

Strategic Regional Water Resource Solutions: Annex B1.4: Environmental Assessment Methodology Paper

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

Date: November 2022



Severn to Thames Transfer

Environmental Assessment Methodology Paper

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Disclaimer

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



SEVERN THAMES TRANSFER (STT) SOLUTION

Methodology Report

Report for: United Utilities on behalf of the STT Group

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Glossary and Abbreviations

Glossary and Abbreviations	
Term	Description
Cotswold Canals	Partially refurbished canal network and associated infrastructure (including pumping stations, bypass pipework, treatment plant and pipeline) with design capacity of 300MI/d to convey river water from River Severn to River Thames.
Deerhurst Pipeline	Pipeline and associated infrastructure (including pump station, treatment plant, break pressure tank) with design capacity of 300/400/500MI/d to convey river water from River Severn to River Thames.
Hands off Flow	This is the flow below which abstractions from the River Severn are restricted or not permitted
Interconnector	Term used to describe infrastructure required to convey river water from River Severn to River Thames. The Interconnector options are the Deerhurst Pipeline or Cotswold Canals.
Interconnector design capacity	Raw water volume abstracted from the River Severn at the start of the Interconnector. Not the volume delivered to the River Thames at the end of the Interconnector and not the Deployable Output of the STT system.
Minworth SRO	Minworth WwTW effluent transfer to the River Avon (covered under Severn Trent Water (STW) Minworth SRO developed by Severn Trent and Affinity Water). This has the capacity to release up to 115MI/d into the River Avon.
Mythe Abstraction Licence	Mythe Water Treatment Works (WTW) source support element (covered under Severn Trent Sources SRO developed by STW). Unused abstraction licence transfer has the capacity to release 15MI/d into the River Severn.
Netheridge Wastewater Treatment Works	Netheridge Wastewater Treatment Works (WwTW) source support element (covered under Severn Trent Sources SRO developed by STW). Effluent diversion has the capacity to release up to 35MI/d into the River Severn.
Plan pathway	A pathway within an adaptive plan.
Preferred options	The set of water resources options included in the preferred plan.
Preferred plan	Comprises a set of options and a schedule of dates for implementing these options. These options have been selected through the planning process and evidence provided as to why they perform better against the objectives of the plan. Sometimes also referred to as the preferred programme of options.
Revised feasible options	A subset of the feasible options, post AIC cuts which are considered in more detail through the decision making process. The list of revised feasible options is generated by high level screening.
Shrewsbury Redeployment	Shrewsbury Redeployment is facilitated by a supply from the Oswestry WTW. This allows the reduction in the abstraction at Shelton WTW of 25MI/d.
Source support elements	Elements which have the potential to make additional raw water resources available for abstraction at the start of the Interconnector.
STT partners	The three companies promoting this SRO i.e. Severn Trent Water, United Utilities and Thames Water
STT SRO	Comprises the Interconnector, the River Vyrnwy Bypass Pipeline, Shrewsbury Redeployment and conveyance of the source support elements through the river systems (Vyrnwy, Severn, Avon, and Thames).
STT system	Comprises the STT SRO plus STT source support elements that together form an operational system.
STT system operating strategy	Description of contribution/operation of source support elements and river systems to form an operational system.

Glossary and Abbreviations	
Term	Description
Supported flow	When the flow in the River Severn is below the hands-off flow rate at which point abstraction from the River Severn may lead to unacceptable environmental impacts downstream. To mitigate these environmental impacts a permitting strategy is being developed whereby additional water put into the River Severn can be abstracted for a Severn to Thames transfer. The additional water is referred to as Supported flow
Unconstrained list of options	All the possible options that could reasonably be used in the plan. This will include all the options considered in the previous planning round, as well as any options that have been identified since.
Unsupported flow	Unsupported flow occurs when the flow in the River Severn is above the hands-off flow rate and raw water can be freely abstracted from the River Severn for transfer to the River Thames
Vyrnwy Mitigation – River Vyrnwy Bypass Pipeline	Pipeline from the Oswestry Water Treatment Works to the River Severn. The release of partially treated water via the bypass pipeline is a mitigation measure to the River Vyrnwy from the Vyrnwy Release source support element. The pipeline has the capacity to convey up to 155MI/d.
Vyrnwy Release	Lake Vyrnwy source support element (covered under North West Transfer SRO developed by United Utilities). This source has a capacity of up to 180MI/d. A direct release of 25MI/d into River Vyrnwy.
Water Resource Zone	Section 4.4. of the draft WRPG defines a water resource zone as “an area within which the abstraction and distribution of water to meet demand is largely self-contained (with the exception of agreed bulk transfers)”.
Abbreviations	
1880 Act	The Liverpool Corporation Act 1880 which authorises the discharge of compensation water from the Vyrnwy Reservoir into the River Vyrnwy
ACWG	All Company Working Group
AEoI	Adverse Effect on Integrity
AMP	Asset Management Plan
BNG	Biodiversity Net Gain
CAPEX	Capital Expenditure
DCO	Development Consent Order
DO	Deployable Output
DWI	Drinking Water Inspectorate
EA	Environment Agency
EIA	Environmental Impact Assessment
HoF	Hands off Flow
HRA	Habitats Regulations Assessment
IEA	Initial Environmental Appraisal
INNS	Invasive Non-Native Species
MI	Mega litres
MI/d	Mega litres per day
NC	Natural Capital
NE	Natural England
NPV	Net Present Value
NRW	Natural Resources Wales
NSIP	Nationally Significant Infrastructure Project
NWT	North West Transfer SRO
OPEX	Operational Expenditure
RAPID	Regulatory Alliance for Progressing Infrastructure Development
SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment
SESRO	South East Strategic Reservoir Option
SMNR	Sustainable Management of Natural Resources
SRO	Strategic Resource Option
STT	River Severn to River Thames Transfer
STW	Severn Trent Water
SWQRA	Strategic Water Quality Risk Assessment
T2AT	Thames to Affinity Transfer
T2ST	Thames to Southern Transfer
TW	Thames Water

Glossary and Abbreviations	
Term	Description
UU	United Utilities
WFD	Water Framework Directive
WRMP	Water Resource Management Plan
WRSE	Water Resources South East
WRW	Water Resources West
WTW	Water Treatment Works
WwTW	Wastewater Treatment Works

1. INTRODUCTION

1.1 BACKGROUND

The All Company Working Group (ACWG) commissioned Mott MacDonald to develop an environmental assessment method for Solutions which was aligned to the draft Water Resources Planning Guidelines for Water Resource Management Plan 2024 (WRMP24)¹, to enable a consistency of environmental assessment.

The Regulators' Alliance for Progressing Infrastructure Development's (RAPID) issued a guidance document² in April 2022 to describe the Gate 2 process and set out the expectations for solutions at standard Gate 2.

The four RAPID gates are as follows:

- Gate 1: Initial concept design and decision making
- Gate 2: Detailed feasibility, concept design and multi-solution decision making
- Gate 3: Developed design, finalised feasibility, pre-planning investigations and planning applications
- Gate 4: Planning applications, procurement, and land purchase

Environmental assessment at Gate 2 included an informal Habitats Regulations Assessment (HRA), informal Water Framework Directive (WFD) assessment, an Initial Environmental Assessment (IEA) report, a Biodiversity Net Gain (BNG) assessment and Natural Capital (NC) assessment (England), and a Sustainable Management of Natural Resources (SMNR) assessment (Wales).

As the Gate 2 builds on the Gate 1 activities, the assessments considered the comments and recommendations made by the various regulators to ensure that overall scheme designs, and operations were amended to avoid or mitigate potential negative impacts (where possible).

1.1.1 Statements of recommendations to methodologies proposed within the environmental assessments

1.1.1.1 HRA methodology

The objective of the Gate 2 informal HRA was to establish whether any of the elements associated with the STT Solution were likely to have had a significant effect on European sites (alone or in-combination with other plans or projects), adopting the precautionary principle (Stage 1 Screening), and where Likely Significant Effects (LSEs) could not be ruled out, to determine through the Stage 2 Appropriate Assessment whether the schemes were likely to adversely affect the integrity of a European site(s).

The Gate 2 informal HRA built on Gate 1 activities to improve the assessment to a standard suitable for submitting into final Regional Plans or final Water Resources Management Plans. As the Gate 2 submission did not form a statutory plan or project, the *principles* of the HRA process were applied to help identify *risks* to feasibility and deliverability of the elements of the STT Solution, as well as to the monitoring and mitigation requirements to reduce any remaining uncertainty.

As the Gate 2 assessment built on the Gate 1 activities, the assessments considered the comments and recommendations made by the various regulators to ensure that overall scheme design and operation was amended to avoid or mitigate potential negative impacts (where possible).

The informal HRA for the Gate 1 assessment³ stated that the conclusion on the risk of LSE and predictions regarding adverse effects would need to be reviewed and updated as more information became available during completion of the Gate 2 assessments. This included the consideration of any monitoring and modelling outputs made available between submission of the initial report and the end

¹ Ofwat (2020) draft Water Resources Planning Guideline (WRPG): Working Version for Water Resource Management Plan 2024

² RAPID (2022) Strategic regional water resource solutions guidance for Gate 2

³ Ricardo Energy & Environment (2021). River Severn to River Thames Transfer (STT) Strategic regional water resource solution. Environmental Assessment Report: Appendix B4.2 Habitats Regulation Assessment. Report on behalf of the STT Group. July 2021

date of the Gate 2 assessments and any changes in the applicability and/or availability of mitigation measures.

1.1.1.2 WFD methodology and background

The Water Framework Directive⁴ (WFD) is an EU Directive establishing a framework for Community action in the field of water policy which aims to protect and improve the water environment. The WFD was brought into UK law in 2003 and subsequently revoked by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 in England and Wales. From this point forward “WFD” refers to the legislation applicable to England and Wales, not the EU Directive.

The approach the WFD adopted at Gate 1 was in accordance with ACWG guidelines for environmental assessment methods for strategic schemes. The schemes have been developed to a standard suitable for submitting into final regional plans and / or final water resources management plans (WRMPs).

1.1.1.3 BNG, NC, and SMNR methodology

The ACWG guidance stipulates that Solutions should look to maximise BNG and include any required mitigation to offset adverse effects of the scheme.

Our methodology considered the Defra Biodiversity Metric tool and Defra’s Enabling a Natural Capital Approach (ENCA) Guidance. It also incorporates the over-arching SMNR requirements, which delivers duties under the Environment (Wales) Act (2016), and the Well-being of Future Generations Act (2015). In the context of biodiversity and the management of natural resources, these Acts consider the resilience of ecosystem and the wider benefits they provide, whilst meeting the needs of present generations of people without compromising the ability of future generations to meet their needs and contributing to the achievement of the well-being goals⁵.

1.1.1.4 IEA methodology

It was confirmed in the RAPID letter dated April 2020⁶, that a full statutory SEA was not required for Gate 1. Statutory SEAs, required by the Environmental Assessment of Plans and Programmes Regulations 2004 are, however, being undertaken through the WRMP process, and Regional Plans, with the Solutions forming options within these.

In consequence, a formal statutory SEA for submission at Gate 1 was not undertaken. Instead, at Gate 1 the *principles* of SEA were applied to the STT Solution in order to inform the overall assessment of the environmental feasibility and deliverability of the solution. The SEA was informed by other technical workstreams, including the informal Habitats Regulations Assessment (HRA) and Water Framework Directive (WFD) assessment.

1.2 GATE 1 REGULATORY FEEDBACK

1.2.1 Initial feedback

The Gate 1 assessments were subject to review by the regulators, including Natural England (NE), Natural Resources Wales (NRW) and the Environment Agency (EA).

The key issues raised by the regulators in relation to the HRA, BNG / NC / SMNR and SEA conclusions at Gate 1 are listed in **Table 1** and were considered and addressed in the Gate 2 assessments.

