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WFD

Severn Trent Sources SRO

Severn Trent Water

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Severn Trent Sources SRO

Environmental Assessment Report: Water Framework Directive Regulations Compliance Assessment Report

Report for Severn Trent Water

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Contents

Figures

Tables

Separate Annexes (Excel workbooks)

Filename	Content
WFD_Annex_1_Mythe_280421	Completed ACWG WFD compliance worksheet for STW Sources SRO scheme 1: Mythe abstraction licence transfer (15 Ml/d)
WFD_Annex_2_Netheridge_Deerhurst_280421	Completed ACWG WFD compliance worksheet for STW Sources SRO scheme 2A: Netheridge WwTW discharge diversion, Deerhurst pipeline (35 Ml/d)
WFD_Annex_3_Netheridge_Eastern_Channel_280421	Completed ACWG WFD compliance worksheet for STW Sources SRO scheme 2B: Netheridge WwTW discharge diversion, Cotswold Canals (35 Ml/d)

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 Determination[1] 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 Trent Water (STW) Sources has been identified as an SRO in the PR19 Final Determination, with funding provided to STW as an individual company. Although the STW Sources SRO is considered a company solution with no identified partner this has potential to benefit other companies and interact with joint solutions, therefore its delivery will benefit from development funding and RAPID facilitation.

In October 2020, the group of Water Companies involved in developing SROs (known as the All Company Working Group - ACWG), published guidance[2] 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 guidelines indicate that the process requires Water Companies to provide the following information related to each SRO at the stage outlined (see **Figure 1**).

This report sets out the Water Framework Directive Regulations[3] (WFD) Compliance Assessment for Severn to Thames Transfer (STT) at gate-1. The Water Framework Directive[4] is an EU Directive which, as of 31/12/2020, is no longer applicable to the United Kingdom. Therefore, the principle 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 compliance 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.

[1] Ofwat (2019), PR19 Final Determinations, Strategic regional water resource solutions appendix
[2] Mott MacDonald Limited (2020). All Companies Working Group WRMP environmental assessment guidance and applicability with SROs. Published October 2020
[3] Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. SI 2017 No. 407
[4] European Union (2000) Directive 2000/60/EC of the European Parliament and of the Council

