ANNEX B4

Regulatory Environmental Assessment: Tame & Trent EAR

Minworth SRO

Severn Trent Water & Affinity Water

Minworth Strategic Resource Option (SRO)

Regulatory Environmental Assessments for Gate 2
Environmental Assessment Report

Affinity Water and Severn Trent Water

Project reference: Minworth Gate 2
Project number: 60679900
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Produced for Affinity Water and Severn Trent Water

Delivering a better world

Author names redacted

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Prepared by	Checked by	Verified by	Approved by
[redacted] Technical Director, Water Environment	[redacted] Technical Director, Water Environment	[redacted] Water Sector Lead (Environment)	[redacted] Technical Director

Topic Leads

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Author names and contact details redacted

Prepared for:

Affinity Water and Severn Trent Water
[redacted]
Environmental and Water Resources Lead - Interconnector
Chief Engineer
Severn Trent Water Ltd

Prepared by:

[redacted]
Technical Director, Water Environment

AECOM Limited
12 Regan Way
Chetwynd Business Park
Nottingham NG9 6RZ
United Kingdom

T: +44 (115) 907 7000
aecom.com

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This Environmental Assessment Report (EAR) supports the Gate 2 submission to the Regulators' Alliance for Progressing Infrastructure Development (RAPID) for the Minworth Strategic Resource Option (SRO). Minworth SRO supports the Severn to Thames Transfer (STT) SRO and the Grand Union Canal (GUC) SRO.

This EAR presents the following regulatory environmental assessments: Strategic Environmental Assessment (SEA); Informal Habitats Regulations Assessment (HRA); Water Framework Directive (WFD) Assessment; Biodiversity Net Gain (BNG) Assessment; Natural Capital Assessment; and qualitative Carbon Assessment.

The assessments have been completed to support the Gate 2 Submission for the Minworth SRO scheme, according to the strategic regional water resource solutions: detailed feasibility and concept design: Gate 2 Guidance, and All Company Working Group Guidance.

Minworth SRO is investigating the potential to provide water to the STT SRO by diverting some of the Minworth WwTW final effluent to the River Avon, as well as to the GUC via the Coventry Canal. This EAR summarises changes to the SRO scheme between Gate 1 and Gate 2 and considers potential impacts of reducing discharge to the Rivers Tame and Trent, together with impacts of the pipeline transporting water to the River Avon for STT.

Strategic Environmental Assessment (SEA)

Major and moderate negative and positive effects have been identified for the schemes assessed, which is to be expected given the scale of the proposed schemes. Some of the major negative effects identified are temporary in nature and largely unavoidable while construction works take place. In addition to the identification and assessment as to the effectiveness of further mitigation measures it is proposed as part of Gate 3 activities to reaffirm the identified embedded mitigation measures set out as part of these assessments.

Habitats Regulations Assessment (HRA)

The HRA concludes that the Minworth SRO will not result in a likely [adverse] significant effect on the River Mease SAC; however, a likely significant effect on the Humber Estuary SAC cannot be dismissed once the improved fish passes at Crowell Weir are installed. As such, appropriate assessment will be required at Gate 3.

Water Framework Directive (WFD) Assessment

The assessment suggests that three of the four flow reduction scenarios may have the potential to cause non-compliances with WFD objectives due to status (or within status) deterioration of the fish, hydrological regime, or water quality supporting elements. It is recommended that this is examined further during Gate 3 as further hydraulic modelling and assessment is completed, in consultation with the Environment Agency.

Natural Capital Assessment

Results indicate that all four scenarios are expected to lead to a net benefit, compared to the do-nothing scenario. All the natural capital values are similar across the scenarios and higher relative to the baseline, except for the embodied and operational carbon emissions. There may be the potential for the wider SRO schemes (Minworth, STT, and GUC) to jointly provide Natural Capital benefits and BNG across the entirety of the schemes.

Biodiversity Net Gain (BNG) Assessment

The BNG assessment demonstrates that through the identification of appropriate mitigation options, habitat creation/ enhancement, and wider benefits, it will be possible to achieve a Net Gain minimum of 10% through the SRO schemes. The creation of new wetlands within the Study Area will particularly benefit those species associated with those habitat types.

Carbon Assessment

Embodied and operational carbon emissions for the lifespan of the SRO schemes are considered through the carbon assessment, and recommendations made to refine the assessment through Gate 3 and implement appropriate mitigation measures including energy efficiency, renewable energy installations, and ensuring that official projections of grid carbon intensity are factored into all operational carbon estimates.

Recommendations for Gate 3

Detailed next steps are provided for further and on-going environmental assessment at Gate 3, linked to parallel environmental assessments for the schemes. On-going assessment will be informed by the RAPID Gate 3 Guidance, when it is published, and the requirements for Gate 3 submission.

Recommendations include the incorporation of on-going Gate 2 assessments, including hydraulic modelling, into the assessments, on-going discussions with Regulators / Stakeholders that may identify topics that require further assessment, further targeted environmental assessments, and the evolution of appropriate mitigation measures to offset predicted environmental effects.

2. Introduction

2.1 Purpose of Report

2.1.1 This Environmental Assessment Report (EAR) supports the Gate 2 submission to the Regulators' Alliance for Progressing Infrastructure Development (RAPID) for the Minworth Strategic Resource Option (SRO). Minworth SRO supports the Severn to Thames Transfer (STT) SRO and the Grand Union Canal (GUC) SRO. Minworth was identified as an SRO in the PR19 Final Determination, with funding allocated to Affinity Water (AW) and Severn Trent Water (STW).

2.1.2 This EAR presents the following regulatory environmental assessments for the Minworth SRO and supports the related schemes, the STT and GUC SROs:

- Environmental Appraisal – Strategic Environmental Assessment (SEA), including options assessment, consideration of resilience (e.g., climate change), and the development of mitigation and enhancement opportunities;
- Informal Habitats Regulations Assessment (HRA);
- Water Framework Directive (WFD) Assessment;
- Other Environmental Considerations: Biodiversity Net Gain (BNG) Assessment, and Natural Capital Assessment; and
- A qualitative carbon Assessment (summarised from the Engineering Assessments, Jacobs 2022).

2.1.3 The assessments have been completed to support the Gate 2 Submission for the Minworth SRO scheme, according to the Strategic regional water resource solutions: detailed feasibility and concept design: Gate 2 Guidance[1] (April 2022).

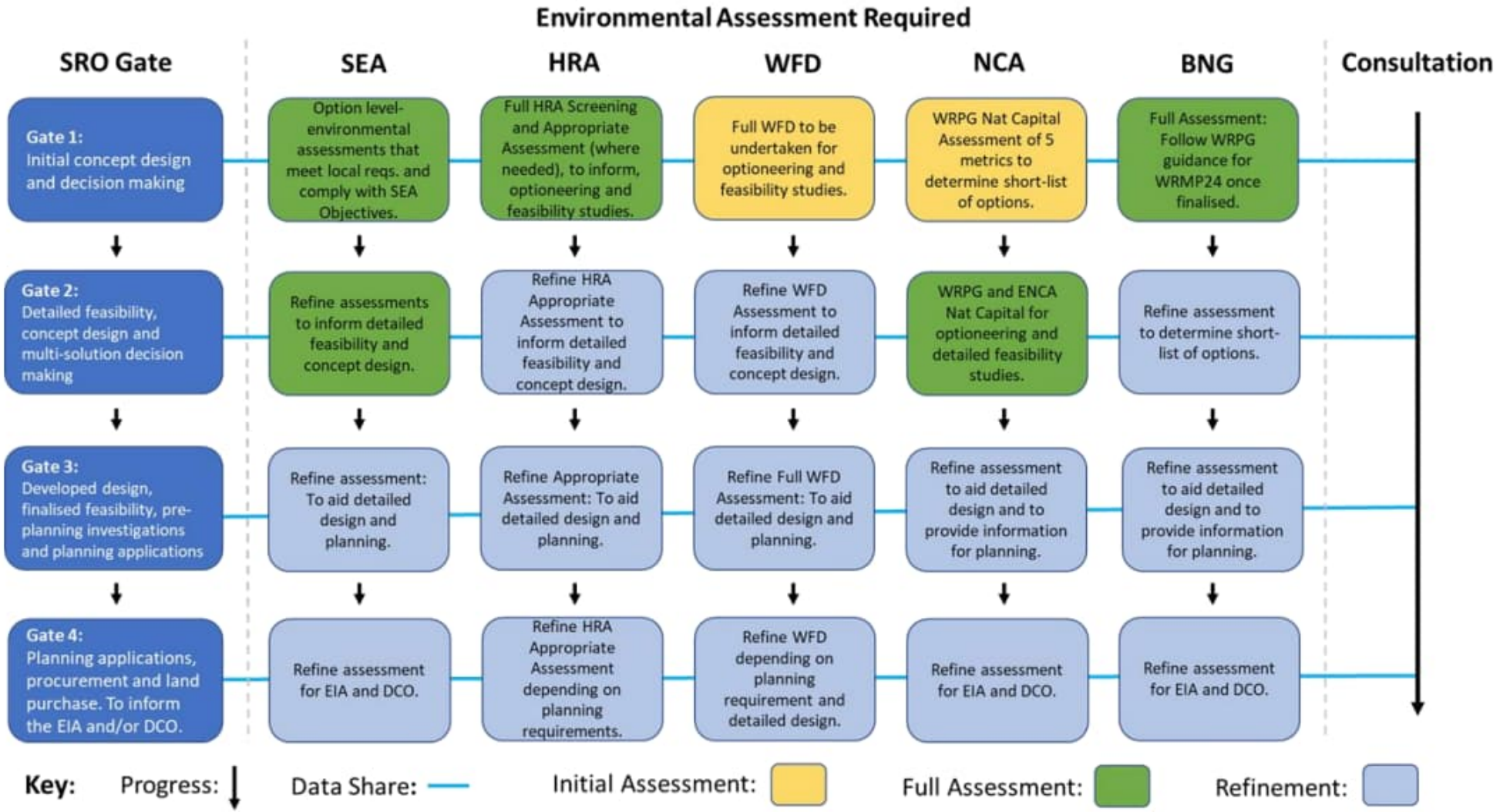
2.1.4 In addition, the assessment has been completed in accordance with:

- All Company Working Group (ACWG): WRMP environmental assessment guidance and applicability with SROs (October 2020);
- All Company Working Group: Strategic Environmental Assessment: Core objective identification; and
- All Company Working Group: Water Framework Directive: Consistent framework for undertaking no deterioration assessments (November 2020); and the accompanying ACWG WFD No Det Consistent Framework Assessment Spreadsheet (November 2020).

2.1.5 The All Company Working Group (ACWG) guidance ensures the consistency of environmental assessments across the various SROs, including the evaluation of potential impacts and benefits on environmental water quality and associated watercourses, habitats, and designated sites. The ACWG methodology indicates that the process requires Water Companies to provide the following information related to each SRO at the stages outlined in Figure 2-1.

[1] https://www.ofwat.gov.uk/publication/strategic-regional-water-resource-solutions-guidance-for-gate-two/

Figure 2-1: Environmental Assessment Integration with SRO Gates (ACWG, October 2020)



2.1.6 The assessment has been undertaken for environmental impacts for each scenario of the options that form Minworth SRO, including:

Site construction:

2.1.7 Impacts of the proposed new treatment processes at Minworth Wastewater treatment works (WwTW) for:

- 57 Ml/d (Megalitres per day) discharge to GUC SRO
- 115 Ml/d discharge to GUC SRO
- 57 Ml/d discharge to River Avon for STT SRO
- 115 Ml/d discharge to River Avon for STT SRO
- Combined 230 Ml/d transfer to both River Avon (STT) and GUC (115 Ml/d to each)
- Impacts of the pipeline transporting water to River Avon for STT

River impacts:

2.1.8 Impacts of reducing discharge to the River Tame and Trent system by:

- 115 Ml/d discharge to GUC SRO
- 115 Ml/d discharge to River Avon for STT SRO
- Combined 230 Ml/d transfer to both River Avon (STT) and GUC (115 Ml/d to each)
- “Step” assessments e.g., 57 Ml/d and 172 Ml/d (both ways – Avon and/or GUC)

2.2 Background – The Gated Process

2.2.1 Through the PR19 Final Determination, Ofwat set up RAPID (a partnership made up of the three water regulators – Ofwat, the Environment Agency (EA), and the Drinking Water Inspectorate (DWI)), in 2019. The National Infrastructure Commission estimated that new water supplies equivalent to the water consumed by over nine million people would be needed by the mid-2030s. Responding to the scale of that challenge, RAPID was formed to help facilitate the development and funding of new, large-scale strategic water supply options (SROs) by the water companies. RAPID is working alongside the five regional water resources planning groups (including Water Resources West, the region in which Minworth is located)), to ensure the timely delivery of new infrastructure.

2.2.2 The Gated process relates to the funding of investigations and development of water resources solutions from April 2020 until March 2024.

2.2.3 There are four Gates during this period. At each Gate, Water Companies submit information about their work on a solution, which is assessed to ensure companies are making progress on investigation and development of solutions. Ofwat also decides whether companies should continue to be allowed funding to further investigate and develop a solution to the next Gate.

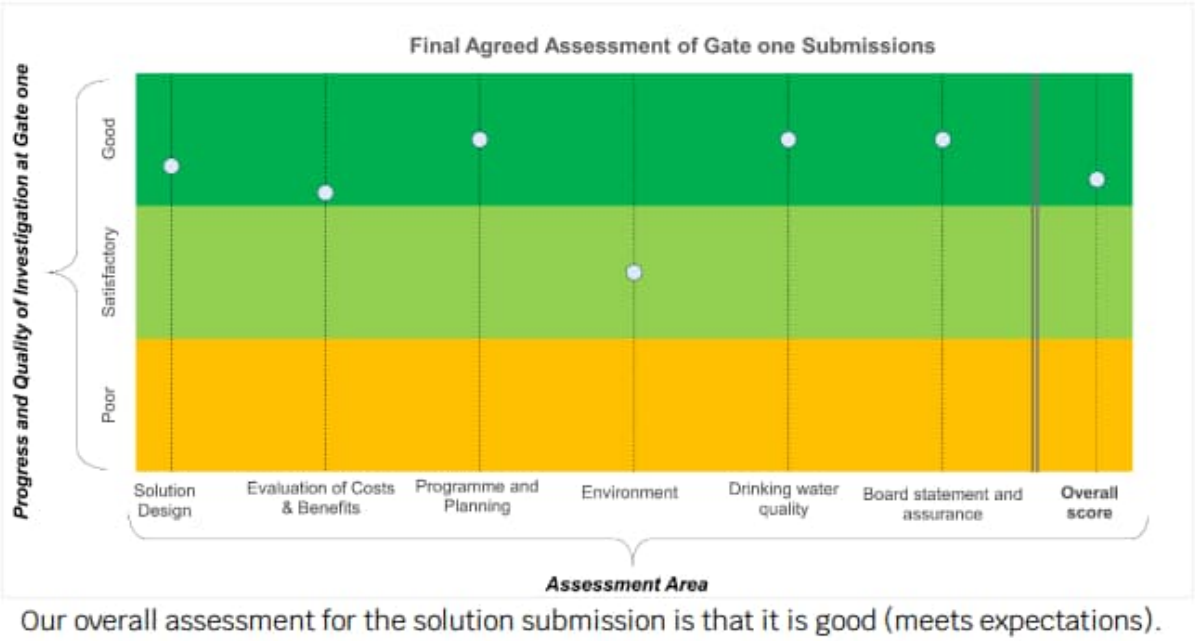
2.2.4 The purpose of the Gated process is to ensure at each Gate that:

- companies are progressing strategic water resource solutions that have been allocated funding at PR19;
- costs incurred in doing so are efficient; and
- solutions merit continued investigation and development during the period 2020 to 2025.

Gate 1

2.2.5 Gate 1 was a first opportunity to check progress on investigations and development of solutions in the Gated process. At Gate 1, all solutions were expected to proceed to Gate 2, meaning that companies could continue to spend ring-fenced funding on their investigation and development to Gate 2, unless there was a clear reason why this was no longer merited. RAPID’s final decision for Gate 1 was published on 8 December 2021, in which the Gate 1 submission for Minworth was rated ‘Good’ overall, as shown in Figure 2-2 below.

Figure 2-2: RAPID Gate 1 submission assessment for Minworth SRO



2.2.6 The 'Satisfactory' rating for environmental assessment determined satisfactory evidence of progress in the environmental assessment, potential mitigations, future work programmes and embodied and operational carbon commitments for Gate 1. Areas of shortfall identified related to environmental assessments, the identification of environmental risks and mitigation measures and a lack of detail in the presented programme of work to address environmental assessment requirements including monitoring. The recommendation was for environmental assessments to be refined for Gate 2, including a review of scopes and further monitoring. It was noted that there remained a significant amount of further work required to understand the hydrological, water quality, and geomorphological dynamics along the River Tame and River Trent and potential impact on ecology and environment.

Gate 2

2.2.7 Gate 2 looks at the solutions in more detail with focus on ensuring that funding for continued investigation and development of solutions is aligned to water resources planning. Decisions about whether or not a solution goes ahead will be made through water resources planning and subsequently applications for local planning and environmental consents.

2.2.8 The scheme will be resubmitted to RAPID for Gate 2 review in November 2022 with a decision from RAPID on whether the scheme can commence to Gate 3 in March 2023. Should the scheme be taken forward to construction, Minworth WwTW upgrade and pipeline will be construction ready in AMP8 (2025 to 2030).

Work Completed to Date

2.2.9 AECOM previously completed the Concept Design Report (CDR) for the Minworth SRO (AECOM, March 2021), and the Hydrology, Environment, and Ecological (HEE) gap analysis of the River Tame, River Trent and Humber (TTH) system for Gate 1, carried out jointly for Minworth and South Lincolnshire Reservoir (SLR) SROs (AECOM, March 2021). Also underway are the overall environmental assessments for the Tame and Trent systems in support of the Minworth and SLR SROs, and the Monitoring and Environmental Assessment work packages, due in June/July 2022. The Gate 2 Environmental Assessments are built upon the previous work undertaken for Gate 2, as well as updating the corresponding assessments completed for RAPID Gate 1.

2.2.10 The Gate 1 work involved considering Water Framework Directive (WFD) related impacts and benefits, baseline ecological data, and in particular the potential impacts of changes in flow to ecological receptors such as designated sites and their qualifying features, protected and notable species, and particular constraints from the presence or future spread of Invasive Non-Native Species (INNS). Other topics assessed in the AECOM Baseline Assessment were Navigation, Sedimentation, Assets along the Trent, Abstraction and Discharge Licences, Saline Intrusion, Fish

Habitats and Migration, Biodiversity Net Gain, Natural and Social Capital, and Soil and Humidity. Some of these topics were carried forward for further detailed assessment at Gate 2 upon the recommendations of stakeholders including the Environment Agency (EA) and Natural England (NE), as presented in this report and the accompanying technical appendices, and the accompanying parallel workstreams for Environmental Assessment (see below).

2.2.11 Previous and current assessments in support of Minworth SRO are summarised below:

Gate 1 Assessments

- Gate 1 submission documents for the Minworth, GUC, and STT SROs[2]

Gate 2 Assessments

2.2.12 The Gate 2 regulatory assessments presented in this report incorporate the work completed for Gate 1, and the on-going environmental assessments for Gate 2, including work completed to inform the Minworth SRO scheme by AECOM and other Consultants:

- Environmental Assessment for the Trent Strategic Resource Options (SRO): Minworth SRO and South Lincolnshire Reservoir (SLR) SRO: Results and Recommendations. Report to Affinity Water, Anglian Water Services Ltd and Severn Trent Water Ltd. (60669746_REP_002_Env-Ass_Trent_SRO_V5: Annex B3.1). AECOM, September 2022, and supporting Technical Appendices as follows:
  - Annex B3.1.1: Appendix A SSSI Interaction
  - Annex B3.1.2: Appendix B(i) Ecology; and Appendix B(ii) Aquatic Ecology
  - Annex B3.1.3: Appendix C River Mease SAC
  - Annex B3.1.4: Appendix D Invasive Non-Native Species
  - Annex B3.1.5: Appendix E Sedimentation
  - Annex B3.1.6: Appendix F Natural Capital and Biodiversity Net Gain Assessment
- Annex B5: Water Quality - Baseline Monitoring and Modelling: Minworth Strategic Resource Option. Report to Affinity Water and Severn Trent Water Ltd. AECOM, October 2022.
- Annex B1: Trent Strategic Resource Options: Aquatic Ecology Monitoring Final Report to Affinity Water, Anglian Water Services Ltd and Severn Trent Water Ltd. AECOM, July 2022.
- Annex B2: Tame and Trent Hydraulic and Hydrological Modelling Report: Minworth SRO and South Lincolnshire Reservoir (SLR) SRO. Report to Affinity Water, Anglian Water Services Ltd and Severn Trent Water Ltd. AECOM, October 2022.
- Concept Design Report (Draft), Revision no: 0B. Report to Severn Trent Water: Minworth SRO. Jacobs, August 2022 [and accompanying appendices].
- Cost and Carbon Report (Draft), Revision no: 0B. Report to Severn Trent Water: Minworth SRO. Jacobs, August 2022 [and accompanying appendices].
- STT Preferred Route Carbon Calculation – STT115. Severn Trent Water - Carbon Calculator - Summary of Results. Jacobs; received May 2022.
- Grand Union Canal Strategic Resource Option Water Quality Monitoring Quarterly Report 3 2022. Severn Trent Water, Affinity Water, and the Canal & River Trust. Atkins, 31st March 2022 [including Minworth effluent water quality data].
- Details of the habitat assessment for the Avon Pipeline for STT (Ricardo) – received GIS corridor, and summary of CDR; received April 2022.

2.2.13 The Gate 2 assessments listed above include those topics taken forward for further assessment following discussion with stakeholders (including the EA and NE) upon completion of the Gate 1 assessments, and those specifically identified for assessment in the RAPID Gate 2 Guidance. Engagement with the Regulators agreed and refined the scope of assessment for Gate 2 environmental assessments, including for example specific assessment of the River Mease SAC in the light of HRA and potential in-combination effects with other plans and schemes.

[2] https://www.ofwat.gov.uk/regulated-companies/rapid/the-rapid-gated-process/gate-one-submissions-and-final-decisions/

2.3 Assessment Rationale

2.3.1 The purpose of this Gate 2 assessment is to assess the impact of the proposed reduction of discharge from Minworth, which currently discharges a Dry Weather Flow (DWF) of 417 Ml/d (as per Concept Design Report CDR, Jacobs 2022), of up to 230 Ml/d. This assessment is critical to supporting concept design and scheme environmental assessment for key SROs at Gate 2.

2.3.2 This Environmental Assessment Report collates the assessments from each regulatory assessment (SEA, HRA, WFD, BNG, Nat Cap), including any links and interdependencies between them, any gaps, or limitations to the assessment (e.g., the availability of supporting information, which would have been established and flagged at an early stage), and any recommendations to incorporate into further environmental assessment for Gate 3. This will inform the next stage of environmental assessment in support of the related SRO schemes.

2.3.3 A key element of the Minworth SRO is to investigate the environmental risks and opportunities for wider environmental benefits associated with delivery of the scheme.

Objectives

2.3.4 The key objectives of the Gate 2 Environmental Assessments are as follows:

- Build on the work completed in Gate 1 to provide a robust impact assessment of the discharge reduction from Minworth in to the River Tame system and surrounding environment (particularly, connected watercourses e.g., River Mease Special Area of Conservation (SAC), Humber Estuary SAC, and connected water dependent habitats), and assess the impact the proposed transfer could have on WFD status, flow regime, water quality, ecology, habitats etc.
- Define what mitigation measures need to be implemented to satisfy regulators that the SROs are viable. Any mitigation measures that require engineering solutions such as modification to fish passes or weirs, will be fed back into the Engineering workstream.
- Support engagement with key stakeholders including the Environment Agency, Natural England, Water Resources West, etc. This has taken the form of monthly workshops to present findings and/or discuss key themes, risks, or mitigations, site visits to inform the assessment of specific features, data sharing, and regular informal consultation.
- Identify the likely significant environmental effects of the proposed SRO schemes and make recommendations for further work to support the development of the schemes to be completed at Gate 3.

2.3.5 This report sets out the results of the regulatory environmental assessments, the requirements for which are set out in the RAPID Gate 2 Guidance; to drive engagement with relevant regulators and other decision-makers.

2.4 Environmental Assessment

2.4.1 This report constitutes the Environmental Assessments Gate 2 requirement document (Environmental Assessment Report, EAR) as set out in the Gate 2 regulator expectations document, in order to allow standardization of assessment and comparison with other SRO schemes at Gate 2. It is supported by technical appendices / annexes and supporting Gate 2 assessment reports detailing the results of the supporting Environmental Assessments.

2.4.2 The EAR includes the technical summary for all sections listed in the RAPID Gate 2 Guidance, Section 6: Environmental Assessment (6.1 WFD Assessment, 6.2 Informal HRA, 6.3 Environmental Assessment (SEA), 6.4 Other Environmental Considerations (BNG, Natural Capital Assessment – including Benefits assessment)).

2.4.3 As per ACWG and RAPID Gate 2 Guidance this Gate 2 EAR document includes:

- Scheme details and background information, including design changes since Gate 1.
- A description of the scheme location, design, and operation.

- A concise summary of assessment results, providing an overview of each individual environmental assessment.
- A summary of Strategic Environmental Assessment for the SRO, using the specified scoring criteria.
- An SEA assessment of all scheme options.
- HRA test of likely significance ('Screening') – updated 'informal' Stage 1 screening; Preparation of 'informal' Stage 2, and an outline plan for 'informal' Stage 3 assessment.
- WFD Screening, and requirements for further detailed assessment.
- Biodiversity Net Gain assessment and outputs of the Defra biodiversity metric, including calculations.
- Natural Capital stock assessment and Ecosystem Services valuation.
- Assessments of the whole life carbon cost of the solution; designs and opportunities for e.g., renewable energy and/or carbon sequestration, and/or joint opportunities with other sectors (presented from the results of the draft Cost and Carbon Report (Jacobs, April 2022).

Grid references for continued monitoring locations redacted

3. Minworth SRO – Scheme Details

3.1 Site Location

3.1.1 Minworth Wastewater Treatment Works (WwTW), located to the east of Birmingham and south-east of Sutton Coldfield, is Severn Trent Water's largest sewage treatment works serving an equivalent population of 1.75 million people from Birmingham. The plant treats sludge from an equivalent population of 2.5 million. The WwTW discharges treated effluent, according to consented discharge permit, to the River Tame at two outfall locations, approximately [redacted] (downstream of Water Orton Lane) and [redacted] (upstream of Edison Road).

3.1.2 Minworth SRO is investigating the potential to provide water to the STT SRO by diverting some of the Minworth WwTW final effluent to the River Avon which is a tributary of the River Severn as well as to the GUC via the Coventry Canal. Additional treatment at Minworth WwTW – the Advanced Water Treatment Plant (AWTP) will be provided to ensure water quality is appropriate for discharge to the River Avon and the Coventry Canal allowing water to be diverted from the final effluent flow at Minworth and transferred to a combination of the River Avon and Coventry Canal.

3.2 Options Assessment

3.2.1 The following section is summarised from the Gate 1 Submission document, and from the CDR (Jacobs 2022) and supporting appendices.

Gate 1 Options

3.2.2 Minworth SRO is unique in that it is a potential source of raw water for two transfer SROs: STT SRO and GUC SRO. The assessment scenarios described below allow for the parallel development of several options, based on the transfer of different volumes, and combinations of volumes, for each scheme. The Gate 1 assessment considered engineering requirements for the following scheme configurations:

- STT SRO supply of 115 Ml/d with additional treatment processes and a pipeline to allow discharge to the River Avon.
- GUC supply of 50 Ml/d and 100 Ml/d with an additional treatment process to allow discharge to the canal network.
- Combined supply to STT and GUC SROs of 165 Ml/d and 215 Ml/d. Individual additional treatment processes to allow discharge to each receiving waterbody. Pipeline for 115 Ml/d to the River Avon.
- Combined supply to STT and GUC SROs of 165 Ml/d and 215 Ml/d. Combined treatment processes to allow discharge to the waterbody with the most stringent discharge consent. Pipeline to the River Avon with a branch connection to the canal network.

3.2.3 For all options considered at Gate 1, additional treatment processes required at Minworth WwTW were considered to meet the likely discharge consent for each of the receiving waterbodies, which were expected to be different for the River Avon and the canal network (GUC). This assessment sought to ensure there would be no deterioration to the published WFD status in terms of physio-chemical elements.

3.2.4 At Gate 1 it was envisaged that the new assets required at Minworth WwTW could be phased to meet either the individual need of the two transfer SROs, or a combination of the two. The combined option represented an increase in the scope of this SRO since PR19.

Water Treatment Development

3.2.5 At Gate 1 the treatment process was developed to allow Minworth to meet a 0.2 mg/l total phosphorus target. For the GUC the removal of trace determinants was not considered due to the lack of water quality data for the Canal, which has been progressed at Gate 2. The treatment processes have changed from Gate 1 to Gate 2 – additional treatment stages were added to reach the required water quality – refer to the CDR (Jacobs 2022) for further information.

3.2.6 The Gate 1 solution for the River Avon (STT) identified the following treatment solution: CoMag, UV Disinfection and GAC Adsorption. The UV disinfection at Gate 1 was proposed to prevent biofouling in the GAC, and the GAC process was added to address trace organics.

3.2.7 At Gate 1 different levels of treatment were identified for the discharge to STT and GUC. The GUC discharge was identified as requiring a CoMag treatment stage only with the discharge to STT also requiring GAC filtration. Following an assessment of water quality at the respective discharge locations, Gate 2 includes the same level of treatment for both discharges.

Advanced Water Treatment Plant (AWTP) Options

3.2.8 The AWTP treats water to supply both STT via the River Avon and GUC via the Coventry Canal. Four flow options have been considered that cover the required flows for each – these are the 57, 115, 172, and 230 Ml/d volume options described in Section 2.1. Note that the diverted flow is higher than the transferred flow because it includes an amount of flow returned to the works as backwash. Treated flow options and corresponding diverted flow are shown in Table 3-1 below.

Table 3-1: Treated flow options (Jacobs CDR, 2022)

Option	Diverted Flow (Ml/d)	Returned as Backwash (Ml/d)	Transferred Flow (Ml/d)
TREAT57	62	5	57 (STT or GUC)
TREAT115	123	8	115 (STT or GUC)
TREAT172	184	12	172 (both STT and GUC)
TREAT230	246	16	230 (GUC and STT)

Pipeline Options Development

3.2.9 At Gate 1 two routes were developed, one to the north of Warwick and one to the south of Warwick, which also discharged to the GUC. In addition to this a further route was developed during WRMP19, to a discharge location downstream of the confluence of the River Avon and River Sowe. The Gate 2 solution offers lower embodied carbon than Gate 1, and its upgraded North and South Warwick route options, at 2.38% and 29.61%, respectively.

3.2.10 During Gate 2, the routes developed during Gate 1 and WRMP19 were included in a route appraisal exercise to allow comparison with three alternative options developed during Gate 2. One preferred route was then selected following an evaluation of the six Gate 1 and 2 options. The preferred route is shown in the CDR (Jacobs 2022).

3.2.11 For the conveyance side, additional items were added to the cost such as the transfer pumping station, the flow control valves, and the outfall structure, as well as more detailed costs considered for the crossings including pipejacking which was not part of the costs for Gate 1.

3.2.12 The scope of this assessment includes the pumping station and transfer pipeline to STT only (Not the pipeline to GUC, which is considered in the separate GUC SRO Environmental Assessments). The treatment could be built in two phases of 57 Ml/d, however the STT transfer pipeline will only be constructed in one phase. STT57 is a pipeline that is the same size as STT115 but only transfers 57Mld and is included in the CDR for the purposes of calculating alternative OPEX/Carbon/AIC figures (Jacobs 2022).

Water Resources

3.2.13 The SRO transfer capacities are defined as above. This scheme will benefit the WRSE region either via STT SRO or GUC SRO, or in combination. Deployable Output (DO) benefits will be realised through a combination of the interregional transfer SROs (detailed in the CDR, Jacobs 2022) and new or existing treatment and distribution systems in the WRSE region. All losses within the proposed treatment works at Minworth are accounted for within the design such that the required DO is able to be provided. The DO for Minworth/GUC will be introduced to the Affinity Water network in the Lee Community (WRZ3).

3.2.14 A new discharge licence will be required for the new River Avon and Coventry Canal discharges, along with an amendment to the current discharge consents for discharges to the River Tame. Planning permission may be required; however, it is not anticipated that compulsory purchase orders would be required.

Links and Interdependencies

3.2.15 Minworth SRO as a source is not dependent on any other SRO schemes; however, in order for the water to supply London and South East England, wider aspects of either STT and / or GUC SRO's would be required to be constructed.

3.2.16 The Minworth SRO has the potential to provide water for both STT and GUC. To provide water for the GUC, a transfer pumping station and pipeline must also be constructed to the Coventry canal. For STT to be able to utilise the Minworth SRO as a source other infrastructure must be constructed such as the transfer between the River Severn and the River Thames.

3.2.17 To realise the benefits of this additional water resource for discharge to STT, STT transfer between the River Severn and the River Thames has to be constructed to transfer water to Thames catchment. If this is not completed the water will be lost to the River Severn.

3.2.18 The CDR (Jacobs 2022) also provides detail of:

- Source water abstraction design components: Connection to existing Final Effluent Channel and Inlet Pipework; Influent Pumping Station.
- Advanced Water Treatment Plant Design Components.
- Pipeline Design Components, including construction methods.
- Ground Conditions.
- Land Requirements.
- Operating Philosophy.
- Inter Site Control System Requirements.
- Power Requirements.
- Energy Recovery and Renewable Energy Opportunities.
- Carbon Opportunities.

3.3 Development Since Gate 1

3.3.1 The Concept Design Report (CDR) (Jacobs, 2022) provides details of the development of the Minworth SRO in support of the STT and GUC SROs. Table 3-2 summarises the development of the schemes from Gate 1 to Gate 2; the latest available information on Gate 2 design and the associated environmental impacts and benefits are assessed in this EAR.

Table 3-2: Summary of SRO development from Gate 1 to Gate 2

SRO Scheme Element	Gate 1 Design	Developments for Gate 2 Design
Additional effluent treatment for discharge to STT and GUC	GUC discharge was identified as requiring a CoMag treatment (Magnetite system for enhanced primary or tertiary treatment) stage only with the discharge to STT also requiring UV Disinfection and GAC (Granular Activated Carbon) filtration. All construction would be within the existing boundaries of the Minworth WwTW site.	Following an assessment of the water quality at the respective discharge locations, the Gate 2 design will include the same level of treatment for both discharges. **This is a 'worst-case' position and the requirements for alternative [smaller] treatment scenarios are being developed by way of sensitivity analysis.** An activated carbon-based treatment train has been proposed with the following key process units: CoMag mixing, flocculation, and sedimentation (floc/sed) followed by ozone oxidation, biologically active carbon (BAC) filtration, GAC adsorption, and ultraviolet (UV) disinfection. Reverse osmosis treatment is unfeasible as Minworth does not have a coastal discharge route. Site returns from backwash and return of fully-treated sweetening flow to River Tame. All construction will be within the existing boundaries of the Minworth WwTW site.
Pipeline transfer route to STT	At Gate 1 two STT routes were developed, one to the north of Warwick and one to the south of Warwick, which also discharged to the GUC. In addition to this a further route was developed during WRMP19, to a discharge location downstream of the confluence of River Avon and River Sowe (refer to the CDR report for further detail).	During Gate 2, the routes developed during Gate 1 and WRMP19 were included in a route appraisal exercise to allow comparison with three alternative options developed during Gate 2. One preferred route for STT (Minworth to River Avon) was then selected following an evaluation of the six Gate 1 and 2 options.
Pipeline transfer for STT from Minworth to River Avon	This element comprised a pumping station at the Minworth WwTW site and pipeline from the Minworth WwTW site to a new outfall on the River Avon. The pipeline from Minworth WwTW to the River Avon outfall would be some 37.6km in length. The outfall location was identified during studies undertaken at Gate 1 and would be located on the River Avon to the south of Warwick.	The treatment could be built in two phases of 57 Ml/d, however the STT transfer pipeline will only be constructed in one phase. The pipeline consists of a section of pumped pressurised pipework rising up from the transfer pumping station (rising main) followed by a section of gravity pressurised pipework (gravity main) falling from the break pressure tank to the outfall (total 28.2 km).

SRO Scheme Element	Gate 1 Design	Developments for Gate 2 Design
Construction of the STT pipeline to the River Avon	Five watercourse and two canal crossings during pipeline construction. Construction impacts, including intake, pipeline and outfall headworks construction are assessed as a minor negative effect. Tunnelling for all water courses where needed in addition to those specified. With further consideration of watercourses to cross without in-channel works, construction impacts would be neutral for WFD compliance[3]. Tunnelling for all sections of route which goes through priority habitat. The route should be realigned to avoid the SSSIs. Discussions with NE regarding SSSI and ancient woodland protection measures.	All main rivers will be crossed by trenchless techniques (pipe jack or auger). All ordinary watercourses will be crossed by open-cut crossings. Initial aim to avoid and/or limit direct impacts to environmental features: variable working width buffer around the pipeline; a standard 40 m (20 m either side) corridor that has been adjusted to take account of sensitive features that require a small working width (such as hedgerows etc). In open-cut sections, it is assumed that the pipeline will be buried at a minimum cover of 1.2m, up to a maximum depth of 6m. For the purposes of the Gate 2 design, it is assumed that 90-95% of the as-dug material will be recycled for use as pipe bedding with the steel pipe. Where the recycled pipe bedding does not meet the required quality to be used as backfill, imported granular material will be required. Construction duration TBC; approx. 60 months.
Flow quantities required for each of the transfers (STT and GUC)	At Gate 1 three options for flow transfer from Minworth were considered: Minworth / STT (115 Ml/d) Minworth / GUC (100 Ml/d) Minworth Combined (215 Ml/d)	The AWTP treats water to supply both STT via the Avon and GUC via the Coventry Canal. Four flow options have been considered that cover the required flows for each (transferred flow of 57, 115, 172, or 230 Ml/d). Refer to Section 2.3 Assessment Scenarios for further detail of flow transfers and utilisation.
Minworth final effluent channel and inlet pipework	Best practice construction techniques assumed due to the presence of priority habitat (coastal and floodplain grazing marsh) and being within a Nature Improvement Area. Mitigation measures including best practice construction practices, the identification and removal of invasive species on site in advance of construction.	The existing final effluent channel for the Minworth WwTW is a 5m x 5m concrete channel, with an invert level of 75mAOD. A new connection into this channel is required to allow a new 1300mm diameter abstraction pipeline to connect into the downstream influent pumping station (PS).

