



# ANNEX B3

## Environmental Regulatory Assessments (WFD)

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

# B3 Severn Trent Sources Strategic Resource Option

Water Framework Directive Assessment

Severn Trent Water Limited

18 August 2022

5213609 / 9.3 / DG / 003



# Notice

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## Client signoff

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# 1. Introduction

## 1.1. Background

This report provides a Water Framework Directive (WFD) assessment of the Severn Trent Sources (STS) Strategic Resource Option (SRO) ('the Scheme'). The Scheme was identified as an SRO in the PR19 Final Determination, with funding provided to Severn Trent Water (STW) as an individual company. The STS SRO is considered integral to the Severn Thames Transfer (STT) SRO. The central aspect of the STT is the interconnector which enables the transfer of raw water from the River Severn to the River Thames (Deerhurst to Culham pipeline). To support this transfer, additional sources of water are required to support baseline river flows. These additional sources of water will be supported by United Utilities and STW, which comprise of water resources that can be added, or not abstracted (redeployed), from the Rivers Vyrnwy, Severn and Avon. This assessment only considers the STS SRO option, which comprises:

- A transfer of up to 35 MI/d of final effluent from Netheridge Wastewater Treatment Works (WwTW) to the River Severn at Haw Bridge.
- A 15 MI/d temporary licence transfer from Mythe Water Treatment Works (WTW) to the Severn to Thames Transfer pipeline abstraction location at Deerhurst.

This report is a Technical Appendix to the STS SRO Interim Environmental Assessment (IEA), which provides further background information to the Scheme.

In October 2020, the group of Water Companies involved in developing SROs (known as the All Company Working Group - ACWG), published guidance 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 WFD compliance assessment of the STS SRO has been undertaken in the context of the ACWG guidance<sup>1</sup>. This approach has been adopted to assess the various components of STS SRO that will be undertaken for the regional and individual water company WRMPs.

## 1.2. Overview of legislative drivers

The WFD is an EU Directive which, as of 31/12/2020, is no longer applicable to the United Kingdom. Therefore, the principal legal basis is the national legislation which currently mirrors the EU Directive. The Water Framework Directive has been translated into UK legislation as the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 in England and Wales. From this point forward "WFD" refers to the legislation applicable to England and Wales, not the EU Directive.

The WFD's principal aims are to protect and improve the water environment and promote the sustainable use of water. The headline environmental objectives of the WFD and its daughter directives are to:

Prevent the deterioration of aquatic ecosystems; and,

Protect, enhance and restore water bodies to Good Ecological Status (GES); which is based on ecology (with its supporting hydromorphological and physico-chemical factors) and chemical factors for surface water, and water quantity and Chemical Status for groundwaters. Where a water body is designated as Heavily Modified, or Artificial, the water body will need to be Good Ecological Potential (GEP).

The WFD sets a default objective for all rivers, lakes, estuaries, groundwater and coastal water bodies to achieve Good Status (by 2027). For natural surface water bodies, Good Status is a function of both Good Chemical Status (GCS) and GES. The River Basin Management Plans (RBMPs) outline the actions required to enable natural water bodies to achieve these objectives. Artificial and Heavily Modified Water Bodies (AWB/HMWBs) are considered unable to attain GES due to modifications necessary to maintain their function for society or their 'human use' as they provide important socio-economic benefits. They are, however, required to achieve GEP, through the implementation of a series of Mitigation Measures outlined in the RBMP. A/HMWBs still need to attain GCS which, along with GEP will collectively result in Good Status in these water bodies.

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<sup>1</sup> Mott McDonald (2020) All Company Working Group Water Framework Directive: Consistent framework for undertaking no deterioration assessments.

New activities and schemes that affect the water environment may adversely impact biological, hydromorphological, physico-chemical and/or chemical quality elements (WFD quality elements) that could lead to a deterioration in water body status. They may also preclude the implementation or effectiveness of the proposed improvement measures, leading to the water body failing to meet its WFD objectives for GES/GEP. Under the WFD, activities and schemes must not cause deterioration in water body status or prevent a water body from meeting GES/GEP by invalidating improvement measures.

The overall ecological status of a water body is primarily based on consideration of its biological quality elements (phytoplankton, macrophytes, phytobenthos, benthic invertebrates and fish) and is determined by the lowest scoring of these elements. These biological elements are 'supported' by the physico-chemical (water quality) and hydromorphological (hydrological or tidal regime, river continuity and morphological conditions (i.e., habitat)) quality elements.

To achieve GCS, a water body must pass a separate chemical status assessment, relating to pass/fail checks on the concentrations of various identified priority/dangerous substances.

This assessment follows the ACWG methodology in order to assess WFD compliance risk during the initial stages of design. However once the design has been sufficiently progressed such that the project will enter into the formal planning system (the project could be designated as a Nationally Significant Infrastructure Project (NSIP) and therefore it would enter the Development Consent Order (DCO) process), WFD compliance will be assessed in respect of the process set out in The Planning Inspectorate (PINS) Advice Note 18<sup>2</sup>. The guidance suggests that a WFD compliance assessment be comprised of three key components:

- Screening assessment – to determine what activities associated with the proposed development can be screened out at this stage of the process;
- Scoping assessment – to identify activities as part of the proposed development which have the potential to impact relevant water bodies and their quality elements, and;
- Impact assessment – a detailed impact assessment of the water bodies and their quality elements that are considered to be likely affected by the proposed development. Any potential issue for non-compliance would be highlighted at this stage along with consideration to Mitigation Measures and enhancements that would contribute to WFD objectives.

At the current stage (Gate 2), the assessment is set out to align with the ACWG methodology adopted for all SROs up to and including Gate 3. At Gate 4, this WFD assessment will be refined to support the DCO process which will require the assessment to align with the PINS guidance.

### 1.3. Purpose of report

This report sets out the WFD Regulations<sup>3</sup> Compliance Assessment for the STS SRO Scheme at Gate 2 and builds upon work undertaken at Gate 1 of the design process. The Scheme is integral to a larger STT SRO system, which does not form part of this assessment and is being assessed separately. Details of the legislative drivers are outlined in Section 1.2.

The aims of the document are to provide:

- background information on the STS SRO Scheme at Gate 2 relevant for the WFD compliance assessment;
- a summary of the Gate 1 WFD compliance assessment findings;
- a high-level baseline understanding of the water bodies that would be affected by the proposed Scheme;
- an assessment of the potential for the Scheme to cause deterioration in the WFD status of any water body directly or indirectly, provide impediments to achieving GES/GEP, or compromise the programme of measures to protect; and/or enhance the status of any water body.

### 1.4. Structure of report

The remainder of this report is divided into the following sections:

- Section 2: Description of proposed STS SRO
- Section 3: Methodology used for the WFD Regulations compliance assessment

<sup>2</sup> Planning Inspectorate, 2017, The Water Framework Directive, Advice Note 18.

<sup>3</sup> Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. SI 2017 No. 407

- Section 4: Identification of relevant water bodies
- Section 5: Level 1 basic screening assessment
- Section 6: Level 2 detailed screening assessment
- Section 7: Conclusions and recommendations

An accompanying Excel workbook contains the completed ACWG WFD compliance worksheets for the STS SRO (Technical Appendix B3.1).



## 2. Scheme description

A summary of the two main STS SRO components is provided in Sections 2.1 and 2.2, and their joint operation in Section 2.3. A detailed overview of the scheme is presented within the main IEA report and a map of the STS SRO Scheme is available in Technical Appendix B3.2. The Scheme description provided at Gate 2 (on which Gate 2 assessments have been based) will be subject to further review in Gates 3 and 4.

