration Working width Approx. location / area of compounds Area of option (ha) HGV movements required Quantity of material Quantity of concrete Waste to landfill Power usage	Appendix E – Section 4
2.9	Construction - Pipeline and transfers	Pipeline length Pipeline size Option Deployable Output (DO) Pipeline capacity Quality of water being transferred Quantity of water being transferred Construction route Pipeline construction methods No. / type of crossings	Appendix E – Section 5
2.10	Operations	Land take Waste to landfill Power usage Chemical usage Vehicle movements	Appendix E – Section 6
2.11	Carbon	Operations Carbon Embedded Carbon	Appendix E – Section 6

The following sections described the approach that has been taken by Atkins to review and provide the qualitative or quantitative information.

2.1. Option visualisations

2.1.1. Schematics

An outline schematic of each option has been produced using option concept information sourced from WRMP19 option proformas. An existing SST network schematic provided to Atkins by SST during WRMP19 (named: Copy of 700-000e.dwg, 1999, drawing no. ED700-00E) was used as the base distribution system schematic, this was condensed to focus on the specific functional area impacted by each option. The schematics, updated to include the option concept, are provided in Appendix B.

2.1.2. GIS data

A GIS representation of options was prepared by Atkins during the WRMP19 option development process. The GIS files from that study have been collated and the alignment with the current WRMP24 option descriptions reviewed and updated where necessary.

Options for which GIS data was requested and options where changes were required are provided in digital form as ESRI shapefiles in Appendix C. An accompanying file register (5209396-ATK-CA-7.2-014) is provided that includes a narrative to address specific queries and comments raised by SST.

Whilst GIS information for option 2.1.1 was not specifically requested in the study scope, a revisit of the option gap analysis identified commentary to the effect that GIS data was missing, therefore it was provided within this study.

2.2. Option costs

The study scope required analysis of cost inconsistencies identified by the gap analysis review. This focusses on a misalignment between the current concept information and WRMP19 data for options 1.1.3a, 1.1.3b and 1.1.10. No further commentary was provided regarding the cause of misalignment. The scope also included the need to provide CAPEX cost information for option 7.1.5.

Comparison of costs presented by SST at the commencement of this study and the outputs by Atkins at WRMP19 stage showed that these were not consistent. The inference being that further development of the options may have occurred since Atkins involvement in WRMP19 ended, or that there had been updates to the cost methodology applied to the options. SST were informed about these reservations with the latest cost data, but no robust explanation could be established. Similarly, an initial assessment of the variance did not identify any particular trends in terms of common cost increase, or decrease, applied to either all options or to specific types of option. Further reducing confidence in the option cost information provided by SST at the start of this study was the omission of some operating costs, namely third-party import costs, in the 2021 dataset, when compared with the WRMP19 output data. As detailed explanation of these anomalies could not be established, Atkins has reverted to the cost methodology presented in WRMP19 to arrive at cost estimates with known provenance, and these figures have been uplifted by the Construction Output Price Indices (COPI) between January 2016 and January 2020. Any subsequent changes required to update costs to align with a WRMP24 / PR24 cost methodology should be assessed.

As described in Section 1.3, Atkins were asked to provide interim cost data to SST in October 2021 for inclusion into the WRW reconciliation tables. Originally the data provided for this interim assessment was based on the option supply benefit (DO) estimated at WRMP19. This influenced the OPEX costs of the option which had been estimated from values provided in £/Ml of benefit. In turn the benefit value has a significant influence on the 80year NPV cost

Since the provision of interim cost data, SST provided an update (4th November 2021) to the expected option benefits (DO) in the form of WRW Reconciliation table WAFU (Ml/d)[1]. Comparison of those benefit datasets shows notable differences and means that the ongoing OPEX cost and NPV is not aligned with the benefit presented for the option. The different benefits for each option have been represented in Table 2-2.

[1] 2017-03-17 Master option input workbook V3 6 (bulk) – ATKINS 210317, provided by SST in October 2021.

In most cases, the assumed annual benefit output from the options is less than the annual benefit that would be inferred from the WRW Reconciliation table. This means there is an under-representation of the OPEX costs of an option, making it appear more favourable from a cost perspective. It is strongly recommended that communication and engagement with the SST water resources modelling team is carried out to provide greater clarity on the expected option benefits.

8Nr options (1.1.3a, 1.1.3b, 2.3.1, 2.3.2 and 7.5.1a, b, c and d for WRMP19) have not applicable (n/a) status as these options were not taken forward onto the feasible list in WRMP19, therefore no data is available to be provided for comparison. Option 1.1.3 for WRW reconciliation table also is not applicable as this option has been sub-divided.

Table 2-2 - Comparison of different option benefit data

Option Ref:	Option benefit based on WRMP19 DO Peak (October 2021)			Assumed equivalent annual benefit for OPEX cost purposes	Updated option benefit, taken from SST WRW reconciliation table WAFU (Ml/d) (November 2021)	Assumed equivalent annual benefit for cost purposes (Ml/yr)
	NYAA	DYAA	DYCP			
	Ml/d	*Ml/d*	*Ml/d*	*Ml/yr*	*Ml/d*	*Ml/yr*
1.1.1	0	0	9	329	8.9	3,249
1.1.3	0	0	5	183	n/a	n/a
1.1.3a	n/a			n/a	4.9	1,789
1.1.3b	n/a			n/a	4.9	1,789
1.1.7	5	5	5	1,825	4.9	1,789
1.1.9	2	2	2.5	748	2	730
1.1.10	n/a			n/a	4.9	1,789
1.4.5	2	2	4	803	1.9	694
2.1.1.1	20	20	40	8,030	40	14,600
2.2.1.1	10	10	0	3,258	8.5	3,103
2.2.2.1	20	20	0	6,570	12.4	4,526
2.3.1	n/a			n/a	15	5,475
2.3.2	n/a				30	10,950
6.1.1	30	30	40	11,315	40	14,600
6.1.3	55	55	70	20,623	60	21,900
7.1.2.1	5	5	0	1,643	5	1,825
7.1.5	2	2	2	730	15	5,475
7.5.1.5b	n/a			n/a	15	5,475
7.5.1.5a	n/a			n/a	30	10,950
7.5.1.5c	n/a			n/a	45	16,425
7.5.1.5d	n/a			n/a	75	27,375