[3] Technical reports to support Gate 1 submission: https://www.ofwat.gov.uk/regulated-companies/rapid/the-rapid-gated-process/gate-one-submissions-and-final-decisions/

3.4 Assessment Scenarios

3.4.1 Assessment of different scenarios for operation of the SRO schemes has been undertaken – the assessment scenarios in Section 2.1 are further informed by predicted utilisation for the STT and GUC SROs. This is based on the likely seasonal operation and operational regime requirements for the Minworth transfers, summarised as detailed in the sections below.

Minworth SRO

3.4.2 The Minworth SRO supports two options for transfer of final effluent, resulting in corresponding reductions in the discharge of effluent to the River Tame. These are transfer to the GUC SRO, and transfer to the River Avon for the STT SRO. This is currently divided into the volume options detailed in Section 2.1.

3.4.3 Therefore, the current approximately 417 Ml/d discharge of final treated effluent from Minworth will reduce by a maximum of 230 Ml/d.

3.4.4 With the River Tame DWF averaging 180 Ml/d upstream of the site and Minworth current DWF averaging 417 Ml/d in the same period, effluent from Minworth currently makes up approximately 70% of the total DWF downstream flow in the river. The four flow options for Minworth SRO, as identified above, are as high as 230 Ml/d, which is approximately 55% of the current measured Minworth DWF. In addition, treated effluent from Coleshill WwTW enters the River Tame between the two Minworth discharge points, at a rate of approximately 50 Ml/d, thereby also contributing to flow in the Tame. This therefore implies that there is likely to be sufficient volume for transfer throughout the year (Jacobs, 2022). Further detail of modelled utilisation is provided in the sections below.

3.4.5 The potential environmental impacts of the transfer options described above and taking into account wherever possible the predicted utilisation of the transfers as described below, have informed the environmental assessments in this EAR.

GUC Transfer

3.4.6 For GUC transfer, current modelling suggests that the full volume (115 Ml/d) would be required primarily in significant drought conditions (likely close to Q99 flows); however, it would also operate to some extent constantly as sweetening flow for the treatment processes. It may also be required in the event of a resilience issue, for example if supply from the River Thames was interrupted.

3.4.7 In most dry years, GUC would only be run at 80% (92 Ml/d) but only for summer months during peak demands; and for normal years around 25% (28.75 Ml/d). It is considered that in most drought years the GUC scheme would operate less than 80% because hosepipe bans, and non-essential-use bans would kick in and reduce demand accordingly.

3.4.8 The GUC transfer is demand-driven except in the most significant drought years when hydrological constraints (groundwater levels) also take effect. Operation of the GUC scheme is not constant and the environmental assessment should take into account this likely frequency and scale of operation, as summarised in the bullet points below:

- Full utilisation expected in the summer months to cope with increased summer peak demands;
- Most dry years, GUC will run at 80% capacity (92 Ml/d);
- 25% (28.75 Ml/d) utilisation October-April (inclusive);
- May: 50% utilisation (57 Ml/d) to ramp up to June-Aug c. 80% utilisation;
- September dropping to 50% utilisation.

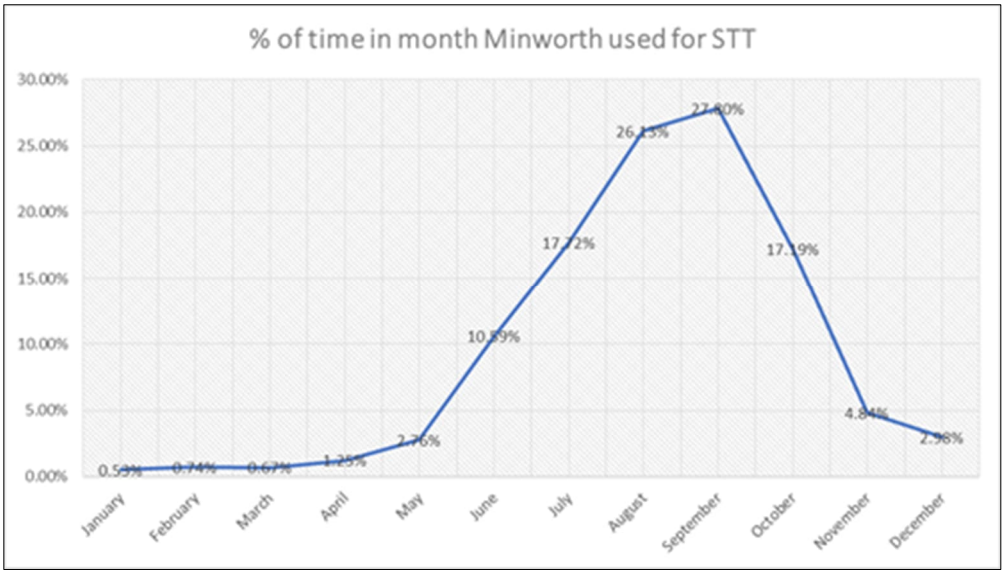
3.4.9 Further detail of the proposed operational regime of the Minworth SRO is presented in Table 3-3.

Severn to Thames Transfer (STT)

3.4.10 Minworth will support the Severn to Thames Transfer as required, alongside supply from other sources – Lake Vyrnwy reservoir (Powys, Wales) releases and Netheridge Sewage Treatment Works (STW). Netheridge STW serves the city of Gloucester, currently discharging final effluent to the River Severn.

3.4.11 The likely frequency of use of the Minworth transfer for STT (based on when the transfer will be required, not on a particular volume scenario) has been modelled as a percentage of time used over the 90-year record, as shown in Figure 3-1.

Figure 3-1: STT modelled utilisation, percentage of time



3.4.12 Modelled STT utilisation is based on a 500 Ml/d transfer between the Severn and the Thames (although it is likely that there will be no limit on abstraction during spate), with a maximum of 300 Ml/d coming from supported sources, i.e., Lake Vyrnwy, Netheridge STW, and Minworth. Peak transfer from Minworth (112 Ml/d – the current maximum that would be required based on the modelled scenarios [Jacobs, 2022]) would only be required 9% of the time over the 90-year period; otherwise Minworth is currently predicted to only rarely support STT. This utilisation is based on Gate 2 modelled scenarios, which will be revisited at Gate 3, potentially leading to a change in how the Minworth to STT transfer is required.

3.4.13 A summary of the modelled and predicted seasonal operation of the STT and GUC transfers is shown in Table 3-3 below.

Table 3-3: Operational regime of the Minworth and associated SROs

Operation / Seasonality	Minworth GUC Transfer	Minworth STT Transfer
Winter / Autumn – during periods of moderate to high flow	September to April Outside of the summer months (May to August) this will mostly operate at 25% capacity (around 27 Ml/d)	November to May Lake Vyrnwy and Netheridge are prioritised to supply STT up to 188 Ml/d. Minworth, being third-in-line in the supply hierarchy, is rarely used to support STT.
Summer – during periods of low flow	May to August During summer this will increase up to 80% (around 92 Ml/d) but only during dry years. During significant dry years (> 1 in 50-year drought) this may increase in the summer to the full transfer of 115 Ml/d.	June to October Peak transfer from Minworth (112 Ml/d) would only be required 9% of the time over the modelled 90-year period.
Activation of Trent HoF	During significant dry years (> 1 in 50-year drought) this may increase in the summer to the full transfer of 115 Ml/d, and therefore consideration will need to be given to its contribution to HoF in the Trent.	Consideration will need to be given to contribution to HoF in the Trent, in combination with GUC and SLR.
Additional operational requirements	Additional treatment will be installed at Minworth to ensure that effluent quality is of a suitable standard to be transferred to the River Avon and GUC. This will be a combination of CoMag flocculation and settlement, ozonation, BAC/GAC, and UV disinfection. Some effluent treated to this higher standard will be returned to the River Tame when not required for GUC and/or STT.	

4. Methodology

4.1.1 This section summarises the assessment methodology for each component of the Gate 2 regulatory assessment, including the specific requirements of the RAPID Gate 2 guidance and ACWG methodologies.

4.2 General Assessment Approach

4.2.1 The assessment approach follows the All Company Working Group (ACWG) guidance for environmental assessments and calls upon the robust Gate 1 and Gate 2 assessments undertaken and currently being completed for the SRO schemes. Key objectives to take Minworth SRO from Gate 1 through to Gate 2 submission include:

- **Adherence to ACWG methodologies** – To ensure that Gate 2 submission is robust, the assessment has been completed according to Gate 2 requirements and the relevant ACWG methodologies for Gate 2 submission. Any inconsistencies, either technically or specific to Minworth SRO, have been highlighted. Changes to ACWG methodologies have been implemented to ensure that the positioning of the scheme for Gate 2 aligns with expectations for the flight path to future Gates.
- **Engagement with the delivery engineering consultant** – It has been critical to understand any updates/changes on engineering design since the initial engineering concept design report was completed. In particular, predicted (if any) quality changes of the remaining effluent discharge and a review of the most likely volumes to be utilized.
- **Refine HRA Appropriate Assessment to inform detailed feasibility and concept design** – The HRA builds on the assessments undertaken for Gate 1. Using this approach, it has been determined whether the risk of an adverse effect exists (beyond reasonable scientific doubt) and thus whether an appropriate assessment would be required. If not, the assessment can stop at the HRA screening stage. If an appropriate assessment is required, then a report to inform appropriate assessment must be produced. Note that 'appropriate assessment' is not a technical term, it simply means whatever further assessment is required to draw a conclusion regarding adverse effects on the integrity of the European site.
- **Refine WFD Assessment to inform detailed feasibility and concept design** – A review has been undertaken of the Gate 1 WFD assessment and the consistent ACWG framework to assess WFD 'No Deterioration' has been implemented, including impacts on raw water quality and the movement of INNS (assessed using the EA INNS Risk Assessment Tool; refer to Tame and Trent Environmental Assessments: Appendix D INNS, AECOM 2022). The approach to confirming existing WFD status and reasons for not achieving good (RNAG) status for all relevant water bodies has included use of GIS and interaction with the Environment Agency Catchment Explorer API via Python script. The outcome of the WFD assessment will be linked back into the engineering design team to ensure a fully integrated approach to Gate 2 assessment.
- **Enabling a Natural Capital Approach (ENCA) for optioneering and detailed feasibility studies** – Social impacts and benefits are considered in conjunction with environmental impacts and benefits, to support holistic decision-making that considers the trade-offs and synergies between different types of adverse and beneficial impacts. Catchment initiatives have been identified to deliver Net Gain, and where possible infer Natural Capital benefits. The possibilities for non-water resource benefits due to the SRO have been identified, along with opportunities for the natural and human environment that the SRO could be a vehicle to deliver. This has considered how design changes may create benefits within the immediate zone of influence and on functionally linked habitats, e.g., fish passes, recreational activities, minimising greenhouse gas emissions, flood risk reduction, upland water retention, etc.

4.2.2 The environmental assessments provide a clear line of sight to further detailed assessment at Gate 3 and beyond. This will identify potential significant effects and inform the scope for future assessments, including further appraisal of WFD related impacts and benefits, baseline ecological data, and potential impacts to ecological receptors such as designated sites and their qualifying features, protected and

notable species, and particular constraints from the presence or future spread of Invasive Non-Native Species.

4.3 Strategic Environmental Assessment (SEA)

Introduction

4.3.1 The regulatory requirement for the SEA is established through the Environmental Assessment of Plans and Programmes Regulations 2004 (the 'SEA Regulations'). SEA is a mechanism for considering and communicating the likely effects of an emerging plan or programme, and its alternatives, with a view to avoiding and mitigating negative effects and maximising positive effects. The SEA Regulations state in Regulation 5 that SEA should be carried out for a plan or programme.

4.3.2 The Draft Environmental Report (dated 29th June 2021) that formed part of the Gate 1 submission for the Minworth SRO stated that **a full statutory SEA was not required at that stage**. This is still considered to be the case at the Gate 2 stage for the following reasons:

- The ACWG environmental assessment guidance (Oct 2020) for SROs does not refer to SEA under Gate 2 information; however, it is noted that it does refer to SEA under Gate 3 information.
- RAPID's strategic regional water resource solutions guidance for Gate 2 (April 2022) states in Section 6.3 that:
- "Strategic Environmental Assessment is implemented at the strategic scale and applies to plans and programmes. For many of the solutions, where they are more project based, an SEA may not be required. The solutions feed into the WRMPs and Regional Plans, which are both undergoing SEAs, and as such the solutions are more appropriately assessed for SEA purposes as part of these plans".
- The regional resilience plans and individual water company WRMPs set the framework for supply-side schemes that will come forward in future assessment management plan periods, which includes SROs such as Minworth. It is through these plans that the decisions are made by the responsible authorities to progress and invest in the Minworth scheme or other alternatives. The SEAs accompanying these plans, in particular the individual company WRMPs (as they are required by legislative provisions), should be considering the Minworth SRO scheme (if reasonable/ realistic) alongside other alternatives. The Environmental Reports accompanying these plans, must also present outline reasons for the selection of the preferred approach in light of alternatives, in line with Regulation 12 and Schedule 2 of the SEA Regulations.

4.3.3 Despite this and as per the Gate 1 stage, the principles of SEA continue to be applied to the Minworth SRO at Gate 2, in order to inform the overall assessment of the environmental feasibility and deliverability of the solution, as well as the development of the emerging regional resilience plans and WRMPs. The Gate 1 SEA assessment has been reviewed, updated, and refined, where relevant, to incorporate results of on-going detailed environmental assessments at Gate 2.

Methodology

4.3.4 The same SEA methodology applied at Gate 1 has also been applied at Gate 2 and is presented below. The approach is in line with the ACWG guidelines and consistent with the approach being used for regional resilience plans.

4.3.5 Key issues were identified from a review of baseline conditions and of relevant plans, programmes and policies undertaken during the development of STW's WRMP24 SEA Scoping Report. These key issues were reviewed as part of the Gate 1 SEA work for the Minworth SRO and presented in Appendix A1 of the Draft Environmental Report (29th June 2021).

4.3.6 The list of SEA topics and objectives set out in Table 6.1 of the ACWG SEA: Core Objective Identification report (October 2020) were used as the basis for establishing the SEA framework. Some revisions were made to the objectives, in relation to carbon levels for assessing climatic factors, following advice provided by the authors of the ACWG SEA methodology.

4.3.7 The key issues referred to above were used to create a number of key guide questions related to the assessment of each SEA topic. These key guide questions have been used as prompts in the assessments to help ensure consistent and robust assessment for each of the SEA topic areas. As for the SEA objectives the development of the guide questions was informed by other sources of information including:

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

4.3.8 The list of SEA topics, SEA objectives and associated key guide questions for the SEA are set out in Table 4-1 below.

Table 4-1: SEA framework

SEA topic	SEA objective	Key guide questions
Biodiversity, flora, and fauna	To protect designated sites and their qualifying features	Is the option likely to affect the conservation status of any SPAs, SACs, Ramsar sites, SSSIs or National Nature Reserves? Will it affect HRA compliance (taken from HRA assessment results)? Will the option affect the marine environment, habitats and species (including MCZs and MPAs)? Is the option likely to affect ancient woodland?
	To avoid a net reduction, and where possible enhance natural capital assets	Are there any opportunities for habitat creation or restoration and a net benefit/gain for biodiversity? Will the option contribute to the loss or gain in habitat connectivity? Does it protect, conserve and enhance biodiversity natural capital and the ecosystem services the natural capital provides (taken from the natural capital assessment results)?
	To protect and enhance biodiversity, priority habitats and species	Will the option protect and enhance priority habitats and species? Will the option affect a priority habitat on the priority habitat inventory?
	To avoid and, where required, manage invasive and non-native species (INNS)	Is there a possibility for INNS to be spread/ introduced? Is there an opportunity to improve biodiversity value through removal of INNS?
	To meet WFD objectives relating to biodiversity	Will it affect WFD compliance e.g. good ecological potential/status?
Soil	To protect and enhance the functionality, quantity and quality of soils, including the protection of high-grade agricultural land	Will the option affect high grade agricultural land? Will the option promote the efficient use of land? Will the option prevent soil erosion and retain soil stocks as a natural resource? Will the option involve use of brownfield or greenfield land? Is the option likely to affect SSSIs of geological importance?
Water	3.1 To minimise or manage flood risk, taking climate change into account	Is the option vulnerable to flood risk? Will the option contribute to the risk of flooding? Will the option protect and enhance the environmental resilience of the water environment to climate change, flood risk and drought?
	3.2 To enhance or maintain groundwater quality and resources	Will the option affect groundwater quality or quantity?
	3.3 To enhance or maintain surface water quality, flows and quantity	Will the option affect surface water quality or quantity?
	3.4 To meet WFD objectives	Is the option likely to contribute to or conflict with the achievement of WFD objectives (taken from the WFD assessment results)?
	3.5 To improve water efficiency through provision of access to a resilient and sustainable supply of water.	Does the option provide a reliable and sustainable water supply which meets changing demand?
Air	To minimise air emissions during construction and operation	Is the option in an air quality management area (AQMA)? Will the option affect local air quality?
Climatic Factors	5.1 To introduce climate mitigation where required and improve the climate resilience of assets and natural systems	Is there potential for the option to incorporate climate mitigation measures to reduce its carbon footprint, such as lower embodied carbon or incorporating renewable energy? Is the option vulnerable to climate change effects? Does the option include climate resilience measures?

SEA topic	SEA objective	Key guide questions
	5.2 To minimise embodied and operational emissions	Will the option affect carbon or other greenhouse gas (GHG) emissions? Will the option minimise energy demand during construction and operation?
Landscape	To conserve, protect and enhance landscape and townscape character and visual amenity	Will the option have an effect on the character of the landscape or townscape, including views? Will the option improve access to the countryside? Will the option create or improve green infrastructure which contributes to access to the landscape? Will the option protect and enhance designated landscapes and features? Will the option affect visual amenity?
Historic Environment	7.1 To conserve/protect and enhance historic assets/cultural heritage and their setting, including archaeological important sites	Will the option affect designated historic assets, sites and features? Will the option affect the setting and/or significance of a historic asset? Will the option affect archaeological important sites?
Population and Human Health	8.1 To maintain and enhance the health and wellbeing of the local community, including economic and social wellbeing	Will the option allow for economic development? Will the option provide employment opportunities? Will the option affect road or rail infrastructure? Will the option minimise disturbance from noise, light, visual, and transport? Will the option affect the local area in terms of noise emissions?
	8.2 To maintain and enhance tourism and recreation	Will the option have an effect on active lifestyles, such as impacts on active travel through disruption to pedestrian and cycle routes? Will the option affect Public Rights of Way? Will the option maintain or enhance tourism? Will the option affect water resources that are used to provide tourist facilities?
	8.3 To secure resilient water supplies for the health and wellbeing of customers	Will the option secure resilient water supplies for the health and wellbeing of customers? Does the option promote water efficiency and encourage a reduction in water consumption?
	8.4 To increase access and connect customers to the natural environment, provide education or information resources for the public	Does the option improve access to the natural environment for recreation, including those living within deprived areas?
Material Assets	9.1 To minimise resource use and waste production	Will the option minimise the use of resources? Will the option minimise the production of waste?
	9.2 To avoid negative effects on major built assets and infrastructure	Will the option reuse existing infrastructure? Will the option affect major built assets and infrastructure, including transport infrastructure?

4.3.9 As can be seen from Table 4-1 above, the SEA is informed by the results of the HRA and WFD assessments that have been carried out at Gate 2. In particular, the HRA assessment results help inform the assessment of objectives related to biodiversity, flora, and fauna whilst the WFD assessment results help to inform the assessment of objectives 1.5 and 3.4. Furthermore, the natural capital and biodiversity assessments undertaken as part of the SRO have assisted the conclusions reached in terms of the SEA topic area of biodiversity, flora, and fauna.

4.3.10 The scheme and various options are described in Chapter 2. For the purposes of the SEA at Gate 2, the following options were considered:

- 57 Ml/d (Megalitres per day) discharge to GUC SRO, OR 57 Ml/d discharge to River Avon for STT SRO;
- 115 Ml/d discharge to GUC SRO, OR 115 Ml/d discharge to River Avon for STT SRO;
- Combined 230 Ml/d transfer to both River Avon and GUC (115 Ml/d to each); and
- Impacts of the pipeline transporting water to the River Avon for STT.

4.3.11 As the SEA has considered the components of the 172 Ml/d (57 and 115 Ml/d both ways – Avon and/or GUC) option, this option has not been subject to a detailed individual assessment as no additional effects are likely. The options listed above were assessed against the full SEA framework of objectives

with summary findings presented in Section 5.2 and the detailed assessment matrices provided as attachments to this report.

4.3.12 The likely significant effects (positive and negative) for both construction and operation phases have been considered against each SEA objective, with a commentary provided to justify those effects. Where necessary, mitigation and/ or enhancement measures are proposed, and residual likely significant effects (positive and negative) are also identified for both construction and operation.

4.3.13 The assessment has been carried out applying the SEA assessment significance ratings shown in Table 4-2 below.

Table 4-2: SEA significance key

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

4.3.14 The criteria for determining likely significant effects are provided in Appendix A, and they were informed by the scoring criteria presented in Table B.1 of the ACWG environmental assessment guidance (Oct 2020). The criteria were also refined in order to be consistent with the WRSE regional plan, for example, to reflect consideration of INNS and a revised carbon threshold scale.

4.3.15 The assessment takes into account the sensitivity of the environmental receptor and magnitude of the effect, the latter of which is a factor of the scale of effect, whether the effects arise in the short, medium, or long term, and whether the effects are permanent or temporary.

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

4.3.17 As a formal SEA process is not being carried out, there is no requirement to undertake a full cumulative effects assessment. This requirement will need to be addressed with the statutory SEA process being carried out for the Severn Trent and Affinity Water WRMPs. The emerging regional resilience plans will be undertaking a cumulative effects assessment of proposed schemes, including SROs, and this will inform the cumulative effects assessment work carried out for individual WRMPs.

4.4 Habitats Regulations Assessment (HRA)

Introduction

4.4.1 Internationally important wildlife sites, also known as ‘European sites’ for simplicity, constitute either Special Areas of Conservation (SACs) which are designated for habitats and non-avian fauna, Special Protection Areas (SPAs) which are designated for birds, or Ramsar sites which are wetlands of international importance and can also be SACs or SPAs. There are two such sites of relevance to the Minworth SRO, as identified in the Gate 1 informal HRA work: River Mease SAC and Humber Estuary SAC, SPA and Ramsar site.

4.4.2 In fact, the River Mease SAC was not discussed in the Gate 1 informal HRA but liaison with the Environment Agency, Natural England and other relevant stakeholders before commencing Gate 2

identified concerns regarding potential effects the River Mease SAC depending on hydrological connectivity with the Minworth SRO, particularly in combination with Environment Agency proposals to divert flows from Packington WwTW out of the catchment, where they currently discharge into the Gilwiskaw Brook and thus the River Mease SAC, proposals which would help to restore a more natural flow regime in the River Mease.

4.4.3 As well as the assessment of volume transfer options described in Section 2.1, this HRA also considers the potential for impacts on European sites arising from the pipeline from Minworth to the River Avon for STT. There would be an upgrade to the existing Minworth WwTW to improve the existing quality of wastewater to an acceptable standard to discharge into the River Avon.

4.4.4 Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended) states that 'A competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which… is likely to have a significant effect on a European site [a Special Area of Conservation, Special Protection Area or, as a matter of Government policy, a Ramsar site] or a European offshore marine site (either alone or in combination with other plans or projects) …must make an appropriate assessment of the implications of the plan or project for that site in view of that site's conservation objectives'.

4.4.5 Regulation 105 of the same regulations (applicable specifically to plans) says something very similar, stating: 'Where a land use plan… is likely to have a significant effect on a European site (either alone or in combination with other plans or projects), and… is not directly connected with or necessary to the management of the site, the plan-making authority for that plan must, before the plan is given effect, make an appropriate assessment of the implications for the site in view of that site's conservation objectives'.

4.4.6 This entire process is called Habitats Regulations Assessment (HRA). The HRA process follows available guidance including that published by UKWIR, that published by the government in February 2021[4] and that in the Habitats Regulations Assessment Handbook.

4.4.7 The RAPID Gate 2 Guidance suggests an 'informal HRA' should be carried out:

- Although a full HRA for a solution is not required until a planning and/or permit application (or its equivalent, for example a Development Consent Order (DCO)) is submitted, it is strongly recommended that the principles of a HRA are followed to reduce the risk of noncompliance at the decision-making stage.

4.4.8 The following general approach to informal assessment is suggested in the Gate 2 Guidance:

- Updated informal Stage 1 screening.
- Preparation of informal Stage 2: An informal appropriate assessment should be commenced with data available and associated informal site integrity test.
- If required and if possible, with evidence available: Begin to plan for informal stage 3 (Appropriate Assessment) document.

Methodology

4.4.9 HRA commences with a simple Test of Likely Significant Effects (also dubbed 'HRA Screening') which considers the qualifying interest features of the European sites, relevance being determined by the impact pathways likely to arise from the scheme and either professional judgment or available guidance on the distance such impacts are likely to affect European sites, including any water resource modelling information regarding drawdown or effects on water levels and flow for European sites that may be connected to the Tame/Trent catchment.

4.4.10 The HRA builds on the assessment undertaken for Gate 1. Using this approach, it has been determined whether the risk of an adverse effect exists (beyond reasonable scientific doubt) and thus whether an appropriate assessment is required. If not, the assessment can stop at the HRA screening stage. It is understood that three possible impact 'corridors' have been identified:

- the fluvial Trent and direct linkages via watercourses and riparian habitats;

[4] https://www.gov.uk/guidance/habitats-regulations-assessments-protecting-a-european-site

- groundwater linkage to the Tame/Trent corridor; and
- the discharge from Packington WwTW on Gilwiskaw Brook out of the SAC catchment.

Screening of European Sites

4.4.11 Potential for effects on the River Mease SAC is considered limited but needs to be proven beyond reasonable scientific doubt. The preliminary Gate 1 assessment did not identify any significant transmission pathways by which a Likely Significant Effect could reasonably occur. This has been determined and verified for Gate 2.

4.4.12 A 10km search corridor was used for the Minworth to Avon pipeline route to identify any European sites that could conceivably be affected by pipeline construction. This is considered a very precautionary corridor given the most likely impact pathways associated with pipeline construction would be noise and visual disturbance, and local temporary habitat loss. No European sites were identified within 10km of the pipeline corridor.

4.4.13 The closest European site is Ensor's Pool SAC at south-west Nuneaton, 13km from the pipeline corridor. Ensor's Pool is designated for its population of white-clawed crayfish. As reported in the HRA for the Warwickshire Minerals Plan A dye tracing exercise of the pool by the Environment Agency has confirmed Ensor's Pool is groundwater fed and is not hydraulically linked to nearby ordinary watercourses. To inform the HRA of the Warwickshire Minerals Plan HRA in 2019[5] the Environment Agency's Groundwater Team highlighted that any development within 2-3km of Ensor's Pool SAC could have a hydrogeological connection to Ensor's Pool. The pipeline is therefore well beyond any area for effects on SAC groundwater. The pipeline is therefore scoped out of assessment.

4.4.14 If necessary, and possible, the informal HRA would also include information to inform Appropriate Assessment. Appropriate Assessment is not a technical term, it literally means whatever assessment is required to draw a conclusion regarding adverse effects on the integrity of the European sites. In other words, it considers whether the ability of the European sites to achieve their conservation objectives will be impaired by the scheme either alone or in combination with other plans and projects. At Gate 2 it is entirely possible insufficient information on the scheme(s) would exist to enable a meaningful appropriate assessment to be undertaken, in which case the report would make recommendations for any additional work that would be needed for Gate 3 in order to undertake the assessment.

4.4.15 However, in this case it has been possible to screen out likely significant effects on European sites based on the information available at Gate 2.

4.5 Water Framework Directive (WFD) Assessment

4.5.1 The RAPID Gate 2 Guidance states that all options must be assessed 'to ensure they comply with and support the achievement of WFD Regulations requirements and objectives set out in the River Basin Management Plans' (RBMP), specifically:

- Screening: Updated water body risk assessment.
- Options assessment: An assessment of options in relation to WFD objectives, allowing a comparison of the options and identification of those options are uncertain/unlikely to meet WFD objectives.
- Consideration of mitigation measures and monitoring, implementation of monitoring to reduce uncertainty of impacts and support identification of potential mitigation in relation to options within solutions that are uncertain/or are unlikely to be able to meet WFD objectives. Where options within solutions that could not meet objectives are taken forward, justification should be given to allow a clear audit trail.
- Regulation 19[6]: If applicable, gather evidence to meet Regulation 19 criteria.
- Addressing uncertainties: Provide a plan to gather further evidence for Gate 3. Report initial evidence at Gate 2.

[5] Available at this link: https://warwickshire-consult.objective.co.uk/portal/warwickshire_minerals_plan_submission
[6] The Water Environment (Water Framework Directive) Regulations 2017

4.5.2 All options have been assessed to ensure they comply with and support the achievement of WFD Regulations requirements and objectives set out in the River Basin Management Plans. This includes, but is not limited to, those to protect eels under the Eels (England and Wales) Regulations 2009; and improving fish passage under the Salmon and Freshwater Fisheries Act 1975. The effects that these and other measures will have on each option have been assessed.

4.5.3 The WFD assessment, according to the ACWG methodologies, includes the following steps:

- Screening: Updated water body risk assessment;
- Options assessment: An assessment of options in relation to WFD objectives, allowing a comparison of the options and identification of those options are uncertain/unlikely to meet WFD objectives;
- Consideration of mitigation measures and monitoring: Implementation of monitoring to reduce uncertainty of impacts and support Identification of potential mitigation in relation to options that are uncertain/or are unlikely to be able to meet WFD objectives. Where options that could not meet objectives are taken forward, justification should be given to allow a clear audit trail;
- Regulation 19: If applicable, gather evidence to meet Regulation 19 criteria; and
- Addressing uncertainties: Provide a plan to gather further evidence for Gate 3. Report initial evidence at Gate 2.

4.5.4 It is important that assessments adequately test prevention of future target status (as well as no deterioration) to highlight where the full WFD objective requirements could be at risk; this is considered by reviewing the mitigation measures required to reach future status proposed in each affected water body to determine whether any option would prevent those measures from being successful.

4.5.5 The consistent ACWG framework to assess WFD No Deterioration has been implemented, including impacts on raw water quality and the movement of INNS. The approach to confirming existing WFD status and reasons for not achieving good status for all relevant water bodies has involved the use of GIS and interaction with the Environment Agency Catchment Explorer API via Python script. Existing work from Gate 1 has been reviewed to identify:

- All downstream WFD water bodies that could be impacted by abstraction and discharge points; and
- All WFD water bodies that will be crossed by new pipelines.

4.5.6 The second step involves interaction with the API to extract relevant information on water body and element WFD status and reasons for not achieving good status, where this information has not already been procured, or needs updating.

4.6 Biodiversity Net Gain (BNG) Assessment

4.6.1 The RAPID Gate 2 Guidance states that BNG assessment 'should support the net gain actions in the Government's 25-year Environment plan and aim to meet the likely future requirements as per the Environment Act.'

4.6.2 DEFRA's 25-year Environment Plan seeks to '*embed an environmental net gain principle for development, including housing and infrastructure*'[7] it is also government policy that planning decisions should seek to minimise impacts on, and provide net gains for, biodiversity[8]. The Environment Act 2021[9] includes provisions to mandate the delivery of Biodiversity Net Gain in England. Secondary legislation, anticipated in late 2023, will require all relevant developments to achieve a minimum 10% net gain in biodiversity units relative to the site's baseline biodiversity value. Therefore, a BNG Assessment has been undertaken using DEFRA's Biodiversity Metric 3.0, in accordance with the metrics accompanying guidance[10] and industry accepted best practice principles[11].

[7] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/693158/25-year-environment-plan.pdf
[8] National Planning Policy Framework - GOV.UK (www.gov.uk)
[9] https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted
[10] http://nepubprod.appspot.com/publication/5850908674228224
[11] https://cieem.net/resource/biodiversity-net-gain-good-practice-principles-for-development-a-practical-guide/

4.6.3 The approach to the Biodiversity Net Gain Assessment has been informed by further guidance set out in both the All Company Working Group (ACWG) 'WRMP environmental assessment guidance and applicability with SROs' and RAPID (2022) 'Strategic regional water resource solutions guidance for Gate 2'.

4.6.4 ACWG guidance sets out how:

- Biodiversity net gain or net loss (BNG/BNL) must be considered at both the option and programme level and that each option should look to maximise biodiversity net gains
- That a biodiversity baseline should be developed from spatial data sets derived from habitat inventories and assessed in line with metric guidance to allow BNG change to be calculated for each option.
- That Priority Habitat Inventories and site designations including Sites of Special Scientific Interest (SSSI) and Ramsar should be used to identify areas with high biodiversity importance.
- That metric calculations should assign biodiversity units to the pre-impact land use according to the habitats present in the project boundary and that post-impact land use (including agreed mitigation) should be used to calculate the post-impact biodiversity score and calculate any percentage net gain or losses in biodiversity, and
- That individual schemes should seek to supplement the open-source habitat data used in the assessment with local datasets or Phase 1/UKHab site data to increase the accuracy of the BNG calculation for each option.

4.6.5 RAPID Gate 2 Guidance sets out how:

- The Gate 2 submission should be supported by an environmental appraisal that describes the connection to other assessments including BNG and that developments in England should seek to support the net gain actions in the Government's 25-year plan as described in para 2.4.20.

Site Identification

4.6.6 Following a review of the designated sites and water-dependent wetland habitats identified during the Gate 1 desk-top assessment a total of 21 floodplain locations within 500m of the Rivers Tame and Trent, between Minworth and upstream of the SLR abstraction at East Stoke and the habitats located within the Minworth Pipeline study area as defined during Gate 1[12] studies, were identified for inclusion in the Gate 2 BNG Assessment. The following sites were then subject to preliminary ground truthing survey visits during winter and/or spring 2021/22:

- EON Meadows (Whitacre Flood Meadow Local Wildlife Site (LWS) & Whitacre Pool LWS) - 3 December 2021
- Ladywalk LWS - 3 December 2021
- Whitacre Heath Site of Special Scientific Interest (SSSI) - 3 December 2021
- Lea Marston LWS & Coton Pools LWS – 3 March 2022
- Kingsbury Wetlands (Water Park) LWS – 20 April 2022
- RSPB Middleton Lakes (Fisher's Mill Meadow LWS and Dosthill Pit & Middleton Hall Pit LWS) – 3 December 2021
- Tameside Local Nature Reserve (LNR) – 3 December 2021
- Broad Meadow LNR – 20 April 2022
- Drakelow Reserve LWS – 28 January 2022
- Sports Ground Marsh LWS – 28 January 2022
- Stanton Barn Marsh LWS – 28 January 2022
- Trentside Ponds LWS – 28 January 2022
- Trent Fleet LWS – 28 January 2022

[12] Technical reports to support Gate 1 submission: https://www.ofwat.gov.uk/regulated-companies/rapid/the-rapid-gated-process/gate-one-submissions-and-final-decisions/

- River Derwent Mouth Lock LWS - 10 December 2021
- Sawley Carr LWS - 10 December 2021
- Lockington Marshes SSSI - 10 December 2021
- Lockington Confluence Backwater LWS - 10 December 2021
- Attenborough Gravel Pits SSSI – 26 January 2022
- Clifton Grove, Clifton Woods, and Holme Pit Pond LNR (including Holme Pit SSSI and Trent Carr LWS) - 17 December 2021
- Netherfield Lagoon LNR Netherfield Pits LWS - 17 December 2021
- Shelford Carr LWS - 17 December 2021

Habitat Identification/classification

4.6.7 At Gate 2 biodiversity metric calculations have been undertaken using a tiered approach to habitat identification/classification. Habitat types used in the Gate 2 BNG Assessment include:

- Wetland habitats identified during preliminary ground truthing survey visits during winter and/or spring 2021/22;
- Wider non-water dependant site habitats, identified using open-source Priority Habitat Inventory data[13] held for each site; and
- For areas of 'white space'[14] within each site boundary, neither identified as wetland or priority habitat, a proxy UKHab habitat of "Grassland - Floodplain Wetland Mosaic" has been used to ensure full site coverage.

4.6.8 Habitat data has been converted into UK Habitat (UKHab) Classification habitat types used by the Metric 3.0 by a qualified ecologist. Both Phase 1/UKHab and National Vegetation Classification (NVC) vegetation surveys are seasonally constrained. Therefore, it is intended that the results of the habitat condition assessment surveys scheduled for 2022 will further refine the above data set in order to fully inform the Gate 3 assessment.

4.6.9 Habitat areas have been recorded and measured digitally using a Geographic Information System and net gain calculations have been undertaken in excel using the publish Metric 3.0 algorithms.

Assigning Habitat Distinctiveness and Condition

4.6.10 At this high-level assessment stage habitat condition has been assigned using distinctiveness as a proxy. Therefore, habitats with a 'Very High' distinctiveness have been assigned a 'Good' condition, habitats with a 'Medium' distinctiveness have been assigned a 'Moderate' condition and habitats with a 'Low' condition have been assigned a 'Poor' Condition. This precautionary approach weights the value of higher distinctiveness habitats to ensure potential impacts are not underestimated at this stage in the assessment.

Assigning Strategic Significance

4.6.11 At this high-level assessment stage Strategic Significance has been assigned based on each sites statutory or non-statutory nature conservation designation. With all sites being designated Local Wildlife Site or higher all sites have been assigned as being of 'High' strategic significance. At Gate 3 Strategic Significance for each site will be further refined using an 'opportunity mapping' approach using a combination of open-source habitat datasets alongside Local Nature Recovery/Biodiversity Opportunity Areas. The final strategic significance scores for each site/habitat at Gate 3 will be agreed during stakeholder engagement sessions.

Post-impact habitat data

4.6.12 The river level, depth, and wetted perimeter changes as a consequence of the proposed options have been modelled using Aquator software. From the preliminary model results, it appears that changes in river level, depth and wetted perimeter are very minor and prevalent during extreme low flows. The greatest change in river level is predicted in the upper Tame in two localities:

[13] https://data.gov.uk/dataset/4b6ddab7-6c0f-4407-946e-d6499f19fcde/priority-habitat-inventory-england
[14] Areas of land within the redline boundary of the designated site that contained no priority habitat data or wetland habitat identified during site surveys

- Between Ladywalk LWS and Whitacre Heath SSSI, and
- Between Coton Pools LWS and Kingsbury Water Park LWS

4.6.13 Seasonal winter flooding of the Tame and Trent floodplains is predicted to continue and will not be affected by the scheme options. The SRO options are predicted not to have a significant effect on water levels on wetland habitats either side of the tidal River Trent (downstream of Cromwell Lock).

4.6.14 The hydrological assessment has considered whether surface waters in the SSSIs may be affected directly from lower flows in the rivers Tame and Trent, and whether changing water levels will affect groundwater levels that then may affect surface water features in the SSSIs. This has then been considered in the context of natural seasonal variation in water levels in the rivers and aquifers, and other features controlling water levels near the SSSIs such as weirs, abstractions, and discharges.