### 2.1. Mythe WTW temporary abstraction licence transfer (15 MI/d)

This part of the Scheme provides support to the STT System from the Severn catchment by temporarily redeploying 15 MI/d of the existing STW abstraction licence at its Mythe WTW intake in the lower River Severn. When the licence transfer is in operation, this infrequently used licensed volume from Mythe would now remain in the River Severn for abstraction downstream at Deerhurst. When the licence transfer is not in use, STW will retain the 15 MI/d as usable at Mythe. STW has advised that no construction works would be required to redeploy the spare licence volume for abstraction. It is understood from STW that no specific additional resource to replace this current abstraction licence volume has been determined to date but will need replacing within the STW network prior to the transfer being made available. The Mythe WTW abstraction licence Scheme will not operate alone and will operate in-combination with the Netheridge WwTW discharge diversion to Haw Bridge, based on current utilisation assumptions from STT and may be subject to change as plans for STT develop.

### 2.2. Netheridge WwTW discharge diversion to Haw Bridge pipeline (35 MI/d)

Currently treated effluent from the Netheridge WwTW is discharged into the upper Severn Estuary. STS SRO proposes to divert a 35 MI/d portion of this treated discharge from Netheridge WwTW (approx. grid reference: SO 80963 15949) to a new outfall at Haw Bridge (just downstream from Deerhurst (approx. grid reference: SO 84595 27955)), on the freshwater River Severn to support STT abstraction at Deerhurst.

The outfall location to the River Severn will be located just upstream of the level gauge at Haw Bridge (see Scheme map in Technical Appendix B3.2). 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 15.5 km long with tunnelling under named watercourses, such as the River Severn.

The pipeline discharge to Haw Bridge will not be continuous. It will range from zero (when flows are high enough in the River Severn to support the STT transfer) to 35 MI/d when fully operational (during periods of lower flows in the River Severn). The pipeline will include nine drain-down points through which water in the pipeline is drained following completion of each operating cycle to prevent it becoming septic and posing a greater risk to the environment on start up of the next operating cycle. It is estimated that the pipeline would need to be drained within 3 days of completing an operation cycle to maintain sufficient water quality standards. The drain-down points will not be opened during pipeline operation. The drain-down points will be a combination of either pumped or gravity-flow outlets, set back at least 10 m from water courses with the discharge piped into rivers, small water courses and, where possible, returned to the main pipeline for gravity discharge. The locations of the drain-down points (Technical Appendix B3.3) will be dictated by topography (at low points) and crossing points (e.g. tunnel crossings of rivers, railways, etc.). The current drain-down plans are draft only and further details for a more complete assessment are expected at Gate 3.

The Netheridge WwTW final effluent would receive additional treatment to mitigate any water quality issues, which includes the removal of ammonia using a Multi-Bed Bio Reactor (MBBR), removal of phosphorus using 'CoMag'®, and removal of selected organic compounds including phenols, Perfluorooctane sulfonic (PFOS) and some pesticides using Ozone, Biological Aerated Flooded Filter (BAFF) and Granulated Activated Carbon (GAC).

### 2.3. Indicative operation of STS SRO

There are the following modes of operation. Please note the duration of the Scheme's operation is indicative at this stage and could be refined based on further modelling or changes to river flow triggers.

- Mode 1 -STT SRO sweetening flow provided by unsupported river abstraction: STS SRO is not in operation and STT is also off. There is enough water in the River Severn at Deerhurst to provide the 20

MI/d STT sweetening flow between the River Severn to the Thames, with no undesirable effects on the River Severn.

- Mode 2- STT SRO sweetening flow provided by STS Netheridge WwTW effluent transfer at 20 MI/d: STS is 'on' but STT off. This means 20 MI/d is piped from Netheridge WwTW to Haw Bridge because STT is not working and thus only requires the sweetening flow, which the river can't provide. This mode of operation would be expected to occur 12 % of the time (modelled over a 47-year period).
- Mode 3- STT SRO water resources provided by the STS Netheridge WwTW effluent transfer at 35 MI/d: STS is 'on' and STT is 'on'. This means 35 MI/d is piped from Netheridge to Haw Bridge to allow a 35 MI/d STT abstraction. STT takes the additional 15 MI/day from Mythe WTW temporary abstraction licence transfer, so STT takes a 50 MI/d contribution from STS overall. This mode of operation would be expected to occur 16% of the time (modelled over a 47-year period).

## 2.4. Summary of Gate 1 findings

The Gate 1 WFD assessment<sup>4</sup> considered the Mythe WTW temporary licence transfer and a previous version of the Netheridge WwTW discharge transfer (to Deerhurst rather than Haw Bridge) as separate schemes, alongside an alternative route option for the Netheridge WwTW diversion via the Cotswold Canals. The findings from the Gate 1 WFD assessment are summarised in **Table 2-1**. Only the alternative option for the Netheridge WwTW effluent transfer via the Cotswold Canals was considered to have potential for WFD non-compliance at the Level 2 assessment and on that basis has not progressed beyond Gate 1. The other options, also assessed at Gate 2, were considered compliant. It should be noted that at the Gate 1 assessment, the proposed Netheridge WwTW effluent treatment plan was not as developed as the tertiary treatment plan outlined at Gate 2.

**Table 2-1 - Summary of Gate 1 WFD assessment findings**

Option	WFD Level 1 findings	Level 2 findings
Scheme 1 Mythe WTW temporary abstraction licence transfer (15 MI/d)	WFD compliance (high confidence), supported by bespoke hydrological assessment.	N/A
Netheridge WwTW effluent discharge diversion, Deerhurst pipeline (35 MI/d)	WFD compliance (high confidence), supported by bespoke hydrological assessment.	N/A
Netheridge WwTW effluent discharge diversion, Cotswold Canals (35 MI/d)	Potential for WFD non-compliance. Level 2 assessment required.	Potentially non-compliant with fish and macroinvertebrate objectives (low data confidence, high design confidence). Option rejected at Gate 1.

<sup>4</sup> Severn Trent (2021) Severn Trent Sources SRO Environmental Assessment Report: Water Framework Directive Regulations Compliance Assessment Report

## 3. Methodology for Gate 2

### 3.1. Overall approach

The ACWG guidelines set out an assessment approach and accompanying reporting spreadsheet for undertaking the constraint test of WFD compliance that is required for SRO. The ACWG guidelines identify three WFD objectives for assessing WFD constraints. These are established from Regulation 13 of the original European WFD legislation and are as follows:

- Objective 1: To prevent deterioration<sup>5</sup> of any WFD element of any water body- in line with Regulation 13(2)a and 13(5)a;
- Objective 2: To prevent the introduction of impediments to the attainment of 'Good' WFD status or potential for any water body. in line with Regulation 13(2)b and 13(5)c<sup>6</sup>; and,
- Objective 3: To ensure that the planned programme of water body measures in the second cycle of River Basin Management Planning (RBMP2)<sup>7</sup> to protect and enhance the status of water bodies are not compromised.

The opportunity to benefit Protected Areas was also reviewed.

The ACWG methodology was adopted at Gate 1 and has been repeated for Gate 2 based on the updated Scheme design and further technical studies. The methodology uses a spreadsheet assessment tool and follows a staged process:

- List relevant water bodies - identify water bodies which have the potential to be impacted by the Scheme.
- Level 1 – basic screening assessment (broadly aligns with Screening and Scoping stages of the PINS guidance<sup>8</sup> (see Section 1.2) – activities from a preselected list are assigned to those water bodies identified based on design information.
- Level 2 – detailed screening assessment (broadly aligns to the Impact assessment of the PINS guidance) – where water bodies have been identified as being potentially impacted, they are carried forward to Level 2 where specific activities and potential impacts are assessed against all relevant WFD elements for the three objectives identified above.

The version of the ACWG spreadsheet used in this assessment uses the 2019 draft RBMP3 (dRBMP3) status and objectives for our baseline; as we understand that (1) there are no further data after 2019 due to the impacts of COVID-19 on data collection; and (2) we understand that RBMP3 will now not be released until September 2022 which is too close to the RAPID Gate 2 submission deadline to be taken into account as part

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<sup>5</sup> European Court of Justice (ECJ) ruling

ECJ Case C-461/13: Bund für Umwelt und Naturschutz Deutschland v Bundesrepublik Deutschland <http://curia.europa.eu/juris/document/document.jsf?docid=178918&mode=req&pageIndex=1&dir=&occ=first&part=1&text=&doclang=EN&cid=175124> [accessed 11/04/2022] clarified that 'no deterioration' means a deterioration **between** a whole 'status class' (e.g. 'good', 'moderate', etc.) of one or more of the relevant 'quality elements' (e.g. biological, physico-chemical, etc.). This definition applies equally to Artificial Waterbodies and Heavily Modified Waterbodies in respect of the relevant quality elements that relate to the defined uses of these waterbodies. The ECJ ruling further states that if the quality element concerned is already in the lowest class, any deterioration of that element constitutes a deterioration of the status. References to 'no deterioration' in this WFD methodology align to this ECJ ruling.