2.2.1. Option cost inconsistencies

Options 1.1.3a, 1.1.3b and 1.1.10

The initial review undertaken of options 1.1.3a, 1.1.3b and 1.1.10 found no trends to explain why, or how, the costs have differed since the WRMP19 data issue. Several aspects might have affected the cost changes, which includes option scope change, oncosts being removed from the capex figures or adjustment from an unknown optimism bias, however none can be confirmed without the supporting data. Therefore, it is recommended that the data provided in WRMP19 be used for these options, with an adjustment for inflation based on COPI detailed in Appendix D NPV methodology, as this can provide an auditable trail of data documentation for each option's output.

All option costs

Due to the inconsistencies identified, for completeness and comparison all the option WRMP19 costs have been provided in Appendix E from the WRMP19 datasets. It should be noted that 7.5.1.5 is represented as 0 as it is assumed the existing River Severn offtake at Hampton Loade WTW will be used and therefore the option is OPEX only (payment to UU).

Option 7.1.5

A cost estimate breakdown spreadsheet for option 7.1.5 is provided in appendix E. This follows the same methodology and cost model as used for the WRMP19 option development. An adjustment for inflation based on COPI has been made to represent the advancement of time to WRMP24.

Option 7.1.5 has a dependency on option 1.1.10, meaning for the option 7.1.5 benefits to be realised option 1.1.10 also needs to be completed. Care should be taken when representing this option data in any multi-criteria analysis decision making tool or in any WRW submissions.

2.3. Reuse of existing assets

A list of the existing assets that are used within each option has been provided in Appendix E. The assumed definition of reused assets is either:

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

2.4. Environmental mitigation and benefits

Subject to each option undergoing detailed analysis, a high-level review of the environmental benefits and mitigation techniques available for each of the option types has been provided in Appendix E workbook.

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

- SST Environment and Sustainability Policy Commitments reference: https://www.south-staffs-water.co.uk/media/2135/appendix-a-south-staffs-water-final-wrmp19-sea-er-final-main-report.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	Transfer of water concerns between source and delivery 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. Water transfer is unlikely to impact the WQ of the ground water or surface water bodies. In terms of network water quality, the proposed import is from UU surface water source. There is a WQ risk associated with mixing of this water with existing ground water sources. Deployment of UU water into network 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 to be applied.
Agriculture	N/a	Agricultural land classification for working areas and access routes to be undertaken at detailed design stage. There is no damage to land, or any adverse impact expected to land from proposed work.
Informal recreation	Operational	Consideration for the reservoir options to increase community engagement and the addition of informal recreation e.g., footpaths that would require ongoing management.
Noise	N/a	The proposed work is not a major construction activity and is not expected to generate high level of noise outside the normal working hours.
Air quality	N/a	Although, there will be increases use of machinery and traffic during the construction work, it is unlikely that there will be any long-term impact on the air quality in the area. Dust suppression techniques are advised.
CO2 emissions	Both	Increased CO2 emissions are expected during construction activities. Consideration of the CO2 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.

2.5. Relevant investigations (WINEP)

WINEP data was not amalgamated into the option dataset presented at WRMP19. During this study Atkins requested SST provide relevant WINEP data associated with the options where available. Unfortunately, this could not be established in the time available, and SST requested Atkins compile this data from available sources.

Atkins have identified a number of relevant investigations to SST on the opensource Environment Agency WINEP data tables (source: Water Industry National Environment Programme - data.gov.uk) and provided any that appear relevant to the options specifics in Appendix E. Further engagement with the SST environment and catchment team is recommended.

2.6. Abstractions

2.6.1. Timings

The abstraction timings were not provided as part of the WRMP19 option information. After consulting SST, 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 in Appendix E.

2.6.2. Hands off Flow (HoF)

Atkins consulted with SST regarding each option's Hands off Flow (HoF) data, and it was determined to use the WRMP19 proforma information where applicable. Further engagement with the SST Environment and Catchment team is recommended. Atkins have summarised the available data in Appendix E.

SST have stated that the aim for the WRW reconciliation table of WAFU for option 2.1.1 is of 40Ml/d, this is an increase of 20Ml/d above the average NYAA since WRMP19. This option relies on the water being available for abstraction from the River Trent that is subject to a HoF restriction, which restricts abstraction during dry seasons. Therefore, it is recommended that further investigation be undertaken to ensure the option benefit can be realised.

2.7. Discharges

2.7.1. Quantity

SST provided an updated option list and assumed WRW reconciliation table of WAFU (Ml/d) on the 4th November 2021. These figures, as shown above in Table 2-2 vary from WRMP19 DO and further engagement with the SST teams is recommended regarding the defined duration of the discharge quantity. The WRW reconciliation table of WAFU (Ml/d) figures have been represented in Appendix E.

2.7.2. Quality

The quality of water being discharged has been compiled using the option information in the WRMP19 proformas. A qualitative assessment of the relative quality of water that is being transferred between different water bodies has been estimated and provided in Appendix E.

2.7.3. Timings

Similarly, to discharge quality, timings have been compiled from the WRMP19 proformas and provided in Appendix E.

2.8. Construction: General data

2.8.1. Duration

The request for information on option duration is only applicable to option 7.1.5 and this has been assumed to be 5 years. The assumption has been made on professional judgement of the option needs. The delivery period of all options has been provided for completeness as it has a direct influence on the estimation of NPV values.