⁴ European Union (2000) Directive 2000/60/EC of the European Parliament and of the Council

⁵ The Natural Environment and Rural Communities (NERC) Act drivers have been incorporated into those of the Environment (Wales) Act 2016 and include: 1) Priority species and habitats; 2) Ecosystem resilience (diversity, connectivity, condition, adaptability and scale); and 3) Maintain and enhance biodiversity.

⁶ Ofwat 3 April 2020 Strategic Regional Water Resource Solutions: Gate one assessment. Letter issued via email to Regulatory Directors of companies with strategic regional water resource solutions.[note incorrect date of April 2019 is stated on the front page of this letter]

Table 1. Regulatory feedback for the informal HRA, SEA, and the BNG, NC and SMNR Gate 1 Assessments

HRA	WFD	SEA	BNG, NC, and SMNR
<p>A high level of certainty is required when assessing whether a plan or project is likely to adversely affect the integrity of a European site</p> <p>The integrity test embodies the precautionary principle: a competent authority must be certain that the project will not have an adverse effect on integrity before giving a permission i.e., there is no reasonable scientific doubt as to the absence of such an effect. It ensures a higher level of environmental protection for European Sites through preventative decision-taking in the case of sufficient uncertainty about the level of risk.</p>	<p>In line with G2 criteria, the assessment should state how it will identify which waterbodies to look at and how elements will be scoped in or out. The assessment should include the Severn Estuary TraC waterbodies, and all determinands listed in the guidance should be considered until they can be scoped out. It should consider how the scheme will affect water bodies reaching WFD objectives and identify mitigation measures and further monitoring where needed. The report should set out how the results will be used in scheme decision making/scheme design; what uncertainties remain and how these will be addressed.</p>	<p>Further consideration is to be given to climate change and drought resilience as part of the assessments undertaken and that benefits and risks for different areas are clearly and separately identified to avoid potential risks being masked by benefits. Furthermore, when considering climate change and resilience of water supplies at Gate 2, regard is given to both the donor and receiving regions.</p> <p>The SEA Regulations require “an outline of the contents, main objectives of the plan or programme and relationship with other relevant plans and programmes” (Schedule 2(1)). Regard will be given to potential cumulative effects of the operation of the STT Solution both alone and in-combination with other major developments such as major planning applications and NSIPs local to the scheme, in the IEA. In addition, the IEA will use the in-combination assessments undertaken by the Regional Plans and WRMPs to support the identification of inter-plan related impacts. A separate note on the in-combination assessment approach is being produced by the Solutions teams, which was shared with the NAU for formal comment in February 2022. This is reflected in the IEA approach documented within this note and is summarised in Figure 3.</p> <p>There is also a need to understand, when considering in-combination effects, how the STT Solution will operate with Severn Regulation releases. As the Severn Regulation releases could occur concurrently with the operation of the STT Solution, the updated modelling work being undertaken for Gate 2 will use a representative pattern for the Seven regulation release as defined by the Environment Agency to run a range of scenarios. This consideration forms part of the Gate 2 assessments.</p> <p>There is an obligation to monitor the significant environmental effects of the implementation of plans and programme (as required by The Environmental Assessment of Plans and Programmes Regulations 2004⁷). Therefore, further consideration is to be given to future monitoring requirements when the STT Solution is operational, including a strategy to mitigate unpredicted future environmental problems.</p> <p>SEA is not a legal requirement: a statutory SEA will not be undertaken at Gate 2. The Solution is however subject to a statutory SEA via the WRMP24 process, which will formally identify a programme for monitoring the implementation of the STT Solution. The Gate 2 IEA will recognise any formal monitoring of significant environmental effects identified in the Regional Plans and relevant WRMP SEAs. However, the Gate 2 IEA will expand on this to include details of proposed future monitoring requirements through Gate 3 for other purposes (e.g., reducing uncertainty, capturing specific flows/seasonal data) and not specifically to address statutory SEA requirements. The proposed monitoring will need further refinement during Gate 3, and onwards as part of the planning application process, construction and operational phases.</p> <p>NE commented that the identification of SEA effects prior to the inclusion of embedded mitigation measures would be welcomed. However, such an approach does not follow the ACWG guidance for Solution projects, nor is it considered appropriate for the environmental appraisal conclusions not to consider and reflect in the appraisal the scheme as designed and costed. On the basis that embedded mitigation is included in the costed concept design, the environmental appraisal will reflect this embedded mitigation. However, requirements for additional mitigation and enhancements, not previously accounted for in scheme design, will be identified. After consideration of further mitigation measures, residual effects will be reported. An assessment of unmitigated effects will not be reported.</p>	<p>A need to account for air quality areas.</p> <p>More discussion on benefits as well as disbenefits is needed. This will be addressed in Gate 2 via the workshops with key stakeholders so that additional knowledge, national and more local information can inform the decision-making process and via an additional workstream that will be supported by the work completed to date.</p> <p>More discussion was requested related to the biodiversity resilience and net gain opportunities for watercourses. In Gate 2 the MorRPh survey data will be used, WFD and water quality data is also to support this assessment.</p> <p>NRW requests that Welsh legislation is embedded into the assessment. We will account for this in the Gate 2 assessment and include a place-based assessment based on Welsh specific data. As such we will provide two outputs to account for English and Welsh requirements.</p>

⁷ The Environmental Assessment of Plans and Programmes Regulations (2004:1633)

1.2.2 Additional information to be considered for the Gate 2 Assessments

The review of the BNG / NC / SMNR, WFD and HRA methods led to additional information being considered for the Gate 2 assessments.

With regards to the BNG / NC / SMNR method review, the ACWG guidance noted that outputs should be refined throughout the gated process. In keeping with this guidance, our conclusions at Gate 1 were underpinned by a long list of recommendations to revise the assessment in Gate 2, to provide greater confidence in the outputs. Much of the improvements related to the need for more information and evidence, and data of a sufficient spatial scale and quality to improve the baseline and ensure more accurate calculations. Further data was collected and modelling undertaken as part of the Gate 2 assessments.

With regards to the WFD method review, the WFD Regulations assessments in Gate 2 were updated as more detailed engineering design and mitigation information was made available. Further, additional evidence collected for the STT solution has been incorporated into the assessments together with evidence preparation, including the use of modelling tools.

To supplement the information disclosed in Table 1, additional information regarding the HRA method led to the identification of some concerns by NE and NRW with regards to certainty expressed in the informal HRA conclusions at Gate 1. These concerns are summarised in **Table 2**.

In advance of a meeting regarding the Severn Estuary European designated site, the regulators provided a summary of additional areas of concern from a HRA perspective, specifically related to the Severn Estuary. These concerns were raised via email on 9 December 2021 and are summarised in Table 3.

Table 2. Concerns raised by NE and the NRW with regards to certainty in the HRA conclusions Gate 1 and methods of addressing the concerns.

HRA	
Water quality associated with the Minworth 115 MI/d element:	There remains uncertainty with regards to the potential effects of a discharge of tertiary treated effluent from the Minworth WwTW into the River Avon on the fish communities of the Severn Estuary European site. This includes a potential impact on olfactory cues and subsequent migration of anadromous fish to the River Severn and tributaries of the River Severn and the Severn Estuary. Therefore, a targeted water quality monitoring programme and a stand-alone olfaction study has been considered as part of the water quality model for Gate 2 to provide the additional information required to complete the appropriate assessment of this element.
Increased flow and water quality associated with supported abstractions:	The regulators have raised concerns with regards to the long-term impacts of higher flows in the River Vyrnwy and the upper reaches of the River Severn associated with supporting flows from the Vyrnwy catchment. The regulators considered there was insufficient evidence in Gate 1 to justify the conclusion that a 75 MI/d release from the Vyrnwy reservoir will not impact the functionally linked habitats of the Severn Estuary SAC and Ramsar site. To address this concern, additional data were made available from extensive water quality, hydrological and habitat monitoring programmes which also informed various models to update the appropriate assessment of the STT Solution.
Impacts of unsupported and supported abstraction on the Severn Estuary:	The regulators indicated their concern with regards to potential effects on supporting processes (freshwater inflows and sediment regime) for the habitats and species associated with the Severn Estuary European designated site as a result of the supported and unsupported abstraction. The assessment should not consider flow conditions at the HoF as sufficient evidence for no LSE. Furthermore, the regulators have identified concerns with regards to changes in water levels and the effects on functionally linked habitat for features of the SPA in the Severn Vale. In response, additional data were made available from extensive water quality, hydrological and habitat monitoring programmes which also informed various models to update the appropriate assessment of the STT Solution.

Table 3 A summary of additional areas of concern from an HRA perspective

Additional concerns
The regulators required the LSE assessment that was completed in Gate 1 to be reviewed. As per the Gate 1 feedback summarised above, the regulators stressed that there was not enough evidence to support the conclusions in Gate 1 of no adverse effect on site integrity. To support this the regulators have agreed to review the flow requirements to the estuary and provide a joint (Natural England and Natural Resources Wales) condition assessment for the estuary. Further work has been completed by the STT group in Gate 2 to determine the impact pathways of the Solution on the estuary and the functionally linked habitats.
From reviewing responses to Gate 1 feedback there was a concern from the regulators that there is insufficient monitoring on the River Severn from Shrewsbury to the confluence with the River Avon.
The regulators have reiterated concerns with regards to emerging chemicals of concern and the quality of water discharged to the estuary.
The regulators have reiterated concerns with regards to water quality impacts on olfaction
The regulators have identified it was not clear how the functionally linked aspect of the HRA is being addressed especially regarding migratory fish.
The regulators identified that it was not clear if the hydraulic modelling work will consider the impact of the altered flow regime to the Severn Estuary in relation to the unsupported element of the Solution, especially with reference to any alteration to parameters such as flow, wetted margins, sediment etc. and the potential to impact directly/indirectly protected habitats and species.
The regulators identified that it was not clear where the in-combination assessment of STT, compensation releases, and River Severn Regulation is being assessed.

As noted in the sections above, the HRA for Gate 1 adopted the *principles* of HRA to identify which elements of the Solution are unlikely to be feasible due to environmental constraints. The HRA for Gate 1 recognised that there were still a number of uncertainties and risks that needed to be managed, with further iterations of the assessment required as more detailed engineering information and modelling work becomes available within Gate 2. As such, the Gate 1 conclusion on the risk of LSE and predictions regarding adverse effects have been reviewed and updated (where required).

This included the consideration of any monitoring and modelling outputs made available by the time the Gate 2 assessments are submitted, and any changes in the applicability and/or availability of mitigation measures. In particular, the HRA for Gate 1 concluded:

- Further monitoring and modelling were required on the potential changes in hydrology, water quality and geomorphology to determine the magnitude and significance of risk associated with the STT. This included monitoring to understand the risk to the fish community of the River Vyrnwy and the supporting processes of the Severn Estuary and functionally linked habitats;
- Further monitoring was required to understand the extent to which the River Vyrnwy provides supporting habitat to the fish populations of the Severn Estuary SAC and Ramsar site;
- More information on the passability of barriers in the River Avon was required; and
- Some uncertainty remained with regards to the potential impacts on migratory cues (chemical) and passability of barriers because of this element. The main concern related to olfactory cues in species such as Atlantic salmon, twaite shad, sea lamprey, river lamprey and European eel. European eel is also known to occur throughout the River Avon catchment and there was some uncertainty regarding the passability of barriers as a result of increased flow.

The Gate 2 informal HRA has benefited from additional information gathered from field monitoring, desk study assessments and changes / updates to scheme design that may affect the construction and operation of the associated scheme.

To address those uncertainties identified by the regulators (and noted in the HRA for the Gate 1 assessments) additional monitoring and modelling commenced in January 2021, prior to the commencement of the Gate 2 process.

