



Dŵr Cymru Welsh Water

Habitats Regulations Assessment of the Water Resource Management Plan 2024

Information to support an assessment under Regulation 63
of the *Conservation of Habitats and Species Regulations*
2017



Report for

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1. Introduction

Water Resource Management Plans set out how water supply-demand balances and water supply security will be maintained over the next 25 years and beyond. These plans are subject to the provisions of the *Conservation of Habitats and Species Regulations 2017* (as amended).

1.1 Dŵr Cymru Welsh Water's Water Resources Management Plan 2024

- 1.1.1 The Water Act 2003 requires that all water companies in England and Wales prepare and maintain Water Resources Management Plans (WRMPs). These plans set out how public water supply (PWS) will be maintained over a minimum of 25 years in a way that is economically, socially and environmentally sustainable. The WRMPs must be revised every five years.
- 1.1.2 Dŵr Cymru Welsh Water (DCWW) has prepared its WRMP (WRMP24) for the period 2025 – 2050. The WRMP sets out DCWW's preferred resource and demand management options ('the preferred options') for meeting predicted deficits in the water available for PWS, and for ensuring security of supply.
- 1.1.3 DCWW's WRMP24 has been developed within a regional water resources planning framework covering all or part of the operational areas of Dŵr Cymru Welsh Water (DCWW), Severn Trent Water (STW), Hafren Dyrfyrdwy (HD), South Staffordshire Water (SSW) and United Utilities Water (UU) that is managed by Water Resources West (WRW). WRW is preparing a Regional Plan¹ for the period 2025 to 2085 that will address long-term regional and inter-regional, multi-sectoral water resources management pressures and will draw on water resource options from the member water companies' WRMP24s, as well as the Strategic Resource Options (SROs) being taken forward by the companies.

1.2 Habitats Regulations Assessment

- 1.2.1 Water company WRMPs are subject to the provisions of the *Conservation of Habitats and Species Regulations 2017* (as amended) (the 'Habitats Regulations')².
- 1.2.2 Regulations 63 and 64 transposed the provisions of Articles 6(3) and 6(4) of Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive') as they related to plans or projects in England Wales.

¹ EA (2020) *Water Resources National Framework: Appendix 2: Regional planning*.

² The 2017 Regulations have been amended by the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 to reflect the UK's exit from the EU, although these largely carried forward the provisions and terminology of the 2017 Regulations and do not fundamentally alter their interpretation. This report therefore primarily refers to the 2017 Regulations and (where appropriate for clarity) the relevant provisions of the Habitats Directive.

- 1.2.3 Regulation 63 states that if a plan or project is “(a) is likely to have a significant effect on a European site³ or a European offshore marine site⁴ (either alone or in combination with other plans or projects); and (b) is not directly connected with or necessary to the management of the site” then the competent authority must “...make an appropriate assessment of the implications for the site in view of that site’s conservation objectives” before the giving consent or authorisation. The plan or project can only be given effect if it can be concluded (following an ‘appropriate assessment’) that it “...will not adversely affect the integrity” of a site unless the provisions of Regulation 64 are met.
- 1.2.4 This assessment process is known as Habitats Regulations Assessment (HRA)⁵. An HRA determines whether there will be any ‘likely significant effects’ (LSE) on any European site as a result of a plan’s implementation (either on its own or ‘in combination’ with other plans or projects)⁶ and, if so, whether there will be any ‘adverse effects on site integrity’⁷.

1.3 This Report

- 1.3.1 DCWW has a statutory duty to prepare a WRMP and is therefore the Competent Authority for the HRA of that plan. DCWW has appointed WSP (formerly Wood Group UK Limited) and Ricardo Energy and Environment (Ricardo) to assist with its assessment of WRMP24 against Regulations 63 and (if required) 64.
- 1.3.2 This report accompanies the revised draft WRMP24 (rdWRMP) and sets out the assessment of DCWW’s preferred options against the requirements of the Habitats Regulations. It also documents the iterative HRA process that has been applied through the development of the WRMP24. The report is structured as follows:
- **Section 2** provides a brief summary of the WRMP and the preferred options;
 - **Section 3** sets out the approach to HRA of WRMP24, including the key issues for these strategic plans;
 - **Section 4** documents the ‘screening’ of the preferred options;

³ As noted, the 2019 amendment to the Habitats Regulations largely carried forward the provisions and terminology of the 2017 Regulations, and so the term ‘European site’ is currently retained and for all practical purposes the definition is essentially unchanged. European sites are therefore: any Special Area of Conservation (SAC) from the point at which the European Commission and the UK Government agreed the site as a ‘Site of Community Importance’ (SCI) (if this was before 31 Jan 2020); any classified Special Protection Area (SPA); and any candidate SAC (cSAC). However, the term is also commonly used when referring to potential SPAs (pSPAs), to which the provisions of Article 4(4) of Directive 2009/147/EC (the ‘new wild birds directive’) are applied; and to possible SACs (pSACs) and listed Ramsar Sites, to which the provisions of the Habitats Regulations are applied a matter of Government policy (NPPF para. 181; TAN5 para. 5.1.3) when considering development proposals that may affect them. “European site” is therefore used in this document in its broadest sense, as an umbrella term for all of the above designated sites. Note, it is likely that this term will be supplanted at some point in the future although an appropriate UK-wide alternative has not yet been agreed (e.g. the NPPF in England has adopted the term ‘Habitats sites’ to refer collectively to those sites defined by Regulation 8; the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 does not offer a direct alternative to “European site” but uses the term ‘National Site Network’ in place of ‘Natura 2000’).

⁴ ‘European offshore marine sites’ are defined by Regulation 18 of The Conservation of Offshore Marine Habitats and Species Regulations 2017; these regulations cover waters (and hence sites) over 12 nautical miles from the coast.

⁵ The term ‘Appropriate Assessment’ has been historically used to describe the process of assessment; however, the process is more typically referred to as ‘Habitats Regulations Assessment’ (HRA), with the term ‘Appropriate Assessment’ limited to a specific stage within the process.

⁶ Also referred to as the ‘test of significance’.

⁷ Also referred to as the ‘integrity test’.

- **Sections 5 – 7** provide ‘appropriate assessments’ for those European sites where significant effects could not be excluded, including option-specific ‘in combination’ assessments;
- **Section 8** summarises the plan-level ‘in combination’ assessment; and
- **Section 9** sets out the proposed conclusion of the HRA of DCWW’s WRMP24 (assuming that final WRMP reflects the revised draft WRMP, and subject to any additional data gathering that may be required to resolve residual uncertainties).

1.3.3 The report necessarily focuses on the assessment of the preferred options; the iterative HRA-related processes used to inform the development of the plan (including the feasible options assessments) are therefore documented separately for clarity. In addition, the assessment is of the rdWRMP only and not the WRW Regional Plan (although it will contribute to the HRA of the Regional Plan).

1.3.4 Note that the HRA draws on the environmental data and assessments undertaken within other assessments, particularly in relation to operational effects and the hydrological zone of influence. These include the Water Framework Directive (WFD) assessment; this HRA report should therefore be read in conjunction with these reports.

2. DCWW's WRMP24

The WRMP process identifies potential deficits between the water available for supply and the projected demand. DCWW has identified four supply-side options and a range of 'demand-side' options to resolve predicted deficits in its supply area, and one additional supply side option to support a potential new bulk supply to a third party.

