

River Severn to River Thames Transfer (STT)

Strategic regional water resource solution

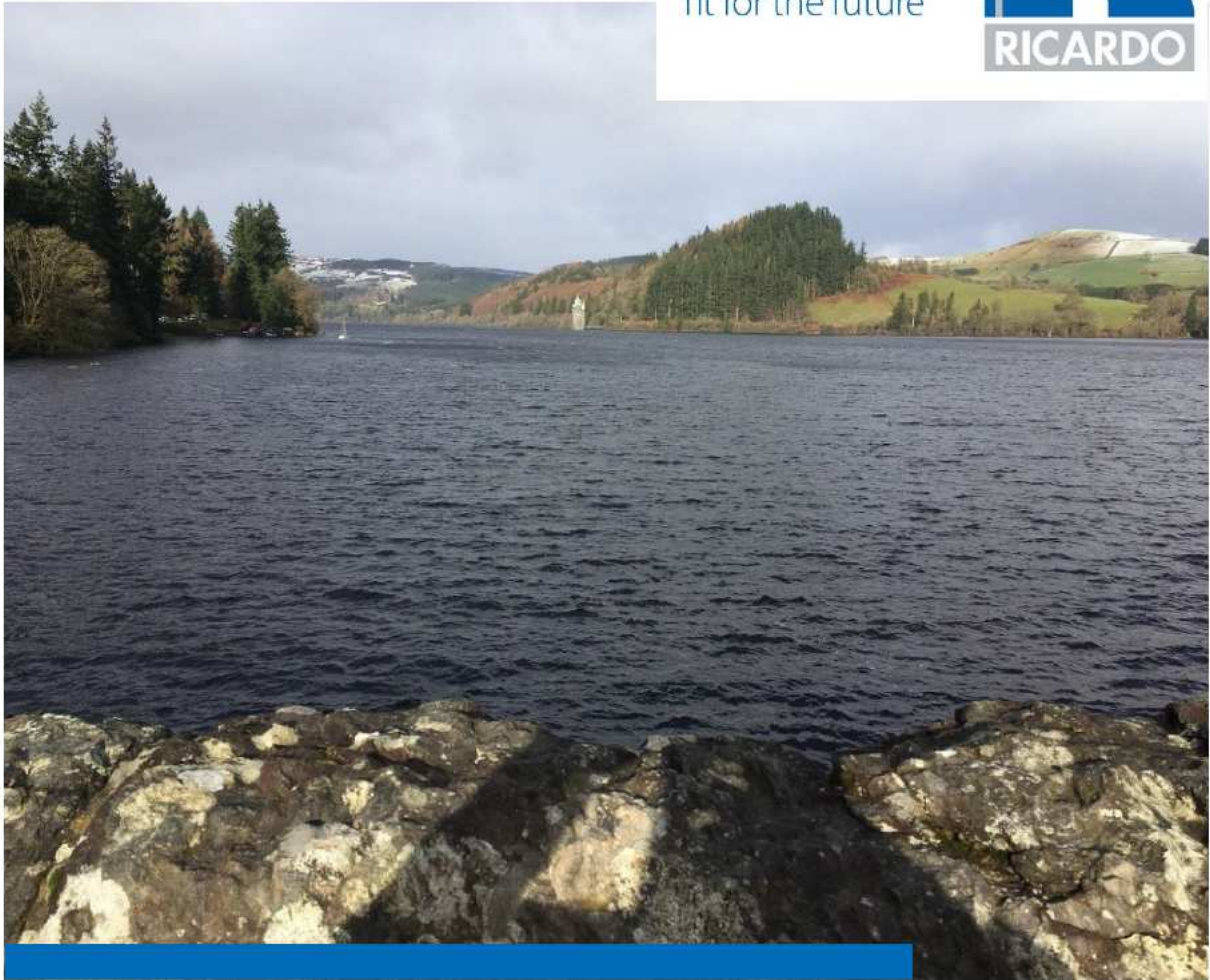
Regulatory Assessment Report:

Strategic Environmental Assessment (SEA)

July 2021



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Severn to Thames Transfer SRO

Evidence Report: Appendix 4.1: Strategic Environmental Assessment (SEA)

STT-S5-021 | 3

Customer:

United Utilities on behalf of the Severn Thames
Transfer programme

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Document history and status

Version	Date	Description	Author	Checked	Reviewed	Approved
1	08/03/2021	Draft for review	[REDACTED]	[REDACTED] [REDACTED]	[REDACTED] [REDACTED]	[REDACTED] [REDACTED]
1.1	31/03/2021	Revised following comments	[REDACTED] [REDACTED] [REDACTED]	[REDACTED] [REDACTED]	[REDACTED] [REDACTED]	[REDACTED] [REDACTED]
2	12/04/2021	Revised following comments	[REDACTED]	[REDACTED] [REDACTED]	[REDACTED] [REDACTED]	[REDACTED] [REDACTED]
3	21/05/2021	For issue to RAPID	[REDACTED]	[REDACTED] [REDACTED]	[REDACTED] [REDACTED]	[REDACTED] [REDACTED]

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1 Introduction

1.1 Background and purpose of report

Ofwat, through the PR19 Final Determination, has identified the potential for companies to jointly deliver strategic regional water resources solutions to secure long-term resilience on behalf of customers while protecting the environment and benefiting wider society. As part of the assessment of companies' PR19 business plans, Ofwat introduced proposals to support the delivery of Strategic Regional Water Resource Options (SROs) over the next 5 to 15 years with solutions required to be 'construction ready' for the 2025-2030 period. Ofwat's Final Determination¹ in December 2019 set out a gated process for development of Strategic Resource Options (SROs) for the co-ordination and development of a consistent set of SROs.

This gated process provides a mechanism for the industry, regulators, stakeholders and customers to input into the development and scheduling of these strategic solutions, through a combined set of statutory and regulatory processes. These include the National Framework, Drinking Water Safety Plans, Business Plans and Water Resource Management Plans (WRMPs). The strategic regional working group (consisting of Affinity Water, Anglian Water, Severn Trent Water, Southern Water, South West Water, Thames Water, United Utilities and Wessex Water) published a joint company statement reiterating a commitment to continue working with the Regulators' Alliance for Progressing Infrastructure Development (RAPID), the Environment Agency (EA), Natural Resources Wales (NRW), Ofwat and the Drinking Water Inspectorate (DWI) to make all of the planning processes and statutory timetables a success.

The Severn to Thames Transfer (STT) Scheme has been identified as an SRO in the PR19 Final Determination, with funding allocated equally between Thames Water (TW), United Utilities Water (UU) and Severn Trent Water (STW).

The STT Scheme involves the transfer of raw water from the lower reaches of the River Severn to the River Thames via an Interconnector, this comprising either a pipeline or a partly restored canal and pipeline route. Due to the risk of concurrent droughts in both river catchments additional sources of water (supported flows) apart from those naturally occurring in the River Severn (unsupported flows) have been identified to augment natural flows.

A map illustrating the components of the STT Scheme is provided in **Figure 1-1**.

¹ Ofwat (2019), PR19 Final Determinations, Strategic regional water resource solutions appendix

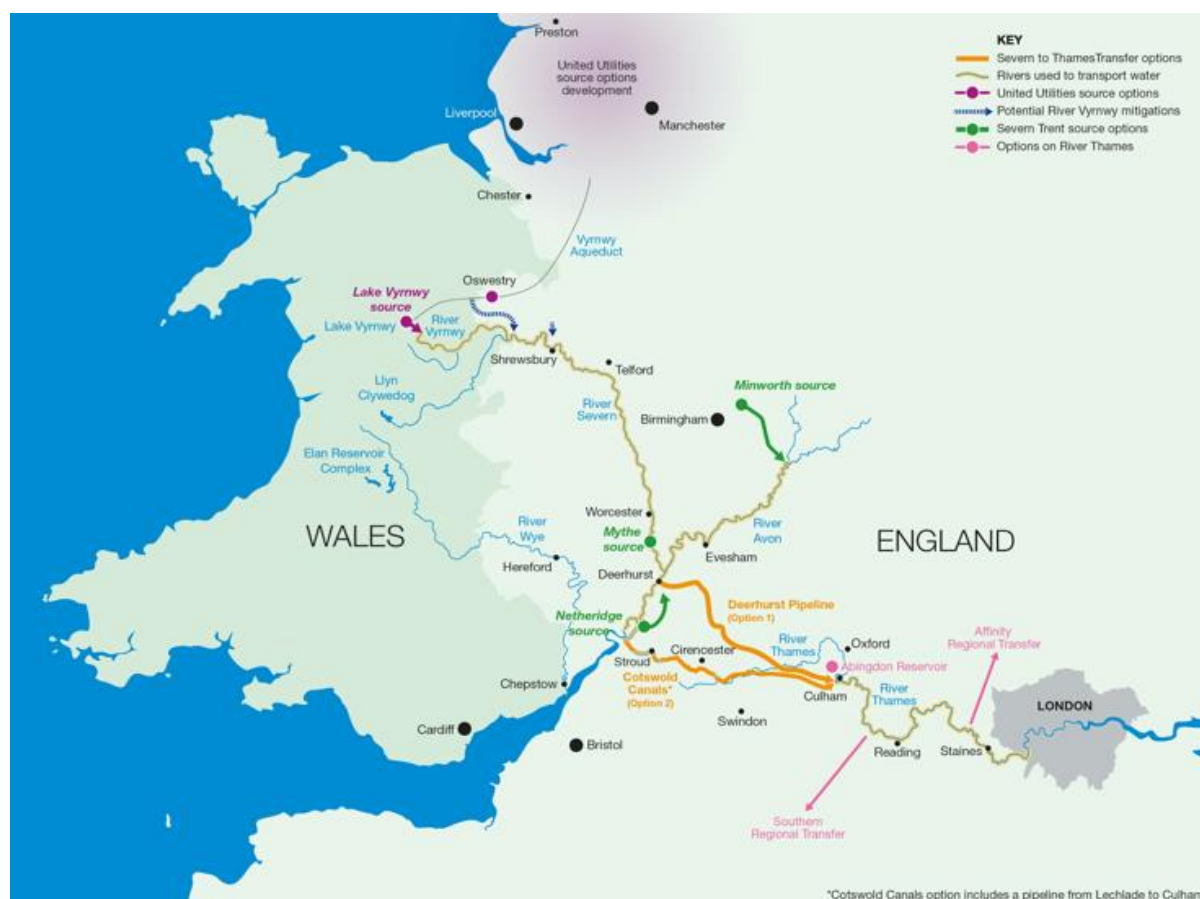


Figure 1-1: Severn to Thames Transfer (STT) Scheme

Two options are being considered for the transfer: a pipeline conveyance and the use of the Cotswold Canals. The pipeline route involves the abstraction of water from the lower River Severn at Deerhurst with conveyance of the water for discharge to the middle River Thames at Culham. An alternative option to this pipeline conveyance is for the transfer of raw water via the Cotswold canals. This option would require the restoration of the canals and the transfer of raw water from the River Severn into the Gloucester & Sharpness Canal at Gloucester Docks, the transfer of raw water from the Gloucester & Sharpness Canal to the restored Cotswold canals, the transfer of water from the restored Cotswold canals near Lechlade to a pipeline for conveyance to the River Thames near Culham. With both of these conveyance options the water available in the River Severn for transfer would be supported by the STT Source Support Elements, these comprising:

- regulation of up to 180 MI/d from the Vyrnwy Reservoir in mid-Wales to the River Severn system;
- the temporary transfer of up to 15 MI/d of abstraction licence volume from STW's Mythe river intake on the River Severn;
- diversion of up to 35 MI/d from Netheridge Wastewater Treatment Works (WwTW) into the River Severn; and
- up to 115 MI/d piped from Minworth WwTW to the River Avon.

Government and regulators have identified the need for a more integrated planning approach – with the National Framework setting out requirements for five regional plans across England. The aim is to identify best value plans at a regional level that include ambitious demand management, take advantage of local surpluses that may be available and identify the best value SROs for implementation. Ofwat's PR19 Final Determination identified that to achieve this objective it will be important that key inputs to the regional planning processes are consistent. It therefore set out requirements in the submission for conceptual design reports *"using comparable methodologies and consistent*

assumptions” including in relation to costs, deployable outputs, environmental and water quality assessments.

The STT System covers a wide geographical area that includes two regional plan areas across England, namely; Water Resources South East (WRSE) and Water Resources West (WRW). Whilst each regional plan area will develop their own approach to environmental assessment and timescales for development of these plans to meet statutory targets it is important that the environmental assessment of the STT Scheme adopts a consistent approach.

In October 2020, the group of Water Companies involved in developing SROs (known as the All Company Working Group - ACWG), published guidance² for environmental assessment methods for SROs which is aligned to the draft Water Resources Planning Guideline (WRPG): Working Version for Water Resource Management Plan 2024 (WRMP24) to increase the consistency of environmental assessment and the evaluation of impacts on environmental water quality in particular.

The ACWG guidelines² indicate that the process requires Water Companies to provide the following information related to each SRO at the stage outlined.

² Mott MacDonald Limited (2020). All Companies Working Group WRMP environmental assessment guidance and applicability with SROs. Published October 2020

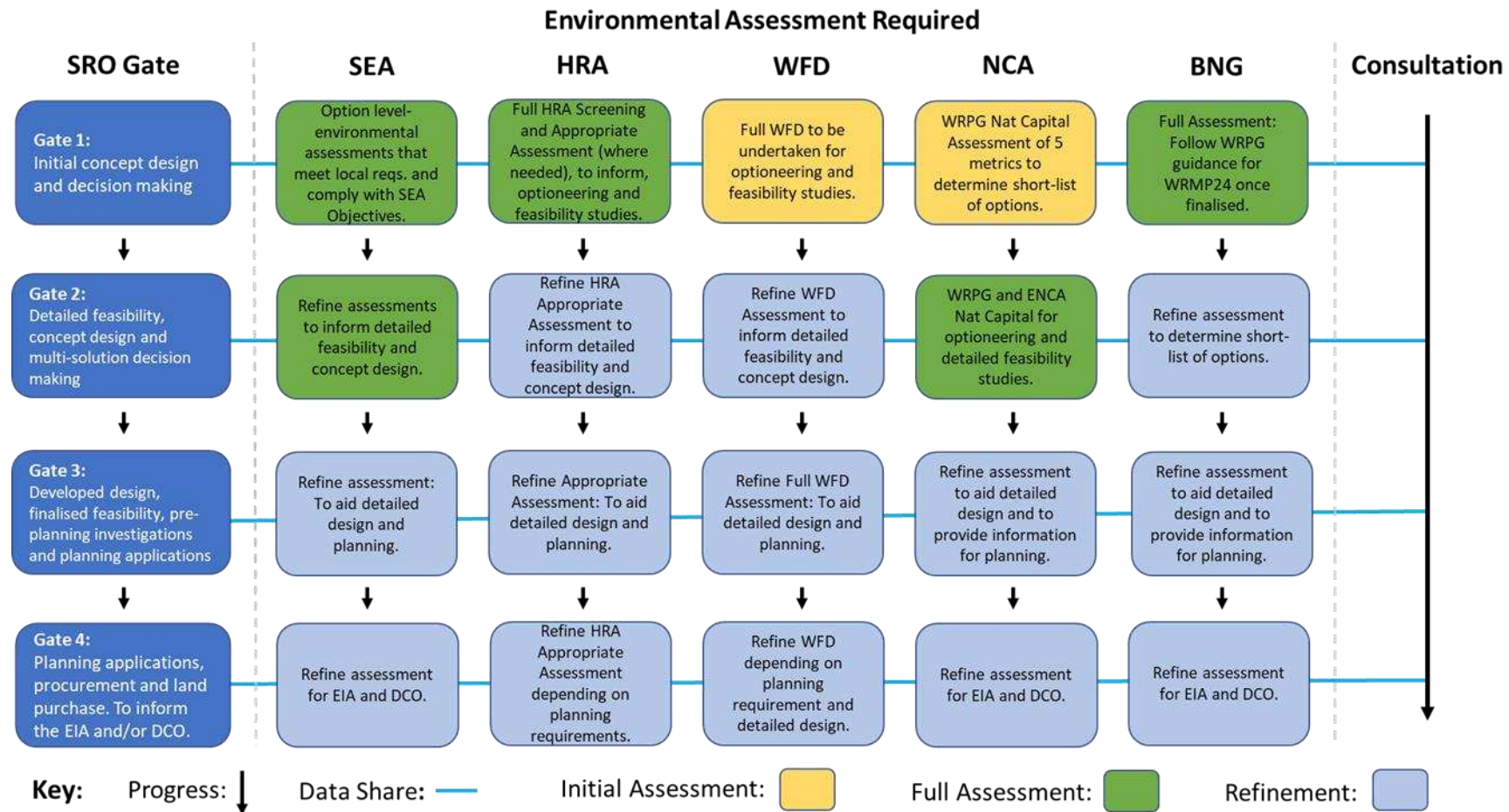


Figure 1-2: Environmental Assessment Integration with SRO Gates

In line with Ofwat's PR19 Final Determination the following is required at gate-1:

- *"Initial option-level Strategic Environmental Assessment and Habitat Risks Assessments³ requirements, including consideration of in-combination effects and identification of environmental risks that need mitigating through the solution design and costing"*

It was confirmed in the RAPID letter dated April 2019⁴ that a full statutory Strategic Environmental Assessment (SEA) is not required for gate 1. In consequence, a formal statutory SEA for submission at gate-1 has not been undertaken, and this report does not include a formal SEA Scoping Report, initial assessments, or associated public consultation.

At Gate 1, the principles of SEA have been applied to the STT SRO to inform an overall assessment of the environmental feasibility and deliverability of the solution. A statutory SEA is not required.

This report provides this initial option-level SEA. The report sets out the objectives and methodologies that will be used for SEA at later stages of the process and uses the principles of SEA to inform an overall assessment of the feasibility of the solution, from an environmental perspective.

The environmental assessment of the STT SRO has been undertaken in the context of the ACWG guidance. This approach has been adopted to assess the various components of the STT System, thus determining the environmental risk of the STT SRO in a manner consistent with the assessments that will be undertaken for the regional and individual water company WRMPs.

The assessment work is predicated on the STT System comprising the Interconnector and STT Source Support Elements identified as part of TW's WRMP19, although some amendments to the scope of the STT Source Support Elements from those assessed in TW's WRMP19 have been made. These are set out in **Table 1.1** below.

Table 1.1 Amendments to STT Source Support Elements from TW's WRMP19

STT Source Support Element assessed in TW's WRMP19	STT Source Support Element assessed in SRO
Vyrnwy Reservoir release (60 MI/d)	Vyrnwy Reservoir release (75 MI/d)
Vyrnwy Reservoir release (148 MI/d)	River Vyrnwy Mitigation - Vyrnwy Bypass release (80 MI/d)
Vyrnwy Reservoir release (180 MI/d)	River Vyrnwy Mitigation – Vyrnwy Bypass release (155 MI/d)
Shrewsbury Redeployment (12 MI/d)	River Vyrnwy Mitigation – Vyrnwy Bypass release (180 MI/d)
Shrewsbury Redeployment (30 MI/d)	River Vyrnwy Mitigation – Shrewsbury Redeployment (25 MI/d)
Mythe abstraction reduction (15 MI/d)	Mythe abstraction reduction (15 MI/d)
Netheridge WwTW discharge diversion (35 MI/d)	Netheridge WwTW discharge diversion (35 MI/d) - Deerhurst Pipeline
River Wye to Deerhurst (60 MI/d)	Netheridge WwTW discharge diversion (35 MI/d) - Cotswold Canals
Minworth WwTW discharge diversion (115 MI/d)	Minworth WwTW discharge diversion (115 MI/d)

The preferred programme and reasonable alternative programmes set out in TW's WRMP19 included the following STT Source Supply Elements: Vyrnwy release; Shrewsbury redeployment; Mythe abstraction reduction; Netheridge WwTW discharge diversion and Minworth WwTW discharge diversion. These preferred programme and reasonable alternative programme options for STT proposed conveyance via the Deerhurst to Culham pipeline. TW's WRMP19 was only published in April 2020 following receipt of approval from the Secretary of State on 31 March 2020. Having regard

³ Clarified by RAPID as being Habitats Regulations Assessment.

⁴ Ofwat 3 April 2020 Strategic Regional Water Resource Solutions: Gate one assessment. Letter issued via email to Regulatory Directors of companies with strategic regional water resource solutions.

to the short timescale since the publication of this report, assessment of these selected and identified STT source supply elements with the STT SRO is appropriate. In addition to which the regulator requested that the Cotswold Canal 300MI/d conveyance option be reconsidered as an option as part of the gate-1 process. In consequence, these source supply and interconnector elements have been assessed as part of the STT SRO. As described further below regard has however also been given to updated information in relation to these elements.

As set out in **Table 1.1** above, further to discussions with STW a slight amendment to the availability of water from the Shrewsbury redeployment source support element has been made, and the possibility of water being sourced from the River Wye as was considered in TW's WRMP19 does not form part of this assessment at gate-1. A further conveyance route from Netheridge WwTW to the Cotswold Canal Interconnector has been added for assessment at the SRO stage and the pipeline routes from both Netheridge and Minworth WwTWs have been amended following further design work by STW.

Whilst the provision of regulation of up to 180 MI/d from the Vyrnwy Reservoir in mid-Wales to the River Severn system still forms part of the STT SRO the manner in which this water can enter the River Severn system has changed from that assessed in TW's WRMP19. In TW's WRMP19 water from the Vyrnwy Reservoir was assessed as being released from the reservoir down the River Vyrnwy at three different flow volumes, these being 60, 148 and 180 MI/d. In light of consultations undertaken during the development of TW's WRMP19 and further assessment work the amount of water that is now being proposed to be released from the Vyrnwy Reservoir down the River Vyrnwy has been limited to 75 MI/d. This reduction in the volume released down the River Vyrnwy from the reservoir has been undertaken in order to overcome concerns raised, especially by Natural Resources Wales (NRW), over potential adverse environmental effects on the River Vyrnwy immediately downstream of the Vyrnwy Reservoir. In consequence, as part of the STT SRO further feasibility work has been undertaken to identify alternative ways in which to deliver a total of 180 MI/d to the River Severn system from the Vyrnwy Reservoir. This alternative option (River Vyrnwy mitigation option) comprises the development of a raw water pipeline from the Vyrnwy Aqueduct upstream of Oswestry to the lower reaches of the River Vyrnwy, or into the River Severn.

Where new source support elements other than those identified and progressed through TW's WRMP19 have been identified, these elements (the River Vyrnwy Bypass pipeline elements) have been subject to high level environmental assessment screening. Further information regarding this is set out in Section 3 of this report.

1.1.1 Area under consideration

The area under consideration for the assessment of the STT System reflects the large spatial scope of the SRO option which includes specific areas of the River Thames catchment area (downstream of Culham), the River Severn catchment area (River Severn corridor, from the confluence with the River Vyrnwy to the Severn Estuary; Lake Vyrnwy Reservoir in Powys (Wales); the downstream River Vyrnwy catchment to the River Severn confluence and the Warwickshire River Avon) and part of the River Tame catchment (downstream of the Minworth sewage treatment works discharge).

1.2 Structure of this report

The report is divided into the following sections:

- Section 1: This introduction
- Section 2: Provides a background to the STT System;
- Section 3: Provides the methodology adopted for the SEA;
- Section 4: Provides the results of the high level screening of the Vyrnwy mitigation bypass pipeline options;
- Section 5: Provides the results of the individual STT Source Support Elements and the Interconnector elements;
- Section 6: Provides the results of the assessment of STT Scheme options (combined STT Source Support Elements and Interconnector elements); and
- Section 7: Conclusions and Recommendations to inform gate-2 assessments.

2 Severn to Thames Transfer System

2.1 Introduction

A STT Scheme that conveys raw water from the lower River Severn into the middle River Thames via an interconnector would increase the catchment area from which water resources can be drawn to the south-east of England. In addition to any flows that may be available to be abstracted under licence from the River Severn, a range of raw water Source Support Elements for the STT System have been identified to provide additional resource.

The STT System comprises 2 principal aspects:

1. An Interconnector to convey the water from the River Severn to the River Thames; and
2. STT Source Support Elements, these comprise water resources that can be added, or not abstracted (redeployed), from the rivers Vyrnwy, Severn and Avon.

In terms of the Interconnector there are two alternative options available. Firstly, a pipeline with a capacity of 300 MI/d, 400 MI/d or 500 MI/d. This involves the abstraction of water from the lower River Severn at Deerhurst, its treatment at a new water treatment plant and then the transferring of the water for discharge to the middle River Thames at Culham. The alternative option to the pipeline conveyance is for the transfer of raw water to be undertaken via the Cotswold canals. This option would require the restoration of the canals and the transfer of raw water from the River Severn into the Gloucester & Sharpness Canal at Gloucester Docks, the transfer of raw water from the Gloucester & Sharpness Canal to the restored Cotswold canals, the transfer of water from the restored Cotswold canals near Lechlade to a water treatment works and then a pipeline for conveyance to the River Thames near Culham.

In order for some of the STT Source Support Elements to be able to deliver the water into the STT System, there is a requirement for these water supplies to be replaced with other water sources. The provision of this additional water is covered under separate SROs that provide the facilities to enable supporting flows for the STT. These SROs are: STW Sources SRO, STW Minworth SRO, UU Sources SRO and UU Vyrnwy Aqueduct SRO.

The environmental effects of providing replacement water to the UU area to enable up to 180 MI/d of regulation to be provided from the Vyrnwy Reservoir in mid-Wales to the River Severn system have been assessed as part of the UU Sources and Vyrnwy Aqueduct SRO work. It is understood that whilst some 27 options for UU Sources are being proposed at gate-1 no preferred option(s) for providing this replacement water will be identified until gate-2. In consequence, at this stage it has not been possible to have regard to these potential environmental impacts when assessing the STT System effects as described in Section 6 of this report. Once the preferred option(s) have been determined these conclusions will be incorporated into the assessment conclusions. This will be undertaken during gate-2.

The environmental effects of up to 115 MI/d from Minworth WwTW, being diverted from the River Tame to the River Avon, has been assessed as part of the STW Minworth SRO work. These assessment details have been incorporated within the WFD, HRA and SEA assessment conclusions for the STT SRO and as such have been given full regard in the assessment of effects set out within this report.

The STT System comprises the STT SRO and the source SROs which would be required to work as a combined system to deliver the required outputs into the River Thames. **Figure 2.1** illustrates the scope of the STT system and the related UU and STW individual company, source-related elements.

