Strategic Regional Water Resource Solutions: Annex A3.1: STT Cost Report

Standard Gate Two Submission for River Severn to River Thames Transfer (STT)

Date: November 2022

Severn to Thames Transfer

STT Cost Report

STT-G2-S3-357

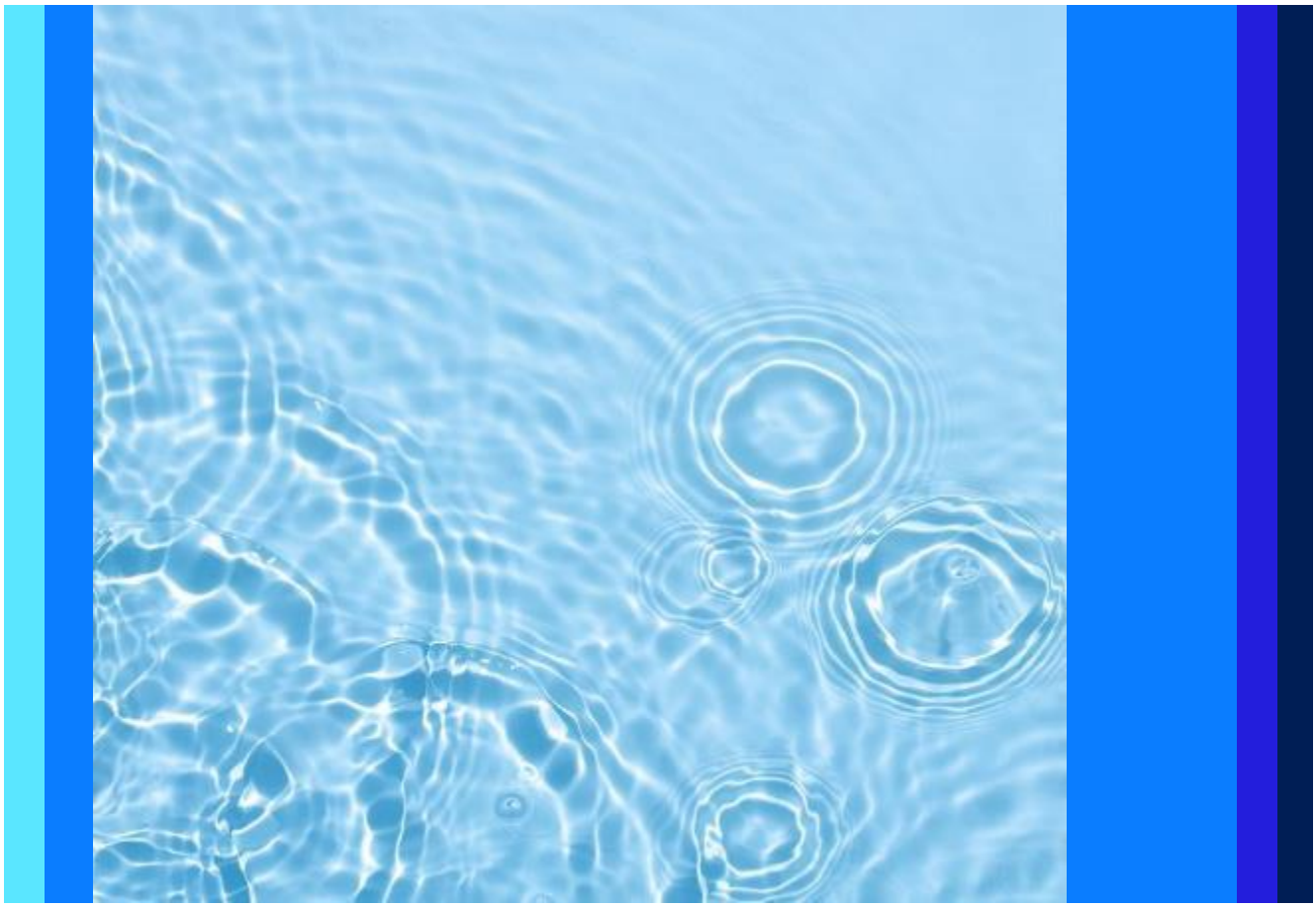
November 2022

Disclaimer

This document has been written in line with the requirements of the RAPID Gate 2 Guidance and to comply with the regulatory process pursuant to Thames Water's, Severn Trent Water's and United Utilities' statutory duties. The information presented relates to material or data which is still in the course of completion. Should the solution presented in this document be taken forward, Thames Water, Severn Trent Water and United Utilities will be subject to the statutory duties pursuant to the necessary consenting processes, including environmental assessment and consultation as required. This document should be read with those duties in mind.

STT Cost Report

Document no: STT-G2-S3-357
Revision no: F



Contents

Executive Summary

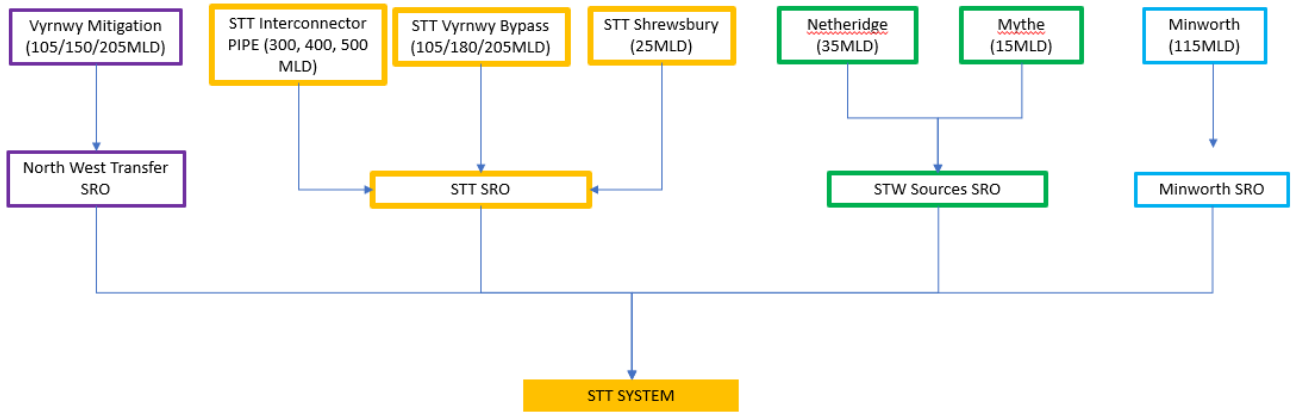
Capital Expenditure (CAPEX), Operational Expenditure (OPEX) and Annual Incremental Costs (AIC) have been generated for the Interconnector and two of the source mitigations associated with the River Severn to River Thames Transfer (STT). The costs are based upon the conceptual design reports prepared for Gate 2.

The Estimates produced consist of the components/elements detailed below, which form the options detailed in Table ES-1:

- Vyrnwy Bypass
  - Vyrnwy Bypass Option 25 – 105Ml/d
  - Vyrnwy Bypass Option 25 – 180Ml/d
  - Vyrnwy Bypass Option 27 – 180Ml/d
  - Vyrnwy Bypass Option 27 – 205Ml/d
- Severn to Thames Interconnector – Deerhurst Pipeline
  - 300Ml/d
  - 400Ml/d
  - 500Ml/d
- Shrewsbury redeployment
  - 25 Ml/d

This report does not detail the methodology for the derivation of costs associated with the North West Transfer, Severn Trent sources (which details Mythe Abstraction License, Netheridge Sewage Treatment Works) or Minworth SRO's as these are separate Gate 2 submissions. Additional information and the full breakdown of scope and costs are presented in the relevant SROs. The relationship between STT and the other SROs is presented below in Figure ES-1.

Figure ES-1 STT and the related SROs



CAPEX costs were generated using United Utilities, Thames Water and Severn Trent Water cost databases for the River Vyrnwy Bypass Pipeline, Interconnector and Shrewsbury Redeployment respectively. The approach to CAPEX costing used at Gate 2 was consistent with the approach used at Gate 1 and PR19. Costs were produced in accordance with the ACWG Cost Consistency Methodology Revision E, issued February 2022. Outline designs have been developed and costed using company costs where available, or industry costs for items such as the large pipelines. All costs are presented at 2020/21 prices.

Optimism bias (unknown unknowns) was calculated in conjunction with a Quantitative Risk Analysis as detailed in the ACWG Cost Consistency Methodology, resulting in a scaled-back optimism bias figure. Known unknowns have been identified in the costed risk register and include allocations for ground conditions, land agreements and planning requirements. Risks are quantified and allocated minimum and maximum expected budgets, and the probability of that risk occurring is assessed. Risk costs can be linked to delays to construction activities and the impact can be estimated using previous experience. Some costed risk items have been reallocated to optimism bias due to the unknown nature of the risk. This includes material price volatility which is difficult to quantify at present. The Interconnector options have been redefined as Non-Standard for this Gate 2 submission (due to the large diameters of the pipelines proposed) in accordance with the guidance provided by the ACWG. This has increased the optimism bias percentage applied, but with the removal of some of the costed risk items, the overall total risk allocation remains broadly unchanged in value from the Gate 1 submission.

OPEX costs were generated for each option. OPEX includes labour, power, chemicals, and an allowance for operational maintenance. OPEX costs are presented with a fixed and variable component. Fixed OPEX relates to staffing and maintenance work which is required to operate the system for all flows and the variable OPEX relates to power and chemical usage. OPEX has been calculated using the minimal operational regime and also for maximum capacity for comparison.

We note that the current high costs for power have not been incorporated in the variable calculations and rates will be reviewed at Gate 3 across all options. A significant increase in electricity will not affect the optioneering presented here but it may affect the WRSE draft regional modelling being undertaken. A summary of the estimates for the Interconnector, Vyrnwy Bypass and Shrewsbury are detailed in Table ES-1 below. Costs for the Canal option associated with the Interconnector are not presented, as this option is not preferred at this stage.

Table ES-1 CAPEX and OPEX costs for each element/option (2020/21 base date)

Option Name	Units	Option 1C Pipeline – 500Ml/d	Vyrnwy Bypass 27_180	Shrewsbury Source (25 Ml/d)*
Option Benefit	MLD	490	150	25
CAPEX				
Base Capex	£m	909.1	143.2	2.8
Costed Risk	£m	25.7	13.3	0.2
Optimism Bias	£m	335.0	42.1	0.7
Total G2 Capex	£m	1269.8	198.5	3.7
Total G1 Capex	£m	1222.8	154.3	n/a
Change G1 to G2	%	3.8%	28.7%	n/a
OPEX				
G2 Fixed	£m/ annum	3.84	0.21	n/a
G2 Variable	£/ML	187.1	0.00	n/a
G1 Fixed	£m/ annum	2.94	0.14	n/a
G1 Variable	£/ML	178.8	0.01	n/a
Change (Min Flow)	%	-15%	n/a	n/a

* Shrewsbury not available to STT at Gate 2

For the Interconnector options, there have been several minor changes to the pipeline option as it has developed during Gate 2. Additional water quality sampling has resulted in changes to the WTW design and also chemical usage. CAPEX costs remain broadly similar to Gate 1 figures and the numbers submitted for the WRSE draft regional plan. The biggest changes are due the reduction in pipe sizes, the reduction of size of the break pressure tank and the removal of the need for an intake tunnel between the river intake and the low lift pumping station. There have been some changes to the costed risk and Optimism Bias allocations, but risk budgets remain similar to the previous submissions. There has been a small increase in fixed OPEX from the Gate 1 and WRSE Draft Regional Plan submission to Gate 2. Interconnector minimum OPEX has dropped for the 400Ml/d and 500Ml/d options due to a decrease in the minimum sweetening flow rates (reduced from 10% to 20 Ml/d).

Vyrnwy Bypass costs have increased from Gate 1 and the WRSE Draft Regional Plan. This is mainly due to a change in the preferred option which now requires a longer route and larger pipe due to increased flows. The preferred option at Gate 1 required a pipeline to convey 80ML/d to the River Vyrnwy and this increased to 105Ml/d for the WRSE Draft Regional Plan submission. The preferred option at gate 2 requires a pipeline to convey 150Ml/d to the River Severn. Costs have also increased due to the identification of poor ground conditions which require additional trench support, as well as additional environmental mitigations. Further development of the route has resulted in increases to the average depth of pipe and the number of trenchless crossings has more than doubled. These elements have resulted in a significant increase to the direct works cost. OPEX has increased slightly as the operational maintenance is linked to the capital value of the scheme. All OPEX costs are classified as fixed i.e., they do not vary with flows in the pipe.

Shrewsbury costs were presented at Gate 1 as £/ML only and this source is not available for STT at Gate 2.