4.6.15 From the preliminary model results no significant effect on groundwater levels that then may affect surface water features which sustain wetland habitats are predicted. Therefore, post-development modelling of BNG assumes no reduction in existing habitat condition or any degree of habitat loss or reduction in habitat extent. Therefore a 10% gain for all scenarios has been modelled by calculating metrics that aim to enhance existing habitat condition values.

4.6.16 The findings of this preliminary BNG assessment in the accompanying Metric 3.0 spreadsheet has been provided in the Annex of this report. Refer to Appendix B(i) Ecology for supporting figures illustrating relevant designated sites and priority habitats.

4.6.17 Post-development habitat data is not available for Minworth SRO due to the uncertainties of flow reductions as a result of the SRO proposals (and corresponding mitigation requirements for the River tame and adjacent habitats), and the restriction of infrastructure construction works to the Minworth site itself. Post-development details for the STT pipeline are based on the current corridor option between Minworth and the River Avon. Therefore, a baseline scenario has been presented with different scenarios for various habitat loss, creation, and enhancement options, in order to provide an indication of the likely extent of habitat mitigation required to ensure ‘no negative impact as a minimum’ as a result of the SRO proposals, and to support the aspiration of the SRO schemes to seek wider environmental benefits and achieve a minimum 10% Biodiversity Net Gain

4.6.18 At Gate 3, in order to demonstrate a more accurate 10% Biodiversity Net Gain for the proposed scheme, it is recommended that opportunities to create and enhance wetland habitats within the Study Area are identified through a combination of habitat opportunity mapping and stakeholder engagement. The creation of new wetlands within the Study Area will particularly benefit those species associated with those habitat types. The selection of candidate wetland habitat creation and enhancement sites will need to be discussed with local biodiversity groups and will aim to benefit key habitats and the species they support.

Priority Areas

4.6.19 A baseline register has been compiled of habitat extent and condition at key sites within the River Trent, River Tame and Humber Estuary study area. This has been informed by on-going liaison with the EA and NE, including joint attendance on site visits, to identify key sites and habitats for assessment and potential mitigation opportunities.

4.6.20 This baseline has been informed by existing data sets held by Natural England, Local Biodiversity Record Centres, Local Nature Conservation organisations (inc. Wildlife Trusts), Centre for Ecology & Hydrology (CEH) Landcover mapping and the analysis of aerial imagery.

4.6.21 Where the requirement for further ecological site surveys was identified, BNG habitat condition surveys (UKHab) have been completed as part of the survey methodology. However, as BNG Condition Assessments, Phase 1 habitat, and NVC vegetation surveys are seasonally constrained, it is possible that comprehensive survey data will not be available to inform the Gate 2 assessment. Therefore, the results of these surveys will inform future stages of the assessment, i.e., Gate 3. At the Gate 2 stage, where existing condition data does not exist, a combination of habitat distinctiveness and professional judgement has been used to determine an indicative habitat condition value.

4.6.22 Habitat extent and condition data has been compiled into a GIS system to facilitate access, data sharing and ease of update. This mapping tool has been used to identify where opportunities to

protect, restore or enhance biodiversity and other ecosystem services may be targeted during further stages of the project.

4.6.23 To ensure a strategic approach is taken to identifying potential offsetting sites, additional key partners and stakeholders have been identified through a scoping exercise.

4.6.24 The impacts of flow changes on ecosystem services and the associated social and economic benefits those services provide have been focused on areas where the outputs of the hydrological modelling and ecological assessments reveal changes in flow levels that could impact upon instream recreation (boating, angling) or on the condition of SSSIs and other terrestrial habitats that provide carbon storage, sequestration, and flood control services.

4.7 Natural Capital Assessment

4.7.1 The RAPID Gate 2 Guidance states that Natural Capital Assessment (NCA) 'should be completed/updated as the solution level and used to support identification of best value solutions. The NCA should be consistent with WRMP24 guidelines supplementary guidance on Regional and WRMPs.'

4.7.2 For the Tame, Trent, and Humber Gate 1 baseline assessment, studies which sought to define the socio-economic benefits from habitats and species associated with the main river system of the Trent were reviewed. The review focused on studies within the last 15 years that covered habitats within 5 km of the River Tame, River Trent and the Humber Estuary.

4.7.3 Most studies covered more than one Ecosystem Service, and the results show that the majority of the studies reviewed focused on biodiversity (78%), natural hazard regulation (70%), aesthetic value (65%), and recreation (65%). This is a function of the variety of studies that focused on flood risk attenuation in relation to the River Trent and the Humber Estuary, which have historically been susceptible to flooding. The material services that are not well covered by the literature included local climate regulation, pollination, disease and pest control and minerals. These services tend to be challenging to quantify in physical and monetary terms due to limitations in the existing evidence and approaches available. However, it has been possible to capture some of their characteristics by compiling and monitoring indicators of the extent and condition (quantity and quality) of habitats within the study area. This inventory of indicators constitutes a Natural Capital Asset Register for the study area

4.7.4 Relatively few studies covered economic impacts, compared to the coverage of ecosystem services. The economic impacts primarily considered tended to be job creation and tourism. The latter impact is correlated with recreational benefits, which are well covered in the literature.

4.7.5 Social impacts were significantly less considered in the literature, compared to ecosystem services and, to a lesser extent, economic impacts. At most, two out of the 17 studies considered a given social impact. Social impacts, particularly those associated with community engagement, awareness raising, and preparedness are important in the context of the study area, given its historical susceptibility to flooding and pollution.

4.7.6 A review and update has been completed of the baseline assessment of habitats and ecosystem services and benefits for the River Tame, River Trent and the Humber Estuary systems, undertaken for Gate 1. While it is recognised that this may be considered to be an aspirational ambition, it would facilitate robust future decision-making by allowing potential interventions to be assessed against the baseline. The assessment follows industry best practice including guidance within the Green Book (HM Treasury, 2020) and Defra's Enabling a Natural Capital Approach (ENCA) guidance (Defra, 2020).

4.7.7 A consistent approach to measuring biodiversity and environmental net gain has been implemented in accordance with the ACWG guidance. Applying a common approach and metric promotes a more consistent approach across the assessed catchments for measuring and reporting biodiversity and wider environmental losses and gains with respect to land management and development activity.

4.7.8 In addition to considering opportunities to deliver Biodiversity Net Gain, the SROs have been explored in terms of their potential to deliver socio-economic benefits.

Six Capitals Assessment

4.7.9 The six capitals assessment includes a range of indicators showing the extent and condition of existing and proposed assets, as well as the negative and positive impact of the proposed activities. The assessment is designed to provide opportunities for:

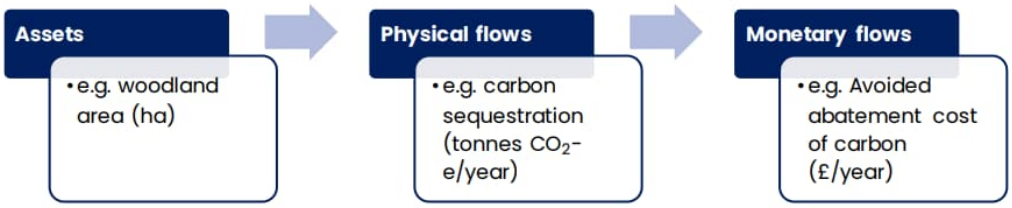
- Knowledge: Growing understanding of our positive and negative impacts, and the things we depend on.
- Engagement: Sharing this knowledge to help customers and stakeholders shape our approach and hold us to account.
- Service: Applying this knowledge to become more efficient, resilient, and sustainable.
- Public value: Using this knowledge to grow our contribution to society, the economy, and the environment.

4.7.10 The six capitals approach is an enabler for an organisation to develop a more structured and integrated view of its impacts and dependencies in decision making to recognise the growing expectations to deliver greater public value in the face of unprecedented pressures, including:

- The challenges posed by the climate emergency and biodiversity crisis, which bring with them the risk of ecosystem collapse;
- Socio-economic changes, such as rising inequality and population growth; and
- The financial challenges of delivering public value in a financially constrained and regulated environment.

4.7.11 AECOM's six capitals approach is built around a framework of assets, flows and values, following the latest guidance from Defra and the Natural Capital Committee. This considers the extent and condition of assets and receptors, the physical flows of services and impacts upon them, as well as the monetary value of those impacts across all six capitals as illustrated in Figure 4-1.

Figure 4-1: The assets/flows/values accounting framework used in this assessment



4.7.12 The assessment followed the four stages outlined in the Capitals Coalition's 'Natural Capital Protocol'[15], set out in Figure 4-2, as well as the 'Social and Human Capital Protocol'[16]. The assessment adopts an integrated six capitals approach which recognises natural, social, human, intellectual, manufactured, and financial capital, as set out in Figure 4-3.

[15] Capitals Coalition 2021. Capitals approach – Natural Capital Protocol. Available at: https://capitalscoalition.org/capitals-approach/natural-capital-protocol/?fwp_filter_tabs=training_material
[16] Capitals Coalition, 2021. Capitals approach – Social and Human Capital Protocol. Available at: https://capitalscoalition.org/capitals-approach/social-human-capital-protocol/

Figure 4-2: Overview of the stages of the Natural Capital Protocol

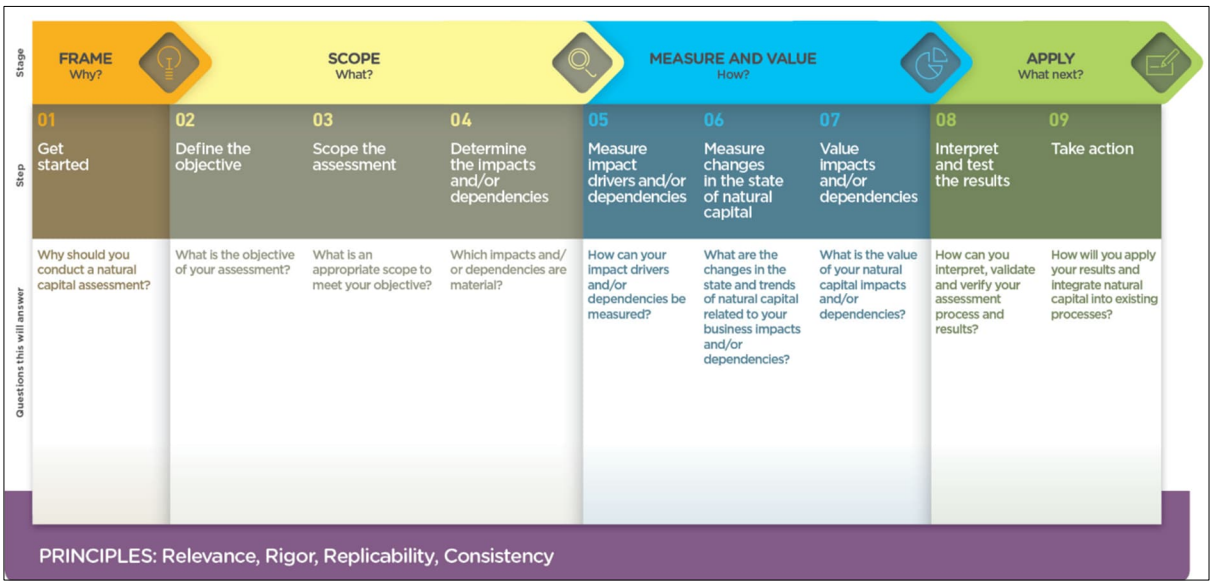
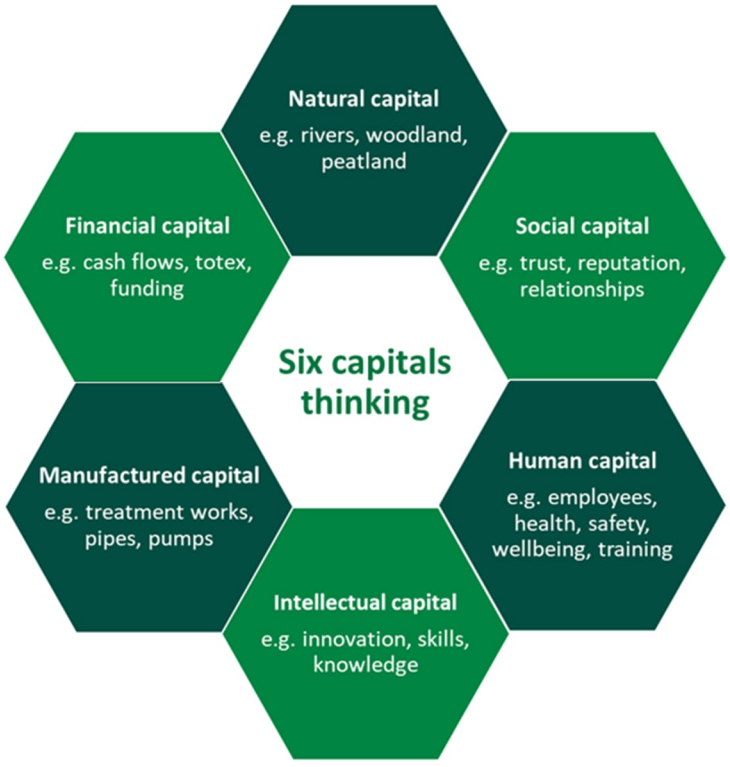


Figure 4-3: Components of an integrated six capitals approach



4.7.13 The assessment compares the range of six capitals impacts of the interventions in a consistent format (i.e., net present value) to allow standardised comparison and identification of best value. Ordinarily it includes Financial capitals which cover CAPEX and OPEX, but these have been redacted from this report. Quantification and valuation will draw on the latest UK Gov guidance including the Defra Biodiversity Metric, Defra's ENCA guidance, and the EA Water Industry National Environment Programme (WINEP) metrics.

Limitations

4.7.14 The following limitations have been identified in terms of the six capitals and BNG assessment:

- The use of Gate 1 baseline assessment data as well as the extensive use of assumptions to cover the current limited quantitative data, result in a reduced level of confidence in the accuracy of the assessment. Where data was available the capitals impacts have been valued to the highest resolution possible. However generally, detailed data to undertake quantitative assessment of the scoped in impacts is not yet available. The data gaps are explored further in the results section. These gaps will be filled with further results expected from ongoing assessments and further information regarding potential mitigation measures, which will help refine this assessment at Gate 3.
- There are potential overlaps between the impact and dependencies identified across the six capitals. However, the risk of double-counting has been avoided by utilising tools and data sets which measure specific and different parameters for the services that have been scoped in.
- Third party habitat data was used when projecting BNG losses and gains along the STT pipeline (to the River Avon) development corridor, as such these data have not been subject to AECOM's full data management and assurance processes. It is recommended that at Gate 3 the accuracy of this data is refined further in line with ACWG protocols for SRO assessment.

4.8 Carbon Assessment

4.8.1 The RAPID Gate 2 Guidance states that 'Solution development to Gate 2 should follow the Water Resources Planning Guidelines for WRMP24 section 8.3.2 which states expectations for accounting for and reducing greenhouse gas emissions.

4.8.2 The most up to date carbon costs and values as per government guidance should be used. The additional guidance [refer to the RAPID Gate 2 Guidance] should be considered as per the Water Resources Planning Guidelines for WRMP24 section 8.3.2.'

4.8.3 Solutions must be designed in line with the Ofwat net zero principles position paper of 6 January 2022. In particular '*companies need to prioritise the reduction of GHG emissions before the use of offsets, as set out in the GHG Management Hierarchy*[17] *and that a whole life approach to carbon assessment is taken ensuring a focus on reducing both operational and embedded emissions in tandem*'.

4.8.4 Gate 2 submissions should clearly present the following:

- Assessments of the whole life carbon cost of the solution. Estimations of carbon costs and absolute operational and embodied carbon of the solution should be presented (in tCO2e) for all variations of solution options. Thorough consideration and discussion should be presented as to how whole life carbon has been reduced within the design. Discussion should be included on how carbon has been considered in the best value planning approaches, metrics and decision making and (operational and embedded carbon emissions are expected to be part of best value assessment and due consideration is expected to the six main greenhouse gases) show how solution designers are using relevant policies, frameworks, and approaches to drive down carbon emissions within the solution design.
- A description of how solutions are embracing innovative designs and opportunities to generate or be powered by renewable energy and/or sequester carbon and explore joint opportunities with other sectors. Evidence may be sought as to whether a focus on carbon reduction has been able to drive down solution costs. The level of uncertainty associated with the solution carbon assessments will be expected to reduce as solutions are refined through the Gated process. Assessment outlining key emission areas and considering opportunities to reduce emissions. We expect the submission to demonstrate consideration of Scope 1, 2, and 3 emissions. This would include an explanation of how materials have been selected and whether the lowest carbon options have been considered as part of solution design (if lowest carbon options not taken forward, why not). We expect water companies to use their influence to help shape the supply chain where low carbon materials may not be readily available. Outline whether a role for monitoring and reporting on project emissions during and post project completion is envisaged.

[17] The GHG Management Hierarchy, as detailed by the Institute of Environmental Management and Assessment (2020 version), is a framework organisations can use to guide the scoping and strategic planning of their energy and carbon management activities.

Carbon Assessment Methodology

4.8.5 The Carbon assessment has been completed by Jacobs as part of the Minworth Engineering workstream and is qualitatively summarised in this EAR. The carbon assessment was carried out using a bespoke carbon calculator, developed by Jacobs for Severn Trent Water. The carbon calculator estimates the embodied and operational carbon impact for different options to be considered within a project.

4.8.6 A list of assets that can be included in embodied carbon calculations is provided within the calculator. For each relevant asset within an option, users input information relating to quantity and primary and secondary metrics as applicable. The calculator uses bespoke algorithms to convert this information into embodied carbon expressed in tonnes of carbon dioxide equivalent (tCO_2e).

4.8.7 The carbon calculator estimates the annual operational impact of an option based on the quantity of grid electricity, fuels, and chemicals (water and wastewater) consumed each year. The calculator applies standard emissions factors as applicable to estimate annual operational emissions in tCO_2e.

4.8.8 The Gate 2 carbon assessment considered four additional wastewater treatment scenarios (57, 115, 172 and 230 Ml/d – the latter stated as 253 Ml/d to take into account backwashing; the reduction of discharge to the River Tame would constitute 230 Ml/d as assessed in this report), and a single water transfer scenario (115 Ml/d) for the STT pipeline to the River Avon.

4.8.9 For each of the four wastewater treatment scenarios, total embodied carbon was estimated for the following assets:

- Biological Activated Carbon (BAC)
- UV Disinfection
- Granular Activated Carbon (GAC)
- Interstage Pumping Station Wet Well
- Influent Pumping Station Wet Well
- CoMag Mixing and Flocculation Tanks
- CoMag Settlement Tanks (Clarifiers)
- Site Returns Pumping Station
- CoMag Ferric Storage and Dosing.

4.8.10 Annual operational emissions were estimated for each wastewater treatment scenario based on consumption of grid electricity and chemicals.

4.8.11 Embodied carbon was estimated for the single water transfer scenario for the following assets:

- Pipe Gravity Main Length within field
- Pipe Raising Main Length within field
- Trenchless Rising Main
- Trenchless Gravity Main
- Break Pressure Tank
- Sewerage Pumping Station
- Surge Vessel

4.8.12 Annual operational emissions for the water transfer scenario were estimated on the basis of annual consumption of grid electricity.

4.8.13 For the wastewater treatment scenarios, an operational lifetime of 80 years was assumed, while for the water transfer scenario the assumed operational lifetime was 50 years.

4.8.14 For each scenario, the Gate 2 carbon assessment carried out by Jacobs assumed that embodied emissions could be reduced by a flat rate of 20% through the implementation of a range of innovative measures. These are listed in section 5.7 below.

Climate Assessment Methodology

4.8.15 In addition to the carbon assessment described above, the CDR (Jacobs, 2022) included a summary table setting how climate principles and targets had been addressed within the engineering design.

4.8.16 These principles, targets and indicators are summarised in Section 5.7.

5. Regulatory Assessments

5.1 Introduction

5.1.1 The results of each component of the regulatory assessments are set out in the sections that follow.

5.1.2 There is particular inter-dependency between different aspects of the assessment, and also dependencies between different parallel workstreams (AECOM and other Consultants), as summarised in Table 5-1 below.

Table 5-1: Assessment inter-dependencies matrix

Topics	HRA	WFD	Nat Cap	BNG	Carbon
Wider Tame and Trent Environmental Assessments*	HRA Calls upon Tame and Trent Env Assessments of impacts on designated sites and qualifying features	WFD assessment informed by Tame and Trent assessment, hydrological/hydraulic and water quality modelling, and aquatic ecological assessment of biological elements, fish passage, and INNS	Natural Capital assessment reliant upon Tame and Trent Environmental Assessment for impacts on biodiversity, and ecological mitigation options	Biodiversity Net Gain assessment pulls information from Tame and Trent BNG assessment of relevance to Minworth, i.e., all habitat assessments and mitigation options upstream of the SLR abstraction location	Carbon assessment, and carbon aspects of the Nat Cap assessment, are entirely dependent upon details provided within the Concept Design Report (CDR) (Jacobs 2022), for both the Minworth treatment options and the STT pipeline to the River Avon
SEA	Coordination between HRA and SEA for assessment of European designated sites, and construction/operation mitigation. SEA relies on HRA for assessment of European designated sites and their qualifying features	SEA relies on WFD for assessment of WFD objectives; To enhance or maintain groundwater and surface water quality and resources, flows and quantity	SEA relies on Nat Cap assessment of natural capital assets including biodiversity, climatic factors, tourism, and recreation, etc. Importance of Social and Human Capitals, e.g., trust and reputation of Water Companies, sharing of water resources, and customer engagement; integration of SROs with wider water resources plans; opportunities for jobs and training, and supporting local economies	SEA relies on BNG assessment for the protection and enhancement of biodiversity, Priority Habitats, and species	Consideration of climate mitigation; improvement of the climate resilience of assets and natural systems; assessment of embodied and operational emissions
HRA		WFD assessment quantifies potential impacts to qualifying		European designated sites were scoped out of BNG	Carbon would be considered as part of the HRA where climatic impacts were

Topics	HRA	WFD	Nat Cap	BNG	Carbon
		features of European designated sites – water quality, fish and fish passage, hydrological regime		assessment in the Tame and Trent Env. Assessments due to lack of potential impacts; specific mitigation in relation to these sites would be recommended as an outcome of the HRA	considered likely to impact upon the designated features of the European site, which is not the case for the River Mease SAC or Humber Estuary SAC/SPA/Ramsar site
WFD			Natural Capital assessment reliant upon WFD for assessment of water quality regulation, and impacts of water quality on biological elements, and corresponding effects on recreation, flood regulation, disease and pest control (INNS), etc.	BNG assessment considers potential impacts on WFD supporting elements in terms of potential impacts to riparian and water dependent habitats; e.g., hydrological regime, water quality	Recommendations of carbon assessment have potential benefits for WFD receptors; e.g., reduce demolition through trenchless techniques and avoid impacts on watercourses, best-practice construction methods, and re-use of demolished and existing material to minimise transport and run-off to surface water
Nat Cap				BNG and Nat Cap assessment are intrinsically linked in terms of impacts and opportunities for biodiversity gains; consistency of assessment across these topics	Carbon forms an inherent component of Nat Cap assessment in terms of global climate regulation; consideration of carbon impacts and benefits, and carbon sequestration of created or enhanced habitats
BNG					As above, carbon sequestration of high-value wetland habitat creation/enhancement feeds into carbon assessment

* Most of the assessments (with the exception of Carbon) are supported by aspects of the Tame and Trent environmental assessments, as referenced in Section 1.2.

5.2 Strategic Environmental Assessment (SEA)

5.2.1 The detailed SEA assessment matrices for each of the scenarios are provided as attachments to this report.

5.2.2 The assessment conclusions during the construction and operational phases of each scheme after consideration of embedded mitigation are summarised below using a colour-coded visual evaluation summary matrix (Table 5-2). The colours in the table reflect the level of significance of the effect as set out below (Table 5-3). The assessment conclusions during the construction and operational phases of each scheme after consideration of further potential mitigation measures are summarised in Table 5-4.

Table 5-2: SEA significance key

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

Table 5-3: SEA Assessment Summary Matrix including embedded mitigation

Scheme	Construction and Operation effects		SEA Topics and Objectives																					
			Biodiversity, flora & fauna					Soil	Water					Air	Climatic Factors		Land-scape	Historic Environ-ment	Population and Human Health				Material Assets	
			1.1	1.2	1.3	1.4	1.5	2.1	3.1	3.2	3.3	3.4	3.5	4.1	5.1	5.2	6.1	7.1	8.1	8.2	8.3	8.4	9.1	9.2
Minworth 57 Ml/d (STT or GUC)	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
Minworth 115 Ml/d (STT and/or GUC)	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
Minworth combined (230 Ml/d) (STT and GUC)	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
Minworth - pipeline to River Avon	Construction Effects	+ve																						
		-ve																						
	Operational effects	+ve																						
		-ve																						

Table 5-4: SEA Assessment Summary Matrix after further mitigation

Scheme	Construction and Operation effects		SEA Topics and Objectives																					
			Biodiversity, flora & fauna					Soil	Water					Air	Climatic Factors		Land-scape	Historic Environ-ment	Population and Human Health				Material Assets	
			1.1	1.2	1.3	1.4	1.5	2.1	3.1	3.2	3.3	3.4	3.5	4.1	5.1	5.2	6.1	7.1	8.1	8.2	8.3	8.4	9.1	9.2
Minworth 57 Ml/d	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
Minworth 115 Ml/d	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
Minworth combined (230 Ml/d)	Construction Effects	+ve																						
		-ve																						
	Operational Effects	+ve																						
		-ve																						
Minworth - pipeline to River Avon	Construction Effects	+ve																						
		-ve																						
	Operational effects	+ve																						
		-ve																						

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

57 Ml/d Scenario

5.2.4 This scheme has moderate negative and moderate positive effects in relation to climatic factors after consideration of currently embedded mitigation measures.

5.2.5 Moderate negative effects are identified due to the estimated embodied carbon emissions of the scheme, as calculated by Jacobs as part of the Minworth Engineering workstream. Moderate positive effects are identified in respect of the scheme contributing to a resilient water supply. The additional water resource from this scheme will provide essential water supply infrastructure to help support a sustainable socio-economy. Furthermore, with respect to climatic factors this scheme provides additional water resource and will during operation assist the reliable transfer of water, therefore reducing the vulnerability to drought risks associated with climate change and improving resilience to the likely effects of climate change.

5.2.6 The Gate 2 carbon assessment carried out by Jacobs identifies a set of potential embodied carbon reduction opportunities that could reduce embodied emissions by a standard rate of 20%, Through the implementation of further mitigation measures these currently identified effects could be reduced to a minor negative effect. Potential embodied carbon reduction opportunities, which are proposed to be investigated further during Gate 3, include:

- Low carbon concrete, substituting cement with other materials/ additives
- Novel alternatives to steel reinforcement in reinforced concrete (e.g., fibre-reinforced polymer bars).
- Re-use demolished material.
- Re-use existing available materials, e.g., processing, re-use of excavated material as fill.
- Sustainable construction materials.
- Efficient methods of work, e.g., more sustainable transport solutions.
- Prioritising local suppliers to reduce the distance travelled to site.
- Minimising material import. Where required sourcing material from other nearby projects to reduce the amount of virgin material used and also reduce transport emissions.
- Where new materials are required, utilising materials that have a high recycled content such as recycled steel and concrete mixes with ground granulated blast furnace slag.
- Selecting materials that have a long-life span and require minimal maintenance.

5.2.7 The Jacobs Gate 2 carbon assessment only identified potential embodied carbon reduction opportunities and did not propose any measures to reduce the emissions projected to occur over the operational lifetime of each scenario.

5.2.8 As illustrated in Table 5-4 as well as moderate effects being reduced through the implementation of mitigation measures, the adoption of further mitigation measures also reduces a number of identified minor negative effects to neutral effects.

115 Ml/d Scenario

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

5.2.10 Moderate negative effects include:

- Risk to WFD deterioration in three river water bodies (further details provided in the WFD report);

- Effects on flows in the Rivers Tame and Trent (further details provided in the WFD report);
- Effects on WFD objectives during operation due to effects of discharge reduction from Minworth WwTW on the downstream Rivers Tame and Trent (further details provided in the WFD report);
- Effects on climatic factors due to the estimated embodied carbon of the proposed scheme as calculated by Jacobs as part of the Minworth Engineering workstream; and
- Impacts on local air quality due to increased HGV movements and other activities associated with construction – noting that the site is within an AQMA.
- A net loss in natural capital, compared to the do-nothing scenario, reflecting the fact that the increases in biodiversity and recreational benefits are generally lower in magnitude than the expected capital and operating costs of the scheme.

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

5.2.12 The Gate 2 carbon assessment carried out by Jacobs identifies a set of potential embodied carbon reduction opportunities that could reduce embodied emissions by a standard rate of 20%. Through the implementation of further mitigation measures the currently identified moderate negative effects could be reduced to a minor negative or neutral effect.

5.2.13 These measures, which are proposed to be investigated further during Gate 3, include:

- Low carbon concrete, substituting cement with other materials/ additives
- Novel alternatives to steel reinforcement in reinforced concrete (e.g., fibre-reinforced polymer bars).
- Re-use demolished material.
- Re-use existing available materials, e.g., processing, re-use of excavated material as fill.
- Sustainable construction materials.
- Efficient methods of work, e.g., more sustainable transport solutions.
- Prioritising local suppliers to reduce the distance travelled to site.
- Minimising material import. Where required sourcing material from other nearby projects to reduce the amount of virgin material used and also reduce transport emissions.
- Where new materials are required, utilising materials that have a high recycled content such as recycled steel and concrete mixes with ground granulated blast furnace slag.
- Selecting materials that have a long-life span and require minimal maintenance.

5.2.14 The Jacobs Gate 2 carbon assessment only identified potential embodied carbon reduction opportunities and did not propose any measures to reduce the emissions projected to occur over the operational lifetime of each scenario.

5.2.15 Measures to be explored at Gate 3 which could reduce effects on local air quality to a minor negative effect include sensitive siting of construction compounds, routing of construction traffic and limiting hours of working.

5.2.16 In relation to WFD, further flow modelling and assessment that includes scheme operating procedures is suggested for Gate 3. This is to improve data confidence for hydrological regime in waterbodies where there is uncertainty that it would be compliant with WFD objectives.

5.2.17 In relation to natural capital, the findings from the Natural Capital assessment are intended to feed into recommendations for further assessment for Gate 3. Specifically, further work in Gate 3 should be undertaken to better understand where recreational services are currently provided and how/where they are likely to be improved within the study area.

5.2.18 As illustrated in Table 5-4, as well as moderate effects being reduced through the implementation of further mitigation measures, the adoption of further mitigation measures also reduces a number of identified minor negative effects to neutral effects.

Combined 230 Ml/d transfer

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

5.2.20 Moderate negative effects include:

- Risk to WFD deterioration in three river water bodies (further details provided in the WFD report);
- Effects on flows in the Rivers Tame and Trent. (further details provided in the WFD report);
- Effects on WFD objectives during operation due to effects of discharge reduction from Minworth WwTW on the downstream Rivers Tame and Trent (further details provided in the WFD report);
- Effects on climatic factors due to the estimated embodied carbon and operational carbon predicted for the proposed scheme, as calculated by Jacobs as part of the Minworth Engineering workstream;
- Impacts on local air quality due to increased HGV movements and other activities associated with construction – noting that the site is within an AQMA; and
- Effects on heritage assets during construction due to the proximity of scheduled monuments, listed buildings and registered parks and gardens.
- A net loss in natural capital, compared to the do-nothing scenario, reflecting the fact that the increases in biodiversity and recreational benefits are generally lower in magnitude than the expected capital and operating costs of the scheme.

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

5.2.22 The Gate 2 carbon assessment carried out by Jacobs identifies a set of potential embodied carbon reduction opportunities that could reduce embodied emissions by a standard rate of 20% Through the implementation of further mitigation measures these currently identified moderate negative effects could be reduced to a minor negative or neutral effect.

5.2.23 These measures, which are proposed to be investigated further during Gate 3,include:

- Low carbon concrete, substituting cement with other materials/ additives
- Novel alternatives to steel reinforcement in reinforced concrete (e.g., fibre-reinforced polymer bars).
- Re-use demolished material.
- Re-use existing available materials, e.g., processing, re-use of excavated material as fill.
- Sustainable construction materials.
- Efficient methods of work, e.g., more sustainable transport solutions.
- Prioritising local suppliers to reduce the distance travelled to site.
- Minimising material import. Where required sourcing material from other nearby projects to reduce the amount of virgin material used and also reduce transport emissions.
- Where new materials are required, utilising materials that have a high recycled content such as recycled steel and concrete mixes with ground granulated blast furnace slag.
- Selecting materials that have a long-life span and require minimal maintenance.

5.2.24 The Jacobs Gate 2 carbon assessment only identified potential embodied carbon reduction opportunities and did not propose any measures to reduce the emissions projected to occur over the operational lifetime of each scenario.

5.2.25 Measures to be explored at Gate 3 which could reduce effects on local air quality to a minor negative effect include sensitive siting of construction compounds, routing of construction traffic and limiting hours of working.

5.2.26 In relation to natural capital, the findings from the Natural Capital assessment are intended to feed into recommendations for further assessment for Gate 3. Specifically, further work in Gate 3 should be undertaken to better understand where recreational services are currently provided and how/where they are likely to be improved within the study area.

5.2.27 In terms of WFD, further flow modelling related to flow scenarios combining operating conditions at Minworth WWTW are required at Gate 3. Further assessments related to the fish WFD quality element on the Tame from R Blythe to River Anker (GB104028046440) should be undertaken at Gate 3. The medium data confidences related to hydrological regime within the Tame - R Rea to R Blythe (GB104028046841), the Tame from R Blythe to River Anker (GB104028046440), and the Tame from River Anker to River Trent (GB104028047050) should be mitigated by further monitoring and modelling to improve data confidence to “high” at Gate 3.

5.2.28 As illustrated in Table 5-4 as well as moderate effects being reduced through the implementation of further mitigation measures, the adoption of further mitigation measures also reduces a number of identified minor negative effects to neutral effects.

Pipeline transporting water to River Avon for STT

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

5.2.30 Major negative effects include:

- Impacts on climatic factors due to the estimated level of embodied carbon resulting from the proposed scheme, as calculated by Jacobs as part of the Minworth Engineering workstream; and
- Biodiversity effects during construction as the scheme crosses two SSSIs and is close to other designated areas.

5.2.31 Moderate negative effects include:

- Impacts on local air quality due to increased HGV movements and other activities associated with construction. Part of the pipeline would be within an AQMA;
- Impacts on climatic factors due to the estimated level of operational carbon resulting from the proposed scheme, as calculated by Jacobs as part of the Minworth Engineering work stream;
- Effects on heritage assets during construction due to the proximity of scheduled monuments, listed buildings and registered parks and gardens; and
- Potential effects on the health and well-being of the local community, including recreational assets, built assets and infrastructure during construction of the proposed pipeline.

5.2.32 Major positive effects are identified in respect to climatic factors, as this scheme supports the provision of additional water resource and will during operation assist the reliable transfer of water, therefore reducing the vulnerability to drought risks associated with climate change and improving resilience to the likely effects of climate change.

5.2.33 Moderate positive effects are identified in respect to population and communities, as the scheme contributes towards delivering a resilient water supply. The transfer of additional water resource will provide essential water supply infrastructure to help support a sustainable socio-economy.

5.2.34 The Gate 2 carbon assessment carried out by Jacobs identifies a set of potential embodied carbon reduction opportunities that could reduce embodied emissions by a standard rate of 20%. Through the implementation of further mitigation measures these currently identified major and moderate negative

effects could be reduced to minor negative or neutral effects. These measures, which are proposed to be investigated further during Gate 3, include:

- Low carbon concrete, substituting cement with other materials/ additives
- Novel alternatives to steel reinforcement in reinforced concrete (e.g., fibre-reinforced polymer bars).
- Reduce demolition through trenchless techniques and avoid infrastructures such as railway lines, canals, motorways, highways, and urban areas.
- Re-use demolished material.
- Re-use existing available materials, e.g., processing, re-use of excavated material as fill.
- Sustainable construction materials.
- Efficient methods of work, e.g., more sustainable transport solutions.
- Minimising removal of vegetation to prevent loss of carbon storage in soils. In particular, minimising removal of trees as they have a higher potential to sequester carbon.
- Prioritising local suppliers to reduce the distance travelled to site.
- Minimising material import. Where required sourcing material from other nearby projects to reduce the amount of virgin material used and also reduce transport emissions.
- Where new materials are required, utilising materials that have a high recycled content such as recycled steel and concrete mixes with ground granulated blast furnace slag.
- Selecting materials that have a long-life span and require minimal maintenance.

5.2.35 The Jacobs Gate 2 carbon assessment only identified potential embodied carbon reduction opportunities and did not propose any measures to reduce the emissions projected to occur over the operational lifetime of each scenario.

5.2.35.1 Wider mitigation to be explored at Gate 3 includes:

- Re-routing the pipeline away from SSSIs and consultation with Natural England regarding SSSI and ancient woodland protection measures.
- Consideration of heritage aspects when further developing the alignment of the pipeline. This should be done during design development and in consultation with Historic England and Council officers.
- Sensitive siting of construction compounds, routing of construction traffic and limiting hours of working. This could reduce effects on the environment and amenity to a minor negative effect.

5.2.36 As illustrated in Table 5-4 as well as major and moderate effects being reduced through the implementation of further mitigation measures, the adoption of further mitigation measures also reduces a number of identified minor negative effects to neutral effects.

5.3 Habitats Regulations Assessment (HRA)

European sites

5.3.1 Having scoped out Ensor's Pool SAC (refer to Section 3.4) the only European sites that require consideration are the River Mease SAC, and the Humber Estuary SAC, SPA and Ramsar site.

River Mease SAC

5.3.2 The Natural England standing advice for the River Mease SAC describes the river as a relatively natural lowland river which contains a diverse range of physical in-channel features including riffles, pools, slacks, vegetated channel margins and bankside tree cover, providing the conditions necessary to sustain populations of spined loach *Cobitis taenia* and bullhead *Cottus gobio*. The river is also considered to support a significant presence of water-crowfoot *Ranunculus fluitans* and water starwort *Callitriche* sp.

5.3.3 The River Mease is primarily designated as a SAC due to its population of spined loach, for which the SAC is one of only four known outstanding localities in the UK, as well as for its population of bullhead. Although not primary reasons for site selection the SAC also qualifies due to its floating vegetation often dominated by water-crowfoot and because it has a significant presence of both otter *Lutra lutra* and white-clawed crayfish *Austropotamobius pallipes*.