2.1 Water Resources Planning

- 2.1.1 The WRMP process establishes supply and demand balances for each Water Resource Zone⁸ (WRZ) operated by the water company, identifying potential deficits between the water available for supply and the projected demand. Each supply-demand balance calculation is structured around a consistent central set of planning assumptions and is used to identify WRZs in deficit over the plan period. Options are then proposed to resolve these deficits.
- 2.1.2 The supply-demand balance calculations are based on the comparison of how much supply capability DCWW has (Water Available For Use (WAFU)) which is then compared against the forecast demand for water, plus an allowance for planning uncertainty known as Headroom.
- 2.1.3 Supply and Demand forecasts are completed in accordance with the *Water Resources Planning Guideline*⁹ (WRPG).
- 2.1.4 The supply-demand balance calculations are based on deployable output (DO) and demand forecasts. The estimation of DO is based on:
- abstraction volumes allowed under current statutory licences, as impacted by actual source yield;
 - any future reductions in abstraction expected under environmental improvement regimes; and
 - predicted future demand for water based on government data for population and housing growth plans (including Local Plans) and information on major infrastructure schemes likely to have high water demand.
- 2.1.5 It should be noted that various licence review arrangements and protocols are implemented at the start of each WRMP cycle, which take account of the Environment Agency's or Natural Resources Wales' requirements through the Water Industry National Environment Programme (WINEP) and National Environment Programme (NEP) respectively. This review process (and WINEP) is undertaken in conjunction with Natural England and NRW, which identify protected sites (including European sites) to the EA/NRW where it believes abstraction-related issues are affecting the achievement of favourable conservation status.

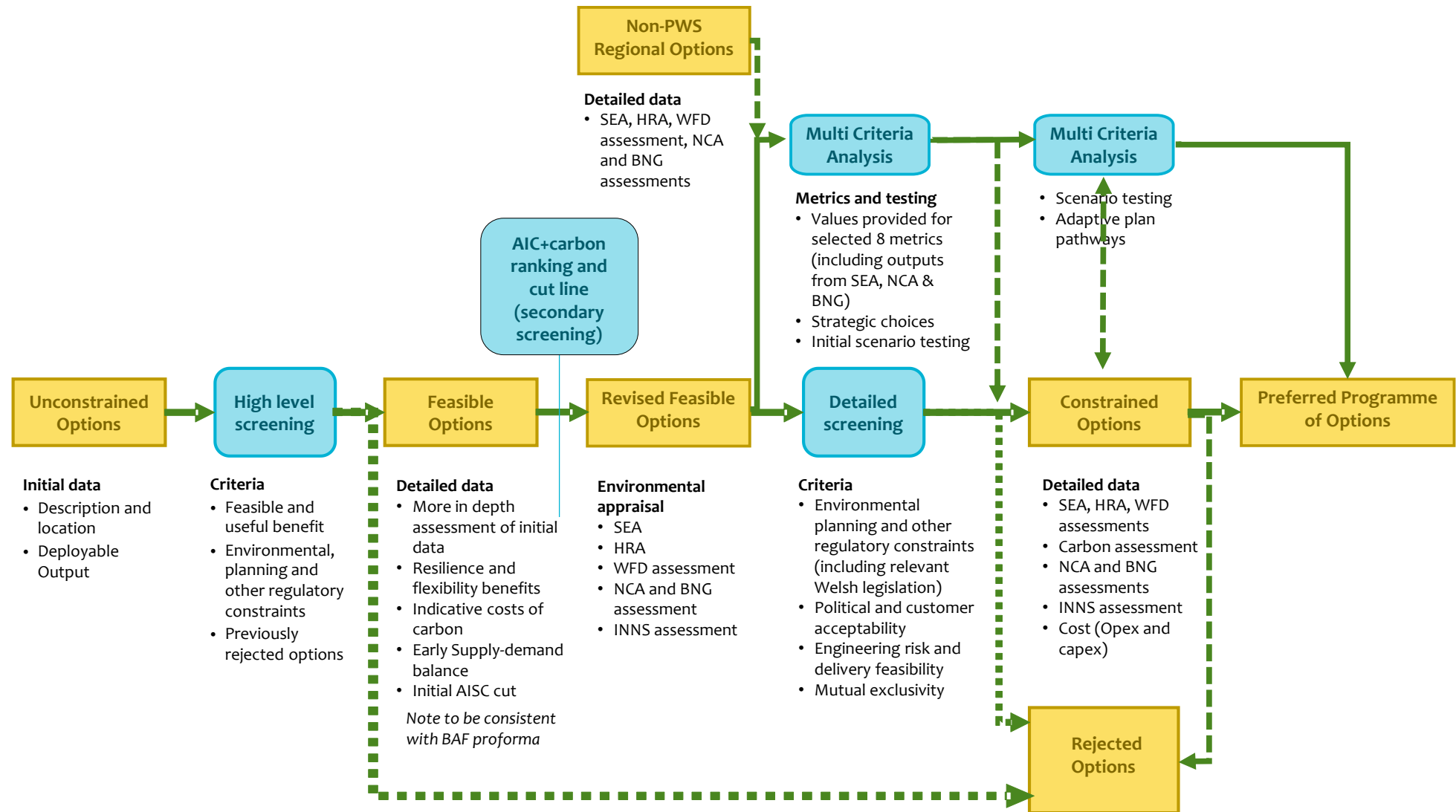
⁸ Section 4.4. of the draft WRPG defines a water resource zone as "an area within which the abstraction and distribution of water to meet demand is largely self-contained (with the exception of agreed bulk transfers)".

⁹ UK Government (2023). Water resources planning guideline [online.]. Available at: <https://www.gov.uk/government/publications/water-resources-planning-guideline/water-resources-planning-guideline>. [Accessed May 2023].

- 2.1.6 This review is important to the development of the supply/DO forecast at the start of the WRMP process, and is consequently reflected in Section 5.4 ('Developing Your Supply Forecast') of the the Water Resource Planning Guideline (2020 draft and 2023 published versions) which outlines the requirements for sustainable abstraction taking into account existing statutory requirements and environmental destination.
- 2.1.7 Demand forecasts are completed in accordance with the WRPG and consider (*inter alia*):
- Estimates of baseline demand from:
 - ▶ household customers;
 - ▶ non-household customers;
 - ▶ water leaks;
 - ▶ any other losses or uses of water such as water taken unbilled.
 - Future demands which will be subject to many influences, including:
 - housing development and population changes, including changes in occupancy;
 - the impact of prolonged high demand;
 - changes in water use behaviour and distribution of demand (in both household and non-household users);
 - metering and smart metering;
 - changes in government policy and expectations, for example water efficiency standards in new homes and water labelling;
 - changing water efficiency and sustainable water use practices;
 - changing design standards of devices that use water such as more efficient washing machines;
 - changes in technology and practices for leakage detection and repair;
 - a changing climate;
 - weather patterns;
 - potential changes in demand from the energy sector as it moves to low carbon technology.
- 2.1.8 The supply forecast informs the supply-demand balance calculations for the planning period, which is in effect the 'predicted future baseline' for water resources in a supply area. The water company then develops 'options' for resolving any predicted deficits in the supply-demand balance, which are then tested against various metrics to determine the 'preferred plan'. Note that all references to WRMP 'options' in the WRPG are made in the commonly-accepted sense, i.e. explicit interventions proposed by the WRMP to increase water supply or reduce consumption (e.g. WRPG Section 1.1), not a broad 'catch all' for ongoing water company operations such as those existing abstractions that will form part of the 'predicted future baseline'.
- 2.1.9 The WRMP process initially identifies as many potential deficit solutions as possible (the 'unconstrained list' of options) irrespective of cost or technical merit. These are then refined to identify '**feasible options**' and subsequently the '**preferred options**' for meeting any supply-demand deficits. All zones with deficits are subject to a decision-making process using a Multi-Criteria Analysis (MCA), and other methods where appropriate, to identify a preferred plan (comprising 'preferred options') to address the

supply demand deficit. The decision-making method factors in multiple costs and benefits and considers the interaction between zones to establish a best value plan for the region (and individual company). This staged filtering process allows various assessments, including HRA, to inform the plan development (see **Figure 2.1**).