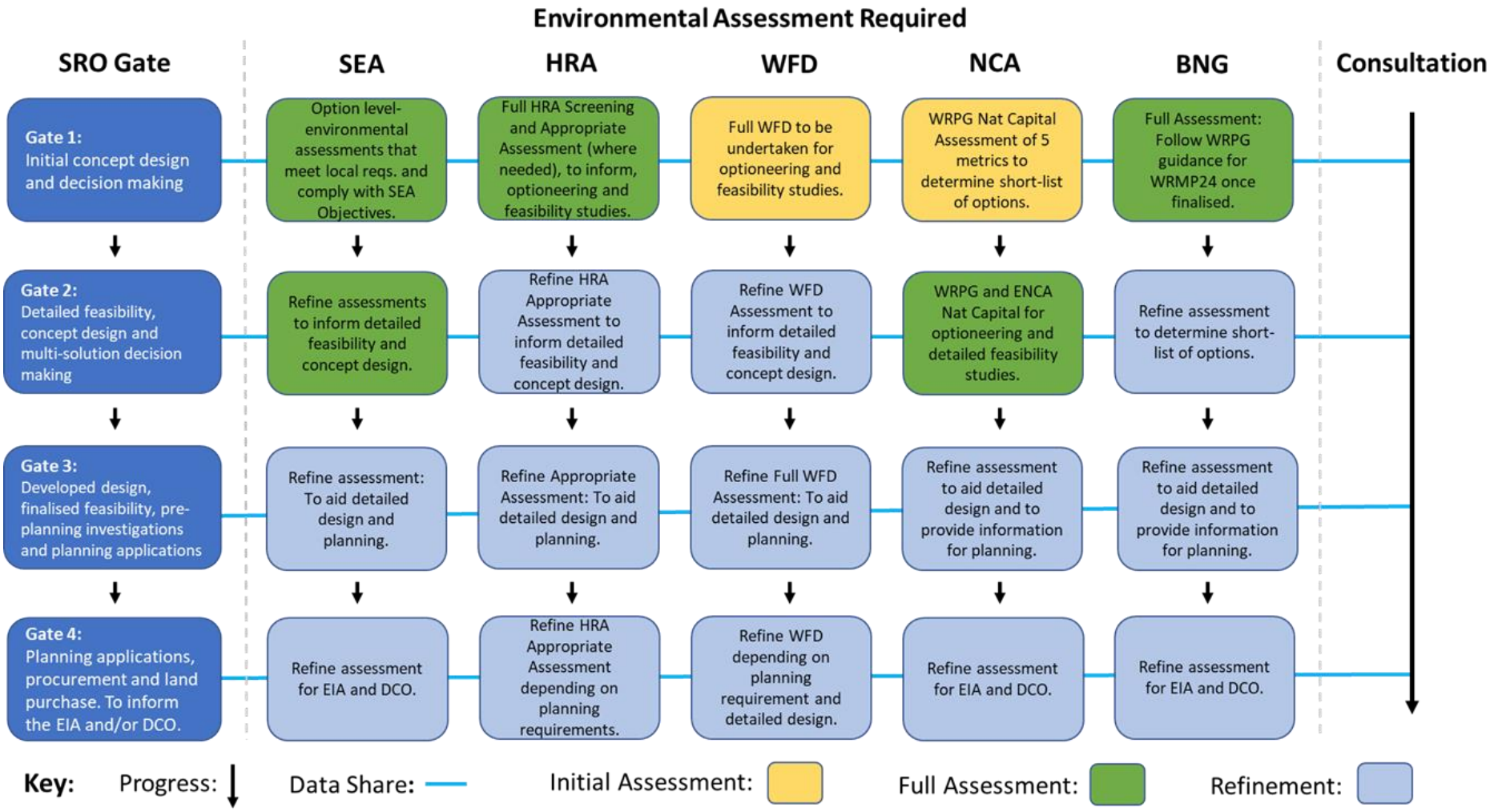

Figure 1 Environmental Assessment Integration with SRO Gates

1.1 Area under consideration

The area under consideration for the assessment reflects the spatial scope of the STW Sources SRO schemes which includes specific areas of the River Severn catchment area. This comprises the River Severn corridor, from the existing STW abstraction licence at its Mythe intake in the lower River Severn to the Severn Estuary.

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 STW Sources SRO
- Section 3: Provides the methodology adopted for the WFD Regulations compliance assessment
- Section 4: Provides the results of the WFD compliance assessment Level 1 screening of STW Sources SRO
- Section 5: Provides the results of the WFD compliance assessment Level 2 assessment of STW Sources SRO
- Section 6: Conclusions and recommendations to inform gate-2 assessments.

A series of accompanying Excel workbooks have been included as separate annexes. These are the completed ACWG WFD compliance worksheets for the STW Sources SRO.

2 Severn Trent Water Sources SRO

2.1 Introduction

The STW Sources SRO schemes are considered integral to a STT System.

A STT conveying raw water from the lower River Severn into the upper or 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 are under consideration to provide additional resource.

The STT SRO comprises two principal aspects:

1. Severn to Thames Conveyance – Deerhurst to Culham pipeline or Cotswold canal conveyance, including piping to Culham – 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 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.

STW Sources SRO include three schemes:

1. Mythe abstraction licence transfer (15 Ml/d)

2A. Netheridge Wastewater Treatment Works (WwTW) discharge diversion, Deerhurst pipeline (35 Ml/d)

2B. Netheridge WwTW discharge diversion, Cotswold Canals (35 Ml/d)

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

2.2 Mythe abstraction licence transfer (15 Ml/d)

This scheme provides support to STT abstraction from the Severn catchment by redeploying 15 Ml/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. The Mythe intake is located on the River Severn near Tewkesbury, 5km northeast of Deerhurst. STW has advised that no construction works would be required to redeploy the spare licence volume for abstraction by Thames Water (TW).

To provide sufficient water to support the STT System from the Mythe intake, additional resource may be required within STW's 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.

2.3 Netheridge WwTW discharge diversion, Deerhurst Pipeline (35 Ml/d)

Currently treated discharge from the Netheridge WwTW is input to the upper Severn Estuary. It is proposed to divert a 35 Ml/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[redacted]

The gate-1 engineering conceptual design of the Netheridge support option states the inclusion of ferrous dosing prior to discharge, as presented in the Conceptual Design Report.

The transfer of WwTW discharge 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 water of up to 35 Ml/d.

2.4 Netheridge WwTW discharge diversion, Cotswold Canals (35 Ml/d)

Currently treated discharge from Netheridge WwTW is input to the upper Severn Estuary. It is proposed to divert a 35 Ml/d portion to a new outfall on the freshwater River Severn to support STT abstraction from the River Severn at Gloucester & 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 WwTW would be pumped by a new pumping station, located at the WwTWs via[redacted]

The gate-1 engineering conceptual design of the Netheridge support option states the inclusion of ferrous dosing prior to discharge, as presented in the Conceptual Design Report. At present in gate-1 there is limited evidence on the receiving water flows or quality in the eastern channel of the River Severn.

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 Ml/d.

The locations of these three schemes are shown on **Figure 2**.