The duration and spend profiling are as applied in WRMP19 Appendix W[2]:

Spend Profile	Description
Profile A:	5 year spend profile – generic 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:	10 year spend profile – generic 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:	10 year spend profile – complex scheme Used for major new water treatment works schemes with a longer construction period than Profile B.
Profile D:	10 year spend profile – significant scheme 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:	5 year spend profile – expedited complex scheme 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 2-1 - Extract from Appendix C of WRMP19 Appendix W

2.8.2. Working width

The construction working width provided is from 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.

2.8.3. Approximate location / area of compounds

The compound locations have been identified as a point layer and are provided with the GIS files in Appendix C. 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.

[2] https://www.south-staffs-water.co.uk/media/2153/appendix-w-wrmp19-methodology-for-estimnating-supply-scheme-costs-sst.pdf

Table 2-4 - Option compound areas

Option Type	Assumed area of compound (ha)
Groundwater and borehole refurbishment	50 x 50 = 2,500m2 (0.25ha)
Dams and reservoirs	200 x 50 = 10,000m2 (1ha)
Canal and River Trust options	50 x 50 = 2,500m2 (0.25ha)

2.8.4. Area for option

The option area data has 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.

The intent of this metric should be further confirmed, as 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.

2.8.5. HGV movements

The estimated number of HGV movements for option construction has been adapted from review of the 'Draft Results of Environmental and Social Costing for SST WRMP19' report, which was prepared for the options in WRMP19. This provided a range between the + and - 10% for each option.

No previous WRMP19 data for HGV movement was available for options 2.3.1, 2.3.2 and 7.1.5 therefore a pro-rata estimation was applied from similar option types.

2.8.6. Quantity of material (t or m3)

The outputs of this section are pending further guidance and discussions with SST for methodology to ensure consistency with WRW requirements.

2.8.7. Quantity of concrete (t or m3)

The outputs of this section are pending further guidance and discussions with SST for methodology to ensure consistency with WRW requirements.

2.8.8. Waste to landfill

Construction wastes arising from each option can occur from many different activities. As options are developed in the design stages, a Materials Waste Management Plan and Site Waste Management Plan are likely to be developed, but currently there is insufficient option definition at this stage to provide this level of detail. However, for linear pipeline options, a nominal proportion excavated trench spoil has been assumed as needing landfill disposal.

At this stage of the option data enhancement, this has been estimated as 25% of the soil from the working trench size. The trench size has been estimated from engineering judgement as $3m^3$ multiplied up by the pipeline length for all options.

Non-linear works including the dam and reservoir options have been assumed based on the assets sizing (length and width of dam wall), with an estimated 25% of the works as waste to landfill. It is recommended that this approach is discussed with SST and WRW to ensure consistency with WRW requirements.

2.8.9. Power

The outputs of this section are pending further guidance and discussions with SST for methodology to ensure consistency with WRW requirements.

2.9. Construction: Pipeline and transfers

2.9.1. Pipe length

The pipe length (m) data has been provided from the WRMP19 option workbook datasheet for each option, the data for both the treated and raw water pipelines has been provided in separate columns in Appendix E.

2.9.2. Pipe size

The pipe size (mm) data has been provided from the WRMP19 option workbook datasheet for each option, in Appendix E.

2.9.3. DO

As discussed in section 2.2, Table 2-2 contains a comparison between WRMP19 and WRMP24 DO assumptions. The SST WRW Reconciliation table WAFU (Ml/d), has been provided in Appendix E.

2.9.4. Pipeline capacity

Pipeline capacity has been assumed based on peak DO, with the data supplied from WRMP19 worksheet.

2.9.5. Quality

Pipeline water quality has been categorised by the pipeline type, of raw water or potable water. The data provided in Appendix E is adapted from the WRMP19 spreadsheet with an indication of water type for each option.

2.9.6. Quantity of transfer

The quantity of transfer has been estimated by adjusting the option benefit provided in the SST WRW Reconciliation table to represent an annual volume (i.e., multiplying the daily WAFU in Ml/d by 365).

2.9.7. Construction route

A high-level assessment of the most suitable route for construction traffic to reach the option site(s) has been undertaken, taking into consideration road capacity, accessibility, and provision of the largest available road to the options sites. Consideration of the land use and proximity to protected sites was also included.

The outputs have been provided in the Appendix C as GIS shapefiles.

2.9.8. 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). Passing environmental sensitive areas may require trenchless techniques to be used. A specific construction methodology is expected to be developed once an option reaches later design stages.

2.9.9. No. / type of crossings

The number of each type of crossings provided in Appendix E 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) crossings	50
Major Road (M) crossings	75

Minor Road (uncl) crossings	20
Railway line crossings (Private)	100
Railway line crossings (Public)	100
Watercourse crossings	25
Major River Crossings	100

2.10. Operations

2.10.1. Land take of completed option

Subject to SST 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 permeant compounds included in the option have been included to provide a high-level assumption of land take per option.

2.10.2. 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.

2.10.3. Power

An estimate of the option power usage during operation was provided for most options in the WRMP19 cost estimation spreadsheet. This itemised power in units of power per Ml of option benefit.

This source data was adjusted to an annual power need for each option by multiplied by the option benefit as listed in the WRW Reconciliation table WAFU (provided in November 2021) and 365 to represent an annual usage.

2.10.4. Chemical usage

The chemicals data was taken from the WRMP19 workbook, which provided the types of chemical at each option's WTW and the assumed concentration used by SST (%). This allowed for a high-level assessment of pro-rata assumptions using TWORT 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.

2.10.5. Vehicle movements

The number of HGV movements data has been provided with reference to the 'Draft Results of Environmental and Social Costing for SST WRMP19' report undertaken by an external consultant, which provided a range between the + and - 10% for each option.

Options 2.3.1, 2.3.2 and 7.1.5 had no data provision provided previously, therefore a pro-rata from similar options has been applied.

2.11. Carbon

2.11.1. Operational Carbon

Operational Carbon data has been provided in two formats: total tonnes of carbon over lifespan (80 years) and NPV (£k).