5.3.4 The conservation objectives of the SAC are to ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the favourable conservation status of its qualifying features, by maintaining or restoring:

- the extent and distribution of qualifying natural habitats and habitats of qualifying species;
- the structure and function (including typical species) of qualifying natural habitats;
- the structure and function of the habitats of qualifying species;
- the supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;
- the populations of qualifying species; and
- the distributions of qualifying species within the site.

5.3.5 The principal risks to the integrity of River Mease SAC[18] are:

- water pollution;
- drainage discharges;
- inappropriate weirs and dams and other structures within, and adjacent to, the river corridor, thus blocking movement of fish or otter;
- invasive species;
- siltation; and
- water abstraction.

5.3.6 The river is vulnerable to deterioration of water quality from agricultural runoff, direct pollution, and discharge of treated sewage effluent. According to the Environment Agency, the current water quality status of the river is either poor or moderate with a target to be good by 2027[19]. According to Natural England advice[20] the river is not currently achieving its target due to rural diffuse pollution and water company point source pollution.

[18] Natural England Site Improvement Plan: River Mease SAC
http://publications.naturalengland.org.uk/publication/6640857448972288
[19] https://environment.data.gov.uk/catchment-planning/OperationalCatchment/3303 [Accessed September 2022]
20 River-Mease-standing-advice-Jan-2022-Final.pdf (rivermease.co.uk)

Humber Estuary SAC, SPA and Ramsar site

5.3.7 The Humber Estuary is a large macro-tidal estuary with high suspended sediment loads, leading to the rapid accreting and eroding of intertidal mudflats, sandflats, saltmarsh and reedbeds. With declining salinity upstream, tidal reedbeds and brackish saltmarsh lie on the fringes of the estuary. Notable fish species include river and sea lamprey, which migrate up the estuary to breed in upstream freshwater bodies. The south bank of the estuary (Donna Nook) provides habitat for breeding grey seal colonies from autumn onwards.

5.3.8 The diverse array of habitats supports many wintering and passage waterfowl. Sandy sediments of the outer estuary attract knot and grey plover, while waterfowl preferentially forage in the upper zones of the estuary dominated by freshwater input. At high tide, mixed-species flocks congregate on key roost sites, which have become scarce due to combined impacts of land claim, coastal squeeze and disappearance of supporting habitats. In summer the SPA / Ramsar supports breeding populations of bittern, marsh harrier, avocet and little tern. Some developing managed realignment sites on the estuary now provide replacement habitats for SPA / Ramsar birds.

5.3.9 During the non-breeding season, the SPA[21] regularly supports:

- Great bittern *Botaurus stellaris;*
- Common shelduck *Tadorna tadorna;*
- Hen harrier *Circus cyaneus;*
- Pied avocet *Recurvirostra avosetta;*
- European golden plover *Pluvialis apricaria;*
- Red knot *Calidris canutus;*
- Dunlin *Calidris alpina;*
- Ruff *Philomachus pugnax;*
- Black-tailed godwit *Limosa limosa islandica;*
- Bar-tailed godwit *Limosa lapponica;* and
- Common redshank *Tringa totanus*.

5.3.10 During the breeding season the SPA regularly supports:

- Great bittern *Botaurus stellaris;*
- Eurasian marsh harrier *Circus aeruginosus;*
- Pied avocet *Recurvirostra avosetta;* and
- Little tern *Sterna albifrons.*

5.3.11 The SPA also supports an internationally important waterbird assemblage.

5.3.12 The Humber Estuary qualifies as a Ramsar site under the following criteria:

Ramsar criterion 1

5.3.13 The site is a representative example of a near-natural estuary with the following component habitats: dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and coastal brackish/saline lagoons. It is a large macro-tidal coastal plain estuary with high suspended sediment loads, which feed a dynamic and rapidly changing system of accreting and eroding intertidal and subtidal mudflats, sandflats, saltmarsh and reedbeds. Examples of both strandline, foredune, mobile, semi-fixed dunes, fixed dunes and dune grassland occur on both banks of the estuary and along the coast.

[21] Available in the marine sites Supplementary Advice on Conservation Objectives available at: https://designatedsites.naturalengland.org.uk/Marine/SupAdvice.aspx?SiteCode=UK9006111&SiteName=humber&SiteNameDisplay=Humber+Estuary+SPA&countyCode=&responsiblePerson=&SeaArea=&IFCAArea=&NumMarineSeasonality=15 [Accessed on the 10/11/2020]

5.3.14 The estuary supports a full range of saline conditions from the open coast to the limit of saline intrusion on the tidal rivers of the Ouse and Trent. Wave exposed sandy shores are found in the outer/open coast areas of the estuary. These change to the more moderately exposed sandy shores and then to sheltered muddy shores within the main body of the estuary and up into the tidal rivers. The lower saltmarsh of the Humber is dominated by common cordgrass *Spartina anglica* and annual glasswort *Salicornia* communities. Low to mid marsh communities are mostly represented by sea aster *Aster tripolium*, common saltmarsh grass *Puccinellia maritima* and sea purslane *Atriplex portulacoides* communities. The upper portion of the saltmarsh community is atypical, dominated by sea couch *Elytrigia atherica* (*Elymus pycnanthus*) saltmarsh community. In the upper reaches of the estuary, the tidal marsh community is dominated by the common reed *Phragmites australis* fen and sea club rush *Bolboschoenus maritimus* swamp with the couch grass *Elytrigia repens* (*Elymus repens*) saltmarsh community. Within the Humber Estuary Ramsar site there are good examples of four of the five physiographic types of saline lagoon.

Ramsar criterion 3

5.3.15 The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast. The dune slacks at Saltfleetby-Theddlethorpe on the southern extremity of the Ramsar site are the most north-easterly breeding site in Great Britain of the natterjack toad *Bufo calamita*.

Ramsar criterion 5

5.3.16 Waterbird assemblage of international importance: 153,934 waterfowl, non-breeding season (5-year peak mean 1996/97-2000/2001).

Ramsar criterion 6

5.3.17 Species / populations occurring at levels of international importance

- Eurasian golden plover *Pluvialis apricaria*;
- Red knot *Calidris canutus islandica*;
- Dunlin *Calidris alpina*;
- Black-tailed godwit *Limosa limosa islandica*;
- Common redshank *Tringa totanus*;
- Common shelduck *Tadorna tadorna*;
- European golden plover *Pluvialis apricaria*; and
- Bar-tailed godwit *Limosa lapponica*;

Ramsar criterion 8

5.3.18 The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.

5.3.19 With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the 'Qualifying Features' listed below), and subject to natural change the conservation objectives of the Humber Estuary SPA[22] are to:

5.3.20 'Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring;

- The extent and distribution of the habitats of the qualifying features
- The structure and function of the habitats of the qualifying features
- The supporting processes on which the habitats of the qualifying features rely

[22] Available at: http://publications.naturalengland.org.uk/publication/5382184353398784 [Accessed on the 10/11/2020]

- The population of each of the qualifying features, and,
- The distribution of the qualifying features within the site'.

5.3.21 The following threats and pressures to the integrity of the Humber Estuary SPA have been identified in Natural England's Site Improvement Plan23 or Supplementary Advice on the Conservation Objectives:

- Water pollution
- Coastal squeeze
- Changes in species distributions
- Undergrazing
- Invasive species
- Natural changes to site conditions
- Public access / disturbance
- Fisheries: Fish stocking
- Fisheries: Commercial marine and estuarine
- Direct land take from development
- Air pollution: Impact of atmospheric nitrogen deposition
- Shooting / scaring
- Direct impact from third party
- Inappropriate scrub control

5.3.22 The Humber Estuary SAC is designated for a range of different habitats, providing important roosting and foraging areas for SPA / Ramsar birds. The SAC covers a large area of approx. 36,657.15ha, comprising tidal rivers / estuaries (94.9%), salt marshes (4.4%), coastal sand dunes (0.4%) and bogs / marshes (0.4%). The SAC's key interest feature is its estuary, the second largest coastal plain estuary in the UK. The SAC's high content of suspended sediments is derived from a number of sources, such as marine sediments and eroding boulder clay. In turn, the estuary comprises several other habitats, including Atlantic salt meadows, sand dunes, subtidal sandbanks, mudflats and glasswort beds. Upstream from the Humber Bridge, the estuary is noteworthy for extensive mud and sand bars, forming semi-permanent islands. The SAC supports a range of important fish species, including river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus*.

5.3.23 Annex I habitats that are a primary reason for selection of this site are[24]:

- Estuaries; and
- Mudflats and sandflats not covered by seawater at low tide.

5.3.24 Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site:

- Sandbanks which are slightly covered by sea water all the time;
- Coastal lagoons;
- *Salicornia* and other annuals colonizing mud and sand;
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*);
- Embryonic shifting dunes;
- Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes");
- Fixed coastal dunes with herbaceous vegetation ("grey dunes"); and
- Dunes with *Hippophae rhamnoides.*

5.3.25 Annex II species present as a qualifying feature, but not a primary reason for site selection:

[23] Available at: http://publications.naturalengland.org.uk/publication/5427891407945728 [Accessed on the 10/11/2020]
[24] Available at: https://sac.jncc.gov.uk/site/UK0030170 [Accessed on the 10/11/2020]

- Sea lamprey *Petromyzon marinus;*
- River lamprey *Lampetra fluviatilis;* and
- Grey seal *Halichoerus grypus*.

5.3.26 With regard to the natural habitats and/or species for which the site has been designated (the 'Qualifying Features' listed below), and subject to natural change, the conservation objectives of the SAC[25] are:

5.3.27 Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring;

- The extent and distribution of qualifying natural habitats and habitats of qualifying species;
- The structure and function (including typical species) of qualifying natural habitats;
- The structure and function of the habitats of qualifying species;
- The supporting processes on which qualifying natural habitats and habitats of qualifying species rely;
- The populations of qualifying species; and
- The distribution of qualifying species within the site.

5.3.28 The following threats and pressures to the integrity of the Humber Estuary SAC have been identified in Natural England's Site Improvement Plan[26] or Supplementary Advice on the Conservation Objectives:

- Water pollution;
- Coastal squeeze;
- Changes in species distributions;
- Undergrazing;
- Invasive species;
- Natural changes to site conditions;
- Public access / disturbance;
- Fisheries: Fish stocking;
- Fisheries: Commercial marine and estuarine;
- Direct land take from development;
- Air pollution: Impact of atmospheric nitrogen deposition;
- Shooting / scaring;
- Direct impact from third party; and
- Inappropriate scrub control.

Test of Likely Significant Effects: River Mease SAC

5.3.29 For the Gate 2 study, an investigation has been undertaken into potential hydrological linkages between the River Tame and the River Mease SAC. The underlying geology for the River Mease consists of superficial river terrace deposits overlying the Gunthorpe Member (comprising mudstone). The river terrace deposits allow for more groundwater movement and infiltration of surface water due to their high permeability, whereas the Gunthorpe member has very low permeability. It therefore allows limited amounts of groundwater movement and there is limited infiltration from surface water. Due to the high permeability of the river terrace deposits, it is expected that these deposits will have relatively high hydraulic conductivity and interact with the River Mease, providing baseflow.

[25] Available at: http://publications.naturalengland.org.uk/publication/5009545743040512 [Accessed on the 10/11/2020]
[26] Available at: http://publications.naturalengland.org.uk/publication/5427891407945728 [Accessed on the 10/11/2020]

5.3.30 The accretion data indicate that the Mease does not gain additional baseflow from the superficial aquifer in the Tame surface water catchment at the expense of the River Tame but continues to accrete from baseflow from the superficial aquifer within the Mease surface water catchment. The flows and levels in lower River Mease will therefore not be influenced by changes in River Tame levels via hydraulic continuity with the river terrace gravels secondary aquifer and are therefore not expected to be affected by reduction in discharge at Minworth. Rather river flows are dependent on local recharge to the superficial aquifer and the sandstone principal aquifer in its upper reaches, and upstream discharges.

5.3.31 Moreover, even under the scenario with a 230 Ml/d flow reduction at Minworth (equivalent to both GUC and STT operating at their maximum) the predicted fall in River Trent levels (8.2cm at Q95 and 5.2cm at Q50) is not considered likely to lower groundwater levels in the lower Mease area sufficiently to result in loss of flow to the superficial secondary aquifer, compared to seasonal variation in river levels, aquifer recharge, and the influence of discharges and evaporative losses from former quarry lakes on river levels. Water levels are recorded on the River Trent near the confluence with the River Mease at Croxall. Water levels show a seasonal variation in excess of 1m. Water levels are recorded on the River Tame at Tamworth, upstream of where River Tame water levels may interact with the superficial aquifer considered to be in hydraulic continuity with the lower River Mease. The gauge shows a typical seasonal variation of approximately 0.3m, with occasional brief peaks in excess of 1m higher than the typical range.

5.3.32 Abstractions and discharges local to the site may influence flow and river levels. The Gate 1 assessment identified that there are no significant surface water abstractions near the mouth of the River Mease as it flows into the River Trent. There are five discharge points close to the mouth of the River Mease which are associated with Barton quarry and Alrewas quarry, discharging to the River Tame and River Trent. However, these locally augment flow near the River Mease and may support local groundwater levels in the superficial aquifer and are therefore not expected to reduce flows in the Mease in combination with the Minworth SRO. Since changes in levels and flows in the River Tame will not affect levels and flows in the River Mease SAC, and even the maximum reduction in flow at Minworth would not result in a sufficient fall in River Trent levels to materially affect the superficial aquifer linked to the lower River Mease, it can be concluded that the Minworth SRO will not result in a likely [adverse] significant effect on the River Mease SAC or its qualifying interest features either alone or in combination with other plans and projects.

5.3.33 Moreover, since both white-clawed crayfish and bullhead are species preferring relatively shallow water (as identified in the Supplementary Advice on the Conservation Objectives for River Mease SAC) it is understood that Natural England have an aspiration to reduce flow levels in the River Mease SAC to restore them to a more natural level compatible with its international interest features. This is reflected in the SAC target (associated with the Supplementary Advice on the Conservation Objectives) to '*Restore the natural flow regime of the river, with daily flows as close to what would be expected in the absence of abstractions and discharges (the naturalised flow)'*. As such, it is possible that the planned reduction in flows in the River Mease that will arise from the relocation of the discharge from Packington WTW on the Gilwiskaw Brook out of the River Mease SAC catchment could make a positive contribution to this objective. In the unlikely event that the Minworth SRO contributes to the reduction in flow in the Mease, it would also contribute to this benefit, although any beneficial in-combination effect would be very minor.

Test of Likely Significant Effects: Humber Estuary

5.3.34 Given the separation between the WwTW outfall locations and the Humber Estuary European sites (200km) the only potential impact pathway is whether the Minworth SRO would result in a reduction in water levels in the Humber Estuary SAC or Ramsar site, or upstream of the site, sufficient to disrupt the ability of sea lamprey and river lamprey to travel to and from the SAC/Ramsar site, given that the Humber Estuary SAC and Ramsar site includes approximately 15 km of the River Trent in its tidal reaches between Keadby and the Humber Estuary itself. Upstream dispersion of river and sea lamprey in the River Trent is considered to be severely limited by 2.6m high, 100m broad Cromwell Weir (located on the main River Trent at grid reference SK 80931 61141), which is impassable to both species. However, there is a consented proposal to install two eel passes which would also be passable to lamprey.

5.3.35 The reduction in final treated wastewater discharge could cause a local increase in nutrient concentrations, pH, and water temperature, as the dilution capacity around the outfall site declines; however, water quality modelling (as referenced in Section 2.2) for this Gate 2 exercise has shown that this would not be sufficient to cause a deterioration in WFD status, even in the River Tame. Modelling for this Gate 2 exercise has shown that water quality changes in the River Tame due to reductions in final treated wastewater against moderate Water Framework Directive limits are unlikely in relation to physicochemical pollutants. Increased sedimentation at the locality of the reduced flows is also expected. This could impact on the availability of suitable spawning sites for river and sea lamprey. However, due to the local nature of the impact, likely significant effects are not anticipated.

5.3.36 During operation, the lack of final treated wastewater release on the River Tame would cause reductions in flow and water level which for the Gate 1 environmental assessments were considered to lead to a reduction in extent of wetted habitat at the periphery of the River Tame of less than 5% between Q50 and Q95 flow conditions. Due to the distance between the designated site and the outfall locations (200km) and the anticipated localised impact on flow, geomorphology and water quality, no likely significant effects will arise.

5.3.37 Fish can only migrate upstream if water velocity is equal to or less than the fish's swimming ability. Therefore, fish passage should ensure the water velocity is not greater than the natural stream velocity. It is probable that a reduction in flow would reduce velocities and so the magnitude of this is not considered to pose further passage issues. Changes in depth would, however, potentially affect lamprey passage upstream and thus the Humber Estuary SAC and Ramsar site.

5.3.38 Hydraulic modelling has been undertaken to appraise the combined effects of the Minworth and SLR SROs on fish passability. Hydraulic models have been developed for the River Tame within the study area, and for the River Trent as far downstream as Burton Joyce, slightly upstream of Gunthorpe Weir. For these reaches results have been provided for the Q50 (median) and Q95 (low) flow conditions for Baseline scenario (including 417 Ml/d dry weather flow at Minworth WwTW); Scenario A (115 Ml/d flow reduction at Minworth WwTW); and Scenario B (230 Ml/d flow reduction at Minworth WwTW). A total of 25 weirs or potential barriers were examined.

5.3.39 Three of these barriers have been screened out as posing no likely significant effect on the SAC. These are Site 1, Site 2, and Site 25 (refer to Tame and Trent Environmental Assessment: Appendix B(ii) Aquatic Ecology, AECOM 2022). The first two are located upstream of the discharge and it is deemed variation on the Minworth WwTW would not affect fish passability. In addition to this, there is an eel pass at Site 1 and further fish passes have been proposed (i.e., rock ramp or low-cost baffles). Site 2 is a bridge with flowing river beneath and as such it is not considered to be a barrier. Lastly, Site 25 is a submerged weir on River Blythe where previous hydrological assessment determined that at all flows the weir is drowned out with enough water depth to enable fish passage.

5.3.40 However, results for Site 3 to Site 24 indicate that flow reductions at Minworth WwTW may negatively affect fish passability. This is mainly due to reductions in water depth which are translated on an increment of the head drop at the weirs but also as such drops can also reduce the efficacy of existing fish passes, where present. At these locations, targeted 2D modelling is proposed to unpick the relative effects of the SROs on fish passage. This additional modelling is underway and will further inform the assessment of fish passage, and therefore the HRA, as it becomes available (model results will be presented in the Hydraulic and Hydrological Modelling report referenced in Section 2.1, and subsequent updates as results become available. This will inform further refinement of the fish passage assessment through Gate 3).

5.3.41 Under current circumstances, Cromwell Weir (barrier 24) is impassable to river and sea lamprey even without Minworth SRO and therefore if Crowell Weir is unchanged the Minworth SRO scheme would not result in likely significant effects on passage of sea or river lamprey from the Humber Estuary SAC. However, there is a consented proposal to install two eel passes at Cromwell Weir that would also render it passable to lamprey. Once these fish passes are installed, Cromwell Weir would be passable.

5.3.42 The reduction in water levels due to the SROs is considered to be low (0.02m under low flows, above Cromwell Weir) and at this point the River Trent is level-controlled (by weirs) so potential larger effects are buffered. The risk to fish passage is likely to be low but cannot be entirely dismissed without further investigation, which is on-going at the time of reporting (refer to Hydraulic and Hydrological Modelling report referenced in Section 2.1).

5.3.43 At Gate 2 there is thus a residual risk that the Minworth SRO will affect the ability of sea and river lamprey to travel upstream from the Humber Estuary SAC to breed, once the fish passes at Cromwell Weir have been installed. A conclusion of no likely significant effects requires there to be 'no reasonable scientific doubt'. While case law is clear that this is a lower standard than absolute certainty, it does indicate a high degree of confidence. The aquatic ecology report identifies that to investigate the risk at this weir further 2D modelling at and around the site is recommended and this will also inform any mitigation that may be required. The reference to the potential need for mitigation underlines why a conclusion of 'no likely significant effect' cannot be drawn at this stage since mitigation cannot legally be taken into account at the Test of Likely Significant Effects stage of HRA but only at the later appropriate assessment stage. **As a result, likely significant effects cannot be dismissed without further investigation as part of Gate 3.**

5.3.44 Until the recommended further 2D modelling is undertaken it is not possible to produce a comprehensive appropriate assessment of the SROs. Since there are further stages of scheme design before any scheme were to be consented it is permissible to defer appropriate assessment to a later stage of evidence gathering and scheme development. **Therefore, any appropriate assessment will need to be undertaken at Gate 3 once 2D modelling has been completed and any mitigation devised.** This is procedurally acceptable as the Gate 2 submission does not constitute a formal plan or project.

Other plans and projects

5.3.45 The Conservation of Habitats and Species Regulations (2017 as amended) require that plans are not considered purely in isolation but 'in combination' with other projects and plans. The Minworth SRO is considered integral to the delivery of the STT and GUC SROs. These are subject to separate Gated submission processes and therefore a full in combination assessment will need to be undertake for Gate 3.

5.3.46 Separately the South Lincolnshire Reservoir (SLR) SRO is proposing abstraction of up to 300 Ml/d from the River Trent at East Stoke. This will act in combination with the reduced flows from Minworth to potentially reduce flows further in the River Trent. Therefore, effects of Minworth and SLR on the River Trent, and on the Humber Estuary SAC and Ramsar site and its qualifying features, will need to be considered through HRA at Gate 3. This is dependent upon the WRMPs and Regional Plans, as the Minworth and SLR SROs are likely to be constructed under different timelines for different delivery dates, which are yet to be confirmed.

5.3.47 Changes in levels and flows in the River Tame will not affect levels and flows in the River Mease SAC, and even the maximum reduction in flow at Minworth would not result in a sufficient fall in River Trent levels to materially affect the superficial aquifer linked to the lower River Mease. This will remain the case irrespective of other plans and projects. Even without detailed knowledge of the other components of the STT or GUC transfer SROs it can therefore be concluded that the Minworth SRO will not result in a likely [adverse] significant effect on the River Mease SAC or its qualifying interest features either alone or in combination with other plans and projects. Moreover, since both white-clawed crayfish and bullhead are species preferring relatively shallow water (as identified in the Supplementary Advice on the Conservation Objectives for River Mease SAC) Natural England have an aspiration to reduce flow levels in the River Mease SAC to restore them to a more natural level compatible with its international interest features and it is possible that the Minworth SRO could make a minor positive contribution to this objective when considered in combination with the planned reduction in flows in the River Mease that will arise from the Environment Agency's intention to relocate the discharge from Packington WTW on the Gilwiskaw Brook out of the River Mease SAC catchment, although any beneficial in combination effect will be very minor.

5.3.48 Since it is not possible to dismiss effects on fish (lamprey) passage up from the Humber Estuary SAC due to Minworth and SLR SROs alone it is also not possible to dismiss them in combination with other projects and plans that might also result in a reduction in levels at structures from Cromwell Weir upstream. This will therefore need to be investigated more fully in the Appropriate Assessment for Minworth SRO Gate 3 submission once the 2D modelling (and devising of any necessary mitigation) for Minworth SRO are completed.

Conclusion

5.3.49 In conclusion, no likely significant effect will arise on any European sites from the STT Avon pipeline, and the further investigations and modelling undertaken regarding the River Mease SAC has supported a conclusion of no likely significant effect on the River Mease SAC either alone or in combination with other projects and plans. However, while the impact of the Minworth and SLR SROs on fish passage over Cromwell Weir is likely to be low a likely significant effect cannot be dismissed once the improved fish passes at Crowell Weir are installed. As such, an appropriate assessment will need to be undertaken at Gate 3 once 2D modelling has been completed and any mitigation devised. This will include an in-combination assessment to include the effects of the SLR SRO, and other plans and projects should they arise.

5.3.50 Changes in levels and flows in the River Tame will not affect levels and flows in the River Mease SAC, and even the maximum reduction in flow at Minworth would not result in a sufficient fall in River Trent levels to materially affect the superficial aquifer linked to the lower River Mease. This will remain the case irrespective of other plans and projects. Even without detailed knowledge of the other components of the STT or GUC transfer SROs it can therefore be concluded that the Minworth SRO will not result in a likely [adverse] significant effect on the River Mease SAC or its qualifying interest features either alone or in combination with other plans and projects. Moreover, since both white-clawed crayfish and bullhead are species preferring relatively shallow water (as identified in the Supplementary Advice on the Conservation Objectives for River Mease SAC) Natural England have an aspiration to reduce flow levels in the River Mease SAC to restore them to a more natural level compatible with its international interest features and it is possible that the Minworth SRO could make a minor positive contribution to this objective when considered in combination with the planned reduction in flows in the River Mease that will arise from the EA's intention to relocate the discharge from Packington WTW from the Gilwiskaw Brook and River Mease SAC catchment, although any beneficial in combination effect is considered likely to be minor.

5.3.51 Since it is not possible to dismiss effects on fish (lamprey) passage up the River Trent from the Humber Estuary SAC due to the Minworth and SLR SROs alone, it is also not possible to dismiss them in combination with other projects and plans that might also result in a reduction in levels at structures from Cromwell Weir upstream. This will therefore need to be investigated more fully in the Appropriate Assessment for Minworth SRO Gate 3 submission once the 2D modelling (and devising of any necessary mitigation) for Minworth SRO are completed.

5.4 Water Framework Directive (WFD) Assessment

5.4.1 The Water Framework Directive Assessment is presented in full in Appendix I (Annex B4 WFD), and a summary of conclusions and recommendations is provided in Section 6.3 of this report. The WFD assessment is summarised below.

ACWG Level 1 Screening

Introduction

5.4.2 Level 1 screening within ACWG assessment was undertaken for each of the four flow scenarios for the Minworth SRO, these include:

List of relevant water bodies, the WFD water bodies included within the assessment template as outlined in the methodology

Level 1 activities selected for construction and operational activities.

5.4.3 The result of the Level 1 assessment is a summary spreadsheet that is generated within the ACWG template. This template confirms which water bodies should be taken forward for a Level 2 assessment. The following assessment spreadsheets have been generated:

- The ACWG assessment for the 57 Ml/d option at Level 1 was generated in the file “WFD Annex 3 Minworth 57Mld.xlsm”.
- The ACWG assessment for the 115 Ml/d option at Level 1 was generated in the file “WFD Annex 3 Minworth 115Mld.xlsm”.
- The ACWG assessment for the 172 Ml/d option at Level 1 was generated in the file “WFD Annex 3 Minworth 172Mld.xlsm”.
- The ACWG assessment for the 230 Ml/d option at Level 1 was generated in the file “WFD Annex 3 Minworth 230Mld.xlsm”.

5.4.4 Specific tributaries of the Rivers Tame and Trent, namely the River Blythe (Tame) and River Mease (Trent), have been the subject of other assessment topics. While the corresponding WFD water bodies (GB104028042572 Blythe from Patrick Bridge to R Tame; GB104028046560 Mease from Hooborough Brook to Trent) have the potential to be affected by the SRO schemes at their downstream ends, impacts at the water body scale have been scoped out of this Gate 2 WFD assessment. Reference should be made to other assessment reports as referenced in the main Environmental Assessment Report, to which this WFD report forms an appendix.

Minworth 57 Ml/d scheme option

5.4.5 For the Minworth 57 Ml/d scheme the watercourses included within the Level 1 assessment were those with a flow pathway of influence within the River Trent catchment, extending from the outfall of Minworth WWTW on the River Tame to the confluence of the River Trent with the River Derwent.

Minworth 57 Ml/d scheme Level 1 water bodies within assessment

5.4.6 Water bodies included within the Level 1 assessment with the potential to be impacted by a “Decommissioning” activity stated as “Cessation of flow to a watercourse” resulting from a transfer of 57 Ml/d at Minworth WWTW were:

- GB104028046841, Tame - R Rea to R Blythe;
- GB104028046440, Tame from R Blythe to River Anker;
- GB104028047050, Tame from River Anker to River Trent;
- GB104028047180, Trent - R Tame to R Dove; and
- GB104028047420, Trent from Dove to Derwent.

Water bodies and activities not passed forward from Minworth 57 Ml/d Level 1 assessment

5.4.7 For the Minworth 57 Ml/d scheme option there were no water bodies that were not passed forward to the Level 2 assessment.

Water bodies and activities passed forward from Minworth 57 Ml/d Level 1 assessment

5.4.8 The water bodies included within the Level 1 assessment that would be impacted by a "Decommissioning" activity stated as "Cessation of flow to a watercourse" resulting from a transfer of 57 Ml/d were:

- GB104028046841, Tame - R Rea to R Blythe;
- GB104028046440, Tame from R Blythe to River Anker;
- GB104028047050, Tame from River Anker to River Trent;
- GB104028047180, Trent - R Tame to R Dove; and
- GB104028047420, Trent from Dove to Derwent.

Minworth 115 Ml/d scheme option

5.4.9 For the Minworth 115 Ml/d scheme the watercourses included within the Level 1 assessment were those with a flow pathway of influence within the River Trent catchment, extending from the outfall of Minworth WwTW on the River Tame to the confluence of the River Trent with the River Derwent.

Minworth 115 Ml/d scheme Level 1 water bodies within assessment

5.4.10 Water bodies included within the Level 1 assessment with the potential to be impacted by a "Decommissioning" activity stated as "Cessation of flow to a watercourse" resulting from a transfer of 115 Ml/d at Minworth WWTW were:

- GB104028046841, Tame - R Rea to R Blythe;
- GB104028046440, Tame from R Blythe to River Anker;
- GB104028047050, Tame from River Anker to River Trent;
- GB104028047180, Trent - R Tame to R Dove; and
- GB104028047420, Trent from Dove to Derwent.

STT Pipeline to River Avon

5.4.11 The SST pipeline route from Minworth WwTW to the River Avon was also assessed at Level 1. The proposed SST transfer pipeline route is currently planned to cross the following water bodies (grid references of crossing points given in brackets):

- GB104028042420, Cole from Hatchford – Kingshurst Brook to R Blythe water Body ([redacted]);
- GB104028042572, Blythe from Patrick Bridge to R Tame Water Body ([redacted];
- GB109054044520, Canley Bk - source to conf with Finham Bk water Body ([redacted]; and
- GB109054044480, Finham Bk - conf Canley Bk to conf R Sowe water Body [redacted]);

5.4.12 With the end of the pipeline culminating in a newly constructed outfall on the River Avon (Warks) - conf R Sowe to conf R Leam Water Body ([redacted], discharge destination).

Water bodies and activities not passed forward from Minworth 115 Ml/d Level 1 assessment

5.4.13 All proposed watercourse crossings for the STT transfer (pipeline to the River Avon) were assessed using the ACWG methodology, with none scoring greater than "1" during the Level 1 assessment. As a

result, none of these crossings passed to Level 2. The following assumptions for the Level 1 assessment are applicable:

- It is assumed that bedding material for any pipelines will be constructed such that they do not form preferential pathways for groundwater flow;
- It is 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 restored to its natural state; and,
- A flood risk assessment will be carried out to ensure that new in channel features will not adversely impact on flood risk.

Water bodies and activities passed forward from Minworth 115 Ml/d Level 1 assessment

5.4.14 The Level 1 assessment identified five WFD water bodies within the 115 Ml/d Minworth scheme that should be passed forward from Level 1 to Level 2 for further assessment, these were:

- GB104028046841, Tame - R Rea to R Blythe;
- GB104028046440, Tame from R Blythe to River Anker;
- GB104028047050, Tame from River Anker to River Trent;
- GB104028047180, Trent - R Tame to R Dove; and
- GB104028047420, Trent from Dove to Derwent.

Minworth 172 Ml/d scheme option

5.4.15 For the Minworth 172 Ml/d scheme the watercourses included within the Level 1 assessment were those with a flow pathway of influence within the River Trent catchment, extending from the outfall of Minworth WWTW on the River Tame to the confluence of the River Trent with the River Derwent.

Minworth 172 Ml/d scheme Level 1 water bodies within assessment

5.4.16 Water bodies included within the Level 1 assessment with the potential to be impacted by a “Decommissioning” activity stated as “Cessation of flow to a watercourse” resulting from a transfer of 172 Ml/d at Minworth WWTW were:

- GB104028046841, Tame - R Rea to R Blythe;
- GB104028046440, Tame from R Blythe to River Anker;
- GB104028047050, Tame from River Anker to River Trent;
- GB104028047180, Trent - R Tame to R Dove; and
- GB104028047420, Trent from Dove to Derwent.

Water bodies and activities not passed forward from Minworth 172 Ml/d Level 1 assessment

5.4.17 For the Minworth 172 Ml/d scheme option there were no water bodies that were not passed forward to the Level 2 assessment.

Water bodies and activities passed forward from Minworth 172 Ml/d Level 1 assessment

5.4.18 The water bodies included within the Level 1 assessment that would be impacted by a “Decommissioning” activity stated as “Cessation of flow to a watercourse” resulting from a transfer of 172 Ml/d were:

- GB104028046841, Tame - R Rea to R Blythe;
- GB104028046440, Tame from R Blythe to River Anker;
- GB104028047050, Tame from River Anker to River Trent;
- GB104028047180, Trent - R Tame to R Dove; and

- GB104028047420, Trent from Dove to Derwent.

Minworth 230 Ml/d scheme option

Minworth 230 Ml/d scheme Level 1 water bodies within assessment

5.4.19 Water bodies included within the Level 1 assessment with the potential to be impacted by a "Decommissioning" activity stated as "Cessation of flow to a watercourse" resulting from a transfer of 230 Ml/d at Minworth WWTW were:

- GB104028046841, Tame - R Rea to R Blythe;
- GB104028046440, Tame from R Blythe to River Anker;
- GB104028047050, Tame from River Anker to River Trent;
- GB104028047180, Trent - R Tame to R Dove; and
- GB104028047420, Trent from Dove to Derwent.

Water bodies and activities not passed forward from Minworth 230 Ml/d Level 1 assessment

5.4.20 For the Minworth 230 Ml/d scheme option there were no water bodies that were not passed forward to the Level 2 assessment.

Water bodies and activities passed forward from Minworth 230 Ml/d Level 1 assessment

5.4.21 The water bodies included within the Level 1 assessment that would be impacted by a "Decommissioning" activity stated as "Cessation of flow to a watercourse" resulting from a transfer of 230 Ml/d were:

- GB104028046841, Tame - R Rea to R Blythe;
- GB104028046440, Tame from R Blythe to River Anker;
- GB104028047050, Tame from River Anker to River Trent;
- GB104028047180, Trent - R Tame to R Dove; and
- GB104028047420, Trent from Dove to Derwent.

ACWG Level 2 Assessment

Introduction

5.4.22 A Level 2 assessment was undertaken for each of the four flow scenarios for the Minworth SRO. This including completing an assessment for each potentially impacted water body included within the flow scenario.

5.4.23 Within each of the four flow scenarios, all five water bodies were assigned the "cessation of existing discharge to a watercourse" Level 2 activity, which is in the "decommissioning" category.

5.4.24 Following the assignment of the activity, the potential impacts of the activity were also identified, and these are referenced within the subsequent Level 2 assessment. With reference to the "cessation of existing discharge to a watercourse", the following were identified as potential impacts:

- Changes to channel footprint;
- Changes in flow velocity and volume (increase or decrease);
- Changes in sedimentation deposition;
- Changes to water body hydromorphology leading to changes in river processes and habitats upstream and downstream; and
- Change in water quality due to new or changes to existing discharge of surface water into surface water body.

5.4.25 Following on from this, a Level 2 template was completed for each water body included within the flow scenario. The purpose was to identify the potential impacts to WFD elements specific to each water body that may be caused by the activity.

- The ACWG assessment for the 57 Ml/d option at Level 2 was generated in the file "WFD Annex 3 Minworth 57Mld.xlsm".
- The ACWG assessment for the 115 Ml/d option at Level 2 was generated in the file "WFD Annex 3 Minworth 115Mld.xlsm".
- The ACWG assessment for the 172 Ml/d option at Level 2 was generated in the file "WFD Annex 3 Minworth 172Mld.xlsm".
- The ACWG assessment for the 230 Ml/d option at Level 2 was generated in the file "WFD Annex 3 Minworth 230Mld.xlsm".

Hydro-Ecological Modelling Results

5.4.26 Flow data and macroinvertebrate community data was extracted from the EA Hydrology Data Explorer and EA Ecology & Fish Data Explorer respectively for use with the HEM tool. A total of six sites downstream of the Minworth discharge were used with the HEM tool to create site-specific hydroecological models. Three scenarios with flow reductions of 115 ML/d (scenario 1), 230 ML/d (scenario 2) and 417 ML/d (scenario 3) were modelled – the latter a hypothetical scenario based on the total Dry Weather Flow (DWF) from Minworth Wastewater Treatment Works (WWTW).

5.4.27 HEM model significance, the ecological classification, and the contributing biological elements' WFD status of the most recent publicly available WFD assessment, the 2019 status, for the WFD water bodies comprising the Rivers Tame and Trent within the study area (excluding the furthest downstream WFD water body) are presented in Table 6-1 in Appendix I.

5.4.28 Whilst the model developed for site TA2 appears highly significant, the invertebrate data demonstrates substantial water quality pressures influencing the macroinvertebrate community and a strong correlation exists between LIFE and both WHPT-ASPT and WHPT-NTAXA OE values. Consequently, the model developed between LIFE O:E values and flow may be coincidental and spurious, and the model outcomes are considered unreliable.

5.4.29 The majority of the remaining models were found to not be significant, and that macroinvertebrate LIFE scores could not be modelled from flow data. This indicates that other factors, such as water quality, river morphology and/or habitat quality, are significantly greater pressures and thus are substantially more influential on the resident macroinvertebrate community than flow. This is further reinforced by the reasons for not achieving good (RNAG) reported for the tabulated WFD water bodies on the EA Catchment Data Explorer website and detailed in the Environmental Assessment for the Trent Strategic Resource Options Appendix B(ii): Aquatic Ecology[27].

5.4.30 Briefly, the RNAGs include, but are not limited to, urbanisation of the watercourse resulting in physical modification and diffuse pollution, point source intermittent sewage discharge and continuous sewage discharge from waste water treatment, poor livestock management resulting in diffuse pollution, and transport drainage resulting in diffuse pollution.

5.4.31 Consequently, any reduction in discharge from Minworth is unlikely to result in a decrease in WFD water body status for those sites with non-significant models given the overall ecological status is being driven by such factors and may actually benefit the resident aquatic ecological communities by reducing a source of nutrient input (pending the results of on-going water quality modelling).

5.4.32 The model resulting from HEM analysis of site LT4 was significant, and the scenarios modelled demonstrated minimal difference from the historic model, indicating any reduction in discharge from Minworth is unlikely to result in a decrease in WFD status in the River Trent at this point (WFD water body GB104028053110).