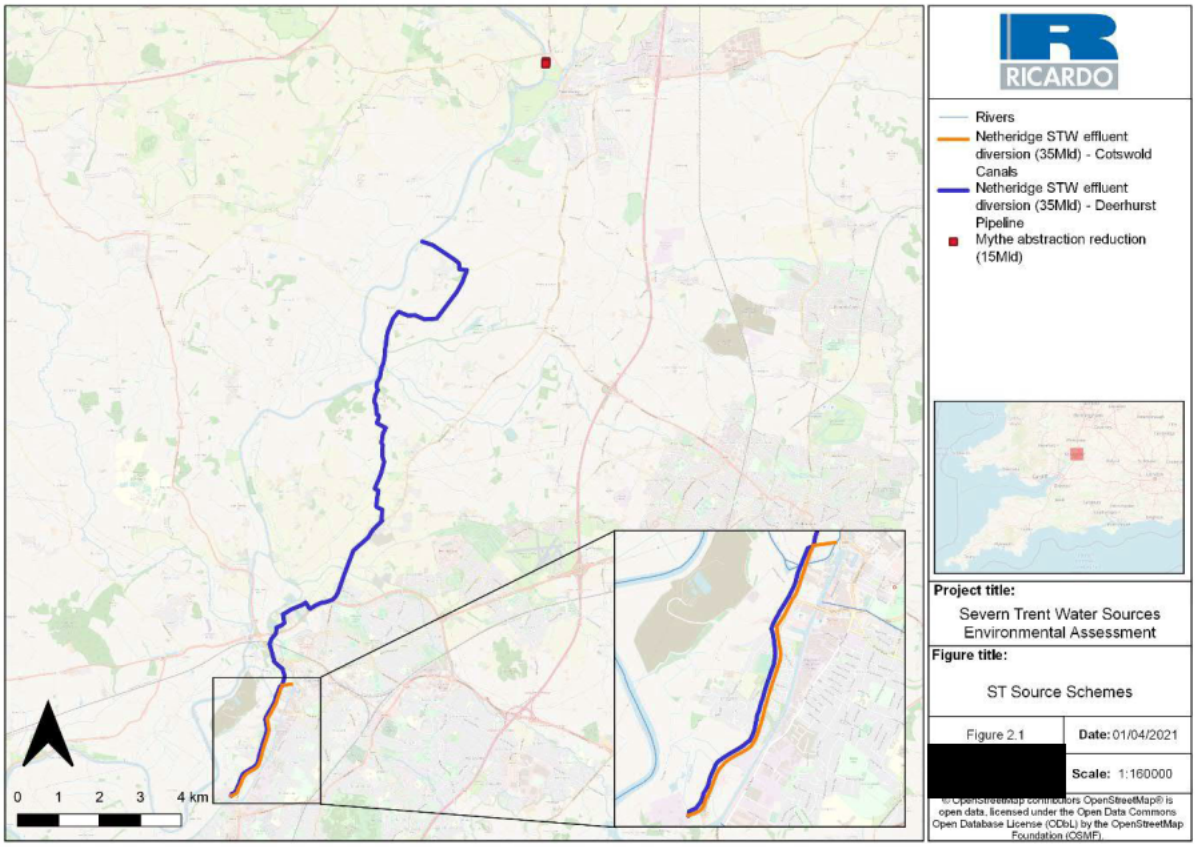

Figure 2 Location of STW Sources SRO Schemes

3 Methodology for Gate-1

3.1 Overall approach

The ACWG guidelines set out an assessment approach and accompanying reporting spreadsheet for undertaking the constraint test of WFD Regulations 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 WFD Regulation as follows:

1. To prevent deterioration[5] of any WFD element of any water body.- in line with Regulation 13(2)a and 13(5)a
2. To prevent the introduction of impediments to the attainment of 'Good' WFD status or potential for any water body. It is accepted that for some water bodies achievement of Good status or potential is currently technically infeasible or disproportionately costly. Where this is the case, the test is applied to the currently agreed objectives for that water body rather than against Good status/potential.- in line with Regulation 13(2)b and 13(5)c.
3. To ensure that the legally binding planned programme of water body measures in the second cycle of River Basin Management Planning (RBMP2) to protect and enhance the status of water bodies are not compromised.-

These are the WFD compliance objectives that have been tested for constraints for the three STW Sources SRO schemes.

Following the ACWG guidelines, each STW Sources SRO Schemes has been assessed separately and individually using the Level 1 basic screening to identify potentially affected WFD water bodies and possible impacts based on activities. Using relevant EA guidance[6] most construction activities have been screened out at Level 1 as these would not lead to WFD non-compliance. For each of the WFD water bodies screened into the Level 2 assessment for each STW Sources SRO Schemes separately and individually the ACWG reporting spreadsheet has been completed and is available as a separate annex, see **Table 1**.

Table 1 Accompanying ACWG assessment spreadsheets to this report

Filename	Content
WFD_Annex_1_Mythe_280421	Completed ACWG WFD compliance worksheet for STW Sources SRO scheme 1: Mythe abstraction licence transfer (15 Ml/d)
WFD_Annex_2_Netheridge_Deerhurst_280421	Completed ACWG WFD compliance worksheet for STW Sources SRO scheme 2A: Netheridge WwTW discharge diversion, Deerhurst pipeline (35 Ml/d)
WFD_Annex_3_Netheridge_Eastern_Channel_280421	Completed ACWG WFD compliance worksheet for STW Sources SRO scheme 2B: Netheridge WwTW discharge diversion, Cotswold Canals (35 Ml/d)

Level 2 is a detailed screening for impact on each status element and RBMP2 programme of measures. For each WFD water body, the ACWG reporting spreadsheet sets out the published RBMP2 (2015) status of each WFD status element - for assessing elements included in status classification, not supporting elements. This provides the baseline for no deterioration to be established; therefore, supports the assessment of WFD Objective 1. This information also informs the assessment of WFD Objective 2 – for status elements already achieving Good status or their published RBMP3 target Objective 2 is not required to be tested. The spreadsheet also identifies the published Reasons for Not Achieving Good status assessments undertaken by the EA. The spreadsheet has been used to record

[5] As defined in Section 1.3
[6] Environment Agency Operational Instruction OI 488_10_SD01 WFD compliance assessment for new physical modifications

the published RBMP2 programme of measures for the water body for the assessment of WFD Objective 3.