The outcomes of this monitoring and modelling work were used to review the conclusion of the Gate 1 HRA (both screening of the *risk* of LSE and the assessment of *risk* adverse effects on site integrity).

This further informs the environmental appraisal of the various elements of the STT Solution and whether elements needed to be taken forward for assessment for the formal HRA as part of the consenting process.

The specific tasks that have been undertaken to address the regulatory concerns are summarised below.

1.2.3 Water quality monitoring, modelling, and olfaction risks

- A detailed modelling and monitoring programme was completed and data used to review and update the informal HRA in Gate 2. This was implemented in September 2020 and includes survey locations on the River Severn, River Vyrnwy, Vyrnwy Reservoir, River Avon, the Netheridge WwTW and the Minworth WwTW. The water quality monitoring data were used in the water quality model which was developed for the STT Solution. The monitoring programme included the following components:
 - Continuous monitoring of water quality – which involved collection of dissolved oxygen and temperature data every 15 minutes.
 - Monitoring for WFD determinands – which involved monthly spot sampling and analysis of samples for all 117 no. WFD determinands, as set out in the 2015 WFD Directions; including supporting parameters such as hardness, alkalinity, dissolved inorganic carbon and acid neutralising capacity.
 - EQSD – which involved monthly spot sampling and analysis of samples for determinands as set out in the surface water pollution risk assessment for environmental permits and which are not covered under the WFD Directions, at sites that may require permitting; and
 - Drinking Water – which involved monthly spot sampling and analysis of determinands contained in selected Drinking Water Safety Plans (DWSP).
- The monitoring programme included all waterbodies directly associated with support releases as well up to the tidal limit. Following a review of the risk of olfactory inhibitors, a monitoring location within the Severn Estuary was also recommend.
- These data were used to complete an empirical assessment of the risk associated with changes in temperature and dissolved oxygen.
- These data were used to inform a detailed water quality model from Warwick to the tidal limit to inform the potential change in the concentration of determinands downstream of the potential discharge location.
- A study on olfaction and olfactory cues to inform the risk to the fish community as a result of the implementation of a Minworth 115 Ml/d element and the associated changes in water quality and the water quality modelling has also been completed. This study reviewed available information to provide more information on:
 - The chemicals/determinands in WwTW discharge that are known or likely to affect migratory fish in terms of migration cues.
 - The chemical/determinands of concern that could affect reproduction of fish (e.g., pharmaceuticals); and
 - What treatment or measures are available to mitigate any adverse impacts associated with the above noted chemicals or determinands.

1.2.4 Hydrological modelling and monitoring

Further hydrological monitoring and modelling was carried out to determine the potential changes in flow as a result of both supported and unsupported abstraction. The study area included all waterbodies associated with a supported abstraction and an unsupported abstraction (up to the tidal limit). In summary:

- Further monitoring data was used to update a hydraulic model for the study area to simulate potential changes under a range of different scenarios, including modelled data on the potential changes in flows into the Severn Estuary under both supported and unsupported abstractions. Data collection activities included:
 - Repeat hydraulic surveys and detailed habitat mapping under different flow conditions that were representative of the operation of the STT Solution, from May 2021;

- In-channel habitat mapping, from May 2021, which informed the risk of altered flow and habitat conditions in supporting habitats. Data collection activities included extended walkovers and RiverMorph assessments of reaches of the River Vyrnwy, upper and lower River Severn, River Avon and River Thames to map habitat availability and conditions; and monitoring and review of sediment dynamics in river reaches associated with the STT Solution.
- Following the incorporation of regulator feedback on Gate 1, the hydraulic, water quality and in-stream habitat modelling considered a range of scenarios that addressed STT Solution operation, including:
 - A range of increasing severity of low flow years i.e., moderate-low flow (1:5-1:10 return period), very low flow (1:20 return period) and extremely low flow (1:50-1:100 return period);
 - A range of future climate conditions i.e., a future (2050s) version of “very low flow” and a future (2050s) version of “extremely low flow”;
 - Showed change from natural flow conditions;
 - For hydraulic, water quality, and in-channel habitat modelling, each model scenario was proposed as 365 days from 1 April to 31 March (a water year); and
 - The baseline for all scenarios considered a Severn Regulation operational pattern representative of each scenario (i.e., the assessment/modelling considered the STT operational in-combination with all compensation releases and Severn regulation releases).
 - An assessment to determine if the flow additions from the scheme had the potential to cause or exacerbate the risk of flooding and altered flow regimes in floodplain habitats and protected habitats associated along affected reaches of the River Vyrnwy, River Avon, River Severn and Gloucester and Sharpness Canal. Data was collected from July 2021, on the habitat types, condition, and extent of connectivity of priority habits and water-dependent features of SSSIs associated with the Solution.

1.2.5 Functionally linked habitat

This section gives insight into how the functionally linked aspect of the HRA was addressed especially with regard to migratory fish. The study area covered all waterbodies associated with a supported abstraction and an unsupported abstraction (up to the tidal limit). Targeted fisheries surveys and monitoring in those watercourses directly impacted by support releases have been completed to inform the quality and the extent of off-site functionally linked habitat. These included:

- Walkovers to identify and map the extent and location of spawning habitats for Atlantic salmon in the River Vyrnwy - completed in January 2021;
- Walkovers to map the location and extent of supporting habitat for river and sea lamprey and twaite and allis shad - completed in August 2021;
- An extensive fishery monitoring programme implemented in June 2020 and in 2021 which includes targeted lamprey surveys at several locations in the Rivers Vyrnwy, Avon and Severn.
- An investigation into the passability of existing barriers in the River Avon - completed in September 2021; and
- An extensive monitoring programme on the River Vyrnwy, River Avon and River Severn implemented since June 2021 to understand inform the risk to supporting ecological features (such as macroinvertebrates, diatoms, macrophytes and Invasive Non-Native Species).

In addition to the above, data have been collection on the habitat types, condition, and extent of connectivity of priority habits and water-dependent features of SSSIs associated with the Solution. The risk to tributaries that could be considered functionally linked habitat (e.g., the River Wye, River Usk, River Clun) was addressed through water quality modelling.

1.2.6 Requirements for additional modelling/monitoring

The requirement for further monitoring and modelling is continuously reviewed as part of the gated approach and a proportionate approach has been adopted. In summary:

- The Gate 1 assessments considered the potential changes in river flows in the context of the Standardised Streamflow Index (SSI). The SSI was calculated using average monthly river flows for each catchment using the Tweedie distribution and standard period of 1961–2010.
 - Based on the hydrological assessments in Gate 1 it was concluded that, for the reach of the River Severn from downstream of Shrewsbury to the confluence with the River Avon on 3,481 dates in a representative 10 year period (95.3%), the same flow band was retained. On 131 dates (3.6%) flows would change by one flow band, and 40 dates (1.1%) would increase by two flow bands – either from notably low flows to normal flows or from exceptionally low flows to below normal.
 - For the 221 dates with exceptionally low flow in the River Severn in this reach during the representative 10 year period, 18 dates changed to notably low flows which could be perceived as a benefit at those times.
 - As flow changes were considered non discernible (all low flows were retained), the impact pathway was not considered of a magnitude that required further investigation.
- As noted above, additional monitoring and modelling was completed in Gate 2 and the monitoring scope was amended to consider this reach, should the results indicate a discernible change in flow and/or water quality.
- Should water quality and hydrological modelling identify a discernible change, further modelling related to the Severn Estuary will be identified and agreed in consultation with the regulators at an early stage.
- It is noted that the assessment of potential impacts on hydrology was linked to the current HoF. The HoF limitations were advised by the Environment Agency and are considerably higher than the Q_{95} flows at Hawbridge and the suggested residual flows for WFD deterioration. It is noted that the HoF was under review and the work considered information and limitations at the time of the assessment.

2. GATE 2

For Gate 2, our methodology builds on the information collected and assessed at Gate 1 and uses the new and emerging data recently collected.

2.1 STUDY AREA

The study area for the STT Solution for Gate 2 assessment covers specific reaches, as shown in **Figure 1**:

1. The River Vyrnwy catchment (River Vyrnwy from Vyrnwy Reservoir to the confluence with the River Severn);
2. The River Severn catchment (River Severn from the confluence with the River Vyrnwy to the Severn Estuary), as well as those tributaries of the River Severn which could indirectly be affected by the operation of the STT Solution;
3. The Warwickshire River Avon upstream of Warwick to the River Severn confluence; and
4. The River Thames catchment (River Thames from Culham to Teddington Weir).

It should be noted that the consideration of impacts in the River Tame and Trent, from the transfer of treated discharge from Minworth Wastewater Treatment Works (WwTW) to the River Avon, is included in Severn Trent Water's Minworth Strategic Resource Solution and therefore excluded from the STT assessment.

Similarly, the STT Solution assessment accounts for the effects from the relevant solutions related to the supply of water into the STT system (United Utilities and Severn Trent Water Sources). It therefore includes an assessment of the potential effects of the water arising from the outfalls from the transfers (Minworth and Netheridge). It does not cover the impact of infrastructure construction as this is included in Severn Trent Water's Minworth and Sources Solution assessments.

2.2 INVESTIGATIONS

Figure 2 shows the investigations being undertaken for STT Gate 2 and their interactions, in order to show the full scope of work across both environmental and engineering disciplines. Reporting for the environmental investigations has been undertaken in a phased way to account for, and incorporate all previous assessments, data collection and feedback: (i) the evidence reports were produced first, and set out the data and evidence to be used in the assessments; (ii) assessment reports were then produced using the evidence to determine the potential effect of the STT solution on the physical environment, water quality and ecological receptors (dark blue box in in Figure 2); (iii) based on the evidence and assessments, the statutory reports, and assessments required to meet the RAPID and regulatory expectations for solutions at Gate 2 were produced.