Figure 2.1 Environmental assessments into Option and plan development



2.1.10 WRMP options are typically characterised as **supply-side** (measures that increase available supply, such as new sources of water) or **demand-side** (measures which reduce the amount of water required such as leakage detection and reduction). HRAs generally focus on supply-side options¹⁰ and their potential effects; these options would typically involve one or more of the following:

- development of new surface or groundwater sources, or desalination of sea water ('new water');
- modification of an existing licence to alter the operational and network regimes (e.g. additional abstraction; changes in timing of abstractions; etc);
- use of 'spare water' from existing licensed sources through operational adjustments or capital works (e.g. new treatment facilities);
- re-instatement of existing, mothballed sources (with or without current licences);
- capital works to the distribution network (e.g. to improve resilience);
- transferring water from adjacent water companies or third-parties with a supply / demand surplus; or
- Strategic Resource Options¹¹ involving multiple companies and sources.

2.2 DCWW's WRMP24

2.2.1 Welsh Water manages its water supplies and demands across 23 water resource zones (WRZs). Welsh Water provides water and sewerage services to some 3 million customers in much of Wales and small parts of Cheshire and Herefordshire in England. It also has over 100,000 business customers, and in total delivers more than 850 million litres of drinking water every day. This can increase by up to 20 per cent during a hot summer. Most of the water Welsh Water abstracts is supplied from impounding reservoirs although significant volumes are abstracted from lowland river sources such as those on the Rivers Wye and Usk in South East Wales, the River Towy in South West Wales and the River Dee in North Wales. Groundwater accounts for less than 5 per cent of water supplies by Welsh Water but at a local level, may be the whole supply¹².

2.2.2 In previous WRMPs, Welsh Water identified and implemented significant asset investment to manage the implementation of the Water Framework Directive and Habitats Directives through abstraction licence changes. Demand management and leakage reduction by at least 15% during AMP7 was also mandated by regulatory expectation.

2.2.3 Although the environment remains a key aspect of the rdWRMP24, no confirmed abstraction licence changes have been agreed through the National Environment Programmes that would reduce Welsh Water's current supply capability.

2.2.4 Welsh Water's supply demand balances (SDB) have been generated for each of the 23 water resource zones. This identified that three zones would not be resilient under the

¹⁰ 'Demand management' options (i.e. options designed to reduce treated water use such as metering or provision of water butts) are generally considered unlikely to have any significant or adverse effects on any European sites (see Section 3.2).

¹¹ There are six Strategic Resource Options (SROs) being taken forward by the companies (the Severn Thames transfer, Grand Union Canal transfer, Minworth Effluent Reuse, Severn Trent Sources, Vyrnwy Reservoir Source, United Utilities Sources).

¹² Welsh Water (2019) Final Water Resources Management Plan 2019. Technical Report. March 2019. Available online: <https://www.dwrcymru.com/en/our-services/water/water-resources/final-water-resources-management-plan-2019> [Accessed March 2021].

preferred planning scenario (1 in 200 year level of drought resilience for emergency measures as soon as possible, and 1 in 500 year level of drought resilience by 2039/40, tested against a medium emission climate change scenario). The WRZs with an identified shortfall are SEWCUS; Tywi Gower; and Lleyn Harlech – Barmouth.

2.2.5 As part of the WRMP development process, DCWW initially identified feasible supply-side and demand-side options to resolve deficits, improve network resilience and make water available for transfer. These options were subject to a staged filtering process (which included a high-level consideration of the HRA-related risks associated with each option) designed to establish the best-value plan for DCWW taking into account the regional plan requirements.

2.2.6 Welsh Water’s draft WRMP24 therefore proposes the following interventions:

- For Lleyn Harlech – Barmouth WRZ, the deficit will be overcome by demand management measures only for household and non-household customers (e.g. leakage / network improvement programmes, metering enhancements, water efficiency audits, grey water recycling, rainwater harvesting, etc.).
- For SEWCUS WRZ and Tywi Gower WRZ, the deficit will be overcome by demand management measures and four supply-side options (see **Tables 2.1 – 2.3**). Note that for the purposes of environmental assessment, option SEW052 – Afon Lwyd is included within the ‘Preferred Plan’ as this may be required to support a potential bulk supply to the Canal and River Trust and so DCWW wish to be proactive in understanding any potential negative environmental effects from this option.

Table 2.1 Preferred Supply-Side Options for the Tywi Gower WRZ included in the rdWRMP24

Option ID	Option name	Gain in WAFU (MI/d)	Description
TWG12	Crai Distribution Option - Upsize Christopher Road WPS	13.91	In order to reduce demand on Crai resources, GCG SRV (2.4 MI/d average demand) and Bros SRv(1.7MI/d average demand) will be rezoned to the Felindre WTW by upsizing Christopher Road PS to reverse flows in the 17" main from Crai and putting two booster PS's to pump to GCG SRV and Bros SRv.
TWG14	Ystradfellte - Reverse flow through Tonna control valve	20.87	In order to reduce the stress on the resource from Cefn Drysgoed, flows through the Tonna Flow control valve will be reversed so that 2.5MI/d from the Felindre system can meet some of the demand on the Cefn Drysgoed network. Elements: New Park Field Pumping Station (PS) to pump to the Cefn Drysgoed network (2.5MI/d - from the model).

Table 2.2 Preferred Supply-Side Options for the SEWCUS WRZ included in the rdWRMP24

Option ID	Option name	Gain in WAFU (MI/d)	Description
SEW166	Memorial and Cefn Mably upgrade	34.8	This option would involve providing 47 MI/d peak flows to the Pontsticill Low Level network in order to release the flows from the Pontsticill WTW to enable other WRMP options and the trading option. In order to be able to supply the combined 47 MI/d, Cilfynydd WPS (21MI/d) will be reinstated to support the Memorial WPS (26 MI/d). The Pumps at Memorial WPS will be replaced with Low suction, high lift pumps to be able to pump to Ty Gwyn SRv. Cefn Mably WPS will be reinstated to provide additional pressure to the supply side of Memorial WPS and Tongwynlais SRv. Installation of a pressure and flow control valve arrangement at the inlet to Tongwynlais SRv to ensure that the service reservoir does not overtop.
SEW168	Removal of Llwynon Min flow	8.17	Scheme to enable DCWW to stop supplying c.9 MI/d minimum sweetening flow year round into the Llwynon gravity main in order to avoid WQ issues. The scheme comprises installation of new pressure reducing valves (PRVs), meters, burst protection valves and flow control valves.