Construction CAPEX and OPEX costs have been used to generate the net present value (NPV) values for the elements, using the Treasury Green Book, with a declining schedule of discount rates (Annex 6, Table 8) and an 80-year period. Each option is composed of many elements with varying design lives which range from four years to 250 years. Assets with a shorter life will require ongoing replacement over the life of the scheme and these replacement costs are used in the determination of NPV. The estimated NPV and average incremental cost (AIC) for each of the options are shown in Table 8-2. AIC is presented for the minimum and maximum flows for each of the options. There are many potential operating regimes for the system but for consistency of presentation the minimum and maximum flows have been used in the calculation.

Table ES 2 Net Present Value and Average Incremental Cost (Standard Discount Rate) (2020/21 prices)[1]

Option Name	Units	Option 1C Pipeline – 500Ml/d	Vyrnwy Bypass 27_180	Shrewsbury Source (25 Ml/d)*
Option Benefit (max flow)	MLD	490	180	25
Min Flow (Gate 2)	MLD	20	0	0
Min Flow (Gate 1)	MLD	50	0	0
Total planning period option benefit (NPV)	Ml	3,442,617	1,626,968	234,198
Total planning period indicative capital cost of option (CAPEX NPV)	£m	1009.1	166.8	4.8
Minimum Flow				
Total planning period indicative operating cost of option (OPEX NPV)	£m	100.3	5.1	n/a
Total planning period indicative option cost NPV)	£m	1109.4	171.9	n/a
Average Incremental Cost (AIC)	p/m³	32.2	10.6	n/a
Gate 1 AIC	p/m³	32	n/a	n/a
Maximum Flow				
Total planning period indicative operating cost of option (OPEX NPV)	£m	718	5.1	n/a
Total planning period indicative option cost NPV)	£m	1727.3	171.9	n/a
Average Incremental Cost (AIC)	p/m³	50.2	10.6	n/a
Gate 1 AIC	p/m³	48.1	n/a	n/a

* Shrewsbury not available to STT at Gate 2

[1] Only the preferred option for Vyrnwy Bypass shown in this summary table – Option 27_180. Costs for Option 25 are detailed in the relevant sections of this report.

1. Introduction

During periods of drought in the South East, the River Severn to River Thames Transfer (STT) would convey raw water from the River Severn into the River Thames via an Interconnector. The source of the water would be a combination of un-supported flows from the River Severn, and supported flows from source support elements. The source support elements are North West Transfer, Mythe Abstraction License transfer, Netheridge Sewage Treatment Works and Minworth inter-catchment transfer. There is an opportunity that additional source support elements will be identified during the development of the STT System. The source support elements listed above are covered under separate SRO's.

The current preferred option for the Interconnector is a pipeline with pumping and raw water treatment facilities which would abstract flows from the lower freshwater River Severn at Deerhurst, near Gloucester, and discharge into the middle River Thames near Culham, Oxfordshire. Additional optioneering undertaken after Gate 1 has deemed the re-constituting the disused, derelict Cotswold Canals is not currently preferred and this has not been taken forward for costing at Gate 2. An overall illustration of the scheme is shown below in Figure 1-1.

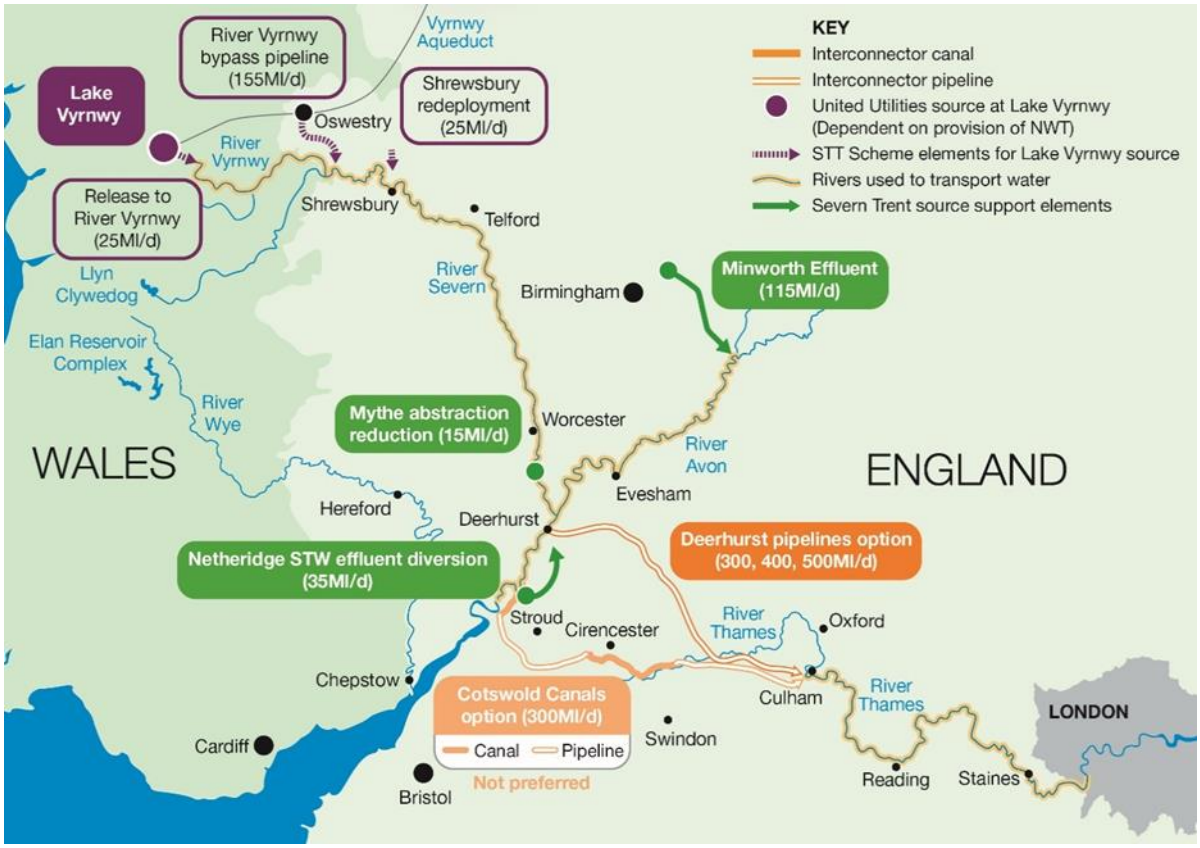


Figure 1-1 Overview of STT System

The River Vyrnwy bypass pipeline is a pipeline from Oswestry to the River Severn. The pipeline is a mitigation measure for the River Vyrnwy resulting from the North West TransferSRO. Three pipeline capacities 105/180/205Ml/d have been developed. The River Vyrnwy bypasspipeline is included in the STT SRO.

This report details the methodology used for the costing of the Deerhurst Pipeline, Vyrnwy Bypass and Shrewsbury re-deployment. A similar approach has been used for the other source support elements of the STT system.

1.1 River Vyrnwy Bypass Pipeline

Lake Vyrnwy discharges raw water into the River Vyrnwy, which eventually joins into the River Severn. Lake Vyrnwy is the sole raw water resource feeding Oswestry. The raw water is transferred from Lake Vyrnwy to Oswestry through the Vyrnwy Raw Water Aqueduct (RWA) system. Oswestry then processes the raw water and then supplies treated water to customers in Cheshire and Liverpool via the Vyrnwy Treated Water Aqueduct (TWA). There is an existing bulk supplypoint connection to Severn Trent Water (STW) named Shrewsbury connection, which is supplied fromthe TWA. Note this is only used in a rare event as and when Severn Trent (ST) require supply from UnitedUtilities (UU).

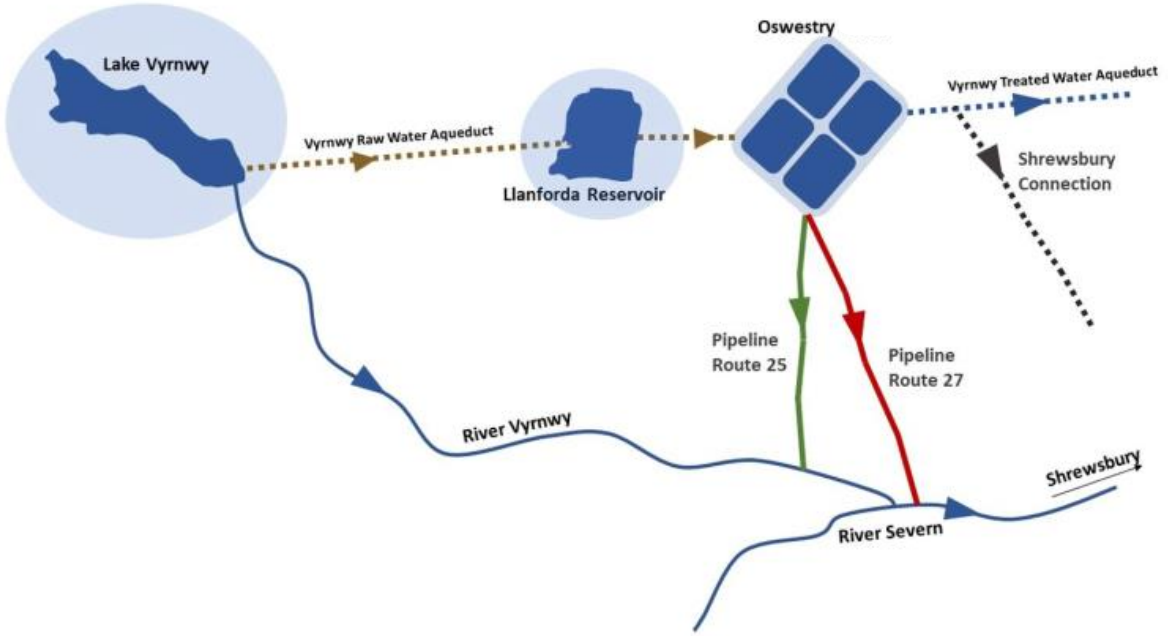


Figure 1-2 Lake Vyrnwy, Oswestry, Aqueduct System and Shrewsbury Connection

The proposal for a River Vyrnwy Bypass Pipeline for the purposes of Water Trading is considered as part of the river studies and investigations – hydrology, water quality, ecology and regulation related investigations and studies associated with the receiving rivers Vyrnwy, Severn, Avon and Thames.

It has been concluded that sustained discharges from Lake Vyrnwy into the River Vyrnwy may have unacceptable environmental impacts. Environmental studies have concluded that the full flow cannot be discharged into the River Vyrnwy and must be curtailed. To ensure that the full benefit of the source can be realised, the current proposal is to release 25Ml/d into the head of the river Vyrnwy and to divert additional flows to the upper reaches of River Severn via the existing raw water aqueduct and the new 155Ml/d bypass pipeline.

The current outline physical scope of work is as follows (subject to scheme development):

- Pipeline, total length circa 16km, and circa 1.1-1.2m diameter (will vary dependent on demand requirements to be advised by WRSE)
- Washouts along the route provided with permanent discharge pipework to adjacent watercourses (dependent on proximity)
- An outfall with actuated control valves and a discharge structure

1.2 Severn to Thames Interconnector – Deerhurst Pipeline

The indicative, conceptual design location for the Interconnector pipeline runs from the River Severn at Deerhurst (north of Gloucester) to Culham (between Abingdon and Didcot) on the River Thames,

with treatment sited at Deerhurst. The scope is detailed below and summarised on the schematic shown in Figure 1-3.