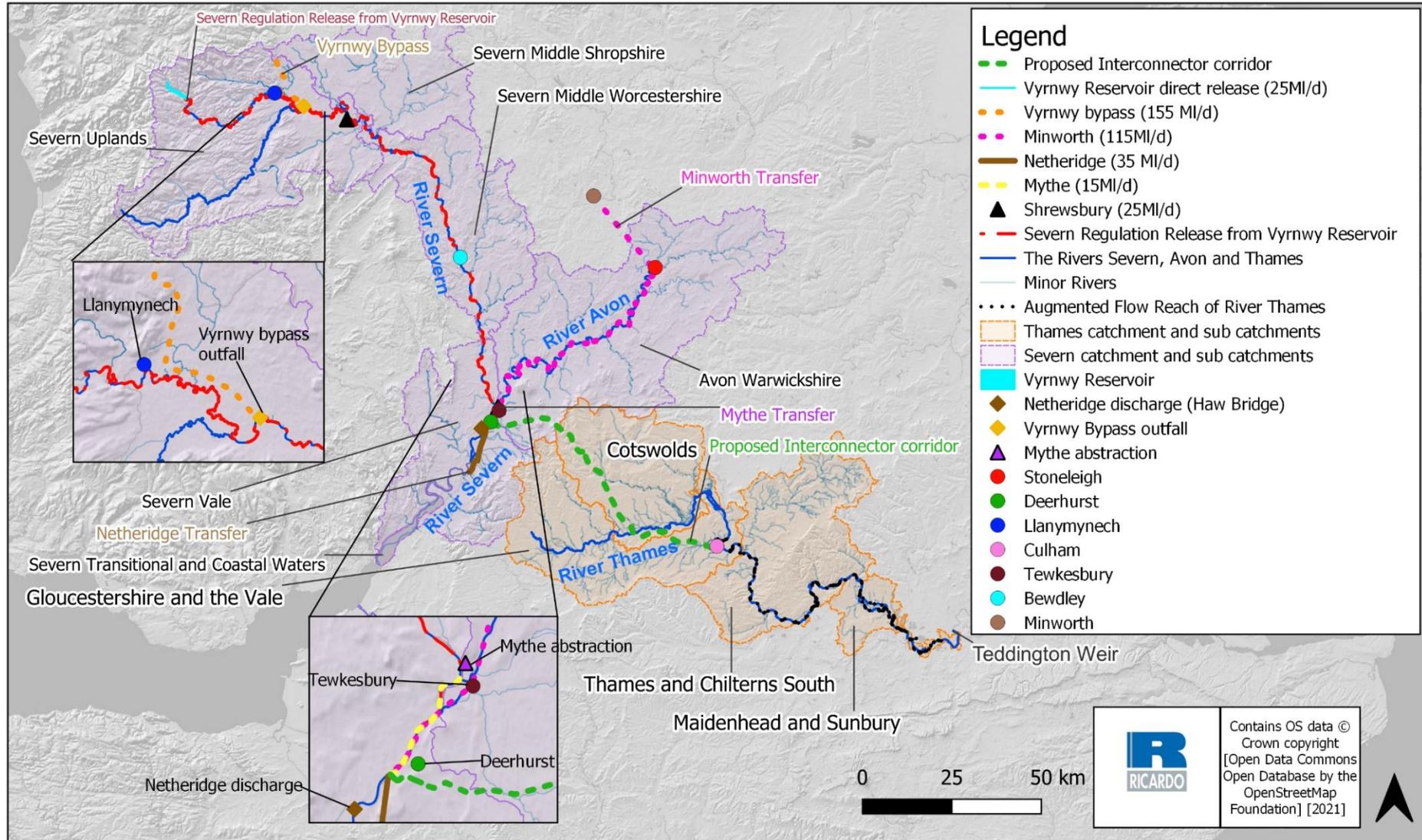


Figure 1 Map showing the study area and associated catchments

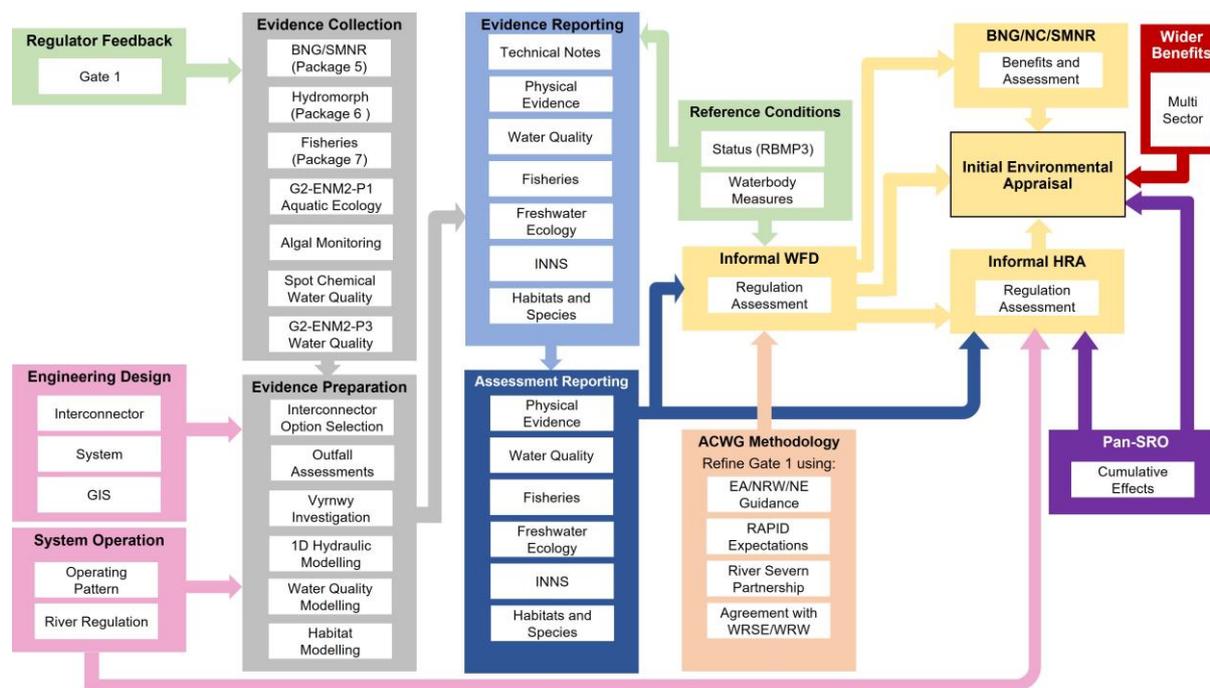


Figure 2 Flow chart showing the scope of investigations for STT Gate 2 and their interactions

2.3 HRA

The HRA for Gate 1 adopted the *principles* of HRA to identify which elements of the Solution are unlikely to be feasible due to environmental constraints. The HRA for Gate 1 recognised that there were still a number of uncertainties and risks that needed to be managed, with further iterations of the assessment required as more detailed engineering information and modelling work became available within Gate 2. As such, the Gate 1 conclusion on the risk of LSE and predictions regarding adverse effects were reviewed and updated (where required) as more information became available.

In addition, the regulators provided updated guidance on setting out the expectations for solution submission at Gate 2. This guidance noted that, although a full HRA for a solution was not required until a planning and/or permit application was submitted it was strongly recommended that the principles of a HRA were followed to reduce the risk of non-compliance at the decision-making stage.

Therefore, the regulators recommended the following tasks:

- **Updated informal Stage 1 screening** – if relevant new information is available, any projects previously screened out should be reviewed and brought back in as necessary. Then taken to an informal stage 2 Appropriate Assessment.
- **Preparation of informal Stage 2:** An informal Appropriate Assessment should be commenced with data available and associated informal site integrity test. Any gaps in evidence should have clear future plans showing how and when this evidence will be available in advance of any full formal HRA feeding into a planning submission.
- If required and if possible, with evidence available: **Begin to plan for informal stage 3 document.** If on development of the informal appropriate assessment, it appears that risks remain from uncertainty in the assessment or actual risk to the integrity of the site, an informal assessment of Alternative Solutions (stage 3) could be commenced. If sufficient evidence is available to suggest no alternatives, then consideration could be given to commencing developing plans for a case for Imperative Reasons of Overriding Public Interest (IROPI) and compensatory measures (informal stage 4).

The approach used in completing each of the tasks is provided below.

2.3.1 Stage 1 Screening

For Gate 2, each element associated with the STT Solution was considered to determine whether there were any *risks* of LSEs arising from construction or implementation activities and/or operation on one or more European sites, including SPAs⁸, Special Areas of Conservation (SACs)⁹ and Ramsar sites (also known as National Site Network) adopting the *principles* of HRA.

Updated GIS and design information was used to map the locations and boundaries of European sites in relation to the different elements of the STT Solution. The attributes of the European sites, which contribute to and define their integrity, current conservation status, and the specific sensitivities of the site were considered, with reference to:

- Standard Data Forms for SACs and SPAs and Information Sheets for Ramsar sites. An analysis of these information sources that identify the site's qualifying features.
- Article 12 reporting under the EU Birds Directive (which includes general information about the implementation of the Directive and the bird species' status and trends) and 17 reporting which captures the status and trends of Annex I habitat types and Annex II species.
- Site conservation objectives.
- Supplementary advice to the conservation objectives (SACO) where available.
- Site Improvement Plans.
- Core Management Plans (Wales); and
- the supporting Site of Special Scientific Interest's favourable condition tables where relevant and no SACOs applicable to the features were available.

This information was used to analyse how potential impacts of each element could affect the European sites.

The qualifying habitats and species of European sites are vulnerable to a wide range of impacts such as physical loss or damage of habitat, disturbance from noise, light, human presence, changes in hydrology (e.g., changes in water levels/flow, flooding), changes in water or air quality and biological disturbance (e.g., direct mortality, introduction of disease or non-native species). The review of the Gate 1 assessment considered any updates to the potential construction and operational effects because of monitoring and modelling data available in Gate 2 as well as any changes in scheme design.

In reviewing the likelihood of significant effects on European sites, particular consideration was given to the possible source-receptor pathways through which effects may have been transmitted from activities associated with each element, to features contributing to the integrity of the European sites (e.g., surface water catchments, air, etc.).

Screening for LSEs in Gate 1 was determined on a proximity basis for many of the types of impacts, based on the potential closeness of the element locations, to each European site. Where impact pathways were identified at greater distances (>10km), because of hydrological connectivity for example, designated sites were screened in as appropriate. Consideration was also given to the NE SSSI Impact Risk Zone (IRZ) datasets. The IRZs are reviewed regularly to ensure they reflect the current understanding of specific site sensitivities and potential risks posed to SSSIs. Where the notified features of a European site and SSSI are different, the SSSI IRZs have been set so that they reflect both. As such, these IRZs were used in Gate 1 to help determine the likelihood of significant effects from a particular development on the interest features of the European site.

⁸ SPAs are classified under the European Council Directive 'on the conservation of wild birds' (2009/147/EC; 'Birds Directive') for the protection of wild birds and their habitats (including particularly rare and vulnerable species listed in Annex 1 of the Birds Directive, and migratory species).

⁹ SACs are designated under the Habitats Directive (92/43/EEC) and target particular habitats (Annex 1) and/or species (Annex II) identified as being of European importance.

Schemes that will not have LSE alone but may be affected by in-combination effects with other plans and projects, were taken forward for further assessment.

The Gate 2 review considers the updated monitoring and modelling data listed in the sections above to confirm the conclusions of the Gate 1 assessments, including the conclusion of no LSE on the Severn Estuary European sites as a result of unsupported and supported abstractions. The Gate 2 assessment also considers any changes in scheme design (construction and operation) as part of the review of the conclusions of LSE and adverse effects completed in Gate 1.

2.3.2 Stage 2 Appropriate Assessment

Where a *risk* of LSE was identified at Stage 1 Screening (noting the precautionary principle), the scheme was subject to the *principles* of the Stage 2 Appropriate Assessment. The Appropriate Assessment considered the potential impact pathways of the STT Solution, both during construction and operation, that could have impacted on attribute targets associated with a European site's qualifying features.

2.3.2.1 Impact Pathways

Where required, the potential impact pathways associated with each element of the Solution were considered in the context of their effect on the qualifying features for the sites under consideration. To determine if identified impact pathways could have an adverse effect on site integrity, the following parameters were used as appropriate to define the impact (i.e., mechanism by which effects are caused):

- Impact type - direct or indirect, positive or negative;
- Magnitude of impact – the 'amount' or intensity of an impact. This may sometimes be synonymous with 'extent' (see below) for certain impacts, such as habitat loss;
- Extent of impact – the area over which the impact will be felt;
- Duration of impact – how long it will occur. The guidelines suggest that ecological impact durations should be described in terms of ecological characteristics (e.g., species lifecycles/longevity) rather than human timeframes;
- Timing of impact – when it will occur, taking note of seasonality;
- Frequency of impact – how often it will occur; and
- Reversibility of impact – whether recovery or reinstatement is possible.

2.3.2.2 Adverse Effect

An Adverse Effect on Integrity (AEoI) was likely to be one which prevents the site from making the same contribution to favourable conservation status for the relevant feature. In addition, an adverse effect would be one which causes a detectable reduction of the features for which a site was designated, at the scale of the site rather than the location of the impact.

The Habitats Directive defines the conservation status of habitats as 'favourable' when:

- Its natural range, and area it covers within that range, are stable or increasing; and
- The species structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future.

The Habitats Directive defines the conservation status of species as 'favourable' when:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats;
- The natural range of the species is neither being reduced for the foreseeable future; and
- There is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

The assessment of adverse effects considered the current condition of the associated site in line with the relevant judgements in European Court of Justice and UK courts (e.g., the Waddenzee Judgement).