<sup>6</sup> WRPG (2021) states that this a test to identify any options that 'prevent the achievement of the water body status objectives in the river basin management plan'. Discussion with EA review of EA internal guidance<sup>#1</sup> has identified that the EA consider 'less stringent objectives are not permanent and the assessment of any new activity or project must take into account the need to continue to aim for good status. The new activity or project must not jeopardise the achievement of good status in the future, irrespective of whether a less stringent objective was set in RBMP2'.

<sup>7</sup> Until publication of draft RBMP3 there are no catalogued published water body measures that update from those published with RBMP2.

<sup>8</sup> National Infrastructure Planning (2012) Advice Note Eighteen: The Water Framework Directive, <https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-18/>

of Gate 2. However, for the Mitigation Measures assessment we have used RBMP2 measures. This approach was discussed and agreed with the Environment Agency (EA) on 12 May 2022.

At this stage, groundwater has not been assessed as part of this WFD assessment as the ACWG methodology does not set out a standard approach to assessing the impacts to groundwater bodies. There is limited design information to determine scheme activities which may have potential to impact on groundwater bodies (such as the presence of shafts or retaining walls) hence, the assessment cannot yet be completed with any confidence. The potential impacts to groundwater should be considered at the next stage of the assessment if the Scheme activities have the potential to impact on WFD groundwater bodies or sensitive groundwater features.

### 3.2. Level 1 – basic screening assessment

The Level 1 screening has been completed for all in-river construction works and the operating effects of the SRO Scheme and the water bodies that it interacts with.

The Level 1 assessment involves the following steps:

- Identify affected water bodies;
- Breakdown option into activities involved in construction, operation and decommissioning phases;
- Assign each activity an impact score (based on a predefined list);
- Consider any embedded mitigation measures; and
- Calculate a screening score (using a 6-point scale from -2 to 3) to ‘screen out’ water bodies and options with no or very minor potential impacts from further assessment (see Technical Appendix B3.4). If the maximum impact score is greater than 1 (minor localised impact) then the water body is taken forward into a Level 2 assessment.

### 3.3. Level 2 – detailed screening assessment

The Level 2 assessment involves the following steps:

- Detailed assessment at the water body scale of impacts to each WFD quality element for each activity proposed as part of an option;
- Assessment of data confidence level and design certainty – confidence levels are assigned for each assessment, based on the quality and availability of both physical data and design information about the option at the time of assessment. Where the confidence levels are medium or low, the requirements for further data or design information to raise this confidence level for future Gates would be listed;
- Identification of further mitigation needs;
- Assessment of impacts after mitigation (scoring on a 6-point scale); and
- Identification of activities to improve certainty of assessment outcomes.

All assessments have been undertaken using the mitigation measures designed into the STS SRO Scheme, as documented in the Conceptual Design Report<sup>9</sup> (Technical Annex A1). Furthermore, this includes the assumptions/ mitigations as set out in the ACWG template which recognise compliance with regulations and good design practice. As such, there is no difference between the “impact” and “post mitigation impact” in the Level 2 assessment worksheet.

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<sup>9</sup> 70088464-WSP-NETHSRO-RP-GT-2001 Netheridge Concept Design Report, 1st issue May 2022 (WSP)

## 4. Identification of relevant water bodies

The Level 1 WFD assessment determines which water bodies have the potential to be affected by the STS SRO Scheme (see map of Scheme in Technical Appendix B3.2). The water bodies with potential to interact with the Scheme are all within the Severn Vale Management Catchment and include rivers, a canal, a transitional estuarine water body and a coastal water body (**Table 4-1**). The types of interactions with the Scheme include direct discharge from the pipeline outfall at Haw Bridge, pipeline water crossings, discharge from pipeline drain-down points and indirect interactions with a 1 km buffer zone around the proposed pipeline route. The Scheme is not considered to interact with groundwater bodies.

**Table 4-1 – Water bodies interacting with the STS SRO**

Operational Catchment	Water Body	Water Body ID	Type	Interaction
Severn River and Trib	Severn - conf R Teme to conf R Avon	GB109054039760	River, HMWB	Contains Mythe WTW Intake site
	Severn - conf R Avon to conf Upper Parting	GB109054044404	River, HMWB	Haw Bridge outfall, transfer of water through main River Severn channel, pipeline water course crossings, drain-down point 9.
	Combe Hill Canal	GB70910059	Canal, AWB	Pipeline water course crossing, drain-down point 8
Chelt Hatherley and Normans Brook	Leigh Bk - source to conf R Chelt Water Body	GB109054039770	River (not A/HMWB)	No direct interaction with Scheme; water body intersects with 1 km buffer zone only
	Chelt - M5 to conf R Severn	GB109054032810	River (not A/HMWB)	Pipeline water course crossing, drain-down point 7
	Hatherley Bk - source to conf R Severn	GB109054032801	River, HMWB	Pipeline water course crossings, drain-down points 5-6
Gloucester Trib	Horsebere Bk - source to conf R Severn	GB109054032760	River, HMWB	No direct interaction with Scheme; water body intersects with 1 km buffer zone only
	Wotton Bk - source to conf Horsebere Bk	GB109054032761	River, HMWB	No direct interaction with Scheme; water body intersects with 1 km buffer zone only
	Twyver - source to conf R Severn	GB109054032702	River, HMWB	No direct interaction with Scheme; water body intersects with 1 km buffer zone only
	Sud Bk - source to conf R Severn	GB109054032701	River, HMWB	No direct interaction with Scheme; water body intersects with 1 km buffer zone only
	Daniels Bk - source to Glos-	GB109054032680	River, HMWB	No direct interaction with Scheme; water body

Operational Catchment	Water Body	Water Body ID	Type	Interaction
	Sharpness Canal			intersects with 1 km buffer zone only
Leadon	Leadon - conf Preston Bk to conf R Severn (W Channel)	GB109054032511	River (not A/HMWB)	No direct interaction with Scheme; water body intersects with 1 km buffer zone only
Severn River and Trib Estuary	Severn (E Channel) - Horsebere Bk to Severn Est	GB109054032750	River, HMWB	Pipeline drain-down points 3 and 4
	Severn Upper	GB530905415403	Transitional, HMWB	Transfer of water from main River Severn channel, pipeline water course crossings, drain-down point 2
Coastal bodies	Not part of a river water body	154	Coastal	No direct interaction with Scheme; water body intersects with 1 km buffer zone only
	Not part of a river water body	155	Coastal	Pipeline water course crossings, drain-down point 1

At this stage of the assessment, based on the design assumptions outlined in Section 2, the scheme interacts with 16 surface water bodies (including 3 rivers that are not A/HWBs, 1 AWB, 9 HMWBs in rivers, 1 transitional HMWB and 2 coastal ) as outlined in **Table 4-1**. All of these water bodies will be carried forward to the Level 1 – basic screening assessment (Section 5) and will be assessed using the Level 1 – basic screening assessment methodology.

## 5. Level 1 – basic screening assessment

### 5.1. Introduction to Level 1 assessment

Section 5.2 sets out the baseline WFD data in relation to the water bodies carried forward for this assessment.

A summary of the specific Mitigation Measures relevant to these water bodies, based on the EA's Cycle 2 Measures data, has been provided in Section 5.3. Section 5.4 outlines the results of the Level 1 – basic screening by outlining activities assigned to each water body based on design information and mitigation assumptions and giving an impact score as outlined in the ACWG guidance for the Level 1 – basic screening methodology. The ACWG template Level 1 - basic screening findings have been recorded in Technical Appendix B3.1, notably: Worksheet 2 – “Level 1 activities”. Worksheet 3 “Level 1 summary” is auto-generated to summarise those water bodies to be carried forward to the Level 2 – detailed screening assessment.