The current outline physical scope of work is as follows:

- Abstraction from the River Severn via a river intake structure at Deerhurst including inlet screens and a twin pipeline to a raw water pump station
- Low Lift (raw water) pumping station (PS) transferring raw water via a twin pipeline to treatment works
- Water treatment works (WTW) to improve the quality of the abstracted water, principally removing suspended solids, metals, and invasive non-native species.
- High Lift PS (treated water)
- A rising main to the break pressure tank
- A break pressure tank at the high point
- A gravity main to discharge point
- A discharge outfall at Culham with an actuated valve and an aeration cascade
- Washouts along the route provided with permanent discharge pipework to adjacent watercourses
- Air valves along the route for pipe drain down and refill during pipeline maintenance

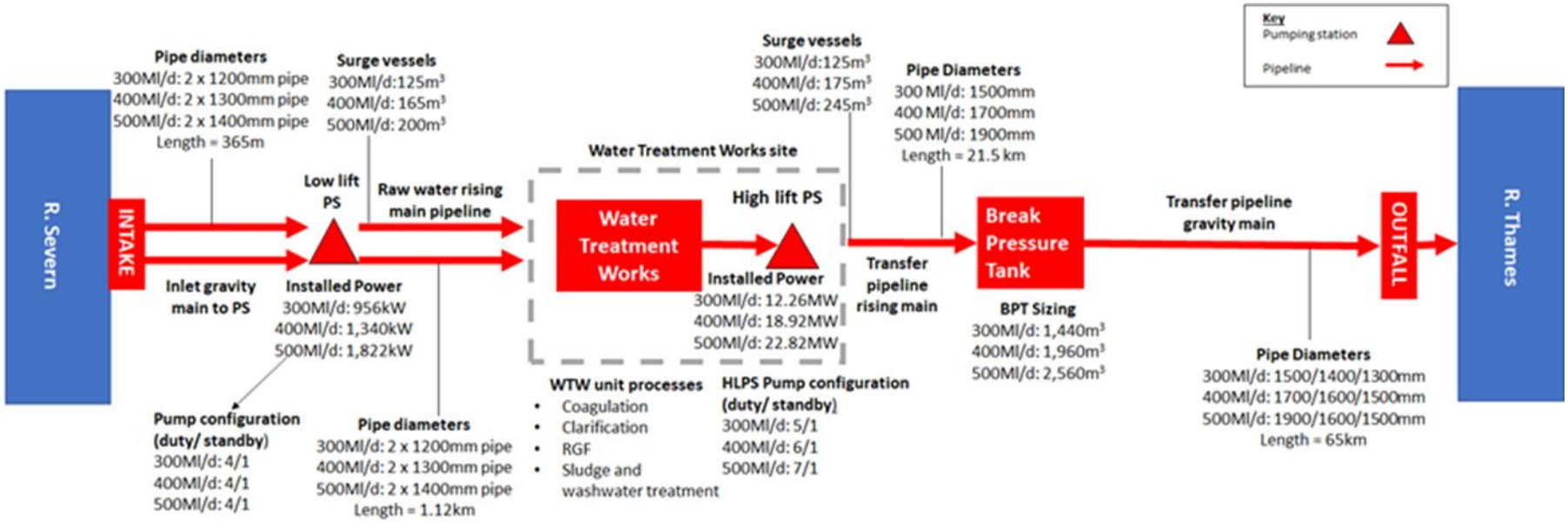


Figure 1-3 Severn to Thames Interconnector – Pipeline Schematic

1.3 Shrewsbury re-deployment

The purpose of the scheme is the diversion of up to 25Mld of treated water for Oswestry to supply STW's customers via an existing emergency import, the Llanforda connection, thus enabling a reduction on abstraction at Shelton WTW, which is the normal supply for Shrewsbury. Reducing abstraction from the River Severn would allow a temporary transfer of 25 Mld licence to STT. The scope is detailed below and summarised on the schematic shown in Figure 1-3.

The current outline physical scope of work is as follows:

- Network reinforcements – construction of two new cross connections (300mm) and installation of new Flow Control Valves at five locations (100 -300mm)
- New booster Pumping Station and upgrade of other two.
- Upgrade of Shelton WTW – Decommissioning and removal of Cl2 dosing for Borehole 1, installation of Rapid Gravity Filtration Plant for Borehole 2, Hypochlorite dosing plant post UV disinfection and raw water pre-treatment chemical dosing pumps.

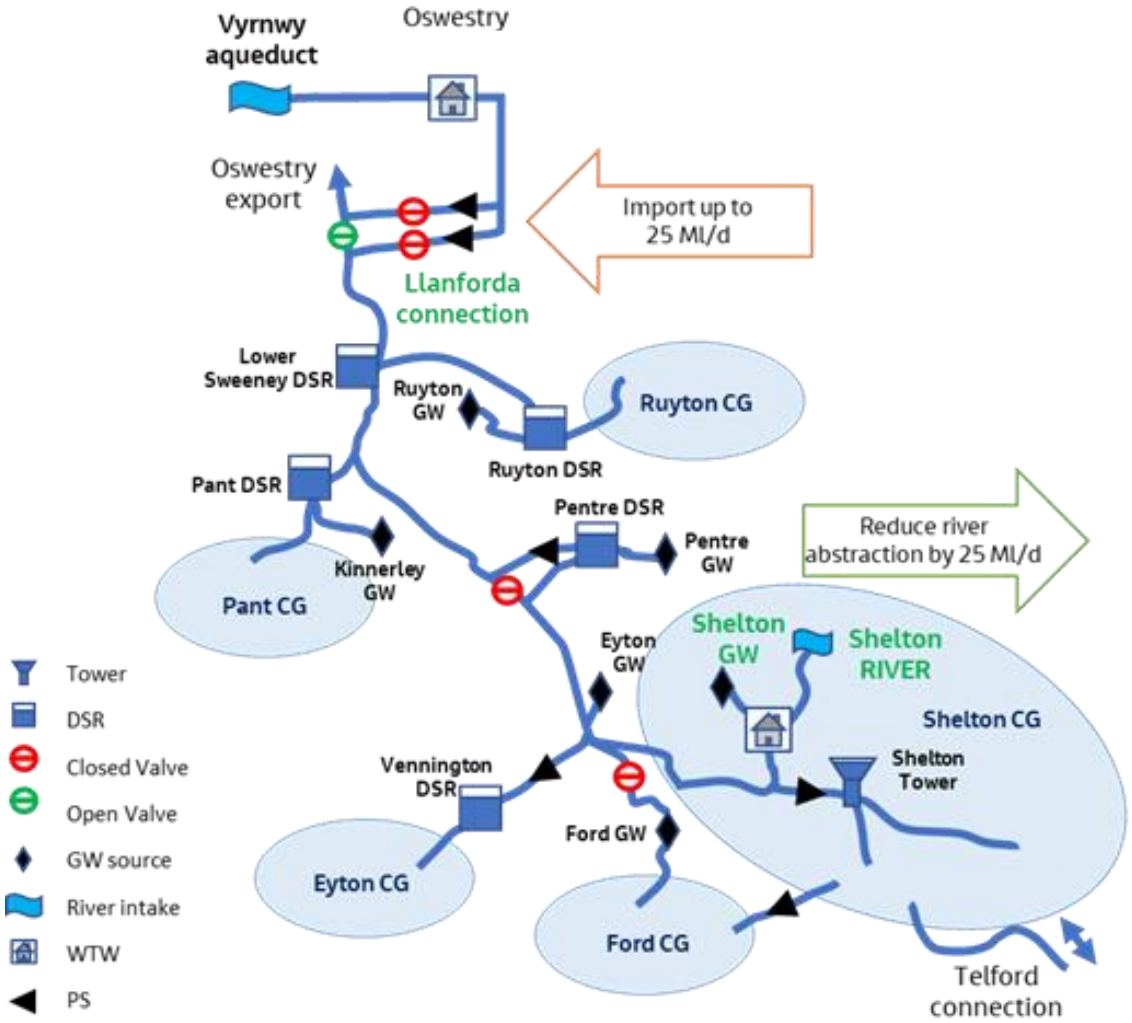


Figure 1-4 Shrewsbury re-deployment

2. CAPEX Costing

2.1 Methodology

2.1.1 Approach and Data sources

The requirements identified in each CDR were reviewed by the costing teams and the appropriate cost models from the costing library selected. Cost curves were available for Civil, M&E and ICA elements as well as Land (temporary hire for contractor compounds during construction and purchased for permanent structures as well as Easements for the pipeline route).

The relevant yardstick required was also entered and the costing tool generated the CAPEX cost. Where the required yardstick value was outside the upper range of the cost curve, the costing teams used a bottom-up approach to generate the costs using current supplier data.

The various elements of the scheme were costed using water company data as summarised below:

- Interconnector Pipeline – Thames Water (TW)
- Vyrnwy Bypass – United Utilities (UU)
- Shrewsbury re-deployment – Severn Trent Water (STW)

Indirect costs are added as a percentage uplift to the base costs to account for additional costs associated with design, construction supervision and prelims, contractor risk, project management, site supervision, feasibility studies, client overheads etc. Indirect costs from company systems have been applied consistently, ensuring that all requirements are included. Figures used are consistent with WRMP24 costing methodologies. These indirect percentage uplifts have not been adjusted for this project. The figures used have not been included in this report due to the sensitive nature of the data.

The key assumptions and exclusions associated with this estimate are detailed below:

- Land is rented for contractor compounds and agricultural rates apply.
- All permanent structures are located on land that is purchased at agricultural rates and are connected to the network with roads and protected with permanent site fencing and gates.
- No allowance has been included for piling, specifically for all the proposed buildings and selected process plant base slabs
- 40m easement is adequate and compensation payments included. Land purchase for pipeline route is excluded.
- All works are assumed to be carried out during normal day time working hours.
- It is assumed that the working area is not impacted in any way by hazardous working conditions or contaminated ground / material and that no works involving asbestos are required.
- It is assumed that there are no restrictions to access
- Average pipe depths unless ground profile suggests deeper will reduce the number of air valves and washouts required. Battered excavation assumed, unless ground conditions suggest sheet piling will be required for trench support.
- Major crossings are tunnelled with launch and reception shafts. Single pipeline used with average lengths.
- Power supplies will be required for each location. Typical average historical budgets used but suppliers have not been approached and costs may vary significantly depending on the capacity of the local network.
- No allowance has been made for dealing with any impact that the proposed works may have on any existing assets plant or foundations

The costs generated for each element of the total project were exported from the company costing tool and were presented in a format suitable for population of the WRSE template (total cost grouped by asset life). The costs included all company overheads but excluded risks. Costed risks and Optimism Bias

were added by the STT costing teams using the methodology agreed through the All Company Working Group (ACWG). The detailed breakdown of CAPEX costs by component types/asset life (Table 5A and 5B formats) are shown in Appendix A-B for the Interconnector and Vyrnwy Bypass. Shrewsbury costs are not presented in detail as this source is not available to STT at Gate 2.

Changes in Capex from Gate 1 to Gate 2 are summarised in Section 8.

2.1.2 Base Date

Costs are presented at 2020/21 base date for consistency as suggested the ACWG. The deflation factors used for CAPEX and OPEX have also been agreed with the ACWG and are based on the figures used by the WRSE draft regional plan modelling team. Figures used are summarised below in Table 2-1. Inflation factors will require updating for Gate 3, as current inflation is well above the figures predicted when these indices were developed.

Table 2-1 Inflation/ Deflation factors

F/Yr	CAPEX indices	CAPEX Factors	OPEX indices	OPEX Factors
2017/18	275.5	1.1002	104.3	1.0662
2018/19	284.8	1.0645	106.7	1.0417
2019/20	293.7	1.0323	109.0	1.0197
2020/21	303.1	1.0000	111.2	1.0000
2021/22	312.9	0.9688	113.3	0.9811
2022/23	322.3	0.9405	115.6	0.9619

2.2 Severn to Thames Interconnector Base Capex

The base CAPEX costs have been generated by the Thames Water costing tool based on the cost curve data entry and are summarised below in Table 2-2. The CAPEX costs for the preferred option (500Ml./d flow) are presented in more detail in Appendix A.

Table 2-2 STT Interconnector CAPEX costs (£m 2020/21 prices)

Element	Sub-option	Gate 2 CAPEX £/m (excl risk)
Interconnector – Deerhurst pipeline or Cotswolds canal plus treatment	Treatment and pipeline capacity 300Ml/d	702.3
	Treatment and pipeline capacity 400Ml/d	836.2
	Treatment and pipeline capacity 500Ml/d	909.1
	Cotswold Canal minimum reinstatement and treatment capacity 300Ml/d	N/A

2.3 River Vyrnwy Bypass Pipeline Base Capex

The base CAPEX costs generated by the UU costing team are summarised below in Table 2-3. The current estimates have been developed using a bottom-up estimate incorporating recent company cost data and the scope requirements identified. The CAPEX costs for the preferred option (27_180) are presented in further detail in Appendix B.

Table 2-3 Vyrnwy Bypass Pipeline base CAPEX excluding costed risk (2020/21 prices)

Element	Sub-option	Gate 2 CAPEX £/m (excl risk)
Vyrnwy mitigation - River Vyrnwy Bypass Pipeline	Vyrnwy Bypass Option 25 – 105Ml/d	66.8
	Vyrnwy Bypass Option 25 – 180Ml/d	74.8
	Vyrnwy Bypass Option 27 – 180Ml/d	143.2
	Vyrnwy Bypass Option 27 - 205Ml/d	143.2

2.4 Shrewsbury re-deployment Base Capex

CAPEX costs were developed for each option using STW standard costing tool STUCA and are summarised below in Table 2-4.

Table 2-4 Shrewsbury Re-deployment CAPEX costs (2020/21 prices)

Element	Gate 2 CAPEX £/m (excl risk)
Shrewsbury Re-deployment	2.8

3. Costed Risk

3.1 Methodology

3.1.1 Identify Risks

This section sets out the approach to the identification and scoring of known risks associated with each section. The list of risks considered at Gate 1 were reviewed by the Gate 2 costing teams. Internal workshops were held with inputs from the Engineering teams in order to generate the list of potential risks, taking account of any items that have been included in the base cost to avoid double counting.

The risk register covers risks during all stages of the project including procurement, stakeholders and planning, construction, and commissioning. Changes in costed risk from Gate 1 to Gate 2 are summarised in Section 8.

3.1.2 Risk Scoring

The likelihood of an event occurring is entered directly into the Risk Register as an estimated probability, which is then used to generate a Probability Score using the ranges shown in the Risk Matrix below in Table 3-1.