2.3.2.3 Integrity Test

The integrity test is the conclusion of an Appropriate Assessment and requires the competent authority to ascertain whether the proposed elements of the STT Solution (either alone or in-combination with other plans or projects), has no adverse effect on site integrity. The following definition is provided by Defra: the integrity of the site is “*the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the level of populations of the species for which it was classified*”¹⁰.

2.3.2.4 Mitigation Measures

The assessment considered measures that were available to reduce the likelihood, magnitude, scale, and duration of the effect to a lower level, which were applied at the Appropriate Assessment stage to inform the overall integrity test¹¹. This included costed mitigation (typically following best practice guidelines) and additional mitigation, recommended to reduce the likelihood of adverse effects on site integrity. These measures included both avoidance and reduction measures.

2.3.3 Stage 3 (Assessment of Alternative Solutions and Stage 4 (IROPI and compensation measures))

The updated Gate 2 guidance states that should the informal appropriate assessment identify that any of the STT activities (construction and operation) could result in adverse effects on site integrity and no mitigation measures are available (e.g., will cause a direct loss of habitat) an informal Assessment of Alternative Solutions (Stage 3 HRA) will be considered. If sufficient evidence is available to suggest no alternatives, then consideration will be given to commencing developing plans for a case for Imperative Reasons of Overriding Public Interest (IROPI) and compensatory measures (informal stage 4).

In accordance with the Habitats Regulations, Stage 3 of the HRA process requires the consideration of feasible alternative to the STT Solution. The consideration of alternatives was limited to options which were financially, legally and technically feasible, and which achieved the project objectives. As such, only alternatives that provided a similar deployable output and at a similar frequency as the STT were considered as alternative solutions.

For the Gate 2 HRA it was proposed that, if required, Alternative Solutions will be identified through the regional planning process to ensure that schemes are compliant with the requirements of the Habitat Regulations (i.e., to avoid the consideration of schemes with a similar or greater impact on European sites).

In the absence of any reasonable or feasible alternative solutions, where a plan or project may have adverse effects on a European site, a Competent Authority can only consent to a plan or project if there are “imperative reasons of overriding public interest” (IROPI) for the plan or project to proceed and **all** necessary compensatory measures has been secured to ensure that the overall coherence of the network of European sites is protected. Where a public interest which is in principle capable of being classed as “overriding” has been identified, it must be weighed against the damage caused to the European site by the plan or project in question. Accordingly, applying the IROPI derogation involves, for example, a balancing exercise between the human health and public safety interests versus the implications for the European site in view of its relevant conservation objectives. This derogation assessment exercise is fact specific.

¹⁰ Defra Circular 01/2005. *Government Circular: Biodiversity and Geological Conservation – Statutory Obligations and Their Impact Within The Planning System*. August 2005.

¹¹ The “People over Wind” or “Sweetman” judgment ruled that Article 6(3) of the Habitats Directive must be interpreted as meaning that mitigation measures should be assessed within the framework of an Appropriate Assessment and that it is not permissible to take account of mitigation measures at the screening stage.

Should the Gate 2 assessment identify adverse effects on site integrity for any European site and no Alternative Solutions be identified from the regional planning process, an informal IROPI assessment will be completed. A high level, informal assessment of the different elements of the derogation will consider:

- Imperative: the STT it must be essential (whether urgent or otherwise), weighed in the context of the other elements below, that the project proceeds.
- Overriding: the interest served by the STT outweighs the harm (or risk of harm) to the integrity of the European site as identified in the Appropriate Assessment.
- Public Interest: a public benefit must be delivered rather than a solely private interest. Public interest can occur at national, regional or local level.

Should no Alternative solutions be identified in the regional plan and should there be a demonstrable case for IROPI compensation measures will be required. For the Gate 2 process the *principals* of selecting compensation measures will be agreed with regulators: they will not be fully developed at Gate 2.

Based on previous experience, the compensation measures should be selected based on the following:

1. There must be realistic mechanisms available for appropriate and guaranteed long-term management of the designated interests/compensation site, and no risk of damage to other features as a result of the compensation measures plan.
2. Compensation measures should specifically and proportionately compensate for the loss/degradation of the relevant qualifying feature caused by the effect of the drought order(s) whilst considering uncertainty with regards to the likelihood and the physical extent of adverse effects. Ultimately, it must maintain the coherence of the National Site Network.
3. Compensation measures should be able to be implemented in a timely manner, preferably prior to effects occurring as a result of scheme implementation.
4. Compensation measures do not need to be restricted to within the relevant European site boundaries. (i.e. non-designated and/or SSSI water bodies could be identified, enhanced and protected as compensation habitat to then be protected as a fully designated site of similar (or better quality).
5. Compensation measures should be separate and additional to measures that already form part of the intended management of a site (for example, measures already contained within a draft or agreed management plan for a designated site). In other words, measures cannot be counted if there is a reasonable chance, they will happen anyway.
6. Within a legal context, measures to address harmful activity that is clearly in breach of regulation cannot be considered.

Where required, the Stage 3 and Stage 4 of the HRA (including the detailed development of compensatory measures and associated costs and feasibility) will be further considered at Gate 3. It is noted that these stages are unlikely to be required as the gated process aims to avoid the promotion of schemes that will result in significant environmental impacts.

2.4 WFD

2.4.1 ACWG guidelines

For Gate 1, the ACWG guidelines set out an assessment approach and accompanying reporting spreadsheet for undertaking the constraint test of WFD Regulations¹² compliance that is required for Solutions. Discussions with the ACWG identified that no new WFD guidance was being prepared by ACWG for Gate 2. There were important updates made by the project team to the Gate 1 approach incorporating the latest position of EA and NRW on testing WFD compliance of water resources options,

¹² Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 SI 2017 No. 407

and also revising the baseline for testing to RBMP3, which was published in December 2021. These updates were made to the ACWG Gate 1 reporting template.

2.4.2 Regulators Gate 2 Guidance (draft)

We saw a draft of the Regulators Guidance for Gate 2 (issued 25 November 2021), and the section on WFD. The guidance did not alter the core WFD assessment. It did however reference that the Environment Agency or Natural Resources Wales will also identify other measures to consider. We welcomed a discussion with EA and NRW on these measures.

2.4.3 WFD Baseline for Testing Compliance

The assessments were undertaken for the reporting unit of a WFD water body. The appropriate baseline information for water body status and targets was set out using 2021 WFD status as published in the third cycle of RBMPs (RBMP3). When these data became available, they were incorporated by the project team into the ACWG Gate 1 reporting template.

2.4.4 WFD Assessment Objectives for Testing Compliance

This section provides the WFD Assessment Objectives that were used as a test of constraint within the ACWG Gate 1 reporting template. The ACWG guidelines also provides the additional, progressive WFD Assessment Objectives to support decision making, as set out in WRP (2021)¹³, was documented in the accompanying Gate 2 WFD Regulations assessment report.

2.4.4.1 WFD Assessment Objectives: Tests of Constraint

Principally, the WFD acts as an indicator of constraint and determines where options do not meet WFD Objectives set out in Regulation 13 of the WFD Regulations.

Following discussion with EA and NRW during preparation of the WFD Regulations assessment methodology for the Water Resources West group of companies' 2022 Regional Plan, the WFD assessment objectives as used in ACWG Gate 1 have been revised. In Gate 2, the STT Solution was tested against the principle WFD Assessment Objectives as follows:

1. To prevent deterioration¹⁴ of any WFD element of any water body - in line with Regulation 13(2)a, and 13(5)a¹⁵;

¹³ Specifically set out in WRP (2021) (updated 17 March 2021) at Section 8.2.2

¹⁴ European Court of Justice (ECJ) ruling

ECJ Case C-461/13: Bund für Umwelt und Naturschutz Deutschland v Bundesrepublik Deutschland <http://curia.europa.eu/juris/document/document.jsf?docid=178918&mode=req&pageIndex=1&dir=&cc=first&part=1&text=&doclang=EN&cid=175124> [accessed 30.6.16]

clarified that 'no deterioration' means a deterioration **between** a whole 'status class' (e.g. 'good', 'moderate', etc.) of one or more of the relevant 'quality elements' (e.g. biological, physico-chemical, etc.). This definition applies equally to Artificial Water Bodies and Heavily Modified Water Bodies in respect of the relevant quality elements that relate to the defined uses of these water bodies. The ECJ ruling further states that if the quality element concerned is already in the lowest class, any deterioration of that element constitutes a deterioration of the status. References to 'no deterioration' in this WFD methodology align to this ECJ ruling.

¹⁵ The no deterioration baseline for each water body and element is the status reported in the RBMP. The RBMP 3 will be used.

Discussion with EA and review of EA internal guidance^{#1} has identified that the EA consider 'When making management decisions, any 'interim' classification results are also relevant [in addition to the published RBMP status] to making sure any deterioration in status is taken into account and to meet the objective of aiming to achieve good status in water bodies.'

^{#1} EA (2021) Supporting implementation of river basin management plans position. LIT 14339. 01/2021 Discussion with NRW and through review of NRW internal guidance^{#2} identified that NRW consider 'You must use the most recent classification information in any assessment.'

^{#2} NRW (2020) Guidance for assessing activities and projects for compliance with the Water Framework Directive. Operation Guidance Note 72

2. To prevent the introduction of impediments to the attainment of 'Good' WFD status or potential for any water body in line with Regulation 13(2)b and 13(5)c¹⁶; and
3. To ensure that the planned programme of water body measures in RBMP3, to protect and enhance the status of water bodies, are not compromised.

If there was the possibility that the STT Solution could influence priority hazardous substance or priority substances in a water body, additional WFD Assessment Objectives may have to be agreed with the regulator in line with Regulation 13(3) and 13(5)d.

2.4.4.2 WFD Assessment Objectives: Progressive Assessments to support Decision Making

The WFD Assessment Objectives were the fundamental WFD Assessment Objectives that were used for testing.

There are a number of further WFD Assessment Objectives, set out in the WRPG, which was documented. These are considered as progressive WFD Assessment Objectives rather than tests of constraint and do not lead to WFD non-compliance if not achieved. These were as follows:

4. To assist the attainment of the WFD Objectives for the water body – in line with Regulation 13(2)b and 13(2)c;
5. To assist the attainment of the objectives for associated WFD protected areas – in line with Regulation 13(6); and
6. To reduce the treatment needed to produce drinking water and look to work in partnership with others; promoting the requirements of Article 7 of the WFD¹⁷.

Furthermore, with reference to components of the STT located in Wales, additional WFD Assessment Objectives have been identified as appropriate from OGN72¹⁸. Again, these are progressive WFD Assessment Objectives rather than tests of constraint. These are as follows:

7. To promote the sustainable use of water as a natural resource;
8. To conserve habitats and species that depend directly on water;
9. To progressively reduce or phase out the release of individual pollutants or groups of pollutants that present a significant threat to the aquatic environment;
10. To progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants and
11. To contribute to mitigating the effects of floods and droughts.

A negative answer to WFD Assessment Objectives 4-11 above does not determine that the STT Solution has WFD constraints; however, they can be used in decision making.

It is noted, though not specifically linked to WFD, The Welsh Government Guiding Principles for Developing Water Resources Management Plans (WRMP's) for 2020¹⁹ outlines that water companies should have regard to Section 6 and Section 7 of the Environment (Wales) Act 2016 when producing their WRMPs. The obligations of this Act were covered in the SEA and Natural Capital/Environmental Resilience assessments which was undertaken in parallel to the WFD assessment.

¹⁶ WRPG (2021) states that this a test to identify any options that 'prevent the achievement of the water body status objectives in the river basin management plan'. At present this is RBMP2. Discussion with EA review of EA internal guidance^{#1} has identified that the EA consider 'less stringent objectives are not permanent and the assessment of any new activity or project must take into account the need to continue to aim for good status. The new activity or project must not jeopardise the achievement of good status in the future, irrespective of whether a less stringent objective was set in RBMP2'.