Table 2.3 Preferred Supply-Side Option to support the Third Party bulk supply included in the rdWRMP24

Option ID	Option name	Gain in WAFU (MI/d)	Description
SEW052	New abstraction from the Afon Lwyd	6	This option would involve a new abstraction capable of a maximum of 10MI/d from the Afon Lwyd by means of a new intake structure, and pumping the raw water to Court Farm WTW through 400m of 450mm HDPE pipe connecting to the LG Main.

2.3 Relationship with the WRW Regional Plan and SROs

Regional Plan

2.3.1 The Water Resources West (WRW) Regional Plan covers the management of water resources in the North West of England, the West Midlands and the cross-border catchments with Wales. It includes all or part of the operational areas of Dŵr Cymru Welsh Water (DCWW), Hafren Dyfrdwy¹³, Severn Trent Water (STW), United Utilities (UU) and South Staffordshire Water (SSW) (see figure to right).

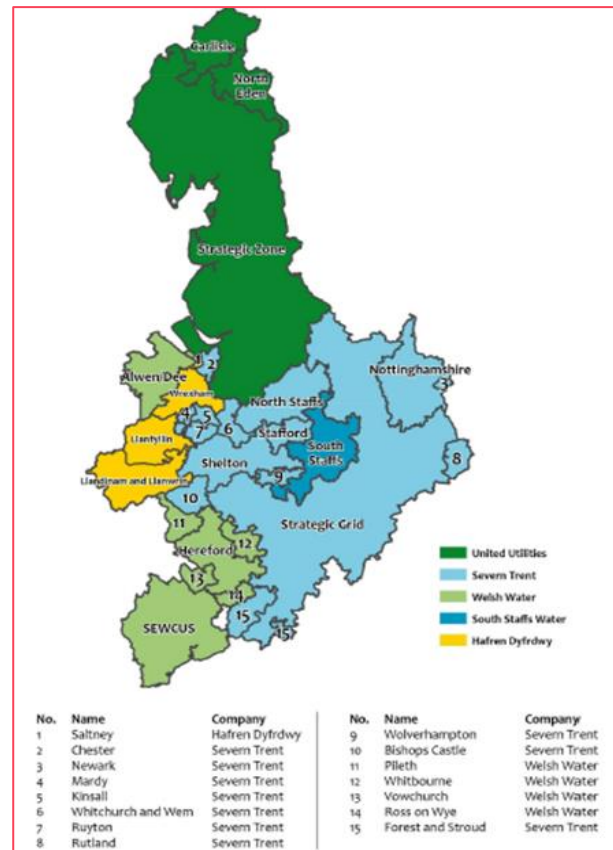
2.3.2 These five companies, like all water companies in England and Wales, are required¹⁴ to prepare, maintain and publish a WRMP.

2.3.3 WRW is taking an integrated approach to preparing the Regional Plan and the WRMPs and aims to provide a Regional Plan that is multi-sector and takes account of the water supply needs of non-public water supply (non-PWS) abstractors as well as public water supplies. WRW member water companies have used a regionally consistent set of methodologies to reflect local, regional and national needs into the development of the plans.

2.3.4 Each water company is leading the development of their individual WRMP and relevant aspects of the regional plan in the parts of their area included with WRW as a single piece of work. This has necessitated a high degree of integration and fostered greater collaboration between companies and stakeholders.

2.3.5 The WRW Regional Plan covers the period 2025 to 2085 and addresses long-term regional and inter-regional, multi-sectoral water resources management pressures and draws on water resource options from the member water companies' WRMP24s, as well as the Strategic Resource Options¹⁵ (SROs) being taken forward by the companies.

2.3.6 Water Resources West published its draft regional plan¹⁶ on 16 November 2022, for a 12-week consultation period to 22 February 2023. The plan sets out how its members propose to achieve long-term, best-value and sustainable water resources across the region. By 2050, WRW are committed to reduce leakage by 50% and support households to reduce their consumption to 110 litres per person per day. WRW forecasts that by



¹³ AT 1st July 2018, Hafren Dyfrdwy combined the water service area of Dee Valley Water and Severn Trent lying in Wales.

¹⁴ Section 37 and 37A of Water Industry Act 1991, as amended by the Water Act 2003 and the Water Act 2014.

¹⁵ The Strategic Water Resource Options (SROs) programme has been initiated by Ofwat to provide at least 1500Ml/d of water to areas of England facing a water deficit. The SRO Programme includes 17 schemes which will be funded and assessed during AMP7 to determine the right portfolio of projects to be selected by Regional Plans ready for implementation in AMP8. Schemes are evaluated at a series of decision points (Gates).

¹⁶ WRW (2022) Draft Regional WRMP (Nov, 2022). Available from: <https://waterresourceswest.co.uk/draftplandocuments>

2050, despite the ambitious demand policies that would be implemented, the region will need an additional 221 MI/d to meet public water supply needs and 97 MI/d to meet the needs of other sectors.

Strategic Resource Options

- 2.3.7 Two SROs are associated to some extent with water-supply infrastructure or environmental receptors in Wales (but not within the DCWW supply area): the North-West Transfer (NWT) SRO and the Severn-Thames Transfer (STT) SRO.
- 2.3.8 Currently, U UW's Revised Draft WRMP24 is consistent with the reconciled regional preferred pathway. Under this pathway the NWT SRO only requires the three supply-side options that are in U UW's Revised Draft WRMP24 (i.e. this version of the NWT SRO is essentially the same as the Revised Draft WRMP24), and the STT SRO is not deployed.
- 2.3.9 However, under the 'WRSE higher demand' and 'No SESRO' scenarios, additional water from Vyrnwy Reservoir would be transferred to the Water Resources South East (WRSE) region via the STT SRO, requiring further sources of supply (from the constrained list of U UW WRMP24 options) to maintain supply resilience to U UW customers; the 'WRSE higher demand' and 'No SESRO' scenarios would require an additional four or five supply-side options respectively (i.e. seven or eight options in total). In these scenarios the NWT SRO would comprise two principal components:
- new sources to offset water transferred out of region from Lake Vyrnwy as part of the STT SRO; and
 - enabling works on the Vyrnwy Aqueduct to allow treated water from regional U U sources to be transferred by pumping into the Vyrnwy Aqueduct to maintain customer supplies (for transfer volumes greater than 75MI/d).
- 2.3.10 It should be noted that there remains considerable uncertainty over the 'WRSE higher demand' and 'WRSE no SESRO' scenarios as these are dependent on confirmation from other water companies (who are managing future uncertainties relating to demand, climate change and environmental destination) and the reliability or acceptability of other large-scale options.
- 2.3.11 Importantly, decisions relating to implementation of these scenarios are also external to U UW's own decision making, including RAPID's gated decision-making process in respect of STT. Currently, STT is not part of any other water company revised draft WRMP24 preferred plan and so the NWT SRO scenario is fundamentally the same as the revised draft WRMP24 (i.e. three options).
- 2.3.12 Consequently, the NWT SRO as it might be delivered under 'WRSE higher demand' and 'WRSE no SESRO' scenarios is dependent on selection of STT in future planning cycles by other water companies and is not a 'plan' or 'programme' that can be meaningfully assessed for in combination effects at this point (since substantial components of the assessment would be speculative, and the additional SRO options would not be required until 2043 at the earliest). The same applies to the STT; as it currently stands this option is not selected in any WRMPs and so is not a 'plan' or 'programme' that is likely to proceed and which can be meaningfully assessed.
- 2.3.13 Note that the NWT SRO is currently being assessed as part of RAPID's gated process for SROs; this includes environmental compliance. The environmental compliance assessments, and the supporting investigations, are ongoing with the outcomes available to inform the RAPID Gate 3 submission in 2024. In consequence, the findings have not been available in time for the Revised Draft WRMP24 (and its assessment).