For construction and operation activity types, such as “new or increased surface water abstraction”, the ACWG guideline has established a checklist of potential impact types such as “changes in flow velocity”. This has been used to inform the change in pressure on status elements. The Reasons for Not Achieving Good status assessments has been used to guide the understanding of existing pressures on the WFD status element in that water body. In the assessment we document in the spreadsheet the impact of each action’s potential impact type on WFD status elements and complete the impact score for each status element using the ACWG guideline’s scale (-2 (very beneficial) to +3 (high adverse impact)). Compliance with WFD Objectives has been reported for each WFD status element and RBMP2 measure. Assessments have been undertaken proportionate to gate-1, noting the level of confidence in the assessment and the level of design certainty.

The Level 1 basic screening of the three STW Sources SRO Schemes is summarised in Section 4. The Level 2 assessment of the three STW Sources SRO Schemes is summarised in Section 5. The STT SRO gate-1 documentation[7] provides the supporting physical environment, water quality and aquatic ecology assessments that underpin the WFD compliance assessment.

3.2 Specific commentary on completion of the ACWG template

The ACWG template has been completed three times. Each of the accompanying Excel workbooks is specific to one of the three STW Sources SRO Schemes. The WFD compliance assessment of each scheme includes the Level 1 screening, the selection of Level 2 activities and the Level 2 assessment. The summary worksheets are auto-generated in the template for consistency in summary across SROs.

3.3 Level 1 WFD screening

The Level 1 screening has been completed for all in-river construction works and the operating effects of the SRO scheme.

For construction activities this includes any intake and outfall construction. The screening does not include pipeline activities. It is noted that within the Level 2 activities assessment that all pipeline activities are scored as 0 or 1 and therefore no pipeline activities pass-forward to the detailed assessment. For the STW Sources SRO there are many river water bodies which would include part of a pipeline corridor for the Netheridge discharge transfer pipelines. For completeness, the relevant river water bodies associated with the pipeline corridors are listed in Section 4 below.

A bespoke hydrological assessment of each of the SRO schemes has been undertaken, reported in the STT SRO gate-1 documentation[8]. That reach-based assessment along the flow pathway of the STT has been used to identify which waterbodies are subject to a major, moderate, minor or negligible flow change when compared with normal conditions. That assessment reviewed river flows over a 30-year period (1990-2019) to characterise river flow into bands from exceptionally low flow to exceptionally high flow on a given date. An indicative operational pattern specific to this scheme was established for the 10-year period (1 January 2010 to 31 December 2019) and compared with river flows under normal conditions in those years. The Level 1 screening also considers those water bodies downstream of these changes along the flow pathway. Those water bodies with a major or moderate flow change have been passed forward from Level 1 screen as requiring further WFD consideration based on flow changes. A secondary screen based on potential water quality changes has been used to select additional water bodies to pass forward from the Level 1 screen as requiring further WFD consideration. All other water bodies have been screened out at Level 1 as these would not lead to WFD non-compliance.

The ACWG approach lists activities relevant to river regulation releases as “High volume discharge of water with a quality element of the same/of a lower WFD status as the receiving water body”. In

[7] Specifically STT SRO gate-1 Environmental Assessment Reports (Appendix B3)
[8] Specifically STT SRO gate-1 Environmental Assessment Report Appendix B3.1 Modelling - Physical Environment Evidence

assessment we identify effects mostly associated with flow changes as "the same WFD status", in acknowledgement that the flow discharged would be appropriately treated prior to discharge with high confidence in design achieving target requirements (e.g. Scheme 2A). In assessment we identify effects associated with flow and/or quality changes as "a lower WFD status" where there is not, at gate-1, high confidence in the design of the treatment prior to discharge achieving target requirements (e.g. Scheme 2B). The STW Sources SRO does not include any activities relevant to the consideration of WFD groundwater bodies.

3.4 Level 2 WFD assessment

Within the ACWG template, we note the following style guide to how we have documented the WFD assessment:

- Assessment has been undertaken against published RBMP2 (2015) status, RBMP2 mitigation measures, and RBMP3 published status targets. The embedded data in the ACWG template also includes status in other years, these are not applicable and have not been assessed against.
- The ACWG template includes the objective "Assists attainment of water body objectives". That objectives is outside the ACWG guidelines and has not been used in the assessment of STW Sources SRO schemes
- For WFD status elements, in the upper section of the worksheet, the relevant WFD objectives that have been assessed against are "Deterioration between status classes" (Objective 1) and "Impediments to GES/GEP" (Objective 2).
- Where RBMP2 (2015) reported status is High or Good, Objective 2 is not applicable and has not been used in the assessment.
- Where RBMP2 (2015) reported status is at the RBMP3 target status, and that is noted as lower than High or Good, Objective 2 is not applicable and has not been used in the assessment.
- For RBMP2 mitigation measures, in the lower section of the worksheet, the relevant WFD objective that has been assessed against is "Compromise WB objectives" (Objective 3).
- The relevant WFD status elements for assessment of Objective 1 and Objective 2 in river water bodies[9] are those in the Water Framework Directive (WFD) Directions[10], as listed in **Table 2**. It is noted that the ACWG template includes hydro-morphological supporting elements and these are not applicable and have not been assessed against.
- The ACWG template includes data from the EA "Reasons for Not Achieving Good" [status] database. These are not applicable to Objectives 1, 2, or 3 and have not been assessed against.
- For proportionality of assessment, the ACWG template "potential impacts of asset" have been collated for each "activity" with one consolidated assessment undertaken for each WFD status element.
- All assessments have been undertaken using the mitigation measures designed into the STW Sources SRO schemes, as documented in the Conceptual Design Reports. 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. Where there is 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 in Section 5 below, but not included in the WFD compliance assessment as it is not currently committed to or costed into STW Sources SRO Scheme design.

[9] It is noted that only river water bodies have been passed forward to the Level 2 WFD assessment of STW Sources SRO.
[10] Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.

Table 2 Relevant WFD status elements from which to assess compliance in river water bodies

Ecological status			
Biological status elements	Fish Invertebrates Macrophytes & phytobenthos combined		
Physio-chemical	Water temperature pH Dissolved oxygen Ammonia Reactive phosphorus (orthophosphate)		
Specific pollutants	2,4-dichlorophenol 2,4-dichlorophenoxyacetic acid 3,4 dichloroaniline Arsenic Benzyl butyl phthalate Carbendazim Chlorothalonil Chromium (III) (VI) Chlorine	Copper Cyanide Cypermethrin Diazinon Dimethoate Glyphosate Iron Linuron Manganese	Mecoprop Methiocarb Pendimethalin Permethrin Phenol Tetrachloroethane Toluene Triclosan Zinc
Chemical status			
Priority Substances, Priority Hazardous Substances and Other pollutants contributing to chemical status	Alachlor Anthracene Atrazine Benzene Benzo(a)-pyrene (BaP) Benzo(b)-fluor-anthene Benzo(k)-fluor-anthene Benzo(g,h,i)-perylene Brominated diphenylether Cadmium and its compounds Carbon tetrachloride Chlorfenvinphos C10-13 chloroalkanes Chlorpyrifos Cyclodiene pesticides isodrin	DDT total Para-para-DDT 1,2-dichloro-ethane Dichloro-methane Di(2-ethylhexyl)-phthalate (DEHP) Diuron Endosulphan Fluoranthene Hexachloro-benzene Hexachloro-butadiene Hexachloro-cyclohexane Indeno(1,2,3-cd)-pyrene Isoproturon Lead and its compounds	Mercury and its compounds Naphthalene Nickel and its compounds Nonylphenol Octylphenol Pentachloro-benzene Pentachloro-phenol Simazine Tetrachloro-ethylene Tributyltin compounds Trichloro-benzenes Trichloro-ethylene Tricholoro-methane Trifluralin

The 2015 Directions note the reporting of additional substances from 2018. These are not status elements in RBMP2 and do not currently have a formal status. Although an interim status position has been documented by the EA for 2019, it is not considered appropriate at this time to include these substances in a WFD compliance assessment. It is noted that the gated process will continue beyond RBMP3 publication, at which point these additional substances will have a formal status and a target status for 2027 from which to update the WFD compliance assessment.

4 Summary of basic Level 1 WFD screening of Severn Trent Sources SRO

4.1 Introduction

For each of the STW Sources SRO schemes, the ACWG template Level 1 screening comprises the following worksheets completed by Ricardo:

- "1. List relevant waterbodies" – these are the waterbodies in the study area as set out in the conceptualisation below
- "2. Level 1 activities" – completed for construction activities and operational activities as set out below

A third worksheet "3. Level 1 summary" is auto-generated by the template to summarise those water bodies to be carried forward to the level 2 assessment.

As the ACWG template does not have specific sections for documenting the reasoning behind the selection of water bodies or activities, relevant description is set out below.

4.2 Scheme 1 Mythe abstraction licence transfer (15 Ml/d)

4.2.1 Conceptualisation of study area

For the Mythe abstraction licence transfer, the flow pathway zone of influence in the River Severn catchment would extend from the Mythe intake on the River Severn, locally upstream of the River Avon confluence, along the remainder of the freshwater River Severn. With the licence transfer there would nominally be a flow increase along the flow pathway zone of influence. However, as the Mythe abstraction licence is only occasionally used to full capacity, the regularity of a quantifiable flow benefit in the River Severn is very limited and in practice the flow change would be negligible. On all dates the scheme would be operational as a support option for water resources purposes flow in the River Severn would be low and unsupported abstraction would be limited by hands-off flow conditions in the river.