Table 3-1 Risk likelihood scoring matrix [2]

Score - Description	Probability
1 - Very Low	Improbable (1-10%)
2 - Low	Remote (11-30%)
3 - Medium	Possible - Likely (31-50%)
4 - High	Probable (51-70%)
5 - Very High	Almost certain (71-99%)

3.1.3 Costed Risk

A scoring scheme was also developed to improve the consistency of estimating the potential cost implication of risks and provided by the ACWG. The scoring scheme was based on the percentages of the total CAPEX of the option as shown below in Figure 3-2. It was recommended by the ACWG that threats and opportunities are included in the costed risk figures generated.

Table 3-2 Risk cost impact scoring scheme[3]

Score - Description	Cost Impact	Min	Max
1 - Very Low	Minimal (<1%) effect on project cost	0.5%	1%
2 - Low	Small (1-2%) effect on project cost	1%	2%
3 - Medium	Moderate (2.1-5%) increase in project cost	2%	5%
4 - High	Significant (5.1-15%) increase on project cost	5%	15%
5 - Very High	Major (>15%) increase in project cost	15%	30%

These estimates are necessary in order to construct the Monte Carlo simulation that provides a bottom-up assessment of the 'known risk'.

[2] ACWG Cost Consistency Methodology Rev E Feb 2022, Table 3-14
[3] ACWG Cost Consistency Methodology Rev E Feb 2022, Table 3-15

3.1.4 Monte Carlo Analysis

The likelihood and impact probability distributions for the different risks that apply to an option are combined using Monte Carlo simulation using the '@Risk' Excel add-in. The output includes a range of summary statistics including percentiles for the cost of risk. The cost risk value taken forward is the 50th percentile (P50), half of the potential outcomes are expected to be below the selected value.

The Monte Carlo model relied on the structure and the risk register within the provided template, and utilised Triangular/Uniform distribution for cost and Bernoulli distribution for probability. Each of the identified risks were treated as discrete events thus no multiple impacts were accounted for statistically. No correlation or other adjustments were applied. The "@Risk" software package with standard settings was used to run the model at 10,000 iterations.

Risk registers were generated for each option and the Monte Carlo analysis undertaken in order to generate the P50 figure for inclusion in the costs.

3.2 Severn to Thames Interconnector

The list of risks considered as part of the Gate 1 submission were updated by the STT interconnector team, taking into consideration work undertaken during Gate 2. Table 3-3 below shows the P50 costed risk allocation included in the CAPEX estimates.

Table 3-3 Interconnector Outputs from risk analysis (2020/21 prices)

Option	Gate 2 Costed Risk (P50) £m
Interconnector Option 1 Pipeline – 300Ml/D	13.8
Interconnector Option 1B Pipeline – 400Ml/D	22.3
Interconnector Option 1C Pipeline – 500Ml/D	25.7

The key risks for this element of the scheme are:

- Uncertainty over ground conditions including assumptions around rock, groundwater, contaminated land, utilities, pipe depths and archaeology.
- Environmental risks including compensatory habitats, habitat mitigation and field drainage requirements
- Construction Programme schedule delay owing to several factors including weather, archaeology, ecology licences, discharge of planning, landowner agreements, etc.

3.3 River Vyrnwy Bypass Pipeline

The list of risks considered as part of the Gate 1 submission were reviewed by the team, taking into consideration work undertaken during Gate 2.

The Gate 2 review of risk has resulted in an increase in costed risk at this stage as shown in Table 3-4 below, this is due to the following:

- Reassessment of methodology with all risks now calculated using the ACWG methodology
- Additional information enables specific risks to be quantified and incorporated as costed risk and removed from Optimism Bias

Table 3-4 River Vyrnwy Bypass Pipeline Outputs from risk analysis (2020/21 prices)

Element	Sub-option	Gate 2 Costed Risk (P50) £m
Vyrnwy mitigation - River Vyrnwy Bypass Pipeline	Vyrnwy Bypass Option 25 – 105Ml/d	7.4
	Vyrnwy Bypass Option 25 – 180Ml/d	7.6
	Vyrnwy Bypass Option 27 – 180Ml/d	13.3
	Vyrnwy Bypass Option 27 - 205Ml/d	13.3

The key risks for this element of the scheme are listed below:

- Ground Conditions – Geotech desk study has identified that the route crosses large areas of granular glacial material with potential high groundwater, soft / loose ground
- Environmental – Environmental mitigations resulting from Environmental assessments and surveys, protected species etc.
- Construction Programme schedule delay owing to several factors including weather, landowner agreements, etc.

3.4 Shrewsbury re-deployment

The list of risks considered as part of the Gate 1 submission were reviewed by the team, taking into consideration work undertaken during Gate 2.

Table 3-5 Shrewsbury Re-deployment Outputs from risk analysis (2020/21 prices)

Element	Gate 2 Costed Risk (P50) £m
Shrewsbury Re-deployment	0.22

The key risks for this element of the scheme are listed below:

- Capacity– performance of existing WTW, pipelines and boreholes for additional flows. Actual capacity may not align with condition and additional works may be required for refurbishment or replacement of mains.
- Environmental – Environmental mitigations resulting from Environmental assessments and surveys, protected species etc.

4. Optimism Bias

Optimism Bias has been derived using the methodology outlined in the Cost Consistency Methodology – Technical Note and Methodology Revision E Issued February 2022. This sets out the requirements for a three-stage approach to the derivation of an Optimism Bias figure to support the P50 Costed Risk figure derived using the Quantitative Risk Analysis.

4.1 Methodology

4.1.1 First Stage

An initial estimate of the proportion of the scheme that related to Standard and Non-Standard Civil Engineering is required. Guidance was provided in the ACWG taking account of the type of work required with guidance provided where the assessment will be dependent on the particulars of the option. For example, while a new transfer pipeline would typically be assessed as a standard civil engineering project, a transfer could be considered non-standard if:

- The transfer route is unusually space constrained (e.g., the route goes through a congested urban area with challenging local infrastructure and/or environmental constraints)
- The transfer has unusual output specifications, such as:
  - Raw water transfers where there is invasive non-native species transfer risk where mitigation requirements are uncertain,
  - Large diameter pipelines that are not usually implemented by the company and for which there is limited information to support robust cost estimation

The upper bound is 66% for non-standard civil engineering and 44% for standard civil engineering. The ACWG provided templates in Excel for consistency of application.

4.1.2 Second Stage

A review of the contributory factors for Optimism Bias was then undertaken involving those with detailed technical knowledge of the scheme and the costing methodology. Each contributory factor was reviewed and the proportion of cost within each confidence banding was assessed. Most of the items were entered as one but some contributory factors were split across the confidence bands in accordance with the Cost Consistency Methodology. The average mitigation and Optimism Bias for each group of contributory factors was also reviewed during the workshop.

In assessment of the figures to apply under each section, the team also took cognisance of the costing sources and whether these were based on actual outturn costs (within the range of the cost models), extrapolated cost models or estimates. Where possible, elements have been split within the costing tool to enable the cost curves to fall within the upper yardstick limit but this has not been possible in all cases due to the nature of the cost curves and the fixed costs associated with the formulas.

4.1.3 Third Stage

The Optimism Bias figures were again reviewed after the completion of the Quantitative Risk Assessment (QRA). Risks that are accounted for in the QRA were scaled back to ensure there was no double counting. The split of Standard and Non-Standard costs was also reviewed after a detailed assessment of the scope, the cost curves used and the extent of unsupported extrapolation beyond the yardstick range.

Changes in Optimism Bias allocations from Gate 1 to Gate 2 are summarised in Section 8.

4.2 Summary of Optimism Bias

Table 4-1 presents a summary of the Optimism Bias development for the various options. The stage 3 figures have been used to derive the additional risk which is added to base CAPEX. There are minor differences in the costed risk elements for the various sizes of the Pipeline solutions, but these were deemed not significant for the derivation of separate Optimism Bias figures for each flow scenario.

Table 4-1 Scaled back Optimism Bias added to the CAPEX estimates (2020/21 base date)

Risk Category	Option	Flow	Gate 2 £m	Gate 2 (%)
Vyrnwy Bypass Pipeline	25_105	105	19.6	29.4%
	25_180	180	22.0	29.4%
	27_180	180	42.1	29.4%
	27_205	205	42.1	29.4%
Severn to Thames Interconnector - Pipeline (all sizes)	300	300	258.8	36.9%
	400	400	308.1	36.9%
	500	500	335.0	36.9%
Shrewsbury re-deployment	25	25	0.69	25.0%

5. CAPEX Benchmarking

Benchmarking of the CAPEX costs associated with the various elements of the scheme have been undertaken. The benchmark was undertaken using data from UK water companies.

All costs shown include Contractor's overheads and Client indirect costs. The land and power supply costs generated by the project teams have been used directly as these are unique to the region. Costed Risk and Optimism Bias are not included in the benchmark figures as these are project specific and are applicable to both the derived numbers and the benchmark base CAPEX numbers.

5.1 Methodology

The cost benchmark has been mainly derived using a CAPEX database, industry knowledge and estimating experience of costing similar projects and assets within the water sector. The approach has been used for the standard construction items experienced in the water sector including intakes, pipelines, pumping stations, Break Tank and Water Treatment works. For specialist activities, high level estimates have been obtained from Contractors. The pipeline benchmark used 72 data points from the last 10 years, for diameters between 1,000 and 2,400 mm dia from multiple sources to derive our industry cost model. These models were calibrated with Contractor bottom up pricing and recent supplier costs for steel pipe supply. Data sources are summarised below in Table 5-1.

Table 5-1 Benchmark data sources

Work Type	Benchmark Data Source
Water Treatment Works	CAPEX database
Break Pressure Tank	CAPEX database
Pipelines	CAPEX database
Intake	CAPEX database
Pumping Stations	CAPEX database
Well pointing	Contractor Estimate
Land purchase and easements	Water Company estimate
Power Supplies	Water Company estimate

There were several adjustments applied to the costings as described below.

5.1.1 Direct Costs - Adjustments for base date and location

The water sector CAPEX database comprises of outturn project cost data and cost models captured from UK water companies over the past 20 years. Cost data from several different water companies was used to produce a benchmark cost. Time and regional price adjustments were required to normalise the source cost data with the benchmark estimate requirements.

To adjust cost data to account for its age, a factor has been applied that represents the industry's variance in construction costs from the cost data's base date to the estimate base date of Q2 2021. The factor used is determined by an index. The index traditionally used is the Construction Output Price Index (CPI) which is published by the Office for National Statistics (ONS). Where a specific index is required to be used, the systems can be updated quickly to account for changes. Over a period of circa ten years, cost data reliability typically reduces and cannot be improved by applying base date adjustments. Therefore, to produce a relevant cost estimate, source data older than 10 years is excluded from the benchmark cost comparisons.

To adjust cost data for UK regional differences, a factor has been applied to adjust the cost data's base region to reflect the UK average. The factor is determined by an index of UK regions (Regional Index) which is published by the BCIS.

5.1.2 Item / Scope Coverage

The process for deriving a total cost to client CAPEX cost is based on estimating direct cost consisting of aggregated labour, plant and material costs to reflect the scope. In addition to the direct cost, indirect costs relevant to the asset type are added as an uplift factor for contractor management, design, and client overheads. Costed risk and Optimism Bias are not included in the benchmark.

Expert estimator's judgement has been used to interpret the scope to be costed and to align cost data and derive an overall robust cost. The cost database comprises data and models that utilise various cost structures and definitions. The data sources were carefully aligned to derive costs that meet the scope requirements without exceeding it. Where a scope exceeds the coverage of a single data source, multiple data sources are combined to fulfil the scope requirements. Similarly, where scope requires a partial cost of a data source or sub process, the cost database is examined to identify similar scopes to determine an appropriate adjustment to apply to the data source.

5.2 Benchmarking Results

5.2.1 River Vyrnwy Bypass Pipeline

Table 5-2 presents the costs generated from the UU costing system compared to the independent benchmark. The benchmark is presented as a mid-point estimate, but we also present an upper and lower range to reflect the range in the cost database. Historical project costs will vary as every project is different in terms of average depths, number of valves and washouts and site specifics relating to access points, number of hedges and drainage crossings etc.

Table 5-2 STT benchmark – Vyrnwy Bypass (excl risk and OB) (2020/21 Prices)

Option	Independent Benchmark £m	Benchmark Range £m	Gate 2 STT Costs (£m)	Variance (from midpoint)
Vyrnwy Bypass Option 25 – 105Ml/d	66.6	57.6 - 75.4	66.8	0%
Vyrnwy Bypass Option 25 – 180Ml/d	75.9	65.7 - 65.9	74.8	-1%
Vyrnwy Bypass Option 27 – 180Ml/d	136.8	118.4 - 155	143.2	5%
Vyrnwy Bypass Option 27 - 205Ml/d	136.8	118.4 - 155	143.2	5%

The results show the figures generated by the UU team are between 1% lower and 5% higher when compared to the independent mid-point benchmark but are well within the benchmark upper and lower ranges of uncertainty. Site specifics such trench support have been costed to ensure like for like comparisons. The proposed pipeline is deeper than typical projects and we have made an allowance to account for this in the direct cost associated with the pipelaying.