^{#1} EA (2021) Supporting implementation of river basin management plans position. LIT 14339. 01/2021

¹⁷ Specifically set out in WRPG 2021 (updated 17 March 2021) at Section 9.4.5

¹⁸ NRW. (2020). Guidance for assessing activities and projects for compliance with the Water Framework Directive. Operation Guidance Note 72

¹⁹ Welsh Government (2016), The Welsh Government Guiding Principles for Developing Water Resources Management Plans (WRMP's) for 2020, April 2016

2.5 BNG, NC, AND SMNR

The assessment performed at Gate 1 was updated using new datasets and other evidence such as revised tools, knowledge inputs from stakeholder engagement, and refined or more detailed scheme design. The Gate 2 assessment incorporated detail which supported the overall SMNR and Well-being for Future Generations Act (2015)²⁰ requirements.

The aim was to provide a robust assessment of opportunities for ecological enhancement and an assessment of associated wider ecosystem benefits, which was monetised, where applicable, to support future planning processes. The work for Gate 2 included the following activities, each of which is described in more detail in the following sections:

- Data Review: Collection of new data and review of previously collated data;
- Consultation workshops to discuss the approach and findings with key stakeholders;
- Revision of BNG assessment including the field-based data that has been gathered between Gate1 and Gate 2 to support this work;
- Review of NC assessment;
- Assessment against SMNR principles; and
- Reporting.

2.5.1 Data Review

The Gate 1 outcome included a recommendation to collect more data, particularly to verify (“ground truth”) the condition and extent of habitats. As a result, surveys were undertaken in August 2021.

In addition to collecting new data, we also revisited high-level collated data on identified local and national environmental ambitions (plans and policies, WFD, river basin management plans, local restoration, and local wildlife sites etc) for the preferred routes.

A list of the data that was required is shown in **Annex A**.

The data review and associated compiled information provided the basis for workshop discussions. Where overlapping data sources with upstream Solution work streams occurred, data sources were shared where possible.

2.5.2 Consultation: workshops and questionnaires

The updating of the Gate 2 assessment was dependent on data collection and an understanding of local environmental and societal ambitions. Therefore, we proposed to deliver a series of interactive online workshops with associated questionnaires with the environmental regulators (NE, NRW, and EA) and additional key stakeholders following discussion with the STT steering group. Information arising from the data review and consultation helped to build a picture of biodiversity opportunities and the linkages between them, and the knowledge gained through consultation was linked with ground-truthed data.

Our review of local policies found that most councils did not have specific net gain policies and were in the process of development. Wider work on Local Nature Recovery Networks informed of strategically identified areas for opportunities and we fed in knowledge related to this data as/when this became available. Therefore, the aim of our consultation was to understand any planning ambitions which might either have supported ecosystem service opportunities or which may have had an impact on benefit opportunities (e.g., where other infrastructure planning existed). This information was used and linked to Water Company ambitions to ensure that these could be delivered. Workshop discussions covered other linked, upstream source, Solutions to ensure these were considered.

Overall, the objective of workshops was to obtain data, evidence, and an understanding of any local ambition. To facilitate discussions, we used maps, infographic-displayed outputs, and remote sensed imagery. We built on the imagery completed for Gate 1 (by updating routes, variable working widths,

²⁰ <https://gov.wales/sites/default/files/pdf-versions/2021/6/3/1623854132/well-being-future-generations-act-essentials.pdf>

hydrological zones of influence, land types etc). Information derived from the consultation was fed into the assessment, particularly the River Biodiversity Metric tool. The benefits assessment was updated to account for both English and Welsh regulatory requirements.

The specific objectives of the workshops were:

- To obtain any non-open-source data on more localised initiatives;
- To refine the data review to identify areas of greatest suitability for opportunities;
- Identify where multiple benefits can be gained;
- Explore a pathway for delivery, for example, prioritising government owned land (LWS, LNR and SSSI) as an approach;
- Explore linkages between opportunity areas for improved resilience through larger, more connected areas (connectivity is an important factor in site selection);
- Explore where other planning is in place or likely to occur (i.e., any planned changes such as large-scale building developments);
- Identify other data sources that may be useful for the overall natural capital assessment which includes the habitat opportunities that feed into the NC assessment; and
- Identify landownership constraints to deliver the identified biodiversity opportunity.

We held a number of online workshops. Each workshop was developed around an agenda that was sent out ahead of the workshops. It should also be noted that this work links to a separate but aligned project that was looking at the potential operation impacts and benefits: we used the workshops outlined in this methodology document to also cover a discussion on potential operation impacts and benefits. In this way we ensured links were made between the different projects plus others such as those related to the effect of the scheme on changes to flow and INNS transfer, for example.

- **Workshop 1: December 2021** – Online stakeholder meeting with NRW, NE and EA to discuss:
 - The approach and what feedback we require to input into the methodology which will include a map of where we have carried out habitat surveys between gate 1 and gate 2.
 - Use the discussion to develop the content and planning for further workshops.
 - National habitat network opportunities to support understanding of the assessment.
 - Any other key stakeholders we should include in further discussion
 - Habitats and condition – using mapped areas (subject to agreement with the STT steering group).
- Following this workshop, a **questionnaire** was issued outlining the information needed ahead of the December 2021 workshop for further discussion. This briefed participants ahead of the workshop and helped increase the effectiveness of the session. The questionnaire included a set of questions, the answers to which supported the Gate 2 assessment of biodiversity, associated sustainable management of natural resources, and ecosystem benefits.
- **Workshop 2: January** – Online stakeholder meeting with NRW, NE and EA and key stakeholders as agreed with the STT steering group and via discussion at workshop 1 to:
 - Review the locations of biodiversity opportunity areas, and key areas to target for net gain and environmental resilience; and
 - Raise awareness of any planning taking place in the areas that may affect opportunities to avoid any double counting.
- **Workshops 3 and 4: May 2022** - NRW, NE and EA (online) to discuss:
 - Project progress, the work completed, and any gaps.
 - The integration of the information provided; and
 - The spatial mapping outputs
 - The results showing potential for opportunities, risks or likely changes, and a hierarchy of opportunities to account for net gain and wider natural resource management and ecosystem benefits.

2.5.3 Refinement of the Gate 1 BNG assessment

Having collated new and revised information, the following steps were undertaken for the Gate 2 assessment:

- Refined the BNG assessment by considering the scheme concept designs, in accordance with the ACWG guidance. Greater detail on the construction methods and construction easement of the scheme generated through Gate 2 provided greater clarity on the impact pathways and improved accuracy of habitat loss and benefit opportunities.
- Refined the Gate 1 understanding on the length and location of the impacted reaches using the outcome of assessments on the scheme's operational impacts on hydrology and ecology (such as water quality and flow changes). This information enabled the review of the potential operational biodiversity impacts and gains by improving baseline knowledge and helped the identification of suitable waterbodies for offsetting and restoration / enhancement opportunities.
- Reviewed survey data on habitat type, condition, and extent to update baseline data on potential habitat loss. The surveyed area covered c.25% of the affected area; we interpolated for the remaining impacted areas on habitat extent and quality and digitised this into a GIS. It should be noted that the extent and location of the surveyed areas along with initial findings was discussed at workshop 1.
- Used the Green Infrastructure Assessment and Area Statements to aid the identification of suitable locations within Wales for securing appropriate 'place based' off-site compensation. We consulted with NRW via the consultation workshops to ensure there was no additional data available for river habitats: we noted that the NRW identified Opportunity Catchments identified by NRW for the third cycle of WFD River Basin Planning (2021-2027), were not available online²¹.
- Applied the Defra Biodiversity Metric 3.0 tool. This tool was released in July 2021, with updated information and functionality. It now includes a function to calculate the uplift (compensation) required to ensure no net loss, and a net gain assessment for rivers. The tool was completed on a maximum of 4 options resulting in a more confident comparison of net gain, resilience, and associated ecosystem benefits. This revised tool provided the baseline platform with which to assess impacts and information needed to complete a full assessment of wider benefits via both a standardised natural capital approach, and an assessment against SMNR principles for opportunities within Wales.
- Incorporated information on local opportunities to support offsite mitigation, linking information from the data review process and field data. These opportunities were mapped using GIS, to support the discussion in the consultation workshops.
- Used the principles of the Nature Recovery Networks initiative and ecosystem resilience, to identify connection opportunities through habitat restoration and/or creation and also any risks. We incorporated any 'hotspots' opportunities i.e. those already identified within Local Plans/LBAPs/strategies.
- Created heatmaps identifying areas where Local Wildlife Sites, Local Nature Reserves and designated sites were within closer proximity. We proposed using the heatmaps to refine the biodiversity opportunity areas and to underpin discussions with stakeholders during the proposed workshops.
- Linked the outputs of this work to the SEA, WFD and Natural Capital approaches to ensure opportunities for biodiversity gain inform those assessments.

The BNG outputs underpinned the understanding of the benefits associated with Natural Capital and SMNR principles. It enabled a baseline to be provided for comparison with options, and a robust assessment of wider Natural Capital gain, which then supported the best value and most environmentally resilient Gate 2 outputs.

2.5.4 Natural Capital stocks

Stocks of Natural Capital underpin the provision of ecosystem services, i.e., the goods and services provided by nature that benefit humans and society. Some ecosystem services can be valued in monetary terms based on the benefits they provide where needed.

²¹ *The Wales Environmental Information Portal provides the evidence base for Area Statements. It currently holds no data on ecosystem resilience.*

For Gate 2, we built on the qualitative assessments made Gate 1 of recreation and tourism; natural hazard regulation²²; and agriculture (including soil condition) ecosystem services. We did this by using quantified information where possible (and where monetised) supported by knowledge of local ambitions.

As for Gate1, the Gate 2 data sources used to value ecosystem services included the WRPG, ACWG Guidance, Defra’s Enabling a Natural Capital Approach (ENCA) Guidance and, in some cases, the ONS Natural Capital Accounts Methodology 2019.

The Gate 2 assessment made use of the revised ENCA Guidance, which was updated in August 2021. Specific updates to ecosystem services included revised valuation evidence and data in the ENCA Services Databook as well as the inclusion of new ecosystem services, such as the mental-health benefits of nature. We also accounted for the latest water resources planning guideline (WRPG) supplementary guidance (‘Environment and Society in decision-making’ of which a draft was issued in 2021). Where relevant, these updates were incorporated into the respective ecosystem services that was assessed for Gate 2. We identified the additional information related to ecosystem services required for Gate 2, compared to Gate 1. This included, for example, the need to account for new and emerging knowledge on best practice assessment which may go above the minimum requirement to account for biodiversity and habitat; climate regulation; natural hazard regulation; water purification and water regulation as outlined in the WRPG supplementary guidance (2021).

Notably since Gate 1, there have been some refinements to the assessments of Natural Capital in the context of monetisation. The detail of these updates is provided in **Annex B**. We used the ENCA guidance and referred to the Treasury’s Green book and new supplementary guidance to support monetisation of ecosystem services for England. We completed this for both England and Wales for comparison purposes across other Solutions and Water Resource Management plans noting that additional bespoke work was completed for the Welsh area as outlined in section 3.2.5 below. Key elements of change or update summarised below.