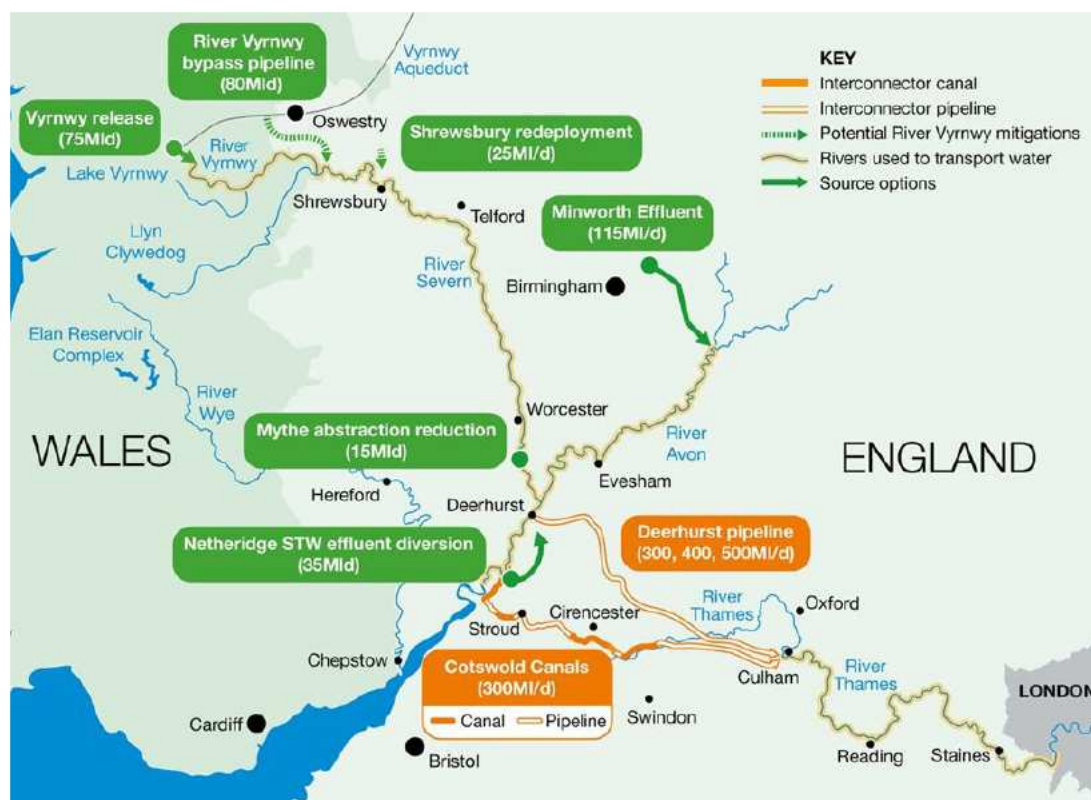


Figure 2.1: STT SRO key elements

In total, there are eight different STT Source Support Elements at a variety of different capacities that comprise the STT System (see Table 2.1). The current compensation release from the Vyrnwy Reservoir is 45 Mld. In consequence, element reference 1a represents the baseline position and as such has not been considered as a separate assessment.

Table 2.1 STT Source Support and Interconnector Elements

Element Ref	Element ID	Name
1a	VyrnwyRelease_45	Vyrnwy Reservoir release (45 Mld)
1b	VyrnwyRelease_75	Vyrnwy Reservoir release (75 Mld)
2a	MiddleVyrnwyBypass_80	River Vyrnwy Mitigation - Vyrnwy Bypass release (80 Mld)
2b	MiddleVyrnwyBypass_155	River Vyrnwy Mitigation – Vyrnwy Bypass release (155 Mld)
2c	VyrnwyBypass_180	River Vyrnwy Mitigation – Vyrnwy Bypass release (180 Mld)
3	ShrewsburyRedeployment_25	River Vyrnwy Mitigation – Shrewsbury Redeployment (25 Mld)
4	Mythe_15	Mythe abstraction reduction (15 Mld)
5a	NetheridgePipelineDeerhurst_35	Netheridge WwTW discharge diversion (35 Mld) - Deerhurst Pipeline
5b	NetheridgePipelineCotswold_35	Netheridge WwTW discharge diversion (35 Mld) - Cotswold Canals
6	Minworth_115	Minworth WwTW discharge diversion (115 Mld)
7a	DeerhurstPipeline_300	Pipeline conveyance, Deerhurst to Culham (300 Mld)
7b	DeerhurstPipeline_400	Pipeline conveyance, Deerhurst to Culham (400 Mld)
7c	DeerhurstPipeline_500	Pipeline conveyance, Deerhurst to Culham (500 Mld)
8	CotswoldCanals_300	Canal conveyance, including piping to Culham (300 Mld)

As part of the development of the STT Scheme, Jacobs undertook modelling of the STT Source Support Elements to determine the order in which the support elements would become operational for each of the Interconnector alternatives. This order was determined having regard to a number of factors including cost and resilience. The ordering of the support elements for both the Deerhurst to Culham pipeline conveyance and the Canal conveyance are set out in Table 2.2.

Table 2.2 STT Source Support Element Groupings

Pipeline conveyance		Canal conveyance	
Element Ref	Element ID	Element Ref	Element ID
7a	DeerhurstPipeline_300	8	CotswoldCanals_300
4	Mythe_15	4	Mythe_15
1b	VyrnwyRelease_75	5b	NetheridgePipelineCotswold_35
5a	NetheridgePipelineDeerhurst_35	1b	VyrnwyRelease_75
3	ShrewsburyRedeployment_25	3	ShrewsburyRedeployment_25
2a	MiddleVyrnwyBypass_80	2a	MiddleVyrnwyBypass_80
6	Minworth_115	6	Minworth_115

On the basis that the ordering of when the different STT Source Support Elements can become operational has been fixed through the work undertaken by Jacobs the environmental assessment of each of these support elements has had regard to the changing baseline position in terms of the receiving water environment. For example, when considering the introduction of the Shrewsbury Redeployment support element the assessment has regard that the water in the River Severn system would include the additional water being made available / provided by the: Mythe (15 MI/d); Vyrnwy release (75 MI/d); and Netheridge (35 MI/d) source support elements.

A more detailed description of each element is provided in the sections below.

2.2 Pipeline conveyance, Deerhurst to Culham (300, 400 and 500 MI/d) – element 7 a, b, and c

This element comprises a conveyance pipeline from Deerhurst on the River Severn to Culham on the River Thames initially with the unsupported flow from the River Severn system and then including for additional supported flows with a 300, 400 or 500 MI/d capacity and a total length [REDACTED]. The element includes all engineering works required to transfer the flow to the River Thames. This includes: a river intake structure at Deerhurst including inlet screens and a twin pipeline to a low lift pump station, a raw water low lift pump station and a twin pipeline to the water treatment works, treatment works, a treated water high lift pump station, a rising main, a break pressure tank at the high point, a gravity main to discharge, an outfall at Culham with an actuated valve and an aeration cascade, washouts along the route provided with permanent discharge pipework to adjacent watercourses.

2.3 Canal conveyance, including piping to Culham (300 MI/d) – element 8

The concept of canal conveyance is to utilise the historic infrastructure of the Cotswold Canals (Stroudwater Navigation and Thames and Severn Canals), in conjunction with the Gloucester and Sharpness Ship Canal and new pipeline, to transfer 300 MI/d water from the River Severn to the River Thames. Initially this conveyance element will make use of the unsupported flow from the River Severn system and will then include for additional supported flows with a 300 MI/d capacity. The engineering concept can be split into four broad segments:

1. River Severn (at Gloucester) to Summit Pound. The water will be abstracted from the River Severn at Gloucester via a low head pumping station and discharged into the Gloucester and Sharpness Ship Canal at the Gloucester Docks basin. Water will transfer by gravity along the operational Gloucester and Sharpness Ship Canal for abstraction at Saul Junction. At [REDACTED], water will be transferred by a series of [REDACTED] to Newtown Pound and via open channel transfer abstracted and transferred to Sapperton tunnel [REDACTED]. Long pounds in the existing canal will be used for flow transfer between the discharge structure of one rising main and the intake to the next. The pipe which constitutes each rising main will be laid in the towpath or canal bed or along adjacent roads.
2. Summit Pound. In this section water will be transferred through the existing but currently damaged Sapperton Tunnel, then along the remainder of the summit pound. This will be

- rehabilitated, both for the water transfer and to allow navigation.
3. Summit Pound to Lechlade. In this section water will be transferred downhill along the canal by gravity, until it meets the River Thames at or near Inglesham. Locks are by-passed by abstracting the transfer water uphill of the lock and transferring it in a short length of pipe to a discharge point just downhill of the lock. This bypass arrangement is required to enable the locks to be used for navigation during the transfer.
 4. Lechlade to Culham/ River Thames: Water will be processed at a new water treatment works and a pipeline will convey transfer flows to a discharge location at Culham. Pipeline diameters will be chosen to keep flow velocities below 2.5m/s, as required by Thames Water Asset Standard.

2.4 Mythe abstraction reduction (15 MI/d) – element 4

This element provides support to STT abstraction from the Severn catchment by redeploying 15 MI/d of the existing STW abstraction licence at its Mythe intake in the lower River Severn. This infrequently used licensed volume would remain in the River Severn for abstraction downstream at Deerhurst or Gloucester Docks by TW. The Mythe intake is located on the River Severn near Tewkesbury, [REDACTED] northeast of Deerhurst. STW has advised that no construction works would be required to redeploy the spare licence volume for abstraction by TW.

Additional resource may be required from Mythe to support the STT System. It is understood from STW that no specific additional resource to replace this current abstraction licence volume has been determined to date and would require consideration at gate-2. This assessment would be undertaken as part of the STW Sources SRO.

2.5 Vyrnwy Reservoir release (75 MI/d) – element 1b

This element comprises the release of 75 MI/d water from Lake Vyrnwy Reservoir, an existing reservoir in Mid Wales, into the River Vyrnwy (a tributary of the River Severn) for supporting flow in the River Severn for downstream re-abstraction from the River Severn at Deerhurst or Gloucester Docks (and subsequent transfer into the River Thames to supply TW as well as potentially other Water Companies). The reservoir is owned and operated by STW but predominately supplies water to UU who hold the abstraction rights for the reservoir and who have offered the water to TW when required.

As shown in **Table 2.2**, this element within the STT System would only become operational after the 15 MI/d of the licensed River Severn abstraction at Mythe has been made available. In consequence, this assessment has had regard to the water environment that includes for this additional water being made available for abstraction. Furthermore, to provide for this release of water to support the STT System from the Vyrnwy Reservoir, additional resource will be required within the UU operational area. This additional resource is subject to separate assessment under the UU Sources SRO.

2.6 Netheridge WwTW discharge diversion - element 5a and 5b

2.6.1 Netheridge WwTW discharge diversion, Deerhurst Pipeline (35 MI/d) – element 5a

Currently treated discharge from Netheridge WwTW is input to the upper Severn Estuary. It is proposed to divert a 35 MI/d portion of this treated discharge to a new outfall on the freshwater River Severn to support STT abstraction from the River Severn at Deerhurst. The outfall location to the River Severn has been identified, during studies undertaken at gate-1, to be located just downstream of the proposed intake from the River Severn at Deerhurst. The discharge diversion from Netheridge WwTW would be pumped by a new pumping station, located at the WwTW via a 700 mm diameter pipeline approximately [REDACTED] long.

WwTW discharge transfer for STT support would not be continuous, only discharging to the freshwater river outfall according to an operating regime when support is required to enable abstraction from the River Severn. The discharge would be a flow replacement for river water abstracted locally upstream. The element will result in a relocation of up to 35 MI/d.

As shown in **Table 2.2**, this element within the STT System would only become operational after both the Mythe abstraction reduction (15 MI/d) support element and the Vyrnwy Reservoir Release (75 MI/d)

support element have been made available. In consequence, this assessment has had regard to the water environment that includes for this additional water being made available for abstraction.

2.6.2 Netheridge WwTW discharge diversion, Cotswold Canals (35 MI/d) – element 5b

Currently treated discharge from Netheridge WwTW is input to the upper Severn Estuary. It is proposed to divert a 35 MI/d portion to a new outfall on the freshwater River Severn to support STT abstraction from the River Severn at Gloucester and Sharpness Canal. The discharge location is into the East Channel of the River Severn, just downstream of the proposed abstraction discharging to Gloucester & Sharpness Canal. The diversion from Netheridge WwTWs would be pumped by a new pumping station, located at the WwTWs via a 700 mm diameter pipeline approximately [REDACTED] long.

WwTW discharge transfer for STT support would not be continuous, only discharging to the freshwater river outfall according to an operating regime when support is required to enable abstraction from the River Severn. The discharge would be a flow replacement for river water abstracted locally upstream. The element will result in a relocation of up to 35 MI/d.

As shown in **Table 2.2**, this element within the STT System would only become operational after the Mythe abstraction reduction (15 MI/d) support element has been made available. In consequence, this assessment has had regard to the water environment that includes for this additional water being made available for abstraction.

2.7 River Vyrnwy Mitigation

Sustained high volume releases from the Vyrnwy Reservoir into the River Vyrnwy in support of the STT System has been identified as being of particular concern by NRW. A number of potential mitigation measures have been investigated to overcome potential unacceptable environmental impacts on the River Vyrnwy yet still providing up to 180 MI/d from the Vyrnwy Reservoir. One option is to suspend the abstraction licence at Shrewsbury, which would have a commensurate reduction of up to 25 MI/d in supply from Vyrnwy Reservoir, as Shrewsbury would then be supplied from the Vyrnwy Reservoir. A further mitigation option is the development of a River Vyrnwy Bypass pipeline that will be capable of transferring part of the Lake Vyrnwy Reservoir raw water releases from the Vyrnwy Aqueduct into the lower reaches of the River Vyrnwy or after its confluence with the River Severn.

As part of the Lake Vyrnwy Reservoir source, four potential source supply elements that could be used as environmental mitigation for Lake Vyrnwy Reservoir regulation releases directly into the River Vyrnwy have been identified. These being:

1. River Vyrnwy Mitigation - Shrewsbury redeployment (25 MI/d)
2. River Vyrnwy Mitigation – Vyrnwy Bypass release (80 MI/d)
3. River Vyrnwy Mitigation – Vyrnwy Bypass release (155 MI/d)
4. River Vyrnwy Mitigation – Vyrnwy Bypass release (180 MI/d)

2.7.1 Shrewsbury redeployment (25 MI/d) – Element 3

This element comprises additional redeployment of the existing River Severn abstraction at Shrewsbury, which will require the construction of a number of booster and pumping stations and process enhancements at Shelton water treatment works (WTW). Abstraction at Shrewsbury currently serves STW customers in Shrewsbury and Oswestry. UU and WwTW have offered to provide a supply to both Shrewsbury and Oswestry from Lake Vyrnwy Reservoir using the existing aqueduct and a new pipeline to Shrewsbury. This would reduce abstraction from the upper River Severn by 25 MI/d at Shrewsbury and leave water in the river for abstraction at Deerhurst or Gloucester Docks (and subsequent transfer into the River Thames to supply TW as well as potential other Water Companies).

As shown in **Table 2.2**, this element within the STT System would only become operational after the 75 MI/d Vyrnwy Reservoir Release support element, the 35 MI/d Netheridge WwTW discharge diversion support element, and the 15 MI/d Mythe support element, have been made available for abstraction at Deerhurst, or Gloucester Docks. In consequence, this assessment has had regard to the water environment that includes for this additional water being in the River Severn.

2.7.2 Vyrnwy Bypass release (80 MI/d) - element 2a

This element comprises a raw water pipeline which will transport up to 80 MI/d from the Vyrnwy Aqueduct (which feeds Oswestry WTW) to the lower reaches of the River Vyrnwy. The pipeline is a mitigation measure for the impact of a support release from Lake Vyrnwy Reservoir.

As shown in **Table 2.2**, this element within the STT System would only become operational after the 75 MI/d Vyrnwy Reservoir Release support element, the 35 MI/d Netheridge WwTW discharge diversion support element, the 25 MI/d Shrewsbury Redeployment support element and the 15 MI/d Mythe support element have been made available for abstraction at Deerhurst, or Gloucester Docks. In consequence, this assessment has had regard to the water environment that includes for all this additional water being in the River Severn.

The contribution of 25 MI/d from the abstraction reduction at Shrewsbury (element 3) and 75 MI/d from the Vyrnwy Reservoir release (element 1b), provides a total of 180 MI/d to the STT scheme from the Vyrnwy Reservoir.

2.7.3 Vyrnwy Bypass release (155 MI/d) – element 2b

This element comprises a raw water pipeline which will transport 155 MI/d from the Vyrnwy Aqueduct, (which feeds Oswestry WTW) to the River Vyrnwy. The pipeline is a mitigation measure for the impact of a support release from Lake Vyrnwy Reservoir.

Operationally, this element also includes a contribution of 25 MI/d from the abstraction reduction at Shrewsbury (element 3) to contribute a total of 180 MI/d to the STT scheme. In addition to the above support elements this option would only become operational after the 35 MI/d Netheridge WwTW discharge diversion support element and the 15 MI/d Mythe support element have been made available for abstraction at Deerhurst, or Gloucester Docks. In consequence, this assessment has had regard to the water environment that includes for all this additional water being in the River Severn.

2.7.4 Vyrnwy Bypass release (180 MI/d) – element 2c

This element comprises a raw water pipeline which will transport 180 MI/d from the Vyrnwy Aqueduct, (which feeds Oswestry WTW) to the River Severn. The pipeline is a mitigation measure for the impact of a support release from Lake Vyrnwy Reservoir.

This option would only become operational after the 35 MI/d Netheridge WwTW discharge diversion support element and the 15 MI/d Mythe support element have been made available for abstraction at Deerhurst, or Gloucester Docks. In consequence, this assessment has had regard to the water environment that includes for all this additional water being in the River Severn.

2.8 Minworth WwTW discharge diversion (115 MI/d) – Element 6

Currently treated discharge from STW's Minworth WwTW is input to the River Tame, a tributary of the River Trent. It is proposed to divert a 115 MI/d portion to a new outfall on the River Avon and hence into the River Severn catchment to support STT abstraction from the River Severn at Deerhurst or Gloucester Docks.

There would be a new extended treatment facility and pumping station at Minworth WwTW. The pipeline from Minworth WwTW to the River Avon outfall would be some [REDACTED] in length. The outfall location has been identified, during studies undertaken a gate-1, and would be located on the River Avon to the south of Warwick.

WwTW discharge transfer for STT support would not be continuous – only discharging to the River Avon according to an operating regime when support is required to enable abstraction from the River Severn. The discharge would be a regulating release augmenting flows in the downstream Rivers Avon and Severn to the STT abstraction location at Deerhurst or Gloucester Docks.

As shown in **Table 2.2**, this element within the STT System would only become operational after the 75 MI/d Vyrnwy Reservoir Release support element, the Vyrnwy 80 MI/d support element, the 35 MI/d Netheridge WwTW diversion support element, the 25 MI/d Shrewsbury Redeployment support element and the 15 MI/d Mythe support element have all been made available for abstraction at Deerhurst, or Gloucester Docks. In consequence, this assessment has had regard to the water environment that includes for this additional water being in the River Severn. Furthermore, the environmental effects of

up to 115 Ml/d from Minworth WwTW being diverted from the River Tame to the River Avon has formed part of this assessment.

3 Methodology

3.1 Methodology for Gate-1

3.1.1 Overall approach

The objective of SEA is to provide a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans with a view to promoting sustainable development.

The requirement for SEA was brought into legislation by the SEA Regulations⁵. These regulations transposed the requirements of EU Directive 2001/42/EC (the SEA Directive) into English legislation. Following Brexit, minor amendments, to correct deficiencies and terminology, were made to the SEA Regulations through the Environmental Assessments and Miscellaneous Planning (Amendment) (EU Exit) Regulations 2018.

It is recognised that the SEA approach can assist in the identification of likely significant environmental effects (positive and negative) of water resource components, both individually and in-combination, and that knowledge of these effects can help to identify preferred options and programmes of options.

Whilst it is acknowledged that there is no requirement for a statutory SEA with respect to SROs, adoption of some of the principles of SEA in the assessment of SROs can help inform decision-making by bringing different environmental considerations into one place. In the same way that a statutory SEA, is informed by the HRA and WFD assessments, the approach adopted to the environmental assessment approach for gate-1 has equally had regard to the assessment conclusions of the HRA and WFD assessment work that has been undertaken to inform the submission at gate-1.

The methodology adopted for the initial option-level environmental assessment uses a two-stage approach, based on the principles of SEA, consistent with that set out in the ACWG published guidance for environmental assessment methods for SROs. The two-stage approach has consisted of:

- (1) high level screening (only with respect to the new Vyrnwy mitigation bypass pipeline elements not identified for the STT Scheme at WRMP19) to highlight potential showstoppers, followed by
- (2) more detailed assessment using the SEA objectives, to identify key environmental risks that need to be addressed for each element and for each option (grouping of elements).

3.1.2 High Level Screening

The aim of the *high level screening* is to provide a rapid assessment of significant adverse effects, risks, benefits and disbenefits to support feasibility assessment.

It does not take the place of the detailed assessment, but rather supports its detail and understanding.

High level screening of elements (source supply and interconnector) that form the STT Scheme was undertaken during the development of STT options through TW's WRMP19. The preferred programme and reasonable alternative programmes set out in TW's WRMP19 included the following STT Source Supply Elements: Vyrnwy release; Shrewsbury redeployment; Mythe abstraction reduction; Netheridge WwTW discharge diversion and Minworth WwTW discharge diversion. These preferred programme and reasonable alternative programme options for STT proposed conveyance via the Deerhurst to Culham pipeline. TW's WRMP19 was only published in April 2020 following receipt of approval from the Secretary of State on 31 March 2020. Having regard to the short timescale since the publication of this report, assessment of these selected and identified STT source supply elements with the STT SRO is appropriate. In addition to which the regulator requested that the Cotswold Canal 300Ml/d conveyance

⁵ The Environmental Assessment of Plans and Programmes Regulations 2004 (Statutory Instrument 2004 No. 1633) apply to any plan or programme which relates solely or in part to England.

option be reconsidered as an option as part of the gate-1 process. In consequence, these source supply and interconnector elements have been assessed as part of the STT SRO.

As described in Sections 1 and 2 of this report new elements other than those identified and assessed in TW's WRMP19 have been identified to overcome potential adverse environmental effects from the release of large volumes of water from Lake Vyrnwy. These Vyrnwy bypass release options have therefore been subject to high level environmental assessment screening.

The high-level screening assessment of route options for the raw water pipeline, to transfer all or part of the Lake Vyrnwy releases to the lower reaches of the River Vyrnwy, or into the River Severn, has been undertaken using a Red-Amber-Green (RAG) approach to flag high environmental risk options to help support the site selection process.

The criteria adopted for the high-level screening of potential route options for the raw water pipeline, has followed the principles of SEA. Details on how the screening undertaken relates to the SEA topic areas listed in the SEA Regulations and the criteria considered under each of these topic areas are outlined further in **Annex A1**. These criteria have had regard to the approach to feasibility assessments adopted by water company WRMP19s as well as the approach set out in the WRSE Regional Plan SEA Scoping Report (September 2020). The assessment utilised a GIS-based system to help identify and map environmental constraints within the study area, comprising land between the Vyrnwy Aqueduct upstream of Oswestry and the upper reaches of the River Severn. A list of the datasets used in this assessment is provided in **Annex A2**.

An appraisal against each of the assessment criterion along with a written summary of the performance and overall conclusions was used to select the best performing conveyance options for raw water transfer. This selection, the conclusions of which are provided in Section 4 of this report, provided a short-list of further STT Source Support Elements for more detailed assessment.

The aim of the high-level screening was not to automatically exclude route options on the basis of identifying 'red' constraints but to identify those route options that would be affected by a significant number of constraints or risks to delivery if they were to be considered further.

3.1.3 Detailed Assessment

The two identified Interconnector elements, the STT Source Support Elements from TW's WRMP19 together with the further STT Source Support Elements shortlisted from the high-level screening exercise were then subject to more detailed assessment. In addition to these element assessments detailed assessments were also undertaken on potential STT Scheme options. These option assessments have been undertaken in order to assess the full scope of potential environmental effects of these various elements being combined and to ensure that in-combination effects are considered.

An objectives-led approach to SEA has become standard practice in the assessment of both WRMPs and Drought Plan (DPs). An objective-led approach to this environmental assessment has therefore been adopted. The establishment of SEA objectives are commonly derived from a review of baseline conditions and of relevant plans, programmes and policies. Key issues that were identified from a review of baseline conditions and of relevant plans, programmes and policies undertaken during TW's WRMP19, UU's WRMP19 and STW's WRMP19 have been reviewed as part of this assessment. These are summarised in **Annex A3**.

In undertaking this environmental assessment work the list of SEA objectives set out in Table 6.1 of the ACWG Strategic Environmental Assessment: Core Objective Identification report (October 2020) have been adopted. These SEA objectives were identified by the ACWG following a review of Water Company approaches to SEA and an updated assessment of legislation, policies and guidance. These SEA objectives were also set out in the environmental assessment methodology that was circulated to Regulators prior to the assessments being undertaken.

The gate-1 option-level environmental assessment has used SEA objectives to identify key environmental risks that need to be addressed for each option. The SEA objectives proposed by the ACWG have been adopted and these objectives form the basis against which the options have been assessed.

Regarding the STT SRO for gate-1, the principles of SEA, HRA and WFD have been adopted. The ACWG guidelines have been followed with regard to the approach to SEA. The approach adopted included for updates, such as in relation to carbon levels for assessing climatic factors, that were subsequently advised by the authors to the ACWG SEA methodology.

On the basis that the STT SRO includes water source options located in Wales, regard has also been given to relevant Welsh plans and policies including the Well-being of Future Generations (Wales) Act (2015), which includes a goal to develop a more resilient Wales, which is described as:

“a nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems that support social, economic and ecological resilience and the capacity to adapt to change (for example climate change).”

The key issues identified in **Anne A3** have also been used to create a number of key guide questions related to each SEA topic. These key guide questions have been used as prompts in the assessments to help ensure consistent and robust assessment for each of the SEA topic areas. As with the development of the SEA objectives the development of the guide questions has also drawn upon other sources of information including:

- the SEA guide questions set out in the WRSE Regional Plan SEA Scoping Report September 2020; and
- the SEA guide questions included in the SEAs of recent WRMPs.

The list of SEA topics, SEA objectives and associated key guide questions adopted for the SEA undertaken for the STT SRO are set out in **Table 3.1** below.