2.11.1.1. 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 the WRMP19 spreadsheet data of option delivery period; the outputs of the operational power (kWh/yr) produced in this scope; and the Grid carbon factor taken from 'Greenbook supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal', data tables 1 to 19 (source: Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal - GOV.UK (www.gov.uk) 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 SST, this is due to the relatively small change from the overall SST usage and therefore it 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 is no data for years 77-80, assumptions have been made that they will be consistent with that of year 76's data. This data has 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 2025. 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.

2.11.2. Embedded Carbon

The outputs of this section are pending further guidance and discussions with SST for methodology to ensure consistency with WRW requirements.

2.11.3. Carbon NPV

Once embedded carbon has been estimated, the monetised operational and embedded carbon values will be discounted over the 80-year period to produce a carbon NPV value. The same approach as provided in Appendix D to update the costing NPV will be applied.

3. Risks and limitations

Several limitations have been identified that need to be considered when using the data supplied:

- All information supplied has been developed through the methodology and assumptions detailed in this document.
- Some areas of the scope outputs have been limited by the data made available. Where possible, assumptions and identified data have been used. Where appropriate, recommendations for further investigation have been made, this includes but is not limited to:
  - WINEP schemes
  - Discharge quality and timings
  - Abstraction timings and HoF assumptions.
- The level of detail and information available for each option was variable. However, where sufficient data was established to provide informative commentary on each option, this can form the basis from which the next stages of options development can be progressed. Significant amounts of supporting data were taken from WRMP19 data, where available.
- Where no data has been identified and/or further guidance and discussions with SST are needed to confirm and agree the required methodology (to ensure consistency with WRW requirements) this has been highlighted.

4. Recommendations

Recommended next steps include:

- Shortlisting of the options, with explanation and justification of why options have been screened out where appropriate.
- It is strongly recommended that there is engagement with the SST water resources modelling team to provide greater clarity on the expected option benefits, particularly with reference to proposed option's operation and costing data.
- Any subsequent changes that are required to update costs to align with a WRMP24 / PR24 cost methodology should be assessed.
- In the absence of more recent information, it is recommended that data used to estimate CAPEX for all options makes use of the WRMP19 outputs. This is because there is an auditable trail of assumptions that relate to the WRMP19 outputs.
- 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 screening stages progress, it is recommended that those parameters are updated to reflect any additional information that is established.
- Evaluation of the scope applied to options 2.3.1, 2.3.2 and 7.5.1.5b, c and d to ensure all required data has been provided; assumptions were made for these options based on similar options.
- It is recommended that the reasons for option scope changes are collated by SST and included in the option rejection log for WRMP24.
- Further engagement with the SST Environment and Catchment team is recommended to ensure the identified WINEP schemes are the only relevant schemes that need to be considered for the options.
- Further engagement with the SST Environment and Catchment team is recommended for HoF data to be updated from WRMP19 proforma data.
- Further engagement with the SST Environment and Catchment team is recommended to define the duration requirement of the discharge quantity.
- Further engagement with the SST teams is recommended to ensure the methodology applied for waste to landfill is appropriate to SST expectations.

Appendices

Appendix A. Offer of Services

Redacted version provided in data package, SSW WRMP24 Support Offer v1 30Jul2021 redacted, reference SN0240647-DG-001.

Appendix B. Option Schematics

Appendix C. GIS Shapefiles

GIS Shapefiles for each option are located in the reports associated folder Appendix C – GIS Shapefiles. A document register (5209396-ATK-CA-7.2-014) has also been provided.

Appendix D. NPV Methodology

Appendix E. WRMP24 Option Data Supporting Workbook

A workbook (5209396-ATK-CA-7.2-015) has been provided as part of the report associated documentation, this contains the option data for each aspect of the scope in tabulated format.

Appendix F. Client meeting register

Appendix F provides a list of client project meetings and the associated discussion topics.

Table F.-1 - Client Meeting Register

Date	SST and third-party attendees	Topics discussed
22/09/21	Lesley Knowles Natalie Akroyd	**Project Start Up Meeting** • Understanding the concept and objectives • Appreciation of limitations • RFI request
13/10/21	Lesley Knowles Natalie Akroyd	**Progress update 1** Discussion of: • Scope of work requirements for new options • CAPEX inconsistencies • RFI meeting proposal
04/11/21	Lesley Knowles	**Progress update 2** Discussion of: • Company x option delivery • Verbal acceptance of T&C – document T&Cs to be sent to LK and signed • LK to provide SST available option data • Confirmation of list of options – including the removal of 3 options • Change events 1-3

Appendix G. Option concept descriptions

Appendix G provides the option concept descriptions, provided from the WRMP19 proformas.

Table G-1 - Option concept descriptions

Ref	2.1.1.1
Name	40 Ml/d new sw abst R.Trent to Blithfield Reservoir
Concept Summary	40 Ml/d capacity raw water abstraction from the Trent to Blithfield
Description	Blithfield reservoir is the primary source of raw water for Seedy Mill WTW. Blithfield reservoir has a capacity of approximately 18,200 Ml and sources water from the River Blithe and Tad Brook. Output at Seedy Mill WTW is seasonally limited due to a lack of raw water availability and this option seeks to promote an alternative source of raw water into the reservoir from the River Trent. An existing abstraction point on the River Trent at Nethertown can be used by SST to support Seedy Mill WTW. This abstraction point can also be used to introduce River Trent water into Blithfield reservoir. However, the mode of operation to fill the reservoir requires flow reversal in the pipelines and causes restricted raw water transfer between Blithfield reservoir and Seedy Mill WTW for the duration of the reservoir filling. Any new water from the River Trent would be subject to a Hands-Off Flow at the Yoxall gauge, thereby limiting option yield. The proposed option is to provide a new 40Ml/d surface water abstraction on the River Trent, including: a river intake (380kW pump (760kW pumping station)) and raw water pumping station connected to a new dedicated pipeline to Blithfield reservoir (3.8km, 900mm). A new inlet into Blithfield reservoir will be installed. However, the abstraction on the Trent would be restricted for much of the summer by the Trent flow restrictions. The exact location of the new river intake will need to be determined through further investigation and third-party consultation; however, for the purpose of this option assessment a notional location to the north-west of Rugeley has been selected. Permanent land take would be required for the river intake and associated plant/building. The pump back capacity would also need to be established, as the option would not add extra water if it resulted in cutback to the existing Blithe pump back. The River Trent has a high proportion of treated sewage effluent, which gives rise to water quality concerns, particularly associated with introducing River Trent water to Blithfield reservoir which is also used for recreational activities. Similarly, there may be Invasive Non-Native Species (INNS) transfer implication which should be assessed during subsequent option development. The River Trent and Blithfield reservoir are likely to offer different types of habitat thereby presenting less opportunity for INNS populations to become established as a result of the transfer.