[27] Environmental Assessment for the Trent Strategic Resource Options (SRO): Minworth SRO and South Lincolnshire Reservoir (SLR) SRO: Results and Recommendations. Report to Affinity Water, Anglian Water Services Ltd and Severn Trent Water Ltd. REP-003_Summary Report. April 2022 [And supporting Technical Appendices]

5.4.33 Three of the six WFD water bodies presented in Appendix I have overall WFD Ecological Classifications defined by the macrophyte & phytobenthos biological sub-element, which is in part derived using the River Macrophyte Nutrient Index (RMNI) - a metric designed to reflect the nutrient condition of the watercourse in which the surveyed macrophyte community grows – alongside measures of diversity and cover of green filamentous algae. A further metric designed to link aquatic macrophyte community data to antecedent flow conditions in UK waters is the River Macrophyte Hydraulic Index (RMHI). RMHI taxon scores range from 1 for rheophilic indicators to 9.82 for taxa adapted for lentic conditions.

5.4.34 Investigation of the EA Ecology & Fish Data Explorer revealed the EA monitoring location closest to the Minworth discharge with recent (i.e., within five years) macrophyte survey data was EA site 52917 (AECOM site TA6), located at gird reference SK 18790 13953 near Alrewas. The site was last surveyed in 2018, and the resulting taxa list with their associated RMNI and RMHI scores are presented in Appendix I.

5.4.35 The results demonstrate that the macrophyte community is substantially adjusted towards lentic conditions, indicated by the majority of recorded taxa possessing RMHI scores greater than 7 and all taxa with RMHI scores more than 5. Consequently, any reduction in flow velocity due to a decrease in the Minworth discharge is highly unlikely to adversely affect the macrophyte community. In fact, a decrease in nutrient enrichment is likely to benefit the macrophyte community and allow a greater diversity of species to flourish, with subsequent improvements additionally benefitting both macroinvertebrates and fish by diversifying available habitat.

5.4.36 Analysis of AECOM macrophyte survey data on the River Tame (sites TA2 and TA4; see AECOM report Trent Strategic Resource Options Aquatic Ecology Monitoring: Annex B1) downstream of the Minworth discharge (Appendix I) reveals a similar outcome. The surveyed macrophyte communities reflect generally slow-flowing conditions, indicated by the majority of recorded taxa possessing RMHI scores greater than 7 and all taxa with RMHI scores more than 5. Consequently, a decrease in flow velocity is also unlikely to result in an adverse effect on the macrophyte communities at these locations and may benefit the communities for the same reason explained above.

Minworth 57 Ml/d scheme option Level 2 output

5.4.37 The watercourses included within the Level 2 assessment for the 57 Ml/d scheme option were:

- GB104028046841, Tame - R Rea to R Blythe
- GB104028046440, Tame from R Blythe to River Anker
- GB104028047050, Tame from River Anker to River Trent
- GB104028047180, Trent - R Tame to R Dove
- GB104028047420, Trent from Dove to Derwent.

5.4.38 Output from the ACWG Level 2 assessment for the 57 Ml/d flow scenario from Minworth SRO is illustrated below in Figure 5-1 below.

Waterbody ID	Waterbody Name	Maximum Level 2 Impact score	Confidence in WFD data	Confidence in option design
GB104028046841	Tame - R Rea to R Blythe	0	High	Moderate
GB104028046440	Tame from R Blythe to River Anker	0	High	Moderate
GB104028047050	Tame from River Anker to River Trent	0	High	Moderate
GB104028047180	Trent - R Tame to R Dove	0	High	Moderate
GB104028047420	Trent from Dove to Derwent	0	High	Moderate

Figure 5-1. Output from the ACWG Level 2 assessment for the 57 Ml/d flow scenario from Minworth SRO

5.4.39 The assessment suggested that the transfer of 57 Ml/d flow from Minworth WwTW would have an impact score of "0" for all of the water bodies. Therefore, it is suggested that it would be compliant with WFD status and objectives for all water bodies.

5.4.40 Confidence in the 57 Ml/d flow option was suggested to be "moderate" for all watercourses.

5.4.41 Confidence in WFD quality element data (labelled WFD data) was "high" for all water bodies

Minworth 115 Ml/d scheme option Level 2 output

5.4.42 The watercourses included within the Level 2 assessment for the 115 Ml/d scheme option were:

- GB104028046841, Tame - R Rea to R Blythe
- GB104028046440, Tame from R Blythe to River Anker
- GB104028047050, Tame from River Anker to River Trent
- GB104028047180, Trent - R Tame to R Dove
- GB104028047420, Trent from Dove to Derwent.

5.4.43 The output of the Level 2 assessment for 115 Ml/d flow transfer from Minworth WwTW is illustrated in Figure 5-2 below.

Waterbody ID	Waterbody Name	Maximum Level 2 Impact score	Confidence in WFD data	Confidence in option design
GB104028046841	Tame - R Rea to R Blythe	1	Moderate	Moderate
GB104028046440	Tame from R Blythe to River Anker	1	Moderate	Moderate
GB104028047050	Tame from River Anker to River Trent	1	Moderate	Moderate
GB104028047180	Trent - R Tame to R Dove	0	High	Moderate
GB104028047420	Trent from Dove to Derwent	0	High	Moderate

Figure 5-2: Output from the ACWG Level 2 assessment for the 115 Ml/d flow scenario from Minworth SRO

5.4.44 The assessment suggested that the transfer of 115 Ml/d flow from Minworth WwTW had an impact score "1" on the Tame - R Rea to R Blythe (GB104028046841), Tame from R Blythe to River Anker (GB104028046440), and Tame from River Anker to River Trent (GB104028047050). The WFD quality elements responsible for an impact score of "1" are highlighted below:

- Tame - R Rea to R Blythe (GB104028046841) – Hydrological regime
- Tame from R Blythe to River Anker (GB104028046440) – Hydrological regime
- Tame from River Anker to River Trent (GB104028047050) - Hydrological regime

5.4.45 All WFD quality elements scoring "1" were uncertain for a deterioration in status class, possible impediment to GES or GEP, and possible compromise to water body objectives.

5.4.46 Confidence in the flow option was suggested to be "moderate" for all watercourses.

5.4.47 Confidence in WFD quality element data (labelled WFD data) was "high" for the Trent - R Tame to R Dove (GB104028047180) and the Trent from Dove to Derwent (GB104028047420). Most WFD quality elements in the Tame - R Rea to R Blythe (GB104028046841), the Tame from R Blythe to River Anker (GB104028046440), and the Tame from River Anker to River Trent (GB104028047050) attained "high" confidence, but all three waterbodies have "moderate" data confidence due to hydrological regime.

Minworth 172 Ml/d scheme option Level 2 output

5.4.48 The watercourses included within the Level 2 assessment for the 172 Ml/d scheme option were:

- GB104028046841, Tame - R Rea to R Blythe
- GB104028046440, Tame from R Blythe to River Anker

- GB104028047050, Tame from River Anker to River Trent
- GB104028047180, Trent - R Tame to R Dove
- GB104028047420, Trent from Dove to Derwent.

5.4.49 The output of the Level 2 assessment for 172 Ml/d flow transfer from Minworth WwTW is illustrated in Figure 5-3 below.

Waterbody ID	Waterbody Name	Maximum Level 2 Impact score	Confidence in WFD data	Confidence in option design
GB104028046841	Tame - R Rea to R Blythe	1	Moderate	Moderate
GB104028046440	Tame from R Blythe to River Anker	1	Moderate	Moderate
GB104028047050	Tame from River Anker to River Trent	1	Moderate	Moderate
GB104028047180	Trent - R Tame to R Dove	0	High	Moderate
GB104028047420	Trent from Dove to Derwent	0	High	Moderate

Figure 5-3: Output from the ACWG Level 2 assessment for the 172 Ml/d flow scenario from Minworth SRO

5.4.50 The assessment suggested that the transfer of 172 Ml/d flow from Minworth WwTW had an impact score “1” on the Tame - R Rea to R Blythe (GB104028046841), Tame from R Blythe to River Anker (GB104028046440), and Tame from River Anker to River Trent (GB104028047050). The WFD quality elements responsible for an impact score of “1” are highlighted below:

- Tame - R Rea to R Blythe (GB104028046841) – Hydrological regime
- Tame from R Blythe to River Anker (GB104028046440) – Fish and Hydrological regime
- Tame from River Anker to River Trent (GB104028047050) - Hydrological regime

5.4.51 All WFD quality elements scoring “1” were uncertain for a deterioration in status class, possible impediment to GES or GEP, and possible compromise to water body objectives.

5.4.52 Confidence in the 172 Ml/d flow option was suggested to be “moderate” for all watercourses.

5.4.53 Confidence in WFD quality element data (labelled WFD data) was “high” for the Trent - R Tame to R Dove (GB104028047180) and the Trent from Dove to Derwent (GB104028047420). Most WFD quality elements in the Tame - R Rea to R Blythe (GB104028046841), the Tame from R Blythe to River Anker (GB104028046440), and the Tame from River Anker to River Trent (GB104028047050) attained “high” confidence, but all three waterbodies have “moderate” data confidence due to hydrological regime.

Minworth 230 Ml/d scheme option Level 2 output

The watercourses included within the Level 2 assessment for the 230 Ml/d scheme option were:

- GB104028046841, Tame - R Rea to R Blythe
- GB104028046440, Tame from R Blythe to River Anker
- GB104028047050, Tame from River Anker to River Trent
- GB104028047180, Trent - R Tame to R Dove
- GB104028047420, Trent from Dove to Derwent.

5.4.54 The output of the Level 2 assessment for 230 Ml/d flow transfer from Minworth WwTW is illustrated in Figure 5-4 below.

Waterbody ID	Waterbody Name	Maximum Level 2 Impact score	Confidence in WFD data	Confidence in option design
GB104028046841	Tame - R Rea to R Blythe	1	Moderate	Moderate
GB104028046440	Tame from R Blythe to River Anker	1	Moderate	Moderate
GB104028047050	Tame from River Anker to River Trent	1	Moderate	Moderate
GB104028047180	Trent - R Tame to R Dove	0	High	Moderate
GB104028047420	Trent from Dove to Derwent	0	High	Moderate

Figure 5-4: Output from the ACWG Level 2 assessment for the 230 Ml/d flow scenario from Minworth SRO

5.4.55 The assessment suggested that the transfer of 230 Ml/d flow from Minworth WwTW had an impact score "1" on the Tame - R Rea to R Blythe (GB104028046841), Tame from R Blythe to River Anker (GB104028046440), and Tame from River Anker to River Trent (GB104028047050). The WFD quality elements responsible for an impact score of "1" are highlighted below:

- Tame - R Rea to R Blythe (GB104028046841) – Hydrological regime
- Tame from R Blythe to River Anker (GB104028046440) – Hydrological regime
- Tame from River Anker to River Trent (GB104028047050) - Hydrological regime

5.4.56 All WFD quality elements scoring "1" were uncertain for a deterioration in status class, possible impediment to GES or GEP, and possible compromise to water body objectives.

5.4.57 Confidence in the 230 Ml/d flow option was suggested to be "moderate" for all watercourses.

5.4.58 Confidence in WFD quality element data (labelled WFD data) was "high" for the Trent - R Tame to R Dove (GB104028047180) and the Trent from Dove to Derwent (GB104028047420). Most WFD quality elements in the Tame - R Rea to R Blythe (GB104028046841), the Tame from R Blythe to River Anker (GB104028046440), and the Tame from River Anker to River Trent (GB104028047050) attained "high" confidence, but all three waterbodies have "moderate" data confidence due to hydrological regime.

RNAG Assessment

5.4.59 The RNAG assessment has been completed for the 230 Ml/d scenario only, on the basis that the full assessment will be completed at Gate 3 once further assessments of fish passage and water quality have been completed.

5.4.60 The RNAG assessment for WFD water bodies at the 230 Ml/d scenario is as follows:

GB104028046841 Tame – R Rea to R Blythe

5.4.61 The only RNAG measure with the potential to be impacted by the scheme is the Zinc WFD quality element (other chemicals). Zinc is present in the Minworth effluent at an annual mean of 17.6 µg/l, which exceeds the EQS of 12.3 µg/l (bioavailable); however, zinc is present in the River Tame at a bioavailable mean of 30 µg/l. Therefore, a reduction in effluent discharge from Minworth would reduce zinc input into the River Tame, and this has the potential to assist the attainment of water body objectives. However, at the same time the level of dilution of existing zinc concentrations in the River Tame would reduce and there would be the potential for zinc concentrations to increase as a result – a maximum increase of 0.57% from baseline conditions as shown by water quality modelling.

5.4.62 It is recommended that the RNAG assessment is updated once further assessment of zinc has been completed at Gate 3; however, the assessment has been included in the WFD matrix for the 230 Ml/d scenario.

GB104028046440 Tame from R Blythe to River Anker

5.4.63 Dissolved oxygen has the potential to be affected by the cumulative effects of reduced discharge and climate change. This represents an RNAG measure in relation to 'industry' and 'urban and transport' categories for pollution from towns, cities, and transport, and physical modifications.

5.4.64 Dissolved oxygen has not been assessed as a potential WFD deterioration following the results of current water quality modelling; however, there is a recommendation for this to be refined at Gate 3 to take into consideration the cumulative effects of climate change on temperature and reduced flows. There is uncertainty as to whether effects on dissolved oxygen would compromise water body objectives until the results of further assessment and modelling are available; therefore, this has been assessed in the RNAG assessment as a Low impact with Medium data confidence and will be refined further at Gate 3.

GB104028047050 Tame from River Anker to River Trent, GB104028047180 Trent – R Tame to R Dove, and GB104028047420 Trent from Dove to Derwent

5.4.65 The RNAG assessment for the remaining WFD water bodies concludes that no RNAG measures have the potential to be impacted by the SRO scheme.

5.5 Natural Capital Assessment

5.5.1 A six capitals approach is an extension to the conventional financial approach to thinking about the impacts and dependencies of decisions. The approach can help organisations become more sustainable and resilient by considering value in the broadest sense. This can support better potential management of the economic, environmental, and social impacts of proposed schemes. AECOM's six capitals approach is built around a framework of assets, flows and values. It follows the four stages outlined in the Capitals Coalition's 'Natural Capital Protocol' and 'Social and Human Capital Protocol'. The assessment adopts an integrated six capitals approach which recognises natural, social, human, intellectual, manufactured, and financial capital.

5.5.2 This assessment was undertaken based on the expected impacts and dependencies across the six capitals, which include benefits and costs as a result of the implementation of the SROs. Following the Natural Capital Protocol's broad stages, the assessment aims to compare the present value costs and benefits across four scenarios to ultimately select a preferred and best- value scenario based on its net benefit.

5.5.3 In the first instance the scope of the assessment was identified, including defining the spatial and temporal scope of the assessment as well as the four different scenarios to be included:

- Scenario 0 – 'Do nothing': the no-change scenario
- Scenario 1 – STT/GUC Transfer 57Ml/d: 57 Ml/d flow reduction diverted from Minworth and associated mitigation actions;
- Scenario 2 – STT/GUC Transfer 115Ml/d: 115 Ml/d flow reduction diverted from Minworth and associated mitigation actions;
- Scenario 3 – Combined Transfer 172Ml/d (Scenarios 1 and 2 combined): 172 Ml/d flow reduction diverted from Minworth and associated mitigation actions;
- Scenario 4 - Combined Transfer 230Ml/d: 230 Ml/d flow reduction diverted from Minworth and associated mitigation actions

5.5.4 The impacts and/or dependencies on the six capitals included in this assessment were based on the materiality assessment undertaken under the Environmental Assessment for the Trent Strategic Resource Options (SRO)[28] This was informed by Gate 1 data and reports as well as working closely with other disciplines to incorporate the results of their respective assessments. The materiality assessment consisted of a qualitative scoring exercise which identified five impacts on the six capitals as being materially affected by the four scenarios, as follows:

Natural Capital

- Global climate regulation
- Water quality
- Recreation
- Biodiversity

Financial Capital

- OPEX

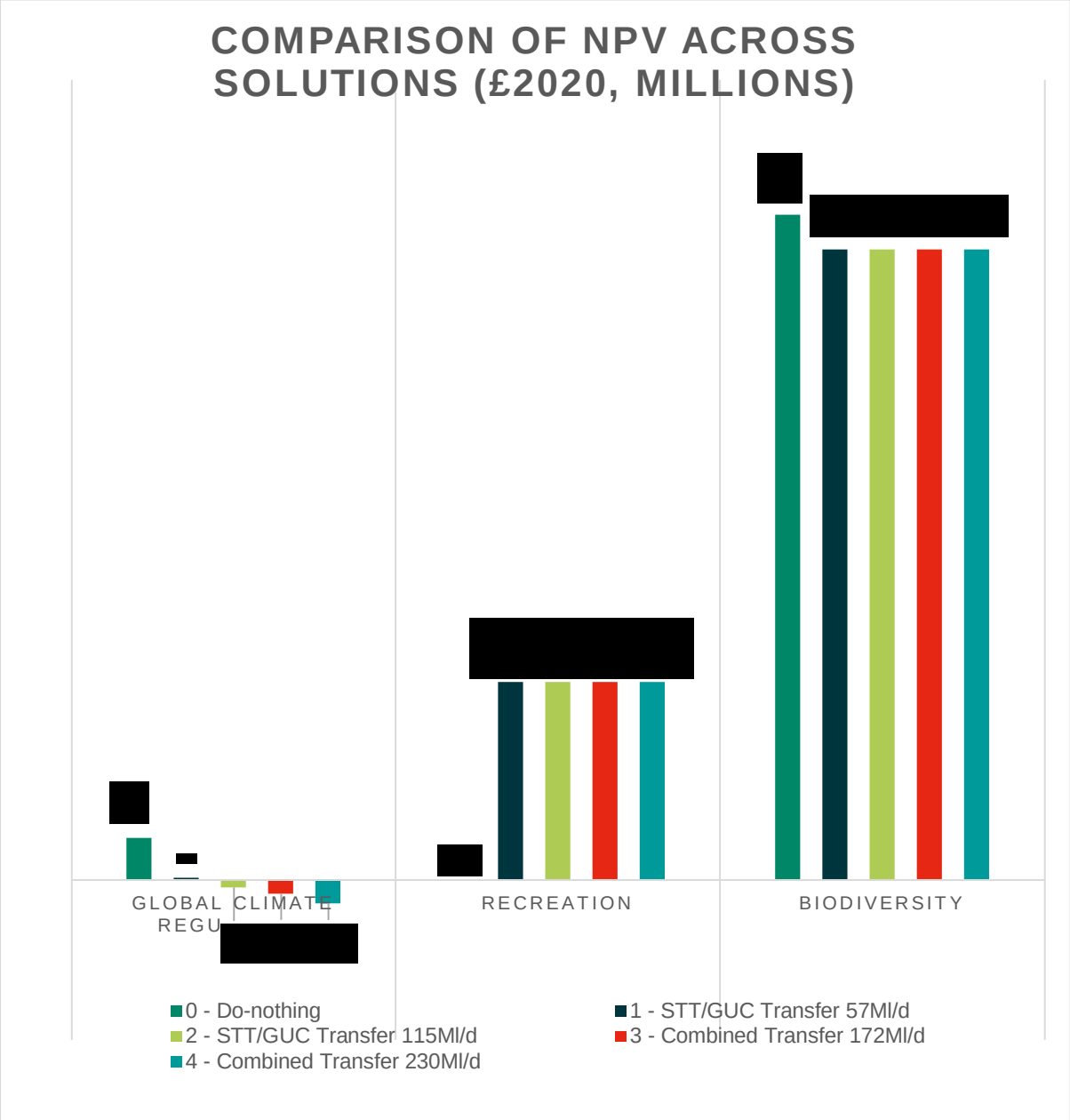
5.5.5 A summary of the results from the assessment of material impacts is presented for each scenario in Table 5-5 and Figure 5-5 below. All values are presented in present value terms over a 30-year time horizon, using a 3.5% declining discount rate and adjusted to 2020 prices.

[28] Environmental Assessment for the Trent Strategic Resource Options (SRO): Minworth SRO and South Lincolnshire Reservoir (SLR) SRO: Appendix F: Non-Water Resources Benefits - Natural Capital and Biodiversity Net Gain Assessment. Report to Affinity Water, Anglian Water Services Ltd and Severn Trent Water Ltd. (AECOM, May 2022).

Table 5-5: Summary results from the assessment (present value; 30 years; £2020, millions)

Option				Estimated Present Value (30 years, £milion)				
Code	**Natural Capital**	**Value Type**	**Confidence**	0 - Do-nothing	1 - STT/GUC Transfer 57Ml/d	2 - STT/GUC Transfer 115Ml/d	3 - Combined Transfer 172Ml/d	4 - Combined Transfer 230Ml/d
NC 13	Global climate regulation			[redacted]				
NC 13a	*Land use change*	External	Moderate					
NC 13b	*Construction and operation*	Private	Low					
NC 21	Recreation	External	Low					
NC 25	Biodiversity	External	Moderate					
	Net Present Value (£2020 millions)							
	Net Impact (£2020 millions)							
	Change in value relative to Do Nothing							

Figure 5-5: Summary of results from the assessment (present value; 30 years; £2020, millions)



5.5.6 The quantification and valuation of each of the material impacts were based on data regarding physical and monetary flows which are presented using impact pathway diagrams in the Environmental Assessment for the Trent Strategic Resource Options (SRO) report (Section 4.4)[29].

5.5.7 The results from this assessment were used and refined to account for the four different scenarios above as well as updated data. In particular, the capital cost associated with each scenario was added to the assessment based on the recent Cost and Carbon report from Jacobs.

5.5.8 In considering the five material impacts above, water quality was ultimately scoped out. Although the recent WFD assessment showed that five downstream WFD waterbodies could be impacted by abstraction and discharge points and passed forward from Level 1 to Level 2 assessment, no deterioration or improvement within any waterbodies was expected under Scenarios 2 and 3. Some possible deterioration in the status of three waterbodies has been flagged under Scenarios 4 and 5 due to uncertainty of supporting data in relation to Hydrological Regime and Fish WFD supporting elements – however, any deterioration is not confirmed and the WFD assessment needs to be

[29] Environmental Assessment for the Trent Strategic Resource Options (SRO): Minworth SRO and South Lincolnshire Reservoir (SLR) SRO: Appendix F: Non-Water Resources Benefits - Natural Capital and Biodiversity Net Gain Assessment. Report to Affinity Water, Anglian Water Services Ltd and Severn Trent Water Ltd. (AECOM, May 2022).

informed by on-going hydraulic modelling and liaison with the EA. It is considered that the impacts would not result in a decline in WFD status and would be unlikely to prevent WFD targets from being achieved, and any deterioration within WFD class would be minor, with some water quality benefits also demonstrated through water quality modelling. As such, the impact of the scenarios on water quality were not deemed highly material and were scoped out of the quantitative assessment.

5.5.9 Further assessments to include the benefits of mitigation options are recommended for Gate 3.

5.6 Biodiversity Net Gain Results

On-site Baseline Habitat Units

In total, the baseline biodiversity value of the habitats present within the study area was calculated as comprising a projected 18414.33 habitat units. Table 5-6 details biodiversity units by site; Table 5-7 details biodiversity units by habitat.

Table 5-6: Baseline Habitat Units per Site

Site	Baseline Habitat Units
Attenborough Gravel Pits	3991.17
Broad Meadow	451.10
Clifton Grove, Clifton Woods and Holme Pit Pond	692.95
Drakelow Reserve	629.08
Eon Meadows	461.15
Kingsbury Wetlands (Water Park)	3767.15
Ladywalk	718.79
Lea Marston Lake	1019.44
Lockington Confluence Backwater	111.42
Lockington Marshes	243.69
Minworth Corridor	387.99
Netherfield	1190.28
River Derwent Mouth Lock	87.43
RSPB Middleton Lakes	2886.65
Sawley Carr	150.28
Shelford Carr	239.31
Sports Ground Marsh	32.34
Stanton Barn Marsh	39.77
Tameside	345.47
Trent Fleet	122.26
Trentside Ponds	60.70
Whitacre Heath	785.91
Total	18414.34

Table 5-7: Baseline Habitat Units per Habitat

Habitat (UKHab)	Habitat Units
Cropland - Cereal crops	131.87
Grassland - Floodplain Wetland Mosaic (CFGM)	12074.09
Grassland - Lowland meadows	207.56
Grassland - Modified grassland	0.70
Grassland - Other neutral grassland	462.55
Grassland - Traditional orchards	3.62
Wetland - Fens (upland and lowland)	873.35
Wetland - Reedbeds	765.64
Woodland and forest - Lowland mixed deciduous woodland	2413.05
Woodland and forest - other woodland; broadleaved	12.23
Woodland and forest - Wet Woodland	1469.67
Total	18414.34

Post Impact Habitat Units and Biodiversity Net Gain

5.6.1 Tables 5-8 and 5-9 detail the baseline and modelled post development units for both sites and habitats. Based on enhancements to the condition of all moderate and high distinctiveness habitats present across the study area, excluding the Minworth Corridor.

Table 5-8: Post impact habitat units

Site	Baseline Units	Post Impact Units	Net Unit Change
Attenborough Gravel Pits	3991.17	4426.72	435.54
Broad Meadow	451.10	496.59	45.49
Clifton Grove, Clifton Woods and Holme Pit Pond	692.95	740.33	47.38
Drakelow Reserve	629.08	704.56	75.48
Eon Meadows	461.15	515.89	54.74
Kingsbury Wetlands (Water Park)	3767.15	4148.22	381.07
Ladywalk	718.79	795.77	76.98
Lea Marston Lake	1019.44	1185.86	166.42
Lockington Confluence Backwater	111.42	122.86	11.45
Lockington Marshes	243.69	253.03	9.35
Netherfield	1190.28	1300.40	110.12
River Derwent Mouth Lock	87.43	96.74	9.31
RSPB Middleton Lakes	2886.65	3175.48	288.83
Sawley Carr	150.28	159.49	9.21
Shelford Carr	239.31	291.67	52.36

Sports Ground Marsh	32.34	36.17	3.83
Stanton Barn Marsh	39.77	44.50	4.73
Tameside	345.47	387.42	41.94
Trent Fleet	122.26	136.86	14.60
Trentside Ponds	60.70	67.87	7.16
Whitacre Heath	785.91	864.35	78.43

Table 5-9: Post impact habitat types

Habitats (UKHab)	Baseline Units	Post Impact Units	Net Unit Change
Grassland - Floodplain Wetland Mosaic (CFGM)	12066.56	13575.96	1509.39
Grassland - Lowland meadows	207.56	207.56	0.00
Grassland - Other neutral grassland	226.89	306.30	79.41
Grassland - Traditional orchards	3.62	4.03	0.41
Wetland - Fens (upland and lowland)	873.35	873.35	0.00
Wetland - Reedbeds	765.64	851.52	85.87
Woodland and forest - Lowland mixed deciduous woodland	2413.05	2524.54	111.48
Woodland and forest - Wet Woodland	1469.67	1607.52	137.85

5.6.2 The baseline BNG scores for the STT pipeline corridor to the River Avon are presented in Table 5-10.

Table 5-10: BNG baseline for the STT pipeline corridor

Habitat Type	Area	Distinctiveness	Condition	Strategic Significance	Biodiversity Units
Woodland and forest - other woodland; broadleaved	1.39	Medium	Moderate	Medium	12.23
Grassland - Floodplain Wetland Mosaic (CFGM)	0.57	High	Moderate	Medium	7.52
Grassland - Other neutral grassland	26.78	Medium	Moderate	Medium	235.66
Grassland - Modified grassland	0.16	Low	Moderate	Medium	0.70
Cropland - Cereal crops	59.94	Low	N/A Agricultural	Medium	131.87

5.6.3 The gains and losses arising from the development have been calculated assuming all habitats within the STT pipeline Corridor will be lost and then reinstated to the same habitat. Post-development habitat data is not available for Minworth SRO due to the uncertainties of flow reductions as a result of the SRO proposals (and corresponding mitigation requirements for the River tame and adjacent habitats), and the restriction of infrastructure construction works to the Minworth site itself. Table 5-11 presents the projected losses and gains occurring within the STT pipeline corridor based upon the above assumptions.

Table 5-11: BNG Summary Results: STT pipeline Corridor

Area/Linear Units	On-site baseline	On-site post-development	Off-site baseline	Off-site post-development	Total net unit change	Total net % change
Habitat Units	387.99	333.98	0	0	-54.01	-13.92%

Delivering Biodiversity Net Gain

5.6.4 Table 5-12 below summarises the projected delivery of biodiversity net gain at the Gate 2 stage including those sites identified as sensitive along the Rivers Tame and Trent, and the STT pipeline corridor to the River Avon. Enhancing the baseline of 18414.33 habitat units by 1813.44 habitat units to a post impact vale of 20227.77 delivers a modelled net gain of 9.85%.

5.6.5 The data in Table 5-12 are presented as habitat units between the Minworth discharges to the River Tame at the upstream end, to the abstraction for SLR SRO at the downstream end (with the addition of the STT pipeline corridor). This is because at this stage it has not been possible to split mitigation opportunities downstream of the SLR abstraction between the Minworth and SLR schemes, and therefore anything upstream of the SLR abstraction is simply allocated to Minworth. The assessment of habitats and BNG is described in further detail in the Ecology, and Natural Capital and BNG Reports, referenced in Section 2.1.

Table 5-12: Biodiversity Net Gain Gate 2 Summary

	Habitat Units
Minworth to SLR abstraction baseline	18026.34
Minworth Corridor (STT pipeline) baseline	387.99
Total Baseline	18414.34
Minworth to SLR Post-Intervention Net change	1867.45
Minworth Corridor (STT pipeline) post-intervention net change	-54.01
Total Post intervention net change	1813.44
% Biodiversity Net Gain	9.85%

5.6.6 It is anticipated that further refinements to the level of proposed habitat enhancements above would deliver a 10% net gain at Gate 3. However, the modelling of further enhancements along the STT pipeline corridor would likely enable the 10% net gain to be delivered. This would involve the enhancement of 0.57ha of 'wetland mosaic' and 26.78ha of 'other neutral grassland' from a predicted baseline condition of 'moderate' to 'good' and would result in a modelled net gain increase of 10.42%.

5.7 Carbon and Climate Assessments

Carbon Assessment Results

5.7.1 Full quantitative results of the carbon assessment carried out by Jacobs for the four wastewater treatment scenarios and the single water transfer scenario are contained within the Engineering Assessments (Jacobs, 2022) available separately.

Carbon Reduction Opportunities

5.7.2 The Gate 2 carbon assessment carried out by Jacobs for each option/scenario identifies a series of potential embodied carbon reduction opportunities.

5.7.3 A common set of opportunities were identified for each of the four wastewater treatment scenarios as follows:

- Low carbon concrete, substituting cement with other materials/ additives
- Novel alternatives to steel reinforcement in reinforced concrete (e.g., fibre-reinforced polymer bars).
- Reduce demolition through trenchless techniques and avoid infrastructures such as railway lines, canals, motorways, highways, and urban areas.
- Re-use demolished material.
- Re-use existing available materials, e.g., processing, re-use of excavated material as fill.
- Sustainable construction materials.
- Efficient methods of work, e.g., more sustainable transport solutions.
- Minimising removal of vegetation to prevent loss of carbon storage in soils. In particular, minimising removal of trees as they have a higher potential to sequester carbon.
- Prioritising local suppliers to reduce the distance travelled to site.
- Minimising material import. Where required sourcing material from other nearby projects to reduce the amount of virgin material used and also reduce transport emissions.
- Where new materials are required, utilising materials that have a high recycled content such as recycled steel and concrete mixes with ground granulated blast furnace slag.
- Selecting materials that have a long-life span and require minimal maintenance.

5.7.4 For the water transfer scenario, carbon reduction opportunities were identified as follows:

- Low carbon concrete, substituting cement with other materials/ additives
- Novel alternatives to steel reinforcement in reinforced concrete (e.g., fibre-reinforced polymer bars).
- Reduce demolition trough trenchless techniques and avoid infrastructures such as railway lines, canals, motorways, highways, and urban areas.
- Re-use demolished material. Re-use existing available
- materials, e.g., processing, re-use of excavated material as fill.
- Sustainable construction materials.

5.7.5 As noted above, the Gate 2 carbon assessment carried out by Jacobs assumed that the implementation of these low-carbon opportunities could reduce embodied emissions by a standard rate of 20% (refer to CDR, Jacobs 2022).

5.7.6 The Gate 2 carbon assessment only identified potential embodied carbon reduction opportunities and did not propose any measures to reduce the emissions projected to occur over the operational lifetime of each scenario. Additional recommendations to address both embodied and operational emissions are proposed in Section 6.6 below.

Climate Assessment Results

5.7.7 The CDR (Jacobs, 2022) includes a high-level summary of how climate design principles and targets have been addressed in the engineering design.

5.7.8 These are shown in Table 5-13 below.

Table 5-13: Climate Design Principles from CDR

#	Principle	Target(s)	Gate 2 Indicators
1	Nature knows no boundaries: Water is essential to all life and managing our response to climate change is a collective and urgent activity. Projects must be developed to work across companies and/or legislative boundaries to develop sustainable solutions and environmental enhancement for the wider benefit of society.	1.1. Collaborative working across companies and with stakeholders. 1.2. Timely - preparation of proposals ready to construct in 2025-2030 will involve early and rigorous development of design objectives followed by proposals. 1.3. Alignment with other relevant environmental policy, plans and strategies such as Catchment Management and Local Nature Recovery Plans (see also Place 2)	The engineering design has been informed by the emerging environmental consenting requirements being led by the environmental consultants working on GUC and STT schemes. In particular the process design has been informed from consultations with the permitting authority, the Environment Agency. The design vision and principles have been informed by this engagement.
2	Resource and carbon efficient throughout: Projects shall seek to reuse existing assets, eliminate waste (including waste of water) and make efficient use of materials and transport across the whole of the project lifecycle.	2.1. Lifecycle Carbon: Projects shall support the water industry commitment to achieve Net-Zero in terms of operational carbon in accordance with the industry roadmap and The Carbon Ambition. Projects must be efficient in embodied carbon in both construction and operation. 2.2. Projects should investigate if existing infrastructure assets could be repurposed and reused. 2.3. Projects should look to avoid unnecessary construction and minimise use of materials. 2.4. Projects should seek to minimise the use and waste of water.	The design has considered the minimisation of new works and reducing carbon. The scheme ensures maximum efficiency of the existing treatment process before then proposing the new treatment works.
3	Resilient and adaptable: Design for anticipated future demand at the appropriate scale. Build in the resilience to absorb and recover from the impacts of the extreme events and incremental stresses likely to arise from climate change.	3.1. Designs should be developed to include proportionate measures to anticipate future extreme events and stresses so that they can resist, absorb, recover and, where necessary, be adapted. 3.2. Designs shall support the digitisation of the network at a catchment level using data to inform design, optimise solutions and improve operational efficiency in real time. 3.3. Where proposals add to the resilience of the broader system this should be accounted for in its social value (see Value 3). 3.4. The layout and design of specific elements of infrastructure should be taken in cognisance of planned future development of the immediate area. 3.5. Deploy nature-based approaches to resilience wherever possible (see also Place 2).	This concept design meets the requirements of the flow profiles identified.

6. Conclusions and Recommendations

6.1 SEA

6.1.1 As set out in Chapter 5, major and moderate negative and positive effects have been identified for the schemes assessed within the Minworth SRO, which is to be expected given the scale of the proposed schemes.

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

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

6.1.4 Chapter 5 sets out the key major and moderate effects, prior to the adoption of potential further mitigation measures. Section 5.2 sets out proposed mitigation, which includes a summary of key further investigations and works proposed during Gate 3 that will help to identify further mitigation measures to potentially reduce the identified effects further. It should be noted that the further mitigation measures identified have not been costed for or integrated into detailed design at this stage. In consequence, these measures are subject to more detailed assessment and at this stage the effectiveness of these measures has still to be fully determined.

6.1.5 In addition to the identification and assessment as to the effectiveness of further mitigation measures it is proposed as part of Gate 3 activities to reaffirm the identified embedded mitigation measures set out as part of these assessments.

6.1.6 Further work on co-ordination with the regional plan assessments are proposed to be undertaken as part of Gate 3 activities.

6.2 HRA

STT Pipeline

6.2.1 The HRA assessment concludes that no likely significant effect will arise on any European sites from the STT pipeline to the River Avon.

River Mease SAC

6.2.2 Further investigations and modelling undertaken regarding the River Mease SAC has supported a conclusion of no likely significant effect on the River Mease SAC either alone or in combination with other projects and plans.

6.2.3 Changes in levels and flows in the River Tame will not affect levels and flows in the River Mease SAC, and even the maximum reduction in flow at Minworth would not result in a sufficient fall in River Trent levels to materially affect the superficial aquifer linked to the lower River Mease. This will remain the case irrespective of other plans and projects. Even without detailed knowledge of the other

components of the STT or GUC transfer SROs it can therefore be concluded that the Minworth SRO will not result in a likely [adverse] significant effect on the River Mease SAC or its qualifying interest features either alone or in combination with other plans and projects. Moreover, since both white-clawed crayfish and bullhead are species preferring relatively shallow water (as identified in the Supplementary Advice on the Conservation Objectives for River Mease SAC) Natural England have an aspiration to reduce flow levels in the River Mease SAC to restore them to a more natural level compatible with its international interest features and it is possible that the Minworth SRO could make a minor positive contribution to this objective when considered in combination with the planned reduction in flows in the River Mease that will arise from the EA's intention to relocate the discharge from Packington WTW from the Gilwiskaw Brook and River Mease SAC catchment, although any beneficial in combination effect is considered likely to be minor.

Humber Estuary SAC

6.2.4 While the impact of the SROs on fish passage over Cromwell Weir is likely to be low a likely significant effect cannot be dismissed once the improved fish passes at Crowell Weir are installed. As such, an appropriate assessment will need to be undertaken at Gate 3 once 2D modelling has been completed and any mitigation devised. This will include an in-combination assessment to include the effects of the SLR SRO, and other plans and projects should they arise.

6.2.5 Since it is not possible to dismiss effects on fish (lamprey) passage up the River Trent from the Humber Estuary SAC due to Minworth SRO alone, it is also not possible to dismiss them in combination with other projects and plans that might also result in a reduction in levels at structures from Cromwell Weir upstream. This will therefore need to be investigated more fully in the Appropriate Assessment for Minworth SRO Gate 3 submission once the 2D modelling (and devising of any necessary mitigation) for Minworth SRO are completed.

6.3 WFD

Identified Non-compliances with WFD Objectives

6.3.1 The outcome of the Level 2 assessment at Gate 2 suggests that three of the four flow reduction scenarios may have the potential to cause non-compliances with WFD objectives due to status (or within-status) deterioration or an introduction of impediments for target status within the three assessed water bodies of the Tame. This Gate 2 assessment suggests that the two water bodies in the Trent would not be impacted by any of the assessed flow reduction scenarios.

6.3.2 This assessment determined that hydrological regime was the WFD quality element that would potentially be impacted as a result of 115, 172, and 230 Ml/d flow transfers on Tame - R Rea to R Blythe (GB104028046841), Tame from R Blythe to River Anker (GB104028046440), Tame from River Anker to River Trent (GB104028047050). Impacts upon hydrological regime for the 57 Ml/d scenario are scoped out as a result of HEM assessment and that of other workstreams, where the reduction in river levels as a result of that flow scenario is considered to be not significant.