Table 3.1 SEA objectives and key indicator questions

SEA topic	SEA objective	Key guide questions
Biodiversity, flora and fauna	1.1 To protect designated sites and their qualifying features	<ul style="list-style-type: none"> • Is the option likely to affect the conservation status of any SPAs, SACs, Ramsar sites, SSSIs or National Nature Reserves? • Will it affect HRA compliance (taken from HRA assessment results)? • Will the option affect the marine environment, habitats and species (including MCZs and MPAs)? • Is the option likely to affect ancient woodland?
	1.2 To avoid a net reduction, and where possible enhance, in non-monetised natural capital assets	<ul style="list-style-type: none"> • Are there any opportunities for habitat creation or restoration and a net benefit/gain for biodiversity? • Will the option contribute to the loss or gain in habitat connectivity? • Does it protect, conserve and enhance biodiversity natural capital and the ecosystem services the natural capital provides (taken from the natural capital assessment results)?
	1.3 To protect and enhance biodiversity, priority habitats and species	<ul style="list-style-type: none"> • Will the option protect and enhance priority habitats and species / habitats and species of principal importance? • Will the option affect a priority habitat on the priority habitat inventory?
	1.4 To avoid and, where required, manage invasive and non-native species (INNS)	<ul style="list-style-type: none"> • Is there a possibility for INNS to be spread/ introduced? • Is there an opportunity to improve biodiversity value through removal of INNS?
	1.5 To meet WFD objectives relating to biodiversity	<ul style="list-style-type: none"> • Will it affect WFD compliance e.g. good ecological potential/status?
Soil	2.1 To protect and enhance the functionality, quantity and quality of soils, including the protection of high-grade agricultural land	<ul style="list-style-type: none"> • Will the option affect high grade agricultural land? • Will the option promote the efficient use of land? • Will the option prevent soil erosion and retain soil stocks as a natural resource? • Will the option involve use of brownfield or greenfield land? • Is the option likely to affect SSSIs of geological importance?
Water	3.1 To minimise or manage flood risk, taking climate change into account	<ul style="list-style-type: none"> • Is the option vulnerable to flood risk? • Will the option contribute to the risk of flooding? • Will the option protect and enhance the environmental resilience of the water environment to climate change, flood risk and drought?
	3.2 To enhance or maintain groundwater quality and resources	<ul style="list-style-type: none"> • Will the option affect groundwater quality or quantity?

SEA topic	SEA objective	Key guide questions
	3.3 To enhance or maintain surface water quality, flows and quantity	<ul style="list-style-type: none"> Will the option affect surface water quality or quantity?
	3.4 To meet WFD objectives	<ul style="list-style-type: none"> Is the option likely to contribute to or conflict with the achievement of WFD objectives (taken from the WFD assessment results)?
	3.5 To improve water efficiency through provision of access to a resilient and sustainable supply of water.	<ul style="list-style-type: none"> Does the option provide a reliable and sustainable water supply which meets changing demand?
Air	4.1 To minimise air emissions during construction and operation	<ul style="list-style-type: none"> Is the option in an air quality management area (AQMA)? Will the option affect local air quality?
Climatic Factors	5.1 To introduce climate mitigation where required and improve the climate resilience of assets and natural systems	<ul style="list-style-type: none"> Is there potential for the option to incorporate climate mitigation measures to reduce its carbon footprint, such as lower embodied carbon or incorporating renewable energy? Is the option vulnerable to climate change effects? Does the option include climate resilience measures?
	5.2 To minimise embodied and operational emissions	<ul style="list-style-type: none"> Will the option affect carbon or other greenhouse gas (GHG) emissions? Will the option minimise energy demand during construction and operation?
Landscape	6.1 To conserve, protect and enhance landscape and townscape character and visual amenity	<ul style="list-style-type: none"> Will the option have an effect on the character of the landscape or townscape, including views? Will the option improve access to the countryside? Will the option create or improve green infrastructure which contributes to access to the landscape? Will the option protect and enhance designated landscapes and features? Will the option affect visual amenity?
Historic Environment	7.1 To conserve/protect and enhance historic assets/cultural heritage and their setting, including archaeological important sites	<ul style="list-style-type: none"> Will the option affect designated historic assets, sites and features? Will the option affect the setting and/or significance of a historic asset? Will the option affect archaeological important sites?
Population and Human Health	8.1 To maintain and enhance the health and wellbeing of the local community, including economic and social wellbeing	<ul style="list-style-type: none"> Will the option allow for economic development? Will the option provide employment opportunities? Will the option affect road or rail infrastructure? Will the option minimise disturbance from noise, light, visual, and transport? Will the option affect the local area in terms of noise emissions?
	8.2 To maintain and enhance tourism and recreation	<ul style="list-style-type: none"> Will the option have an effect on active lifestyles, such as impacts on active travel through disruption to pedestrian and cycle routes? Will the option affect Public Rights of Way? Will the option maintain or enhance tourism? Will the option affect water resources that are used to provide tourist facilities?
	8.3 To secure resilient water supplies for the health and wellbeing of customers	<ul style="list-style-type: none"> Will the option secure resilient water supplies for the health and wellbeing of customers? Does the option promote water efficiency and encourage a reduction in water consumption?
	8.4 To increase access and connect customers to the natural environment, provide education or information resources for the public	<ul style="list-style-type: none"> Does the option improve access to the natural environment for recreation, including those living within deprived areas?
Material Assets	9.1 To minimise resource use and waste production	<ul style="list-style-type: none"> Will the option minimise the use of resources? Will the option minimise the production of waste?
	9.2 To avoid negative effects on major built assets and infrastructure	<ul style="list-style-type: none"> Will the option reuse existing infrastructure? Will the option affect major built assets and infrastructure, including transport infrastructure?

As can be seen from **Table 3.1** the SEA is informed by the results of the HRA and WFD assessments undertaken. In particular the HRA assessment results help inform the assessment of objectives related to biodiversity, flora and fauna whilst the WFD assessment results help to inform the assessment of objectives 1.5 and 3.4. Furthermore, the natural capital and biodiversity assessments undertaken as part of the SRO have assisted the conclusions reached in terms of the SEA topic area of biodiversity, flora and fauna.

As well as the baseline being used to inform the SEA objectives it is also important in helping to determine the effects of the proposed options. The ACWG document entitled 'WRMP environmental assessment guidance and applicability with SROs' states that: *"it is envisaged that, the majority of the front-end SRO environmental assessment(s) required for gate-1 would be carried out using a GIS-based system to allow for rapid assessment of multiple options"*. The gate-1 option-level environmental assessment has utilised a GIS-based system to help identify and map environmental constraints within the study area. The datasets used in this detailed assessment, as provided in **Annex A4**, have been updated from those used in the WRMP19 assessments to reflect the current baseline. Figures that illustrate the baseline environment with regard to environmental constraints in proximity to the STT SRO Scheme are provided in **Annex A5**.

The results of the SEA assessments, for each element (interconnector and source supply elements) and each option (groups of elements) for the STT SRO, are presented in output tables, which reflects the SEA outputs set out in Table A.1 of the ACWG guidelines. The SEA detailed assessment table that has been adopted in the assessment of the STT SRO is provided in **Annex A6**. Further details and explanation on the content of the detailed SEA assessment output tables is provided below.

The first and second columns of the assessment output table set out the SEA topics and objectives. The third and fourth columns provide the assessment results, positive and negative effects, during the construction phase and the fifth and sixth columns provide the positive and negative effects, during the operational phase. These assessment results have regard to embedded mitigation (mitigation measures identified as part of the proposed scheme subject to assessment) that have been costed into the design of the element / option. For assessment purposes embedded mitigation includes best practice mitigation and any additional specific mitigation included as part of option design as set out in the conceptual design reports (CDR) for each of the STT SRO elements and options.

In line with best practice the negative and positive effects are assessed separately for each objective and are not aggregated or "netted off" in any way. This approach has been adopted to maintain transparency of negative and positive effects.

The seventh column provides commentary and evaluation of the effects of the element / option on the SEA objective, with reference to the guide questions (outlined in **Table 3.1**). This commentary is split into construction and operational aspects and outlines the key details that underpin the assessment against that SEA objective, providing transparency as to how the significance of effects has been determined.

The eighth column provides details of any further measures to mitigate adverse effects or enhance beneficial effects that are recommended but not committed to as part of the proposed scheme. The residual negative and positive effects (after application of further mitigation measures) during construction are identified in the ninth and tenth columns respectively. Whilst the eleventh and twelfth columns provide the residual positive and negative effects, during the operational phase.

The assessment of the elements, and subsequently the overall STT SRO options has been carried out applying the SEA assessment significance ratings shown in **Table 3.2**.

Table 3.2 Significance ratings

Effect Description

+++	Major Positive
++	Moderate Positive
+	Minor Positive
0	Neutral
-	Minor Negative
--	Moderate Negative
---	Major Negative
?	Uncertain

The definitions for the significance of effects are provided in **Annex A7**, and have had regard both to those set out in Table B.1 of the ACWG guidance, although in order to be consistent with the WRSE regional plan have been updated, for example, to reflect consideration of INNS and a revised carbon threshold scale. The assessment conclusions also consider the sensitivity of the environmental receptor and magnitude of the effect, the latter of which is a factor of the scale of effect, whether the effects arise in the short, medium or long term, and whether the effects are permanent or temporary.

Where qualitative and/or quantitative information was available (e.g. as identified by the HRA or WFD assessment process, conceptual design information, public domain datasets including GIS datasets), this has been used to inform the assessment. Objectives or key guide questions that were not supported by available data or information have been evaluated using spatial analysis, professional judgement and applicable assessment guidelines relating to that topic/objective.

The SEA process has been applied to test the performance of the STT elements and options against environmental objectives to see how far they meet these objectives. This approach enables the environmental performance of these STT elements and options to be used to inform decision-making.

With regard to in-combination effects, there is no specific requirement to undertake a full cumulative effects assessment at gate-1, and indeed at this stage in the absence of outputs from the regional plans and clarity as to which SRO schemes may proceed or not through to gate-2 such an assessment would be of limited value. However, in accordance with the guidance in Ofwat's PR19 Final Determination regard has been given to the in-combination effects of the STT Source Support Elements as they each become operational as well as the in-combination effects of the STT elements within the defined STT options.

As noted in Section 2 of this report Jacobs undertook modelling of the STT Source Support Elements to determine the order in which the support elements would become operational for each of the Interconnector alternatives. In consequence, the SEA of each of the STT Source Support Elements has had regard to the in-combination effects on the water environment of adding each further source of water. For example, when assessing the introduction of the Shrewsbury Redeployment support element the assessment has taken into account that the water in the River Severn system would include the additional water being made available / provided by the: Mythe (15 Ml/d); Vrynwy release (75 Ml/d); and Netheridge (35 Ml/d) source support elements. In terms of the option assessments whilst it is understood that there will be no cumulative construction effects of different elements being constructed at the same time consideration in the assessments has been given to the in-combination effects of all the source support elements and the interconnector element being operational at the same time.

An assessment of the likely significant environmental effects of the STT SRO in combination with those of other relevant plans, programmes or projects, including the regional water resource plans, WRMPs, DPs and other major plans, programmes and projects will be undertaken for gate-2.

3.1.4 Limitations of the study

SEA is a strategic assessment aimed at highlighting potential environmental concerns. The environmental data used in this assessment are based on those that are readily available from existing sources. Limitations in undertaking this SEA included the requirement to rely on conceptual designs

appropriate to the development of the SRO scheme for gate-1 and which therefore have a lower level of detail to inform assessment of very specific impacts on specific receptors. Assessment of impacts is necessarily limited when, for example, pipeline routes are at the outline conceptual design stage only.

The level of detail used in the environmental assessments produced for gate-1 submission is consistent with the strategic nature of SEA and the outline level of detail of the STT elements and options at gate-1. The scope of the assessment has not strayed into the statutory Environmental Impact Assessment (EIA) process which is a detailed project-level assessment using detailed design information. Such detailed information will not be available for the STT SRO until later in the RAPID gated process. For example, assessment of the potential impacts on protected species will be carried out as the option is taken forward for detailed design and environmental surveys are carried out for protected species to inform the assessments. This approach is supported in national guidance⁶ on SEA. It is recognised that if schemes are progressed, there would be more detailed assessment work (including EIA where relevant) to support the detailed design as well as any subsequent planning application and that further engagement with stakeholders would be undertaken during this period.

Where particular limitations or outstanding issues are known, these are described in the SEA output assessment table for the relevant element / option concerned.

⁶ For example the ODPM guidance on SEA.

4 High level screening of the Vyrnwy mitigation bypass pipeline options

4.1 Introduction

During the assessment of the STT option as part of TW's WRMP19 concerns were identified, particularly by NRW, over potential impacts of additional releases on the fish community of the River Vyrnwy downstream of the reservoir and upstream of the confluence with the River Banwy.

As part of the development of the STT SRO up to gate-1 mitigation options to the delivery of up to 180 Ml/d from the Vyrnwy Reservoir to the STT System have been investigated and identified (see section 2.7). A further mitigation option to that considered during TW's WRMP19 is the development of a River Vyrnwy Bypass pipeline that will be capable of transferring part of the Lake Vyrnwy Reservoir raw water releases from a branch off from the Vyrnwy raw water mains between Llanforda open reservoir and Oswestry WTW to the west of Oswestry via a new pipeline into the lower reaches of the River Vyrnwy or after its confluence with the River Severn.

Seven potential route options for this River Vyrnwy Bypass pipeline were identified by UU and are represented in **Figure 4.1** and **Table 4.1** below.

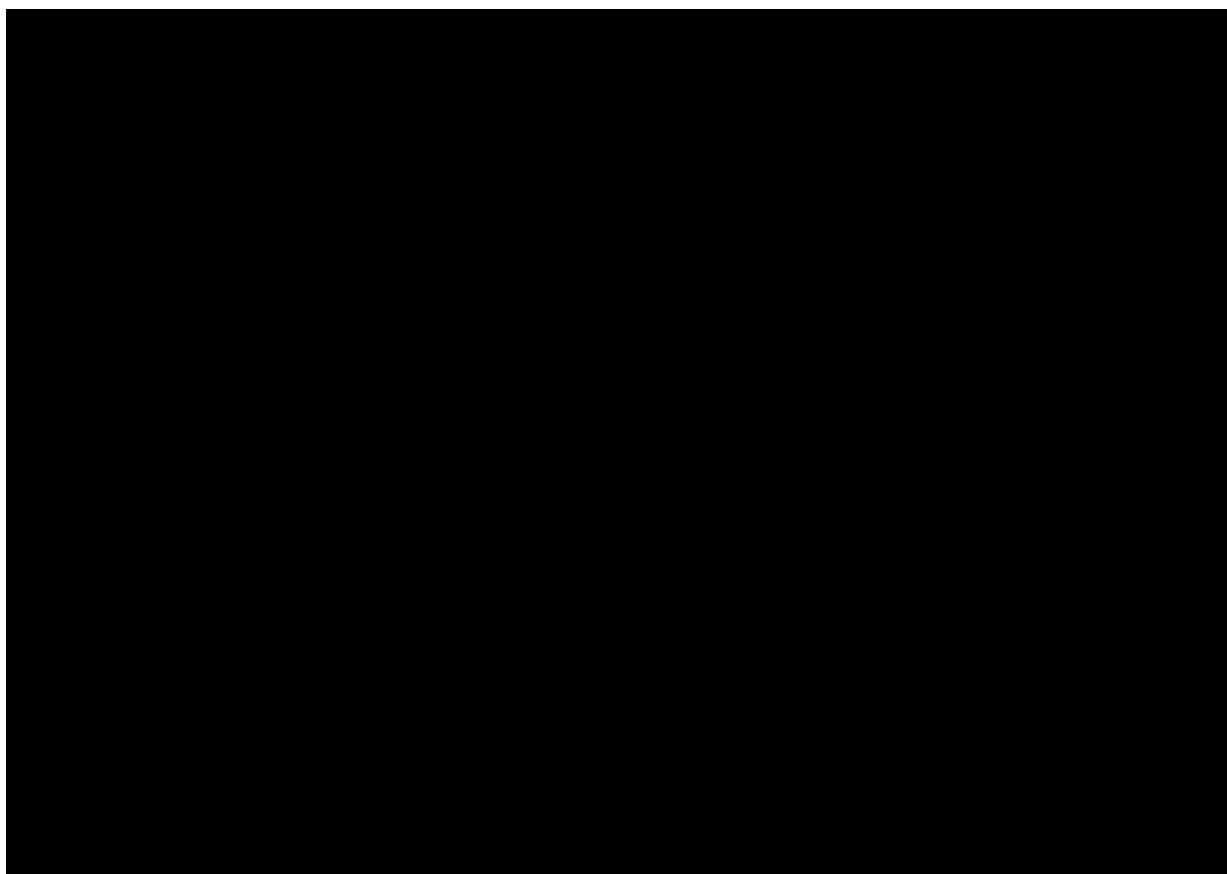


Figure 4.1: Vyrnwy Bypass route options

Table 4.1 Vyrnwy Bypass route options subject to high level screening

Option Ref	Option name	Option description
1	Vyrnwy Mitigation - Middle Vyrnwy release	Branch off from the Vyrnwy raw water mains between Llanforda open reservoir and Oswestry WTW to the west of Oswestry, [REDACTED] of pipeline. Outfall to the Middle Vyrnwy just upstream of the confluence with the River Tanat.
2	Vyrnwy Mitigation - Lower Vyrnwy release	Branch off from the Vyrnwy raw water mains between Llanforda open reservoir and Oswestry WTW to the west of Oswestry, [REDACTED] of pipeline. Outfall to the Lower Vyrnwy to the south east of Llanymynech.
3	Vyrnwy Mitigation - Lower Vyrnwy release	Branch off from the Vyrnwy raw water mains between Llanforda open reservoir and Oswestry WTW to the west of Oswestry, [REDACTED] of pipeline. Outfall to the Lower Vyrnwy just downstream of the confluence with the River Morda.
4	Vyrnwy Mitigation - – Vyrnwy Bypass release	Branch off from the Vyrnwy raw water mains between Llanforda open reservoir and Oswestry WTW to the west of Oswestry, [REDACTED] of pipeline. Outfall to the River Severn approximately [REDACTED] south east of Ponthen.
5	Vyrnwy Mitigation - Lower Vyrnwy release	Branch off from the Vyrnwy raw water mains between Llanforda open reservoir and Oswestry WTW to the west of Oswestry, [REDACTED] of pipeline. Outfall to the Lower Vyrnwy approximately [REDACTED] south east of Llanymynech.
6	Vyrnwy Mitigation - Lower Vyrnwy release	Branch off from the Vyrnwy raw water mains between Llanforda open reservoir and Oswestry WTW to the west of Oswestry, [REDACTED] of pipeline. Outfall to the Lower Vyrnwy approximately [REDACTED] north west of Crosslanes.
7	Vyrnwy Mitigation – Vyrnwy Bypass release	Branch off from the Vyrnwy raw water mains between Llanforda open reservoir and Oswestry WTW to the west of Oswestry, [REDACTED] of pipeline. Outfall to the River Severn approximately [REDACTED] south east of Ponthen.

A feasibility report on these potential options was undertaken by Jacobs. As part of this feasibility report a high-level environmental screening assessment of route options for the raw water pipeline was undertaken. This high-level screening assessment adopted a RAG approach (see section 3.1.2) to flag high environmental risk options. To help integrate the principles of SEA in the development of potential options this screening approach considered environmental topic areas covered by the SEA Regulations, such landscape, air etc.

This approach of adopting the principles of SEA has been undertaken since it is recognised that the SEA approach can assist in the identification of likely significant environmental effects (positive and negative) of water resource components, and that knowledge of these effects at an early stage can help to identify preferred options and programmes of options. It is also recognised that adopting these principles should assist later assessment stages and the SEA assessments that will be undertaken in support of regional plans and subsequent WRMPs.

The objective of the high-level screening was to identify those route options that would be affected by a significant number of constraints or risks to delivery if they were to be considered further. The appraisal against each of the assessment criterion was used to select the best performing conveyance options for the raw water pipeline. The short-list conveyance route options identified were then taken forward for further detailed assessment.

4.1.1 RAG results

The RAG assessments for each of the seven potential raw water pipeline route options are provided in **Annex A8**. A summary of the results is presented in **Table 4.2**.

Table 4.2 Summary of High-Level Screening Assessment Results

Option		RAG Rating per SEA Topic Area							
Ref	Name	Biodiversity –Flora and Fauna	Soil	Water	Air	Historic Environment	Landscape	Material Assets	Population/ Human Health
1	Vyrnwy Mitigation - Middle Vyrnwy release								
2	Vyrnwy Mitigation - Lower Vyrnwy release								
3	Vyrnwy Mitigation - Lower Vyrnwy release								
4	Vyrnwy Mitigation - – Vyrnwy Bypass release								
5	Vyrnwy Mitigation - Lower Vyrnwy release								
6	Vyrnwy Mitigation - Lower Vyrnwy release								
7	Vyrnwy Mitigation – Vyrnwy Bypass release								

The high-level RAG assessment screening of the seven potential routes identified three potential options with no red rated criteria. These being:

- Option 5 - Vyrnwy Mitigation - Lower Vyrnwy release;
- Option 6 - Vyrnwy Mitigation - Lower Vyrnwy release; and
- Option 7 - Vyrnwy Mitigation – Vyrnwy Bypass release

Two of the options (options 5 and 6) proposed discharges into the River Vyrnwy whilst option 7 proposed a discharge into the River Severn.

In light of the concerns previously expressed by NRW with regards to the potential impacts of additional releases on, in particular, the fish community of the River Vyrnwy more detailed assessment of option 7 is proposed on the basis that this route option avoids discharges into the River Vyrnwy.

The high-level screening assessment results with respect to route options 5 and 6 identified similar results for all assessment topic areas with green ratings identified for the topics of air and landscape and amber ratings for the other topic areas. However, on the basis that route option 6 would involve crossing some 4.3km of flood zone 3 upon its approach to the discharge location on the River Vyrnwy and would require a longer conveyance length it was concluded that route option 5 was the better performing option of these two potential routes. In consequence, pipeline route options 5 and 7 were identified to be taken forward for more detailed assessment.

As part of the River Vyrnwy Bypass pipeline feasibility report consideration was also given to a range of potential pipeline flows, of between 60 MI/d and 180 MI/d. At these potential discharge flows it was assessed within the feasibility report that there may be WFD compliance issues at the higher level of discharge volumes at the option 5 discharge location into the River Vyrnwy. In consequence it was determined that detailed assessment would consider two potential flow discharge rates (80 MI/d and 155 MI/d) at the option 5 discharge location into the River Vyrnwy and one flow discharge rate (180 MI/d) at the option 7 discharge location into the River Severn.

5 Element assessments

5.1 Introduction

The STT Source Support Elements and Interconnector elements within the STT System are presented in **Table 5.1**. The current compensation releases from the Vyrnwy Reservoir comprise 45 Ml/d, and therefore element reference 1a represents the baseline position. In consequence, this element has not been considered as a separate element assessment. All other STT Source Support Elements and Interconnector elements presented in **Table 5.1** have been individually assessed.

Table 5.1 STT Elements

Element Ref	Element ID	Name
1a	VyrnwyRelease_45	Vyrnwy Reservoir release (45 Mld)
1b	VyrnwyRelease_75	Vyrnwy Reservoir release (75 Mld)
2a	MiddleVyrnwyBypass_80	River Vyrnwy Mitigation - Vyrnwy Bypass release (80 Mld)
2b	MiddleVyrnwyBypass_155	River Vyrnwy Mitigation – Vyrnwy Bypass release (155 Mld)
2c	VyrnwyBypass_180	River Vyrnwy Mitigation – Vyrnwy Bypass release (180 Mld)
3	ShrewsburyRedeployment_25	River Vyrnwy Mitigation – Shrewsbury Redeployment (25 Mld)
4	Mythe_15	Mythe abstraction reduction (15 Mld)
5a	NetheridgePipelineDeerhurst_35	Netheridge WwTW discharge diversion (35 Mld) - Deerhurst Pipeline
5b	NetheridgePipelineCotswold_35	Netheridge WwTW discharge diversion (35 Mld) - Cotswold Canals
6	Minworth_115	Minworth WwTW discharge diversion (115 Mld)
7a	DeerhurstPipeline_300	Pipeline conveyance, Deerhurst to Culham (300 Mld)
7b	DeerhurstPipeline_400	Pipeline conveyance, Deerhurst to Culham (400 Mld)
7c	DeerhurstPipeline_500	Pipeline conveyance, Deerhurst to Culham (500 Mld)
8	CotswoldCanals_300	Canal conveyance, including piping to Culham (300 Mld)

As set out in Section 2 of this report the order in which the STT Source Support Elements become operational has been determined following modelling work undertaken by Jacobs. In consequence, the environmental assessment of each of these support elements has had regard to a changing baseline position (as each support option flow becomes available) in terms of the receiving water environment.

5.2 Element assessment results

The assessment conclusions during construction and operation for each objective have been determined firstly after application of embedded mitigation measures included in the conceptual design (and cost) of each scheme and then subsequently having regard to the application of potential further mitigation measures.

The mitigation included as embedded mitigation in the assessments has been developed through interaction between the engineering and environmental teams through the work undertaken leading to the gate-1 submission. The mitigation measures identified as embedded mitigation have been shared with the engineering team for inclusion in the CDRs. These mitigation measures have been costed for in the design and thus have been taken into account in the assessment of likely environmental effects. Where, even after the consideration of these embedded mitigation measures, these assessments have identified potential environmental effects regard has been given to further mitigation measures. These are measures that, although have not been costed for as yet, could be undertaken and implemented in order to reduce or overcome negative effects or increase positive effects.

The SEA findings of these individual elements are provided in **Annex A9**. The assessment conclusions during the construction and operational phases of each element after consideration of embedded mitigation are summarised below using a colour-coded visual evaluation summary matrix (**Table 5.2**). The colours in the table reflect the level of significance of the effect as set out in **Table 3.2**. The assessment conclusions during the construction and operational phases of each element after

consideration of further potential mitigation measures are summarised below using a colour-coded visual evaluation summary matrix (**Table 5.3**).