Ref	2.2.1.1
Name	Blithfield Reservoir - 1m raising
Concept Summary	Increase storage at Blithfield: Increase dam height by 1m
Description	Blithfield Reservoir has a stated capacity of 18,172Ml and a surface area of 3,200,000m2 when full to its current top water level of 95.25mAOD. It is used for water supply and recreation and is built across the River Blithe and Tad Brook. This option intends raising the reservoir full supply level by approximately 1m. This will enlarge the actual storage volume of 18,172 Ml to provide an additional 3,180 Ml storage. It is envisaged that the main items included in the works will be as follows: Raising of the main embankment dam by 1m by forming a reinforced concrete wall, connected to the clay core by interlocking plastic sheet piles, and earthworks to the downstream slope of the embankment.

	Raising of the draw off tower, the footbridge and its piers, the main and auxiliary spillways, and the bridges over the spillways. To raise the main and auxiliary spillways a new fuse gate has been envisaged. A new set of props between the raised spillway side walls has been assumed. Raising of the stilling basin side walls, and extension of the stilling basin approximately 3m downstream. Raising of the road embankment on the upstream slope, including the existing causeway bridge. Consequently, the road would be shifted about 2.5m upstream. Two borrow pits have been considered near both embankments in dry land outside of the reservoir. To be conservative, the volume of fill material borrowed was assumed to be twice the granular material needed for the raising of the embankments. An allowance for land acquisition and compensation to affected landowners. It is currently assumed that there would be no change to abstraction licensing. Any additional land take would potentially be within existing SST land holding.

Ref	2.2.2.1
Name	Blithfield Reservoir - 2m raising
Concept Summary	Increase storage at Blithfield: Increase dam height by 2m
Description	Blithfield Reservoir has a stated capacity of 18,172Ml and a surface area of 3,200,000m2 when full to its current top water level of 95.25mAOD. It is used for water supply and recreation and is built across the River Blithe and Tad Brook. approximately 70m long. This option is aimed to raise the reservoir full supply level by approximately 2m. This will enlarge the actual storage volume of 18,172 Ml to provide an additional 6,600 Ml storage. It is envisaged that the main items included in the works will be as follows: Raising of the main embankment dam by 2m by forming a reinforced concrete wall, connected to the clay core by interlocking plastic sheet piles, and earthworks to the downstream slope of the embankment. Raising of the draw off tower, the footbridge and its piers, the main and auxiliary spillways, and the bridges over the spillways. To raise the main and auxiliary spillways a new fuse gate has been envisaged. A new set of props between the raised spillway side walls has been assumed. Raising of the stilling basin side walls, and extension of the stilling basin approximately 3m downstream. Raising of the road embankment on the upstream slope, including the existing causeway bridge. Consequently, the road would be shifted about 2.5m upstream. Two borrow pits have been considered near both embankments in dry land outside of the reservoir. To be conservative, the volume of fill material borrowed was assumed to be twice the granular material needed for the raising of the embankments. An allowance for land acquisition and compensation to affected landowners. It is currently assumed that there would be no change to abstraction licensing. Any additional land take would potentially be within existing SST land holding.

Ref	2.3.1
Name	Chelmarsh reservoir 15Ml/d
Concept Summary	Chelmarsh Reservoir 15 Ml/d - <2m raising
Description	This option is aimed to raise the reservoir full supply level by approximately 1 m. This will enlarge the actual storage volume of 3,063 Ml to provide an additional 420 Ml storage. The storage capacity has been estimated using GIS based tools included within AutoCAD Civils 3D software. AutoCAD drawings have been prepared based on the Ordnance Survey mapping and the record drawings to perform a design sketch of the raised dams. These sketches were used to form the bill of quantities to allow a high-level cost estimate of this option. It is envisaged that the main items included in the works will be as follows: • Raising of the main embankment dam by 1 m by forming a reinforced concrete wall, connected to the clay core by interlocking plastic sheet piles, and earthworks to the downstream slope of the embankment. • Raising of the overflow and inlet towers, the footbridges, and their piers. • Extension of the culvert and stilling basin approx. 3 m downstream. • Raising of the subsidiary dams on the downstream slope. Consequently, the road would be shifted about 2.5m upstream. • Two borrow pits have been considered near the embankments in dry land outside of the reservoir. To be conservative, the volume of fill material borrowed was assumed to be twice the granular material needed for the raising of the embankments. Land acquisition and compensation to affected landowners.

Ref	2.3.2
Name	Chelmarsh Reservoir 30Ml/d
Concept Summary	Chelmarsh Reservoir 30 Ml/d - up to 2m raising
Description	This option is aimed to raise the reservoir full supply level by approximately 2 m. This will enlarge the actual storage volume of 3,063 Ml to provide an additional 890 Ml storage. The storage capacity has been estimated using GIS based tools included within AutoCAD Civils 3D software. AutoCAD drawings have been prepared based on the Ordnance Survey mapping and the record drawings to perform a design sketch of the raised dams. These sketches were used to form the bill of quantities to allow a high-level cost estimate of this option. It is envisaged that the main items included in the works will be as follows: • Raising of the main embankment dam by 2 m by earthworks to the crest and downstream slope of the embankment. • Raising of the overflow and inlet towers, the footbridges, and their piers. • Extension of the culvert and stilling basin approx. 10 m downstream. • Raising of the subsidiary dams on the downstream slope. Consequently, the road would be shifted about 5.0m upstream.