### 5.2. Existing WFD baseline data for the interacting water bodies

A summary of the baseline information from dRBMP3 for the water bodies is provided below with more detail for each in the completed ACWG template (Technical Appendix B3.1).

#### 5.2.1. Severn - conf R Teme to conf R Avon (GB109054039760)

This HMWB water body is currently at Moderate ecological status; it is not expected to reach GES but should be aiming for GEP. The current reasons for not achieving good (RNAG) include:

- Diffuse source pollution linked to poor livestock management affecting macrophytes and phytobenthos combined and phosphate concentrations;
- Point source pollution from sewage discharge, linked to the water industry, and urban/transport sources affecting macrophytes and phytobenthos combined and phosphate concentrations;
- Physical modifications for navigation and local/central government affecting the mitigation measures assessment;
- Chemical status is affected by failures against polybrominated diphenyl ethers (PBDE), mercury and its compounds and PFOS.

This water body contains the following Protected Areas:

- Drinking Water Protected Area (UKGB109054039760) on the River Severn;
- Safeguard Zone (SWSGZ2101);
- Urban Waste Water Treatment Directive area on the River Severn and associated phosphate removal schemes at the Malvern (7ST201827) and Powick (7ST201826) sewage treatment works as part of Asset Management Plan (AMP) 7.
- Urban Waste Water Treatment Directive area (UKENRI38) on the River Teme.

#### 5.2.2. Severn - conf R Avon to conf Upper Parting (GB109054044404)

This HMWB water body is currently at Moderate ecological status; it is not expected to reach GES but should be aiming for GEP. The current RNAGs include:

- Point source pollution linked to continuous sewage discharge from the water industry affecting invertebrates and phosphate concentrations;
- Physical modifications for navigation, urban transport and local/central government affecting the mitigation measures assessment;
- Chemical status is affected by failures against PBDE, mercury and its compounds, PFOS and benzo(g-h-i)perylene.

This water body contains the following Protected Areas:

- Urban Waste Water Treatment Directive area on the River Severn
- Urban Waste Water Treatment Directive area (UKENRI46) on the River Chelt;
- Urban Waste Water Treatment Directive area (UKENRI10) on the River Avon (Warwickshire).

### 5.2.3. Combe Hill Canal (GB70910059)

This AWB is currently at GEP. However, its chemical status is affected by failures against several priority hazardous substances: PBDE, mercury and its compounds and PFOS. It also interacts with the Nitrates Directive (S580) Protected Area on the River Chelt.

### 5.2.4. Leigh Bk - source to conf R Chelt (GB109054039770)

This water body is not designated as artificial or heavily modified and is currently at Moderate ecological status. The current RNAGs include:

- Diffuse source pollution linked to poor livestock management affecting macrophytes and phytobenthos combined and phosphate concentrations;
- Diffuse source pollution linked to poor nutrient management on agricultural land affecting macrophytes and phytobenthos combined;
- Diffuse source pollution linked to urbanisation affecting macrophytes and phytobenthos combined;
- Point source pollution linked to continuous sewage discharge from domestic sources affecting phosphate concentrations;
- Chemical status is affected by failures against PBDE and mercury and its compounds.

This water body contains the following Protected Areas:

- Nitrates Directive area (S580) on the River Chelt.

### 5.2.5. Chelt – M5 to conf R Severn (GB109054032810)

This water body is not designated as artificial or heavily modified and is currently classified as having Poor ecological status. The current RNAGs include:

- Diffuse source pollution from domestic septic tanks and poor nutrient management on agricultural land affecting macrophytes and phytobenthos combined;
- Diffuse source pollution linked to poor livestock management and transport drainage affecting phosphate concentrations;
- Point source pollution from continuous sewage discharge by the water industry affecting macrophytes and phytobenthos combined and phosphate concentrations;
- Chemical status is affected by failures against benzo(b)fluoranthene, benzo(g-h-i)perylene, PBDE, mercury and its compounds and PFOS.

This water body contains the following Protected Areas:

- Urban Waste Water Treatment Directive area (UKENRI46) on the River Chelt;
- Nitrates Directive area (S580) on the River Chelt.

### 5.2.6. Hatherley Bk - source to conf R Severn (GB109054032801)

This HMWB water body is currently at Moderate ecological status; it is not expected to reach GES but should be aiming for GEP. The current RNAGs include:

- Diffuse source pollution linked to urbanisation and poor nutrient/livestock management on agricultural land affecting phosphate concentrations;
- Point source pollution from continuous sewage discharge by the water industry affecting phosphate concentrations;
- Chemical status is affected by failures against priority hazardous substances PBDE and mercury and its compounds.

This water body contains the following Protected Areas:

- Nitrates Directive area (S579) on Hatherley Brook.

### 5.2.7. Horsebere Bk - source to conf R Severn (GB109054032760)

This HMWB water body is currently at Moderate ecological status; it is not expected to reach GES but should be aiming for GEP. The current RNAGs include:



- Diffuse source pollution linked to poor nutrient and livestock management affecting phosphate concentrations;
- Physical modifications for urban/transport reasons affecting fish and the mitigation measures assessment;
- Chemical status is affected by failures against PBDE and mercury and its compounds.

This water body does not contain any Protected Areas.

#### 5.2.8. Wotton Bk - source to conf Horsebere Bk (GB109054032761)

This HMWB water body is currently at Moderate ecological status; it is not expected to reach GES but should be aiming for GEP. The current RNAGs include:

- Diffuse source pollution linked to in-river activities (including bankside erosion) affecting invertebrates and phosphate concentrations;
- Diffuse source pollution linked to poor livestock management affecting phosphate concentrations;
- Physical modifications for urbanisation affecting invertebrates;
- Chemical status is affected by failures against PBDE and mercury and its compounds.

This water body does not contain any Protected Areas.

#### 5.2.9. Twyver - source to conf R Severn (GB109054032702)

This HMWB water body is currently at Moderate ecological status; it is not expected to reach GES but should be aiming for GEP. The current RNAGs include:

- Diffuse source pollution linked to in-river activities (including bankside erosion) affecting invertebrates;
- Diffuse source pollution linked to urbanisation and poor nutrient management on agricultural land affecting phosphate concentrations;
- Physical modifications for urbanisation affecting invertebrates;
- Chemical status is affected by failures against PBDE and mercury and its compounds.

This water body does not contain any Protected Areas.

#### 5.2.10. Sud Bk - source to conf R Severn (GB109054032701)

This HMWB water body is currently at Moderate ecological status; it is not expected to reach GES but should be aiming for GEP. The current RNAGs include:

- Diffuse source pollution linked to in-river activities (including bankside erosion) affecting invertebrates and fish;
- Physical modifications for urbanisation affecting invertebrates and fish;
- Chemical status is affected by failures against PBDE and mercury and its compounds.

This water body contains the following Protected Areas:

- Urban Waste Water Treatment Directive area (UKENRI48) on the Gloucester and Sharpness Canal.

#### 5.2.11. Daniels Bk - source to Glos-Sharpness Canal (GB109054032680)

This HMWB water body is currently at Moderate ecological status; it is not expected to reach GES but should be aiming for GEP. The current RNAGs include:

- Diffuse source pollution linked to transport drainage affecting fish and dissolved oxygen;
- Diffuse source pollution linked to poor nutrient management affecting phosphate concentrations and dissolved oxygen;
- Diffuse source pollution linked to poor livestock management affecting dissolved oxygen;
- Point source pollution linked to private sewage treatment affecting invertebrates and phosphate concentrations;
- Point source pollution linked to urbanisation affecting dissolved oxygen;
- Physical modifications for urbanisation affecting invertebrates and fish;

- Physical modifications creating barriers for fish;
- Physical modifications for local/central government affecting the mitigation measures assessment;
- Chemical status is affected by failures against PBDE and mercury and its compounds.