6.3.3 Hydrological regime is currently within "good" classification status on all three watercourses as per WFD cycle 2 assessment data, therefore a deterioration in the status of the quality element would be significant. These predicted changes in flow are potentially not large enough to affect the classification though there is uncertainty as to how the classification was determined by the EA, and as such we have conservatively assigned an impact score of 1 (uncertain):

- **Impact score of 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 (ACWG WFD framework).

6.3.4 It is recommended that this is examined further during Gate 3 and the EA are consulted to advise on how the Hydrological Regime classification was made. Furthermore, a worst-case assessment of the scheme operating at all times has been undertaken and each would likely be more intermittently used (with smaller flow reductions occurring more often than larger ones).

6.3.5 While reductions in flow were found to be unlikely to impact upon macroinvertebrates and macrophytes within the River Tame and Trent for all of the flow scenarios (as per Hydro-Ecological Modelling output), it was noted that the WFD status for fish may also be impacted during 172 and 230 Ml/d flows on the Tame from R Blythe to River Anker (GB104028046440). Flow is the main factor that is likely to drive the impact upon fish presence, migration, and habitats within the water body in addition to other migration barriers. The weir at Lea Marston can be considered a migration barrier as it does not have any fish passages currently installed to allow fish migration upstream. This water body was potentially considered more at risk than that immediately upstream and downstream, since it is currently at Good status for fish (with neighbouring waterbodies being at Poor).

6.3.6 The assessment of physico-chemical quality elements, specific pollutants, and chemical elements has been informed by detailed water quality monitoring and modelling as described in the Water Quality - Baseline Monitoring and Modelling report (AECOM 2022). Six determinands are modelled to increase by up to almost 80%, but these remain significantly below the EQS. This increase would be due to reduced dilution by Minworth effluent, as they are currently present in the Tame upstream of Minworth. Further monitoring for 'Benzo (ghi) perylene and indeno (123-cd) pyrene' and zinc is recommended due to lack of confidence in current monitoring and classification data. At least seven determinands are modelled to reduce in the Tame due to reduced effluent from Minworth.

6.3.7 For context, Atrazine (an herbicide) is not present in Minworth effluent, but is currently present in the Tame downstream of Minworth at 0.00005 µg/l. At the 230 Ml/d scenario it will increase in the Tame to 0.00009 µg/l, but the EQS is 0.6 µg/l. Therefore, this does not represent a risk in terms of WFD status.

6.3.8 A flow reduction of 57 Ml/d was assessed to be non-detrimental to the WFD status quality elements within each of the water bodies assessed. Modelled water quality data based on AECOMs long term modelling and Minworth effluent data inferred that a reduction in flow by 57 Ml/d was unlikely to provide any additional benefit related to water quality within the Tame and Trent.

WFD Summary and Conclusions

6.3.9 The four proposed flow transfer scenarios for the Minworth SRO have been assessed using the ACWG guidance for WFD compliance assessment, and a ACWG template has been completed for each flow transfer scenario.

6.3.10 The assessment for the 57Ml/d flow transfer determined that this is considered to be compliant with WFD objectives.

6.3.11 The assessment for the 115Ml/d flow transfer inferred that there is uncertainty that it would be compliant with WFD waterbody objectives in the Tame - R Rea to R Blythe (GB104028046841), Tame from R Blythe to River Anker (GB104028046440), and Tame from River Anker to River Trent (GB104028047050). Further flow modelling and assessment that includes scheme operating procedures is suggested for Gate 3 to improve data confidence for hydrological regime in those water bodies.

6.3.12 This assessment suggested that the 172Ml/d and 230Ml/d flow transfers would likely not be compliant with WFD water body status and objectives related to hydrological regime on the Tame - R Rea to R Blythe (GB104028046841), the Tame from R Blythe to River Anker (GB104028046440), and the Tame from River Anker to River Trent (GB104028047050). Additionally, there is potential status deterioration in the Tame from R Blythe to River Anker (GB104028046440) related to fish. Further flow modelling related to flow scenarios combining operating conditions at Minworth WwTW are required at Gate 3. Further assessments related to the fish WFD quality element on the Tame from R Blythe to River Anker (GB104028046440) should be undertaken at Gate 3. The two flow schemes are considered to be compliant for other WFD quality element status and objectives. The medium data confidences related to hydrological regime within the Tame - R Rea to R Blythe (GB104028046841), the Tame from R Blythe to River Anker (GB104028046440), and the Tame from River Anker to River Trent (GB104028047050) should be mitigated by further monitoring and modelling to improve data confidence to "high" at Gate 3.

6.3.13 The assessed uncertain or possible WFD non-compliances detailed above do not take into account the frequency or seasonality of operation of the proposed transfers; refer to Section 2.3. The assessment of possible WFD non-compliance is dependent upon the outcome of further 2D hydraulic modelling, and subsequent fish passage assessment, which is on-going at the time of submission of

this report. Where possible, the results of the on-going assessments will be incorporated into the work undertaken for Gate 2; otherwise, the assessments will be refined further at Gate 3.

6.3.14 Assessment of the potential impacts of scheme utilisation and seasonality on WFD receptors will also take into account such factors as fish migration seasons and associated effects on fish passage at those times, which can only be informed by on-going 2D hydraulic modelling. Likewise, it is recommended that consultation with the Environment Agency is undertaken to establish how to quantify assessment of the Hydrological Regime WFD element, and whether this is likely to represent a WFD non-compliance under the different scenarios.

6.3.15 The RNAG assessment for the 230 Ml/d scenario has concluded that RNAG in relation to Zinc and Dissolved Oxygen have the potential to be impacted by the Minworth SRO in the two upstream water bodies. It is recommended that the RNAG assessment is updated once further assessment of zinc has been completed at Gate 3 - Further monitoring for 'Benzo (ghi) perylene and indeno (123-cd) pyrene' and zinc is recommended due to lack of confidence in current monitoring and classification data. Dissolved oxygen has not been assessed as a potential WFD deterioration following the results of current water quality modelling; however, there is a recommendation for this to be refined at Gate 3 to take into consideration the cumulative effects of climate change on temperature and reduced flows. The approach to the assessment of cumulative effects of the Minworth SRO scheme with climate change in relation to temperature and dissolved oxygen in the River Tame will be refined at Gate 3.

6.4 Natural Capital

6.4.1 The results from the Natural Capital Assessment demonstrate that:

Global climate regulation:

6.4.2 For most scenarios, the estimated volume of embodied and operational carbon emissions is greater than the estimated volume of carbon sequestered by habitats within the study area over the 30-year time period. This is the case for all scenarios except Scenario (1 - STT Transfer 57Ml/d). This result is driven by the carbon emissions associated with agricultural activities on cropland, located within the STT Minworth corridor, which offset the carbon sequestration benefits associated with other habitats (including coastal marshes, fens, floodplains, and deciduous woodland). With respect to Scenario 1 in particular, while the scenario delivers positive net carbon sequestration benefits, it is nonetheless lower than the benefits present within the "do-nothing scenario".

Biodiversity:

6.4.3 The biodiversity benefits are the same across all four scenarios as mitigation actions are equivalent across options. The biodiversity benefits present within the do-nothing scenario are however greater than the benefits delivered by other scenarios. This is explained by the time taken for interventions and benefits to be established, which is assumed to take 10 years. This reflects the loss of habitats within the STT pipeline corridor which is assumed to be reinstated to the same habitats, and the expected site enhancements to achieve a 10% net gain. Note that, the impacts on biodiversity were valued using the estimated number of biodiversity units (cf section 5.6 Biodiversity Net Gain) delivered by each option, multiplied by the average cost of creating a hectare of habitat for biodiversity offsetting purposes[30]. As such, a cost-based approach is used as a proxy for the benefits.

Recreation:

6.4.4 The catchment-wide spatial boundaries used to estimate the value of recreational benefits from natural capital assets were not deemed suitable for this study. For instance, an estimate of the annual number of visitors and value of recreational benefits can be derived for the Witham management catchment. However, this spatial boundary is not representative of the study area and as such has not been included in the assessment, given it risks being misleading. Therefore, the values of opportunities for potential recreation benefits from mitigation options were estimated using the University of Exeter's Outdoor Recreation Valuation (ORVal) tool[31]. Several hypothetical examples were considered based on potential creation of targeted mitigation sites. Table 6-1 below shows the potential benefits that could be delivered in this respect. More information on the sites and associated interventions can be found in the Environmental Assessment for the Trent Strategic Resource Options (SRO) report (section 4.4)[32]. Further work in Gate 3 should be undertaken to better understand where recreational services are currently provided and how/where they are likely to be improved within the study area.

[30] IEMA 'Briefing on the DEFRA Net Gain consultation' & 'Full costs of biodiversity net gain revealed
[31] University of Exeter (2018) ORVal – The Outdoor Recreational Valuation Tool Version 2.0 [online] available at: https://www.leep.exeter.ac.uk/orval/
[32] Environmental Assessment for the Trent Strategic Resource Options (SRO): Minworth SRO and South Lincolnshire Reservoir (SLR) SRO: Results and Recommendations. Report to Affinity Water, Anglian Water Services Ltd and Severn Trent Water Ltd. REP-003_Summary Report. April 2022 [And supporting Technical Appendices.

Table 6-1: Potential opportunities for recreational benefits from mitigation options involving the creation of hypothetical and illustrative sites

Hypothetical Illustrative Mitigation Sites	Estimated annual number of visitors (thousands per year)	Estimates value of recreational benefits (£million per year)
Site A	[redacted]	
Site B		
Site C		
Site D		
Total		

Note: the estimates of number of visitors were rounded to the nearest hundredth and the estimates value of recreational benefits were rounded to the nearest hundred thousandth. All figures are presented in 2020 prices.

6.4.5 The ORVaL Calculations for the four hypothetical sites are based on a series of modelled habitat creation interventions focusing upon the restoration or creation of habitats within existing floodplain mosaic habitats.

Site A

6.4.6 Site A is a small area of floodplain grassland/wetland mosaic. Additional creation of wet woodland and fen and wetland habitats within this site would result in an outdoor recreational value of [redacted].

Site B

6.4.7 Site B comprises lowland mixed deciduous woodland and wet woodland set within a matrix of wetland mosaic habitats and high value fen. Modelled habitat creation including the creation of additional reedbed habitats within this site would result in an outdoor recreational value of the site of £[redacted].

Site C

6.4.8 Site C comprises expanses of floodplain mosaic with associated reedbed and high-quality grassland. Additional reedbed creation and grassland restoration within this site would result in an outdoor recreational value of £[redacted].

Site D

6.4.9 Site D comprises a floodplain mosaic dominated by high quality fen and reedbed habitats. The creation of additional lowland mixed deciduous woodland and reedbed within this site would result in an outdoor recreational value of [redacted]

Natural Capital Summary

6.4.10 Overall, the results indicate that all four scenarios are expected to lead to a net benefit, compared to the do-nothing scenario. All the natural capital values are similar across the scenarios and higher relative to the baseline, except for the embodied and operational carbon emissions. These emissions increase with higher volumes of water transfer per day, contributing to the decrease in the net benefit.

6.4.11 There may be the potential for the wider SRO schemes (Minworth, STT, and GUC) to jointly provide Natural Capital benefits and BNG across the entirety of the schemes. For example, one scheme could contribute to offsetting or mitigating the impacts of another scheme. This is an approach that could be explored further at Gate 3, for example if priority areas for mitigation are identified that may provide significant overall benefits.

6.4.12 The findings from this assessment are intended to feed into recommendations for further assessment for Gate 3. Data from the ongoing surveys and assessments and more detailed knowledge of the scenario outcomes and mitigation options will be necessary in order to re-run the six capitals

assessment in Gate 3. This is expected to provide a more accurate and detailed assessment of the four scenarios.

6.5 Biodiversity Net Gain

6.5.1 The modelled enhancement of those sites identified as sensitive between Minworth and the SLR abstraction site can be projected to produce 1867.45 habitat units. After accounting for potential impacts arising along the Minworth corridor a loss of 54.01 habitat units can be predicted. This results in an overall habitat unit uplift of 1813.44 habitat units and a projected net gain of 9.85%.

6.5.2 At Gate 3, in order to demonstrate a more accurate Biodiversity Net Gain for the proposed scheme, it is recommended that the calculation is updated to use DEFRA Metric 3.1 and opportunities to create and enhance wetland habitats within the Study Area are identified through a combination of habitat opportunity mapping and stakeholder engagement. The creation of new wetlands within the Study Area will particularly benefit those species associated with those habitat types. The selection of candidate wetland habitat creation and enhancement sites will need to be discussed with local biodiversity groups and will aim to benefit key habitats and the species they support.

6.6 Carbon

6.6.1 Embodied and operational carbon emissions for each option/scenario were estimated through the use of a bespoke carbon accounting tool (Jacobs 2022). Neither the input data nor the carbon calculation methodology was available for the drafting of this EAR, so the **conclusions are reliant on the emissions data as generated by the carbon tool – please refer to the Jacobs CDR for further detail.**

Embodied carbon emissions

6.6.2 The majority of the embodied emissions for each of the four water treatment scenarios result from the Biological Activated Carbon (BAC) and UV Disinfection elements of the construction process. Within the water transfer scenario, embodied emissions are dominated by the pipeline elements (gravity main and rising main). Any mitigation measures to reduce the embodied carbon should focus on the highest embodied emissions sources in order to maximise carbon saving potential.

6.6.3 Given the relatively high embodied emissions from the STT115 water transfer scenario, additional carbon saving measures to those proposed during the Gate 2 carbon assessment should be considered. Selecting lower carbon pipeline materials has the potential to result in significantly lower overall embodied emissions. Furthermore, exploring the use of restraint joints to avoid the need for concrete thrust blocks can also result in lower embodied carbon emissions.

Operational carbon emissions

6.6.4 The overwhelming majority of annual operational emissions for the four treatment scenarios result from the consumption of grid electricity and are broadly proportionate to treatment rates. All the modelled operational emissions for the STT115 water transfer scenario are from grid electricity. For all scenarios, therefore, efforts to reduce power demand through the use of variable speed drives and other energy efficiency measures should be considered. The use of appropriate renewable energy installations should also be explored to partially offset the amount of electricity requiring to be imported from the national grid.

6.6.5 The modelled lifetime operational emissions for the four treatment scenarios assumes an 80-year design life, with the water transfer scenario having a shorter 50-year design life. UK Government projections of grid carbon intensity indicate that by 2050, electricity generated in the UK could have associated emissions per kWh that are almost 97% lower than the current rate. Unless this projected decarbonisation of grid power informs the carbon accounting process, operational emissions are likely to be overstated.

6.6.6 The CDR (Jacobs 2022) and associated reports and appendices state what assumptions were made, and what emissions factors were applied, when lifetime operational emissions were calculated during the Gate 2 carbon assessment. It is important to ensure that official projections of grid carbon intensity are factored into all operational carbon estimates.

6.7 Next Steps

6.7.1 Recommendations for next steps are summarised in Table 6-2 below. Further environmental assessments are also recommended in the Tame and Trent Environmental Assessment report in support of the Minworth and SLR SROs: *Environmental Assessment for the Trent Strategic Resource Options (SRO): Minworth SRO and South Lincolnshire Reservoir (SLR) SRO: Results and Recommendations* (AECOM, July 2022). These recommendations are reproduced in Appendix B of this report.

Table 6-2: Summary of Recommendations for on-going assessment, and for Gate 3

Topic	Recommendations	Rationale
Overall Environmental Assessment	Review RAPID Gate 3 Guidance in the context of the findings of this EAR to inform next steps, with Regulator/ Stakeholder engagement to inform next steps.	RAPID Gate 3 Guidance will inform the next steps of the Environmental Assessments in order to progress the SRO schemes.
Overall Environmental Assessment	Revisit assessment topics from Gate 1 in the light of stakeholder feedback and the outcomes of this EAR, to establish whether any areas not carried forward from Gate 1 need to be re-visited.	On-going discussions with Regulators / Stakeholders may identify topics that require further assessment, e.g., navigation, fish passage, WFD, etc.
Strategic Environmental Assessment (SEA)	Further investigation of potential negative effects to inform appropriate mitigation measures. Further explore potential beneficial effects, for example demonstrating water resources benefits, socio-economical and natural capital benefits, BNG, and improving resilience to the likely effects of climate change. Further work on co-ordination with the regional plan assessments are proposed to be undertaken as part of Gate 3 activities.	Integrate further mitigation measures into the detailed design for the SRO schemes, as informed by on-going environmental assessments, and as part of Gate 3 activities, reaffirm the identified embedded mitigation measures set out as part of these assessments. Ensure further environmental assessments are co-ordinated with Regional Plans.
Habitats Regulations Assessment (HRA)	Undertake Appropriate Assessment for the Humber Estuary SAC – completion of on-going and proposed hydraulic and hydrological modelling to inform assessment of fish passage along the River Trent, which supports qualifying features of the SAC. In-combination assessment to include the effects of the SLR SRO, and other plans and projects should they arise.	Data gaps in hydraulic and hydrological modelling mean it is currently not possible to scope out significant effects on fish passage, and therefore also on the Humber Estuary SAC.
Water Framework Directive (WFD) Assessment	Liaison with the Environment Agency to agree the approach to assessing the Hydrological Regime WFD supporting element.	Three of the four flow reduction scenarios may have the potential to cause non-compliances with WFD objectives due to status (or within status) deterioration or

Topic	Recommendations	Rationale
	Completion of on-going and proposed hydraulic (2D) modelling at targeted locations to inform the assessment of fish passage at weirs and existing fish passes, and to inform the assessment of Hydrological Regime. Further incorporate the likely operational regime of the SRO schemes into the WFD assessment to refine the assessment further at Gate 3.	an introduction of impediments for target status within the three assessed water bodies of the Tame. Consultation with the EA to establish how to quantify assessment of the Hydrological Regime WFD element, and whether this is likely to represent a WFD non-compliance under the different scenarios.
Natural Capital Assessment	Explore opportunities for carbon sequestration through habitat creation. Refine opportunities for habitat and recreational enhancement, using the hypothetical examples for targeted mitigation sites as a starting point. Further work in Gate 3 should be undertaken to better understand where recreational services are currently provided and how/where they are likely to be improved within the study area. Explore opportunities for the wider SRO schemes (Minworth, STT, and GUC) to jointly provide Natural Capital benefits and BNG across the entirety of the schemes. This is an approach that could be explored further at Gate 3, for example if priority areas for mitigation are identified that may provide significant overall benefits.	For most scenarios, the estimated volume of embodied and operational carbon emissions is greater than the estimated volume of carbon sequestered by habitats within the study area over the 30-year time period. Commitment for the SRO schemes to demonstrate wider benefits: ORVaL Calculations for the four hypothetical sites are based on a series of modelled habitat creation interventions focusing upon the restoration or creation of habitats within existing floodplain mosaic habitats. For example, one scheme could contribute to offsetting or mitigating the impacts of another scheme. Data from the ongoing surveys and assessments and more detailed knowledge of the scenario outcomes and mitigation options will be necessary in order to re-run the six capitals assessment in Gate 3. This is expected to provide a more accurate and detailed assessment of the four scenarios.
Biodiversity Net Gain (BNG)	Seek to demonstrate a minimum 10% Net Gain for the SRO schemes. At Gate 3, in order to demonstrate a more accurate Biodiversity Net Gain for the proposed scheme, it is recommended that the calculation is updated to use DEFRA Metric 3.1 and opportunities to create and enhance wetland habitats within the Study Area are identified through a combination of habitat opportunity mapping and stakeholder engagement.	The creation of new wetlands within the Study Area will particularly benefit those species associated with those habitat types. The selection of candidate wetland habitat creation and enhancement sites will need to be discussed with local biodiversity groups and will aim to benefit key habitats and the species they support.
Carbon and Climate Change	Selecting lower carbon pipeline materials has the potential to result in significantly lower overall embodied emissions. Furthermore, exploring the use of restraint joints to avoid the need for concrete thrust blocks can also result in lower embodied carbon emissions. For all scenarios, therefore, efforts to reduce power demand through the use of variable speed drives and other energy efficiency measures should be considered. The use of appropriate	Given the relatively high embodied emissions from the STT115 water transfer scenario, additional carbon saving measures to those proposed during the Gate 2 carbon assessment should be considered.

Topic	Recommendations	Rationale
	renewable energy installations should also be explored to partially offset the amount of electricity requiring to be imported from the national grid. Re-calculate the modelled lifetime operational carbon emissions for the four treatment scenarios, which currently assumes an 80-year design life, with the water treatment scenario having a shorter 50-year design life. Ensure that official projections of grid carbon intensity are factored into all operational carbon estimates.	The overwhelming majority of annual operational emissions for the four treatment scenarios result from the consumption of grid electricity and are broadly proportionate to treatment rates. All the modelled operational emissions for the STT115 water transfer scenario are from grid electricity. UK Government projections of grid carbon intensity indicate that by 2050, electricity generated in the UK could have associated emissions per kWh that are almost 97% lower than the current rate. Unless this projected decarbonisation of grid power informs the carbon accounting process, operational emissions are likely to be overstated.

SEA

SEA scoring criteria

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

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

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

minimise air emissions	+	Minor Positive	The option would result in an enhancement of the air quality.
	0	Neutral	The option would not result in any effects on Air Quality and AQMAs.
	-	Minor Negative	The option would result in a decrease of the air quality.
	--	Moderate Negative	The option would result in a decrease of the air quality within one or more AQMAs.
	---	Major Negative	The option would result in a major decrease in the air quality within one or more AQMAs.
	?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain.
Climate Factors: Reduce embodied and operational carbon emissions Reduce vulnerability to climate change risks and hazards	+++	Major Positive	The option will generate significant additional zero carbon energy that can be fed back into the grid/reduce carbon emissions (see carbon scale) The option will result in a major increase in carbon sequestration. The option will increase resilience/decrease vulnerability to climate change effects.
	++	Moderate Positive	The option will increase resilience/decrease vulnerability to climate change effects. The option will result in a moderate increase in carbon sequestration. The option will generate moderate additional zero carbon energy that can be fed back into the grid/reduce carbon emissions (see carbon scale)
	+	Minor Positive	The option will increase resilience/decrease vulnerability to climate change effects. The option will result in a minor increase in carbon sequestration. The option will generate minor additional zero carbon energy that can be fed back into the grid/reduce carbon emissions (see carbon scale)
	0	Neutral	The option would have no discernible effect on greenhouse gas emissions, nor would the option increase resilience/decrease vulnerability to climate change effects.
	-	Minor Negative	The option will have a minor impact on resilience/decrease vulnerability to climate change effects. The option will generate minor construction carbon emissions (1 - 6,964,452 tCO2e) and/or operational carbon emissions (1 - 3,492 tCO2e).
	--	Moderate Negative	The option will have a moderate impact on resilience/significantly decrease vulnerability to climate change effects. The option will generate moderate construction carbon emissions (6,964,453 - 20,000,000 tCO2e) and/or operational carbon emissions (3,493 - 10,000 tCO2e). The option will result in a moderate release of previously sequestered carbon.
	---	Major Negative	The option will have a major impact on resilience/significantly decrease vulnerability to climate change effects. The option will generate significant construction carbon emissions (Above 20,000,000 tCO2e) and/or operational carbon emissions (Above 10,000 tCO2e). The option will result in a major release of previously sequestered carbon.

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

	-	Minor Negative	The option will result in the loss of significance of undesignated heritage assets and/or their setting, notwithstanding remedial recording of any elements affected. There will be limited damage to known, undesignated archaeology important sites with a consequent loss of significance only partly mitigated by archaeological investigation.
	--	Moderate Negative	The option will result in the loss of significance of undesignated heritage assets and/or their setting, notwithstanding remedial recording of any elements affected. The option will diminish of significance of designated heritage assets and/or their setting, notwithstanding remedial recording of any elements affected.
	---	Major Negative	The option will diminish the significance of designated heritage assets and/or their setting such as: - Demolition or further deterioration in the condition of designated heritage assets especially those identified in the Historic England Buildings/Monuments at Risk Register. - Loss of public access to important heritage assets and lack of appropriate interpretation. - There will be major damage to known, designated archaeology important sites with a consequent loss of significance only partly mitigated by archaeological investigation.
	?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain.
Population, Human Health Maintain and enhance the health and wellbeing of the local community, including economic and social wellbeing Maintain and enhance tourism and recreation	+++	Major Positive	The option leads to major positive effect on the health of local communities and will ensure that surface water and bathing water quality is maintained within statutory limits. The option creates new, and significantly enhances existing, recreational facilities, publicly accessible greenspace and/or tourism within the operational area.
	++	Moderate Positive	The option leads to positive effect on the health of local communities and will ensure that surface water and bathing water quality is maintained within statutory limits. The option enhances existing, recreational facilities, publicly accessible greenspace and/or tourism within the operational area
	+	Minor Positive	The option has a temporary positive effect on the health of local communities and will ensure that surface water and bathing water quality is maintained within statutory limits.
	0	Neutral	The option would not result in any effects on human health and existing recreational facilities and/or tourism.
	-	Minor Negative	The option has a temporary effect on human health (e.g., noise or air quality). The option reduces the availability and quality of existing recreational facilities and/or tourism within the operational area.
	--	Moderate Negative	The option results in the permanent removal of existing recreational facilities, publicly accessible greenspace and/or tourism within the operational area.
	---	Major Negative	The option has a significant long-term effect on human health (e.g. noise or air quality). The option results in the removal of existing recreational facilities, publicly accessible greenspace and/or tourism within the operational area.
	?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain.

Material Assets Minimise resource use and waste production Avoid negative effects on built assets and infrastructure	+++	Major Positive	The option will re-use or recycle substantial quantities of waste materials and any new infrastructure will incorporate substantial sustainable design measures and materials. There will be no increase in energy consumption or energy will be from 100% renewable sources. The option improves national cycle routes or national trails.
	++	Moderate Positive	The option will re-use or recycle moderate quantities of waste materials and any new infrastructure will incorporate some sustainable design measures and materials. There will be no increase in energy consumption or energy will be from 90% renewable sources. The option improves national cycle routes or national trails.
	+	Minor Positive	The option will re-use or recycle a limited quantity of waste materials and any new infrastructure will incorporate some limited sustainable design measures and materials. There will be no increase in energy consumption or energy will be from 80% renewable sources. The option improves national cycle routes or national trails.
	0	Neutral	The option would not result in any effects on material assets.
	-	Minor Negative	The option will require new infrastructure with only limited opportunities for the re-use or recycling of waste materials. There are limited opportunities for sustainable design or the use of sustainable materials. The option results in a minor increase in energy consumption with no renewable energy options. The option results in a minor disruption on built assets and infrastructure, including transport.
	--	Moderate Negative	The option will require new infrastructure with only limited opportunities for the re-use or recycling of waste materials. The option results in a moderate increase in energy consumption with no renewable energy options. The option results in a moderate disruption on built assets and infrastructure, including transport links.
	---	Major Negative	The option will require significant new infrastructure that cannot be provided through the re-use or recycling of waste materials. There are no opportunities for sustainable design or the use of sustainable materials. The option results in a major increase in energy consumption with no renewable energy options. The option results in a major distribution on built assets and infrastructure, including transport links.
	?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain.

SEA matrices

Included as *Minworth SEA matrices V3_Aug22*

Assessment Cover Information	
Element Name	Minworth 57Ml/d
Element Description	

SEA Topic	SEA Objective	Construction Effects		Operational Effects		Effect Description (including embedded mitigation i.e. costed mitigation that is committed to as part of the scheme)	Further mitigation	Residual Construction Effects		Residual Operational Effects	
		+	-	+	-			+	-	+	-
Biodiversity	1.1 To protect designated sites and their qualifying features	0	0	+	-	**Construction effects:** The area for construction includes development within the existing WwTW operational boundary. An HRA screening has been undertaken. This found that no Likely Significant Effects (LSE) are anticipated on the Severn Estuary SAC and Ramsar site or the Humber Estuary SAC, SPA and Ramsar site due to the distance between the proposed construction works and the designated sites. There would be no impact on the River Mease SAC. **Operational effects:** No LSE is anticipated on the River Mease SAC (a tributary of the River Tame) as the qualifying features are not dependent on flows in the River Tame. This has been confirmed during Gate 2 hydrogeological studies which shows that changes in levels and flows in the River Tame will not affect levels and flows in the River Mease SAC, and even the maximum reduction in flow at Minworth would not result in a sufficient fall in River Trent levels to materially affect the superficial aquifer linked to the lower River Mease. No LSE are anticipated on the Humber Estuary SPA. However, LSE cannot be dismissed at Gate 2 for the Humber Estuary SAC and Ramsar site specifically regarding sea lamprey and river lamprey upstream migration. This is because, while Cromwell Weir currently prevents upstream migration further up the River Trent, there is a consented proposal to install 2 eel passes which would also be passable to lamprey. Modelling undertaken of the weirs has shown that, while the impact of the Minworth SROs on fish passage over Cromwell Weir is likely to be low, a likely significant effect cannot be dismissed once the improved fish passes at Crowell Weir are installed. As such, an appropriate assessment will need to be undertaken at Gate 3 once 2D modelling has been completed and any mitigation devised. Direct effects on the SAC and Ramsar site are not expected as the hydrological impacts downstream of the River Tame confluence with the River Trent is considered minor and the European site is ~150 miles downstream of the Minworth WwTW. Embedded mitigation actions will lead to a 10% biodiversity net gain, which may support designated sites and their qualifying features.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** Further 2D modelling at and around the site is recommended and this will inform any mitigation that may be required.	0	0	+	0
	1.2 To avoid a net reduction, and where possible enhance, in non-monetised natural capital assets	0	0	+	0	**Construction effects:** Construction site is located almost entirely on urban land. Risks to natural capital stocks are therefore negligible. **Operational effects:** Mitigation actions will lead to a 10% biodiversity net gain and improvement in climate regulation and recreational benefits. Although embodied and operational emissions decrease the total value of climate regulation benefits, these are lower than the total amount of carbon sequestered by the habitats within Priority Habitat. Overall, results indicate that the scheme is expected to lead to a net benefit, compared to the do-nothing scenario, which increases with higher volumes of water transfer per day. All the natural capital values are similar across the scenarios and higher relative to the baseline, except for the embodied and operational carbon emissions. These emissions increase with higher volumes of water transfer per day, contributing to the decrease in the net benefit.	**Construction mitigation:** No further mitigation proposed. **Operation mitigation:** The findings from the Natural Capital assessment are intended to feed into recommendations for further assessment for Gate 3. Data from the ongoing surveys and assessments and more detailed knowledge of the scenario outcomes and mitigation options will be necessary in order to re-run the six capitals assessment in Gate 3.	0	0	+	0
	1.3 To protect and enhance biodiversity, priority habitats and species	0	0	+	0	**Construction effects:** No habitats are being affected on site. Effects are considered neutral. **Operational effects:** Several priority species of fish have been recorded downstream of the Minworth WwTW in the River Tame. Hydrological assessment of effects of discharge reduction from Minworth WwTW on the downstream River Tame would have a minor effect on flows and impacts on the priority species are considered negligible. Mitigation actions will lead to a 10% biodiversity net gain.	**Construction mitigation:** No further mitigation proposed. **Operation mitigation:** No further mitigation proposed.	0	0	+	0
	1.4 To avoid and, where required, manage invasive and non-native species (INNS)	0	0	0	0	**Construction effects:** Option construction impacts are assessed as neutral. **Operational effects:** Wastewater entering the WwTW will be from sanitary sewers comprised of municipal wastewater. The treatment process will mitigate against the distribution of INNS via the final effluent. The reduction in effluent and subsequent reduction in flows in the River Tame could potentially be beneficial with regards to the distribution of INNS with decreased volumes of water resulting in a decreased risk in the distribution of INNS that spread via seeds and propagules. However, this effect is uncertain and overall has been assessed as neutral.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	0	0
	1.5 To meet WFD objectives relating to biodiversity	0	0	0	0	**Construction effects:** Option construction impacts are assessed as neutral. **Operational effects:** A flow reduction of 57Ml/d was assessed to be non-detrimental to the WFD status of water bodies in the River Tame and Trent.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	0	0
Soil	2.1 To protect and enhance the functionality, quantity and quality of soils, including the protection of high-grade agricultural land	0	0	0	0	**Construction effects:** Construction is taking place on urban land/ the existing WwTW. Effects are therefore neutral. **Operational effects:** The operation of the scheme will not affect land use, soils, or geology.	**Construction mitigation:** No further mitigation proposed. **Operation mitigation:** No further mitigation proposed	0	0	0	0
Water	3.1 To minimise or manage flood risk, taking climate change into account	0	0	0	0	**Construction effects:** While the site is close to (within 200m) areas of flood zone 2 and 3, given the scope of the construction works a neutral effect on flood risk has been identified. **Operational effects:** Operational effects are assessed as negligible.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	0	0
	3.2 To enhance or maintain groundwater quality and resources	0	0	0	0	**Construction effects:** Option construction effects are assessed as neutral. **Operational effects:** Operational effects are assessed as neutral.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	0	0
	3.3 To enhance or maintain surface water quality, flows and quantity	0	0	0	0	**Construction effects:** Option construction impacts are assessed as neutral. **Operational effects:** The transfer of 57Ml/d flow from Minworth WWTW has been assesed as having no/ minimal for all of the water bodies. Therefore, it is suggested that it would be compliant with WFD status and objectives for all water bodies. From a water quality perspective, the potential major flow reduction could associate with changes in physico-chemical river processes from reduced velocities and increased time of travel; and from reduced buffering capacity from known continuous and intermittent water quality pressures.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	0	0

	3.4 To meet WFD objectives	0	0	0	0	**Construction effects:** Option construction impacts are assessed as neutral. **Operational effects:** The Gate 2 WFD assessment concludes that the scheme would be compliant with WFD status and objectives for all water bodies.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	0	0
	3.5 To improve water efficiency through provision of access to a resilient and sustainable supply of water.	0	0	++	0	**Construction effects:** Construction effects are assessed as neutral. **Operational effects:** During operation there would be a moderate positive effect due to the option contributing to a resilient water supply. Whilst this option will provide additional water resource (57 Ml/d) and it will provide essential water supply infrastructure to help support a sustainable socio-economy.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	++	0
Air	4.1 To minimise air emissions during construction and operation	0	-	0	0	**Construction effects:** The site is within Birmingham AQMA. Construction on the WwTW has the potential for minor negative effects on air emissions from construction activities. **Operational effects:** Given the scale of the activities associated with the upgrade of an existing site, neutral effects are anticipated.	**Construction mitigation:** Consider use of rail for transporting materials. Approved traffic routes for construction traffic will be applied in order to minimise impacts on local roads. **Operation mitigation:** No further mitigation proposed	0	-	0	0
Climatic Factors	5.1 To introduce climate mitigation where required and improve the climate resilience of assets and natural systems	0	0	++	0	**Construction effects:** Construction effects are assessed as neutral **Operational effects:** This option provides additional water resource and will during operation assist the reliable transfer of water, therefore reducing the vulnerability to drought risks associated with climate change and improving resilience to the likely effects of climate change. Moderate positive effects are anticipated.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	++	0
	5.2 To minimise embodied and operational emissions	0	--	0	-	The carbon assessment has been completed by Jacobs as part of the Minworth Engineering workstream and is qualitatively summarised in the main EAR. **Construction effects:** Overall, during construction this option is considered to have a moderate negative environmental effect. **Operational effects:** Overall, during operation this option is considered to have a minor negative environmental effect on this objective.	**Construction mitigation:** The Gate 2 carbon assessment carried out by Jacobs assumed that the implementation of a number of low-carbon opportunities could reduce embodied emissions by a standard rate of 20%. Mitigation measures include: Low carbon concrete, substituting cement with other materials/ additives Novel alternatives to steel reinforcement in reinforced concrete (e.g., fibre-reinforced polymer bars). Reduce demoliton trough trenchless techniques and avoid infrastructures such as railway lines, canals, motorways, highways, and urban areas. Re-use demolished material. Re-use existing available materials, e.g., processing, re-use of excavated material as fill.Sustainable constructon materials. Efficient methods of work, e.g., more sustainable transport solutions. Minimising removal of vegetation to prevent loss of carbon storage in soils. In particular, minimising removal of trees as they have a higher potential to sequester carbon. Prioritising local suppliers to reduce the distance travelled to site. Minimising material import. Where required sourcing material from other nearby projects to reduce the amount of virgin material used and also reduce transport emissions.	0	--	0	-
Landscape	6.1 To conserve, protect and enhance landscape and townscape character and visual amenity	0	-	0	0	**Construction effects:** The site is located within the Birmingham Greenbelt. The upgrade works to the WwTW site will be contained with the operational land of the WwTW. The construction works will be temporary and the potential for adverse effects on the greenbelt during construction has been assessed as minor. **Operational effects:** The operational impacts are considered neutral.	**Construction mitigation:** Consider minimising the extent of construction works within the greenbelt. **Operation mitigation:** No further mitigation proposed	0	0	0	0
Historic Environment	7.1 To conserve/protect and enhance historic assets/cultural heritage and their setting, including archaeological important sites	0	0	0	-	**Construction effects:** There is a scheduled monument, Moated Site at Peddimore Hall, approximately 2.1km from the site. There are a number of listed buildings between 500m and 1km from the site. There is a conservation area approximately 600m from the site at Water Orton to the south. There is potential for neutral to minor effects on settings of heritage assets. **Operational effects:** The operational impacts are considered neutral.	**Construction mitigation:** Consultation with HE to identify mitigation measures in particular in relation to the listed buildings and conservation area within proximity. **Operation mitigation:** Screening where settings of heritage assets would be affected.	0	0	0	0
Population and Human Health	8.1 To maintain and enhance the health and wellbeing of the local community, including economic and social wellbeing	+	-	+	0	**Construction effects:** The construction of this option would represent capital investment which is expected to generate some employment opportunities and supply chain benefits. The degree of this benefit will be dependent on the contractors recruitment and supply chain practices and will be temporary. Overall, the benefits are expected to be minor. There are two noise action important areas approximately 800m from the site – one to the east and one to the south. The site is also within an AQMA. There will be adverse effects such as noise, dust and vibrations during construction associated with construction activities and vehicles which could cause impacts on health and wellbeing at nearby sensitive receptors such as residential properties. Regarding indices of multiple deprivation, there are areas of income and health deprivation approximately 1.5km from the site. The upgrade at the WwTW will be within the site boundary and adjacent to existing treatment structures. No additional noise or landscape screening is envisaged at this time. Best practice construction techniques are assumed. However, there will be adverse effects such as noise, dust and vibrations during construction associated with construction activities and vehicles which could cause impacts on health and wellbeing at nearby sensitive receptors such as residential properties. Due to the scale and duration of the construction works and proximity of sensitive receptors a minor effect is anticipated. **Operational effects:** In operation, this scheme will increase regional resilience which may support economic and population growth. It will help to ensure provision of access to a secure resilient supply of drinking water including during times where additional water resources may not be available as part of an overall scheme. Therefore generating a minor positive effect. Traffic during operation expected to be limited therefore a neutral effect is anticipated during operation.	**Construction mitigation:** Construction compounds to be sited sensitively and away from residential areas. The hours of working associated with the construction of the treatment works, other sites and pipeline route limited to minimise amenity and environmental impacts. **Operation mitigation:** No further mitigation proposed	+	-	+	0
	8.2 To maintain and enhance tourism and recreation	0	0	0	0	**Construction effects:** There is an area of playing fields and tennis court approximately 280m from the site at Curdworth. There is an area of CRoW land approximately 700m to the south. Assuming the adoption of best practice construction techniques during construction this option is considered to have a neutral effect on this objective. **Operational effects:** In operation, there will be limited effects on recreational resources	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	0	0
	8.3 To secure resilient water supplies for the health and wellbeing of customers	0	0	+	0	**Construction effects:** Construction effects are assessed as neutral. **Operational effects:** The option would contribute by providing a resilient water supply. It will provide essential water supply infrastructure to help support a sustainable socio-economy and therefore is considered to have a moderate positive effect.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	++	0