	• Two borrow pits have been considered near the embankments in dry land outside of the reservoir. To be conservative, the volume of fill material borrowed was assumed to be twice the granular material needed for the raising of the embankments. Land acquisition and compensation to affected landowners.

Ref	6.1.1
Name	Trent 40 Ml/d - new sw intake with 14 day bankside storage and treatment works
Concept Summary	40 Ml/d capacity treatment works on the Trent, with 6- month bankside storage. 40Ml/d intake on the River Trent between Rugeley and Yoxall
Description	This option seeks to make use of the available water in the River Trent by installing a new 40 Ml/d capacity treatment works adjacent to the River Trent between Rugeley and Yoxall. Due to the likely summer season HoF restrictions to abstraction a new bankside storage reservoir will be required. Water quality on the River Trent is poor so treatment needs are expected to result in high cost for the option for both capital investment and the operational cost requirements. The proposed option is to install a new river abstraction (40Ml/d) on the River Trent which discharges via a new pipeline (0.1km, 900mm, 115kW) into a new bankside storage reservoir (8,052MI, equating to 183 days at 40 Ml/d and 10% of 'dead' storage). The storage reservoir (161ha) is to be sized to provide 6 months storage to enable continued treatment works output when the River Trent is subject to HoF. There may be opportunity to use former gravel workings in the area, both for land and for first stage settlement of river water. However, it should be noted that abstractions from gravel aquifers or former quarry lakes will not be exempt from HoF restrictions, so a new dedicated storage reservoir is likely to be required. A new water treatment works (10ha) with design capacity of 40 Ml/d (1MW power supply) will be constructed. The exact works will need to be designed in accordance with water quality data which requires further investigation and study. A notional treatment plant comprising clarifiers, filters, GAC plant, Manganese contactor and chlorine disinfection has been included for the purpose of this option assessment. A new pipeline connection (0.2km, 900mm) will be required between the bankside storage and WTW. New pipelines will be required between the new treatment works and the existing SST distribution grid. It is proposed that two connections are installed. The first to the network supplying Burton on Trent (25 Ml/d, 4.7km, 750mm and a 210kW pump (420kW pumping station)) thereby reducing demand on Seedy Mill WTW, the second to Seedy Mill WTW for distribution into the rest of the SST grid (15 Ml/d, 5.0km, 600mm and new 90kW pump (180kW pumping station)). Further investigation is required to establish suitable sites for the proposed storage and treatment works. For the purpose of this option assessment, a notional location near to Kings Bromley has been suggested. Land acquisition will be required for this option for both the treatment works and bankside storage. Linear land compensation is also required for the construction of the new pipelines. New links into the power supply grid will be required at the abstraction point and at the new treatment works. An overall delivery period of 10 years.

Ref	6.1.3
Name	Trent 70 Ml/d - new sw intake with 14-day bankside storage and treatment works
Concept Summary	70 Ml/d capacity treatment works on the Trent, with 6- month bankside storage. 70Ml/d intake on the River Trent between Alrewas and Burton
Description	This option seeks to make use of the available water in the River Trent by installing a new 70 Ml/d capacity treatment works adjacent to the River Trent between Alrewas and Burton. Due to the likely summer season HoF restrictions to abstraction a new bankside storage reservoir will be required. Water quality on the River Trent is poor so treatment needs are expected to result in high cost for theoption for both capital investment and the operational cost requirements. The proposed option is to install a new river abstraction on the River Trent which discharges into a new bankside storage reservoir (14,090 MI, equating to 183 days at 70 Ml/d and 10% of 'dead' storage). The storage reservoir (282ha) is to be sized to provide 6 months storage to enable continued treatment works output when the River Trent is subject to HoF. This is to be separated into two reservoir units. Bankside storage 1 would comprise of: a new river intake (200kW) and pumping into bankside storage 1, a new pipeline (0.1km, 1,200mm) between river intake and bankside storage 1, a new inlet to bankside storage 1, a new outlet from bankside storage and associated pumping (200kW), and a new pipeline (1.7km, 1,200mm) between bankside storage

	and WTW. Bankside storage 2 would comprise of: a new river intake (200kW) and pumping into bankside storage 2, a new pipeline (0.1km, 1200mm) between river intake and bankside storage 2, a new inlet to bankside storage 2, a new outlet from bankside storage and associated pumping (200kW) and a new pipeline (0.8km, 1,200mm) between bankside storage and WTW. There may be opportunity to use former gravel workings in the area, both for land and for first stage settlement of river water. However, it should be noted that abstractions from gravel aquifers or former quarry lakes will not be exempt from HoF restrictions, so a new dedicated storage reservoir will be required. A new water treatment works (10ha) with design capacity of 70 Ml/d will be constructed. The exact works will need to be designed in accordance with water quality data which requires further investigation and study. A notional treatment plant comprising clarifiers, filters, GAC plant, Manganese contactor and chlorine disinfection has been included for the purpose of this option assessment. New pipelines will be required between the new treatment works and the existing SST distribution grid. It is proposed that two connections are installed. The first to the network supplying Burton on Trent (25Ml/d, 0.5km, 750mm and a 220kW pump (440kW pumping station)) thereby reducing demand on Seedy Mill WTW, the second to Seedy Mill WTW for distribution into the rest of the SST grid (45 Ml/d, 11.8km, 900mm and new 300kW pump (600kW pumping station)). Further investigation is required to establish suitable sites for the proposed storage and treatment works. For the purpose of this option assessment a notional location near to Walton on Trent has been suggested. Land acquisition will be required for this option for both the treatment works and bankside storage. Linear land compensation is also required for the installation of the new pipelines. New links into the power supply grid will be required at the abstraction point and at the new treatment works. The average deployable output (DO) is anticipated to be 60 Ml/d (70 Ml/d peak). An overall delivery period of 10 years.