3. Approach to HRA

The nature of the WRMP (a long-term strategic plan with specific projects) presents challenges for a 'strategic' or plan-level HRA and it is therefore important to understand how the WRMP is developed and hence how it might consequently affect European sites.

3.1 Key Guidance

- 3.1.1 The key guidance document for HRA of WRMPs is **UKWIR (2021). *Environmental Assessment Guidance for Water Resources Management Plans and Drought Plans***. UK Water Industry Research Limited, London.
- 3.1.2 Other relevant guidance and case-practice includes:
- Regulators' Alliance for Progressing Infrastructure Development (2022). Strategic regional water resource solutions guidance for Gate 2.
 - Defra (2021). *Policy paper: Changes to the Habitats Regulations 2017* [online]. Available at: <https://www.gov.uk/government/publications/changes-to-the-habitats-regulations-2017/changes-to-the-habitats-regulations-2017> [Accessed March 2021].
 - UK Government (2019). *Appropriate assessment: Guidance on the use of Habitats Regulations Assessment* [online]. Available at: <https://www.gov.uk/guidance/appropriate-assessment> [Accessed March 2021].
 - Tyldesley, D. & Chapman, C. (2021). *The Habitats Regulations Assessment Handbook* [online]. DTA Publications Limited. Available at: <https://www.dtapublications.co.uk/handbook/>. [Accessed March 2021].
 - UK Government (2023). Water resources planning guideline [online]. Available at: <https://www.gov.uk/government/publications/water-resources-planning-guideline/water-resources-planning-guideline> [Accessed April 2023].
 - Natural England (2020). *Guidance on how to use Natural England's Conservation Advice Packages in Environmental Assessments*. Natural England, Peterborough.
 - European Commission (2018). *Managing Natura 2000 sites - The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC*. European Union, 1-86.
 - Defra (2012). *The Habitats and Wild Birds Directives in England its seas: Core guidance for developers, regulators & land/marine managers* [online]. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/82706/habitats-simplify-guide-draft-20121211.pdf. [Accessed March 2021].
 - PINS Note 05/2018: *Consideration of avoidance and reduction measures in Habitats Regulations Assessment: People over Wind*, Peter Sweetman v Coillte Teoranta. [withdrawn].
 - SNH (2019). SNH Guidance Note: *The handling of mitigation in Habitats Regulations Appraisal – the People Over Wind CJEU judgement* [online]. Scottish Natural Heritage. Available at: <https://www.nature.scot/sites/default/files/2019-08/Guidance%20Note%20-%20The%20handling%20of%20mitigation%20in%20Habitats%20Regulations%20App>

[raisal%20-%20the%20People%20Over%20Wind%20CJEU%20judgement.pdf](#).
[Accessed March 2021].

3.2 Application of HRA of WRMPs

Process Overview

- 3.2.1 European Commission guidance¹⁷ and established case-practice suggests a four-stage process for addressing Articles 6(3) and 6(4), and hence Regulations 63 and 64 (see **Box 1**), although not all stages will necessarily be required.

Box 1 – Stages of HRA

Stage 1 – Screening or ‘Test of significance’

This stage identifies the likely effects of a project or plan on a European site, either alone or ‘in combination’ with other projects or plans, and considers whether these effects are likely to be significant. The ‘screening’ test or ‘test of significance’ is a low bar, intended as a trigger rather than a threshold test: a plan should be considered ‘likely’ to have an effect if the competent authority is unable (on the basis of objective information) to exclude the possibility that the plan or project could have significant effects on any European site, either alone or in combination with other plans or projects; an effect will be ‘significant’ simply if it could undermine the site’s conservation objectives. Note that mitigation measures should not be taken into account at the ‘screening’ stage, in accordance with the People over Wind (Court of Justice of the European Union (ECJ) Case C-323/17); this reinforces the idea of screening as a ‘low bar’ and makes ‘appropriate assessments’ more common.

Stage 2 – Appropriate Assessment (including the ‘Integrity test’)

An ‘appropriate assessment’ (if required) involves a closer examination of the plan or project where the effects on relevant European sites are significant or uncertain, to determine whether any sites will be subject to ‘adverse effects on integrity’ if the plan or project is given effect. The scope of any ‘appropriate assessment’ stage is not set, and the assessments will not be extremely detailed in every case (particularly if mitigation is clearly available, achievable, and likely to be effective). The assessments must be ‘appropriate’ to the effects and proposal being considered, and sufficient to ensure that there is no reasonable doubt that adverse effects on site integrity will not occur (or sufficient for those effects to be appropriately quantified should Stages 3 and 4 be required).

Stage 3 – Assessment of Alternative Solutions

Where adverse effects remain after the inclusion of mitigation, Stage 3 examines alternative ways of achieving the objectives of the project or plan that avoid adverse impacts on the integrity of European sites. A plan or project that has adverse effects on the integrity of a European site cannot be permitted if alternative solutions are available, except for imperative reasons of overriding public interest (IROPI; see Stage 4).

Stage 4 – Assessment Where No Alternative Solutions Exist and Where Adverse Impacts Remain

This stage assesses compensatory measures where it is deemed that there are no alternatives that have no or lesser adverse effects on European sites, and the project or plan should proceed for imperative reasons of overriding public interest (IROPI). The EC guidance does not deal with the assessment of IROPI, although the IROPI need to be sufficient to override the adverse effects on European site integrity, taking into account the compensatory measures that can be secured (which must ensure the overall coherence of the ‘national site network’).

¹⁷ *Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC* (EC 2002).

- 3.2.2 The stages in Box 1 (if required) are used to ensure compliance with the Habitats Regulations and so principally reflect the stepwise legislative tests applied to the final, submitted project or plan; **there is no statutory requirement for HRA (or its specific stages) to be completed for draft plans or similar developmental stages.**
- 3.2.3 Consequently there is flexibility for the HRA process to be run in a manner that provides maximum benefit for plan-development and sound decision-making, whilst still ultimately meeting the legislative tests.
- 3.2.4 In practice, HRAs of WRMPs usually have two functional components: they informally guide each water company as it considers which water resource options will be included in the published plan; and subsequently provide a formal assessment of the published WRMP against Regulation 63. A degree of separation between these functions is therefore sometimes necessary, and the rigid application of the stages in Box 1 to the emerging or interim stages of strategic plans¹⁸ is not always appropriate, reducing the clarity and usefulness of the HRA as a plan-shaping process for both plan-makers and consultees. For WRMPs this is especially true for the assessment of the emerging feasible options and the application of the ‘People over Wind’ (PoW)¹⁹ case.
- 3.2.5 Therefore, whilst the principles of HRA have been applied to the emerging WRMP and the feasible options **the specific tests associated with Regulation 63 are applied to the preferred programme of options only.** The overarching HRA *process* for the WRMP has therefore included the following key steps:
- An initial ‘**risk review**’ of the **supply-side²⁰ feasible options**, to assist DCWW’s selection of constrained options (i.e. ‘HRA as a process’). The review of the feasible options applied the normal principles and practices associated with ‘HRA screening’ but also took account of the deliverability of the options including potential mitigation opportunities²¹ (for clarity, this review process is not documented in this report since the scope of some options has changed in response to the review).
 - The **assessment of the preferred programme of options** against the provisions of Regulation 63, comprising formal ‘screening’ and an ‘appropriate assessment’ designed to meet the legislative tests (this report).