Assessment Cover Information	
Element Name	Minworth 115Ml/d
Element Description	

SEA Topic	SEA Objective	Construction Effects +	Construction Effects -	Operational Effects +	Operational Effects -	Effect Description (including embedded mitigation i.e. costed mitigation that is committed to as part of the scheme)	Further mitigation	Residual Construction Effects +	Residual Construction Effects -	Residual Operational Effects +	Residual Operational Effects -
Biodiversity	1.1 To protect designated sites and their qualifying features	0	0	+	-	**Construction effects:** The area for construction includes development within the existing WwTW operational boundary. An HRA screening has been undertaken. This found that no Likely Significant Effects (LSE) are anticipated on the Severn Estuary SAC and Ramsar site or the Humber Estuary SAC, SPA and Ramsar site due to the distance between the proposed construction works and the designated sites. There would be no impact on the River Mease SAC. **Operational effects:** No LSE is anticipated on the River Mease SAC (a tributary of the River Tame) as the qualifying features are not dependent on flows in the River Tame. This has been confirmed during Gate 2 hydrogeological studies which shows that changes in levels and flows in the River Tame will not affect levels and flows in the River Mease SAC, and even the maximum reduction in flow at Minworth would not result in a sufficient fall in River Trent levels to materially affect the superficial aquifer linked to the lower River Mease. No LSE are anticipated on the Humber Estuary SPA. However, LSE cannot be dismissed at Gate 2 for the Humber Estuary SAC and Ramsar site specifically regarding sea lamprey and river lamprey upstream migration. This is because, while Cromwell Weir currently prevents upstream migration further up the River Trent, there is a consented proposal to install 2 eel passes which would also be passable to lamprey. Modelling undertaken of the weirs has shown that, while the impact of the Minworth SROs on fish passage over Cromwell Weir is likely to be low, a likely significant effect cannot be dismissed once the improved fish passes at Crowell Weir are installed. As such, an appropriate assessment will need to be undertaken at Gate 3 once 2D modelling has been completed and any mitigation devised. Direct effects on the SAC and Ramsar site are not expected as the hydrological impacts downstream of the River Tame confluence with the River Trent is considered minor and the European site is ~150 miles downstream of the Minworth WwTW. Embedded mitigation actions will lead to a 10% biodiversity net gain, which may support designated sites and their qualifying features.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** Further 2D modelling at and around the site is recommended and this will inform any mitigation that may be required.	0	0	+	0
	1.2 To avoid a net reduction, and where possible enhance, in non-monetised natural capital assets	0	0	+	0	**Construction effects:** Construction site is located almost entirely on urban land. Risks to natural capital stocks are therefore negligible. **Operational effects:** Mitigation actions will lead to a 10% biodiversity net gain and improvement in climate regulation and recreational benefits. Although embodied and operational emissions decrease the total value of climate regulation benefits, these are lower than the total amount of carbon sequestered by the habitats within Priority Habitat. Overall, results indicate that the scheme is expected to lead to a net benefit, compared to the do-nothing scenario, which increases with higher volumes of water transfer per day. All the natural capital values are similar across the scenarios and higher relative to the baseline, except for the embodied and operational carbon emissions. These emissions increase with	**Construction mitigation:** No further mitigation proposed. **Operation mitigation:** The findings from the Natural Capital assessment are intended to feed into recommendations for further assessment for Gate 3. Data from the ongoing surveys and assessments and more detailed knowledge of the scenario outcomes and mitigation options will be necessary in order to re-run the six capitals assessment in Gate 3.	0	0	+	0
	1.3 To protect and enhance biodiversity, priority habitats and species	0	0	+	0	**Construction effects:** No habitats are being affected on site. Effects are considered neutral. **Operational effects:** Loss of terrestrial Priority Habitat would have occurred during construction. Maintenance activities to avoid Priority Habitat areas. Several priority species of fish have been recorded downstream of the Minworth WwTW in the River Tame. Hydrological assessment of effects of discharge reduction from Minworth WwTW on the downstream River Tame would have a minor effect on flows and impacts on the priority species are considered negligible. Mitigation actions will lead to a 10% biodiversity net gain.	**Construction mitigation:** No further mitigation proposed. **Operation mitigation:** No further mitigation proposed.	0	0	+	0
	1.4 To avoid and, where required, manage invasive and non-native species (INNS)	0	0	0	0	**Construction effects:** Option construction impacts are assessed as neutral. **Operational effects:** Wastewater entering the WwTW will be from sanitary sewers comprised of municipal wastewater. The treatment process will mitigate against the distribution of INNS via the final effluent. The reduction in effluent and subsequent reduction in flows in the River Tame could potentially be beneficial with regards to the distribution of INNS with decreased volumes of water resulting in a decreased risk in the distribution of INNS that spread via seeds and propagules. However, this effect is uncertain and overall has been assessed as neutral.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	0	0
	1.5 To meet WFD objectives relating to biodiversity	0	0	0	?	**Construction effects:** Option construction impacts are assessed as neutral. **Operational effects:** The assessment for the 115Ml/d flow transfer inferred that there is uncertainty that it would be compliant with WFD objectives relating to biodiversity. Further flow modelling and assessment that includes scheme operating procedures is suggested for Gate 3 to improve data confidence in hydrological regime in the Tame - R Rea to R Blythe (GB104028046841), Tame from R Blythe to River Anker (GB104028046440), and Tame from River Anker to River Trent (GB104028047050).	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	0	?
Soil	2.1 To protect and enhance the functionality, quantity and quality of soils, including the protection of high-grade agricultural land	0	0	0	0	**Construction effects:** Construction is taking place on urban land/ the existing WwTW. Effects are therefore neutral. **Operational effects:** The operation of the scheme will not affect land use, soils, or geology.	**Construction mitigation:** Ground investigations to be undertaken prior to commencement of works to identify necessary mitigation measures**.** **Operation mitigation:** No further mitigation proposed	0	0	0	0
Water	3.1 To minimise or manage flood risk, taking climate change into account	0	0	+	0	**Construction effects:** While the site is close to (within 200m) areas of flood zone 2 and 3, given the scope of the construction works a neutral effect on flood risk has been identified. **Operational effects:** The removal of water from the Tame and Trent system will provide extra capacity, reducing flood risk with the potential for minor positive effects.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	+	0
	3.2 To enhance or maintain groundwater quality and resources	0	0	0	0	**Construction effects:** Option construction effects are assessed as neutral. **Operational effects:** Operational effects are assessed as neutral.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	0	0
	3.3 To enhance or maintain surface water quality, flows and quantity	0	0	0	--	**Construction effects:** Option construction impacts are assessed as neutral. **Operational effects:** The transfer of 115 Ml/d flow from Minworth WwTW is identified as having a 'low' impact (impact score "1") on the Tame - R Rea to R Blythe (GB104028046841), Tame from R Blythe to River Anker (GB104028046440), and Tame from River Anker to River Trent (GB104028047050). The WFD quality elements responsible for an impact score of "1" are highlighted below: Tame - R Rea to R Blythe (GB104028046841) – Hydrological regime Tame from R Blythe to River Anker (GB104028046440) – Fish and Hydrological regime Tame from River Anker to River Trent (GB104028047050) - Hydrological regime All WFD quality elements scoring "1" were uncertain for a deterioration in status class, possible impediment to GES or GEP, and possible compromise to water body objectives. From a water quality perspective, the potential major flow reduction could associate with changes in physico-chemical river processes from reduced velocities and increased time of travel; and from reduced buffering capacity from known continuous and intermittent water quality pressures.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** Hydrological regime modelling should be further assessed at Gate 3 in relation to scheme transfer operations.	0	0	0	--
	3.4 To meet WFD objectives	0	0	0	--	**Construction effects:** Option construction impacts are assessed as neutral. **Operational effects:** There is uncertainty regarding WFD objectives being met for hydrological regime in waterbodies assessed as having a 'low' impact (scoring 1). Uncertainty relates a deterioration in status class, possible impediment to GES or GEP, and possible compromise to water body objectives.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** Hydrological regime modelling should be further assessed at Gate 3 in relation to scheme transfer operations.	0	0	0	--

	3.5 To improve water efficiency through provision of access to a resilient and sustainable supply of water.	0	0	+++	0	**Construction effects:** Construction effects are assessed as neutral. **Operational effects:** During operation there would be a major positive effect due to the option contributing to a resilient water supply. Whilst this option will provide additional water resource (115 Ml/d) and it will provide essential water supply infrastructure to help support a sustainable socio-economy.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	+++	0
Air	4.1 To minimise air emissions during construction and operation	0	-	0	0	**Construction effects:** The site is within Birmingham AQMA. Construction on the WwTW has the potential for minor negative effects on air emissions from construction activities. **Operational effects:** Given the scale of the activities associated with the upgrade of an existing site, neutral effects are anticipated.	**Construction mitigation:** Consider use of rail for transporting materials. **Operation mitigation:** No further mitigation proposed	0	-	0	0
Climatic Factors	5.1 To introduce climate mitigation where required and improve the climate resilience of assets and natural systems	0	0	+++	0	**Construction effects:** Construction effects are assessed as neutral **Operational effects:** This option provides additional water resource and will during operation assist the reliable transfer of water, therefore reducing the vulnerability to drought risks associated with climate change and improving resilience to the likely effects of climate change. Major positive effects are anticipated.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	+++	0
	5.2 To minimise embodied and operational emissions	0	--	0	-	The carbon assessment has been completed by Jacobs as part of the Minworth Engineering workstream and is qualitatively summarised in the main EAR. **Construction effects:** Overall, during construction this option is considered to have a moderate negative environmental effect. **Operational effects:** Overall, during operation this option is considered to have a minor negative environmental effect on this objective.	**Construction mitigation:** The Gate 2 carbon assessment carried out by Jacobs assumed that the implementation of a number of low-carbon opportunities could reduce embodied emissions by a standard rate of 20%. Mitigation measures include: Low carbon concrete, substituting cement with other materials/ additives Novel alternatives to steel reinforcement in reinforced concrete (e.g., fibre-reinforced polymer bars). Reduce demolition trough trenchless techniques and avoid infrastructures such as railway lines, canals, motorways, highways, and urban areas. Re-use demolished material. Re-use existing available materials, e.g., processing, re-use of excavated material as fill. Sustainable construction materials. Efficient methods of work, e.g., more sustainable transport solutions. Minimising removal of vegetation to prevent loss of carbon storage in soils. In particular, minimising	0	--	0	-
Landscape	6.1 To conserve, protect and enhance landscape and townscape character and visual amenity	0	-	0	0	**Construction effects:** The site is located within the Birmingham Greenbelt. The upgrade works to the WwTW site will be contained with the operational land of the WwTW. The construction works will be temporary and the potential for adverse effects on the greenbelt during construction has been assessed as minor. **Operational effects:** The operational impacts are considered neutral.	**Construction mitigation:** Consider minimising the extent of construction works within the greenbelt. **Operation mitigation:** No further mitigation proposed	0	0	0	0
Historic Environment	7.1 To conserve/protect and enhance historic assets/cultural heritage and their setting, including archaeological important sites	0	-	0	0	**Construction effects:** There is a scheduled monument, Moated Site at Peddimore Hall, approximately 2.1km form the site. There are a number of listed buildings between 500m and 1km from the site. There is a conservation area approximately 600m from the site at Water Orton to the south. There is potential for neutral to minor effects on settings of heritage assets. **Operational effects:** The operational impacts are considered neutral.	**Construction mitigation:** Consultation with HE to identify mitigation measures in particular in relation to the listed buildings and conservation area within proximity **Operation mitigation:** Screening where settings of heritage assets would be affected.	0	0	0	0
Population and Human Health	8.1 To maintain and enhance the health and wellbeing of the local community, including economic and social wellbeing	+	-	++	0	**Construction effects:** The construction of this option would represent capital investment which is expected to generate some employment opportunities and supply chain benefits. The degree of this benefit will be dependent on the contractors recruitment and supply chain practices and will be temporary. Overall, the benefits are expected to be minor. There are two noise action important areas approximately 800m from the site – one to the east and one to the south. The site is also within an AQMA. There will be adverse effects such as noise, dust and vibrations during construction associated with construction activities and vehicles which could cause impacts on health and wellbeing at nearby sensitive receptors such as residential properties. Regarding indices of multiple deprivation, there are areas of income and health deprivation approximately 1.5km from the site. The upgrade at the WwTW will be within the site boundary and adjacent to existing treatment structures. No additional noise or landscape screening is envisaged at this time. Best practice construction techniques are assumed. However, there will be adverse effects such as noise, dust and vibrations during construction associated with construction activities and vehicles which could cause impacts on health and wellbeing at nearby sensitive receptors such as residential properties. Due to the scale and duration of the construction works and proximity of sensitive receptors a minor effect is anticipated. **Operational effects:** In operation, this scheme will increase regional resilience which may support economic and population growth. It will help to ensure provision of access to a secure resilient supply of drinking water including during times where additional water resources may not be available as part of an overall scheme. Therefore generating a minor positive effect. Traffic during operation expected to be limited therefore a neutral effect is anticipated during operation.	**Construction mitigation:** Construction compounds to be sited sensitively and away from residential areas. The hours of working associated with the construction of the treatment works, other sites and pipeline route limited to minimise amenity and environmental impacts. **Operation mitigation:** No further mitigation proposed	++	0	++	0
	8.2 To maintain and enhance tourism and recreation	0	0	0	0	**Construction effects:** There is an area of playing fields and tennis court approximately 280m from the site at Curdworth. There is an area of CRoW land approximately 700m to the south. Assuming the adoption of best practice construction techniques during construction this option is considered to have a neutral effect on this objective. **Operational effects:** In operation, there will be limited effects on recreational resources	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	0	0
	8.3 To secure resilient water supplies for the health and wellbeing of customers	0	0	++	0	**Construction effects:** Construction effects are assessed as neutral **Operational effects:** The option would contribute by providing a resilient water supply. It will provide essential water supply infrastructure to help support a sustainable socio-economy and therefore is considered to have a moderate positive effect.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	++	0

Assessment Cover Information	
Element Name	Minworth Combined (230 Ml/d)
Element Description	

SEA Topic	SEA Objective	Construction Effects +	Construction Effects -	Operational Effects +	Operational Effects -	Effect Description (including embedded mitigation i.e. costed mitigation that is committed to as part of the scheme)	Further mitigation	Residual Construction Effects +	Residual Construction Effects -	Residual Operational Effects +	Residual Operational Effects -
Biodiversity	1.1 To protect designated sites and their qualifying features	0	0	+	-	**Construction effects:** The area for construction includes development within the existing WwTW operational boundary. An HRA screening has been undertaken. This found that no Likely Significant Effects (LSE) are anticipated on the Severn Estuary SAC and Ramsar site or the Humber Estuary SAC, SPA and Ramsar site due to the distance between the proposed construction works and the designated sites. There would be no impact on the River Mease SAC. **Operational effects:** No LSE is anticipated on the River Mease SAC (a tributary of the River Tame) as the qualifying features are not dependent on flows in the River Tame. This has been confirmed during Gate 2 hydrogeological studies which shows that changes in levels and flows in the River Tame will not affect levels and flows in the River Mease SAC, and even the maximum reduction in flow at Minworth would not result in a sufficient fall in River Trent levels to materially affect the superficial aquifer linked to the lower River Mease. No LSE are anticipated on the Humber Estuary SPA. However, LSE cannot be dismissed at Gate 2 for the Humber Estuary SAC and Ramsar site specifically regarding sea lamprey and river lamprey upstream migration. This is because, while Cromwell Weir currently prevents upstream migration further up the River Trent, there is a consented proposal to install 2 eel passes which would also be passable to lamprey. Modelling undertaken of the weirs has shown that, while the impact of the Minworth SROs on fish passage over Cromwell Weir is likely to be low, a likely significant effect cannot be dismissed once the improved fish passes at Crowell Weir are installed. As such, an appropriate assessment will need to be undertaken at Gate 3 once 2D modelling has been completed and any mitigation devised. Direct effects on the SAC and Ramsar site are not expected as the hydrological impacts downstream of the River Tame confluence with the River Trent is considered minor and the European site is ~150 miles downstream of the Minworth WwTW. Embedded mitigation actions will lead to a 10% biodiversity net gain, which may support designated sites and their qualifying features.	**Construction mitigation:** No further mitigation proposed. **Operation mitigation:** Further 2D modelling at and around the site is recommended and this will inform any mitigation that may be required.	0	0	+	0
	1.2 To avoid a net reduction, and where possible enhance, in non-monetised natural capital assets	0	0	+	0	**Construction effects:** Construction site is located almost entirely on urban land. Risks to natural capital stocks are therefore negligible. **Operational effects:** Mitigation actions will lead to a 10% biodiversity net gain and improvement in climate regulation and recreational benefits. Although embodied and operational emissions decrease the total value of climate regulation benefits, these are lower than the total amount of carbon sequestered by the habitats within Priority Habitat. Overall, results indicate that the scheme is expected to lead to a net benefit, compared to the do-nothing scenario, which increases with higher volumes of water transfer per day. All the natural capital values are similar across the scenarios and higher relative to the baseline, except for the embodied and operational carbon emissions. These emissions increase with higher volumes of water transfer per day, contributing to the decrease in the net benefit.	**Construction mitigation:** No further mitigation proposed. **Operation mitigation:** The findings from the Natural Capital assessment are intended to feed into recommendations for further assessment for Gate 3. Data from the ongoing surveys and assessments and more detailed knowledge of the scenario outcomes and mitigation options will be necessary in order to re-run the six capitals assessment in Gate 3.	0	0	+	0
	1.3 To protect and enhance biodiversity, priority habitats and species	0	0	+	0	**Construction effects:** No habitats are being affected on site. Effects are considered neutral. **Operational effects:** Several priority species of fish have been recorded downstream of the Minworth WwTW in the River Tame. Hydrological assessment of effects of discharge reduction from Minworth WwTW on the downstream River Tame would have a minor effect on flows and impacts on the priority species are considered negligible. Mitigation actions will lead to a 10% biodiversity net gain with the potential for minor positive effects.	**Construction mitigation:** No further mitigation proposed. **Operation mitigation:** No further mitigation proposed.	0	0	+	0
	1.4 To avoid and, where required, manage invasive and non-native species (INNS)	0	0	0	0	**Construction effects:** Construction impacts are considered neutral. **Operational effects:** Wastewater entering the WwTW will be from sanitary sewers comprised of municipal wastewater.The treatment process will mitigate against the distribution of INNS via the final effluent. The reduction in effluent and subsequent reduction in flows in the River Tame could potentially be beneficial with regards to the distribution of INNS with decreased volumes of water resulting in a decreased risk in the distribution of INNS that spread via seeds and propagules. However, this effect is uncertain and overall has been assessed as neutral.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	0	0
	1.5 To meet WFD objectives relating to biodiversity	0	0	0	-	**Construction effects:** Option construction impacts are assessed as neutral. **Operational effects:** The Gate 2 assessment concludes that the WFD status for fish may be impacted during 230Ml/d flows on the Tame from R Blythe to River Anker (GB104028046440). Flow is the main factor that is likely to drive the impact upon fish presence, migration, and habitats within the water body in addition to other migration barriers. The weir at Lea Marston can be considered a migration barrier as it does not have any fish passages currently installed to allow fish migration upstream.	**Construction mitigation:** Tunnelling for all water courses where needed in addition to those specified. With further consideration of watercourses to cross without in-channel works, construction impacts would be neutral for WFD compliance. **Operation mitigation:** Further development of operating conditions for effluent transfer and further hydro-ecological and water quality assessment of effects of major change in flow regime in the Rivers Tame and Trent is required.	0	0	0	-
Soil	2.1 To protect and enhance the functionality, quantity and quality of soils, including the protection of high-grade agricultural land	0	0	0	0	**Construction effects:** Construction is taking place on urban land/ the existing WwTW. Effects are therefore neutral. **Operational effects:** The operation of the scheme will not affect land use, soils, or geology.	**Construction mitigation:** No further mitigation proposed. **Operation mitigation:** No further mitigation proposed	0	0	0	0
Water	3.1 To minimise or manage flood risk, taking climate change into account	0	0	++	0	**Construction effects:** The removal of water from the Tame and Trent system will provide extra capacity, reducing flood risk with the potential for moderate positive effects. **Operational effects:** Operational effects have been assessed as neutral	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	++	0
	3.2 To enhance or maintain groundwater quality and resources	0	0	0	0	**Construction effects:** Option construction effects are assessed as neutral. **Operational effects:** Operational effects are assessed as neutral.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	0	0
	3.3 To enhance or maintain surface water quality, flows and quantity	0	0	0	--	**Construction effects:** Option construction impacts are assessed as neutral. **Operational effects:** The transfer of 230Ml/d flow from Minworth WwTW is identified as having a 'low impact' (impact score "1") on the Tame - R Rea to R Blythe (GB104028046841), Tame from R Blythe to River Anker (GB104028046440), and Tame from River Anker to River Trent (GB104028047050). The WFD quality elements responsible for an impact score of "1" are highlighted below: Tame - R Rea to R Blythe (GB104028046841) – Hydrological regime Tame from R Blythe to River Anker (GB104028046440) – Fish and Hydrological regime Tame from River Anker to River Trent (GB104028047050) - Hydrological regime All WFD quality elements scoring "1" were uncertain for a deterioration in status class, possible impediment to GES or GEP, and possible compromise to water body objectives. From a water quality perspective, the potential major flow reduction could associate with changes in physico-chemical river processes from reduced velocities and increased time of travel; and from reduced buffering capacity from known continuous and intermittent water quality pressures.	**Construction mitigation:** Further mitigation measures will be set out in the applications for Flood Defence Consents where these are required for the river crossing construction works. Tunnelling for all watercourse crossings. **Operation mitigation:** Hydrological regime modelling should be further assessed at Gate 3 in relation to scheme transfer operations.	0	0	0	--

	3.4 To meet WFD objectives	0	0	0	--	**Construction effects:** Option construction impacts are assessed as neutral. **Operational effects:** There is uncertainty regarding WFD objectives being met for hydrological regime in waterbodies assessed as having a 'low' impact (scoring 1). Uncertainty relates a deterioration in status class, possible impediment to GES or GEP, and possible compromise to water body objectives.	**Construction mitigation:** No further mitigation proposed. **Operation mitigation:** Hydrological regime modelling should be further assessed at Gate 3 in relation to scheme transfer operations.	0	0	0	--
	3.5 To improve water efficiency through provision of access to a resilient and sustainable supply of water.	0	0	+++	0	**Construction effects:** Construction effects are assessed as neutral. **Operational effects:** During operation there would be a major positive effect due to the option contributing to a resilient water supply. Whilst this option will provide additional water resource (230 Ml/d) and it will provide essential water supply infrastructure to help support a sustainable socio-economy.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	+++	0
Air	4.1 To minimise air emissions during construction and operation	0	-	0	0	**Construction effects:** The site is within Birmingham AQMA. Construction on the WwTW has the potential for minor negative effects on air emissions from construction activities. **Operational effects:** Given the scale of the activities required, neutral effects are anticipated.	**Construction mitigation:** Consider use of rail for transporting materials. **Operation mitigation:** No further mitigation proposed	0	-	0	0
Climatic Factors	5.1 To introduce climate mitigation where required and improve the climate resilience of assets and natural systems	0	0	+++	0	**Construction effects:** Construction effects are assessed as neutral. **Operational effects:** This option provides additional water resource and will during operation assist the reliable transfer of water, therefore reducing the vulnerability to drought risks associated with climate change and improving resilience to the likely effects of climate change. Major positive effects are anticipated**.**	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	+++	0
	5.2 To minimise embodied and operational emissions	0	--	0	--	The carbon assessment has been completed by Jacobs as part of the Minworth Engineering workstream and is qualitatively summarised in the main EAR. **Construction effects:** Overall, during construction this option is considered to have a moderate negative environmental effect. **Operational effects:** Overall, during operation this option is considered to have a moderate negative environmental effect on this objective.	**Construction mitigation:** The Gate 2 carbon assessment carried out by Jacobs assumed that the implementation of a number of low-carbon opportunities could reduce embodied emissions by a standard rate of 20%. Mitigation measures include: Low carbon concrete, substituting cement with other materials/ additives. Novel alternatives to steel reinforcement in reinforced concrete (e.g., fibre-reinforced polymer bars)	0	--	0	-
Landscape	6.1 To conserve, protect and enhance landscape and townscape character and visual amenity	0	-	0	0	**Construction effects:** The site is located within the Birmingham Greenbelt. The upgrade works to the WwTW site will be contained with the operational land of the WwTW. The construction works will be temporary and the potential for adverse effects on the greenbelt during construction has been assessed as minor. **Operational effects:** The operational impacts are considered neutral.	**Construction mitigation:** Consider minimising the extent of construction works within the greenbelt. Use of trenchless techniques for pipeline construction. **Operation mitigation:** No further mitigation proposed	0	0	0	0
Historic Environment	7.1 To conserve/protect and enhance historic assets/cultural heritage and their setting, including archaeological important sites	0	-	0	0	**Construction effects:** There is a scheduled monument, Moated Site at Peddimore Hall, approximately 2.1km form the site. There are a number of listed buildings between 500m and 1km from the site. There is a conservation area approximately 600m from the site at Water Orton to the south. There is potential for neutral to minor effects on settings of heritage assets. **Operational effects:** The operational impacts are considered neutral.	**Construction mitigation:** Consultation with HE to identify mitigation measures in particular in relation to the listed buildings and conservation area within proximity **Operation mitigation:** Screening where settings of heritage assets would be affected.	0	0	0	0
Population and Human Health	8.1 To maintain and enhance the health and wellbeing of the local community, including economic and social wellbeing	+	-	+++	0	**Construction effects:** The construction of this option would represent capital investment which is expected to generate some employment opportunities and supply chain benefits. The degree of this benefit will be dependent on the contractors recruitment and supply chain practices and will be temporary. Overall, the benefits are expected to be minor. There are two noise action important areas approximately 800m from the site – one to the east and one to the south. The site is also within an AQMA. There will be adverse effects such as noise, dust and vibrations during construction associated with construction activities and vehicles which could cause impacts on health and wellbeing at nearby sensitive receptors such as residential properties. Regarding indices of multiple deprivation, there are areas of income and health deprivation approximately 1.5km from the site. The upgrade at the WwTW will be within the site boundary and adjacent to existing treatment structures. No additional noise or landscape screening is envisaged at this time. Best practice construction techniques are assumed. However, there will be adverse effects such as noise, dust and vibrations during construction associated with construction activities and vehicles which could cause impacts on health and wellbeing at nearby sensitive receptors such as residential properties. Due to the scale and duration of the construction works and proximity of sensitive receptors a minor effect is anticipated. **Operational effects:** In operation, this scheme will increase regional resilience which may support economic and population growth. It will help to ensure provision of access to a secure resilient supply of drinking water including during times where additional water resources may not be available. Therefore generating a major positive effect. Traffic during operation expected to be limited therefore a neutral effect is anticipated during operation.	**Construction mitigation:** Construction compounds to be sited sensitively and away from residential areas. The hours of working associated with the construction of the treatment works, other sites and pipeline route limited to minimise amenity and environmental impacts. **Operation mitigation:** No further mitigation proposed	++	0	+++	0
	8.2 To maintain and enhance tourism and recreation	0	0	0	0	**Construction effects:** There is an area of playing fields and tennis court approximately 280m from the site at Curdworth. There is an area of CRoW land approximately 700m to the south. Assuming the adoption of best practice construction techniques during construction this option is considered to have a neutral effect on this objective. **Operational effects:** In operation, there will be limited effects on recreational resources	**Construction mitigation:** No further mitigation proposed. **Operation mitigation:** No further mitigation proposed.	0	0	0	0
	8.3 To secure resilient water supplies for the health and wellbeing of customers	0	0	+++	0	**Construction effects:** Construction effects are assessed as neutral. **Operational effects:** The option would contribute by providing a resilient water supply. It will provide essential water supply infrastructure to help support a sustainable socio-economy and therefore is considered to have a major positive effect.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	+++	0

Assessment Cover Information	
Element Name	Piped diversion of final effluent from Minworth STW for discharge to the River Avon
Element Description	Piped diversion of 115 Ml/d of final effluent from Minworth STW for discharge to the River Avon . Components comprise: • Final effluent high lift pump station • Rising main – 15.9km / 900mm diameter • Break Pressure Tank 5Ml at Storehouse Barn adjacent to Bake Lane • Gravity main – 12.34km / 1050mm diameter • Outfall to River Avon

SEA Topic	SEA Objective	Construction Effects		Operational Effects		Effect Description (including embedded mitigation i.e. costed mitigation that is committed to as part of the scheme)	Further mitigation	Residual Construction Effects		Residual Operational Effects	
		+	-	+	-			+	-	+	-
Biodiversity	1.1 To protect designated sites and their qualifying features	0	---	+	0	**Construction effects:** An HRA screening has been undertaken. This found that no Likely Significant Effects (LSE) are anticipated on the Severn Estuary SAC and Ramsar site or the Humber Estuary SAC, SPA and Ramsar site due to the distance between the proposed construction works and the designated sites. There would be no impact on the River Mease SAC. However the pipeline crosses through two SSSIs - Coleshill and Bannerly Pools and River Blythe and is approximately 500m from Berkswell Marsh SSSI. There is a local nature reserve adjacent to the pipeline route at Coleshill. There are areas of ancient woodland within 1km of the pipeline route including one area south of Ballsall Common where the route runs along the edge of the ancient woodland. Due to the crossing of two SSSIs and proximity of other designated sites major adverse effects are anticipated. **Operational effects:** It is assumed that the pipeline would be buried during operation. No effects are therefore considered during operation. Embedded mitigation actions will lead to a 10% biodiversity net gain, which may support designated sites and their qualifying features.	**Construction mitigation:** The route should be realigned to avoid the SSSIs. Discussions with NE regarding SSSI and ancient woodland protection measures. The detail of the working areas (and in some cases construction areas and pipeline itself) will be reviewed with NE as part of the further detailed design of the scheme. A Phase 1 habitat survey of the River Blythe SSSI, Coleshill and Bannerly SSSI and Cole End LNR should be completed to understand the impacts that nearby works could have on these designated sites. Use of trenchless technology, where possible. If the section through the River Blythe SSSI is proposed to be achieved via tunnelling, then further hydrological assessment would be required to establish whether the tunnelling would have an impact on the hydrology of the SSSI. The need to avoid works during certain times of the year will be identified through the completion of the additional environmental investigations. Further investigation for potential effects on fish habitat in the River Tame. **Operation mitigation:** No further mitigation proposed.	0	-	0	0
	1.2 To avoid a net reduction, and where possible enhance, in non-monetised natural capital assets	0	0	+	0	**Construction effects:** Construction site is located almost entirely on urban land. Risks to natural capital stocks are therefore negligible. **Operational effects:** Mitigation actions will lead to a 10% biodiversity net gain and improvement in climate regulation and recreational benefits. Although embodied and operational emissions decrease the total value of climate regulation benefits, these are lower than the total amount of carbon sequestered by the habitats within Priority Habitat. Overall, results indicate that the scheme is expected to lead to a net benefit, compared to the do nothing scenario, which increases with higher volumes of water transfer per day. All the natural capital values are similar across the scenarios and higher relative to the baseline, except for the embodied and operational carbon emissions.	**Construction mitigation:** No further mitigation proposed. **Operation mitigation:** The findings from the Natural Capital assessment are intended to feed into recommendations for further assessment for Gate 3. Data from the ongoing surveys and assessments and more detailed knowledge of the scenario outcomes and mitigation options will be necessary in order to re-run the six capitals assessment in Gate 3.	0	0	+	0
	1.3 To protect and enhance biodiversity, priority habitats and species	0	-	+	0	**Construction effects:** The pipeline passes through a number of priority areas. Priority species within the construction zone may be subjected to short term, temporary impacts of a minor magnitude. Best practice construction techniques are assumed. Minor impact pathways to priority species include increases in noise and vibration disturbance, and temporary fragmentation of habitat. It is unlikely that construction will affect priority species such as birds through noise disruption due to distance and proximity from site. In consideration of these impacts the effects on this objective are considered minor negative. **Operational effects:** Loss of terrestrial Priority Habitat would have occurred during construction. However, embedded mitigation actions will ensure a 10% biodiversity net gain. It is assumed that the pipeline would be buried during operation.	**Construction mitigation:** Tunnelling for all sections of route which goes through priority habitat. The detail of the working areas (and in some cases construction areas and pipeline itself) will be reviewed with NE as part of the further detailed design of the scheme. If site specific ecological assessments identify any impacts to protected species or habitats associated with the construction work, appropriate mitigation measures including (where appropriate) relocation of such species will be undertaken in advance of the works being undertaken. **Operation mitigation:** No further mitigation proposed.	0	-	+	0
	1.4 To avoid and, where required, manage invasive and non-native species (INNS)	0	0	0	0	**Construction effects:** Whilst there is a potential risk of spreading INNS during construction, mitigation measures will be adopted including best practice construction practices, the identification and removal of invasive species on site in advance of construction, and pipeline commissioning with treated water. In consideration of these mitigation measures the impacts of these risks are considered neutral. **Operational effects:** The operation of the pipeline will not affect INNS.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	0	0
	1.5 To meet WFD objectives relating to biodiversity	0	-	0	0	**Construction effects:** There will be five watercourse and two canal crossings during pipeline construction. Construction impacts are therefore assessed as a minor negative effect. **Operational effects:** The operation of the pipeline will not affect WFD objectives relating to biodiversity.	**Construction mitigation:** Tunnelling for all water courses where needed in addition to those specified. With further consideration of watercourses to cross without in-channel works, construction impacts would be neutral for WFD compliance. **Operation mitigation:** No further mitigation proposed	0	0	0	0
Soil	2.1 To protect and enhance the functionality, quantity and quality of soils, including the protection of high-grade agricultural land	0	-	0	0	**Construction effects:** Most of the pipeline route is within grade 3 agricultural land and a small area is within grade 2. The pipeline route runs along the edge of permitted and historic landfills and is within 1km of a number of other landfilled areas. Although the route does not encroach directly onto any landfill areas there is potential for contamination pathways during construction. Overall, the construction impacts are considered minor negative. **Operational effects:** The operation of the pipeline will not affect land use, soils, or geology.	**Construction mitigation:** Limiting the extent of pipeline construction will minimise the time period for soil disturbance. Review the pipeline route to maximise distance from landfilled areas. Ground investigations to be undertaken prior to commencement of works to identify necessary mitigation measures. **Operation mitigation:** No further mitigation proposed	0	-	0	0