Table 5.2 SEA Assessment Summary Element Matrix after embedded mitigation

Elements			SEA Topics and Objectives																					
			Biodiversity , flora & fauna					Soil	Water					Air	Climatic Factors		Landscape	Historic	Population and Human Health				Material Assets	
			1.1	1.2	1.3	1.4	1.5	2.1	3.1	3.2	3.3	3.4	3.5	4.1	5.1	5.2	6.1	7.1	8.1	8.2	8.3	8.4	9.1	9.2
1b Vyrnwy Reservoir release	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
2a River Vyrnwy Mitigation - Vyrnwy release	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
2b River Vyrnwy Mitigation – Vyrnwy Bypass release	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
2c River Vyrnwy Mitigation –	Construction Effects	+ve																						
		-ve																						

Elements			SEA Topics and Objectives																					
			Biodiversity , flora & fauna					Soil	Water					Air	Climatic Factors		Landscape	Historic	Population and Human Health				Material Assets	
			1.1	1.2	1.3	1.4	1.5	2.1	3.1	3.2	3.3	3.4	3.5	4.1	5.1	5.2	6.1	7.1	8.1	8.2	8.3	8.4	9.1	9.2
Vyrnwy Bypass release	Operational Effects	+ve																						
		-ve																						
3 River Vyrnwy Mitigation – Shrewsbury Redeployment	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
4 Mythe abstraction reduction	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
5a Netheridge WwTW discharge diversion - Deerhurst Pipeline	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
		+ve																						

Elements			SEA Topics and Objectives																					
			Biodiversity , flora & fauna					Soil	Water					Air	Climatic Factors		Landscape	Historic	Population and Human Health				Material Assets	
			1.1	1.2	1.3	1.4	1.5	2.1	3.1	3.2	3.3	3.4	3.5	4.1	5.1	5.2	6.1	7.1	8.1	8.2	8.3	8.4	9.1	9.2
5b Netheridge WwTW discharge diversion - Cotswold Canals																								
	Construction Effects	-ve																						
	Operational Effects	+ve																						
-ve																								
6 Minworth WwTW discharge diversion	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
7a Pipeline conveyance, Deerhurst to Culham	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
7b Pipeline conveyance, Deerhurst to Culham	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						

Elements			SEA Topics and Objectives																					
			Biodiversity , flora & fauna					Soil	Water					Air	Climatic Factors		Landscape	Historic	Population and Human Health				Material Assets	
			1.1	1.2	1.3	1.4	1.5	2.1	3.1	3.2	3.3	3.4	3.5	4.1	5.1	5.2	6.1	7.1	8.1	8.2	8.3	8.4	9.1	9.2
7c Pipeline conveyance, Deerhurst to Culham	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
8 Canal conveyance, including piping to Culham	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						

Table 5.3 SEA Assessment Summary Element Matrix after further mitigation

Elements			SEA Topics and Objectives																					
			Biodiversity, flora & fauna					Soil	Water					Air	Climatic Factors		Landscape	Historic	Population and Human Health				Material Assets	
			1.1	1.2	1.3	1.4	1.5	2.1	3.1	3.2	3.3	3.4	3.5	4.1	5.1	5.2	6.1	7.1	8.1	8.2	8.3	8.4	9.1	9.2
1b Vyrnwy Reservoir release	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
2a River Vyrnwy Mitigation - Vyrnwy release and Bypass	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
2b River Vyrnwy Mitigation – Vyrnwy Bypass release	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
		+ve																						

Elements			SEA Topics and Objectives																					
			Biodiversity, flora & fauna					Soil	Water					Air	Climatic Factors		Landscape	Historic	Population and Human Health				Material Assets	
			1.1	1.2	1.3	1.4	1.5	2.1	3.1	3.2	3.3	3.4	3.5	4.1	5.1	5.2	6.1	7.1	8.1	8.2	8.3	8.4	9.1	9.2
2c River Vyrnwy Mitigation – Vyrnwy Bypass release	Construction Effects	-ve																						
	Operational Effects	+ve																						
		-ve																						
3 River Vyrnwy Mitigation – Shrewsbury Redeployment	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
4 Mythe abstraction reduction	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
5a Netheridge WwTW discharge	Construction Effects	+ve																						
		-ve																						

Elements			SEA Topics and Objectives																					
			Biodiversity, flora & fauna					Soil	Water					Air	Climatic Factors		Landscape	Historic	Population and Human Health				Material Assets	
			1.1	1.2	1.3	1.4	1.5	2.1	3.1	3.2	3.3	3.4	3.5	4.1	5.1	5.2	6.1	7.1	8.1	8.2	8.3	8.4	9.1	9.2
diversion - Deerhurst Pipeline	Operational Effects	+ve																						
		-ve																						
5b Netheridge WwTW discharge diversion - Cotswold Canals	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
6 Minworth WwTW discharge diversion	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
7a Pipeline conveyance, Deerhurst to Culham	Construction Effects	+ve																						
		-ve																						
		+ve																						

Elements			SEA Topics and Objectives																					
			Biodiversity, flora & fauna					Soil	Water					Air	Climatic Factors		Landscape	Historic	Population and Human Health				Material Assets	
			1.1	1.2	1.3	1.4	1.5	2.1	3.1	3.2	3.3	3.4	3.5	4.1	5.1	5.2	6.1	7.1	8.1	8.2	8.3	8.4	9.1	9.2
	Operational Effects	-ve																						
	Construction Effects	+ve																						
7b Pipeline conveyance, Deerhurst to Culham	Operational Effects	+ve																						
		-ve																						
7c Pipeline conveyance, Deerhurst to Culham	Operational Effects	+ve																						
		-ve																						
8 Canal conveyance, including piping to Culham	Operational Effects	+ve																						
		-ve																						
	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						

A summary of the key environmental effects of each of the STT elements after embedded mitigation measures have been considered are provided below. The potential effects of undertaking the further mitigation measures identified in the SEA assessment output tables is discussed at the end of each element assessment.

5.2.1 Vyrnwy Reservoir release (75 Mld)

This element has major and moderate negative and major positive effects, after consideration of currently embedded mitigation measures.

Major negative effects include:

- Potential impact on WFD compliance during operation associated with potential adverse effects on aquatic ecology in the River Vyrnwy, between Vyrnwy Reservoir and the confluence with the Banwy.

Moderate negative effects include:

- Potential effects on surface water flows during operation if flows were to coincide with other regulation releases from Vyrnwy Reservoir

Major positive effects are identified in respect of the provision of a substantial volume of reliable water supplies and improved resilience to the water supply system, which may help support economic and population growth. Furthermore, the scheme would reduce the vulnerability to climate change effects and consequently improve resilience to such effects.

The major and moderate negative effects identified with the currently costed for embedded mitigation measures could potentially be further mitigated to reduce effects to a minor negative or neutral effect through the implementation of further mitigation measures. These measures, which are proposed to be investigated further during gate-2, include:

- Further consideration of the operating regime, which could reduce the surface water flow effects to minor negative effects at all times of operation and potentially introduce hydro-ecological or flood management flow benefits; and
- Further consideration of the operating regime, which could ensure no effect on WFD status.

5.2.2 River Vyrnwy Mitigation - Vyrnwy Bypass release (80 Mld)

This element has some major and moderate negative and major and moderate positive effects after consideration of currently embedded mitigation measures.

Major negative effects include:

- Potential effects on surface water flows in the River Vyrnwy between the bypass outfall and the confluence with the Severn during operation if flows were to coincide with other regulation releases from Vyrnwy Reservoir
- Potential impact on WFD compliance during operation associated with potential adverse effects on aquatic ecology in the River Vyrnwy, between the bypass outfall and the confluence with the Severn.

Moderate negative effects include:

- Potential effects on the health and well-being of the local community during construction of the proposed development.

An uncertain effect relates to potential effects on climatic factors due to the expected level of operational carbon resulting from the proposed scheme. This effect is currently uncertain as the levels of construction and operational carbon from the development and operation of the scheme are currently unknown.

Major positive effects are identified in respect of the provision of a substantial volume of reliable water supplies and improved resilience to the water supply system, which may help support economic and population growth. The scheme would also reduce the vulnerability to climate change effects and

consequently improve resilience to such effects. A further moderate positive effect was identified with respect to potential economic opportunities during construction.

The major and moderate negative effects identified with the currently costed for embedded mitigation measures could potentially be further mitigated to reduce effects to a minor negative or neutral effect through the implementation of further mitigation measures. These measures, which are proposed to be investigated further during gate-2, include:

- Further consideration of the operating regime, which could reduce the surface water flow effects to minor negative effects at all times of operation;
- Further consideration of the operating regime and river investigations, which could ensure no effect on WFD status; and
- Sensitive siting of construction compounds, routing of construction traffic and limiting hours of working could reduce effects on the environment and amenity to a minor negative effect.

5.2.3 River Vyrnwy Mitigation – Vyrnwy Bypass release (155 Mld)

This element has some major and moderate negative and major and moderate positive effects after consideration of currently embedded mitigation measures.

Major negative effects include:

- Potential effects on surface water flows from the bypass outfall to the River Severn confluence during operation
- Potential impact on WFD compliance during operation associated with potential adverse effects on aquatic ecology status targets in the River Vyrnwy, between the bypass outfall and the confluence with the Severn.

Moderate negative effects include:

- Potential effects on biodiversity during operation due to potential effects on Severn Estuary SAC and Ramsar site from a flow discharge of up to 155 Ml/d.
- Potential effects on the health and well-being of the local community during construction of the proposed development.

An uncertain effect relates to potential effects on climatic factors due to the expected level of operational carbon resulting from the proposed scheme. This effect is currently uncertain as the levels of operational carbon from the development and operation of the scheme are currently unknown. There is also an uncertain effect for material assets as information about resource use and waste generation is currently unknown.

Major positive effects are identified in respect of the provision a resilient water supply. Whilst this option will provide additional water resource and it will provide essential water supply infrastructure to help support a sustainable socio-economy. Also a major positive effect for climatic factors as the scheme would enable the reliable transfer of water for the benefit of flows in the River Severn and resource availability during times of low flow. This will reduce the vulnerability to increased drought risks associated with climate change and thereby improving resilience to the likely effects of future climate change. A further major positive effect for population as the scheme will increase regional resilience which may support economic and population growth and also in relation to the option contributing to a resilient water supply. A further moderate positive effect was identified with respect to potential economic opportunities during construction.

The major and moderate negative effects identified with the currently costed for embedded mitigation measures could potentially be further mitigated to reduce effects to a minor negative or neutral effect through the implementation of further mitigation measures. These measures, which are proposed to be investigated further during gate-2, include:

- Additional monitoring and assessment of the potential effects of the discharge on the anadromous species that are qualifying features of the Severn Estuary SAC and Ramsar site. These studies would increase confidence in the assessment conclusions and lead to the identification of additional targeted and specific mitigation measures to be incorporated into the

detailed design. This could enable effects on biodiversity during operation to reduce from moderate adverse to minor; and

- Sensitive siting of construction compounds, routing of construction traffic and limiting hours of working could reduce effects on the environment and amenity to a minor negative effect.

5.2.4 River Vyrnwy Mitigation – Vyrnwy Bypass release (180 Mld)

This element has some major and moderate positive effects after consideration of currently embedded mitigation measures.

Major positive effects are identified in respect of the provision a resilient water supply. This option will provide additional water resource and it will provide essential water supply infrastructure to help support a sustainable socio-economy. Also a major positive effect for climatic factors as the scheme would enable the reliable transfer of water for the benefit of flows in the River Severn and resource availability during times of low flow. This will reduce the vulnerability to increased drought risks associated with climate change and thereby improving resilience to the likely effects of future climate change. A further major positive effect for population as the scheme will increase regional resilience which may support economic and population growth and also in relation to the option contributing to a resilient water supply. A further moderate positive effect was identified with respect to potential economic opportunities during construction.

An uncertain effect relates to potential effects on climatic factors due to the expected level of operational carbon resulting from the proposed scheme. This effect is currently uncertain as the levels of operational carbon from the development and operation of the scheme are currently unknown. There is also an uncertain effect for material assets as information about resource use and waste generation is currently unknown.

5.2.5 River Vyrnwy Mitigation – Shrewsbury Redeployment (25 Mld)

This element has one moderate negative and a number of moderate positive effects after consideration of currently embedded mitigation measures.

The moderate negative effect relates to potential effects on climatic factors due to the expected level of operational carbon resulting from the proposed scheme. No further mitigation measures have been identified to reduce this moderate effect.

The moderate positive effects are identified in respect of the scheme making use of an existing licensed source of water and use of a surplus, sustainable abstraction volume and would enable the 25 Mld to be made available for Thames Water. Furthermore, the scheme would reduce the vulnerability to climate change effects and consequently improve resilience to such effects.

5.2.6 Mythe abstraction reduction (15 Mld)

This element does not have any major or moderate positive or negative effects associated with it. The element has some uncertain effects associated with operational carbon emissions and resource use. Effects are otherwise neutral with a few minor positives identified during operation.

5.2.7 Netheridge WwTW discharge diversion (35 Mld) - Deerhurst Pipeline

This element has some major and moderate negative and moderate positive effects after consideration of currently embedded mitigation measures.

Major negative effects include:

- Effects associated with soil as the route crosses a landfill site and is within proximity of others therefore there exists the potential for contaminated land and associated risks to health and environment during construction.

Moderate negative effects include:

- Effects on heritage assets during construction due to the proximity of scheduled monuments, listed buildings and conservation areas.
- Potential effects on the health and well-being of the local community during construction of the proposed development.

Moderate positive effects are identified in respect of the option contributing to a resilient water supply. The additional water resource from this option will provide essential water supply infrastructure to help support a sustainable socio-economy. Furthermore, with respect to climatic factors this option provides additional water resource and will during operation assist the reliable transfer of water, therefore reducing the vulnerability to drought risks associated with climate change and improving resilience to the likely effects of climate change. A further moderate positive effect was identified with respect to potential economic opportunities during construction.

The major and moderate negative effects identified with the currently costed for embedded mitigation measures could potentially be further mitigated to reduce effects to a minor negative or neutral effect through the implementation of further mitigation measures. These measures, which are proposed to be investigated further during gate-2, include:

- Re-routing the pipeline away from the historic landfill and undertaking investigations/remediation for land contamination. This could mitigate the potential negative effects relating to soil;
- Consideration of heritage aspects when further developing the alignment of the pipeline. This should be done during design development and in consultation with Historic England and Council officers; and
- Sensitive siting of construction compounds, routing of construction traffic and limiting hours of working. This could reduce effects on the environment and amenity to a minor negative effect.

5.2.8 Netheridge WwTW discharge diversion (35 Mld) - Cotswold Canals

This element has some major and moderate negative and moderate positive effects after consideration of currently embedded mitigation measures.

Major negative effects include:

- Potential effects on WFD compliance during operation in terms of impacts on water quality and available wetted habitat;
- Effects associated with soil as the route crosses a landfill site and is within proximity of others therefore there exists the potential for contaminated land and associated risks to health and environment during construction.
- Potential effects on surface water quality in the eastern channel of the lower River Severn during operation due to the unknown dilution capacity at this location to manage inputs
- Potential effects on WFD compliance during operation in terms of water quality, aquatic ecology and chemical status targets in the eastern channel of the lower River Severn.

Moderate negative effects include:

- Effects on heritage assets during construction due to the proximity of scheduled monuments, listed buildings and conservation areas.

Moderate positive effects are identified in respect of the option contributing to a resilient water supply. The additional water resource from this option will provide essential water supply infrastructure to help support a sustainable socio-economy. Furthermore, with respect to climatic factors this option provides additional water resource and will during operation assist the reliable transfer of water, therefore reducing the vulnerability to drought risks associated with climate change and improving resilience to the likely effects of climate change.

The major and moderate negative effects identified with the currently costed for embedded mitigation measures could potentially be further mitigated to reduce effects to a minor negative or neutral effect through the implementation of further mitigation measures. These measures, which are proposed to be investigated further during gate-2, include:

- Advanced water treatment and attainment of water quality discharge levels. These would help meet permitting requirements and minimise potential effects relating to WFD compliance and water quality concerns;
- Re-routing the pipeline away from the historic landfill and investigations/remediation for land contamination. This could mitigate the potential negative effects relating to soil;

- Consideration of heritage aspects when further developing the alignment of the pipeline. This should be done during design development and in consultation with Historic England and Council officers; and
- Sensitive siting of construction compounds, routing of construction traffic and limiting hours of working. These could reduce effects on the environment and amenity to a minor negative effect.

5.2.9 Minworth WwTW discharge diversion (115 Mld)

This element has several major and moderate negative and positive effects after consideration of currently embedded mitigation measures.

Major negative effects include:

- Effects on designated sites during construction, with the current pipeline route running through two SSSIs;
- Effects on water quality in the River Avon including potential effects on WFD compliance during operation; and
- Effects on climatic factors due to the expected level of operational carbon resulting from the proposed scheme.

Moderate negative effects include:

- Impacts on local air quality due to increased HGV movements and other activities associated with construction;
- Effects on heritage due to the large number of heritage assets within close proximity to the pipeline route; and
- Potential effects on the health and well-being of the local community during construction of the proposed development.

Major positive effects are identified in respect of the provision of a substantial volume of reliable water supplies and improved resilience to the water supply system, which may help support economic and population growth. The scheme would also reduce the vulnerability to climate change effects and consequently improve resilience to such effects. A further moderate positive effect was identified with respect to potential economic opportunities during construction.

Some of the major and moderate negative effects identified with the currently costed for embedded mitigation measures could potentially be further mitigated to reduce effects to a minor negative or neutral effect through the implementation of further mitigation measures. These measures, which are proposed to be investigated further during gate-2, include:

- Realignment of the pipeline route to avoid the SSSIs, and potential avoidance of works during certain times of the year. This will help mitigate effects on the environment and biodiversity;
- Consideration of heritage aspects when further developing the alignment of the pipeline. This should be done during design development and in consultation with Historic England and Council officers; and
- Sensitive siting of construction compounds, routing of construction traffic and limiting hours of working. This could reduce effects on the environment and amenity to a minor negative effect.

Further investigation works into the effects of discharge into the River Avon in terms of water quality, temperature and chemistry is proposed. This combined with some uncertainty as to the effectiveness of the treatment currently proposed has on a precautionary basis led to a potential major negative effect remaining following further mitigation. As noted in the assessment output table the discharge would be subject to regulatory permitting of water quality to ensure no effect on WFD status and subject to review this could mitigate impacts. In regard to the major negative climatic effects due to the expected level of operational carbon resulting from the proposed scheme, no further mitigation measures have been identified to reduce this effect. The moderate negative effect relating to potential effects on air emissions during construction of the proposed scheme is not anticipated to alter following the implementation of further mitigation measures.

5.2.10 Pipeline conveyance, Deerhurst to Culham (300 Mld)

The pipeline conveyance, Deerhurst to Culham (300 Mld) element has several major and moderate negative and positive effects after consideration of currently embedded mitigation measures.

Major negative effects include:

- Effects on climatic factors due to the expected level of operational carbon resulting from the proposed scheme; and
- Effects on landscape as the pipeline would pass through approximately 44km of AONB.

Moderate negative effects include:

- Effects on biodiversity during construction due to the proximity of a number of areas of ancient woodland to the pipeline route and during operation in relation to aquatic ecology downstream of the discharge at Culham;
- Potential effects on natural capital assets during construction;
- Effects on biodiversity during construction due to the scheme impacts on Priority Habitats;
- Effects on soil during construction due to the pipeline route crossing areas of best and most versatile agricultural land;
- Effects on flood risk and surface water flows and quality during construction as the pipeline route crosses numerous rivers and watercourses and is within large areas of flood zones 2 and 3;
- Effects on heritage during construction due to the proximity to scheduled monuments, registered parks and gardens and listed buildings and the crossing of conservation areas;
- Effects on health due to the scale and duration of the construction works (61 months) and proximity of sensitive receptors;
- Effects on population associated with recreation during construction due to the route crossing a number of PRoW and being in proximity to a number of other recreational resources;
- Effects on material assets as the scheme would require large quantities of materials and energy and generate waste during construction and operation; and
- Effects on material assets as the construction of the pipeline route would cause disruption to built assets due to the route crossing numerous roads.

Major positive effects on water provision due to the option contributing to a resilient water supply. This option will provide additional water resource and it will provide essential water supply infrastructure to help support a sustainable socio-economy. In terms of climatic factors the scheme will provide additional water resource and will during operation assist the reliable transfer of water, therefore reducing the vulnerability to drought risks associated with climate change and improving resilience to the likely effects of climate change. Major beneficial effects will also arise during operation on population and health as this scheme will increase regional resilience which may support economic and population growth. It will help to ensure provision of access to a secure resilient supply of drinking water including during times where additional water resources may not be available. A further moderate positive effect was identified with respect to potential economic opportunities during construction.

Some of the major and moderate negative effects identified with the currently costed for embedded mitigation measures could potentially be further mitigated to reduce effects to a minor negative or neutral effect through the implementation of further mitigation measures. These measures, which are proposed to be investigated further during gate-2, include:

- Discussions with Natural England regarding ancient woodland protection measures;
- Further detailed studies to assess the effects on aquatic ecology in the flow regime of the weir pools in the reaches below the discharge point. These studies would increase confidence in the assessment conclusions and lead to the identification of additional targeted and specific mitigation measures to be incorporated into the detailed design.;
- Tunnelling for all sections of route which goes through priority habitat, and undertaking a review of the pipeline route, construction areas and working widths with Natural England as part of the further detailed design of the scheme;

- Reviewing the pipeline route to minimise disruption to best and most versatile agricultural land and recreational uses;
- Review of further mitigation measures as part of the detailed design to mitigate flood risk and water quality risks during construction, including provision of flood compensation areas and preparation of applications for Flood Defence Consents where required for river crossing construction works;
- Consideration of heritage aspects when further developing the alignment of the pipeline. This should be done during design development and in consultation with Historic England and Council officers;
- Investigation and implementation of waste minimisation techniques;
- Sensitive siting of construction compounds, routing of construction traffic and limiting hours of working. This could reduce effects on the environment and amenity to a minor negative effect; and
- Minimise works on infrastructure where open cut is proposed during peak periods. This will help to minimise disruption to infrastructure during construction.

Despite the further mitigation measures proposed some one major negative and three moderate negative effects are still anticipated. The major effect relates to climatic effects due to the expected level of operational carbon resulting from the proposed scheme, no further mitigation measures have been identified to reduce this effect. The moderate effects relate to construction effects on natural capital assets and uses of resources in the construction period. A moderate negative effect on the landscape is also expected during construction, although by minimising the extent of construction works within the AONB and near to the viewpoints at any one time and through the use of trenchless techniques for pipeline construction these effects are anticipated to reduce from the major negative effect assessed prior to the adoption of further mitigation measures.

5.2.11 Pipeline conveyance, Deerhurst to Culham (400 Mld)

The pipeline conveyance, Deerhurst to Culham (400 Mld) element has the same major negative and positive effects both after consideration of currently embedded mitigation measures and further mitigation measures as for the 300 Ml/d pipeline element. It does, however, also have some further moderate negative effects identified relating to the 400 Ml/d element, these include:

The additional moderate negative effects include:

- An operational effect on priority habitat due to potential effects in the River Thames downstream of the discharge point at Culham; and
- Operationally there is greater uncertainty over potential extent of changes in the wetted habitat and effects on water quality and water chemistry from a WFD perspective as well as on surface water flows in the River Thames downstream of the discharge point at Culham.

These additional moderate negative effects identified with the currently costed for embedded mitigation measures could potentially be further mitigated to reduce effects to a minor negative or neutral effect through the implementation of further mitigation measures. These measures, which are proposed to be investigated further during gate-2, include:

- Further monitoring of potential impacts on priority species; and
- Further investigation on the extent of changes in the wetted habitat, water quality and water chemistry in the River Thames downstream of the discharge location at Culham. These studies would increase confidence in the assessment conclusions and lead to the identification of additional targeted and specific mitigation measures to be incorporated into the detailed design.

There are no changes to the major or moderate positive effects of the scheme or changes to the assessment conclusions for the 300 Ml/d pipeline element in terms of major and moderate negative aspects following the implementation of the further mitigation measures identified in the SEA output tables.

5.2.12 Pipeline conveyance, Deerhurst to Culham (500 Mld)

The pipeline conveyance, Deerhurst to Culham (500 Mld) element has the same major negative and positive effects both after consideration of currently embedded mitigation measures and further mitigation measures as for the 400 Mld pipeline element.

5.2.13 Canal conveyance, including piping to Culham (300 Mld)

This element has several major and moderate negative and positive effects after consideration of currently embedded mitigation measures.

Major negative effects include:

- Potential effects in terms of the potential spreading of INNS during operation
- Effects associated with soil as the route crosses a number of landfill sites and therefore there exists the potential for contaminated land and associated risks to health and environment during construction
- Effects on climatic factors due to the expected level of operational carbon resulting from the proposed scheme; and
- Effects on landscape as the pipeline would pass through approximately 13km of AONB.

Moderate negative effects include:

- Effects on biodiversity during construction due to the proximity of a number of designated areas and areas of ancient woodland to the proposed route and during operation in relation to aquatic ecology downstream of the discharge at Culham;
- Potential effects on natural capital assets during construction;
- Effects on biodiversity during construction due to the scheme impacts on Priority Habitats;
- Effects on flood risk during construction as the pipeline route crosses numerous rivers and watercourses and is within large areas of flood zones 2 and 3;
- Impacts on local air quality due to increased HGV movements and other activities associated with construction;
- Effects on heritage during construction due to the proximity to scheduled monuments, registered parks and gardens and listed buildings and the crossing of conservation areas;
- Effects on health due to the scale and duration of the construction works (62 months) and proximity of sensitive receptors;
- Effects on population associated with recreation during construction due to the route crossing a number of PRoW, being in proximity to a number of other recreational resources and requiring the closure of Sapperton Tunnel;
- Effects on material assets as the scheme would require large quantities of materials and energy and generate waste during construction and operation; and
- Effects on material assets as the construction of the pipeline route would cause disruption to built assets due to the route crossing numerous roads.

Major positive effects on water provision due to the option contributing to a resilient water supply. This option will provide additional water resource and it will provide essential water supply infrastructure to help support a sustainable socio-economy. In terms of climatic factors the scheme will provide additional water resource and will during operation assist the reliable transfer of water, therefore reducing the vulnerability to drought risks associated with climate change and improving resilience to the likely effects of climate change. Major beneficial effects will also arise during operation on population and health as this scheme will increase regional resilience which may support economic and population growth. It will help to ensure provision of access to a secure resilient supply of drinking water including during times where additional water resources may not be available.

A number of moderate positive effects are also identified in relation to this scheme. These include the potential economic opportunities that are likely to arise during construction and the potential benefits to improved recreation from a tourism perspective. There is currently a lack of specificity in the design for the precise location of the rewetted canals or recreational opportunities. When the design for the scheme progresses in gate-2 it will be possible to reappraise the level of benefits arising from the canal

in terms of social, amenity and economic aspects. This may increase the benefits associated with this option.

Some of the major and moderate negative effects identified with the currently costed for embedded mitigation measures could potentially be further mitigated to reduce effects to a minor negative or neutral effect through the implementation of further mitigation measures. These measures, which are proposed to be investigated further during gate-2, include:

- Discussions with Natural England regarding ancient woodland protection measures;
- Further detailed studies to assess the effects on aquatic ecology in the flow regime of the weir pools in the reaches below the discharge point. These studies would increase confidence in the assessment conclusions and lead to the identification of additional targeted and specific mitigation measures to be incorporated into the detailed design;
- Tunnelling for all sections of route which goes through priority habitat, and undertaking a review of the pipeline route, construction areas and working widths, with Natural England, as part of the further detailed design of the scheme;
- Reviewing the pipeline route to avoid crossing landfilled areas and recreational uses;
- Review of further mitigation measures as part of the detailed design to mitigate flood risk during construction including provision of flood compensation areas and preparation of applications for Flood Defence Consents where required for river crossing construction works;
- Consideration of heritage aspects when further developing the alignment of the pipeline. This should be done during design development and in consultation with Historic England and Council officers;
- Investigation and implementation of waste minimisation techniques;
- Sensitive siting of construction compounds, routing of construction traffic and limiting hours of working. This could reduce effects on the environment and amenity to a minor negative effect; and
- Minimise works on infrastructure where open cut is proposed during peak periods to minimise disruption to infrastructure during construction.