4.2.2 In-river hydrological effects from operation

The STT SRO gate-1 documentation[11] has indicated a scenario of flow changes in the study area for the period 2010-2019. The assessed scenario described a Mythe abstraction licence transfer would be operational as a support option for water resources purposes approximately 15% of the study period, clustered in six of the 10 years and within the months May to November. These range from continuous periods in June to September 2015 (96 dates) to shorter duration periods in 2010 (50 dates) and intermittent periods in 2011 (overall 112 dates), 2017 (overall 99 dates), 2018 (overall 128 dates) and 2019 (overall 78 dates). The assessment, listed for Option 4 in the STT SRO gate-1 documentation[12], is a negligible magnitude of flow change.

Indicative flow changes in the study reaches are summarised in **Table 3** listing the WFD water body and assessment of the magnitude of flow change. The hydrological zone of influence is considered to not extent into either the Severn Estuary and no transitional water bodies are included in the assessment. For the Severn Estuary this is on the understanding that the hands-off flow conditions provided by the EA for unsupported abstraction management is ecologically sustainable.

[11] Specifically STT SRO gate-1 Environmental Assessment Report "Appendix B3.1 Modelling - Physical Environment Evidence
[12] Specifically STT SRO gate-1 Environmental Assessment Report "Appendix B3.1 Modelling - Physical Environment Evidence Sections 1.2.4 and 1.2.6

Table 3 Relevant reaches and associated indicative flow changes from operation of the Mythe abstraction licence transfer (15 Ml/d)

WFD water body	Flow change during operation	Assessed magnitude of flow change
Severn - conf R Teme to conf R Avon (GB109054039760).	Nominally +15 Ml/d but in effect no change	Negligible
Severn - conf R Avon to conf Upper Parting (GB109054044404)	Nominally +15 Ml/d but in effect no change	Negligible
Severn (E Channel) – Horsebere Bk to Severn Estuary (GB109054032750)	Nominally +15 Ml/d but in effect no change	Negligible

4.2.3 Water bodies and activities deemed WFD compliant and not passed forward from Level 1 screen

No Mythe abstraction licence transfer construction activities have been passed forward from the Level 1 screen. No in-river or pipeline construction activities are associated with this scheme and none have been documented in the Level 1 spreadsheet:

4.2.4 Water bodies and activities passed forward from Level 1 screen as requiring further consideration

For the Mythe abstraction licence transfer SRO scheme the hydrological assessment identified no WFD water bodies passed forward from Level 1 screen as requiring further consideration based on major or moderate hydrological effects. The scheme is assessed as compliant with WFD Regulations without the need for a Level 2 assessment.

4.3 Scheme 2A: Netheridge WwTW discharge diversion, Deerhurst pipeline (35 Ml/d)

4.3.1 Conceptualisation of study area

For the Netheridge WwTW discharge diversion (Deerhurst pipeline), the flow pathway zone of influence in the River Severn catchment would extend from the Deerhurst intake, along the remainder of the freshwater River Severn. With the discharge diversion there would be a short flow depleted reach of 100-200m between the intake and outfall as the scheme is designed on a take-and-put basis so that the discharge itself is not transferred as part of the STT.

4.3.2 In-river hydrological effects from operation

The STT SRO gate-1 documentation[13] has indicated a scenario of flow changes in the study area for the period 2010-2019. The assessed scenario described transfer discharge diversion would be operational as a support option for water resources purposes approximately 15% of the study period, clustered in six of the 10 years and within the months May to November. These range from continuous periods in June to September 2015 (96 dates) to shorter duration periods in 2010 (50 dates) and intermittent periods in 2011 (overall 112 dates), 2017 (overall 99 dates), 2018 (overall 128 dates) and 2019 (overall 78 dates). On all dates the scheme would be operational as a support option for water resources purposes flow in the River Severn would be low and unsupported abstraction would be limited by hands-off flow conditions in the river. The assessment, listed for Option 5a in the STT SRO

[13] Specifically STT SRO gate-1 Environmental Assessment Report Appendix B3.1 Modelling - Physical Environment Evidence

gate-1 documentation[14], is a negligible magnitude of flow change.

Indicative flow changes in the study reaches are summarised in **Table 4** listing the WFD water body and assessment of the magnitude of flow change. With a local scale take-and-put arrangement at Deerhurst assessment of hydraulic information has identified negligible flow effects in the freshwater River Severn. The intermittent 35 Ml/d reduction from Netheridge WwTW to the upper Severn Estuary has been reviewed as with negligible flow effects in the estuary.

Table 4 Relevant reaches and associated indicative flow changes from operation of the Netheridge WwTW discharge diversion, Deerhurst pipeline (35 Ml/d)

WFD water body	Flow change during operation	Assessed magnitude of flow change
Severn - conf R Avon to conf Upper Parting (GB109054044404)	Nominally -35 Ml/d for short reach (100-200m) but no hydraulic changes	Negligible
Severn (E Channel) – Horsebere Bk to Severn Estuary (GB109054032750)	No change	Negligible

4.3.3 Water bodies and activities deemed WFD compliant and not passed forward from Level 1 screen

No Netheridge WwTW discharge diversion (Deerhurst pipeline) construction activities have been passed forward from the Level 1 screen. The range of in-river construction activities associated with this scheme have been documented in the Level 1 spreadsheet:

- Outfall headworks for Netheridge WwTW discharge diversion in the River Severn at Deerhurst

No Netheridge WwTW discharge diversion (Deerhurst pipeline) pipeline construction activities have been passed forward from the Level 1 screen. It is noted that within the Level 2 activities assessment that all pipeline activities are scored as 0 or 1 and therefore 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 diverted, appropriate measures will be in place to protect the watercourse will be returned back 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.