Water	3.1 To minimise or manage flood risk, taking climate change into account	0	-	0	0	**Construction effects:** The pipeline is within a number of areas of flood zone 2 and 3. It crosses a number of main rivers. Use of trenchless techniques to cross the watercourses. Construction compounds would be sited sensitively and away from flood risk zones. Adequate methods of construction will be adopted to minimise the impact, including sheet piling, dewatering and treatment of the groundwater prior to discharge. Flood compensation ponds will be constructed as part of the enabling works. Earthworks sequencing will include cofferdam formation to avoid flooding of borrow areas during construction. Given the scope of the construction works a minor negative effect on flood risk has been identified. **Operational effects:** The scheme would not affect flood storage once operational and the necessary flood plain compensation are complete.	**Construction mitigation:** Further mitigation measures will be set out in the applications for Flood Defence Consents where these are required for the river crossing construction works. **Operation mitigation:** No further mitigation proposed	0	-	0	0
	3.2 To enhance or maintain groundwater quality and resources	0	-	0	0	**Construction effects:** The scheme is within a source protection zone to the north west of Hatton Park. It is within a WFD groundwater body. During construction of the pipeline, areas with high permeability and high groundwater levels would require permits to be obtained by the contractor from the relevant authorities for the disposal of the groundwater to a suitable location. There would also be a need for lagoons to intercept and treat the commissioning wastewater. The lagoons would need to be available prior to pressure testing and land would be reinstated after commissioning. All vehicles and any chemical/oil storage will be fully bunded to prevent any accidental pollution of groundwater. Overall a minor negative effect on groundwater is considered. **Operational effects:** The pipeline would not affect groundwater quality and resources once operational.	**Construction mitigation:** Further mitigation measures will be developed in consultation with the regulators as part of the detailed design process. **Operation mitigation:** No further mitigation proposed	0	0	0	0
	3.3 To enhance or maintain surface water quality, flows and quantity	0	-	0	0	**Construction effects:** A number of rivers (including six main rivers) would be crossed by the scheme and a risk to water quality therefore exists. Construction of discharge and abstraction points and pipeline river crossings have the potential to effect water quality in the river and downstream. Five watercourses and two canals would be crossed via tunnelling. Best practice construction methods will also be adopted. Given the scale of the construction activities required and that some water courses may not be tunnelled, minor negative effects are anticipated. **Operational effects:** The pipeline would not affect surface water quality, flows and quantity once operational.	**Construction mitigation:** Further mitigation measures will be set out in the applications for Flood Defence Consents where these are required for the river crossing construction works. Tunnelling for all watercourse crossings. **Operation mitigation:** No further mitigation proposed	0	-	0	0
	3.4 To meet WFD objectives	0	-	0	0	**Construction effects:** Construction of the pipeline is assessed as minor negative effect prior to mitigation. **Operational effects:** The pipeline would not impact upon WFD objectives once operational.	**Construction mitigation:** With further consideration of watercourses to cross without in-channel works, construction impacts would be neutral for WFD compliance. **Operation mitigation:** No further mitigation proposed	0	0	0	0
	3.5 To improve water efficiency through provision of access to a resilient and sustainable supply of water.	0	0	0	0	**Construction effects:** Construction effects are assessed as neutral. **Operational effects:** Operational effects are assessed as neutral.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	0	0
Air	4.1 To minimise air emissions during construction and operation	0	--	0	0	**Construction effects:** The duration of construction would be 60 months. There would be approximately 2,500 HGV movements, which will result in vehicle emissions to air. The scheme passes through a number of urban areas and part of the route near Minworth is within the Birmingham AQMA. Therefore there is potential for moderate negative effects on air emissions from construction activities. **Operational effects:** During operation there would be approximately 76 vehicle movements per year. Given the scale of the activities required, neutral effects are anticipated.	**Construction mitigation:** Consider use of rail for transporting materials. Approved traffic routes for construction traffic will be applied in order to minimise impacts on local roads. **Operation mitigation:** No further mitigation proposed	-	0	0	0
Climatic Factors	5.1 To introduce climate mitigation where required and improve the climate resilience of assets and natural systems	0	0	+++	0	**Construction effects:** Construction effects are assessed as neutral **Operational effects:** This option supports the provision of additional water resource and will during operation assist the reliable transfer of water, therefore reducing the vulnerability to drought risks associated with climate change and improving resilience to the likely effects of climate change. Major positive effects are anticipated.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	+++	0
	5.2 To minimise embodied and operational emissions	0	---	0	--	The carbon assessment has been completed by Jacobs as part of the Minworth Engineering workstream and is qualitatively summarised in the main EAR. **Construction effects:** Overall, during construction this option is considered to have a major negative environmental effect. **Operational effects:** Overall, during operation this option is considered to have a moderate negative environmental effect on this objective.	**Construction mitigation:** The Gate 2 carbon assessment carried out by Jacobs assumed that the implementation of a number of low-carbon opportunities could reduce embodied emissions by a standard rate of 20%. Mitigation measures include: Low carbon concrete, substituting cement with other materials/ additives Novel alternatives to steel reinforcement in reinforced concrete (e.g., fibre-reinforced polymer bars). Reduce demolition trough trenchless techniques and avoid infrastructures such as railway lines, canals, motorways, highways, and urban areas. Re-use demolished material. Re-use existing available materials, e.g., processing, re-use of excavated material as fill. Sustainable construction materials. **Operation mitigation:**	0	--	0	-
Landscape	6.1 To conserve, protect and enhance landscape and townscape character and visual amenity	0	-	0	0	**Construction effects:** The pipeline does not pass through any National Parks and AONBs. The site is located within the Birmingham Greenbelt. Costruction works will be temporary and the potential for adverse effects on the greenbelt during construction has been assessed as minor. **Operational effects:** It is assumed that the pipeline would be buried during operation. Furthermore, landscape planting will be adopted to screen new infrastructure where necessary. In the short to medium term, fields would return to their original condition. Overall, the operational impacts are considered neutral.	**Construction mitigation:** Consider minimising the extent of construction works within the greenbelt. Use of trenchless techniques for pipeline construction. **Operation mitigation:** No further mitigation proposed	0	0	0	0
Historic Environment	7.1 To conserve/protect and enhance historic assets/cultural heritage and their setting, including archaeological important sites	0	--	0	0	**Construction effects:** The scheme is approximately 250m from a scheduled monument, Coleshill Bridge. There are others within 1km including Cursus, enclosures and other cropmarks 900m NNW of Barford Church. There are three registered parks and gardens within 500m of the pipeline route - Warwick Castle, Wroxall Abbey and Packington Hall. There are also others within 3km with potential to affect views. The pipeline route runs in close proximity to a large number of listed buildings, a number of which are immediately adjacent to the route. It is therefore considered that there exists potential moderate negative effects on a number of heritage assets. **Operational effects:** It is assumed that the pipeline will be buried and therefore operational effects are neutral.	**Construction mitigation:** The alignment of the pipeline should be developed further during design development and further consultation with Historic England should be undertaken during this process. This should include refining mitigation measures in particular in relation to the scheduled monuments, listed buildings and conservation areas within proximity of the pipeline route. Sensitive location of construction compounds to avoid heritage assets and retain a buffer around them to be defined further in consultation with Historic England. The development of an archaeological programme of works including archaeological monitoring is proposed. **Operation mitigation:** No further mitigation proposed.	0	-	0	0
Human Health	8.1 To maintain and enhance the health and wellbeing of the local community, including economic and social wellbeing	++	--	0	0	**Construction effects:** The construction of this option would represent significant capital investment which is expected to generate a number of employment opportunities and supply chain benefits. The degree of this benefit will be dependent on the contractors recruitment and supply chain practices and will be temporary. Overall, the benefits are expected to be moderate. The duration of construction would be 60 months. There are sensitive buildings such as schools and places of worship within 500m of the pipeline route. The pipeline route is within five Noise Action Important Areas and adjacent to a number of others. There will be adverse effects such as noise, dust and vibrations during construction associated with construction activities and vehicles which could cause impacts on health and wellbeing at nearby sensitive receptors such as residential properties. The scheme is within 1km of areas of income and health deprivation. The upgrade at the WwTW will be within the site boundary and adjacent to existing treatment structures. No additional noise or landscape screening is envisaged at this time. There would be temporary construction areas adjacent to permanent sites at the outfall and along the pipeline route. Overall, 2500 HGV movements are anticipated during the construction period. Construction activities would cause minor disruption to road and rail infrastructure as a result of crossings. Five railway crossings, four motorway crossings, 11 A/B road crossings and 26 minor road crossings would be via tunnelling. Best practice construction techniques are assumed. However, there will be adverse effects such as noise, dust and vibrations during construction associated with construction activities and vehicles which could cause impacts on health and wellbeing at nearby sensitive receptors such as residential properties. Due to the scale and duration of the construction works and proximity of sensitive receptors a moderate effect is anticipated. **Operational effects:** Traffic during operation expected to be limited therefore a neutral effect is anticipated during operation.	**Construction mitigation:** Tunnelling for all rail and A road crossings. Construction compounds to be sited sensitively and away from residential areas. Construction compounds along the pipeline next to a main road, so that there is least disturbance to local traffic. The hours of working associated with the construction of the treatment works, other sites and pipeline route limited to minimise amenity and environmental impacts. **Operation mitigation:** No further mitigation proposed	++	-	0	0

Population and	8.2 To maintain and enhance tourism and recreation	0	--	0	0	**Construction effects:** The pipeline route is located at the edge of a number of recreational facilities such as a golf course to the west of Meriden and within 500m of a number more. The pipeline route crosses a number of PRoW including National Trails and also a cycle route. The pipeline route also crosses main rivers and there are areas of CRoW Act section 15 land within 500m. All reasonable effort will be made to avoid temporary closure of public rights of way and diversions will be provided instead. Public rights of way will be reinstated following construction completion. Careful siting and use of screening where work locations are in proximity to public rights of way will be undertaken. Overall, during construction this option is considered to have a minor negative effect on this objective. **Operational effects:** In operation, there will be limited effects on recreational resources.	**Construction mitigation:** Consider reviewing route to avoid recreational areas. Avoid temporary closure of public rights of way and diversions. Public rights of way reinstated following construction completion. Careful siting and use of screening where work locations are in proximity to public rights of way. **Operation mitigation:** There is the opportunity to improve footpaths and connections in and around proposed pipeline route as part of the construction work, giving rise to a permanent minor beneficial effect.	0	0	+	0
	8.3 To secure resilient water supplies for the health and wellbeing of customers	0	0	++	0	**Construction effects:** Construction effects are assessed as neutral **Operational effects:** The option would contribute towards providing a resilient water supply. It will provide essential water supply infrastructure to help support a sustainable socio-economy and therefore is considered to have a major positive effect.	**Construction mitigation:** No further mitigation proposed **Operation mitigation:** No further mitigation proposed	0	0	++	0

Environmental Assessments – Scoping Checklist

Recommendations for further environmental assessments from the Tame and Trent environmental assessment report (*Environmental Assessment for the Trent Strategic Resource Options (SRO): Minworth SRO and South Lincolnshire Reservoir (SLR) SRO: Results and Recommendations*. AECOM, July 2022) are reproduced below. Appendices to the that report are referenced within the table. Those recommendations relevant to the Minworth SRO are shown below, with the final column indicating their relevance to the Regulatory Assessments presented in this EAR.

Table B: Scoping Checklist for post-Gate 2 assessment and mitigation

Receptor or Feature under Assessment	Significance	Impact Pathway and Source (Minworth and/or SLR)	Scale of Impact (Positive / Neutral / Negative)	Red/Amber/Green Risk of SRO affecting the receptor (High / Medium / Low)	Recommendations for Further Assessment	Mitigation Options	Relevance to Regulatory Assessment Topics
SSSI Interaction – refer to Appendix A SSSI Interaction							
Donington Park	National	Minor impact from Minworth SRO felt in River Trent levels, superficial Secondary aquifer, and bedrock Principal aquifer. SSSI has no hydraulic connection to changing water levels related to River Trent.	Neutral	Low	None required	None required	SEA, BNG, Nat Cap
Whitacre Heath SSSI	National	Minor impact from Minworth SRO felt in River Tame levels, and superficial Secondary aquifer. SSSI water features have no hydraulic connection to changing water levels related to River Tame. Ponds supported by rainfall and flooding.	Neutral	Low	None required	None required	SEA, BNG, Nat Cap

Receptor or Feature under Assessment	Significance	Impact Pathway and Source (Minworth and/or SLR)	Scale of Impact (Positive / Neutral / Negative)	Red/Amber/Green Risk of SRO affecting the receptor (High / Medium / Low)	Recommendations for Further Assessment	Mitigation Options	Relevance to Regulatory Assessment Topics
		No significant change in high flows to affect inundation by flooding. Change in flow from Minworth discharge a small component of high flows.					
Attenborough Gravel Pits SSSI	National	Minor impact from Minworth SRO felt in River Trent levels, and superficial aquifer. SSSI water features disconnected from river by flood embankments, weirs, sluices. Superficial Secondary aquifer groundwater levels supported by River Erewash as well as River Trent. Impact on superficial Secondary aquifer groundwater levels not significant compared to seasonal variation and with River Trent levels controlled by nearby weir.	Neutral	Low	None required	None required	SEA, BNG, Nat Cap
Holme Pit	National	Minor impact from Minworth SRO felt in River Trent levels, and superficial Secondary aquifer. SSSI water features at higher elevation than River Trent, no backing up in surface water levels	Neutral	Low	None required	None required	SEA, BNG, Nat Cap

Receptor or Feature under Assessment	Significance	Impact Pathway and Source (Minworth and/or SLR)	Scale of Impact (Positive / Neutral / Negative)	Red/Amber/Green Risk of SRO affecting the receptor (High / Medium / Low)	Recommendations for Further Assessment	Mitigation Options	Relevance to Regulatory Assessment Topics
		caused by the River Trent that would support surface water features, Impact on superficial Secondary aquifer groundwater levels not significant compared to seasonal variation.					
Lockington Marshes	National	Minor impact from Minworth SRO felt in River Trent levels, and superficial Secondary aquifer. SSSI water features disconnected from river by flood embankments, sluices. Superficial Secondary aquifer groundwater levels supported by River Soar as well as River Trent. River Trent levels controlled by nearby weir. Impact on superficial Secondary aquifer groundwater levels not significant compared to seasonal variation.	Neutral	Low	None required	None required for SRO. Breach in flood embankments would potentially improve SSSI condition. SSSI at risk from proposed new quarrying	SEA, BNG, Nat Cap
Lea Marsh	National	Minor impact from Minworth and SLR SROs felt in River Trent	Neutral	Low	None required	None required	SEA, BNG, Nat Cap

Receptor or Feature under Assessment	Significance	Impact Pathway and Source (Minworth and/or SLR)	Scale of Impact (Positive / Neutral / Negative)	Red/Amber/Green Risk of SRO affecting the receptor (High / Medium / Low)	Recommendations for Further Assessment	Mitigation Options	Relevance to Regulatory Assessment Topics
		levels, and superficial Secondary aquifer. SSSI water features at higher elevation than River Trent, no backing up of River Trent levels that would support surface water features. Impact on superficial Secondary aquifer groundwater levels not significant. Cromwell Weir controlling flow into lower River Trent reaches. Tidal variation is a significant control on water levels. Change in level expected to be not significant compared to tidal range.					
Humber Estuary	International	Minor impact from Minworth and SLR SROs felt in River Trent levels, and superficial Secondary aquifer. Cromwell Weir controlling flow into lower River Trent reaches. Tidal variation is a significant control on water levels. Change in	Neutral	Low	None required	None required	SEA, BNG, Nat Cap, HRA, WFD

Receptor or Feature under Assessment	Significance	Impact Pathway and Source (Minworth and/or SLR)	Scale of Impact (Positive / Neutral / Negative)	Red/Amber/Green Risk of SRO affecting the receptor (High / Medium / Low)	Recommendations for Further Assessment	Mitigation Options	Relevance to Regulatory Assessment Topics
		level not significant compared to tidal range.					
River Mease	International	Minor impact from Minworth SRO felt in River Tame and River Trent levels, and superficial Secondary aquifer. River Mease found not to gain flow from superficial aquifer at expense of River Tame. Change in River Trent levels will not lower groundwater levels in the lower Mease area significantly to cause loss of flow to superficial Secondary aquifer.	Neutral	Low	None required	None required	SEA, BNG, Nat Cap, HRA, WFD
River Blythe	National	Minor impact from Minworth SRO felt in River Tame levels, and superficial Secondary aquifer. Impact on superficial Secondary aquifer groundwater levels not significant. Groundwater levels in superficial Secondary aquifer supported by River Cole levels, River Blythe levels and aquifer recharge. May reduce backing up on lower River Blythe caused by	Neutral (for groundwater interactions effect on SSSI) See other topic areas for other effects (Aquatic Ecology Appendix B(ii)).	Low (for groundwater interactions effect on SSSI) See other topic areas for other effects.	None required (for groundwater interactions effect on SSSI) See other topic areas for other effects.	None required (for groundwater interactions effect on SSSI) See other topic areas for other effects.	SEA, BNG, Nat Cap, WFD

Receptor or Feature under Assessment	Significance	Impact Pathway and Source (Minworth and/or SLR)	Scale of Impact (Positive / Neutral / Negative)	Red/Amber/Green Risk of SRO affecting the receptor (High / Medium / Low)	Recommendations for Further Assessment	Mitigation Options	Relevance to Regulatory Assessment Topics
		abstraction. Influence on river levels from weirs.					
Terrestrial Ecology – refer to Appendix B(i) Ecology							
E.ON Meadows (Whitacre Flood Meadow LWS & Whitacre Pool LWS)	County	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth lowering baseflows adjacent to this site.	Neutral	Low	No significant effects predicted. Further assessment recommended to inform potential mitigation options for BNG.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG
Ladywalk LWS	County	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth lowering baseflows adjacent to this site.	Neutral	Medium	Further assessment recommended to assess connectivity of existing channels to the River Tame, and to inform potential mitigation options for BNG.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG
Whitacre Heath SSSI	National	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth lowering baseflows adjacent to this site.	Neutral	Low	No significant effects predicted. Further assessment recommended to inform potential mitigation options for BNG.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG
Lea Marston LWS & Coton Pools LWS	County	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth lowering baseflows adjacent to this site.	Neutral	Low	No significant effects predicted. Further assessment recommended to inform potential mitigation options for BNG.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG

Receptor or Feature under Assessment	Significance	Impact Pathway and Source (Minworth and/or SLR)	Scale of Impact (Positive / Neutral / Negative)	Red/Amber/Green Risk of SRO affecting the receptor (High / Medium / Low)	Recommendations for Further Assessment	Mitigation Options	Relevance to Regulatory Assessment Topics
Kingsbury Wetlands (Water Park) LWS	County	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth lowering baseflows adjacent to this site.	Neutral	Medium	Further assessment recommended to assess connectivity of existing channels to the River Tame, and to inform potential mitigation options for BNG.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG
RSPB Middleton Lakes (Fisher's Mill Meadow LWS and Dosthill Pit & Middleton Hall Pit LWS)	County	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth lowering baseflows adjacent to this site.	Neutral	Medium	Further assessment recommended to assess connectivity of existing channels to the River Tame.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG
Tameside LNR	County	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth lowering baseflows adjacent to this site.	Neutral	Medium	Further assessment recommended to assess connectivity of existing channels to the River Tame, and to inform potential mitigation options for BNG.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG
Broad Meadow LNR	County	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth lowering baseflows adjacent to this site.	Neutral	Low	No significant effects predicted. Further assessment recommended to inform potential mitigation options for BNG.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG
Drakelow Reserve LWS	County	Impact on wetland habitats and the species they support, due to reduction in discharge from	Neutral	Low	No significant effects predicted.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG

Receptor or Feature under Assessment	Significance	Impact Pathway and Source (Minworth and/or SLR)	Scale of Impact (Positive / Neutral / Negative)	Red/Amber/Green Risk of SRO affecting the receptor (High / Medium / Low)	Recommendations for Further Assessment	Mitigation Options	Relevance to Regulatory Assessment Topics
		Minworth lowering baseflows adjacent to this site.			Further assessment may be required to inform potential mitigation options for BNG.		
Sports Ground Marsh LWS	County	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth lowering baseflows adjacent to this site.	Neutral	Low	No significant effects predicted. Further assessment may be required to inform potential mitigation options for BNG.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG
Stanton Barn Marsh LWS	County	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth lowering baseflows adjacent to this site.	Neutral	Low	No significant effects predicted. Further assessment may be required to inform potential mitigation options for BNG.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG
Trentside Ponds LWS	County	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth lowering baseflows adjacent to this site.	Neutral	Low	No significant effects predicted. Further assessment may be required to inform potential mitigation options for BNG.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG
Trent Fleet LWS	County	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth lowering baseflows adjacent to this site.	Neutral	Low	No significant effects predicted. Further assessment may be required to inform potential mitigation options for BNG.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG
River Derwent Mouth Lock LWS	County	Impact on wetland habitats and the species they support, due to reduction in discharge from	Neutral	Low	No significant effects predicted.	Site visit to assess the potential for wetland habitat creation	SEA, BNG

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		Minworth lowering baseflows adjacent to this site.			Further assessment may be required to inform potential mitigation options for BNG.	and/or enhancement opportunities at this site.	
Sawley Carr LWS	County	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth lowering baseflows adjacent to this site.	Neutral	Low	No significant effects predicted. Further assessment may be required to inform potential mitigation options for BNG.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG
Lockington Marshes SSSI	County	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth lowering baseflows adjacent to this site.	Neutral	Low	No significant effects predicted. Further assessment may be required to inform potential mitigation options for BNG.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG
Lockington Confluence Backwater LWS	County	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth lowering baseflows adjacent to this site.	Neutral	Low	No significant effects predicted. Further assessment may be required to inform potential mitigation options for BNG.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG
Attenborough Gravel Pits SSSI	County	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth lowering baseflows adjacent to this site.	Neutral	Low	No significant effects predicted. Further assessment may be required to inform potential mitigation options for BNG.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG
Clifton Grove, Clifton Woods, and Holme Pit Pond LNR (including	National	Impact on wetland habitats and the species they support, due to reduction in discharge from	Neutral	Low	No significant effects predicted.	Site visit to assess the potential for wetland habitat creation	SEA, BNG

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Holme Pit SSSI and Trent Carr LWS)		Minworth lowering baseflows adjacent to this site.			Further assessment may be required to inform potential mitigation options for BNG.	and/or enhancement opportunities at this site.	
Netherfield Lagoon LNR Netherfield Pits LWS	County	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth lowering baseflows adjacent to this site.	Neutral	Low	No significant effects predicted. Further assessment may be required to inform potential mitigation options for BNG.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG
Shelford Carr LWS	County	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth lowering baseflows adjacent to this site.	Neutral	Low	No significant effects predicted. Further assessment may be required to inform potential mitigation options for BNG.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG
Besthorpe Meadows SSSI	National	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth and abstraction for SLR lowering baseflows adjacent to this site.	Neutral	Low	No significant effects predicted. Further assessment may be required to inform potential mitigation options for BNG.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG
Fledborough Holme LWS	County	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth and abstraction for SLR lowering baseflows adjacent to this site.	Neutral	Low	No significant effects predicted. Further assessment may be required to inform potential mitigation options for BNG.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG

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Lea Marsh SSSI	National	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth and abstraction for SLR lowering baseflows adjacent to this site.	Neutral	Low	No significant effects predicted. Further assessment may be required to inform potential mitigation options for BNG.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG
Alkborough Flats LWS	County	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth and abstraction for SLR lowering baseflows adjacent to this site.	Neutral	Low	No significant effects predicted. Further assessment may be required to inform potential mitigation options for BNG.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG
Humber Estuary SPA, SAC, Ramsar site & SSSI	International	Impact on wetland habitats and the species they support, due to reduction in discharge from Minworth and abstraction for SLR lowering baseflows adjacent to this site.	Neutral	Low	No significant effects predicted. Further assessment may be required to inform potential mitigation options for BNG.	Site visit to assess the potential for wetland habitat creation and/or enhancement opportunities at this site.	SEA, BNG, HRA, WFD, Nat Cap
Otter	District/borough	Impact on wetland habitats that support otter due to reduction in discharge from Minworth and abstraction for SLR lowering baseflows at adjacent sites across the Study Area.	Neutral	Low	No significant effects predicted. Targeted otter surveys where areas of suitable habitat may be impacted, e.g., connecting channels to designated sites.	Site visits to assess the potential for wetland habitat creation and/or enhancement opportunities for otter.	SEA, BNG
Water vole	County	Impact on wetland habitats that support water vole due to reduction in discharge from	Neutral	Low	No significant effects predicted.	Site visits to assess the potential for wetland habitat	SEA, BNG

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		Minworth and abstraction for SLR lowering baseflows at adjacent sites across the Study Area.			Targeted water vole surveys where areas of suitable habitat may be impacted, e.g., connecting channels to designated sites.	creation and/or enhancement opportunities for water vole.	
Waterbirds	Up to international	Impact on wetland habitats that support waterbirds due to reduction in discharge from Minworth and abstraction for SLR lowering baseflows at adjacent sites across the Study Area.	Neutral	Low	No significant effects predicted. Requirement for further surveys dependent on assessment of connectivity of sites designated for wetland bird interest to Tame and Trent.	Site visits to assess the potential for wetland habitat creation and/or enhancement opportunities for waterbirds.	SEA, BNG
Aquatic Ecology – refer to Appendix B(ii) Aquatic Ecology (Assessment of fish passage is dependent upon the results of on-going and proposed hydraulic and hydrological modelling							
Site 1 Orton Weir	National	The Environment Agency advised that achieving improved fish passability at this site at low flows (Q70 or lower) is not critical. In addition, it is also located just upstream of the main Minworth discharge. As such it can be screened out.	Neutral	Low	N/A	None required	WFD
Site 2. Water Orton Lane road bridge	National	Site visit determined that this was not a barrier to fish passage, given it is a bridge with flowing river beneath it. It is also located just upstream of the main	Neutral	Low	N/A	None required	WFD

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		Minworth discharge. As such it can be screened out.					
Site 3. Lea Marston Weir	National	There are no fish passes present at this site. The current head drop and hydraulics makes fish passage difficult. Modelling results indicate that the SRO (Scenario B) will negatively affect fish passability. It should be noted that the restoration plan of Lea Marston includes a bypass from upstream of Site 3 to the downstream lake. if suitably designed, should improve fish passage at this site	Negative	Medium	The suitability of the bypass design should be investigated in order to assess fish passability at this site, informed by 2D modelling of normal situation and with SRO occurring. This will be undertaken along with other restoration options downstream (e.g., removal of Sites 4 and 6). Hydraulics and fish passability at the barriers present at Lea Marston Lakes should be assessed considering the system (from site 3 to site 8) as a whole to evaluate the impact of the restoration plan.	Bypass as part of Lea Marston lakes restoration	WFD
Site 4 and 6. Coton Weirs (E) & (W)	National	There are no fish passes present at these sites. Similar to Site 3, the current conditions at this site are challenging for fish passage and the reduction of flows (Scenario B) will have negative effects. It should be noted that the restoration plan of Lea Marston	Negative	Medium	Further modelling (2D) will be necessary to assess the impact of SRO on fish passability at this site. Lea Marston restoring plans should be evaluated in order to assess fish passability impacts.	TBC – awaiting results of further hydraulic modelling	WFD

Receptor or Feature under Assessment	Significance	Impact Pathway and Source (Minworth and/or SLR)	Scale of Impact (Positive / Neutral / Negative)	Red/Amber/Green Risk of SRO affecting the receptor (High / Medium / Low)	Recommendations for Further Assessment	Mitigation Options	Relevance to Regulatory Assessment Topics
		includes removal of these weirs which might highly improve fish passage					
Site 5. Coton Weir (Central)	National	There are no fish passes present at this site. Although the head drop at this site is relatively low, the current hydraulics at this site are deemed too difficult for fish passability. Modelling results indicated that reduction in flow will negatively affect fish passability. It should be noted that the restoring plan of Lea Marston includes removal of Coton Weir (E) & (W) which will improve fish passability upstream	Negative	Medium	Further modelling (2D) will be necessary to assess the impact of SRO on fish passability at this site. Lea Marston restoring plans should be evaluated in order to assess fish passability impacts.	Removal of Coton Weir (E) in particular & Coton Weir (W) might allow fish pass upstream, therefore no fish pass or other mitigation option would be required at this site Otherwise, the installation of Larinier technical fish pass will improve passability	WFD
Site 7. A4097 Weir	National	There are no fish passes present at this site. The head drop could be passable by salmonids. Nonetheless, upstream elver and lamprey passage may find this more challenging. Modelling results predict reduction in levels which will negatively affect fish passability.	Negative	Medium	Further modelling (2D) will be necessary to assess the impact of SRO on fish passability at this site. Fish could also make its way upstream previous this barrier, through Site 8. Also bypassing this barrier through the northern channel that flows the northern area which encounters Site 6.	TBC – awaiting results of further hydraulic modelling. Notching the weir Standalone fish passes (e.g., elver pass)	WFD

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					Lea Marston restoring plans should be evaluated in order to assess fish passability impacts.		
Site 8. Nether Whitacre Weir	National	There are no fish passes present at this site. The hydraulics at the weir apron are no uniform. Without 2D modelling it is difficult to determine impacts on fish passage.	Negative	Uncertain	Further modelling (2D) will be necessary to assess the impact of SRO on fish passability at this site. Fish could also make its way upstream through Site 7. Also, through the northern bypass which encounters Site 6. Fish passage improvements at the site should be sought as part of the wider restoration (noting that attractant flow seems to be up to this weir, based on observed aerial imagery) or firefighters rescue works planned at the site (e.g., the removal of dragon's teeth to enable personnel training should consider fish passability).	TBC – awaiting results of further hydraulic modelling	WFD
Site 9. Broad Meadow LNR Upstream Weir	National	There is a Larinier and eel pass on the LHB	Negative	Medium	Further modelling (2D) will be necessary to assess the impact of SRO on fish passability at this site.	Bypass New fish pass	WFD

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Site 10. Broad Meadow LNR Upstream Weir	National	There are no fish passes present at this site	Negative	Low	Further modelling (2D) will be necessary to assess the impact of SRO on fish passability at this site, when considered in combination with Site 9.	None may be needed at this site, but if mitigation at Site 9 is difficult then achieving it at Site 10 may be worth considering.	WFD
Site 11. Meadow Weir	National	There is a rock ramp fish pass on the LHB	Negative	Medium	Further modelling (2D) will be necessary to assess the impact of SRO on fish passability at this site.	Fish pass adaption New fish pass	WFD
Site 12. Newton Weir	National	There are no fish passes present at this site.	Negative	Medium	Further modelling (2D) will be necessary to assess the impact of SRO on fish passability at this site.	Larinier Other new fish pass	WFD
Site 13. Sawley Weir	National	There are no fish passes present at this site.	Negative	Low	Further modelling (2D) will be necessary to assess the impact of SRO on fish passability at this site.	Weir notch Fish pass	WFD
Site 14. Thrumpton Weir	National	There are no fish passes present at this site.	Negative	Low	Further modelling (2D) will be necessary to assess the impact of SRO on fish passability at this site.	Assessment cannot be fully completed until modelling results for the lower Trent are available.	WFD, HRA
Site 15. Beeston Weir	National	The main weir has a defunct denil fish pass near the RHB. There is a vertical slot fish pass between the HEP and the side weir.	Negative	Low (anticipated)	2D modelling will be necessary to assess the impact of SRO on fish passability at this site.	Fish pass adaption or new fish pass	WFD, HRA

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Site 16 Holme Sluices Colwick	National	There are no fish passes present at this site. Although to date, conduction works for the installation of a twin vertical slot fish pass have started	TBC	TBC	Assessment cannot be fully completed until modelling results for the lower Trent are available.	Assessment cannot be fully completed until modelling results for the lower Trent are available.	WFD, HRA
Site 17. Stoke (Bardolph) Weir	National	There are no fish passes present at this site.	TBC	TBC	Assessment cannot be fully completed until modelling results for the lower Trent are available.	As part of a HEP scheme, it is proposed the installation of a two stage Larinier fish pass for coarse and salmonids on the LHB and eel and lamprey pass. Assessment cannot be fully completed until modelling results for the lower Trent are available.	WFD, HRA
Site 18. Gunthorpe Weir	National	A triangular pool and traverse fish pass comprising three pools and four traverses is located at the LHB although is sub-optimal.	TBC	TBC	Assessment cannot be fully completed until modelling results for the lower Trent are available.	As part of a HEP scheme, it is proposed the installation of a dual flight Larinier fish pass on the RHB. In case the HEP application does not come to fruition, the Environment Agency has a strong interest on installing a fish pass on this weir.	WFD, HRA
Site 19. Hazelford Weir (South)	National	There are no fish passes present at this site.	TBC	TBC	Assessment cannot be fully completed until modelling results for the lower Trent are available.	As part of a HEP scheme, it is proposed the installation of a dual flight Larinier fish pass proposed on the LHB, a lamprey	WFD, HRA

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						tile pass and a separate gravity-fed eel pass on the LHB. Assessment cannot be fully completed until modelling results for the lower Trent are available.	
Site 20. Hazelford Weir (North)	National	There is an eel pass installed on the canoe footprint on the RHB.	TBC	TBC	Assessment cannot be fully completed until modelling results for the lower Trent are available.	As part of a HEP scheme, it is proposed the installation of a dual flight Larinier fish pass on the LHB. Assessment cannot be fully completed until modelling results for the lower Trent are available.	WFD, HRA
Site 21. Averham Weir	National	There are no fish passes present at this site.	TBC	TBC	Assessment cannot be fully completed until modelling results for the lower Trent are available.	The Environment Agency are working on fish pass concepts with landowners, with a Larinier or vertical notch pass being considered possible. Assessment cannot be fully completed until modelling results for the lower Trent are available.	WFD, HRA
Site 22. Newark Weir	National	There are no fish passes present at this site.	TBC	TBC	The weir can be bypassed by fish that migrate through the left-hand (north-westerly) channel;	Assessment cannot be fully completed until modelling	WFD, HRA

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					however, these fish will encounter the Averham weir. Assessment cannot be fully completed until modelling results for the lower Trent are available.	results for the lower Trent are available.	
Site 23. Nether Lock Weir	National	There is a fish pass installed as part of the HEP on the LHB.	TBC	TBC	The weir can be bypassed by fish that migrate through the left-hand (north-westerly) channel; however, these fish will encounter the Averham weir. Assessment cannot be fully completed until modelling results for the lower Trent are available.	Assessment cannot be fully completed until modelling results for the lower Trent are available.	WFD, HRA
Site 24. Cromwell Weir	National	There is a pool and traverse fish pass located on the LHB although considered sub-optimal.	TBC	TBC	Assessment cannot be fully completed until modelling results for the lower Trent are available.	Along with a HEP scheme it is proposed the installation of a Larinier fish pass on the RHB. In addition, it has been proposed the installation of two eel passes. Assessment cannot be fully completed until modelling results for the lower Trent are available.	WFD, HRA
Site 25. Weir in the lower Blythe	National	Additional potential barrier identified through stakeholder consultation.	N/A	Low	N/A	Not required.	WFD, HRA

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		Hydrological investigations indicated that water depths over the weir are higher than 0.1m during all flows. Therefore, it is not considered this is a barrier for fish passage. In addition, the AMP6 indicated no further action is needed on the River Blythe. As such it can be screened out.					
River Mease SAC – refer to Appendix C River Mease SAC							
River Levels	National	Impact from Minworth SRO. Reduction in river levels within the River Trent at confluence with River Mease may reduce river levels within lower reaches of River Mease. In combination with proposed diversion of discharge from Packington and/or Measham WwTW.	Neutral	Low	Review full report of the River Mease hydrological assessment study when available.	None required	SEA, HRA, WFD
River Mease (HRA)	National	Impact from Minworth SRO. Reduction in river levels within the River Trent at confluence with River Mease may reduce river levels within lower reaches of River Mease. In combination with proposed diversion of discharge	Neutral	Low	Review full report of the River Mease hydrological assessment study when available. Determine the requirement for Appropriate Assessment.	Mitigation options to be informed by Appropriate Assessment, if required.	SEA, HRA, WFD

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		from Packington and/or Measham WwTW.					
Invasive Non-Native Species – refer to Appendix D Invasive Non-Native Species							
Minworth / River Tame	National	New tertiary treatment at Minworth WwTW, which would reduce the existing INNS risk associated with potential for INNS propagules or seeds to be blown into the treated water prior to discharge, or to be introduced to/from site via staff. No increased risk, or potential positive effect, due to Minworth SRO. Existing Biosecurity Plan will reduce the risk further.	Neutral	Low	None	Checking and implementation of existing Biosecurity Strategy	SEA, BNG, Nat Cap, WFD
Minworth / River Tame	Local	Impact from Minworth SRO. Reduction in river levels within the River Tame may allow INNS species to further colonise	Negative	Low	Identification of catchment wide INNS schemes	Monitor a 1 km buffer downstream of the discharge for habitat destabilisation (with the potential to facilitate relevant INNS, i.e., those not already widespread), following reduction in flow. Develop a rapid response protocol (i.e., targeted herbicide treatment aimed at keeping INNS down until	SEA, BNG, Nat Cap, WFD

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						habitats restabilise, if destabilisation occurs).	
Sedimentation – refer to Appendix E Sedimentation							
Tame – R Rea to R Blythe (GB104028046841)	Regional	Minworth	Neutral	Low	Sediment and turbidity monitoring. Analysis of hydraulic modelling results for SRO sedimentation risks. Hydraulic modelling for SRO floodplain inundation effects. Optioneering and feasibility for targeted mitigation areas.	River restoration measures specific to detailed impact assessment, likely to focus on techniques such as SUDS and in-channel enhancement	WFD
Rea from Bourn Brook to River Tame (GB104028042550)	Regional	Minworth	Neutral	Low	Sediment and turbidity monitoring. Analysis of hydraulic modelling results for SRO sedimentation risks. Hydraulic modelling for SRO floodplain inundation effects. Optioneering and feasibility for targeted mitigation areas.	River restoration measures specific to detailed impact assessment, such as floodplain reconnection and in-channel enhancement.	WFD

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Tame from R Blythe to River Anker (GB104028046440)	Regional	Minworth	Neutral	Low	Sediment and turbidity monitoring. Analysis of hydraulic modelling results for SRO sedimentation risks. Hydraulic modelling for SRO floodplain inundation effects. Optioneering and feasibility for targeted mitigation areas.	River restoration measures specific to detailed impact assessment, such as floodplain reconnection and in-channel enhancements.	WFD
Non-Water Resources Impacts and Benefits – Refer to Appendix F Natural Capital and Biodiversity Net Gain Assessment							
Natural Capital Assessment							
Tame and adjacent habitats	Local	Impacts from Minworth SRO on fisheries. Barriers to fish migration is likely to be exacerbated by the drop in water level, affecting access to areas that are essential for fish key life stages. Sedimentation accumulation at the riverbed within the channel could also be detrimental for fish spawning, feeding and nursery habitats as well as for invertebrates and macrophytes.	Negative or Neutral	Low	Further assessments on fish passage, migratory species, and sedimentation to correlate with and understand the wider impacts on fish, looking at changes in stock and characteristics for each impacted species	Consider mitigation options to improve fish passage, as informed by further assessments.	SEA, BNG, Nat Cap, WFD

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Tame and adjacent habitats	Local	Impacts from Minworth SRO on water quality regulation. Minworth effluent is already treated to a good standard and may currently improve water quality in the Tame. However, not discharging the effluent from Minworth into the River Tame would remove residual phosphates and contaminants, contributing to water quality improvement.	Neutral or Positive AWAITING MODELLING	Low	N/A	Not required	SEA, BNG, Nat Cap, WFD
Tame and adjacent habitats	Local	Impacts from Minworth SRO on disease and pest control. At Minworth, there is a very low risk of spread in margins widened by the flow reduction. However, given existing flow fluctuation and the prevalence of INNS in this location, this is not considered a significant impact.	Neutral or Negative	Low	Refer to Appendix D INNS	See mitigation options in Appendix D INNS	SEA, BNG, Nat Cap, WFD
Tame and adjacent habitats	Local	Impacts from Minworth SRO on trust and reputation. The potential negative impacts on INNS spread and on fish/angling clubs could erode public's trust in Affinity Water although this could be remediated with appropriate	Negative/Positive	Low	Collect customers and public feedback from further surveys that would aim to ask whether they are satisfied with decisions over SROs, considering the potential impacts and measures to address them. Assess the	A potential decrease in public's trust would be mitigated with actions undertaken to minimise impacts on INNS spread and on recreation (c*aptured above*).	SEA, BNG, Nat Cap, WFD

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		mitigation measures. Anglian Water, Affinity Water and Severn Trent customers views on the two SROs collected as part of a programme of customer engagement in the approach to Gate 1, showed a global support for 'sharing' water. However, for Minworth SRO, customers were concerned over a change in taste and water hardness.			number of satisfied customers.		
Tame and adjacent habitats		Impacts from Minworth SRO on engagement and networks. Minworth SRO has a key role in wider regional water resources plans bringing together stakeholders from various sectors, including energy, retail, land management and agriculture. Discussions around concept design, construction planning and policies, risks and issues, and mitigation actions, involve engaging with key stakeholders such as water companies, the Environment Agency, Natural England, DEFRA, trusts and local authorities. Community and customers were engaged early through a research programme developed to ensure transparency, build	Positive	Low	Assess the number of partnerships created.	Not required	SEA, BNG, Nat Cap, WFD

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		understanding, and gather feedback. (*Captured within Trust and Reputation*)					
Tame and adjacent habitats		Impacts from Minworth SRO on engagement and networks. Given the nature of the potential mitigation actions around the river Tame (biodiversity improvement and natural spaces enhancement), it is possible that it would lead to slight positive impacts on the local economy due to a potential increase in recreational activities and the number of visitors.	Positive	Low	Assess visitor expenditure	Develop plans to include facilities and amenities in the design of mitigation options to convert the created/enhanced sites into visitor destinations.	SEA, BNG, Nat Cap, WFD

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