Despite the further mitigation measures proposed some one major negative and five moderate negative effects are still anticipated. The major effect relates to climatic effects due to the expected level of operational carbon resulting from the proposed scheme, no further mitigation measures have been identified to reduce this effect. The moderate effects relate to construction effects on natural capital assets, air emissions and uses of resources in the construction period. One further moderate negative effect on the landscape is also expected during construction, although by minimising the extent of construction works within the AONB and near to the viewpoints at any one time and through the use of trenchless techniques for pipeline construction these effects could potentially be reduced from the major negative effect identified prior to the adoption of further mitigation measures. A further moderate effect during operation of the scheme is expected in terms of the potential spread of INNS. Through screening and filtration at the intakes and use of monitoring downstream of discharge locations these risks could potentially be reduced from the major negative effect assessment originally made. These potential further mitigation measures are proposed to be investigated further during gate-2 activities.

5.3 Element assessment conclusions

Overall, the conclusions of the SEA of the STT elements are that, as would generally be expected, larger scale water source and conveyance elements have greater adverse and beneficial effects than those associated with the smaller scale elements.

The precise significance of adverse effects vary between minor and major adverse effects as the impact significance is highly dependent on the specific geographical setting of the element and its proximity (or otherwise) to sensitive environmental, human and built environment receptors.

The larger scale option elements, in particular, also offer a range of beneficial effects including:

- the resilience to climate change and water supply reliability afforded;
- supporting economic and population growth through regional resilience in water provision;

- the opportunity for provision of co-benefits, for example enhanced biodiversity value, recreational and/or educational benefits;
- the contribution to a more sustainable water resources management system; and
- the opportunity to provide local economic and employment opportunities during construction works.

In discussions with WRSE it is understood that the SEA assessments undertaken for the WRSE regional plan, whilst broadly consistent, show some variances mainly around the benefits of this large scale option. For example, in terms of this option providing economic and social benefits to the South East by delivering a reliable and secure water supply as well as in terms of positive effects during construction such as employment and economic benefits. Both of these factors are considered relevant, especially when considering this large scale potential development. Whilst these factors have not been taken into account in the WRSE regional plan assessments consideration of these potential benefits have been taken into account in the SEA assessment of the STT Source Support Elements. As set out above and in the SEA assessment output tables in **Annex A9**.

The STT Source Support Elements and the Interconnector elements have included for embedded and costed mitigation measures that have reduced potential major and moderate negative environmental effects. Some of the elements also provide moderate positive effects during the construction, such as economic benefits in respect of impacts on the local economy and employment market around these schemes.

6 Option assessments

6.1 Introduction

In addition to assessment of the individual STT Source Support Elements and the Interconnector elements assessments have been undertaken of overall STT Scheme options, which comprise a combination of elements.

A total of four STT SRO Scheme groups have been identified, two relating to utilising the pipeline conveyance as the Interconnector and two utilising the canal conveyance as the Interconnector. Which STT Source Support Elements have been identified in the groups as well as the order in which these sources become operational was determined through modelling undertaken by Jacobs. This modelling considered a number of factors including cost and resilience. Further details on the modelling undertaken and justification for the choice of the STT Source Support Elements is provided in Jacob's work.

It is understood that the Minworth source support element could be made available as a water source to the Grand Union Canal (GUC) SRO. In the event that this source support element is chosen as part of the GUC SRO then the Minworth source support element would not be available for the STT System. In consequence, for each of the conveyance alternatives, one grouping includes a number of source support elements including Minworth and the other grouping excludes the Minworth source support element.

A summary of the elements that form each of the four STT SRO Scheme options that have been assessed as part of the STT SRO are identified in **Table 6.1** in terms of the pipeline options and **Table 6.2** in respect of the canal options.

Table 6.1 STT Pipeline Conveyance Groupings

Pipeline without Minworth		Pipeline with Minworth	
Element Ref	Element ID	Element Ref	Element ID
7a	DeerhurstPipeline_300	7a	DeerhurstPipeline_300
4	Mythe_15	4	Mythe_15
1b	VyrnwyRelease_75	1b	VyrnwyRelease_75
5a	NetheridgePipelineDeerhurst_35	5a	NetheridgePipelineDeerhurst_35
3	ShrewsburyRedeployment_25	3	ShrewsburyRedeployment_25
2a	MiddleVyrnwyBypass_80	2a	MiddleVyrnwyBypass_80
		6	Minworth_115

Table 6.2 STT Canal Conveyance Groupings

Canal without Minworth		Canal with Minworth	
Element Ref	Element ID	Element Ref	Element ID
8	CotswoldCanals_300	8	CotswoldCanals_300
4	Mythe_15	4	Mythe_15
5b	NetheridgePipelineCotswold_35	5b	NetheridgePipelineCotswold_35
1b	VyrnwyRelease_75	1b	VyrnwyRelease_75
3	ShrewsburyRedeployment_25	3	ShrewsburyRedeployment_25
2a	MiddleVyrnwyBypass_80	2a	MiddleVyrnwyBypass_80
		6	Minworth_115

6.2 Assessment Results

For each of these four short-listed options, environmental assessments were carried out that had regard to the construction and operation of all of the elements cumulatively within the option. The assessment

conclusions during construction and operation for each objective have been determined firstly after application of embedded mitigation measures included in the conceptual design (and cost) of each scheme and then subsequently having regard to the application of potential further mitigation measures.

The SEA findings of the four options are provided in **Annex A10**. The assessment conclusions during the construction and operational phases of each element after consideration of embedded mitigation are summarised below using a colour-coded visual evaluation summary matrix (**Table 6.3**). The colours in the table reflect the level of significance of the effect as set out in **Table 3.2**. The assessment conclusions during the construction and operational phases of each element after consideration of further potential mitigation measures are summarised below using a colour-coded visual evaluation summary matrix (**Table 6.4**).

Table 6.3 SEA Option Assessment Summary Matrix after embedded mitigation

Groups			SEA Topics and Objectives																					
			Biodiversity, flora & fauna					Soil	Water					Air	Climatic Factors		Landscape	Historic	Population and Human Health				Material Assets	
			1.1	1.2	1.3	1.4	1.5	2.1	3.1	3.2	3.3	3.4	3.5	4.1	5.1	5.2	6.1	7.1	8.1	8.2	8.3	8.4	9.1	9.2
Pipeline with Minworth	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
Canal with Minworth	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
Canal without Minworth	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
Pipeline without Minworth	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						

Table 6.4 SEA Option Assessment Summary Matrix after further mitigation

Groups			SEA Topics and Objectives																					
			Biodiversity, flora & fauna					Soil	Water					Air	Climatic Factors		Landscape	Historic	Population and Human Health				Material Assets	
			1.1	1.2	1.3	1.4	1.5	2.1	3.1	3.2	3.3	3.4	3.5	4.1	5.1	5.2	6.1	7.1	8.1	8.2	8.3	8.4	9.1	9.2
Pipeline with Minworth	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
Canal with Minworth	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
Canal without Minworth	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
Pipeline without Minworth	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						

A summary of the key environmental effects of each of the four STT options after embedded mitigation have been considered are provided below. The potential effects of undertaking the further mitigation measures identified in the SEA option assessment output tables are discussed at the end of each option assessment.

6.2.1 Pipeline conveyance without Minworth

This option has major and moderate negative and major and moderate positive effects after consideration of currently embedded mitigation measures.

Major negative effects include:

- Effects on soil during construction due to the STT option crossing areas of best and most versatile agricultural land and a landfill site;
- Effects on WFD objectives with potential non-compliance with aquatic ecology status targets in water bodies from operation.
- Effects on climatic factors due to the expected level of operational carbon resulting from the proposed scheme; and
- Effects on landscape during construction with the pipeline passing through approximately 44km of AONB.

Moderate negative effects include:

- Effects on biodiversity during construction due to the proximity of a number of areas of ancient woodland to the Deerhurst pipeline route and during operation in relation to aquatic ecology downstream of the discharge at Culham;
- Potential effects on natural capital assets during construction;
- Effects on biodiversity during construction due to the scheme impacts on Priority Habitats;
- Effects on WFD objectives relating to biodiversity due to potential impacts on velocity/depth and wetted margins of the operation of this option;
- Effects on flood risk and surface water flows and quality during construction as the pipeline route crosses numerous rivers and watercourses and is within large areas of flood zones 2 and 3;
- Potential effects on surface water flows during operation if flows were to coincide with other regulation releases from Vyrnwy Reservoir;
- Effects on heritage during construction due to the proximity to scheduled monuments, registered parks and gardens and listed buildings and the crossing of conservation areas;
- Effects on health due to the scale and duration of the construction works and proximity of sensitive receptors;
- Effects on population associated with recreation during construction due to the route crossing a number of PRoW and being in proximity to a number of other recreational resources;
- Effects on material assets as the scheme would require large quantities of materials and energy and generate waste during construction and operation; and
- Effects on material assets as the construction of the pipelines would cause disruption to built assets due to the route crossing numerous roads.

Major positive effects on water provision due to the option contributing to a resilient water supply. This option will provide additional water resource and it will provide essential water supply infrastructure to help support a sustainable socio-economy. In terms of climatic factors the scheme will provide additional water resource and will during operation assist the reliable transfer of water, therefore reducing the vulnerability to drought risks associated with climate change and improving resilience to the likely effects of climate change. Major beneficial effects will also arise during operation on population and health as this scheme will increase regional resilience which may support economic and population growth. It will help to ensure provision of access to a secure resilient supply of drinking water including during times where additional water resources may not be available. Further moderate positive effects were identified with respect to potential improvements to natural capital assets during operation as well as economic opportunities during construction.

Some of the major and moderate negative effects identified with the currently costed for embedded mitigation measures could potentially be further mitigated to reduce effects to a minor negative or neutral effect through the implementation of further mitigation measures. These measures, which are proposed to be investigated further during gate-2, include:

- Discussions with Natural England regarding ancient woodland protection measures;
- Further detailed studies to assess the effects on aquatic ecology in the flow regime of the weir pools in the reaches below the discharge point. These studies would increase confidence in the assessment conclusions and lead to the identification of additional targeted and specific mitigation measures to be incorporated into the detailed design.;
- Tunnelling for all sections of route which goes through priority habitat and undertaking a review of the pipeline route, construction areas and working widths with Natural England as part of the further detailed design of the scheme;
- Reviewing the pipeline route to minimise disruption to best and most versatile agricultural land and recreational uses;
- Re-routing the pipeline away from landfilled areas. Undertake investigations and implement remediation for land contamination.
- Reviewing and implementing further mitigation measures, as part of the detailed design, to mitigate flood risk and water quality risks during construction. These would include the provision of flood compensation areas and preparation of applications for Flood Defence Consents where required for river crossing construction works;
- To mitigate potential effects on WFD compliance further consideration of the operating regime in the River Vyrnwy could be undertaken. Subject to review, this could mitigate impacts, but it is currently not included in the design. Further investigation and implementation of findings of the effect of STT support releases on the downstream extent of potential failure of WFD standards for copper in the River Vyrnwy;
- Consideration of heritage aspects when further developing the alignment of the pipeline. This should be done during design development and in consultation with Historic England and Council officers;
- Investigation and implementation of waste minimisation techniques;
- Sensitive siting of construction compounds, routing of construction traffic and limiting hours of working. This could reduce effects on the environment and amenity to a minor negative effect; and
- Minimise works on infrastructure where open cut is proposed during peak periods, to minimise disruption to infrastructure during construction.

Despite the further mitigation measures proposed one major negative and four moderate negative effects are still anticipated. The major effect relates to climatic effects due to the expected level of operational carbon resulting from the proposed scheme, no further mitigation measures have been identified to reduce this effect. The moderate effects relate to: construction effects on natural capital assets and uses of resources in the construction period; and the effects on WFD objectives relating to biodiversity due to potential impacts on velocity/depth and wetted margins of the operation of this option. A further moderate negative effect on the landscape is also expected during construction. However, it is anticipated that through minimising the extent of construction works within the AONB and near to recognised viewpoints at any one time and through the use of trenchless techniques for pipeline construction these effects could potentially be reduced from the currently assessed major negative effect prior to the adoption of further mitigation measures. This measure is proposed to be investigated further during gate-2.

The implementation of further mitigation measures also offers one further potential moderate positive effect. This relates to the benefits to natural capital stocks and ecosystem service provision, including biodiversity, carbon regulation, natural hazard regulation and water purification from the delivery of required Biodiversity Net Gain.

6.2.2 Pipeline conveyance with Minworth

This option has major and moderate negative and major and moderate positive effects after consideration of currently embedded mitigation measures. The differences to this option created by the addition of the Minworth source support element to the pipeline option are summarised below:

Major negative effects include:

- Effects on biodiversity as the scheme crosses two SSSIs; and
- Effects on surface water flows during operation.

Moderate negative effects include:

- Effects on air quality during construction due to the scheme being within an AQMA.

No amendments to the major or moderate positive effects of the pipeline option result from the addition of the Minworth source support element to this pipeline option.

The major negative effects identified in terms of biodiversity with the currently costed for embedded mitigation measures can be overcome through the implementation of identified further mitigation measures including the re-routing of the Minworth pipeline away from landfilled areas.

Further investigation works into the effects of discharge into the River Avon in terms of water quality, temperature and chemistry is proposed. This combined with some uncertainty as to the effectiveness of the treatment currently proposed has on a precautionary basis led to a potential major negative effect remaining following further mitigation. As noted in the assessment output table the discharge would be subject to regulatory permitting of water quality to ensure no effect on WFD status and subject to review this could mitigate impacts. The moderate effects relating to air quality during construction is expected to remain with limited alternatives to road traffic and the route running through an AQMA.

6.2.3 Canal without Minworth

This option has major and moderate negative and major and moderate positive effects after consideration of currently embedded mitigation measures.

Major negative effects include:

- Potential effects in terms of the potential spreading of INNS during operation;
- Potential effects on WFD compliance during operation in terms of impacts on water quality and available wetted habitat;
- Effects associated with soil as the route crosses a number of landfill sites and therefore there exists the potential for contaminated land and associated risks to health and environment during construction;
- Potential effects on surface water quality in the eastern channel of the lower River Severn during operation due to the unknown dilution capacity at this location to manage inputs
- Potential effect on WFD compliance during operation in terms of water quality, aquatic ecology and chemical status targets in the eastern channel of the lower River Severn.
- Effects on climatic factors due to the expected level of operational carbon resulting from the proposed scheme; and
- Effects on landscape as the pipeline would pass through approximately 13km of AONB.

Moderate negative effects include:

- Effects on biodiversity during construction due to the proximity of a number of designated areas and areas of ancient woodland to the proposed route and during operation in relation to aquatic ecology downstream of the discharge at Culham;
- Potential effects on natural capital assets during construction;
- Effects on biodiversity during construction due to the scheme impacts on Priority Habitats;
- Effects on flood risk during construction as the pipeline route crosses numerous rivers and watercourses and is within large areas of flood zones 2 and 3;
- Impacts on local air quality due to increased HGV movements and other activities associated with construction;

- Effects on heritage during construction due to the proximity to scheduled monuments, registered parks and gardens and listed buildings and the crossing of conservation areas;
- Effects on health due to the scale and duration of the construction works and proximity of sensitive receptors;
- Effects on population associated with recreation during construction due to the route crossing a number of PRow as well as being in proximity to a number of other recreational resources;
- Effects on material assets as the scheme would require large quantities of materials and energy and generate waste during construction and operation; and
- Effects on material assets as the construction of the pipeline route would cause disruption to built assets due to the route crossing numerous roads.

Major positive effects on water provision due to the option contributing to a resilient water supply. This option will provide additional water resource and it will provide essential water supply infrastructure to help support a sustainable socio-economy. In terms of climatic factors the scheme will provide additional water resource and will during operation assist the reliable transfer of water, therefore reducing the vulnerability to drought risks associated with climate change and improving resilience to the likely effects of climate change. Major beneficial effects will also arise during operation on population and health as this scheme will increase regional resilience which may support economic and population growth. It will help to ensure provision of access to a secure resilient supply of drinking water including during times where additional water resources may not be available.

A number of moderate positive effects are also identified in relation to this scheme. These include the potential economic opportunities that are likely to arise during construction and the potential benefits to improved recreation from a tourism perspective.

Some of the major and moderate negative effects identified with the currently costed for embedded mitigation measures could potentially be further mitigated to reduce effects to a minor negative or neutral effect through the implementation of further mitigation measures. These measures, which are proposed to be investigated further during gate-2, include

- Discussions with Natural England regarding ancient woodland protection measures;
- Further detailed studies to assess the effects on aquatic ecology in the flow regime of the weir pools in the reaches below the discharge point. These studies would increase confidence in the assessment conclusions and lead to the identification of additional targeted and specific mitigation measures to be incorporated into the detailed design;
- Tunnelling for all sections of route which goes through priority habitat and undertaking a review of the pipeline route, construction areas and working widths with Natural England as part of the further detailed design of the scheme;
- Reviewing the pipeline route to avoid crossing landfilled areas and recreational uses;
- Review of further mitigation measures as part of the detailed design to mitigate flood risk and water quality during construction including provision of flood compensation areas and preparation of applications for Flood Defence Consents where required for river crossing construction works;
- Advanced water treatment and attainment of water quality discharge levels to meet permitting requirements and minimise potential effects relating to WFD compliance and water quality concerns;
- To mitigate heritage effects the alignment of the pipeline should be developed further during design development and further consultation with Historic England should be undertaken during this process.
- Investigation of waste minimisation techniques;
- Sensitive siting of construction compounds, routing of construction traffic and limiting hours of working could reduce effects on the environment and amenity to a minor negative effect; and
- To minimise disruption to infrastructure during construction minimise works on infrastructure where open cut is proposed during peak periods.

Despite the further mitigation measures proposed some one major negative and six moderate negative effects are still anticipated. The major effect relates to climatic effects due to the expected level of operational carbon resulting from the proposed scheme, no further mitigation measures have been

identified to reduce this effect. The moderate effects relate to: construction effects on natural capital assets and uses of resources in the construction period; and the effects on WFD objectives relating to biodiversity due to potential impacts on velocity/depth and wetted margins of the operation of this option. A further moderate negative effect on the landscape is also expected during construction. However, it is anticipated that through minimising the extent of construction works within the AONB and near to recognised viewpoints at any one time and through the use of trenchless techniques for pipeline construction these effects could potentially be reduced from the currently assessed major negative effect prior to the adoption of further mitigation measures. This measure is proposed to be investigated further during gate-2.

A further moderate effect during operation of the scheme is expected in terms of the potential spread of INNS. Through screening and filtration at the intakes and use of monitoring downstream of discharge locations these risks could potentially be reduced from the major negative effect assessment originally made. These potential further mitigation measures are proposed to be investigated further during gate-2 activities.

The implementation of further mitigation measures also offers one further potential moderate positive effect. This relates to the benefits to natural capital stocks and ecosystem service provision, including biodiversity, carbon regulation, natural hazard regulation and water purification from the delivery of required Biodiversity Net Gain.

6.2.4 Canal with Minworth

This option has major and moderate negative and major and moderate positive effects after consideration of currently embedded mitigation measures. The differences to this option created by the addition of the Minworth source support element to the pipeline option is summarised below:

Major negative effects include:

- Effects on biodiversity during construction as the scheme crosses two SSSIs

No amendments to the major or moderate positive effects of the pipeline option result from the addition of the Minworth source support element to this pipeline option.

The major negative effects identified in terms of biodiversity with the currently costed for embedded mitigation measures can potentially be overcome through the implementation of identified further mitigation measures including the re-routing of the Minworth pipeline away from landfilled areas. This potential further mitigation measure would require further consideration during gate-2.

Further investigation works into the effects of discharge into the River Avon in terms of water quality, temperature and chemistry is proposed. This combined with some uncertainty as to the effectiveness of the treatment currently proposed has on a precautionary basis led to a potential major negative effect remaining following further mitigation. As noted in the assessment output table the discharge would be subject to regulatory permitting of water quality to ensure no effect on WFD status and subject to review this could mitigate impacts.

6.2.5 In-combination effects

No construction-related in-combination effects were identified between elements included in the four options as it has been assumed that the timing of construction/development of the different elements do not overlap.

During operation the different effects of the elements on the water environment through the delivery of more supported elements in the River Severn has been accounted for as part of the individual assessments as described in Section 2. With regard to factors outside of the water environment the different source support elements are spatially distant from one another and at a scale that in-combination effects from the operations have not materially impacted the SEA assessment conclusions from the assessments undertaken at the element level.

7 Conclusions and recommendations

7.1 Introduction

As set out in section 6, some major and moderate negative and positive effects have been identified for each of the four options identified, which is to be expected given the scale of the strategic water resource options under consideration. assessed.

The negative effects in particular are dependent on the specific geographical setting of the option and its proximity (or otherwise) to sensitive environmental, human and built receptors. Some of these major negative effects identified are temporary in nature and largely unavoidable while construction works take place. Some exist as a consequence of the scale of the proposed works, whilst others may be able to be mitigated with investigation of further measures. The beneficial effects have been identified in respect of providing additional water resource, contributing to a resilient water supply, helping to support a sustainable socio-economy and reducing the vulnerability to drought risks associated with climate change and improving resilience to the likely effects of climate change.

In discussions with WRSE it is understood that their SEA assessments, which have still to be received for the STT options, have been unable to have regard to the impacts of undertaking embedded mitigation measures. In addition, it is understood that consideration of positive effects during construction such as employment and economic benefits have not been included in their assessments. Both of these factors are relevant, in particular when considering the larger scale potential developments. As set out in Sections 5 and 6 and in the SEA assessment output tables in **Annex A9** and **Annex A10** the STT elements and Scheme options have included for and costed a number of embedded mitigation measures that have reduced potential major and moderate negative environmental effects.

Section 7.2 sets out the key major and moderate effects, prior to the adoption of potential further mitigation measures. Section 7.3 sets out proposed gate-2 works, which includes a summary of key further investigations and works proposed during gate-2 that will help to identify further mitigation measures to potentially reduce the identified effects further. It should be noted that the further mitigation measures identified have not been costed for or integrated into detailed design at this stage. In consequence, these measures are subject to more detailed assessment and at this stage the effectiveness of these measures has still to be fully determined.

In addition to the identification and assessment as to the effectiveness of further mitigation measures it is proposed as part of gate-2 activities to reaffirm the identified embedded mitigation measures set out as part of these assessments.

The SEA assessment tables produced by WRSE for their regional plan have not as yet been provided for review. In consequence, it has not been able to date to provide an assessment of how these options fit with the regional plan assessments. Further work on co-ordination with the WRSE and WRW regional plan assessments are proposed to be undertaken as part of gate-2 activities.

7.2 Key issues with groups

Each of the four groups have a number of major adverse and moderate adverse effects as identified in section 6. The number of major and moderate negative effects is greater for the canal and pipeline options with Minworth than without.

The pipeline without Minworth option has four major negative effects after consideration of currently embedded mitigation measures. These comprise:

- Effects on soil during construction due to the STT option crossing areas of best and most versatile agricultural land and a landfill site;
- Effects on WFD objectives with potential non-compliance with aquatic ecology status targets in water bodies from operation.
- Effects on climatic factors due to the expected level of operational carbon resulting from the proposed scheme; and

- Effects on landscape during construction with the pipeline passing through approximately 44km of AONB.

The effects on soil and landscape during construction are construction effects have the potential to be mitigated further through discussions with regulators and stakeholders and additional review and revision of the pipeline route. These further activities are proposed to be undertaken and reported on further at gate-2. Equally the potential effects on WFD objectives in the River Vyrnwy has the potential to be further mitigated. This will require further investigation including consideration of the operating regime in the River Vyrnwy. This is also proposed to be undertaken and reported on further at gate-2. The one remaining major negative effect of this option is due to the expected level of operational carbon emissions. It is proposed to undertake further investigations into the potential for energy recovery options as part of the further design of this option through to gate-2, although these major negative effects may remain.

The canal without Minworth option has seven major negative effects after consideration of currently embedded mitigation measures. These comprise:

- Potential effects in terms of the potential spreading of INNS during operation;
- Potential effects on WFD compliance during operation in terms of impacts on water quality and available wetted habitat;
- Effects associated with soil as the route crosses a number of landfill sites and therefore there exists the potential for contaminated land and associated risks to health and environment during construction;
- Potential effects on surface water quality in the eastern channel of the lower River Severn during operation due to the unknown dilution capacity at this location to manage inputs
- Potential effects on WFD compliance during operation WFD effects in terms of water quality, aquatic ecology and chemical status targets in the eastern channel of the lower River Severn.
- Effects on climatic factors due to the expected level of operational carbon resulting from the proposed scheme; and
- Effects on landscape as the pipeline would pass through approximately 13km of AONB.

As with the pipeline without Minworth option only one of the major adverse effects is expected to remain after implementation of further mitigation measures, this being the impact of carbon emissions during operation of the scheme. Each of the other identified potential major negative effects have the potential to be mitigated further through further assessment and investigations through to gate-2. These will not only provide confidence in the assessment conclusions reached but will lead to the development of additional targeted and specific mitigation measures that is to be incorporated into the detailed design of the schemes. .

The effects on soil and landscape during construction are construction effects that have the potential to be mitigated further through discussions with regulators and stakeholders and additional review and revision of the pipeline route. These further activities are proposed to be undertaken and reported on further at gate-2. The potential effects on WFD objectives in the River Vyrnwy has the potential to be further mitigated. This will require further investigation including consideration of the operating regime in the River Vyrnwy. This is also proposed to be undertaken and reported on further at gate-2. It is considered that further investigation and development of advanced water treatment and discussions with regulators over water quality discharge levels has the potential to mitigate concerns over INNS as well as potential effects on relating to WFD and water quality.

The addition of the Minworth source support element to both the pipeline and canal conveyance options increases the number of additional negative effects after consideration. These relate to:

- Effects on designated sites during construction, with the current pipeline route running through two SSSIs; and
- Effects on water quality and flows in the River Avon including potential effects on WFD compliance during operation WFD effects and impacts on wetted habitats.

The Minworth source support element carries additional negative effects. This would require further consideration of the effect on sanitary, nutrient and chemical water quality, as well as water

temperature. The impact on aquatic ecology from mixing tertiary treated water into the River Avon downstream of Warwick, particularly under low river flow conditions in the River Avon, also requires further consideration. Further investigation works into the effects of discharge into the River Avon in terms of water quality, temperature and chemistry is proposed. This combined with some uncertainty as to the effectiveness of the treatment currently proposed has on a precautionary basis led to a potential major negative effect remaining following further mitigation. As noted in the assessment output table the discharge would be subject to regulatory permitting of water quality to ensure no effect on WFD status and subject to review this could mitigate impacts.

7.3 Gate 2 works

The environmental assessment work will be iterative throughout the gated process drawing on additional engineering design, modelling and data available as work progresses.