For this scheme, pipeline activities would occur in one river water bodies, identified as:

- GB109054044404 Severn - conf R Avon to conf Upper Parting

No Netheridge WwTW discharge diversion (Deerhurst pipeline) pipeline washout activities have been passed forward from the Level 1 screen as these are considered to be not intended for routine use and therefore not consistent with WFD assessment periods.

4.3.4 Water bodies and activities passed forward from Level 1 screen as requiring further consideration

For the Netheridge WwTW discharge diversion (Deerhurst pipeline) the hydrological assessment

[14] Specifically STT SRO gate-1 Environmental Assessment Report "Appendix B3.1 Modelling - Physical Environment Evidence Sections 1.3.7

identified no WFD water bodies passed forward from Level 1 screen as requiring further consideration based on major or moderate hydrological effects. The scheme is assessed as compliant with WFD Regulations without the need for a Level 2 assessment.

4.4 Scheme 2B: Netheridge WwTW discharge diversion, Cotswold Canals (35 Ml/d)

4.4.1 Conceptualisation of study area

For the Netheridge WwTW discharge diversion (Cotswold Canals), the flow pathway zone of influence in the River Severn catchment would extend from the Gloucester Docks intake, along the remainder of the Eastern Channel of the River Severn. With the discharge diversion there would be a short flow depleted reach of less than 100m between the intake and outfall as the scheme is designed on a take-and-put basis so that the discharge itself is not transferred as part of the STT.

4.4.2 In-river hydrological effects from operation

The STT SRO gate-1 documentation[15] has indicated a scenario of flow changes in the study area for the period 2010-2019. The assessed scenario described transfer discharge diversion would be operational as a support option for water resources purposes approximately 15% of the study period, clustered in six of the 10 years and within the months May to November. These range from continuous periods in June to September 2015 (96 dates) to shorter duration periods in 2010 (50 dates) and intermittent periods in 2011 (overall 112 dates), 2017 (overall 99 dates), 2018 (overall 128 dates) and 2019 (overall 78 dates). On all dates the scheme would be operational as a support option for water resources purposes flow in the River Severn would be low and unsupported abstraction would be limited by hands-off flow conditions in the river. The assessment, listed for Option 5b in the STT SRO gate-1 documentation, is a negligible magnitude of flow change.

Indicative flow changes in the study reaches are summarised in **Table 5** listing the WFD water body and assessment of the magnitude of flow change. With a local scale take-and-put arrangement at Deerhurst assessment of hydraulic information has identified negligible flow effects in the freshwater River Severn. The intermittent 35 Ml/d reduction from Netheridge WwTW to the upper Severn Estuary has been reviewed as with negligible flow effects in the estuary.

Table 5 Relevant reaches and associated indicative flow changes from operation of the Netheridge WwTW discharge diversion, Cotswold Canals (35 Ml/d)

WFD water body	Flow change during operation	Assessed magnitude of flow change
Severn (E Channel) – Horsebere Bk to Severn Estuary (GB109054032750)	-35 Ml/d for short reach (less than 100m)	Negligible

4.4.3 Water bodies and activities deemed WFD compliant and not passed forward from Level 1 screen

No Netheridge WwTW discharge diversion (Cotswold Canals) construction activities have been passed forward from the Level 1 screen. The range of in-river construction activities associated with this scheme have been documented in the Level 1 spreadsheet:

- Outfall headworks for Netheridge WwTW discharge diversion in the River Severn Severn downstream Gloucester Docks.

[15] Specifically STT SRO gate-1 Environmental Assessment Report Appendix B3.1 Modelling - Physical Environment Evidence Section 1.3.7

No Netheridge WwTW discharge diversion (Cotswold Canals) pipeline construction activities have been passed forward from the Level 1 screen. It is noted that within the Level 2 activities assessment that all pipeline activities are scored as 0 or 1 and therefore 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 diverted, appropriate measures will be in place to protect the watercourse will be returned back 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.

For this scheme, pipeline activities would occur in one river water body, identified as:

- GB109054032750 Severn (E Channel) - Horsebere Bk to Severn Est.

No Netheridge WwTW discharge diversion (Cotswold Canals) pipeline washout activities have been passed forward from the Level 1 screen as these are considered to be not intended for routine use and therefore not consistent with WFD assessment periods.

4.4.4 Water bodies and activities passed forward from Level 1 screen as requiring further consideration

For the gate-1 Netheridge WwTW discharge diversion (Cotswold Canals) the hydrological assessment identified no WFD river water bodies passed forward from Level 1 screen as requiring further consideration based on major or moderate hydrological effects. The Severn (E Channel) – Horsebere Bk to Severn Estuary (GB109054032750) was included for water quality considerations. Water bodies and relevant activities from the ACWG list and the relevant STT element are summarised in **Table 6**.