5.2.2 Severn to Thames Interconnector

Table 5-3 presents the costs generated by the Interconnector team compared to the independent benchmark.

Table 5-3 STT benchmark – Interconnector (excl risk and OB) (2020/21 Prices)

Option	Independent Benchmark £m	Benchmark Range £m	Gate 2 STT Costs (£m)	Variance (from midpoint)
Option 1 Pipeline – 300Ml/d	741.8	662.4 - 866.8	702.3	-5%
Option 1B Pipeline – 400Ml/d	858.6	743.9 - 973.4	836.2	-3%
Option 1C Pipeline – 500Ml/d	950.7	823.7 - 1077.8	909.1	-4%

The results show the figures generated by the Interconnector team are between 3% and 5% lower when compared to the independent mid-point benchmark but are well within the benchmark upper and lower ranges of uncertainty.

5.2.3 Shrewsbury re-deployment

Shrewsbury has not been benchmarked for this Gate 2 submission as the scope of work and costs are relatively minor.

5.2.4 Conclusion

Figures within 5% are deemed acceptable for a benchmark and the figures are reasonable for this stage of the project and are considered acceptable for Gate 2 submission.

Further work will be required at Gate 3 to obtain contractor confirmation for pipeline and crossing costs, as these are the significant components of these projects, and are currently subject to significant inflation increases.

6. OPEX costing

All OPEX costs are indicative only due to the multitude of variations, especially operational regimes employed. It should be noted that the OPEX estimates are based upon a number of assumptions in relation to staffing requirements.

OPEX has been assessed to take account of the operating regime of the works. Fixed OPEX are costs that will be incurred when the system operates with no flow i.e., 100% of maintenance is still required when works is running on sweetening flows and treatment works usually require all staff also. Variable OPEX is directly related to the flow – pumping costs and chemical usage at the treatment works.

We note the current volatility in electricity prices and predicting rates for the future is very difficult at this stage. Costs have been generated at 2020/21 price base, using rates for power which are similar to that used for Gate 1. The electricity cost rate will require review for Gate 3 to ensure the OPEX used in the WRSE Regional Plans and AIC calculations are reflective of forecast market conditions.

6.1 River Vyrnwy Bypass Pipeline

OPEX costs for the Vyrnwy Bypass pipeline were generated using a bottom-up approach, with UU assumptions and base costs. There are no pumping or treatment costs associated with this source. An allowance is used for Capital maintenance of the assets, based on a percentage of the CAPEX build value. This approach is adopted by UU for business planning and the WRMP schemes. The assumptions are detailed below:

- Staff – assumed to be redeployed to other activities for 100% of time when there is no flow in pipe.
- Chemicals – none needed
- Electricity – small usage required to power flow meters, control values and SCADA systems. There is no pumping associated with this element.
- Capital Maintenance - 0.71% of M&E CAPEX and 0.27% of Civil CAPEX

OPEX costs for Fixed and Variable OPEX are shown below in **Table 6-1.**

Table 6-1 River Vyrnwy Bypass Pipeline - Fixed and variable OPEX (2020/21 price base)

Element	Sub-option	Gate 2		
		OPEX Sweetening flow (£m/year)	Fixed OPEX (£m/year)	Variable OPEX (£/ Ml)
Vyrnwy mitigation - River Vyrnwy Bypass Pipeline	25 – 105Ml/d	0.10	0.10	0.0
	25 – 180Ml/d	0.11	0.11	0.0
	27 – 180Ml/d	0.21	0.21	0.0
	27 - 205Ml/d	0.21	0.21	0.0

6.2 Severn to Thames Interconnector

6.2.1 Methodology

OPEX costs were generated using the Thames Water's APS costing tool. Data was entered to the F909 for quantities of electricity (kwh) used by the pumps and other equipment as well as the chemicals dosed and the expected staff required to run the various elements of the scheme. An allowance was also added for capital maintenance of the works based on a percentage of CAPEX. The assumptions are detailed below:

- Staff – assume one member of staff per 50Ml/d treatment. Staff to be retained full time irrespective of flow (min flow 20Ml/d)
- Chemicals – 3 chemicals required:
    - Ferric Chloride
    - Polyelectrolyte (upstream of clarification)
    - Polyelectrolyte (sludge treatment)
- Capital Maintenance - 1.5% of M&E CAPEX and 0.25% of Civil CAPEX

The system then applies company specific rates for electricity, labour and chemicals and generates the resulting OPEX for the Pumping Stations and Treatment works. The estimated OPEX requirements for the scheme are summarised below in Table 6-2.

Table 6-2 Gate 2 Interconnector Annual OPEX (2020/21 prices)

Element	Sub-option	OPEX Sweetening flow (£m/year)	Fixed OPEX (£m/year) – 0 Ml/d	Variable OPEX (£/ Ml)
Interconnector – Deerhurst pipeline or Cotswolds canal plus treatment	Treatment and pipeline capacity 300Ml/d	4.27	2.89	189.18
	Treatment and pipeline capacity 400Ml/d	4.81	3.43	188.49
	Treatment and pipeline capacity 500Ml/d	5.21	3.84	187.12

The unit rates applied for electricity, chemicals and labour are embedded in the APS costing tool and are not detailed in this report due to the confidentiality of the base data.

The TWUL system assumes staff and Capital Maintenance costs will be ongoing irrespective of flows and therefore form the basis for the Fixed OPEX. The variable OPEX presents the costs for each additional Ml/d required by the system – linked to electricity and chemical usage.

6.3 Shrewsbury re-deployment

OPEX costs were generated by STW using a bottom-up approach. Quantities were estimated for electricity (kwh) used by the pumps and other equipment as well as the chemicals dosed and the expected staff required to run the various elements of the scheme. An allowance was also added for capital maintenance of the works based on a percentage of CAPEX. The assumptions are detailed below:

- Staff – assume one member of staff. Staff to be retained full time irrespective of flow
- Chemicals – 1 chemical required:
    - Hypochlorite
- Capital Maintenance - 1.5% of M&E CAPEX and 0.25% of Civil CAPEX

STW specific rates for electricity, labour and chemicals were applied to generate the resulting OPEX for the Pumping Stations and Treatment works. OPEX costs are not shown in this report as Shrewsbury is not available to STT at Gate 2.

7. Net Present Value (NPV) and Average Incremental Cost (AIC)

Average Incremental Costs (AIC) for each option have been developed using the template and guidance issued by the ACWG[4]. This template combines the initial CAPEX and annual OPEX costs, as well as the ongoing replacement costs to generate a Net Present Value (NPV) over an 80-year period. In addition to this, the template also calculates the costs for finance and derives the unit cost £/m3 for each option. The AIC cost has been calculated for the min (sweetening flow) and the maximum flow criteria.

The key assumptions included in this are listed below:

- Optimism Bias and costed Risk are included in the CAPEX estimates.
- The tool assumes a declining discount rate in accordance with HM Treasury Green Book (Standard Discount rate)
- Calculations include M&E Asset replacements in accordance with the Asset Life in the WRSE template
- Land values do not depreciate
- Spend profiles are indicative only to facilitate multi-solution decision making and will be refined at Gate 3
- The NPV for each scheme was calculated over a total project duration of 80 years
- WACC of 2.92% included (using mid-year average)
- Residual costs are not included
- The AIC template utilises the data as presented in the WRSE template where budgets have been allocated against the various categories for asset life (M&E, pipelines, Land etc) as shown below in Table 7-1.

Table 7-1 Asset Life categories from Cost Consistency Methodology,

Asset Type	Asset Life (Yrs)
Land, planning and development, other non-depreciating assets	Non depreciating
Process-related carbon media including GAC, vehicles, computers and data logging	4
Fencing, domestic meters, building services, membranes, ICA (Instrumentation, Control & Automation)	10
Plant and machinery	15
M&E (Mechanical and electrical) works on pumping stations and treatment works, raw water and district meters	20
Power supply	25
Steel/timber/GRP structures, landscaping/environmental works, borehole screening and casing	30
Bridges	40
Brick/concrete office structures	50
Treatment and pumping station civils (incl. intakes), roads and car parks, water towers, borehole installation, headworks/valves, underwater assets	60
Reinforced concrete tanks / service reservoirs	80
Weirs, pipelines, tunnels, aqueducts	100
Embankment works	250

This allocation has then been used to allocate future capital maintenance/renewal costs for each asset type over the 80-year appraisal period used in the NPV and AIC analysis. Capital maintenance/renewals cycles have been taken as in first operating year).

[4] *Cost Consistency Methodology, Rev E, Technical Note and Methodology*' (ACWG, February 2022)

CAPEX costs are the same for min and max utilisation and OPEX varies depending on the utilisation. The Water available for use (WAFU) is the same for min and max utilisation and the AIC is therefore effectively the unit rate for keeping the system available for use.

AIC values have been estimated based on deployable output discounted over the life of the scheme. The AIC provides an estimate of the unit cost for delivering the Deployable Output (or Option Benefit) of the scheme. As the costs will depend upon the level of scheme utilisation, we have estimated maximum and minimum utilisation AIC values. In all cases the denominator (discounted DO over the life of the scheme) is the same - i.e., it is a unit cost for making available a capacity.

The methodology for calculation of AIC has been changed for Gate 2 with the mid year RCV being used, rather than end of year figures. A revised AIC template was issued by the ACWG for the Gate 2 Submission.

We note that STT is part of a larger group of source options but for the purposes of comparison for Gate 2 we present only the AIC figures for the elements included in this SRO with the DO for that element. This approach is consistent with the approach used for Gate 1. Tables 7-2 and 7-3 below show the AIC outputs for:

- Vyrnwy Bypass – two route options (route 25 with flows on 105 and 180 Ml/d and route 27 with flows of 180 Ml/d and 205 Ml/d)
- Interconnector – 3 flow options (300, 400 and 500Ml/d)

Table 7-2 Vyrnwy Bypass NPV and AIC (Standard Discount Rate) (2020/21 prices)

Option name		Units	Vyrnwy Bypass 25_105	Vyrnwy Bypass 25_180	Vyrnwy Bypass 27_180	Vyrnwy Bypass 27_205
Option benefit		Ml/d	105	180	180	205
Total planning period option benefit (NPV)	Gate 2	Ml	949064.9	1626968.3	1626968.3	1852936.2
Total planning period indicative capital cost of option (CAPEX NPV)	Gate 2	£m	79.5	88.3	166.8	166.8
Sweetening Flow						
Sweetening Flow Rate	Gate 1	Ml/d	0	0	0	0
	Gate 2	Ml/d	0	0	0	0
Total planning period indicative operating cost of option (OPEX NPV)	Gate 2	£m	2.4	2.7	5.1	5.1
Total planning period indicative option cost (NPV)	Gate 2	£m	81.9	91.0	171.9	171.9
Average Incremental Cost (AIC)	Gate 2	p/m^3	8.6	5.6	10.6	9.3
Maximum Flow						
Total planning period indicative operating cost of option (OPEX NPV)	Gate 2	£m	2.4	2.7	5.1	5.1
Total planning period indicative option cost (NPV)	Gate 2	£m	81.9	91.0	171.9	171.9
Average Incremental Cost (AIC)	Gate 2	p/m^3	8.6	5.6	10.6	9.3

Table 7-3 Interconnector NPV and AIC (Standard Discount Rate) (2020/21 prices)

Option name		Units	Option 1 Pipeline – 300Ml/d	Option 1B Pipeline – 400Ml/d	Option 1C Pipeline – 500Ml/d
Option benefit		Ml/d	294	392	490
Total planning period option benefit (NPV)	Gate 2	Ml	2,065,570	2,754,094	3,442,617
Total planning period indicative capital cost of option (CAPEX NPV)	Gate 2	£m	768.5	919.0	1009.1
Sweetening Flow					
Sweetening Flow Rate	Gate 1	Ml/d	30	40	50
	Gate 2	Ml/d	20	20	20
Total planning period indicative operating cost of option (OPEX NPV)	Gate 2	£m	82.1	92.5	100.3
Total planning period indicative option cost (NPV)	Gate 2	£m	850.7	1011.5	1109.4
Average Incremental Cost (AIC)	Gate 2	p/m³	41.2	36.7	32.2
Maximum Flow					
Total planning period indicative operating cost of option (OPEX NPV)	Gate 2	£m	446.3	585.2	718.1
Total planning period indicative option cost (NPV)	Gate 2	£m	1214.8	1504.2	1727.3
Average Incremental Cost (AIC)	Gate 2	p/m³	58.8	54.6	50.2

Shrewbury AIC figures are not presented as this source is not avilable to STT for Gate 2.

Most of the interconnector options are not directly comparable, as the benefit varies with each scheme. When the benefit is included in the AIC assessment, the 500Ml/d pipeline provides the best value for customers at maximum and sweetening flows.