It is recommended that gate-2 works should include the consideration of the recommended further mitigation measures. These are identified within each of the option matrices in **Annex A10**. Key recommended further mitigation measures include the following:

Construction:

- Review and confirm the proposed embedded mitigation measures set out in the SEA assessment output tables and CDRs;
- Liaise with the SRO teams for the STW Sources, Minworth and UU sources to obtain and incorporate the latest environmental assessments relating to source support elements for the STT Scheme;
- Discussions with regulators and stakeholders on pipeline routing;
- Re-routing to avoid designations such as SSSIs and ancient woodland, and careful location of construction areas;
- Investigate further key areas for BNG opportunities;
- Re-routing to avoid landfill sites. Undertake investigations/remediation for land contamination;
- Desk based assessment of sensitivity of Scheduled Monuments to pipeline construction and identify if pipeline routes need to be altered;
- Obtain relevant biological record centre data once common pipeline corridors are identified, to aid pipeline route optimisation;
- Desk based assessment of recreational impacts once site selection work and pipeline optimisation complete;
- Desk based assessment with ground truthing of acceptable crossing points of the watercourses (where there is existing infrastructure, no wetland habitat) to identify common crossing points to be used by all pipelines where possible;
- Desk based air quality assessments to be completed, once construction information available (duration of works, plant, HGV movements) to further assess risk of exceeding critical loads during construction;
- Where site selection and common pipeline corridors can be determined, obtain relevant protected species information;
- A habitat survey of the River Blythe SSSI, Coleshill and Bannerly SSSI and Cole End LNR;
- Development of measures to be included in the CEMP for example approved traffic routes;
- Consideration of additional tunnelling to avoid sensitive areas for example all A roads, water courses, priority habitats;
- Consider minimising the extent of construction works and the level of pipeline works being undertaken at any one point to mitigate impacts on designated landscapes and agricultural land;
- Investigate use of renewable energy sources and minimising carbon emissions during construction.

Operation:

- Review and confirm of the proposed embedded mitigation measures set out in the SEA assessment output tables and CDRs;

- Liaise with the SRO teams for the STW Sources, Minworth and UU sources to obtain and incorporate the latest environmental assessments relating to source support elements for the STT Scheme;
- Discussions with regulators and stakeholders on permitted discharges;
- Further detailed studies to assess the effects on aquatic ecology at specific locations. These studies would increase confidence in the assessment conclusions and lead to the identification of additional targeted and specific mitigation measures to be incorporated into the detailed design;
- For Minworth further consideration of the operational regime during key migration periods for biodiversity including further survey work and monitoring to confirm the magnitude of impacts on river margins downstream of the discharge pipeline and also to understand the magnitude of flow effects in the River Tame;
- Additional monitoring and assessment of the potential effects of the discharge on the anadromous species that are qualifying features of designated areas. These studies would increase confidence in the assessment conclusions and lead to the identification of additional targeted and specific mitigation measures to be incorporated into the detailed design;
- Further development of the delivery of Biodiversity Net Gain (BNG) to offset construction losses;
- Monitoring of impacts on river margins;
- Further investigation on the extent of changes in wetted habitat, water quality and water chemistry;
- Further consideration of the operating regime could reduce flow effects;
- Further investigation and potentially further treatment of discharged water associated with the extent of changes in water temperature, water quality and water chemistry;
- Investigate waste minimisation;
- Investigate use of renewable energy sources and minimising carbon emissions during operation; and
- Development of enhancement measures. For example there is the opportunity to improve footpaths and connections in and around parts of the schemes as part of the construction work. In addition the achievement of environmental net gain and biodiversity net gain may need to consider offsite locations.

Consideration of potential cumulative effects and interactions with other major projects identified in programmes and plans should also be assessed during gate-2.

Annexes

A1 High Level Screening criteria and definitions

SEA Topic Area	Criteria considered	Red	Amber	Green
Biodiversity – Flora and Fauna	SPA, Ramsar, SAC, SSSI, NNR, LNR, Ancient woodland, priority habitats	Less than 400 m from European designated site. Direct effect/encroachment upon from national designated sites. Major adverse effects on linkages to European or National designated sites, and/or their qualifying features. Encroaching upon Ancient Woodland. Direct Land take from Priority habitats.	Within 400 m to 5000 m of a European designated site Within a SSSI Impact Risk Zone (IRZ). Moderate/minor adverse effects on linkages to European or National designated sites, and/or their qualifying features. Within 500 m of an Ancient Woodland. Encroachment upon NNR or LNR. Within 500 m of Priority habitats.	Over 5000 m from a European designated site Outside a SSSI IRZ. No adverse effects on linkages to European or National designated sites, and/or their qualifying features. Over 500 m from an Ancient Woodland. Outside of NNR or LNR Over 500 m of Priority habitats.
Soil	Agricultural land classification / landfill sites	Within Grade 1 or 2 land classification and/or major adverse effects on linkages to sites, and/or their qualifying features. Directly through authorised landfill site.	Within Grade 3 land classification and/or moderate/minor adverse effects on linkages to designated sites, and/or their qualifying features. Within 500 m of an authorised landfill site and/or directly through historic landfill site.	Within other or unclassified land. No adverse effects on linkages to designated sites, and/or their qualifying features. Over 500 m from an authorised landfill site.
Water	Flood Risk Zones, Groundwater source protection zones River crossings	Within Flood Risk Zone 3. Within Zone 1 Source Protection Zone. More than 3 main river crossings.	Within Flood Risk Zone 2 or 2/3. Within Zone 2 Source Protection Zone. Between 1-3 main river crossings.	Within Flood Risk Zone 1. Within Zone 3 Source Protection Zone. No main river crossings.
Air	AQMA	No criteria	Within 500 m of an AQMA (potential for significant effect) and/or moderate/minor adverse effects on linkages to designated sites, and/or their qualifying features.	Over 500 m from an AQMA (low potential for significant effect). No adverse effects on linkages to designated sites, and/or their qualifying features.
Historic Environment	Listed Buildings, scheduled monuments, Registered parks and gardens, registered battlefields, World Heritage Sites	Direct effect on heritage sites or assets.	Within 500 m of heritage site or feature.	Over 500 m from heritage site or feature.
Landscape	AONB / National Parks	Encroachment upon AONB or National Park.	Within 500 m of an AONB or National Park.	Over 500 m from an AONB or National Park.
Material Assets	Length of conveyance route (use of resources)	Over 15km conveyance route.	10 to 15km conveyance route.	Less than 10 km conveyance route.
Population and Human Health	Main urban areas. National Trails, other Public Rights of Way (PRoW), cycle routes, country park and Greenbelt.	Within a main urban area. Right of way or cycle route of national importance disrupted or affected.	Between 1-350 m from a main urban area. Recreational resource / PRoW (other than National Trails) disrupted or affected. The development is likely to directly affect regional/local recreational activities i.e. Country Park. Site located in Greenbelt.	Greater than 350 m from a main urban area. No recreational resource / PRoW disrupted or affected. No direct effect on recreational resources or Greenbelt.

A2 List of Datasets used in the High Level Screening

Data Source	Publisher	Year	Date Downloaded
Air Quality Management Areas	DEFRA	2020	01/10/2020
Special Protection Areas (England)	Natural England	2020	12/10/2020
Ramsar	Natural England	2020	12/10/2020
Special Areas for Conservation (England)	Natural England	2020	12/10/2020
Sites of Special Scientific Interest (England)	Natural England	2020	12/10/2020
Local Nature Reserves (England)	Natural England	2020	12/10/2020
National Nature Reserves (England)	Natural England	2020	12/10/2020
Ancient Woodland (England)	Natural England	2020	12/10/2020
Priority Habitat Inventory (England)	Natural England	2020	12/10/2020
Agricultural Land Classification (ALC) Grades - Post 1988 Survey (polygons)	Natural England	2020	12/10/2020
Permitted Waste Sites - Authorised Landfill Site Boundaries	Environment Agency	2020	12/10/2020
Flood Map for Planning (Rivers and Sea) - Flood Zone 2	Environment Agency	2020	12/10/2020
Flood Map for Planning (Rivers and Sea) - Flood Zone 3	Environment Agency	2020	12/10/2020
Source Protection Zones	Environment Agency	2020	12/10/2020
WFD River Canal and Surface Water Transfer Cycle 2	Environment Agency	2020	12/10/2020
Listed Buildings	Historic England	2020	12/10/2020
Registered Parks and Gardens	Historic England	2020	12/10/2020
Registered Battlefields	Historic England	2020	12/10/2020
Scheduled Monuments	Historic England	2020	12/10/2020
World Heritage Sites	Historic England	2020	12/10/2020
Areas of Outstanding Natural Beauty (England)	Natural England	2020	12/10/2020
Country Parks (England)	Natural England	2020	25/09/2020
Built-up Areas (December 2011) Boundaries V2 - 350 metre buffer used	Office for National Statistics	2017	04/10/2020
Data Source	Publisher	Year	Date Downloaded
National Trails	Natural England	2020	29/09/2020
OS OpenMap Local - Roads	Ordnance Survey	2020	04/10/2020
OS OpenMap Local - Railways	Ordnance Survey	2020	04/10/2020
OS OpenMap Local - Buildings	Ordnance Survey	2020	04/10/2020
English Local Authority Green Belt Dataset	Ministry of Housing, Communities and Local Government	2020	29/09/2020

A3 Summary of Key Issues

A summary of the issues associated with the SEA topic areas that has helped inform the development of the SEA objectives and associated indicator questions is set out below.

Biodiversity, Flora and Fauna Key Issues

The key issues arising from the baseline assessment for biodiversity are:

- The need to protect or enhance biodiversity, particularly protected sites designated for nature conservation taking into account HRA compliance.
- The need to avoid activities likely to cause irreversible damage to natural habitats.
- The need to take opportunities to improve connectivity between fragmented habitats to create functioning habitat corridors.
- The need to control the spread of Invasive Non-Native Species (INNS).
- The need to protect, conserve and enhance biodiversity natural capital.
- To seek opportunities for net environmental gain from infrastructure development.

Soil Key Issues

The key issues arising from the baseline assessment for soil, geology and land use are:

- The need to protect geological features of importance (including geological SSSIs) and maintain and enhance soil function and health.
- The need to manage the land more holistically at the catchment level, benefitting landowners, other stakeholders, the environment and sustainability of natural resources (including water resources).
- The need to make use of previously developed land (brownfield land).

Water Key Issues

The key issues arising from the baseline assessment for water are:

- The need to further improve the quality of river and estuarine waters taking into account WFD objectives.
- The need to maintain the quantity and quality of groundwater resources taking into account WFD objectives.
- The need to improve the resilience, flexibility and sustainability of water resources, particularly in light of potential climate change impacts on surface water and groundwater.
- The need to ensure sustainable abstraction to protect the water environment and meet society's needs for a resilient water supply.
- The need to reduce and manage flood risk.

Air Key Issues

The key issue arising from the baseline assessment for air is:

- The need to reduce air pollutant emissions (industrial processes/transport) and limit air emissions to comply with air quality standards.

Climatic Key Issues

The key issues arising from the baseline assessment for climate are:

- The need to adapt to the impacts of climate change for example, through sustainable water resource management, water use efficiencies, specific aspects of natural ecosystems (e.g. connectivity) as well as accommodating potential opportunities afforded by climate change.
- The need to reduce greenhouse gas emissions (industrial processes and transport).

- The need to mitigate against climate change through the reduction in greenhouse gas emissions in order to contribute to risk reduction over the long term.

Landscape and Visual Amenity Key Issues

The key issues arising from the baseline assessment for landscape and visual amenity are:

- The need to protect and improve the natural beauty of AONBs, National Parks and other areas of natural beauty.
- The need to protect and improve the character of landscapes and townscapes.

Historic Environment Key Issues

The key issue arising from the baseline assessment for the historic environment is:

- The need to conserve or enhance sites of archaeological importance and cultural heritage interest, particularly those which are sensitive to the water environment.

Population and Human Health Key Issues

The key issues arising from the baseline assessment for population and human health are:

- The need to ensure water supplies remain affordable especially for deprived or vulnerable communities, reflecting the importance of water and sewerage services for health and wellbeing.
- The need to ensure continued improvements in levels of health across the region, particularly in urban areas and deprived areas.
- The need to ensure continuing safe, reliable and resilient provision of water and sewerage services to maintain the health and wellbeing of the population.
- The need to ensure a balance between different aspects of the built and natural environment that will help to provide opportunities for local residents and tourists, including opportunities for access to protected and enhanced recreation resources, green infrastructure and the natural and historic environment.
- The need to plan water resources management requirements and other essential services to accommodate an increasing population, including ensuring a resilient water supply system to avoid the need for emergency drought orders (rota cuts or severe pressure reduction).
- The need to recognise that sites of nature conservation importance, heritage assets, water resources, important landscapes and public rights of way can all contribute to recreation and tourism opportunities and subsequently health and well-being and the economy.

Material Assets Key Issues

The key issues arising from the baseline assessment for material assets are:

- The need to minimise the consumption of resources, including water and energy.
- The need to reduce the total amount of waste produced, from all sources.
- The need to reduce the proportion of waste sent to landfill.
- The importance of maintaining and improving major infrastructure

A4 List of Datasets used in the Detailed SEA Assessment

Data Source	Publisher	Year	Date Downloaded
Air Quality Management Areas	DEFRA	2020	01/10/2020
Noise Action Planning Important Areas Round 2 England	DEFRA	2020	06/10/2020
Special Protection Areas (England)	Natural England	2020	12/10/2020
Special Areas for Conservation (England)	Natural England	2020	12/10/2020
Ramsar	Natural England	2020	12/10/2020
Sites of Special Scientific Interest (England)	Natural England	2020	12/10/2020
SSSI Impact Risk Zones (England)	Natural England	2020	06/11/2020
Special Areas of Conservation (SACs) with marine components (all UK waters)	JNCC	2020	02/11/2020
Possible Special Areas of Conservation (England)	Natural England	2020	06/11/2020
Special Protection Areas (SPAs) with marine components (all UK waters)	JNCC	2020	02/11/2020
Potential Special Protection Areas (England)	Natural England	2020	06/11/2020
Marine Conservation Zones (England)	Natural England	2020	05/05/2020
National Nature Reserves (England)	Natural England	2020	12/10/2020
Ancient Woodland (England)	Natural England	2020	12/10/2020
Local Nature Reserves (England)	Natural England	2020	12/10/2020
Priority Habitat Inventory (England)	Natural England	2020	12/10/2020
Ancient Woodland (England)	Natural England	2020	12/10/2020
Nature Improvement Areas	Natural England	2020	02/11/2020
National Priority Focus Areas	Natural England	2020	02/11/2020
OS Open Greenspace	Ordnance Survey	2020	30/10/2020
Country Parks (England)	Natural England	2020	12/10/2020
CRoW Act 2000 - Section 4 Conclusive Registered Common Land	Natural England	2020	12/10/2020
CRoW Act 2000 - Section 15 Land	Natural England	2020	12/10/2020
OS OpenMap - Roads	Ordnance Survey	2020	04/10/2020
OS OpenMap - Railways	Ordnance Survey	2020	04/10/2020
OS OpenMap Local - Buildings	Ordnance Survey	2020	04/10/2020
National Cycle Network (Public)	Sustrans	2020	02/11/2020
English indices of deprivation 2015	Ministry of Housing, Communities and Local Government	2015	02/11/2020
Agricultural Land Classification (ALC) Grades - Post 1988 Survey (polygons)	Natural England	2020	12/10/2020
Permitted Waste Sites - Authorised Landfill Site Boundaries	Environment Agency	2020	12/10/2020
Historic Landfill Sites	Environment Agency	2020	12/10/2020
LVMF protected vistas - GIS files	Greater London Authority	2018	02/11/2020
English Local Authority Green Belt Dataset	Ministry of Housing, Communities and Local Government	2019	29/09/2020
Areas of Outstanding Natural Beauty (England)	Natural England	2020	12/10/2020
National Character Areas (England)	Natural England	2020	02/11/2020
Flood Map for Planning (Rivers and Sea) - Flood Zone 2	Environment Agency	2020	12/10/2020
Flood Map for Planning (Rivers and Sea) - Flood Zone 3	Environment Agency	2020	12/10/2020
Statutory Main River Map	Environment Agency	2020	12/10/2020
OS Open Rivers	Ordnance Survey	2020	15/10/2020
Source Protection Zones	Environment Agency	2020	12/10/2020
WFD River Canal and Surface Water Transfer Cycle 2	Environment Agency	2020	12/10/2020
WFD Groundwater Bodies Cycle 2	Environment Agency	2020	12/10/2020
Listed Buildings	Historic England	2020	12/10/2020
Registered Parks and Gardens	Historic England	2020	12/10/2020
Protected Wrecks	Historic England	2020	12/10/2020
Registered Battlefields	Historic England	2020	12/10/2020
Scheduled Monuments	Historic England	2020	12/10/2020
World Heritage Sites	Historic England	2020	12/10/2020
Built-up Areas (December 2011) Boundaries V2 - 350 metre buffer used	Office for National Statistics	2017	04/10/2020
National Trails	Natural England	2020	29/09/2020

A5 Environmental Baseline

Please note the file that comprises this Annex is provided separate to this document.

A6 SEA Detailed Assessment Output Table

Element Name	
Element Reference	
Description	

SEA topic	SEA objective	Construction Effects		Operational Effects		Effect Description (including embedded mitigation)	Further Mitigation	Residual Construction Effects		Residual Operational Effects	
		+ve	-ve	+ve	-ve			+ve	-ve	+ve	-ve
Biodiversity, flora and fauna	1.1 To protect designated sites and their qualifying features					Construction effects: Operation effects:	Construction mitigation: Operation mitigation:				
	1.2 To avoid a net reduction, and where possible enhance, in non-monetised natural capital assets					Construction effects: Operation effects:	Construction mitigation: Operation mitigation:				
	1.3 To protect and enhance biodiversity, priority habitats and species					Construction effects: Operation effects:	Construction mitigation: Operation mitigation:				
	1.4 To avoid and, where required, manage invasive and non-native species (INNS)					Construction effects: Operation effects:	Construction mitigation: Operation mitigation:				
	1.5 To meet WFD objectives relating to biodiversity					Construction effects: Operation effects:	Construction mitigation: Operation mitigation:				
Soil	2.1 To protect and enhance the functionality, quantity and quality of soils, including the protection of high-grade agricultural land					Construction effects: Operation effects:	Construction mitigation: Operation mitigation:				

SEA topic	SEA objective	Construction Effects		Operational Effects		Effect Description (including embedded mitigation)	Further Mitigation	Residual Construction Effects		Residual Operational Effects	
		+ve	-ve	+ve	-ve			+ve	-ve	+ve	-ve
Water	3.1 To minimise or manage flood risk, taking climate change into account					Construction effects: Operation effects:	Construction mitigation: Operation mitigation:				
	3.2 To enhance or maintain groundwater quality and resources					Construction effects: Operation effects:	Construction mitigation: Operation mitigation:				
	3.3 To enhance or maintain surface water quality, flows and quantity					Construction effects: Operation effects:	Construction mitigation: Operation mitigation:				
	3.4 To meet WFD objectives					Construction effects: Operation effects:	Construction mitigation: Operation mitigation:				
	3.5 To improve water efficiency through provision of access to a resilient and sustainable supply of water.					Construction effects: Operation effects:	Construction mitigation: Operation mitigation:				
Air	4.1 To minimise air emissions during construction and operation					Construction effects: Operation effects:	Construction mitigation: Operation mitigation:				
Climatic Factors	5.1 To introduce climate mitigation where required and improve the climate resilience of assets and natural systems					Construction effects: Operation effects:	Construction mitigation: Operation mitigation:				
	5.2 To minimise embodied and operational emissions					Construction effects: Operation effects:	Construction mitigation: Operation mitigation:				

SEA topic	SEA objective	Construction Effects		Operational Effects		Effect Description (including embedded mitigation)	Further Mitigation	Residual Construction Effects		Residual Operational Effects	
		+ve	-ve	+ve	-ve			+ve	-ve	+ve	-ve
Landscape	6.1 To conserve, protect and enhance landscape and townscape character and visual amenity					Construction effects: Operation effects:	Construction mitigation: Operation mitigation:				
Historic Environment	7.1 To conserve/protect and enhance historic assets/cultural heritage and their setting, including archaeological important sites					Construction effects: Operation effects:	Construction mitigation: Operation mitigation:				
Population and Human Health	8.1 To maintain and enhance the health and wellbeing of the local community, including economic and social wellbeing					Construction effects: Operation effects:	Construction mitigation: Operation mitigation:				
	8.2 To maintain and enhance tourism and recreation					Construction effects: Operation effects:	Construction mitigation: Operation mitigation:				
	8.3 To secure resilient water supplies for the health and wellbeing of customers					Construction effects: Operation effects:	Construction mitigation: Operation mitigation:				
	8.4 To increase access and connect customers to the natural environment, provide education or information resources for the public					Construction effects: Operation effects:	Construction mitigation: Operation mitigation:				
Material Assets	9.1 To minimise resource use and waste production					Construction effects: Operation effects:	Construction mitigation: Operation mitigation:				
	9.2 To avoid negative effects on built assets and infrastructure					Construction effects: Operation effects:	Construction mitigation: Operation mitigation:				

A7 SEA Scoring Criteria

SEA Objective	Effect	Description
Biodiversity, Flora, Fauna:	+++	Major Positive The option would result in a major enhancement on the quality of designated sites / habitats due to changes in flow or groundwater levels, water quality or habitat quality and availability. The option would result in a major increase in the population of a priority species. Effects could be caused by beneficial changes in water flows/water quality, or large amounts of creation or enhancement of habitat, promoting a major increase in ecosystem structure and function. The option would result in a major reduction or management of INNS.
	++	Moderate Positive The option would result in a moderate enhancement on the quality of designated and/or non-designated sites / habitats due to changes in flow or groundwater levels, water quality or habitat creation and enhancement measures. The option would result in a moderate increase in the population of a priority species. Effects could be caused by beneficial changes in water flows/water quality, or moderate amounts of creation or enhancement of habitat, promoting a moderate increase in ecosystem structure and function. The option would result in a moderate reduction or management of INNS.
	+	Minor Positive The option would result in a minor enhancement of the quality of designated and/or non-designated sites / habitats due to changes in flow or groundwater levels, water quality or habitat creation and enhancement measures. The option would result in a minor increase in the population of a priority species. Effects could be caused by beneficial changes in water flows/water quality, or small amounts of creation or enhancement of habitat, promoting a minor increase in ecosystem structure and function. The option would result in a minor reduction or management of INNS.
	0	Neutral The option would not result in any effects on designated or non-designated sites including habitats and/or species). It will not have an effect on INNS.
	-	Minor Negative The option would result in a minor negative effect on the quality of designated and/or non-designated sites / habitats due to changes in flow or groundwater levels, water quality or habitat loss or degradation. The option would result in a minor decrease in the population of a priority species. Effects could be caused by detrimental changes in flows/water quality, or small losses or degradation of habitat leading to a minor loss of ecosystem structure and function. The option would result in a minor increase or spread of INNS.
	--	Moderate Negative The option would result in a moderate negative effect on the quality of designated and/or non-designated sites / habitats due to changes in flow or groundwater levels, water quality or habitat loss or degradation. The option would result in a moderate decrease in the population of a priority species. Effects could be caused by detrimental changes in flows/water quality, or moderate loss or degradation of habitat leading to a moderate loss of ecosystem structure and function. The options would result in a moderate increase or spread of INNS.

SEA Objective	Effect	Description
	---	Major Negative The option would result in a major negative effect on the quality of designated and/or non-designated sites / habitats due to changes in flow or groundwater levels, water quality or habitat loss or degradation. The option would result in a major decrease in the population of a priority species. Effects could be caused by detrimental changes in flows/water quality, or large losses or degradation of habitat leading to a major loss of ecosystem structure and function. The option would result in a major increase or spread of INNS.
	?	Uncertain From the level of information available the effect that the option would have on this objective is uncertain
Soil: Protect and enhance the functionality, quantity and quality of soils	+++	Major Positive The option would result in a major enhancement on the quality of soils through the implementation of catchment approaches, remediation or other measures.
	++	Moderate Positive The option would result in a moderate enhancement on the quality of soils through the implementation of catchment approaches, remediation or other measures.
	+	Minor Positive The option is located on a brownfield site and has no effect on soils or existing land use. The option results in the remediation of contaminated land.
	0	Neutral The option would not result in any effects on soils or land use.
	-	Minor Negative The option is not located on a brownfield site and/or results in a minor loss of best and most versatile agricultural land or is in conflict with existing land use. The option results in land contamination.
	--	Moderate Negative The option will result in a moderate loss of best and most versatile agricultural land or is in substantial conflict with existing land use. The option is partially overlying mineral resources leading to partial mineral sterilisation.
	---	Major Negative The option will result in a major loss of best and most versatile agricultural land or is in substantial conflict with existing land use. The option results in land contamination. The option is directly overlying mineral resources leading to mineral sterilisation.
	?	Uncertain From the level of information available the effect that the option would have on this objective is uncertain
Water: Increase resilience and reduce flood risk Protect and enhance the quality of the water environment and water resources	+++	Major Positive The option results in addressing failure of WFD Good Ecological Status / Good Ecological Potential. The option would result in a major improvement to flood risk. The option would result in a major improvement in water efficiency, reduces demand and improves resilience.
	++	Moderate Positive The option achieves savings through demand management and does not require abstraction to achieve yield. The option contributes to addressing failure of WFD Good Ecological Status / Good Ecological Potential. The option would result in a moderate improvement to flood risk. The option would result in a moderate improvement in water efficiency, reduces demand and improves resilience.

SEA Objective	Effect	Description
Deliver reliable and resilient water supplies	+	Minor Positive The option achieves savings through demand management and does not require abstraction to achieve yield. The option would result in a minor improvement to flood risk. The option would result in a minor improvement in water efficiency, reduces demand and improves resilience.
	0	Neutral The option would have no discernible effect on river flows or surface/coastal water quality or on groundwater quality or levels. The option would not have an effect on or be affected by flood risk.
	-	Minor Negative The option would result in minor decreases in river flows. River and/or coastal water quality may be affected and lead to short term or intermittent effects on receptors (e.g. designated habitats, protected species or recreational users of rivers and the coastline) that could not be avoided but could be mitigated. The option would result in minor decreases in groundwater quality or levels. The option is located in Flood Zone 2. The option would result in minor decreases in water efficiency, increases demand and reduces resilience.
	--	Moderate Negative The option would result in moderate decreases in river flows. River and/or coastal water quality may be affected and lead to long term or continuous effects on receptors (e.g. designated habitats, protected species or recreational users of rivers and the coastline) that could not reasonably be mitigated. The option results in the likely deterioration of WFD classification. The option would result in moderate decreases in groundwater quality or levels. The option is located in Flood Zone 3. The option would result in moderate decreases in water efficiency, increases demand and reduces resilience.
	---	Major Negative The option would result in major decreases in river flows. River and/or coastal water quality may be affected and lead to long term or continuous effects on receptors (e.g. designated habitats, protected species or recreational users of rivers and the coastline) that could not reasonably be mitigated. The option results in the deterioration of WFD classification. The option would result in major decreases in groundwater quality or levels. The option is located in Flood Zone 2 or 3 and further contributes to flood risk. The option would result in major decreases in water efficiency, increases demand and reduces resilience.
	?	Uncertain From the level of information available the effect that the option would have on this objective is uncertain.
Air: Reduce and minimise air emissions	+++	Major Positive The option would result in a major enhancement of the air quality within one or more AQMAs.
	++	Moderate Positive The option would result in a moderate enhancement of the air quality within one or more AQMAs.
	+	Minor Positive The option would result in an enhancement of the air quality.
	0	Neutral The option would not result in any effects on Air Quality and AQMAs.