This water body contains the following Protected Areas:

- Urban Waste Water Treatment Directive area (UKENRI48) on the Gloucester and Sharpness Canal.

### 5.2.12. Leadon - conf Preston Bk to conf R Severn (W Channel) (GB109054032511)

This water body is not designated as artificial or heavily modified and is currently classified as having Moderate ecological status. The current RNAGs include:

- Diffuse source pollution from poor livestock and pesticide management affecting phosphate concentrations;
- Diffuse source pollution from poor nutrient management affecting macrophytes and phytobenthos combined and phosphate concentrations;
- Point source pollution from farm/site infrastructure affecting fish and dissolved oxygen;
- Point source trade/industry discharge affecting macrophytes and phytobenthos combined and phosphate concentrations;
- Unknown impacts on flow affecting dissolved oxygen;
- Chemical status is affected by failures against PBDE and mercury and its compounds.

This water body contains the following Protected Areas:

- Urban Waste Water Treatment Directive area (UKENRI43) on the River Leadon;
- Nitrates Directive area (S578) on the River Leadon;
- Nitrates Directive area (G38) on the Newant.

### 5.2.13. Severn (E Channel) – Horsebere Bk to Severn Estuary (GB109054032750)

This HMWB water body is currently at Moderate ecological status; it is not expected to reach GES but should be aiming for GEP. The current RNAGs include:

- Point source pollution linked to continuous sewage discharge from the water industry affecting phosphate concentrations;
- Diffuse source pollution linked to urbanisation affecting phosphate concentrations;
- Physical modifications for navigation, urban transport and local/central government affecting the mitigation measures assessment;
- Physical modifications for inland boating and structures affecting invertebrates;
- Chemical status is affected by failures against PBDE, mercury and its compounds and PFOS .

This water body contains the following Protected Areas:

- Urban Waste Water Treatment Directive area (UKENRI48) on the Gloucester and Sharpness Canal.

### 5.2.14. Upper Severn (GB530905415403)

This HMWB transitional water body is currently at Moderate ecological status; it is not expected to reach GES but should be aiming for GEP. The current RNAGs include:

- Physical modifications linked to urbanisation, coastal erosion protection and coastal squeeze affecting angiosperms;
- Physical modifications linked to local/central government affecting the mitigation measures assessment;
- Unknown causes affecting dissolved inorganic nitrogen;
- High to good deterioration with no sector identified as responsible affecting phytoplankton;
- Chemical status is affected by failures against benzo(g-h-i)perylene, benzo(k)fluoranthene, PBDE and mercury and its compounds.

This water body contains the following Protected Areas:

- Urban Waste Water Treatment Directive area on the River Severn.

### 5.2.15. Areas not part of reportable water body catchments (ID 154/155)

Two areas either side of the Upper Severn water body (GB530905415403) are not part of any reportable water body catchment and are therefore not currently assessed under the WFD as part of the RBMP Cycle 2 or 3. These are considered to be coastal catchments. Although these catchments do not have associated WFD data, they are under the same protection from WFD legislation and therefore these water bodies are included as part of the assessment to ensure compliance. One of these areas (ID 155) contains the current Netheridge WwTW discharge point and the southern end of the discharge diversion pipeline, including a water crossing and drain-down point at a small ditch. The other area (ID 154) does not have any direct interaction with the scheme and intersects only with the 1 km buffer around the proposed pipeline. In the absence of more detailed information, we assume that coastal water bodies are at GES and neither of these water bodies are scoped into the more detailed Level 2 assessment (see Section 5.4).

## 5.3. Mitigation Measures Assessment

The detailed, waterbody-specific mitigation measures for the River Severn Basin District from RBMP3 are not available for this assessment. However, available information from RBMP210 shows that there are planned measures for water body GB109054039760 (Severn - conf R Teme to conf R Avon) for the water industry to address direct biological pressures and remove/ease barriers to fish migration and manage the risk of fish entrainment during water abstractions. Specifically, these measures are to prevent eels and elvers from being entrained (sucked into) river abstractions and prevented from returning upstream by obstructions. The Eels Regulations require appropriate screening to be fitted to abstractions and obstructions to be removed or by-passed. These measures should not only prevent entrainment of eels, but also other fish species.

**Table 5-1** provides a high-level summary of the mitigation measures for the wider Severn Vale Management Catchment<sup>11</sup>, including named rivers in the broader catchment which are not directly affected by this Scheme. Overall, the mitigation measures for the catchment focus primarily on reducing rural and urban diffuse pollution and tackling physical modifications that affect morphology and present barriers to migration.

**Table 5-1 – Mitigation measures in the Severn Vale Management Catchment**

Area	Mitigation measures
River Leadon	Partnership with local landowners to reduce rural diffuse pollution and meet river basin management and Biodiversity 2020 targets Riparian fencing and livestock watering solutions to reduce cattle entry to river Installation of large woody debris and deflectors to create habitats for spawning fish, invertebrates and aquatic plants Tree work to reduce over shading
River Frome	Partnership with Stroud District Council to install woody debris to create habitat and attenuate flood waters Relic channel restoration (1.2 km) at Bond's Mill (north channel), Stonehouse to restore riparian habitat, provide a multi-species fish pass at Bond's Mill weir and create habitat for eels, invertebrates, aquatic wildflowers and UK and local Biodiversity Action Plan species such as water voles. Scheme will also provide natural flood management.
Wider partnership	Wetland and riparian habitat creation to increase flood storage, improve flood resilience and enhance populations of key species (lapwings, eels)

<sup>10</sup> Environment Agency (2020) 2nd cycle measures not linked to 2021 element outcomes v2, <https://data.gov.uk/dataset/1944d7d7-1540-4c6f-b95a-8427fbd1783c/2nd-cycle-measures-not-linked-to-2021-element-outcomes-v2>

<sup>11</sup> Environment Agency (2016) Severn river basin management plan. Part 1.

Removal of invasive non-native plant species  
Exploring funding opportunities for unfunded catchment projects

## 5.4. Screening of activities

There is no direct Scheme interaction for eight of the water bodies, which intersect only with the 1 km buffer zone around the proposed pipeline, and thus can be screened out from further assessment:

- Leigh Bk - source to conf R Chelt Water Body (GB109054039770)
- Horsebere Bk - source to conf R Severn (GB109054032760)
- Wotton Bk - source to conf Horsebere Bk (GB109054032761)
- Twyver - source to conf R Severn (GB109054032702)
- Sud Bk - source to conf R Severn (GB109054032701)
- Daniels Bk - source to Glos-Sharpness Canal (GB109054032680)
- Leadon - conf Preston Bk to conf R Severn (W Channel) (GB109054032511)
- Not part of a river water body (154)

Scheme interaction with four further water bodies is limited to pipeline construction and maintenance (including draining) activities which are not expected to compromise WFD status at the Level 1 assessment, given the assumed mitigations of the ACWG method (**Table 5-2**), and therefore these water bodies are also not passed forward to the Level 2 assessment:

- Hatherley Bk - source to conf R Severn (GB109054032801)
- Chelt - M5 to conf R Severn (GB109054032810)
- Combe Hill Canal (GB70910059)
- Coastal water body (ID 155)