8. Changes from WRSE draft regional plan submission

Costs for the various elements of the STT scheme were submitted in February 2022[5] to WRSE for the latest model runs. The optioneering and cost updates were not all complete at that time and there has been changes to the costs in recent months. Changes and cost updates are summarised below.

8.1 Vyrnwy Bypass

Work was ongoing at the time of the February WRSE submission with regards to proposals for various flow regimes in the river, pipeline and other sources. At Gate 1 the preferred option was 75mld River, 80mld Vyrnwy Bypass pipe and 25ML/d Shrewsbury. The February 2022 submission was based on 105mld in Vyrnwy Bypass Pipe, 75ML/d in River and 25ML/d Shrewsbury. The current Gate 2 submission focused on 4 options (one route with flows of 105Ml/d and 180Ml/d and second route with flows of 180Ml/d and 205 ML/d) but the current preferred option is 155Ml/d Vyrnwy Bypass pipe (costed as 180Ml/d pipeline), 25ML/d river, and 25ML/d Shrewsbury. This is summarised below in Table 8.1.

Until the there is more certainty on the source support elements it has been decided to maintain the 180ML/d option for the Gate 2 submission. Source options will be further considered during Gate 3 after completion of the environmental assessments.

Table 8.1 Summary of preferred option flows costed Gate1, Feb 2022 and Gate 2

		River	Bypass Pipe	Shrewsbury	Total
Gate 1	ML/d	75	80	25	180
Feb-22	ML/d	75	105	25	205
Gate 2	ML/d	25	155 (180)*	25	205

*Preferred option is 155ML/d but 180Ml/d capacity pipeline was costed

Additional work was undertaken after the February submission with regards to flows and route selection as well as assessment of ground conditions and constraints in relation to the discharge and upstream connection locations. The increased flows have resulted in a larger pipeline, and this has impacted on the direct costs which have increased. The risks associated with the scheme have now been assessed in line with the ACWG guidance and this has resulted in additional risks being identified. Optimism Bias allocations remain broadly unchanged although the percentage has decreased from 35% to 29.4%.

8.2 Severn to Thames Interconnector

After the Gate 1 submission, additional work was undertaken with regards to route selection for the pipeline and Canal options. The definition of the type of work changed from Standard to Non-Standard and this increased the OB allocations for the February 22 upload (increased from 29.7% to 40%).

After the draft regional plan submission some refinements were made to the design. The biggest changes are due the reduction in pipe sizes, the reduction of size of the break pressure tank and the removal of the need for an intake tunnel between the river intake and the low lift pumping station.

The costed Risk and Optimism Bias aspects were further revised after the Feb 22 submission, and this resulted in significant decreases in the costed risk allocation for the pipeline options with some opportunities also now included in the costed risk assessment. Some of the costed risk around material costs and inflation have been moved into Optimism Bias due to uncertainty and the overall effect is a reduction in total risk.

There has been a small increase in fixed OPEX from the Gate 1 and WRSE Draft Regional Plan submission to Gate 2. Interconnector minimum OPEX has dropped for the 400Ml/d and 500Ml/d options due to a decrease in the minimum sweetening flow rates (reduced from 10% to 20 Ml/d).

[5] Main submission Feb 2022 but various updates provided up to May 2022

8.3 Shrewsbury re-deployment

The February 2022 submission for Shrewsbury was based on the Gate 1 information. Work has been ongoing with regards to the various upgrades necessary for the transfer and treatment of the additional 25Ml/d. Base CAPEX estimates have been reduced and this is due to the elimination from the scope of a Reverse Osmosis (RO) plant initially proposed for enhancing the boreholes treatment stream. During Gate 2 design development, it was decided that the water quality needs of Shelton WTW could be met by blending river and borehole water. The removal of the RO plant has also significantly reduced the CAPEX and OPEX associated with this source.

Further optioneering undertaken in recent months indicates that this source is now not available to STT.

9. The Journey from Gate 1 to Gate 2

A summary of the CAPEX, OPEX and AIC figures generated for Gate 2 are compared with the Gate 1 submission in this section. In some cases, the preferred option flow has changed which has resulted in larger diameter pipelines. The routes of some of the pipelines has also changed from Gate 1 to Gate 2 and this impacts on costs for pipelaying, easement costs, pumping head and the number of crossings.

9.1 CAPEX

A summary of the CAPEX changes from Gate 1 to Gate 2 are compared in Table 9-1 below. The changes in Optimism Bias percentages applied are summarised in Table 9-2.

Table 9-1 STT CAPEX Summary Gate 1 and Gate 2 (2020/21 price base)

Element	Sub-option	Gate	Base CAPEX (£m)	Costed Risk (£m)	Optimism Bias (£m)	Total CAPEX incl. risk and OB (£m)
Interconnector – Deerhurst Pipeline	Treatment and pipeline capacity 300Ml/d	Gate 1	692.4	70.6	207.7	970.7
		Gate 2	702.3	13.8	258.8	974.9
	Treatment and pipeline capacity 400Ml/d	Gate 1	790.8	74.4	237.2	1102.4
		Gate 2	836.2	22.3	308.1	1166.6
	Treatment and pipeline capacity 500Ml/d	Gate 1	880.3	78.4	264.1	1222.8
		Gate 2	909.1	25.7	335.0	1269.8
Interconnector - Cotswold Canal	Cotswold Canal - 300Ml/d	Gate 1	849.5	143.5	424.7	1417.7
		Gate 2	n/a	n/a	n/a	n/a
River Vyrnwy Bypass Pipeline	Vyrnwy Bypass Option 5 – 90Ml/d	Gate 1	51.2	2.9	19	73.1
		Gate 2	n/a	n/a	n/a	n/a
	Vyrnwy Bypass Option 25 – 105Ml/d	Gate 1	n/a	n/a	n/a	n/a
		Gate 2	66.8	7.4	19.6	93.8
	Vyrnwy Bypass Option 5 – 150Ml/d	Gate 1	63	3.6	23.3	89.9
		Gate 2	n/a	n/a	n/a	n/a
	Vyrnwy Bypass Option 25 – 180Ml/d	Gate 1	n/a	n/a	n/a	n/a
		Gate 2	74.8	7.6	22.0	104.4
	Vyrnwy Bypass Option 27 – 180Ml/d	Gate 1	108.1	6.2	40	154.3
		Gate 2	143.2	13.3	42.1	198.5
	Vyrnwy Bypass Option 27 - 205Ml/d	Gate 1	n/a	n/a	n/a	n/a
		Gate 2	143.2	13.3	42.1	198.5
Shrewsbury Redeployment	Shrewsbury Redeployment	Gate 1	n/a	n/a	n/a	n/a
		Gate 2	2.8	0.2	0.7	3.7

Table 9-2 Optimism Bias percentages applied at Gate 1 and Gate 2

Risk Category	Gate 1 (%)	Gate 2 (%)
Vyrnwy Bypass Pipeline	37.1%	29.4%
Severn to Thames Interconnector - Pipeline (all sizes)	29.7%	36.9%
Shrewsbury re-deployment	n/a	25.0%

9.1.1 Interconnector CAPEX

Base CAPEX

There have been a number of minor changes to the pipeline option as it has developed during Gate 2 such as the re-routing of the pipeline to reduce pumping lift and a small reduction of some pipe diameters. Additional water quality sampling has resulted in changes to the WTW design with increased chemical usage. CAPEX costs remain broadly similar to Gate 1 costs with the biggest changes being due the reduction in pipe sizes, the reduction of size of the break pressure tank and the removal of the need for an intake tunnel between the river intake and the low lift pumping station. Changes are summarised on the schematics shown in Figure 9-1.

Costed Risk

The Gate 2 review of risk has resulted in a reduction of costed risk, this is due to the following:

- Development of the options at this gate
- The reassignment of some risk to Optimism Bias such as material price increases as it was difficult to quantify in Costed Risk
- Reassessment of costing methodology for some risks
- The inclusion of a number of opportunities

Optimism Bias (OB)

Optimism Bias has increased for the Interconnector (29.7% to 36.9%) and this was mainly due to the reclassification of the scheme as Non Standard as per the ACWG guidance, as well as movement of the some of the Costed Risks to Optimism Bias. The total risk allocation (costed risk + OB) for the Interconnector remains similar from Gate 1 to Gate 2.

9.1.2 Shrewsbury

Base Capex

Base CAPEX estimates have been reduced from Gate 1 due to the elimination from the scope of a Reverse Osmosis (RO) plant, initially proposed for enhancing the boreholes treatment stream. During Gate 2 design development, it was decided that the water quality needs of Shelton WTW could be met by blending river and borehole water.

Costed Risk

It has not been possible to compare the costed risk to that generated for Gate 1 as these numbers are not available.

Optimism Bias

It has not been possible to compare the current Optimism Bias figures to Gate 1 figures as these figures are not available.

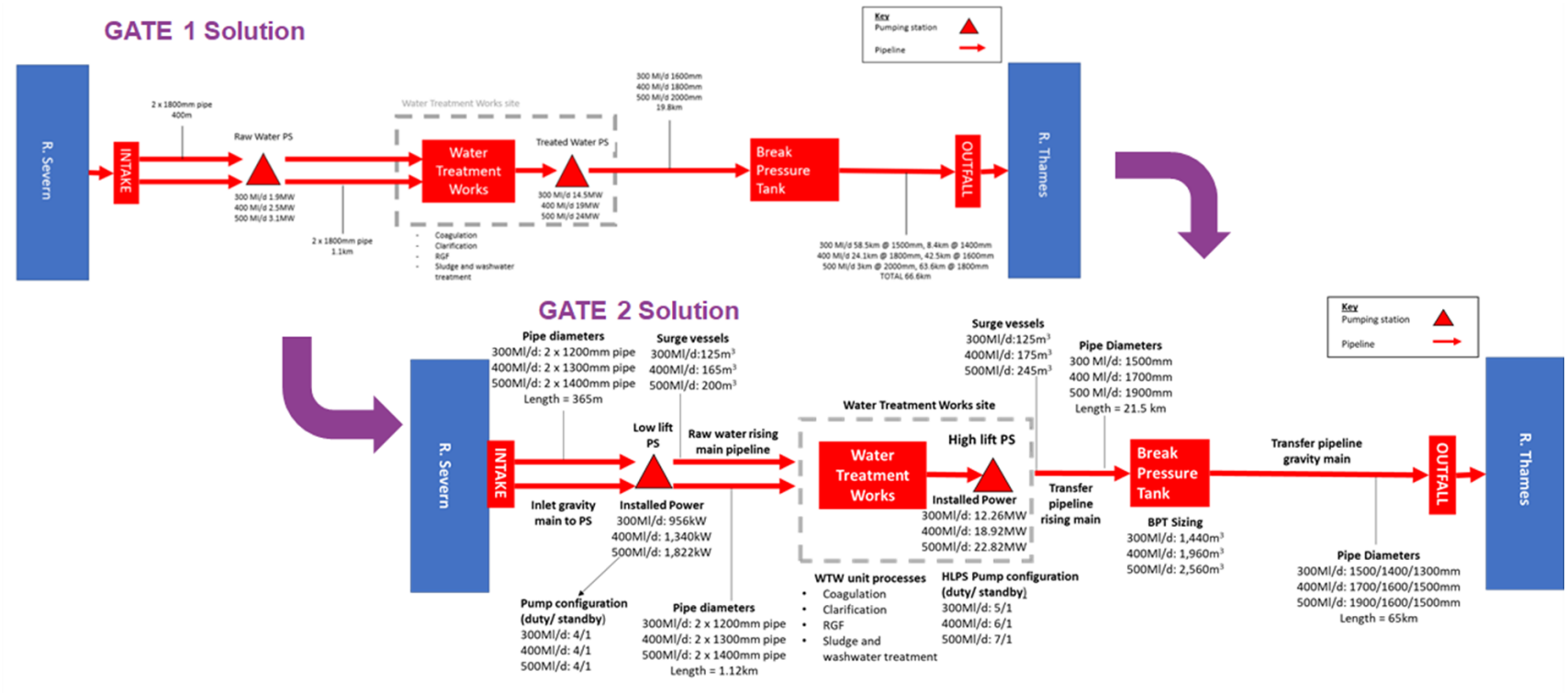


Figure 9.1 Key changes on Interconnector from Gate 1 to Gate 2

9.1.3 Vyrnwy Bypass CAPEX

Base CAPEX

The costs have increased from Gate 1, and this is mainly due to changes in the scope of the scheme as well as the costing methodology. The pipeline is now taking water from a connection point at Oswestry rather than from the Vyrnwy Raw Water Aqueduct (RWA) and the preferred option discharges to the River Severn rather than the River Vyrnwy. Flows have also increased with the preferred option now requiring 155Ml/d though the pipeline and this has resulted in the requirement for a larger diameter pipeline.