¹⁸ Particularly those (such as WRMPs) where the guideline HRA stages do not map easily on to the agreed or statutory stages in the plan development process.

¹⁹ *People Over Wind and Sweetman v Coillte Teoranta (C-323/17)*

²⁰ Demand-side options designed to reduce treated water use (such as metering, provision of water butts or leakage reduction options) are not systematically reviewed at this stage as they are invariably generic and geographically unspecified activities or groups of actions that cannot negatively affect any European sites (or be meaningfully assessed at the strategy level). Since they will form part of the adopted WRMP they are formally subject to Regulation 63 as part of the final HRA, but this is typically a simple screening exercise or ‘down-the-line’ deferral, depending on the nature of the option.

²¹ Applying a PoW-compliant ‘screening’ assessment to the feasible options would have little value for plan-development since mitigation opportunities, including effective and well-established measures for marginal effects, would be ignored. All options with ‘likely significant effects’ would therefore be treated equally, with no distinction between options that would (from an HRA perspective) be easily achievable in practice and those that would be extremely challenging or impossible. The review of the feasible options is not therefore intended to be, or replicate, a formal and fully compliant ‘HRA screening’ or be a ‘draft HRA’ or similar. It takes a broad view of the ‘HRA-related risk’ associated with an option that captures both the risk to DCWW and the delivery of the WRMP within the statutory timescales (for example, the data collection required to definitively demonstrate that an option is acceptable might not be achievable in the time available for delivery of the WRMP) and the risks of the option to European site integrity (i.e. where adverse effects would appear to be an unavoidable outcome of the option as presented). The terminology intentionally reflects a typical RAG risk assessment to provide clarity for DCWW and to avoid the perception of premature assessment conclusions.

Key Challenges and Assumptions

- 3.2.6 The fundamental nature of the WRMP (a long-term strategic plan with specific projects) presents a number of distinct challenges for a 'strategic' or plan-level HRA and it is therefore important to understand how the WRMP is developed, its objectives, and hence how it might consequently affect European sites.

Uncertainty and plan-level mitigation

- 3.2.7 HRAs of plans and strategies typically have to deal with a degree of uncertainty; very often, it is not possible to provide a detailed assessment of the effects of a proposal as many aspects simply cannot be fully defined at the strategy-level in the planning hierarchy. This is particularly true for options that will only be required over longer-term planning horizons, which are inevitably less defined than options that are required in the near term.
- 3.2.8 Where the available information is fundamentally insufficient to complete a meaningful appropriate assessment, then case-practice (both for WRMPs and strategic plans in general) suggests some assessment may be deferred 'down the line' to a lower planning tier provided that certain criteria are met.
- 3.2.9 This is usually only appropriate where there is sufficient certainty that the proposal can (with the implementation of established scheme-level measures that are known to be effective) avoid adverse effects on the integrity of European sites; and/or if appropriate investigation schemes are identified to resolve the uncertainty and commitments are made within the plan to not pursue an option if adverse effects are identified through these investigations.
- 3.2.10 Case-practice in WRMP HRAs²² and the WRPG indicates that it may be acceptable to include Preferred Programme options with residual uncertainties provided that:
- there is sufficient flexibility within the terms of the WRMP to ensure adverse effects can be avoided at the project level (e.g. the plan does not dictate specific pipeline routes or yields that cannot be deviated from); and/or
 - the option is not required within the first five years of the plan period, so allowing time for additional investigations to be completed; and
 - the uncertainty that this creates is mitigated at the plan-level by the inclusion of alternative options which:
 - ▶ will meet the required demand / deficit should the Preferred Programme option prove to have an unavoidable risk of adverse effects on the European sites in question; **and**
 - ▶ will not themselves have any adverse effect on any European sites.
- 3.2.11 Note, this is not intended to provide a mechanism for the inclusion of options where there appears to be no reasonable way of avoiding adverse effects. It should be noted that this flexibility is perhaps desirable in any case, since it is possible that a 'no adverse effect' option might be subsequently proven to have adverse effects when brought to the design stage. This approach allows for the WRMP to be compliant with the Habitats Regulations, since certainty over outcomes for the plan as a whole is provided.
- 3.2.12 However, it is important to note that some uncertainties will remain (particularly with regard to 'in combination' effects) and for some options it will only be possible to fully

²² For example, in relation to DCWW's WRMP14.

assess any potential effects at the pre-project planning stage, when certain specific details are known; for example: construction techniques; site specific survey information; the precise timing of implementation; or the status of other projects that may operate ‘in combination’. In addition, it may be several years before an option is employed, during which time other factors may alter the baseline or the likely effects of the option.

WRMP development parameters and relevance to HRA

- 3.2.13 The modelling underpinning the WRMP development and option selection process incorporates several assumptions that influence and are relevant to the scope of the HRA.

Existing Consents

- 3.2.14 Regulation 9 of the Habitats Regulations requires that “...a competent authority, in exercising any of its functions, must have regard to the requirements of the Directives so far as they may be affected by the exercise of those functions”.
- 3.2.15 For existing abstraction licences and their consideration in WRMPs, the requirements of Reg. 9 are met by the Environment Agency, Natural Resources Wales and the water companies through the licence review arrangements and protocols that are implemented at the start of each WRMP cycle, which also take account of the Environment Agency’s or Natural Resources Wales’ requirements through the Water Industry National Environment Programme (WINEP) and National Environment Programme (NEP) respectively. This review process (and WINEP) is undertaken in conjunction with Natural England and NRW, which identify protected sites (including European sites) to the EA and NRW where they believe abstraction-related issues are affecting the achievement of favourable conservation status.
- 3.2.16 This review is important to the development of the supply forecast at the start of the WRMP process and is consequently reflected in Section 5.4 (*‘Developing Your Supply Forecast’*) of the the Water Resource Planning Guideline (2020 draft and 2023 published versions) which outlines the requirements for sustainable abstraction taking into account existing statutory requirements and environmental destination. Any required licence amendments are factored into the supply-deficit calculations, and the EA or NRW will have confirmed those licences that are considered valid for the planning period when the WRMP modelling is undertaken.
- 3.2.17 The supply forecast informs the supply-demand balance calculations for the planning period, which is in effect the ‘predicted future baseline’ for water resources in a supply area. The water company then develops ‘options’²³ for resolving any predicted deficits in the supply-demand balance, which are then tested against various metrics to determine the ‘preferred plan’.
- 3.2.18 Consideration of the existing consenting regime in relation to European sites is noted in the WRPG (2020 draft and 2023 published versions) solely in relation to the development of the supply forecast (Section 5.4), and not in those sections of the guidance that explicitly consider the application of HRA to the WRMP; and whilst the 2023 guidelines refer to “*Your plan, including any options within it...*” in relation to the Habitats Regulations, all references to HRA (as both a process and legislative test) are explicitly and/or implicitly linked to the options identified by the WRMP. Consequently, the WRMP HRA addresses Regulation 63 of the Habitats Regulations and necessarily focuses on the assessment of the additional effects that the WRMP introduces over the predicted future

²³ Note that all references to WRMP ‘options’ in the WRPG are made in the commonly-accepted sense, i.e. explicit interventions proposed by the WRMP to increase water supply or reduce consumption (e.g. Section 1.1), not a broad ‘catch all’ for ongoing water company operations such as those existing abstractions that will form part of the ‘predicted future baseline’.

baseline (i.e. the supply forecast determined at the start of the WRMP process that takes account of the agreed sustainability reductions and any that are reasonably anticipated).