- **Better representation of recreational areas:** The ORVal tool remains the best estimate available for estimation of recreation however we explored the inclusion of new relevant ecosystem services regarding mental health, education and volunteering, using the evidence provided in the updated ENCA guidance to ensure there is no double counting. Where overlaps did not exist, we incorporated the new evidence into our assessment having performed a sense-check via the consultation workshops. To ensure that the outputs were not overrepresented, we also applied a set of rules as per Gate 1.
- **Land use predictions:** The vast majority of our Natural Capital Assessment is based on land cover. Upcoming changes in land use therefore introduced discrepancies into calculations, making it imperative to account for planned changes such as large-scale building developments. Monetisation depended on how the use of land has changed and whether it could support net gain and environmental resilience. We assessed the changes in land use and chose the most suitable valuation approach to capture the marginal change in value.
- **Inclusion of wider abiotic features** were not included at Gate 1 due to the limitation of data robustness in the context of the high-level assessment and design uncertainties that stage of the gated approach. For Gate 2 we represented abiotic factors as there will be an increased certainty of element routes and the hydrological zones of influence.
- **Air quality** focused on air quality management areas and, where appropriate, was monetised using ENCA guidance.

2.5.5 Accounting for SMNR and Well-being goals

We also ensured that Welsh SMNR principles and well-being of Future Generations Act underpinned our ecosystem assessment work. We accounted for the key SMNR principles outlined in **Table 4** and

²² Note: We also recognise the impact of drought and this is captured in the STT Gate 1 WFD and HRA assessments. At Gate 2 we will consider the potential effect of both floods and droughts in more detail. This will be done using stakeholder discussions and the outputs of the STT flow and morphology surveys. We will use the Defra metric 3 tool to support an enhanced understanding of the riverine system.

the well-being goals. In addition, in the context of building ecological resilience, we specifically considered the elements related to ecosystem diversity, connectivity, scale, condition, and adaptability.

Our knowledge took account of ground-truthed habitat condition data and input from the stakeholder workshops. We used the BNG calculation outputs (driven by key Welsh data sets) related to habitat type and condition, to support the assessment of the building ecosystem resilience aspects. This provided a baseline of habitat types and condition.

To assess the wider benefits assessment, we took account of the local Area Statements to understand local ambitions. Collectively we used all information (including from the workshops) to provide a RAG-type rating related to key opportunities with text to explain the rationale.

Table 4 Principles of sustainable management of natural resources²³

Principles of sustainable management of natural resources		
	Adaptive management	manage adaptively by planning, monitoring, reviewing and where appropriate, changing action
	Scale	consider the appropriate spatial scale for action
	Collaboration and engagement	promote and engage in collaboration and cooperation
	Public Participation	make appropriate arrangements for public participation in decision-making
	Evidence	take account of all relevant evidence, and gather evidence in respect of uncertainties
	Multiple benefits	take account of the benefits and intrinsic value of natural resources and ecosystems
	Long term	take account of the short-, medium- and long-term consequences of actions
	Preventative action	take action to prevent significant damage to ecosystems
	Building resilience	take account of the resilience of ecosystems, in particular the following aspects: (i) diversity between and within ecosystems (ii) the connections between and within ecosystems. (iii) the scale of ecosystems. (iv) the condition of ecosystems (including their structure and functioning). (v) the adaptability of ecosystems.

2.5.6 Reporting/Outputs

Further to the materials provided for the consultation workshops, draft and final reports have been produced for review by stakeholders. The reports focus on opportunities and areas to both improve and increase habitat areas, and ecosystem service benefits. They include commentary on local environmental and societal ambitions to support sustainable natural resource management, linked to the maps that indicate the areas of opportunities for biodiversity resilience. The outputs assess wider benefits and flag any disbenefits related to options.

The reporting includes habitat opportunity maps, an overall 'RAG' type assessment with additional narrative, revised outputs from the BNG and NC calculators for comparison with Gate 1 and with

²³ From: Natural Resources Wales (undated) Introducing Sustainable Management of Natural Resources. Available from: [Introducing Sustainable Management of Natural Resources](https://naturalresources.wales/media/678317/introducing-smnr-booklet-english.pdf)
<https://naturalresources.wales/media/678317/introducing-smnr-booklet-english.pdf>

updated information related to opportunities based on stakeholder discussion. Opportunity maps also highlight the additional benefits related to ecosystem services.

It should be noted that the level of confidence that applied to these outputs were directly related to (a) the level of local knowledge gained from the workshops, (b) an assessment of the ground truthing exercise and (c) the detail of engineering design (i.e., construction width, locations, and size/design) of specific assets) available for each option.

2.6 IEA

2.6.1 Overview

In Gate 2, each element associated with the STT Solution is subject to review to determine the key environmental positive and negative effects. This included consideration of any new and / or amended elements from those assessed in Gate 1.

The environmental positive and negative effects identified from the Gate 1 SEA output tables were reviewed with the engineering team to help determine areas where design refinements and optimisation were to be considered further and helped develop further mitigation and enhancement measures which were embedded within the designs.

To facilitate the environmental appraisal of the STT Solution being developed to a level suitable for submitting into final regional plans or final WRMPs, the SEA output tables produced in Gate 1 were updated. These output tables were in the same format as those adopted in Gate 1 and appended to the IEA.

The main body of the IEA identified potential environmental effects in terms of risks and opportunities and additional mitigation. The report assigned significance values to the risks consistent with SEA or a high-level Red-Amber-Green approach, instead of adopting IEA terminology. The RAG approach was used during the options appraisal process, for example in respect of the interconnector options assessment. An example of this and the proposed RAG criteria used is provided in **Table 5**.

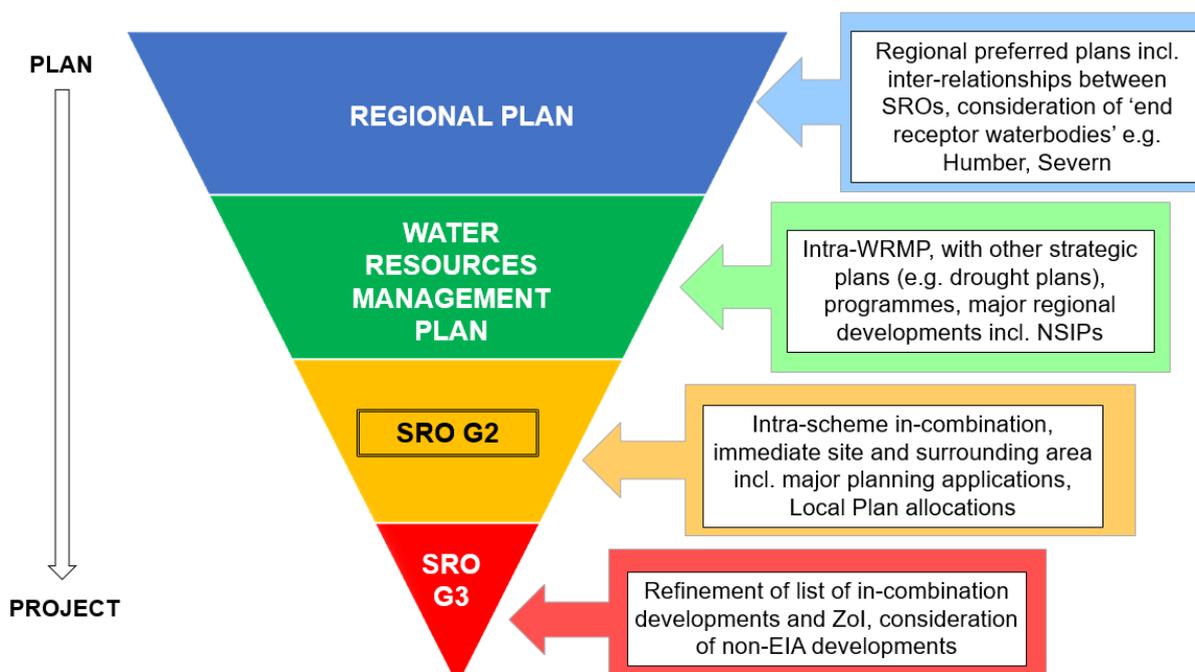


Figure 3 The proposed responsibility for completion of in-combination effects assessment: Regional Plans, WRMPs and Solutions

Table 5 RAG Criteria and application to *example* topic areas

Criteria		Description	
Red		Issue or constraint is likely to be challenging to overcome /major environmental constraints, significant <u>additional</u> mitigation required.	
Amber		Issue or constraint can be overcome / moderate environmental constraints, potentially extensive and/or challenging <u>additional</u> mitigation requirements.	
Green		Neutral or minor issue or constraint, easily mitigatable with best practice measures or minor <u>additional</u> mitigation requirements.	
Topic Area	Criteria considered	Red/Amber/ Green Rating	Assessment Comments (<i>example</i>)
Nature Conservation and Biodiversity	Extent of construction and operational effects on European designated sites and their qualifying features (SPA, SAC, Ramsar)	Amber	One SAC (xxx) is located within 350m of the scheme, given its proximity the construction/ refurbishment of the canal at this location could have impacts on the SAC through permanent changes in the groundwater levels (which are important in determining the composition of the vegetation communities).
Historic Environment	Extent of construction and operational effects on statutory designated heritage assets, including overall setting (Listed Buildings, Scheduled Monuments, Conservation Areas)	Amber	There are numerous listed buildings located along the route, including in proximity to some of the permanent features. There are a number of scheduled monuments within 500m of the proposed scheme including around [xxx], which may experience effects during construction due to their proximity.

2.6.2 Information informing the IEA

The environmental assessment for Gate 1 adopted the principles of SEA to identify which elements of the Solution are likely to generate significant environmental effects (positive and negative) to facilitate decision making.

The Gate 1 STT Solution SEA assessment²⁴ recognised that there were still a number of uncertainties and risks that needed to be managed, and that further iterations of the assessment were required as more detailed information and assessment work became available during Gate 2. The Gate 1 SEA assessment recommended that the Gate 2 work should include the consideration of the recommended *further* mitigation measures identified within each of the Gate 1 STT Solution SEA option matrices.

In this context, the Gate 2 environmental appraisals were updated as a more detailed design and mitigation information became available. These appraisals covered the physical environment, water quality, fish, invasive species, protected species, protected habitats, macroinvertebrates and other ecology, in addition, updated HRA, WFD assessment, NC, BNG Assessment and a SMNR assessment were undertaken and fed into the IEA.

Figure 2 illustrates how the further survey work, studies and assessments helped inform the development of the concept designs, mitigation measures and the IEA. In addition, summaries of other pertinent workstreams, as outlined in the Gate 2 guidance document, were included in the IEA e.g., options appraisal, planning consent route.

²⁴ Ricardo Energy & Environment (2021). River Severn to River Thames Transfer (STT) Strategic regional water resource solution. Environmental Assessment Report: Appendix B4.1 Strategic Environmental Assessment. Report on behalf of the STT Group. July 2021 v3.

The Gate 1 environmental assessment used a GIS-based system to identify and map environmental constraints within the study area. The same Gate 1 datasets were used in Gate 2 (see **Annex C**), incorporating updates of these datasets and new ones where applicable.

The assessment used qualitative and/or quantitative information where this was made available (e.g., as identified by the HRA or WFD assessment process, conceptual design information, and/or public domain datasets including GIS datasets). The appraisal is at a strategic level and makes use of spatial analysis, professional judgement and applicable assessment guidelines relating to that topic/objective.

2.6.3 Other Gate 2 documentation

A number of elements identified in the Gate 2 guidance document (February 2022) were assessed in detail through other STT workstreams outside the environmental assessment work. As stated in the guidance, and at the request of the regulators, they were summarised within the IEA as detailed below and shown in the draft report structure:

- *Options assessment, with sufficient detail to allow comparison of options and identify potential effects (positive and negative) and opportunities*

The IEA included a summary of options appraisals and signposting to specific options appraisal reports produced by Jacobs and Mott MacDonald. A summary of reasons for phasing decisions/optimisation was included, and the environmental appraisal approach used during options appraisal.

- *Clear justification for the options discounted, those taken forward, and the preferred option selected*

The IEA included a summary of environmental input and appraisal approach to the options appraisal for Vyrnwy Bypass, Shrewsbury, Deerhurst to Culham interconnector and signposting to specific options appraisal reports produced by Jacobs/Mott MacDonald.