During Gate 2 design development additional scope was identified e.g., poor ground conditions which has resulted in the addition of sheet piling. Additional environmental mitigations such as surface water lagoons have also been costed based on mitigation measures experienced on recent projects. Further development of the route has resulted in increases to the average depth of pipe (2.5m to 3.5m) and the number of trenchless crossings has more than doubled, with 7 costed at Gate 1 and 20 costed for Gate 2. A further 20 minor crossings have been including in the costs for Gate 2, using Open Cut techniques. These elements have resulted in a significant increase to the direct works cost.

The current estimates have also been developed using a bottom-up estimate incorporating recent company cost data and requirements. The Gate 1 estimates were generated using a high-level scope with limited information and were generated using a top-down approach with generic costs from the company database.

Costed Risk

The list of risks considered as part of the Gate 1 submission were reviewed by the team, taking into consideration work undertaken during Gate 2. This review of risk has resulted in an increase in costed risk due to the following:

- Reassessment of methodology with all risks now calculated using the ACWG methodology
- Bottom-up approach to costing enables specific risks to be quantified and incorporated as costed risk and removed from Optimism Bias. Issues such as dewatering are specifically excluded from Base Capex and included as a costed risk. This will be reviewed further when additional site investigation is made available.

Optimism Bias

Optimism Bias has decreased for the Vyrnwy Bypass pipeline (37.1% to 29.4%) as some risks have moved to Costed Risk. The Optimism Bias budget remains similar between Gate 1 and Gate 2 for Option 7/27_180.

9.2 OPEX

A summary of the OPEX changes from Gate 1 to Gate 2 are compared in Table 9-3 below.

9.2.1 Interconnector

There has been an increase in Fixed OPEX from Gate 1 to Gate 2. This is due to the following:

- An increase in M&E CAPEX – resulting in a higher Capital maintenance costs
- The correction of an under-pricing issue for staffing costs in the Gate 1 submission.

Variable OPEX costs have increased slightly from Gate 1 with increases due to the requirement for additional chemicals required for treatment, following further sampling data. The maximum lift required for the pumps decreased slightly due to the re-routing of the pumping main.

Table 9-3 OPEX Summary (2020/21 prices)

Element	Sub-option	Gate and Base Date	OPEX based on sweetening flow (£m/year)	Fixed OPEX (£m/year)	Variable OPEX (£/Ml)
Interconnector – Deerhurst pipeline	Treatment and pipeline capacity 300Ml/d	Gate 1	4.08	2.16	179.00
		Gate 2	4.27	2.89	189.18
	Treatment and pipeline capacity 400Ml/d	Gate 1	5.17	2.61	179.10
		Gate 2	4.81	3.43	188.49
	Treatment and pipeline capacity 500Ml/d	Gate 1	6.14	2.94	178.80
		Gate 2	5.21	3.84	187.12
Interconnector - Cotswold Canal	Cotswold Canal - 300Ml/d	Gate 1	4.38	2.57	173.70
		Gate 2	n/a	n/a	n/a
Shrewsbury Redeployment	Shrewsbury Redeployment*	Gate 1	n/a	n/a	n/a
		Gate 2	n/a	n/a	n/a
Vyrnwy mitigation - River Vyrnwy Bypass Pipeline	Vyrnwy Bypass Option 5 – 90Ml/d	Gate 1	0.06	0.06	0.02
		Gate 2	n/a	n/a	n/a
	Vyrnwy Bypass Option 25 – 105Ml/d	Gate 1	n/a	n/a	n/a
		Gate 2	0.10	0.10	0.00
	Vyrnwy Bypass Option 5 – 150Ml/d	Gate 1	0.08	0.08	0.01
		Gate 2	n/a	n/a	n/a
	Vyrnwy Bypass Option 25 – 180Ml/d	Gate 1	n/a	n/a	n/a
		Gate 2	0.11	0.11	0.00
	Vyrnwy Bypass Option 27 – 180Ml/d	Gate 1	0.14	0.14	0.01
		Gate 2	0.21	0.21	0.00
	Vyrnwy Bypass Option 27 - 205Ml/d	Gate 1	n/a	n/a	n/a
		Gate 2	0.21	0.21	0.00

* Shrewsbury not available to STT at Gate 2

9.2.2 Vyrnwy Bypass

This scheme has no pumping or treatment associated with the solution and OPEX costs are therefore minimal. There has been an increase in Fixed OPEX from Gate 1 to Gate 2. This is due to the following:

- An increase in Capex – resulting in a higher capital maintenance costs,
- An additional allowance for site power associated with flow meters and monitoring equipment,
- All OPEX costs now deemed to be incurred, even when there is no flow in the pipe and are therefore classified as fixed, and variable costs removed.

9.2.3 Shrewsbury

It has not been possible to compare the OPEX figures for Shrewsbury from Gate 1 to Gate 2 as the figures are not available.

9.3 NPV/AIC

A summary of the AIC changes from Gate 1 to Gate 2 are shown in Table 9-4 below

Table 8-4 Annual Incremental Cost Summary (2020/21 price base)

Element	Sub-option	AIC Sweetening Flow (£/m3)		AIC Maximum Flow (£/m3)	
		Gate 1	Gate 2	Gate 1	Gate 2
Interconnector – Deerhurst pipeline or Cotswolds canal plus treatment	Treatment and pipeline capacity 300Ml/d	40.6	41.2	56.7	58.8
	Treatment and pipeline capacity 400Ml/d	35.4	36.7	51.5	54.6
	Treatment and pipeline capacity 500Ml/d	32.0	32.2	48.1	50.2
	Cotswold Canal capacity 300Ml/d	59.7	n/a	75.3	n/a
Vyrnwy mitigation - River Vyrnwy Bypass Pipeline	Vyrnwy Bypass Option 5 – 90Ml/d*	8.9	n/a	8.9	n/a
	Vyrnwy Bypass Option 25 – 105Ml/d	n/a	8.6	n/a	8.6
	Vyrnwy Bypass Option 25 – 180Ml/d	n/a	5.6	n/a	5.6
	Vyrnwy Bypass Option 27 – 180Ml/d**	n/a	10.6	n/a	10.6
	Vyrnwy Bypass Option 27 - 205Ml/d	n/a	9.3	n/a	9.3
Shrewsbury Redeployment	Shrewsbury Re-deployment ***	n/a	n/a	n/a	n/a

*preferred option at Gate 1- 90ML/d pipeline,. AIC was generated for this Option only at Gate 1
** preferred option at Gate 2 – 150/180ML/d pipeline
*** Shrewsbury not available to STT at Gate 2

9.3.1 Interconnector

There have been minor changes to the CAPEX and OPEX costs during the Gate 2 assessment for the Interconnector but these are minimal as reflected in the Gate 2 AIC numbers presented.

9.3.2 Vyrnwy Bypass

At Gate 1, the preferred option was 5_90 with a proposed flow of 80Ml/d and a direct comparison to the Gate 2 numbers is not possible. The Gate 1 preferred option is closest to the 25_105 option at Gate 2. The Gate 1 AIC for the preffered option was 8.9p/m3 which is similar to 8.6p/m3 at for a slightly larger flows/pipe.

9.3.3 Shrewsbury Bypass

It has not been possible to compare the AIC figures for Shrewsbury as the Gate 1 figures remain confidential.

10. STT System Costs

The interconnector, bypass, and Shrewsbury elements of the system have no resource benefit. Resource benefit comes from the natural flow in the River Severn (unsupported flow) and the related source SROs providing supported flow. The source SROs are:

- North West Transfer;
- Minworth; and
- Severn Trent Sources (this covers both Netheridge and Mythe).

The concept designs for each of the source elements are described in their own Gate 2 submissions

Figure 10.1 below shows the various elements of the STT system and the relevant SROs which can be interrogated for full details of the scope of work being undertaken and the associated CAPEX and OPEX costs. We note that Shrewsbury and Mythe are no longer available to STT for Gate 2.

Figure 10.1 STT system and associated SROs

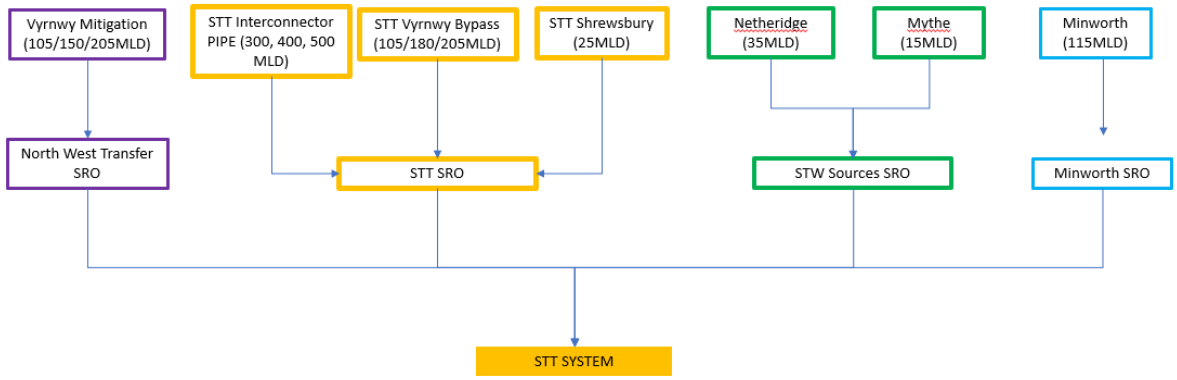


Table 10.1 presents a summary of the total CAPEX associated with the preferred options of the various SROs.

Table 10.1: CAPEX costs for STT System (2020/21 base date)

SRO	Element	Sub-option	500 (Ml/d) £m
STT SRO	Interconnector – Deerhurst Pipeline	Treatment and pipeline capacity 500Ml/d	1269.8
	Vyrnwy mitigation	River Vyrnwy Bypass Pipeline 27_180	198.5
	Vyrnwy mitigation	Shrewsbury Redeployment	0.0
Minworth SRO	Minworth	Minworth	247.3
STW Sources SRO	Netheridge	Netheridge	139.1
North West Transfer SRO	Vyrnwy Mitigation	Vyrnwy Mitigation	852.5
Total CAPEX including risk and OB (£m)			2707.1

OPEX costs for the various elements of STT are summarised below in Table 10.2. The flow regime is unknown and therefore the Min and Max flows are show for comparison. The system will operate at minimum capacity, and flows will increase when needed.

Table 10.2: Min and Max Flow OPEX costs (£/annum) for STT System (2020/21 base date)

		Fixed OPEX (£m/year)	Variable OPEX (£/Ml)	Min Flow - Section (Ml/d)	Max Flow Section (Ml/d)	Min Flow – (£/annum)	Max Flow – (£/annum)
STT SRO	Treatment and pipeline capacity 500Ml/d	3.84	187.12	20	500	5.21	37.99
	River Vyrnwy Bypass Pipeline 27_180	0.21	0.00	0	180	0.21	0.21
	Shrewsbury Redeployment	n/a	n/a	0	0	n/a	n/a
Minworth SRO	Minworth	1.55	387.00	23	115	4.79	17.79
STW Sources SRO	Netheridge	0.85	212.64	20	35	2.40	3.56
North West Transfer SRO	Vyrnwy Mitigation	1.56	81.20	0	205	1.56	7.64
					Total Opex (£m/annum)	14.17	67.19

Appendix A. Cost Breakdown Interconnector Deerhurst to Culham Pipeline – 500Ml/d

STT SRO | Version | Back to title page

Table 5a: WC Level - Option Level Cost Profile Table

Table Instruction	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated.	Total/Fixed/Variable	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Complete for all options (Feasible and preferred)	500 MLD interconnector	Capex			Total							9.0	9.0	23.0	23.0	23.0	164.4	164.4	164.4	164.4	164.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	104.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	104.2	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	234.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.0
	500 MLD interconnector	Opex			Total							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3
	500 MLD interconnector	Financing Cost			Total							0.2	0.5	1.2	2.1	3.0	6.8	13.6	20.3	27.0	33.7	56.9	56.4	55.8	55.2	54.6	54.0	53.4	52.8	52.2	52.0	51.8	51.2	50.6	50.0	49.5	48.9	48.3	47.7	47.1	48.6	50.1	49.5	48.9	48.3	47.8	47.2	46.6	46.0	45.4	45.8	46.2	45.6	45.0	44.4	43.9	43.3	42.7	42.1	41.5	43.0	44.5	43.9	43.3	42.7	42.1	41.6	41.0	40.4	39.8	39.6	39.4	38.8	38.2	37.6	37.0	36.4	35.8	35.3	34.7	38.8	42.9	42.3	41.7	41.1	40.5	39.9	39.3	38.7	38.1	37.9
	500 MLD interconnector	Discount Rate			Total							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Discount Factor			Total							1.0	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	500 MLD interconnector	Capex	Costed Risk		Total							0.0	0.0	0.0	0.0	0.0	5.1	5.1	5.1	5.1	5.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Capex	Optimism Bias		Total							3.3	3.3	8.5	8.5	8.5	60.6	60.6	60.6	60.6	60.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	38.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.4	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0
	500 MLD interconnector	Net Present Cost (NPC)			Total							0.2	0.5	1.1	1.8	2.5	5.6	10.7	15.4	19.8	23.9	64.6	62.0	59.5	57.1	54.9	52.7	50.5	48.5	46.6	44.9	43.3	41.5	39.9	38.3	36.7	35.2	33.8	32.4	31.1	30.6	30.2	29.2	28.1	27.1	26.1	25.2	24.3	23.4	22.6	22.0	21.5	20.7	20.0	19.3	18.6	17.9	17.2	16.6	16.0	15.8	15.7	15.1	14.6	14.0	13.5	13.0	12.6	12.1	11.7	11.3	10.9	10.5	10.1	9.8	9.4	9.1	8.7	8.4	8.1	8.3	8.5	8.2	7.9	7.6	7.3	7.1	6.9	6.7	6.4	6.3
	500 MLD interconnector	Total NPC			Total	1727.3																																																																																			