- 3.2.19 Therefore, the HRA of the WRMP is necessarily a forward looking assessment of the specific options (feasible and preferred) proposed by the WRMP to resolve deficits; it does not (and cannot) re-litigate the existing licences agreed for the planning period (and hence the WRMP supply-demand baseline) since there has to be a starting point / basis for the WRMP (i.e. the modelling / optioneering process cannot start with the assumption that no current consents are reliable; and the HRA of the WRMP does not and cannot determine the licensing baseline from which the supply-demand balance is calculated).
- 3.2.20 In some instances, when considering water that may be available from existing sources, consultees have indicated that consideration of ‘recent actual’ abstraction is more appropriate than the currently licenced maximum, particularly for waterbodies that are considered ‘over-licensed’; it is understood that these licences have been identified to DCWW during the plan-development process and factored into the supply-demand balance calculations.

Regional Growth

- 3.2.21 The WRMP supply-demand balance modelling takes account of predicted local and regional growth when identifying risk areas and potential solutions, based (*inter alia*) on Local Plans and population growth models. Likewise, the modelling accounts for climate change. ‘In combination’ effects with population growth that may be related to land-use plans are therefore inherently considered and accounted for as part of the WRMP option development process (i.e. an option that does not account for local growth is not a solution) and this can be relied on by the HRA; the HRA considers the potential for ‘in combination’ effects with specific proposals within Local Plans (and similar), such as major site allocations, but does not (and cannot) attempt to model an alternative ‘population growth’ scenario to somehow test against specific options.

In combination effects with SROs

- 3.2.22 With regard to schemes involving multiple water companies (particularly some SROs) the assessment will necessarily focus on those European sites directly exposed to the activities proposed and managed by DCWW, rather than sites that will only be affected by those scheme elements proposed and managed by other water companies; i.e. when undertaking the ‘in combination’ assessment of a scheme that appears in multiple plans the effects from source/donor will be considered distinct from supply/beneficiary.
- 3.2.23 For example, the source/donor plan will only consider the implications of the abstraction, etc on relevant European sites and water bodies within its catchment (and downstream catchments where relevant), and the supply/beneficiary plan would consider any implications on European sites / water bodies from the application of the supplied water within its catchment/s²⁴. This approach is intended to ensure unnecessary duplication is avoided, and pragmatism will be applied to address indirect, downstream effects and effects on functional habitat.
- 3.2.24 In addition, as noted in **Section 2.3**, STT is not currently part of any other water company revised draft WRMP24 preferred plan, and the NWT SRO scenario is fundamentally the same as UUW’s revised draft WRMP24 (i.e. three options). The NWT SRO as it might be delivered under ‘WRSE higher demand’ and ‘WRSE no SESRO’ scenarios is dependent

²⁴ Note: for the Severn Thames transfer we would expect the in-combination assessment of impacts on the Severn to feature in both WRW and WRSEs plans. This is due to the complex interaction of releases and abstractions particular to this scheme.

on selection of STT in future planning cycles by other water companies and is not a 'plan' or 'programme' that can be meaningfully assessed for in combination effects at this point (since substantial components of the assessment would be speculative, and the additional SRO options would not be required until 2043 at the earliest). The same applies to STT, which is not currently selected by any water companies so is not a 'plan' or 'programme' that can be reasonably assessed for in combination effects (and, in given this uncertainty, it would not be reasonable to constrain DCWW's WRMP through speculative assessment of a proposal that may or may not be delivered).

- 3.2.25 Note that any such in combination effects will be addressed by the forthcoming SRO Gate 3 investigations (this includes additional groundwater modelling, water quality, ecological and hydrological monitoring and fish pass assessments) and in future WRMP cycles and so there is no risk of 'in combination' effects being overlooked.

3.3 HRA of the Preferred Options

Geographical Scope

- 3.3.1 'Arbitrary' buffers are not generally appropriate for HRA. However, as distance is a strong determinant of the scale and likelihood of effects, the application of a suitably precautionary study area (based on a thorough understanding of both the options and European site interest features) has some important advantages due to the number of options and the benefits of a consistent approach:
- using buffers allows the systematic identification of European sites using GIS, so minimising the risk of sites or features being overlooked;
 - it ensures that sites for which there are no reasonable impact pathways can be quickly and transparently excluded from any further screening or assessment; and
 - when assessing multiple options it provides a consistent point of reference for consultees following the assessment process, and the 'screening' can therefore focus on the assessment of effects, rather than on explaining why certain sites may or may not have been considered in relation to a particular option.
- 3.3.2 Professional experience and case-practice relating to typical water industry schemes demonstrates that environmental changes associated with construction in terrestrial environments are rarely notable more than 2 km from a source, and the UKWIR (2021) guidance includes accepted 'zones of influence' for certain aspects (for example, noise impacts would almost never be significant over 1km from the source). Operational effects can extend further, depending on the scale and nature of the option, and so an intentionally precautionary overarching assessment scope has been used as a starting point for the assessment; this includes:
- All European sites that are within 20km of any operational facilities or new infrastructure required to deliver each option (including temporary infrastructure). This is an intentionally large buffer that can also reliably capture the vast majority of possible interactions with 'mobile species' in terrestrial environments.
 - All European sites that are downstream of any operational facilities or new infrastructure required to deliver each option (including temporary infrastructure), or upstream sites that support migratory fish (no distance thresholds). This reflects the potential for hydrological impacts to operate over greater distances, and to address the potential for catchment-scale in combination effects from operation.
- 3.3.3 These parameters are used as a starting point for identifying potentially exposed sites. It is not a 'hard buffer' and in some instances it may be appropriate to consider more distant

sites²⁵; however, unless otherwise noted, sites over 20km from the options that are not hydrologically linked and which do not support wide-ranging mobile species are typically considered sufficiently remote such that any environmental changes will be effectively nil, and so there will be 'no effects' on sites beyond this distance (and so no possibility of 'in combination' effects).

- 3.3.4 The European sites and interest features considered potentially exposed to the outcomes of the WRMP are listed in **Appendix A**.