**Table 5-2 – Assumed mitigations from ACWG spreadsheet for activities included in Level 1 assessment**

Component	Phase	Activity	ACWG assumed mitigations	Waterbodies
Discharge	Operation	Low volume discharge of water with a quality element of the same WFD status as the receiving water body	No assumed mitigations	GB109054044404
Discharge	Operation	Transfer of water via a river, canal or aqueduct	No assumed mitigations	GB109054044404, GB109054032750, GB530905415403
Licence	Operation	Use of existing surface water and groundwater abstraction licences, within existing licence conditions but outside of the recent actual rates	No assumed mitigations	GB109054039760
Outfall	Construction	Construction of a new outfall structure to a	Appropriate precautions will be taken when working in the channels of watercourses, to appropriately manage flood risk and the potential	GB109054044404

		watercourse or reservoir	for deposition of silt or release of other forms of suspended material or pollution within the water column. All measures will be in line with the requirements set out within the Environment Agency's PPGs (PPG1: General Guide to Prevention of Pollution; PPG5: Works and maintenance in or near water).	
Outfall	Operation	Maintenance and use of river outfall	Appropriate precautions will be taken when working in the channels of watercourses, to appropriately manage flood risk and the potential for deposition of silt or release of other forms of suspended material or pollution within the water column. All measures will be in line with the requirements set out within the Environment Agency's PPGs (PPG1: General Guide to Prevention of Pollution; PPG5: Works and maintenance in or near water).	GB109054044404
Pipelines	Construction	Trenching and laying of pipe lines within the interfluves of a catchment (no watercourse crossings)	Assumed that bedding material for pipelines will be constructed such that they do not form preferential pathways for groundwater flow.	GB109054032750
Pipelines	Construction	Trenching and laying of pipe lines involving watercourse crossings	Assumed that bedding material for pipelines will be constructed such that they do not form preferential pathways for groundwater flow. Assumed that watercourse crossings will be carried out using directional drilling or if the watercourse needs to be temporarily diverted, appropriate measures will be in place to protect ecology and watercourse will be returned back to its natural state.	GB109054044404, GB109054032750, GB530905415403, GB109054032801, GB109054032810, GB70910059, ID154
Pipelines	Operation	Maintenance of pipe lines	No assumed mitigations	GB109054044404, GB530905415403, GB109054032801, GB109054032810, GB70910059, ID154
Pipelines	Operation	Draining of pipelines for maintenance	If water is drained to local watercourse, this will be short term and temporary impacts only	GB109054044404, GB109054032750, GB530905415403, GB109054032801, GB109054032810, GB70910059, ID154

All pipeline activities are scored as 0 or 1 and no pipeline activities pass-forward to the detailed assessment. That assessment within the ACWG template includes the following assumed mitigation for pipeline construction activities, trenching and laying of pipelines involving watercourse crossings:

Assumed that bedding material for pipelines will be constructed such that they do not form preferential pathways for groundwater flow.

Assumed that watercourse crossings will be carried out using directional drilling or if the watercourse needs to be temporarily over pumped, flumed or diverted, appropriate measures will be in place to protect the watercourse will be returned to its pre-crossing state.

Flood risk assessment will be carried out to ensure that new in-channel features will not adversely impact on flood risk.

The ACWG methodology assumes that water course crossings will use directional drilling but, in reality, this Scheme will involve micro-tunnelling on named water course crossings (set back 10 m from the channel) and open cut crossings at unnamed water courses. Despite these differences, we have used the assumptions in the ACWG spreadsheet, as we consider with the impact ratings assigned to directional drilling to be consistent with the methods to be deployed for this Scheme.

The pipeline will include nine drain-down points through which water in the pipeline will be discharged during maintenance activities (Section 2.2 and Technical Appendix B3.3). The diameter of drain-down pipes (<300 mm) is insufficient to warrant explicit WFD assessment but the fact that the drain-down points will be set back at least 10 m from water courses and will discharge the Netheridge WwTW effluent, which has undergone tertiary treatment, means that drain-down activity is considered to be WFD compliant. However, we lack the necessary data to assess the relative impact of the proposed rates of discharge (0.1 – 6.0 l/s over three days; Technical Appendix B3.3) on the flow and water quality of the individual water bodies, some of which are small and unnamed, associated with these drain-down points. This will require further specific consideration at Gate 3 but there is an implicit assumption that WFD compliance would be assessed via permits. Nevertheless, following the Gate 3 assessment, it may be necessary to recommend an extended drain-down time at some of the smaller water courses to mitigate any potential impacts on water quality.

## 5.5. Water bodies passed forward from Level 1 screening assessment

Four water bodies have been identified as needing further consideration through a Level 2 assessment:

- Severn - conf R Teme to conf R Avon (GB109054039760)
- Severn - conf R Avon to conf Upper Parting (GB109054044404)
- Severn (E Channel) - Horsebere Bk to Severn Est (GB109054032750)
- Severn Upper (GB530905415403)

The Severn - conf R Teme to conf R Avon (GB109054039760) water body is affected by the Mythe WTW temporary licence transfer, which will result in a use of an existing licence condition but outside of the recent actual rates (which receives a score of 2 of the Level 1 assessment). The other three water bodies will be affected by pipeline construction and maintenance activities, and although the mitigations outlined in the above section will also apply in these water bodies, the river channel will additionally be affected by the transfer of waters from the Netheridge WwTW diversion downstream of its outfall at Haw Bridge towards the Severn Estuary. This transfer of water receives a score of 2 in the screening process and necessitates a Level 2 assessment.

## 6. Level 2 detailed screening assessment

### 6.1. Introduction

A number of technical studies have been undertaken for STT and these have been used in the Level 2 assessment. These are outlined below in advance of a narrative description of the WFD compliance assessment. In particular, the narrative provides information on the confidence in the assessment – the data confidence and the design certainty. Where the assessment reports the potential for WFD objective non-compliance, additional mitigation actions that may reduce this potential and lead to WFD compliance is indicated in the narrative summary. The full assessment can be found in Technical Appendix B3.1.

### 6.2. Technical Studies

#### 6.2.1. Hydrological Modelling

Studies to model the impact of the STT Scheme on the hydrology of the River Severn for Gate 2 have been undertaken<sup>12</sup>, the results of which are briefly described below. Full details of this modelling work are not available for this assessment but will be submitted as evidence for Gate 2 of the STT Scheme in the Environmental Water Quality Assessment Report.) Please note the duration of the Scheme's operation is indicative at this stage and could be refined based on further modelling or changes to river flow triggers or STT operational modes.

The potential impact of the STS Scheme on the hydrology of the River Severn can be described as follows:

- The augmentation of 35 MI/d at Haw Bridge with treated effluent from Netheridge WwTW.
- The theoretical augmentation of 15 MI/d between Mythe WTW and Deerhurst through temporary licence transfer (affecting approximately 3.9 km of the River Severn) on occasions where the full licence at Mythe would not have been utilised, with net 15 MI/d reduction downstream of the discharge of treated effluent (affecting the River Severn downstream of Haw Bridge and into the Severn Estuary) – although this flow reduction is equivalent to the existing Mythe WTW abstraction licence being used in full.

Investigations using a flow series over a representative 47-year period selected from the 400 stochastic variants of the 47 base years show that there will be the following impacts on the hydrology of the River Severn during operation of the STS Scheme:

- No change to flow in the River Severn between the Mythe WTW intake and the STT intake at Deerhurst (4.0 km stretch).
- Up to 50 MI/d flow reduction for 16% of the time between the STT Deerhurst intake and Netheridge WwTW effluent transfer outfall at Haw Bridge (3.9 km stretch). This is associated with water transfer for STT and occurs once every two years on average, most regularly in July to October, peaking at 47% of days in August. This effect will be very rare in May, December or January and is not anticipated February to April. The effect occurs at River Severn flows less than 2,568 MI/d.
- A 20 MI/d flow reduction for 12 % of the time between the STT Deerhurst intake and Netheridge WwTW effluent transfer outfall at Haw Bridge (3.9 km stretch). This is associated with STT interconnector pipeline maintenance flows when river flows are below hands-off flow and the Netheridge transfer is required; this most regularly occurs in June to August, peaking at 44% of days in July. This effect will be very rare in April or October and is not anticipated November to March. The effect occurs at River Severn flows less than 2,568 MI/d.
- Up to 15 MI/d flow reduction for 16% of the time between the Netheridge WwTW effluent transfer outfall at Haw Bridge to the normal tidal limit at Maisemore Weir (12.5 km stretch). This is associated with water transfer for STT, occurring once every two years on average and most regularly in July to October; peaking at 47% of days in August. This effect will be very rare in May, December or January and is not anticipated February to April. The effect occurs at River Severn flows less than 2,568MI/d.

Overall, this leads to a very minor percentage reduction in flows (**Table 6-1**).