Table 5b: WC Level - Option Level Unit Cost Profile Table

Table Instruction	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated.		2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Complete for all options	500 MLD interconnector	Opex	Cost		Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
	500 MLD interconnector	Opex	Cost		Variable							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5
	500 MLD interconnector	Land (Non depreciating)			Fixed							0.0	0.0	2.7	2.7	2.7	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Planning and Development (Non depreciating)			Fixed							12.3	12.3	28.8	28.8	28.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Other Non-Depreciating Assets (Non depreciating)			Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Process-Related Carbon Media Including GAC (4)		4	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Vehicles (4)		4	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Computers and Data Logging (4)		4	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Fencing (10)		10	Fixed							0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2
	500 MLD interconnector	Domestic Meters (10)		10	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Building Services (10)		10	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Membranes (10)		10	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	ICA (Instrumentation, Control & Automation) (10)		10	Fixed							0.0	0.0	0.0	0.0	0.0	4.9	4.9	4.9	4.9	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.7
	500 MLD interconnector	Plant and Machinery (15)		15	Fixed							0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)		20	Fixed							0.0	0.0	0.0	0.0	0.0	23.3	23.3	23.3	23.3	23.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	116.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	116.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	116.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Raw Water and District Meters (20)		20	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Power Supply (25)		25	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Steel/Timber/GRP Structures (30)		30	Fixed							0.0	0.0	0.0	0.0	0.0	8.3	8.3	8.3	8.3	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Landscaping/Environmental Works (30)		30	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Borehole Screening and Casing (30)		30	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Bridges (40)		40	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Brick/Concrete Office Structures (50)		50	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Treatment and Pumping Station Civils (incl. Intakes) (60)		60	Fixed							0.0	0.0	0.0	0.0	0.0	26.3	26.3	26.3	26.3	26.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	131.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Roads and Car Parks (60)		60	Fixed							0.0	0.0	0.0	0.0	0.0	0.9	0.9	0.9	0.9	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Water Towers (60)		60	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Borehole Installation (60)		60	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Headworks/Valves (60)		60	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Underwater Assets (60)		60	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Reinforced Concrete Tanks / Service Reservoirs (80)		80	Fixed							0.0	0.0	0.0	0.0	0.0	1.2	1.2	1.2	1.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Weirs (100)		100	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Pipelines (100)		100	Fixed							0.0	0.0	0.0	0.0	0.0	145.7	145.7	145.7	145.7	145.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Tunnels (100)		100	Fixed							0.0	0.0	0.0	0.0	0.0	13.6	13.6	13.6	13.6	13.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Aqueducts (100)		100	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Embankment Works (250)		250	Fixed							0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	500 MLD interconnector	Costed Risk			Fixed							0.0	0.0	0.0	0.0	0.0	5.1	5.1	5.1	5.1	5.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix B. Cost River Vyrnwy Bypass Pipeline 27_180Ml/d

Water Company	Version		Back to title page

Table 5a: WC Level - Option Level Cost Profile Table

Table Instruction	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated.	Total/Fixed/Variable	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45
Complete for all options (Feasible and preferred)	Vyrnwy Bypass	Capex			Total							47.729	47.729	47.729	0	0	0	0	0	0	0	0	0	0.5276	0	0	0	0	0	0	0
	Vyrnwy Bypass	Opex			Total							0	0	0	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068
	Vyrnwy Bypass	Financing Cost			Total							0.9662	2.8985	4.8308	7.7121	7.6554	7.5986	7.5419	7.4851	7.4283	7.3716	7.3148	7.2581	7.2113	7.1645	7.1078	7.051	6.9943	6.9375	6.8808	6.824
	Vyrnwy Bypass	Discount Rate			Total							0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
	Vyrnwy Bypass	Discount Factor			Total							0.9662	0.9335	0.9019	0.8714	0.842	0.8135	0.786	0.7594	0.7337	0.7089	0.6849	0.6618	0.6394	0.6178	0.5969	0.5767	0.5572	0.5384	0.5202	0.5026
	Vyrnwy Bypass	Capex	Costed Risk		Total							4.4232	4.4232	4.4232	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Vyrnwy Bypass	Capex	Optimism Bias		Total							14.023	14.023	14.023	0	0	0	0	0	0	0	0	0	0.155	0	0	0	0	0	0	0
	Vyrnwy Bypass	Net Present Cost (NPC)			Total							0.9335	2.7057	4.3571	6.9009	6.6197	6.3497	6.0904	5.8413	5.6021	5.3725	5.1519	4.9401	4.7432	4.5539	4.366	4.1856	4.0125	3.8462	3.6866	3.5334
	Vyrnwy Bypass	Total NPC			Total	171.9																									

Cost Metric (£m)	Cost Sub-metric (£m)	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75
Capex		0	0	0.5276	0	0	0	0	0	0	0	0	0	0.5276	0	0	0	0	0	0	0	0	0	0.5276	0	0	0	0	0	0	0
Opex		0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068
Financing Cost		6.7673	6.7105	6.6637	6.6169	6.5602	6.5034	6.4467	6.3899	6.3332	6.2764	6.2197	6.1629	6.1161	6.0693	6.0126	5.9558	5.8991	5.8423	5.7856	5.7288	5.6721	5.6153	5.5685	5.5218	5.465	5.4083	5.3515	5.2948	5.238	5.1812
Discount Rate		0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Discount Factor		0.4856	0.4692	0.4533	0.438	0.4231	0.4088	0.395	0.3817	0.3687	0.3563	0.3459	0.3358	0.326	0.3165	0.3073	0.2984	0.2897	0.2812	0.2731	0.2651	0.2574	0.2499	0.2426	0.2355	0.2287	0.222	0.2156	0.2093	0.2032	0.1973
Capex	Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex	Optimism Bias	0	0	0.155	0	0	0	0	0	0	0	0	0	0.155	0	0	0	0	0	0	0	0	0	0.155	0	0	0	0	0	0	0
Net Present Cost (NPC)		3.3864	3.2453	3.1143	2.9885	2.8634	2.7434	2.6282	2.5177	2.4116	2.3098	2.2229	2.1391	2.0616	1.9867	1.9114	1.8388	1.7688	1.7013	1.6363	1.5736	1.5131	1.4549	1.4011	1.3493	1.297	1.2467	1.1981	1.1513	1.1063	1.0629

Cost Metric (£m)	Cost Sub-metric (£m)	2075-76	2076-77	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Capex		0	0	0.5276	0	0	0	0	0	0	0	0	0	3.4693	0	0	0	0	0	0	0	0	0	0.5276	0	0	0	0	0	0	0
Opex		0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068	0.2068
Financing Cost		5.1245	5.0677	5.021	4.9742	4.9174	4.8607	4.8039	4.7472	4.6904	4.6337	4.5769	4.5202	4.5289	4.5377	4.481	4.4242	4.3675	4.3107	4.254	4.1972	4.1405	4.0837	4.0369	3.9901	3.9334	3.8766	3.8199	3.7631	3.7064	3.6496
Discount Rate		0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.025	0.025	0.025	0.025	0.025
Discount Factor		0.1915	0.1859	0.1805	0.1753	0.1702	0.1652	0.1604	0.1557	0.1512	0.1468	0.1425	0.1384	0.1343	0.1304	0.1266	0.1229	0.1193	0.1159	0.1125	0.1092	0.106	0.1029	0.1	0.097	0.0942	0.0919	0.0897	0.0875	0.0854	0.0833
Capex	Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex	Optimism Bias	0	0	0.155	0	0	0	0	0	0	0	0	0	1.0193	0	0	0	0	0	0	0	0	0	0.155	0	0	0	0	0	0	0
Net Present Cost (NPC)		1.021	0.9807	0.9437	0.908	0.8719	0.8372	0.8037	0.7714	0.7404	0.7105	0.6817	0.654	0.6361	0.6188	0.5935	0.5693	0.5459	0.5234	0.5018	0.481	0.461	0.4417	0.4242	0.4073	0.3901	0.3753	0.3611	0.3473	0.334	0.3211

Table 5b: WC Level - Option Level Unit Cost Profile Table

Table Instruction	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated.		2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45
Complete for all options >£100m (Feasible and preferred)	Vyrnwy Bypass	Opex	Cost		Fixed							0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	Vyrnwy Bypass	Opex	Cost		Variable							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Land (Non depreciating)			Fixed							0.8	0.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Planning and Development (Non depreciating)			Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Other Non-Depreciating Assets (Non depreciating)			Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Process-Related Carbon Media Including GAC (4)		4	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Vehicles (4)		4	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Computers and Data Logging (4)		4	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Fencing (10)		10	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Domestic Meters (10)		10	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Building Services (10)		10	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Membranes (10)		10	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	ICA (Instrumentation, Control & Automation) (10)		10	Fixed							0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Plant and Machinery (15)		15	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)		20	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Raw Water and District Meters (20)		20	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Power Supply (25)		25	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Steel/Timber/GRP Structures (30)		30	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Landscaping/Environmental Works (30)		30	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Borehole Screening and Casing (30)		30	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Bridges (40)		40	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Brick/Concrete Office Structures (50)		50	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Treatment and Pumping Station Civils (incl. Intakes) (60)		60	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Roads and Car Parks (60)		60	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Water Towers (60)		60	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Borehole Installation (60)		60	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Headworks/Valves (60)		60	Fixed							1.3	1.3	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Underwater Assets (60)		60	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Reinforced Concrete Tanks / Service Reservoirs (80)		80	Fixed							3.7	3.7	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Weirs (100)		100	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Pipelines (100)		100	Fixed							35.5	35.5	35.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Tunnels (100)		100	Fixed							20.3	20.3	20.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Aqueducts (100)		100	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Embankment Works (250)		250	Fixed							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Vyrnwy Bypass	Costed Risk			Fixed							4.4	4.4	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Cost Metric (£m)		2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75
Opex	Fixed	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Opex	Variable	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Land (Non depreciating)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Planning and Development (Non depreciating)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Non-Depreciating Assets (Non depreciating)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Process-Related Carbon Media Including GAC (4)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vehicles (4)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Computers and Data Logging (4)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fencing (10)	Fixed	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Domestic Meters (10)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Building Services (10)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Membranes (10)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ICA (Instrumentation, Control & Automation) (10)	Fixed	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant and Machinery (15)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raw Water and District Meters (20)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Power Supply (25)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Steel/Timber/GRP Structures (30)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Landscaping/Environmental Works (30)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Borehole Screening and Casing (30)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bridges (40)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brick/Concrete Office Structures (50)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Treatment and Pumping Station Civils (incl. Intakes) (60)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Roads and Car Parks (60)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water Towers (60)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Borehole Installation (60)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Headworks/Valves (60)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Underwater Assets (60)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reinforced Concrete Tanks / Service Reservoirs (80)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Weirs (100)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pipelines (100)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tunnels (100)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aqueducts (100)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Embankment Works (250)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Costed Risk	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Cost Metric (£m)		2075-76	2076-77	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Opex	Fixed	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Opex	Variable	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Land (Non depreciating)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Planning and Development (Non depreciating)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Non-Depreciating Assets (Non depreciating)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Process-Related Carbon Media Including GAC (4)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vehicles (4)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Computers and Data Logging (4)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fencing (10)	Fixed	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Domestic Meters (10)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Building Services (10)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Membranes (10)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ICA (Instrumentation, Control & Automation) (10)	Fixed	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plant and Machinery (15)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raw Water and District Meters (20)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Power Supply (25)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Steel/Timber/GRP Structures (30)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Landscaping/Environmental Works (30)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Borehole Screening and Casing (30)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bridges (40)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brick/Concrete Office Structures (50)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Treatment and Pumping Station Civils (incl. Intakes) (60)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Roads and Car Parks (60)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water Towers (60)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Borehole Installation (60)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Headworks/Valves (60)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Underwater Assets (60)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reinforced Concrete Tanks / Service Reservoirs (80)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Weirs (100)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pipelines (100)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tunnels (100)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Aqueducts (100)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Embankment Works (250)	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Costed Risk	Fixed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0