SEA Objective	Effect	Description
	-	Minor Negative The option would result in a decrease of the air quality.
	--	Moderate Negative The option would result in a decrease of the air quality within one or more AQMAs.
	---	Major Negative The option would result in a major decrease in the air quality within one or more AQMAs.
	?	Uncertain From the level of information available the effect that the option would have on this objective is uncertain.
Climate Factors: Reduce embodied and operational carbon emissions Reduce vulnerability to climate change risks and hazards	+++	Major Positive The option will generate significant additional zero carbon energy that can be fed back into the grid/reduce carbon emissions (see carbon scale) The option will result in a major increase in carbon sequestration. The option will increase resilience/decrease vulnerability to climate change effects.
	++	Moderate Positive The option will increase resilience/decrease vulnerability to climate change effects. The option will result in a moderate increase in carbon sequestration. The option will generate moderate additional zero carbon energy that can be fed back into the grid/reduce carbon emissions (see carbon scale)
	+	Minor Positive The option will increase resilience/decrease vulnerability to climate change effects. The option will result in a minor increase in carbon sequestration. The option will generate minor additional zero carbon energy that can be fed back into the grid/reduce carbon emissions (see carbon scale)
	0	Neutral The option would have no discernible effect on greenhouse gas emissions, nor would the option increase resilience/decrease vulnerability to climate change effects.
	-	Minor Negative The option will have a minor impact on resilience/decrease vulnerability to climate change effects. The option will generate minor construction carbon emissions (1 - 6,964,452 tCO ₂ e) and/or operational carbon emissions (1 - 3,492 tCO ₂ e).
	--	Moderate Negative The option will have a moderate impact on resilience/significantly decrease vulnerability to climate change effects. The option will generate moderate construction carbon emissions (6,964,453 - 20,000,000 tCO ₂ e) and/or operational carbon emissions (3,493 - 10,000 tCO ₂ e). The option will result in a moderate release of previously sequestered carbon.
	---	Major Negative The option will have a major impact on resilience/significantly decrease vulnerability to climate change effects. The option will generate significant construction carbon emissions (Above 20,000,000 tCO ₂ e) and/or operational carbon emissions (Above 10,000 tCO ₂ e). The option will result in a major release of previously sequestered carbon.
	?	Uncertain From the level of information available the effect that the option would have on this objective is uncertain.

SEA Objective	Effect	Description
Landscape: Conserve, protect and enhance landscape, townscape and seascape character and visual amenity	+++	Major Positive The option would have a major positive contribution to designated landscape (AONB or National Park) management plan objectives The option results in new, above ground infrastructure that significantly enhances the local landscape, townscape or seascape.
	++	Moderate Positive The option would have a moderate positive contribution to designated landscape management plan objectives The option results in new, above ground infrastructure that has a moderate positive effect on the local landscape, townscape or seascape.
	+	Minor Positive The option results in new, above ground infrastructure that has a minor positive effect on the local landscape, townscape or seascape.
	0	Neutral The option would not result in any effects on the local landscape, townscape or seascape.
	-	Minor Negative The option results in new, above ground infrastructure that has a minor negative effect on the local landscape, townscape or seascape.
	--	Moderate Negative The option would have a moderate negative effect on a designated landscape or feature (i.e. significant visually intrusive infrastructure) whose effects could not be reasonably mitigated. The option results in new, above ground infrastructure that has a moderate negative effect on the local landscape, townscape or seascape.
	---	Major Negative The option would have a negative effect on a designated landscape or feature (i.e. significant visually intrusive infrastructure) whose effects could not be reasonably mitigated. The option results in new, above ground infrastructure that has a major negative effect on the local landscape, townscape or seascape.
	?	Uncertain From the level of information available the effect that the option would have on this objective is uncertain.
Historic Environment Conserve, protect and enhance the historic environment, including archaeology	+++	Major Positive The option will result in enhancements to designated heritage assets and/or their setting, fully realising the significance and value of the asset, such as: - Securing repairs or improvements to heritage assets, especially those identified in the Historic England Buildings/Monuments at Risk Register; - Improving interpretation and public access to important heritage assets.
	++	Moderate Positive The option will result in enhancements to designated heritage assets and/or their setting. Improving interpretation and public access to important heritage assets.
	+	Minor Positive The option will result in enhancements to non-designated heritage assets and/or their setting.
	0	Neutral The option will have no effect on cultural heritage assets or archaeology.
	-	Minor Negative The option will result in the loss of significance of undesignated heritage assets and/or their setting, notwithstanding remedial recording of any elements affected. There will be limited damage to known, undesignated archaeology important sites with a consequent loss of significance only partly mitigated by archaeological investigation.

SEA Objective	Effect	Description
	--	Moderate Negative The option will result in the loss of significance of undesignated heritage assets and/or their setting, notwithstanding remedial recording of any elements affected. The option will diminish of significance of designated heritage assets and/or their setting, notwithstanding remedial recording of any elements affected.
	---	Major Negative The option will diminish the significance of designated heritage assets and/or their setting such as: - Demolition or further deterioration in the condition of designated heritage assets especially those identified in the Historic England Buildings/Monuments at Risk Register. - Loss of public access to important heritage assets and lack of appropriate interpretation. - There will be major damage to known, designated archaeology important sites with a consequent loss of significance only partly mitigated by archaeological investigation.
	?	Uncertain From the level of information available the effect that the option would have on this objective is uncertain.
Population, Human Health Maintain and enhance the health and wellbeing of the local community, including economic and social wellbeing Maintain and enhance tourism and recreation	+++	Major Positive The option leads to major positive effect on the health of local communities and will ensure that surface water and bathing water quality is maintained within statutory limits. The option creates new, and significantly enhances existing, recreational facilities, publicly accessible greenspace and/or tourism within the operational area.
	++	Moderate Positive The option leads to positive effect on the health of local communities and will ensure that surface water and bathing water quality is maintained within statutory limits. The option enhances existing, recreational facilities, publicly accessible greenspace and/or tourism within the operational area
	+	Minor Positive The option has a temporary positive effect on the health of local communities and will ensure that surface water and bathing water quality is maintained within statutory limits.
	0	Neutral The option would not result in any effects on human health and existing recreational facilities and/or tourism.
	-	Minor Negative The option has a temporary effect on human health (e.g. noise or air quality). The option reduces the availability and quality of existing recreational facilities and/or tourism within the operational area.
	--	Moderate Negative The option results in the permanent removal of existing recreational facilities, publicly accessible greenspace and/or tourism within the operational area.
	---	Major Negative The option has a significant long-term effect on human health (e.g. noise or air quality). The option results in the removal of existing recreational facilities, publicly accessible greenspace and/or tourism within the operational area.
	?	Uncertain From the level of information available the effect that the option would have on this objective is uncertain.
Material Assets Minimise resource use and	+++	Major Positive The option will re-use or recycle substantial quantities of waste materials and any new infrastructure will incorporate substantial sustainable design measures and materials. There will be no increase in energy consumption or energy will be from 100% renewable sources. The option improves national cycle routes or national trails.

SEA Objective	Effect	Description
waste production Avoid negative effects on built assets and infrastructure	++	Moderate Positive The option will re-use or recycle moderate quantities of waste materials and any new infrastructure will incorporate some sustainable design measures and materials. There will be no increase in energy consumption or energy will be from 90% renewable sources. The option improves national cycle routes or national trails.
	+	Minor Positive The option will re-use or recycle a limited quantity of waste materials and any new infrastructure will incorporate some limited sustainable design measures and materials. There will be no increase in energy consumption or energy will be from 80% renewable sources. The option improves national cycle routes or national trails.
	0	Neutral The option would not result in any effects on material assets.
	-	Minor Negative The option will require new infrastructure with only limited opportunities for the re-use or recycling of waste materials. There are limited opportunities for sustainable design or the use of sustainable materials. The option results in a minor increase in energy consumption with no renewable energy options. The option results in a minor disruption on built assets and infrastructure, including transport.
	--	Moderate Negative The option will require new infrastructure with only limited opportunities for the re-use or recycling of waste materials. The option results in a moderate increase in energy consumption with no renewable energy options. The option results in a moderate disruption on built assets and infrastructure, including transport links.
	---	Major Negative The option will require significant new infrastructure that cannot be provided through the re-use or recycling of waste materials. There are no opportunities for sustainable design or the use of sustainable materials. The option results in a major increase in energy consumption with no renewable energy options. The option results in a major distribution on built assets and infrastructure, including transport links.
	?	Uncertain From the level of information available the effect that the option would have on this objective is uncertain.

A8 High Level Screening Assessment

Introduction

A number of potential route options running from the Vyrnwy raw water mains between Llanforda open reservoir and Oswestry WTW, to the west of Oswestry, to the lower reaches of the River Vyrnwy and the River Severn (downstream of the confluence with the River Vyrnwy) were identified by United Utilities (UU).

A list of these conveyance options is provided in Table 1.

Table 1: List of raw water pipeline route options

Option Reference	Option Name	Option Description
1	Vyrnwy Mitigation - Middle Vyrnwy release	Branch off from the Vyrnwy raw water mains between Llanforda open reservoir and Oswestry WTW to the west of Oswestry, [REDACTED] of pipeline. Outfall to the Middle Vyrnwy just upstream of the confluence with the River Tanat
2	Vyrnwy Mitigation - Lower Vyrnwy release	Branch off from the Vyrnwy raw water mains between Llanforda open reservoir and Oswestry WTW to the west of Oswestry, [REDACTED] of pipeline. Outfall to the Lower Vyrnwy to the south east of Llanymynech
3	Vyrnwy Mitigation - Lower Vyrnwy release	Branch off from the Vyrnwy raw water mains between Llanforda open reservoir and Oswestry WTW to the west of Oswestry, [REDACTED] of pipeline. Outfall to the Lower Vyrnwy just downstream of the confluence with the River Morda
4	Vyrnwy Mitigation - – Vyrnwy Bypass release	Branch off from the Vyrnwy raw water mains between Llanforda open reservoir and Oswestry WTW to the west of Oswestry, [REDACTED] of pipeline. Outfall to the River Severn approximately [REDACTED] south east of Ponthen
5	Vyrnwy Mitigation - Lower Vyrnwy release	Branch off from the Vyrnwy raw water mains between Llanforda open reservoir and Oswestry WTW to the west of Oswestry, [REDACTED] of pipeline. Outfall to the Lower Vyrnwy approximately [REDACTED] south east of Llanymynech
6	Vyrnwy Mitigation - Lower Vyrnwy release	Branch off from the Vyrnwy raw water mains between Llanforda open reservoir and Oswestry WTW to the west of Oswestry, [REDACTED] of pipeline. Outfall to the Lower Vyrnwy approximately [REDACTED] north west of Crosslanes
7	Vyrnwy Mitigation – Vyrnwy Bypass release	Branch off from the Vyrnwy raw water mains between Llanforda open reservoir and Oswestry WTW to the west of Oswestry, [REDACTED] of pipeline. Outfall to the River Severn approximately [REDACTED] south east of Ponthen

Figures 1 - 7 illustrate each of these potential raw water pipeline route options.