Ref	7.1.2.1
Name	CRT Birmingham to Blithfield or Central Works via canal network.
Concept Summary	Third Party Option: Canal & River Trust: Birmingham Blithfield surplus
Description	This option seeks to make surplus water in the Birmingham Canal Network (BCN) available for water supply purposes. Surplus in the BCN can be supported by the CRT's Bradley borehole and Chasewater Reservoir. The CRT have suggested using the canal network to transfer the water from source to locations more suitable for SST. This option proposes transferring the water to the Trent and Mersey canal where it can be abstracted by SST and used to supplement flows into Blithfield Reservoir. This could potentially be a more attractive alternative to taking water from the River Trent, particularly when the River Trent is subject to Hands-off Flow (HoF) restrictions. However, the dry year yield has been discounted owing to assumption of a 1 in 20-year restrictions by CRT. The option requires upgrades to the canal network to facilitate the transfer to the Trent and Mersey Canal. This broadly requires the provision of an upgraded pumping station (4 kW pump (88 kW pumping station)), lock bypasses, appropriate control equipment and a new abstraction point. Permanent land take would be required for the canal intake. There will be two inlet arrangements at the canal and at the reservoir. SST would also need to provide a new pipeline (6.2km, 450mm) from the abstraction point to Blithfield Reservoir. Once within Blithfield Reservoir the canal water would be blended with other inflows and treated at Seedy Mill WTW before onward distribution into water supply. The CRT have indicated that a transfer of up to 15 Ml/d is available. An overall delivery period of 10 years.

Ref	7.1.5
Name	CRT Chasewater surplus to Crane Brook
Concept Summary	Canal & River Trust: Chasewater options, including augmentation. Release of compensation flow from Chasewater to augment Crane Brook would offset need to use PWS water for this purpose.
Description	CRT to provide surplus from Chasewater Reservoir to SSW. Surplus would be fed from the reservoir to the Wryley & Essington Canal which would then in turn discharge to Cranes Brook. This would free up additional water in the catchment for SSW. The reservoir outflow is released via an automated structure from the Wryley & Essington Canal to the Crane Brook. Detailed hydrological modelling has not been undertaken to determine the surplus, but it is likely to be in the region of 2- 5 Ml/d. The main items included in the work are envisaged to be: • 1.0km of new 450mm dia pipeline between the Chasewater outlet and Crane Brook. To be conveyed by gravity. • Two inlet arrangements (canal and a discharge to the brook. • Drill new borehole at Pipehill, with new borehole pumps, new headworks and new building. • 0.9m of new 450mm dia main to connect new borehole to the existing Pipehill treatment plant. • New 14kW pump (28kW pumping station at new borehole. • Existing treatment at Pipehill WTW. • Existing distribution network from Pipehill BH WTW. • Compensation for linear pipeline scheme • Land for SSW access around Crane Brook site (priced as 1 ha at £20k/ha) • Land for new BH site

Ref	8.1.1
Name	Potable import in Burton-upon-Trent
Concept Summary	The concept is to utilise third-party boreholes and a new potable import in the Burton-upon-Trent area.
Description	Bulk supply of potable water provided to SSW by Company x . In order to facilitate the supply, new pipework and/or pumping plant would be required, to connect into the SSW network. In exchange for the bulk supply, SSW would compensate Company x by providing a mains water supply of an equivalent amount. • The scale and feasibility of this option is dependent on several factors, including: • The amount of water that can be made available by Company x , under the current abstraction licences. • The mains supply that would be needed from SSW as compensation (and the extent to which this gives a net DO benefit to SSW). • The number of abstraction points in and around Burton-upon-Trent that could be utilised and the practicalities of connecting into the SSW network. • Managing water quality risks and overcoming operational constraints. The output from this option is to be confirmed following discussion with Company x and the Environment Agency, to understand the licensed amounts that could be available for a bulk supply / trade. Network modelling and water quality investigations are required to ensure that the proposed bulk supply is feasible. Lead in times for the scheme will be affected by these investigations and assessments. The following assumptions have been made: • A reliable supply of the quantities quoted can be provided by Company x . • There are no licence constraints preventing the assumed DO benefit being achieved. • The assumed bulk supply can be provided by one borehole source or from multiple sources, and this does not affect the feasibility of the option. • There are no water quality risks that cannot be designed out, which would otherwise prevent the scheme progressing. • Hydraulic modelling will determine an acceptable operating regime, such that the bulk supply entering the SSW system does not have an adverse effect on network operations. • The existing borehole pumps can provide the required pumping head to operate the scheme. • Capital and operational costs have been assumed in accordance with the separate document titled 'Methodology for Estimating Scheme Costs'. There are the following risks and uncertainties to the delivery and outcomes of the scheme: • Licence availability. • Commercial arrangements and cost associated with licence trading. • The output (yield and quality) from the new boreholes. • Water quality of the new boreholes. • Suitable land available for purchase to construct the scheme. • Legal / commercial agreement to provide bulk potable water supply. • Compensation payment and / or provision of mains water supply from the SSW network. • Location of boreholes to be used for bulk supply is to be confirmed following discussion with Company x . • Assume no additional treatment is needed since this is a potable bulk supply. • Construction / installation of new pipework connections to import the bulk supply from Company x and deploy the potable water into the SSW supply network. • Assume that additional pipework can be contained within Company x sites. • Assume that any changes to infrastructure can be carried out on existing Company x 's sites without the need for further land purchase. • Assume that the existing Company x 's sites have sufficient power and there are no additional power requirements.