Table 6 Water bodies and activities passed forward from Level 1 screen as requiring further consideration for the Netheridge WwTW discharge diversion (Cotswold Canals) scheme

Water body	ACWG listed activity
Severn (E Channel) – Horsebere Bk to Severn Estuary (GB109054032750)	New or increased surface water abstraction High volume discharge of water with a quality element of the same WFD status as the receiving water body

5 Summary of Level 2 WFD assessment of Severn Trent Sources SRO

5.1 Introduction

For the Netheridge WwTW discharge diversion (Cotswold Canals) scheme of the STW Sources SRO, the ACWG template Level 2 assessment comprises the following worksheets completed by Ricardo:

- "*4. Assign Level2 WB Impacts*" – these are the specific activities to be assessed per water body. For consistency, these have been selected as those reported in worksheet "2. Level 1 activities" and set out in Section 4 above.
- "*5. Level 2 assessment template*" – a copy of this template has been set out for each of the water bodies carried forward to the Level 2 assessment and these are renamed as the water body ID code.

A third worksheet "6. Level 2 summary" is auto-generated by the template to summarise the per water body level 2 assessments.

Using the information presented in the spreadsheets, a narrative description of the WFD compliance assessment for each scheme is provided below. 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 Level 2 WFD assessment has not been undertaken for either the Mythe abstraction licence transfer or the Netheridge WwTW discharge diversion (Deerhurst pipeline) as the Level 1 WFD assessment concluded they were WFD compliant without the need for further assessment.

5.2 Netheridge WwTW discharge diversion, Cotswold Canals (35 Ml/d)

The Netheridge WwTW discharge diversion (Cotswold Canals) scheme has been assessed as with the potential to not comply with WFD objectives. As summarised in **Table 7** this is in one specific water body.

Table 7 WFD compliance assessment summary for the Netheridge WwTW discharge diversion (Cotswold Canals) scheme

Water body	WFD compliant against assessed WFD objectives	Potential non compliant issue
Severn (E Channel) – Horsebere Bk to Severn Estuary (GB109054032750)	No Low data confidence High design confidence	• Fish (Objective 1 status deterioration) • Macroinvertebrates (Objective 1 status deterioration or Objective 2 introducing impediments)

5.2.1 Potential non-compliance with WFD objectives in the River Severn (Eastern Channel)

In the River Severn there is potential for status deterioration or introducing impediments to target status in one waterbody.

Water body GB109054032750 Severn (E Channel) – Horsebere Bk to Severn Estuary is currently Bad status for macroinvertebrate status and Poor status for reactive phosphate. The target status for macroinvertebrate status is Poor in 2021 and for reactive phosphate remains Poor. No other biological status elements have a reported status in this heavily modified water body.

In operation there would be 35 Ml/d transfered from Netheridge WwTW into the River Severn in GB109054032750 Severn (E Channel) – Horsebere Bk to Severn Estuary. Hydrologically there is no data on flow in this former navigation cut bifurcation of the lower River Severn. However, this is not the main flow channel and with STT operation, flow would be put preferentially into Gloucester Docks. Further information would be required in gate-2 to establish the buffering capacity of the remaining river to accommodate 35 Ml/d of tertiary treated water.

The gate-1 engineering conceptual design of the Netheridge support option states the inclusion of ferrous dosing prior to discharge, as presented in the Conceptual Design Report. At present in gate-1 there is limited evidence on the receiving water flows or quality in the eastern channel of the River Severn. A viable SRO element would be required to achieve a discharge permit, and a discharge permit would need to demonstrate that it is WFD compliant. The nutrient quality of the receiving river is currently Poor and without a status improvement target. It is unlikely that a tertiary treated discharge would deteriorate status to Bad.

The water body is currently Bad status for macroinvertebrate status, with a target status of Poor in 2021. No other biological status elements have a reported status in this heavily modified water body. The flow change in the water body, potentially a large replacement of river flow with tertiary treated WwTW discharge is considered, with high confidence, to impact fish and macroinvertebrate status.

This STW Sources SRO scheme has been subject to limited design to date and requires further investigation in gate-2 in order to inform mitigation options.

6 Conclusions and recommendations

The three STW Sources SRO Schemes set out for gate-1 have each been assessed using the ACWG guideline for WFD compliance assessments. In each case the ACWG template has been completed.

That assessment identified WFD compliance for the Mythe abstraction licence transfer or the Netheridge WwTW discharge diversion (Deerhurst pipeline). Those assessments have been supported by bespoke hydrological assessment in the STT SRO gate-1 documentation and have a high confidence.

The Netheridge WwTW discharge diversion (Cotswold Canals) scheme is potentially not compliant with WFD objectives, subject to further development of operating rules and treatment solutions, together with additional bespoke aquatic habitat assessment, water quality monitoring and water quality modelling planned in gate-2. Little is known of the buffering capacity and aquatic habitats of the receiving water course and these require further evidence and assessment in gate-2 to either confirm WFD compliance or identify mitigation actions.

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