<sup>12</sup> Ricardo Energy & Environment (2022). Severn to Thames Transfer SRO. Physical Environment Report, Section 3.7. Report for United Utilities on Behalf of the STT Group. May 2022.

**Table 6-1 – Modelled reductions in flow on two stretches of the River Severn as a result of STS operation**

River Severn flow level	Flow reduction, downstream Deerhurst compared with upstream Deerhurst	Flow reduction, downstream Haw Bridge compared with upstream Deerhurst
Minimum flows	3.7 %	1.1 %
Q99 Exceptionally low flows	3.1 %	0.9 %
Q95 Very low flows	2.5 %	0.7 %
Q90 low flows	1.6 %	0.4 %

### 6.2.2. Water quality modelling

The impact of the STT Scheme on the water quality of the main River Severn channel has been assessed for Gate 2 using a 1D time series deterministic hydraulic and water quality model, full details of which are provided in a Ricardo report<sup>13</sup>. Overall, the model is generally able to reproduce spatial and seasonal variations in the key water quality parameters throughout the model domain and it is considered a suitable tool with which to assess the relative changes in water quality conditions. A summary of the overall findings is provided below.

Downstream of the tidal limit at Gloucester some changes in water quality are expected from operation of the full STT undertaken for STT SRO. This is in consideration of the STS SRO being operational to support the fully supported STT SRO. The changes in the general physical-chemical characteristics are summarised as follows:

- In the River Severn at the tidal limit, the Scheme is predicted to reduce water temperature by 0.2 °C and 0.3 °C.
- Dissolved oxygen concentrations are predicted to be reduced by about 0.1 mg/l.
- Ammoniacal nitrogen concentrations are predicted to be increased by about 0.02 mg/l.
- Oxidised nitrogen is increased by about 0.8 mg/l during the Scheme (~10 % increase on baseline).
- Dissolved available inorganic nitrogen (DAIN) concentrations are increased by a similar amount.

The magnitude of flow change associated with the Netheridge WwTW effluent transfer is low: 20 or 35 Ml/d discharged into a minimum of 1,300 Ml/d identified from flow modelling for the 1:20 return frequency year.

In terms of changes to water quality, the modelled water quality changes are all very low and the planned advanced treatment processes at Netheridge WwTW are specifically designed to avoid water quality effects (see Section 2.2). The change in dissolved oxygen would constitute <1 % change from the baseline. In relation to ammonia, the River Severn (conf. River Avon to conf. Upper Parting) WFD status is 'High' and baseline data for the River Severn at Deerhurst collected by Atkins as part of the STT SRO has a 90<sup>th</sup> percentile result of 0.196 mg/l based on 20 rounds of data since 2020. The WFD standard for ammonia at this location is 0.3 mg/l based on a 90<sup>th</sup> percentile. We are not expecting a class change / class deterioration but this is just on the cusp of a 10 % 'within class' change. Given of the used of enhanced treatment (MBBR) to remove ammonia at Netheridge WwTW, we consider the overall risk of non-compliance to be low.

This particularly holds true for chemicals, where analysis of the full suite of WFD chemicals has identified none would increase in concentration in the River Severn and the Netheridge WwTW effluent transfer would not impede any chemicals currently failing environmental quality standards (EQS) in the River Severn at point of discharge from achieving EQS. Moreover, WFD compliance is not dependent on dilution in the River Severn as a result of the enhanced effluent treatment processes (see Section 2.2). In terms of the load of chemicals entering the Severn Estuary, as the SRO's advanced treatment processes at Netheridge WwTW would remove these to treatment sludges there would be an overall reduction in chemical input into the estuary.

Specific additional analysis has been undertaken in relation to DAIN using the EA long term water quality monitoring point at Haw Bridge<sup>14</sup> for the 10-year period 2013-2022. The 117 data points identify DAIN concentration as 5.65 mg-N/l with a standard deviation of 1.14 mg-N/l. Allowing for the expected removal rates

<sup>13</sup> Ricardo Energy & Environment (2022). Severn to Thames Transfer SRO. Water Quality Assessment Report. Report for United Utilities on Behalf of the STT Group. May 2022.

<sup>14</sup> <https://environment.data.gov.uk/water-quality/view/sampling-point/MD-00025085>



of the SRO's advanced treatment processes at Netheridge WwTW, discharged concentration at Haw Bridge could be 15.8 mg-N/l. Modelling results show that using the operating pattern of STS SRO (in operation 16% of the time)

- once every twenty years, this could lead to an annual increase in DAIN contribution from the freshwater River Severn to the Severn Estuary of 46 tonnes from a baseline of 14,804 tonnes – an increase of 0.31%. It is noted that under these circumstances at least 90 tonnes/year less DAIN would be input into the Severn Estuary from Netheridge WwTW at the current outfall.
- once every five years this could lead to an annual increase in DAIN contribution from the freshwater River Severn to the Severn Estuary of 35 tonnes from a baseline of 15,369 tonnes – an increase of 0.23 %. It is noted that under these circumstances at least 67 tonnes/year less DAIN would be input into the Severn Estuary from Netheridge WwTW at the current outfall.

As such there would be an overall reduction in DAIN input from the freshwater River Severn and Netheridge WwTW combined into the Severn Estuary as result of STS SRO.

Due to the Gate 2 treatment processes at the advanced treatment unit, the Gate 2 assessment is of WFD compliance for WFD chemicals in the Netheridge WwTW effluent transfer discharge. For WFD chemicals listed in dRBMP3 as meeting WFD targets there would be no change in concentration in the River Severn that leads to EQS fail. For WFD chemicals listed in dRBMP3 as failing WFD targets there would be no further reduction in quality. For WFD chemicals listed in RBMP3 as failing WFD targets there would be no impediments to achieving EQS pass. That assessment also holds for all WFD chemicals based on the extensive SRO water quality monitoring undertaken since December 2020, with typically 16 values used in the assessment. The residual compliance risk from other determinands will be considered at future Gates. The review has been undertaken using River Severn at Deerhurst chemical concentrations and post-removal treatment efficacy from STS engineers, and is without recourse to the minimum 1:37 dilution rate of the River Severn at the Netheridge WwTW effluent transfer outfall. Selected endocrine disruptors have only recently been identified<sup>15</sup> and the current evidence base for these chemicals should be kept under review in Gate 3.

It is important to note that the Netheridge WwTW already discharges into the Severn Estuary and the proposed STS SRO will only result in a change in discharge location with an improved treatment process which is designed to lead to no change in chemical concentration in fish migratory pathways and functionally linked habitats within the freshwater River Severn itself; and a consequent reduction in load input to the Severn Estuary itself from the freshwater River Severn and Netheridge WwTW combined.

### 6.3. Summary of Level 2- detailed screening assessment

The four water bodies passed forward to a Level 2 Assessment received maximum scores of zero prior to mitigation (refer to Technical Appendix B3.4 for a description of the impact scoring system) and are therefore not considered to compromise WFD status or objectives (**Table 6-2**). It is therefore also unlikely that the STS SRO will lead to a deterioration in class or impediment to achieving Good status/objectives for these water bodies. This assessment is based on moderate confidence in the available WFD data and the design of the system.

<sup>15</sup> Ricardo Energy & Environment (2021). Technical Note. Severn Thames Transfer SRO – Impact of determinands on olfaction and fish populations in the Severn Estuary. United Utilities on behalf of the Severn Thames Transfer Programme. December 2021.