Ref	8.1.5
Name	New Burton-upon-Trent groundwater source
Concept Summary	The concept is to utilise a third-party abstraction licence(s) and develop as a new groundwater source in the Burton-upon-Trent area.
Description	The proposed scheme is to develop a new groundwater source in the Burton-upon-Trent area, licensing it through spare licence capacity (secured through third party licence trading or similar agreement). Water abstracted would then be pumped for treatment at the existing South Staffs works at Chilcote. This would require construction of a raw water main, sized to accommodate 3 Ml/d. The notional concept is for a 17.5km length of 300mm diameter main. An alternative option would be to install treatment plant at the site, subject to land being available. In the absence of more detailed water quality information at this stage, the concept design assumed similar treatment being needed as for the Warton scheme. The output from this option is to be confirmed following discussion with Company x and the Environment Agency, to understand the licensed amounts that could be available for trading and for continued use by South Staffs Water. Trials are required to ensure that the proposed output is feasible and without detriment. Lead in times for the scheme will be affected by these investigations and a possible EIA. The following assumptions have been made: • The new boreholes will be capable of producing the intended output following the works. • The licence will allow production at the intended output following the works. • Water quality information and treatment requirements have been assumed for the purpose of pricing the scheme at the current design stage. • There is sufficient treatment capacity at Chilcote. • A new dedicated raw water transfer main between Burton-upon-Trent and Chilcote will be constructed. • The new borehole pumps can provide the required pumping head to operate the scheme. • Capital and operational costs have been assumed in accordance with the separate document titled 'Methodology for Estimating Scheme Costs'. There are the following risks and uncertainties to the delivery and outcomes of the scheme: • Licence availability. • Commercial arrangements and cost associated with licence trading. • The output (yield and quality) from the new boreholes. • Water quality of the new boreholes. • Suitable land available for purchase to construct the scheme. • Land purchase. • Drill 2 Nr new boreholes at the new site (duty/standby). • Provide new borehole pumps and headworks. • Provide a new building for the new boreholes. • Provide a notional 17.5km of new 300mm dia raw water main (sized for 3.5 Ml/d) between the site of the new boreholes and Chilcote treatment works. • Assume treatment capacity is available at Chilcote. • Assume that following treatment at Chilcote, the existing distribution network is adequate to deploy the water into supply. • Purchase of new site for borehole construction. An indicative open space has been identified for this optioneering exercise. • Further appraisal and land access negotiations would be required to confirm the location. • 17.5 km of linear land compensation for the pipelines. • Purchase or compensation for the abstraction licence will need to be accounted for in the cost estimate. • New power supply to be provided at new borehole site.

Ref	8.3.1
Name	Burton-upon-Trent raw water reservoir
Concept Summary	Construct a new raw water storage reservoir close to the River Trent in the Burton-upon-Trent area and utilise third-party abstraction licence(s) to fill it.
Description	The proposed scheme is to construct a new raw water reservoir close to the River Trent. Agreement with Company x could enable existing third-party abstraction licences to be used to fill the reservoir. A location may be identified that is currently owned by Company x (i.e. where existing abstraction licences are located but where the boreholes are no longer operational). The scale and feasibility of this option is dependent on several factors, including: • The amount of licensed quantity that can be made available by Company x and approved by the Environment Agency. • Identification of an appropriate location and land purchase. • Planning approval for a new reservoir. • Determination of the DO benefit from increased raw water storage. Several potential sites alongside the River Trent have been considered, for comparison purposes. By inspection, the plan area of each site has been estimated. Three sites appear to offer an area in the region of 250,000 m^2. Assuming an average water storage depth of 2m, this would provide a storage volume of approximately 0.5 Mm^3. A smaller site has a plan area of approximately 79,000 m^2 and an average depth of 2m would correspond to a storage volume of approximately 0.16 Mm^3.

Site	Area (m^2)	2m depth Vol (Ml)	3m depth Vol (Ml)	5m depth Vol (Ml)
A	250,000	500	750	1.25
B	79,000	158	237	395
C	280,000	560	840	1400
D	270,000	540	810	1350

It is proposed that raw water would be pumped from the reservoir to existing SST treatment at Chilcote or Seedy Mill. This would require construction of a new raw water transfer main over a distance of approximately 15 km (Chilcote) or 25 km (Seedy Mill). Alternatively a new, local treatment works could be constructed in the Burton-upon-Trent area, but this would be subject to a suitable location being identified.

Working on the principle that the reservoir would be designed to provide 6 months storage, the largest volume shown above (Site C, 5m average depth) could offer a yield of around 7 Ml/d.

The output from this option is to be confirmed following discussion with Company x and the Environment Agency, to understand the licensed amounts that could be available for a bulk supply / trade.

Network modelling and water quality investigations are required to ensure that the proposed bulk supply is feasible. Lead in times for the scheme will be affected by these investigations and assessments.

The following assumptions have been made:

- Land purchase and planning approval do not prevent the scheme going ahead.
- Abstraction to fill the new reservoir can be licensed through agreement with Company x and the Environment Agency.
- The increased storage has an assumed DO benefit.
- There are no water quality risks that cannot be designed out, which would otherwise prevent the scheme progressing.
- There is capacity to treat the raw water at an existing treatment works.
- Capital and operational costs have been assumed in accordance with the separate document titled 'Methodology for Estimating Scheme Costs'.

There are the following risks and uncertainties to the delivery and outcomes of the scheme:

- Suitable land available for purchase to construct the scheme.
- Planning approval to create a new reservoir.
- Licence availability to fill the reservoir.
- Commercial arrangements and cost associated with licence trading.
- The DO benefit from the scheme.
- Water quality risks and implications for existing treatment facilities.
- Legal / commercial agreement to utilise third-party abstraction licences.
- Intake pumping station.
- Assume no new treatment is provided but raw water will be conveyed to existing treatment works, where there will be capacity.
- Draw-off structures, pumping plant and raw water pipeline to convey water to existing treatment works.
- Assume that existing infrastructure from treatment works will enable potable water to be deployed into SSW supply network.
- Land purchase needed for reservoir construction.
- Planning approval for reservoir construction.
- ~~Pipeline construction to existing treatment.~~

	• Power requirements for pumping (reservoir intake and drawoff / raw water transfer to treatment).

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