- *Where the preferred option is identified, potential environmental effects and opportunities should be discussed*

The IEA included a summary of environmental effects and opportunities of preferred routes selection signposting to specific options appraisal reports produced by Jacobs/Mott MacDonald.

- *Consideration of resilience (e.g., climate change, etc), climate change and within the appraisal work*

A summary of climate change scenarios used in environmental workstreams (modelling, BNG, carbon sequestration) was included and a summary of other workstreams given and signposted to Jacobs/Motts conclusions regarding wider resilience, climate change and carbon accounting.

2.6.4 Proposed IEA structure

With the STT Solution involving elements spread over a wide geographic area and with components that could potentially be developed over different timescales, it was proposed that each STT Solution element was initially considered separately with the final combination(s) of scheme elements, consistent with those taken forward to the Regional Plan and WRMP, then subsequently reported.

Following the Gate 2 guidance (December 2021), the IEA was structured accordingly, in consultation with the environmental regulators. The structure of the IEA report follows formats typically adopted for both the IEA Scoping process via the Town and Country Planning route, and Preliminary Environmental Information reports through the Development Consent Order route. The structure was updated as work continued through Gate 2 to reflect the latest level of information available in the Concept Design Report and Evidence Reports. We circulated an indication of the report structure to regulators for their feedback to ensure the final presentation of the IEA would be acceptable.

3. SUMMARY

This report has set out the approach used for the Gate 2 informal HRA assessment, IEA assessment, BNG, NC and SMNR assessments and the WFD assessment.

It should be noted that the study area focuses on the rivers Vyrnwy, Avon and Severn as well as those tributaries of the River Severn which could indirectly be affected by the construction and operation of the STT Solution. The reaches of the River Thames extend from Lechlade to Culham (as associated with a potential transfer from the canal option); the reaches associated with a pipeline transfer of 300-500MI/d is considered as part of the HRA for the South East Strategic Reservoir Option (SESRO) Solution. In addition, the reaches for the WFD assessments included the reach from Culham to the tidal limit at Teddington. Reaches in the rivers Tame and Trent associated with a Minworth effluent transfer was being considered as part of the HRA for the Minworth Solution.

Regarding the BNG, NC and SMNR assessments, the assessments were based on the existing data and information related to best Solution construction, WRSE modelling and wider environmental knowledge. As a result, the outputs of this work provide a net gain plan based on the existing view at the time of writing the report and together with some ground truthing understanding via workshops and associated stakeholder engagement. However, it is recognised that the Solution scheme is one that will likely take 30+ years of planning and building: as such it is recognised that there needs to be a recognition that some of the opportunities for BNG, NC and SMNR may have already been implemented under other infrastructure plans and programmes. Some of this potential risk will be picked up via ongoing workshops with wider stakeholders and through understanding of local planning policy through the gated process.

4. Appendices

Appendix A: WFD Key data requirements, use and sources

Appendix B: Refinements to the monetisation assessment of Natural Capital

Appendix C: Datasets used in the Gate 1 SEA Assessment

Appendix A: WFD Key data requirements, use and sources

Data	Type open source, purchased etc	Use	Source
Biodiversity resilience/net gain			
Local Wildlife Sites	Data purchase	Assess impacts to LWS along components and opportunities for mitigation within LWS.	Local Environment Record Centres
Local Nature Reserves	Open source	Assess impacts to LNRs along components and opportunities for mitigation within LNRs.	https://data.gov.uk/dataset/acdf4a9e-a115-41fb-bbe9-603c819aa7f7/local-nature-reserves-england
Natural England Habitat Networks	Open source	Used to refine site selection of biodiversity opportunity areas.	https://data.gov.uk/dataset/0ef2ed26-2f04-4e0f-9493-ffbdbfaeb159/habitat-networks-england
Priority Habitats – Hedgerows and Arable Field Margins	Data purchase	Improve baseline data used to calculate habitat loss and mitigation requirements.	Local Environment Record Centres
River Basin Management Plans	Open source	Detailed review to identify any specific BNG objectives for impacted watercourses.	https://www.gov.uk/government/collections/river-basin-management-plans-2015
UK habitat and morph	Ground truth data 2021	To provide update on habitat condition for both terrestrial and aquatic systems to provide a more accurate assessment to feed into the Defra metric	Collected by Ricardo
Habitat Networks Wales	Open source	Used to refine site selection of biodiversity opportunity areas in Wales.	https://lle.gov.wales/catalogue/item/HabitatNetworks/?lang=en
Local Nature Reserves Wales	Open source	Assess impacts to LNRs in Wales and opportunities for mitigation with LNRs	https://lle.gov.wales/catalogue/item/LocalNatureReserves/?lang=en
Ancient Woodland Inventory Wales	Open source	Improve baseline data on habitat loss within Wales and opportunities for woodland creation.	https://lle.gov.wales/catalogue/item/AncientWoodlandInventory2021/?lang=en
Terrestrial Phase 1 Habitat Survey Wales	Open source	Improve baseline data on habitat loss within Wales and opportunities for woodland creation.	https://lle.gov.wales/catalogue/item/TerrestrialPhase1HabitatSurvey/?lang=en
Ecosystem Services			
ENCA Services Databook (Multiple)	Open source	Monetised The ENCA Services databook acts as an initial database of existing evidence to value ecosystem services such as those relating to natural hazard regulation, air pollution, and soil quality.	https://data.gov.uk/dataset/3930b9ca-26c3-489f-900f-6b9eec2602c6/enabling-a-natural-capital-approach
Orval (Recreation)	Open source (stakeholder engagement required)	Monetised ORVal uses of a travel cost method to assign an annual value to the whole site in question. We will use this as a basis for analysis, and request stakeholder input to verify our assumptions on the impact of construction on this value.	https://www.leep.exeter.ac.uk/orval/
UK mineral statistics (Mineral extraction)	Other assessment output	Non-Monetised This data provides the basis for the calculation of the valuation of provisioning services regarding mineral extraction by providing physical accounts of annual extraction.	UK mineral statistics MineralsUK (bgs.ac.uk)
BEIS and ONS Renewable energy	Other assessment outputs	Non-monetised This data provides the basis for the calculation of the valuation of provisioning services regarding renewable energy by providing	Digest of UK Energy statistics: Digest of UK Energy Statistics (DUKES): renewable sources of energy - GOV.UK (www.gov.uk)

Data	Type open source, purchased etc	Use	Source
		physical accounts of annual extraction and distribution.	ONS Annual Business Survey: Non-financial business economy, UK: Sections A to S - Office for National Statistics
<i>BEIS and Oil & Gas Authority Fossil Fuels</i>	Other assessment output	Non-monetised This data provides the basis for the calculation of the valuation of provisioning services regarding fossil fuels by providing physical accounts of annual extraction and distribution.	Digest of UK Energy statistics: Digest of UK Energy Statistics (DUKES): renewable sources of energy - GOV.UK (www.gov.uk) Oil and Gas Authority Production and expenditure projections: Oil and Gas Authority: Production and expenditure projections - Data downloads and publications - Data centre (ogauthority.co.uk)
BEIS Data tables 1-9: supporting the toolkit and the guidance <i>Carbon sequestration</i>	Other assessment output	Monetised This data provides the non-traded carbon price projected up to 2050 and is applied to the physical estimates of carbon sequestered per ha of habitat type.	https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal http://publications.naturalengland.org.uk/publication/5419124441481216 - this contains tables that accounts both Carbon storage t C ha-1 and Carbon sequestration averaged over time period t CO2e ha-1 y- for different habitat types.
Air quality management areas <i>Air quality</i>	Other assessment output		To be defined
Water quality	Ground truthing	To support the assessment of water purification assessment	Ricardo surveys

Appendix B: Refinements to the monetisation assessment of Natural Capital

B.1 Recreation

- The Outdoor Recreation Valuation Tool (ORVal)²⁵ is used to estimate recreation demand from existing or new greenspace as a proxy for recreation value. The values derived from the ORVal²⁵ tool are estimated using a Random Utility Model of travel cost estimates²⁶. The values represent the total welfare lost if the site in question was to be removed.
- In cases where components consist of more than one site, the marginal values of each site will be aggregated based on the assumption that other sites that exist outside of the component scope are substitutes²⁷. The welfare values are based on £2016 prices and will be uplifted by Ricardo to £2021 prices using the green book and ENCA guidance for the assessment to ensure all economic valuations are for the same time frame. The following rules will be applied for the assessment of recreation and tourism using the ORVal tool.
 - If the construction is located on the periphery of a recreation site and is judged to not impact any key attributes of a recreation site that would significantly impact visitor numbers, then we can apply the per ha average value of the recreation site to the area of construction.
 - If the construction is located in or near the centre of the recreation site and/or is judged to impact key attributes of a recreation site that would significantly impact visitor numbers, then the whole site value is used.
 - A conditional percentage could be applied to the footpath values depending on the number of footpath intersections (and therefore alternative routes) present. For example:
 - If there are no intersections, and therefore no alternative routes, then we take 100% of the footpath value.
 - If there are 1-2 intersections present, then we take 50% of the value.
 - If there are 3-4 intersections present, then we take 25%.
 - And if there are 5+ intersections present, then we take 10% of the value.

B.2 Wider abiotic features

Inclusion of wider abiotic features were not included at Gate 1 due to data limitations, given the high level assessment and design uncertainties at that stage. For Gate 2, with increased certainty of the element routes and the hydrological zones of influence, representation of abiotic factors will be sought as outlined below.

- Additional provisioning services will be assessed and valued based on a residual resource rent approach, as outlined by the Office of National Statistics for their UK Natural Capital Accounts (ONS, 2017).
- Other abiotic features which provide supporting ecosystem services, such as soil quality, will be examined using the updated ENCA guidance. However, it must be noted that available valuation evidence available regarding soil quality may be insufficient to provide a monetary value.
- We will ensure that there is no double counting where soil quality affects the provision of other ecosystem services, such as water quality, and will clearly state where overlaps exist.

B.3 Air Quality

The air quality assessment for Gate 2 will follow the key criteria outlined here.

- Do options fall within an Air Quality Management Area? If yes, then we monetise the impacts.
- If no, are any of the receptors reported as being above the world health organisation values? If yes, apply an average annual value for air pollution removal per ha of habitat type (using values from the ENCA

²⁵ <https://www.leep.exeter.ac.uk/orval/>

²⁶ Day & Smith (2017) The ORVal Recreation Demand Model: Extension Project. Accessed via: https://www.leep.exeter.ac.uk/orval/pdf-reports/ORValIII_Modelling_Report.pdf

²⁷ https://www.leep.exeter.ac.uk/orval/pdf-reports/ORVal2_User_Guide.pdf

Services Databook (including Jones et al (2019)²⁸) noting that these values do not account for localised effects of vegetation on air quality (i.e. the specific make-up of vegetation). Therefore, any monetisation outputs should be considered as estimates, and only limited confidence can be placed on their robustness. These will be updated to 2021 in accordance with the current Treasury green book values.

²⁸ Jones, Laurence; Vieno, Massimo; Morton, Dan; Hall, Jane; Carnell, Ed; Nemitz, Eiko; Beck, Rachel; Reis, Stefan; Pritchard, Neil; Hayes, Felicity; Mills, Gina; Cryle, Philip; Dickie, Ian; Koshy, Adam; Holland, Michael. (2017; corrected 2019) Developing estimates for the valuation of air pollution removal in ecosystem accounts. Final report for Office of National Statistics. Wallingford, NERC/Centre for Ecology & Hydrology, 75pp. Available from: <http://nora.nerc.ac.uk/id/eprint/524081/> (CEH Project no. C06156)

Appendix C: Datasets used in the Gate 1 SEA Assessment

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