Figure 1: Map of Route Option 1

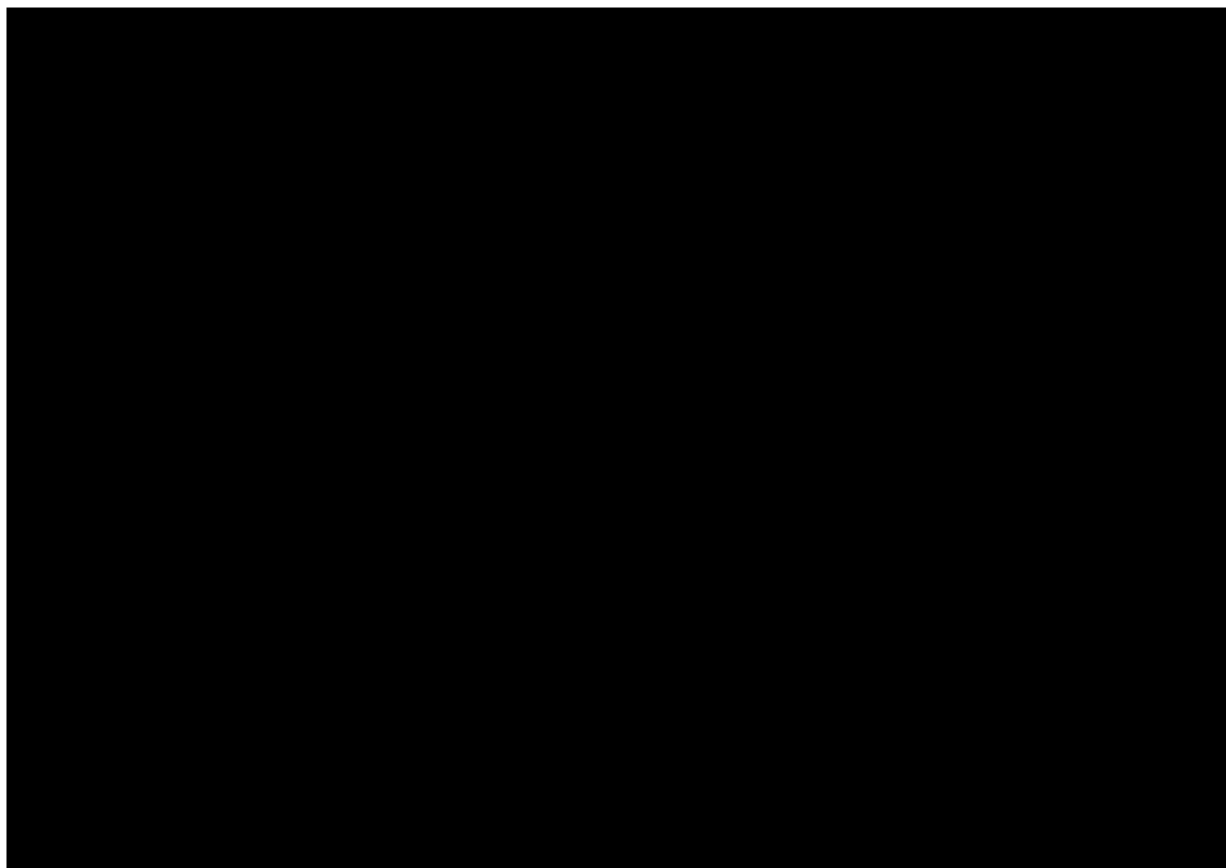


Figure 2: Map of Route Option 2

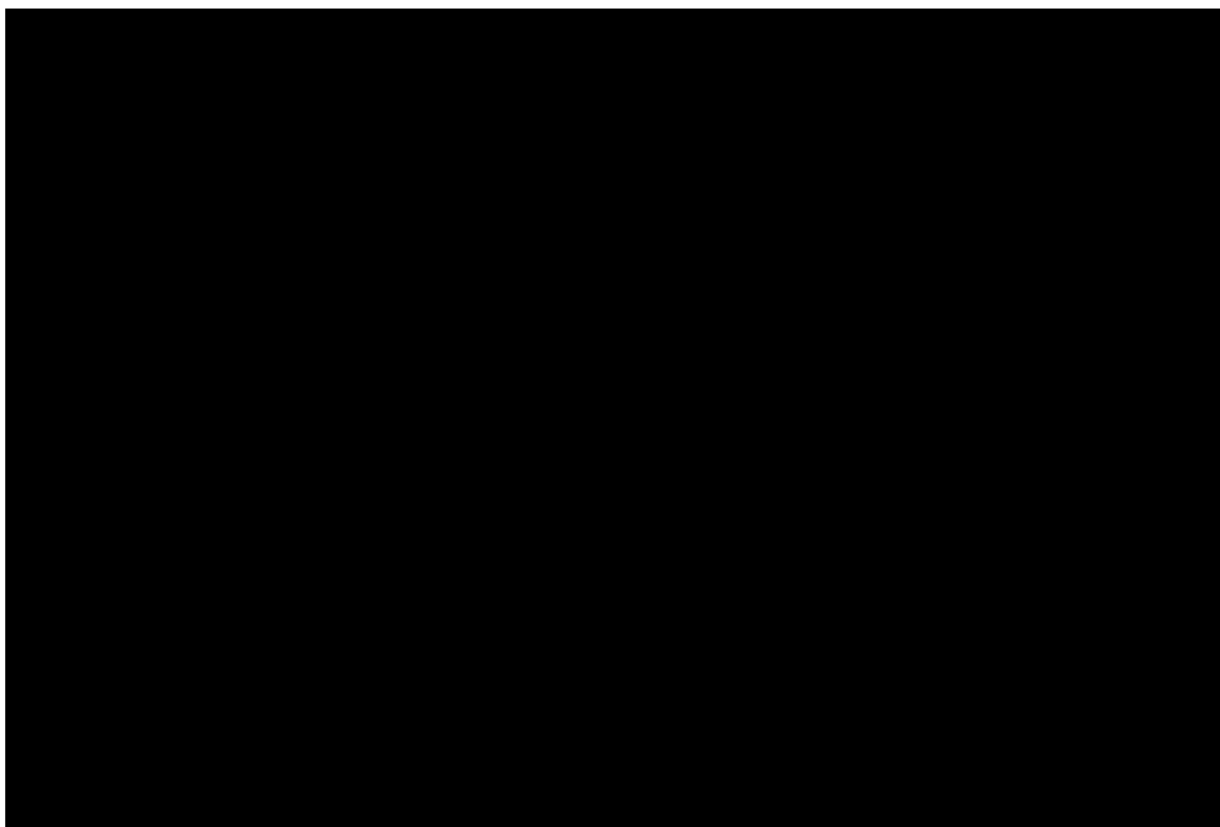


Figure 3: Map of Route Option 3

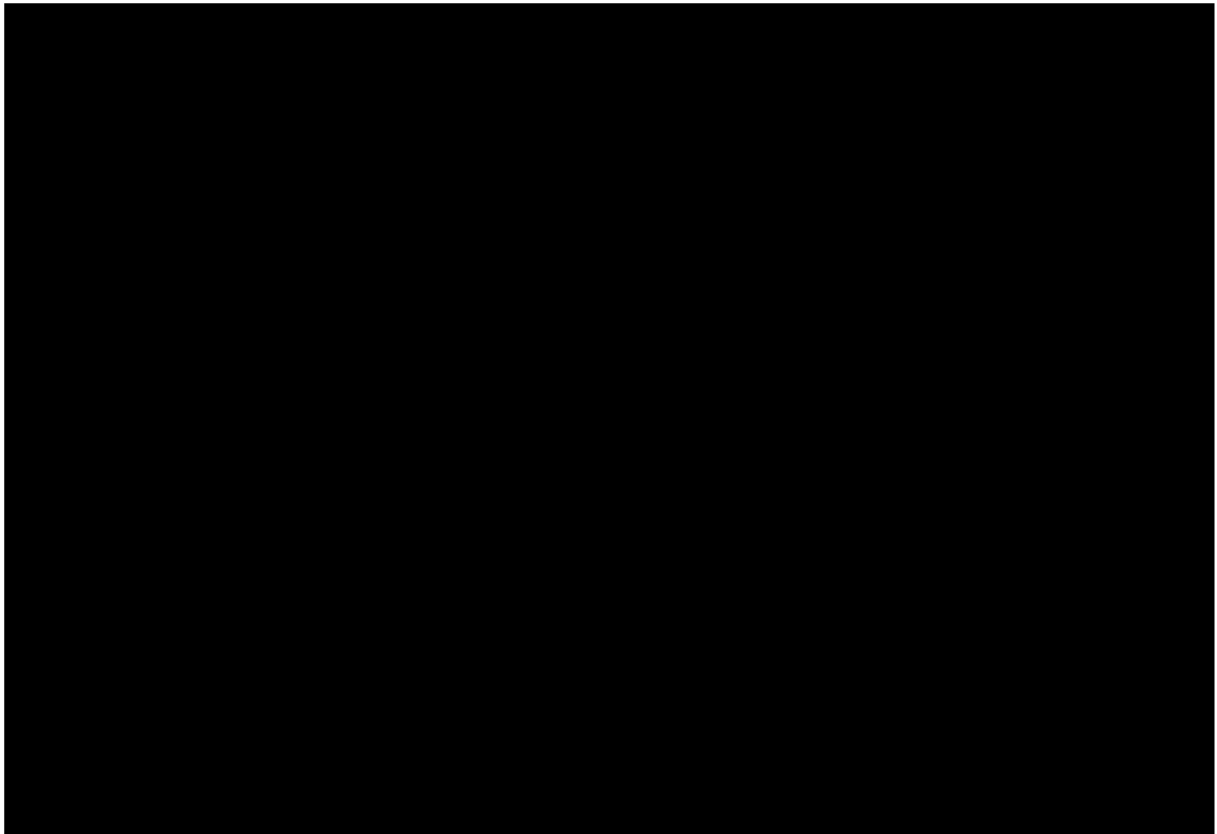


Figure 4: Map of Route Option 4

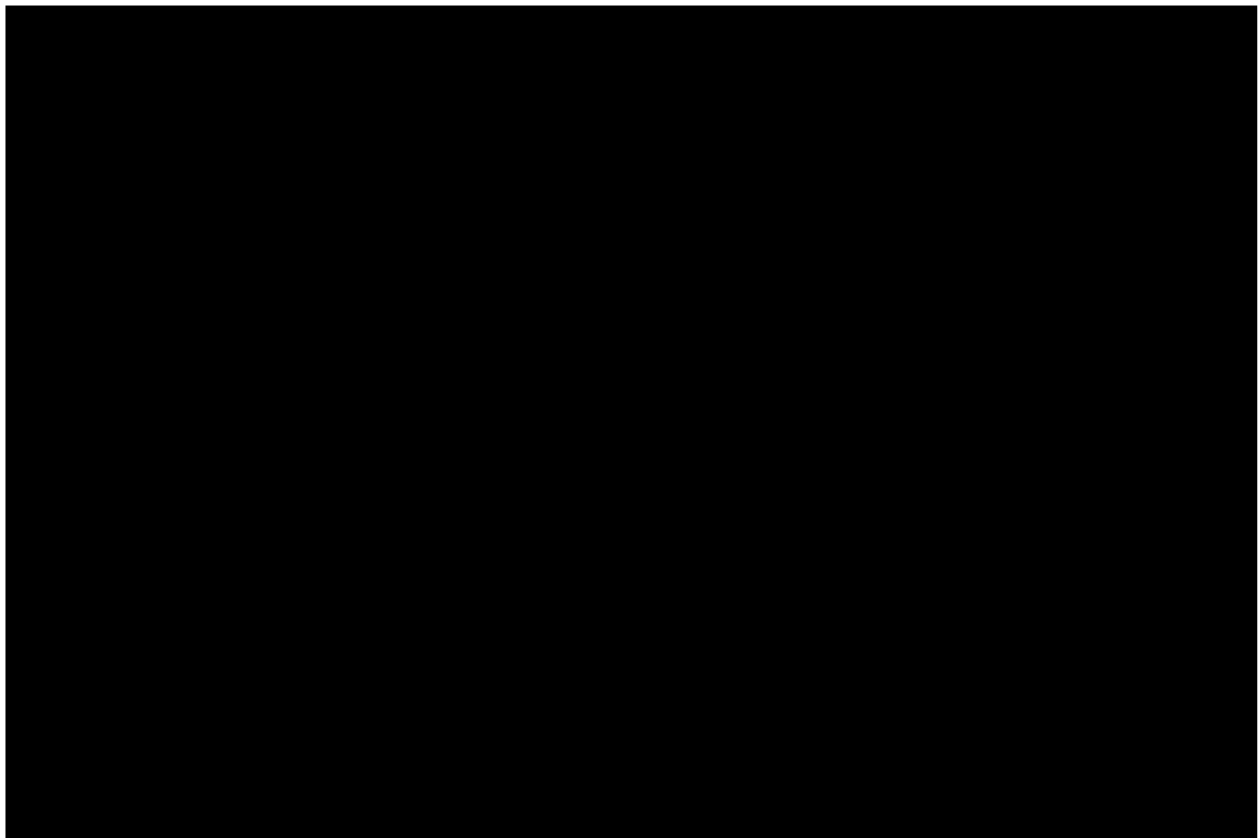


Figure 5: Map of Route Option 5

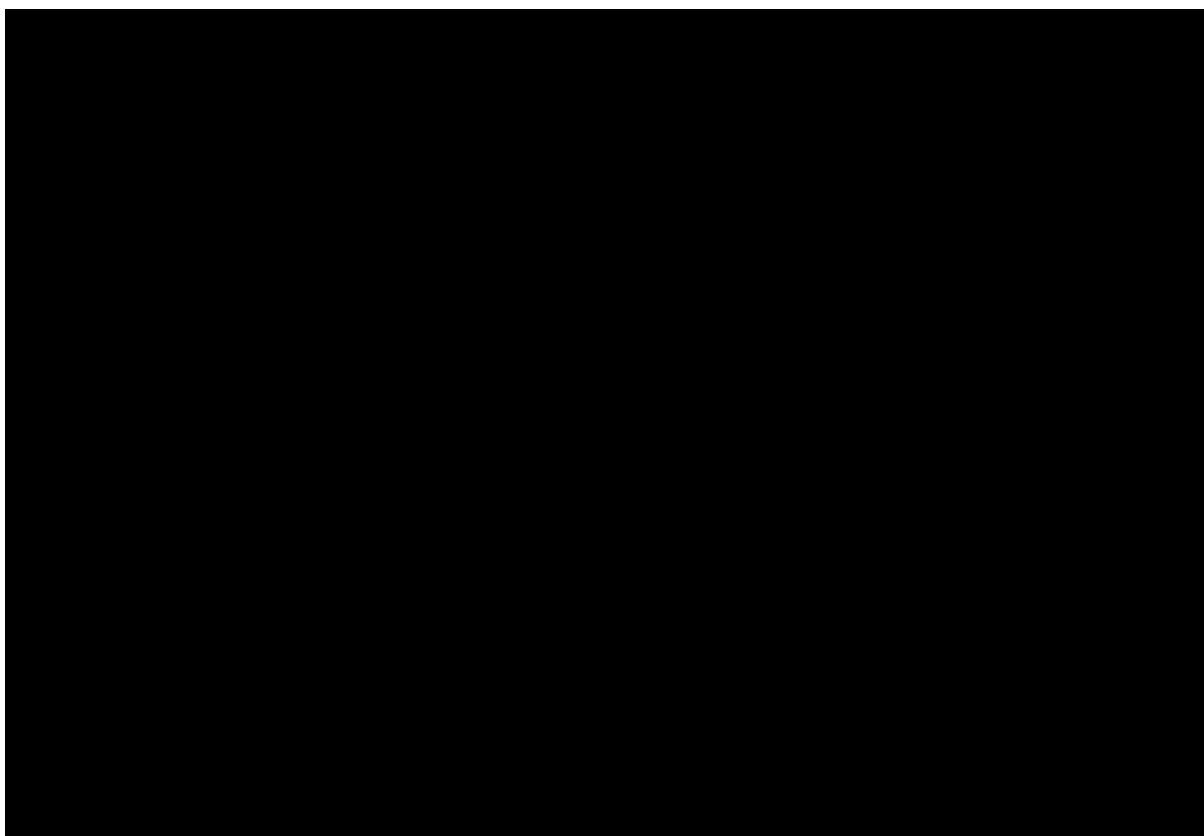


Figure 6: Map of Route Option 6

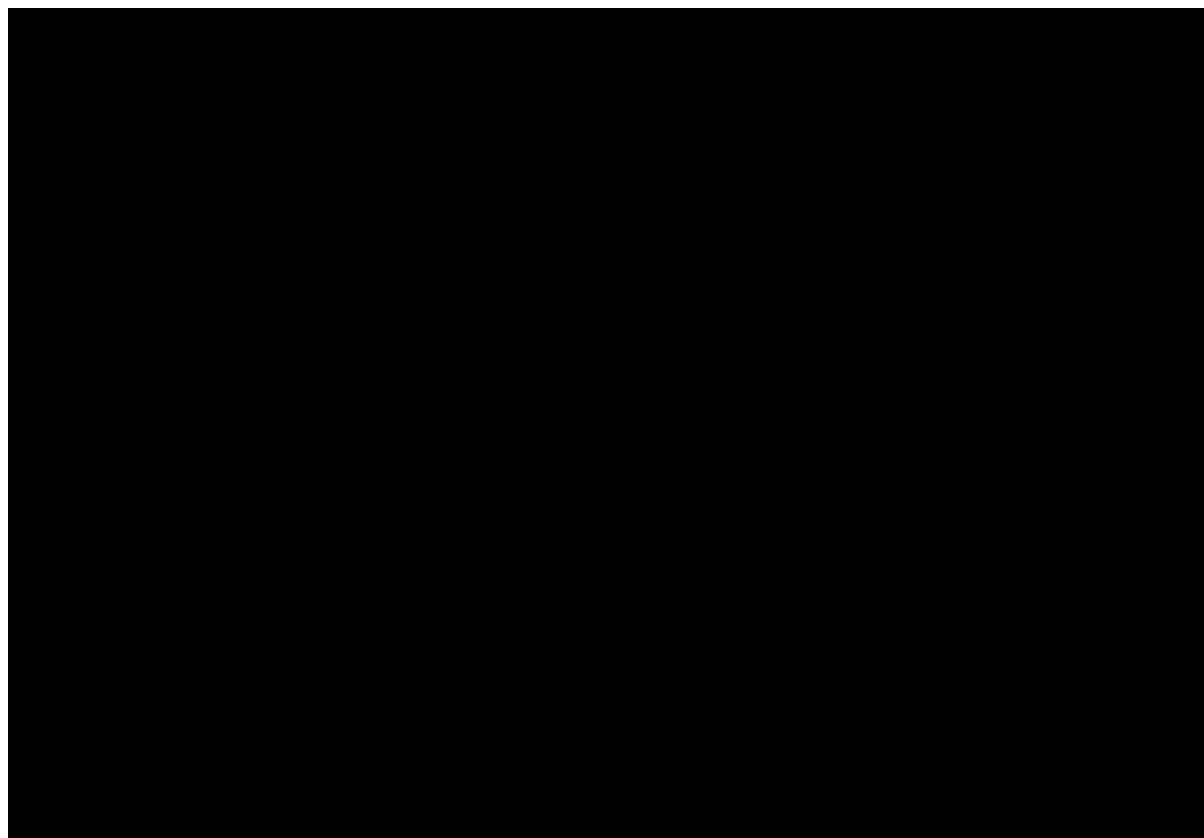
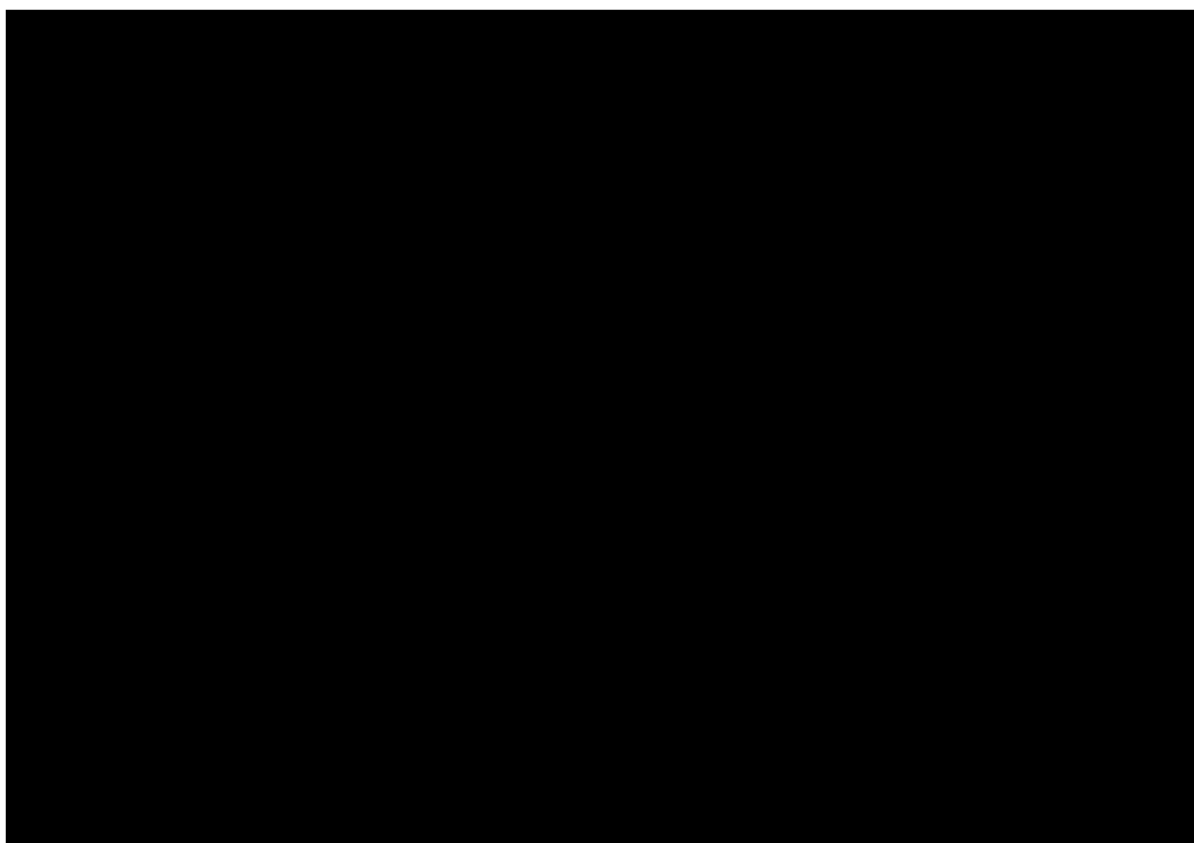


Figure 7: Map of Route Option 7



High Level Screening Assessment

The assessment results of the high level screening for each of the seven potential raw water pipeline route options are presented below.

The assessment of each potential conveyance option has considered the engineering works required from the point of abstraction (from the Vyrnwy raw water mains) to the point of discharge into the receiving watercourse in the River Vyrnwy or River Severn. Water quality and ecology considerations related to the water discharges have been limited to issues related to designated ecological sites only at this stage and therefore the assessment has focussed on the potential impacts of the engineering works required for transfer of water for each of these potential options.

Option 1: Vyrnwy Mitigation - Middle Vyrnwy release: High Level Screening Option appraisal

SEA Topic Area	Criteria considered	RAG Rating	Assessment Comments
Biodiversity – Flora and Fauna	SPA, Ramsar, SAC, SSSI, NNR, LNR, Ancient woodland, priority habitats		The pipeline route passes some [REDACTED] from the Midland Meres and Moses Phase 2 Ramsar site and within [REDACTED] of the Trefonen Marshes SSSI. Whilst the route does not come within [REDACTED] of ancient woodland it does cross some 275m of Priority Habitats including deciduous woodlands. The location avoid impacts on approximately 40km of river downstream of the reservoir. The altered flow could also impact on water levels in coastal and floodplain grazing marshes (priority habitat) downstream of the discharge location. Mitigation measures will be necessary.
Soil	Agricultural land classification / landfill sites		Most of the route consist entirely of greenfield land used for what appears to be agricultural purposes. A majority of the route lies within Grade 3 agricultural land. The route does not lie within 500m of a landfill site.
Water	Flood Risk Zones, Groundwater source protection zones River crossings		The pipeline route crosses flood zones 2 and 3, as well as crossing the Rivers Morda and Tanat. Mitigation measures will be necessary. The route is not located in any source protection zones.
Air	AQMA		The pipeline route does not come within 500m of any designated AQMA. No adverse effects from linkages to designated sites and / or their qualifying features are envisaged as a result of the construction of the pipeline route.
Historic Environment	Listed Buildings, SAM, Registered parks and gardens, registered battlefields, World Heritage Sites		Pipeline route runs within [REDACTED] of fifteen listed buildings. The pipeline route bisects [REDACTED] of Offa's Dyke Scheduled Monument and lies within [REDACTED] of the Trefarclawdd colliery Scheduled Monument. Mitigation measures will be necessary.
Landscape	AONB / National Parks		The pipeline route does not lie within 500m of an ANOB or National Park. The pipeline works will be temporary in nature.
Material Assets	Length of conveyance route (use of resources)		The pipeline route is approximately [REDACTED] in length.
Population and Human Health	Main urban areas. National Trails, other Public Rights of Way (PRoW), cycle routes, country park and Greenbelt.		The pipeline route avoids main urban areas and does not impact any areas of Green Belt or Country Park. The route crosses a National Trail (Offa's Dyke Path) three times as well as PRoW to the west of Oswestry and south of Trefonen. Mitigation measures will be necessary.

Assessing proposed pipeline route option 1 applying the RAG assessment methodology set out in Annex A1 has identified a number of adverse environmental constraints associated with this proposed pipeline route. These include:

- Proximity of the pipeline route to European and nationally designated sites of ecological importance;
- The pipeline route crosses some 275m of Priority Habitats including deciduous woodlands
- Proposed discharge location in the middle Vyrnwy which may not be acceptable to NRW at high volumes due to potential effects on the ecology of the River Vyrnwy;
- The pipeline route directly crosses the Offa's Dyke Scheduled Monument; and
- The pipeline route directly impacts a national trail in three locations.

Option 2: Vyrnwy Mitigation - Lower Vyrnwy release: High Level Screening Option appraisal

SEA Topic Area	Criteria considered	RAG Rating	Comment
Biodiversity – Flora and Fauna	SPA, Ramsar, SAC, SSSI, NNR, LNR, Ancient woodland, priority habitats		The pipeline route passes some [REDACTED] from the Midland Meres and Moses Phase 2 Ramsar site. The route additionally crosses some [REDACTED] of Sweeney Fen SSSI and lies within [REDACTED] of Llanymynech and Llyncllys Hills SSSI at its closest point. Whilst the route does not come within 500m of ancient woodland, it does cross some 125m of Priority Habitats including deciduous woodlands. The location avoid impacts on approximately 45km of river downstream of the reservoir. The altered flow could also impact on water levels in coastal and floodplain grazing marshes (priority habitat) downstream of the discharge location. Mitigation measures will be necessary.
Soil	Agricultural land classification / landfill sites		Most of the route consists entirely of greenfield land used for what appears to be agricultural purposes. The route lies within Grade 3 agricultural land. The route does not lie within 500m of a landfill site.
Water	Flood Risk Zones, Groundwater source protection zones, River crossings		The pipeline route crosses flood zones 2 and 3, as well as crossing the River Morda and Montgomery canal. Mitigation measures will be necessary. The route is not however located in any source protection zones.
Air Quality	AQMA		The pipeline route does not come within 500m of any designated AQMA. No adverse effects from linkages to designated sites and / or their qualifying features are envisaged as a result of the construction of the pipeline route.
Historic Environment	Listed Buildings, SAM, Registered parks and gardens, registered battlefields, World Heritage Sites		The pipeline route runs within [REDACTED] of nine listed buildings.
Landscape	AONB / National Parks		The pipeline route does not lie within 500m of an AONB or National Park. The pipeline works will be temporary in nature.
Material Assets	Length of conveyance route (use of resources)		The pipeline route is approximately [REDACTED] in length.
Population and Human Health	Main urban areas. National Trails, other Public Rights of Way (PRoW), cycle routes, country park and Greenbelt.		The pipeline route avoids main urban areas, national trails and does not impact any areas of Green Belt or Country Park. The route does cross several PRoWs west of Oswestry, east of Trefonen, northwest of Llyncllys and east of Pant.

Assessing proposed pipeline route option 2 applying the RAG assessment methodology set out in Annex A1 has identified a number of adverse environmental constraints associated with this proposed pipeline route. These include:

- Proximity of the pipeline route to European and nationally designated sites of ecological importance;
- The pipeline route crosses some [REDACTED] of Sweeney Fen SSSI and some 125m of Priority Habitats including deciduous woodlands;
- Proposed discharge location in the middle Vyrnwy which may not be acceptable to NRW at high volumes due to potential effects on the ecology of the River Vyrnwy.

Option 3: Vyrnwy Mitigation - Lower Vyrnwy release: High Level Screening Option appraisal

Criteria	Criteria considered	RAG Rating	Comment
Biodiversity – Flora and Fauna	SPA, Ramsar, SAC, SSSI, NNR, LNR, Ancient woodland, priority habitats		The pipeline route passes some [REDACTED] from the Midland Meres and Moses Phase 2 Ramsar site. Whilst the route does not come within 500m of ancient woodland, it does cross some 50m of Priority Habitats including deciduous woodlands. The location avoid impacts on approximately 47km of river downstream of the reservoir. The altered flow could also impact on water levels in coastal and floodplain grazing marshes (priority habitat) downstream of the discharge location. Mitigation measures will be necessary.
Soil	Agricultural land classification / landfill sites		Most of the pipeline route consists entirely of greenfield land used for what appears to be agricultural purposes. A majority of the route lies within Grade 3 agricultural land. The route does not lie within 500m of a landfill site.
Water	Flood Risk Zones, Groundwater source protection zones, river crossings		The pipeline route crosses flood zones 2 and 3, as well as the River Morda and Montgomery canal. Mitigation measures will be necessary. The route is not however located in any source protection zones.
Air Quality	AQMA		The pipeline route does not come within 500m of any designated AQMA. No adverse effects from linkages to designated sites and / or their qualifying features are envisaged as a result of the construction of the pipeline route.
Historic Environment	Listed Buildings, SAM, Registered parks and gardens, registered battlefields, World Heritage Sites		The pipeline route crosses within 500m of 21 listed buildings.
Landscape	AONB / National Parks		The pipeline route does not lie within 500m of an AONB or National Park. The pipeline works will be temporary in nature.
Material Assets	Length of conveyance route (use of resources)		The pipeline route is approximately [REDACTED] in length.
Population and Human Health	Main urban areas. National Trails, other Public Rights of Way (PRoW), cycle routes, country park and Greenbelt.		The pipeline route avoids main urban areas, national trails and does not impact any areas of Green Belt or Country Park. The route does cross several PRoWs south of Morda, east of Llynclys, east of Pant and east of Llanymynech.

Assessing proposed pipeline route option 3 applying the RAG assessment methodology set out in Annex A1 has identified a number of adverse environmental constraints associated with this proposed pipeline route. These include:

- Proximity of the pipeline route to European designated sites of ecological importance;
- The pipeline route crosses some 50m of Priority Habitats including deciduous woodlands;
- Proposed discharge location in the middle Vyrnwy which may not be acceptable to NRW at high volumes due to potential effects on the ecology of the River Vyrnwy.

Option 4: Vyrnwy Mitigation - Vyrnwy bypass: High Level Screening Option appraisal

Criteria	Criteria considered	RAG Rating	Comment
Biodiversity – Flora and Fauna	SPA, Ramsar, SAC, SSSI, NNR, LNR, Ancient woodland, priority habitats		The pipeline route crosses [REDACTED] of the Midland Meres and Moses Phase 2 Ramsar site and [REDACTED] of the Morton Pool and Pasture SSSI. Whilst the route does not come within 500m of ancient woodland, it does cross some 240m of Priority Habitats including deciduous woodlands. The route additionally runs along the western boundary of Holly Banks Nature Reserve upon approach to the River Severn. The location avoids impacts on the entire length of River Vyrnwy downstream of the reservoir. The altered flow could also impact on water levels in coastal and floodplain grazing marshes (priority habitat) immediately downstream of the discharge location. Mitigation measures will be necessary.
Soil	Agricultural land classification / proximity to landfill sites		A majority of the route lies within Grade 3 [REDACTED] and Grade 4 Agricultural Land [REDACTED], with a small length [REDACTED] passing through Grade 2 Agricultural Land. The route does not lie within 500m of a landfill site.
Water	Flood Risk Zones, Groundwater source protection zones, river crossings		The pipeline route crosses flood zones 2 and 3, and also crosses the River Morda and the Montgomery canal. Mitigation measures will be necessary. The route is not however located in any source protection zones.
Air	AQMA		The pipeline route does not come within 500m of any designated AQMA. No adverse effects from linkages to designated sites and / or their qualifying features are envisaged as a result of the construction of the pipeline route.
Historic Environment	Listed Buildings, SAM, Registered parks and gardens, registered battlefields, World Heritage Sites		The pipeline route crosses within 500m of 18 listed buildings.
Landscape	AONB / National Parks		Route does not lie within 500m of an AONB or National Park. The pipeline works will be temporary in nature.
Material Assets	Length of conveyance route (use of resources)		Route is approximately [REDACTED] in length.
Population and Human Health	Main urban areas. National Trails, other Public Rights of Way (PRoW), cycle routes, country park and Greenbelt.		The pipeline route avoids main urban areas, national trails and does not impact any areas of Green Belt or Country Park. The pipeline route crosses a cycle path east of Llynclys and Pant and PRoWs east of Maesbrook.

Assessing proposed pipeline route option 4 applying the RAG assessment methodology set out in Annex A1 has identified a number of adverse environmental constraints associated with this proposed pipeline route. These include:

- The pipeline route crosses some [REDACTED] of the Midland Meres and Moses Phase 2 Ramsar site and [REDACTED] of Morton Pool and Pasture SSSI
- The pipeline route crosses some 240m of Priority Habitats including deciduous woodlands;
- Proposed discharge location in the River Severn which may not be acceptable to NRW;
- A small length of the pipeline route (~900m) passes passing through Grade 2 Agricultural Land.

Option 5: Vyrnwy Mitigation - Lower Vyrnwy release: High Level Screening Option appraisal

SEA Topic Area	Criteria considered	RAG Rating	Comment
Biodiversity – Flora and Fauna	SPA, Ramsar, SAC, SSSI, NNR, LNR, Ancient woodland, priority habitats		The pipeline route lies some [REDACTED] m from the Midland Meres Mosses Phase 2 Ramsar Site and from Llanymynech Llyncllys Hills SSSI. The route does not come within 500m of ancient woodland or cross any priority habitats. The location avoid impacts on approximately 47km of river downstream of the reservoir. The altered flow could also impact on water levels in coastal and floodplain grazing marshes (priority habitat) downstream of the discharge location. Mitigation measures will be necessary.
Soil	Agricultural land classification / proximity to landfill sites		A majority of the route lies within Grade 3 agricultural land. The route does not lie within 500m of a landfill site.
Water	Flood Risk Zones, Groundwater source protection zones River crossings		The proposed pipeline route crosses the River Morda and Montgomery Canal. The route crosses flood zones 2 and 3 at the River Morda and upon its approach to the River Severn. Mitigation measures will be necessary. The route is not however located in any source protection zones.
Air	AQMA		The pipeline route does not come within 500m of any designated AQMA. No adverse effects from linkages to designated sites and / or their qualifying features are envisaged as a result of the construction of the pipeline route.
Historic Environment	Listed Buildings, SAM, Registered parks and gardens, registered battlefields, World Heritage Sites		The pipeline route crosses within 500m of 13 listed buildings.
Landscape	AONB / National Parks		The pipeline route does not lie within 500m of an AONB or National Park. The pipeline works will be temporary in nature.
Material Assets	Length of conveyance route (use of resources)		The pipeline route is approximately [REDACTED] in length.
Population and Human Health	Main urban areas. National Trails, other Public Rights of Way (PRoW), cycle routes, country park and Greenbelt.		The pipeline route avoids main urban areas, national trails and does not impact any areas of Green Belt or Country Park. The pipeline route crosses several PRoWs east of Trefonen and Pant.

Assessing proposed pipeline route option 5 applying the RAG assessment methodology set out set out in Annex A1 identified limited potential adverse environmental constraints associated with this proposed pipeline route.

Option 6: Vyrnwy Mitigation - Lower Vyrnwy release: High Level Screening Option appraisal

SEA Topic Area	Criteria considered	RAG Rating	Comment
Biodiversity – Flora and Fauna	SPA, Ramsar, SAC, SSSI, NNR, LNR, Ancient woodland, priority habitats		The pipeline route lies some 1km from the Midland Meres Mosses Phase 2 Ramsar Site and from the Llanymynech Llynclys Hills SSSI. The route does not come within 500m of ancient woodland or cross any priority habitats. The location avoid impacts on approximately 53km of river downstream of the reservoir. The altered flow could also impact on water levels in coastal and floodplain grazing marshes (priority habitat) downstream of the discharge location.
Soil	Agricultural land classification / to landfill sites		A majority of the route lies within Grade 3 agricultural land and a smaller length of the pipeline lies within Grade 4 agricultural land. The route does not lie within 500m of a landfill site.
Water	Flood Risk Zones, Groundwater source protection zones River crossings		The proposed pipeline route crosses the River Morda and the Montgomery Canal. The route crosses flood zones 2 and 3 at the River Morda and to a larger extent (4.3km) upon its approach to the River Vyrnwy. Mitigation measures will be necessary. The route is not however located in any source protection zones.
Air	Proximity to AQMA		The pipeline route does not come within 500m of any designated AQMA. No adverse effects from linkages to designated sites and / or their qualifying features are envisaged as a result of the construction of the pipeline route.
Historic Environment	Listed Buildings, SAM, Registered parks and gardens, registered battlefields, World Heritage Sites		The pipeline route crosses within 500m of 18 listed buildings.
Landscape	AONB / National Parks		Route does not lie within 500m of an AONB or National Park. The pipeline works will be temporary in nature.
Material Assets	Length of conveyance route (use of resources)		The route is approximately in length.
Population and Human Health	Main urban areas. National Trails, other Public Rights of Way (PRoW), cycle routes, country park and Greenbelt.		The pipeline route avoids main urban areas, national trails and does not impact any areas of Green Belt or Country Park. The pipeline route crosses several PRoWs east of Trefonen and Pant.

Assessing proposed pipeline route option 6 applying the RAG assessment methodology set out in Annex A1 identified limited potential adverse environmental constraints associated with this proposed pipeline route. However, the route does involve crossing some 4.3km of flood zone 3 upon its approach to the discharge location on the River Vyrnwy.

Option 7: Vyrnwy Mitigation - Vyrnwy bypass: High Level Screening Option appraisal

SEA Topic Area	Criteria considered	RAG Rating	Comment
Biodiversity – Flora and Fauna	SPA, Ramsar, SAC, SSSI, NNR, LNR, Ancient woodland, priority habitats		The pipeline route is some [REDACTED] from the from the Midland Meres Mosses Phase 2 Ramsar Site and from Llanymynech Llyncllys Hills SSSI. The route does not come within 500m of ancient woodland or cross any priority habitats. The location avoids impacts on the entire length of River Vyrnwy downstream of the reservoir. The altered flow could also impact on water levels in coastal and floodplain grazing marshes (priority habitat) immediately downstream of the discharge location.
Soil	Agricultural land classification / to landfill sites		A majority of the pipeline route ([REDACTED]) lies within Grade 3 agricultural land and a smaller length of the pipeline ([REDACTED]) lies within Grade 4 agricultural land. The route does not lie within 500m of a landfill site.
Water	Flood Risk Zones, Groundwater source protection zones River crossings		The proposed pipeline route crosses two main rivers and the Montgomery Canal. The route crosses flood zones 2 and 3 at the River Morda and to a larger extent (7.1km) to the east of Llanymynech upon its approach to the River Severn. Mitigation measures will be necessary. The route is partially located within source protection zone 3.
Air	Proximity to AQMA		The pipeline route does not come within 500m of any designated AQMA. No adverse effects from linkages to designated sites and / or their qualifying features are envisaged as a result of the construction of the pipeline route.
Historic Environment	Listed Buildings, SAM, Registered parks and gardens, registered battlefields, World Heritage Sites		The pipeline route crosses within 500m of 19 listed buildings.
SEA Topic Area	Criteria considered	RAG Rating	Comment
Landscape	AONB / National Parks		The pipeline route does not lie within 500m of an AONB or National Park. The pipeline works will be temporary in nature.
Material Assets	Length of conveyance route (use of resources)		The route is approximately [REDACTED] in length.
Population and Human Health a	Main urban areas. National Trails, other Public Rights of Way (PRoW), cycle routes, country park and Greenbelt.		The pipeline route avoids main urban areas, national trails and does not impact any areas of Green Belt or Country Park. The pipeline route crosses several PRoWs east of Trefonen, Pant and Llanymynech.

Assessing proposed pipeline route option 7 applying the RAG assessment methodology set out in Annex A1 identified limited potential adverse environmental constraints associated with this proposed pipeline route. However, the route does involve crossing some 7.1km of flood zone 3 upon its approach to the discharge location on the River Severn.

Assessment Conclusions

The high level RAG assessment screening of the seven potential routes for the raw water pipeline from a branch off from the Vyrnwy raw water mains between Llanforda open reservoir and Oswestry WTW, to the west of Oswestry, to the lower reaches of the River Vyrnwy or the River Severn (downstream of the confluence with the River Vyrnwy) identified three potential options that did not include any red rated criteria.

Two of the options (options 5 and 6) proposed discharges into the River Vyrnwy whilst option 7 proposed a discharge into the River Severn.

Having regard to concerns previously expressed by NRW with regards to the potential impacts of additional releases on in particular the fish community of the River Vyrnwy more detailed assessment of option 7 is proposed since this route option proposes releases direct into the River Severn. The high-level screening assessment results with respect to options 5 and 6 are the same. Having regard to the additional level of flood zone that is traversed with route option 6 and the longer conveyance length of this option it is considered option 5 to be a better performing option. In consequence, options 5 and 7 have been taken forward for further detailed assessment.

A9 Element assessments

Please note the spreadsheets that comprise this Annex are provided separate to this document.

A10 Option assessments

Please note the spreadsheets that comprise this Annex are provided separate to this document.



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