**Table 6-2 – Outcome of Level 2 detailed screening assessment**

Waterbody Name	Maximum Level 2 Impact score	Post mitigation impact score	Deterioration between status classes	Impediments to Good Ecological Status (GES) or Good Ecological Potential (GEP)	Compromises water body objectives
Severn - conf R Teme to conf R Avon (GB109054039760)	0	0	No	No	No
Severn - conf R Avon to conf Upper Parting (GB109054044404)	0	0	No	No	No
Severn (E Channel) - Horsebere Bk to Severn Est (GB109054032750)	0	0	No	No	No
Upper Severn (GB530905415403)	0	0	No	No	No

The design of the STS SRO mitigates any potentially negative impacts on these water bodies associated with pipeline construction, operation and maintenance activities which were identified in the Level 1 Assessment. These in-built mitigations are related to the following key considerations:

- No significant change in abstraction patterns at Mythe WTW Intake.** The temporary licence transfer will not result in any change in abstraction at the Mythe WTW intake, other than making the abstraction volume at Mythe WTW unavailable when STT is in operation. Overall, therefore there will be no hydrological, hydromorphological, ecological or water quality impacts on the stretch of the River Severn between Mythe and Deerhurst (3.9 km). Enhanced abstraction at Deerhurst will also only be active at maximum capacity 16 % of the time and this will lead to a maximum reduction in flow on the stretch of the River Severn between Deerhurst and Haw Bridge (when operating in conjunction with the Netheridge WwTW discharge diversion) of 1.1 % during minimum flows. This is deemed to have a negligible impact on the River Severn and does not present any impediment to WFD compliance.
- Magnitude and frequency of the discharge from the Netheridge WwTW discharge diversion to Haw Bridge.** Based on current utilisation assumptions from STT, the Netheridge WwTW effluent transfer will only be active at maximum capacity (35 MI/d) for 16 % of the time, with a reduced volume pipeline “sweetening” flow (20 MI/d) in operation for periods when there is no active abstraction (i.e., sweetening flow only) at the Deerhurst intake 3.9 km upstream for the STT SRO. These exchanges in water have been assessed as having negligible impact on the overall flow of the River Severn and especially the Upper Severn Estuary given its high tidal range. Therefore, there are unlikely to be any appreciable changes in channel footprint, habitats and in-river processes including sedimentation along the affected reaches.
- Quality of the discharge from the Netheridge WwTW effluent discharge diversion Haw Bridge.** Although available water quality data are somewhat limited, the enhanced treatment of the effluent at Netheridge WwTW prior to diversion via pipeline to Haw Bridge ensures that the waters discharged into the River Severn are of higher quality than the current output from the Netheridge WwTW. Therefore WFD compliance does not rely on dilution in the river and diverting this treated effluent to Haw Bridge is unlikely to have noticeable negative impacts on the chemical status or water quality of the River Severn downstream. This includes both the main channel and the Eastern Channel – Horsebere Brook to Upper Severn (GB109054032750). The enhanced tertiary treatment of the effluent may even offer a marginal benefit to the Upper Severn (GB530905415403) downstream of the Netheridge WwTW, such as an overall reduction in DAIN input. However, given the limited data to test the magnitude of these effects, combined with the negligible hydrological impact of the STS SRO Scheme on this stretch of the River Severn, these potential benefits are considered marginal and insufficient to warrant a negative (beneficial) impact score in this WFD assessment. Moreover, the enhanced tertiary treatment and prompt draining of the pipeline following each operational cycle will mean that discharge from the drain-down points during maintenance does not present a major risk to WFD compliance for the River Severn, however, careful assessment of the impact on water quality in smaller water courses is required at Gate 3.

## 7. Conclusions and recommendations

### 7.1. Conclusions

The STS SRO set out for Gate 2, including the joint operation of the Mythe WTW temporary abstraction licence transfer and the Netheridge WwTW discharge diversion to Haw Bridge pipeline, has been assessed using the ACWG guideline and spreadsheet for WFD compliance assessments. The assessment is supported by bespoke hydrological and water quality modelling of the Scheme undertaken by Ricardo. The Scheme has been deemed compliant with WFD requirements in both Level 1 and Level 2 assessments.

We draw the following conclusions with respect to the WFD Assessment Objectives:

- The Scheme does not lead to deterioration in status of any water body;
- The Scheme does not create any impediments to water bodies achieving their target status;
- The Scheme does not compromise any mitigation measures to protect and enhance water bodies.

Additionally, we identify some benefits associated with the enhanced water quality of flows reaching the Upper Severn estuary that are linked to the tertiary treatment plan for the diverted Netheridge WwTW effluent discharged further upstream at Haw Bridge. A further potential benefit relates to the temporary licence transfer from Mythe WTW which would, theoretically, result in an additional 15 Ml/d in the Severn between the Mythe and Deerhurst intakes on occasions where the full, existing abstraction licence allowance at Mythe WTW was not fully utilised; however, such a scenario was not included explicitly in modelling exercises as the modelled scenarios included sufficient headroom between the full licence and typical abstraction patterns at Mythe WTW.

### 7.2. Recommendations

This assessment will require review and update at Gate 3 as the Scheme design evolves. In particular, several WFD water bodies that are crossed by the proposed pipeline which were screened out at the Level 1 assessment may need to be considered further at the Gate 3 assessment when further details on pipeline drain-down and maintenance become available, and especially if the pipeline is likely to be drained into these water bodies. Additionally, potential impacts to groundwater should be considered at the next stage of the assessment if the Scheme activities have the potential to impact on WFD groundwater bodies or sensitive groundwater features.

# Appendices

## Appendix A. Technical Appendices

### A.1. B3.1. Completed ACWG WFD template

The completed ACWG template for the Gate 2 WFD Assessment of STS SRO is included in the Excel Spreadsheet accompanying this report.

### A.2. B3.2. Map of STS SRO Scheme

A map of the STS SRO Scheme is provided in the accompanying PDF.

### B3.3 Drain Point locations

Table B3-3- Drain point locations along Netheridge WwTW effluent transfer pipeline

Drain Point location	Drain Point Ref	Co-ordinates		Drained Section		Volume m <sup>3</sup>	Time to drain at 10l/s (H)	Flow rate (l/s) to drain in 3 days	Drain Point Type	Discharge Point
		Easting	Northing	From CH*	To CH					
CH 1838	DP1	381349	217364	0	3100	1193	33.1	4.603	Standalone PS	Small un-named water course / drainage ditch
CH 3600	DP2	381821	218830	3100	4140	400	11.1	1.544	Shaft	River Severn East Channel (Tidal).
CH 4411	DP3	381875	219532	4140	4411	104	2.9	0.402	Shaft	Lift from rail tunnel back into rising main at tunnel shaft.
CH 4749	DP4	382136	219678	4411	6200	688	19.1	2.656	Standalone Grav	Discharges under gravity to River Severn East Channel
CH 6274	DP5	382502	221082	6200	7550	520	14.4	2.004	Shaft	Pumped to River Severn East Channel
CH 7600	DP6	383633	221625	7550	11593	1556	43.2	6.003	Standalone PS	Pumped to Cox's Brook
Ch 12786	DP7	385100	225983	11593	13380	688	19.1	2.653	Shaft	River Chelt
CH 13487	DP8	384918	226590	13380	13487	41	1.1	0.159	Shaft	Lifts to main pipeline to be transferred to outfall
CH 14688	DP9	384889	227731	13487	14688	462	12.8	1.783	Shaft	Lifts to main pipeline to be transferred to outfall

\*CH = Chainage

## B3.4. ACWG impact scoring system

Table B3-4- Impact scoring system for WFD assessments

Impact	Score	Description
Very Beneficial	-2	Impacts that, taken on their own, have the potential to lead to the improvement in the ecological status or potential of a WFD quality element for the entire water body
Beneficial	-1	Impacts that, when taken on their own, have the potential to lead to a minor localised or temporary improvement that does not affect the overall WFD status of the water body or any quality elements
No/Minimal	0	No measurable change in the quality of the water environment or the ability for target WFD objectives to be achieved.
Low	1	Impacts that, when taken on their own, have the potential to lead to a minor localised, short-term and fully reversible effects on one or more of the quality elements but would not result in the lowering of WFD status. Impacts would be very unlikely to prevent any target WFD objectives from being achieved.
Medium	2	Impacts that, when taken on their own, have the potential to lead to a widespread or prolonged effect on the quality of the water environment that may result in the temporary reduction in WFD status. Impacts have the potential to prevent target WFD objectives from being achieved.
High	3	Impacts when taken on their own have the potential to lead to a significant effect and permanent deterioration of WFD status. Potential for high impact on preventing target WFD objectives from being achieved

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