Data Collection

European site data collection and conservation objectives

- 3.3.5 The screening and appropriate assessment stages take account of the baseline condition of the European sites and their interest features²⁶, including (where reported) data on
- the site boundaries and the boundaries of the component SSSIs;
 - the conservation objectives;
 - information on the attributes of the European sites that contribute to and define their integrity;
 - the condition, vulnerabilities and sensitivities of the sites and their interest features, including known pressures and threats;
 - the approximate locations of the interest features within each site (if reported); and
 - designated or non-designated 'functional habitats' (if identified).
- 3.3.6 These data were derived from:
- the most recent JNCC-hosted GIS datasets;
 - the Standard Data forms for SACs and SPAs and Information Sheets for Ramsar sites;
 - Article 12 and 17 reporting;
 - the published site Conservation Objectives;
 - Supplementary Advice to the conservation objectives (SACO) where available²⁷;
 - Site Improvement Plans (SIPs);
 - Core Management Plans (Wales); and

²⁵ For example, where an option is likely to directly affect the marine environment (e.g. through desalination schemes) and so potentially result in environmental changes that could coincide with areas used by wide-ranging marine species; however, wide-ranging marine / marine dependent species associated with marine sites that are not directly connected to the hydrological zone of influence are not typically considered to be both sensitive and exposed to the effects of the options.

²⁶ The interest features are taken to be the qualifying features; and other within-site features that may be relevant to site integrity, particularly 'typical species' (for SACs) and within-site supporting habitats for SPAs. 'Functional land' would not usually be considered an interest feature of the site (although it may be important to the integrity of some interest features).

²⁷ NE has published '*Supplementary advice on conserving and restoring site features*' for most European sites in England which describe in more detail the range of ecological attributes which are most likely to contribute to a site's overall integrity, and the targets each qualifying feature needs to achieve in order for the site's conservation objectives to be met.

- the supporting Site of Special Scientific Interest's favourable condition tables where relevant and where no SACOs applicable to the features are available.

3.3.7 Note:

- For SPAs, the qualifying features are taken as those identified on the most recent JNCC datasets and citations where these post-date the 2nd SPA Review (i.e. it will be assumed that any amendments suggested by the SPA review have been made) unless otherwise identified to us by NE or NRW; any site-specific issues relating to the SPA Review can be addressed in the screening and appropriate assessment of the preferred options (see below).
- The conservation objectives for Ramsar sites are taken to be the same as for the corresponding SACs / SPAs (where sites overlap); SSSI Definition of Favourable Condition Tables (FCTs) will be used for those features not covered by SAC/SPA designations.

3.3.8 Where possible the site data are used to identify other features that may be relevant to site integrity, particularly '**typical species**' (for SACs), within-site **supporting habitats**, and designated or non-designated '**functional habitats**'.

3.3.9 A '**typical species**' is broadly described by EC guidance as being any species (or community of species) which is particularly characteristic of, confined to, and/or dependent upon the qualifying Annex I habitat feature at a particular site. This may include those species which:

- are critical to the composition or structure of an Annex I habitat (e.g. constant species identified by the National Vegetation Classification (NVC) community classification);
- exert a critical positive influence on the Annex I habitat's structure or function (e.g. a bioturbator (mixer of soil/sediment), grazer, surface borer or predator);
- are consistently associated with, and dependent upon, the Annex I habitat feature for specific ecological needs (e.g. feeding, sheltering), completion of life-cycle stages (e.g. egg-laying) and/or during certain seasons/times; or
- are particularly distinctive or representative of the Annex I habitat feature at a particular site.

3.3.10 Within-site **supporting habitats** are those which support the population(s) of the qualifying species and which are therefore critical to the integrity of the feature.

3.3.11 '**Functional habitats**' are generally taken to be habitats or features outside a European site boundary that are important or critical to the functional integrity of the site habitats and / or its interest features. These might include, for example:

- 'buffer' areas around a site (e.g. dense scrub areas preventing public access; areas of land that reduce the effects of agricultural run-off; etc.);
- specific features or habitats relied on by mobile species during their lifecycle (e.g. high-tide roosts for waders; significant maternity colonies for bats known to hibernate within an SAC; areas that are critical for foraging or migration; etc).

3.3.12 **Conservation Objectives** benchmark Favourable Conservation Status (FCS) for each feature. Guidance²⁸ from the UK Statutory Nature Conservation Bodies (SNCBs) provides a broad characterisation of FCS, stating that it "*relates to the long-term distribution and*

²⁸ JNCC (2018). *Favourable Conservation Status: UK Statutory Nature Conservation Bodies Common Statement* [online]. Available at: <https://data.jncc.gov.uk/data/b9c7f55f-ed9d-4d3c-b484-c21758cec4fe/FCS18-InterAgency-Statement.pdf>. [Accessed March 2022].

abundance of the populations of species in their natural range, and for habitats to the long-term natural distribution, structure and functions as well as the long-term survival of its typical species in their natural range. It describes a situation in which individual habitats and species are maintaining themselves at all relevant geographical scales and with good prospects to continue to do so in the future”.

3.3.13 In Wales, the Regulation 37 advice and Core Management Plans for the SACs and SPAs set out conservation objectives that benchmark Favourable Conservation Status (FCS) for each feature. For the Welsh European sites the conservation objectives comprise a ‘vision’ for the feature (the key component of the objective) and (where relevant) performance indicators by which the objectives may be measured. **These are used and referred to as necessary within the assessment but are not generally reproduced in this report** as they are freely available online.

3.3.14 The conservation objectives for European sites in England have been revised by Natural England in recent years to improve the consistency of assessment and reporting. As a result, the high-level conservation objectives for all sites are effectively the same:

3.3.15 For SACs in England:

- *With regard to the SAC and the natural habitats and/or species for which the site has been designated (the ‘Qualifying Features’...), and subject to natural change; ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring [as applicable to each site];*
 - ▶ *The extent and distribution of the qualifying natural habitats;*
 - ▶ *The extent and distribution of the habitats of qualifying species;*
 - ▶ *The structure and function (including typical species) of the qualifying natural habitats;*
 - ▶ *The structure and function of the habitats of qualifying species;*
 - ▶ *The supporting processes on which the qualifying natural habitats rely;*
 - ▶ *The supporting processes on which the habitats of qualifying species rely;*
 - ▶ *The populations of qualifying species; and,*
 - ▶ *The distribution of qualifying species within the site.*

3.3.16 For SPAs in England:

- *With regard to the SPA and the individual species and/or assemblage of species for which the site has been classified (the ‘Qualifying Features’...), and subject to natural change; ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the aims of the Wild Birds Directive, by maintaining or restoring:*
 - ▶ *The extent and distribution of the habitats of the qualifying features;*
 - ▶ *The structure and function of the habitats of the qualifying features;*
 - ▶ *The supporting processes on which the habitats of the qualifying features rely;*
 - ▶ *The population of each of the qualifying features; and*
 - ▶ *The distribution of the qualifying features within the site.*

- 3.3.17 NE has published ‘*Supplementary advice on conserving and restoring site features*’ for most sites, which describe in more detail the range of ecological attributes which are most likely to contribute to a site’s overall integrity, and the minimum targets each qualifying feature needs to achieve in order to meet the site’s conservation objectives. These are considered at the screening and appropriate assessment stages, as necessary.
- 3.3.18 The conservation objectives for Ramsar sites are taken to be the same as for the corresponding SACs / SPAs (where sites overlap); where Ramsar sites do not coincide with an SAC or SPA, or where the Ramsar features are not ecologically coincident with SAC or SPA features, the conservation objectives and definitions of favourable condition for the underlying SSSIs are used.
- 3.3.19 **The conservation objectives are considered at both screening and appropriate assessment stages, but are not explicitly reproduced in this report** as (a) they are freely available online and (b) the narrative nature of many of the conservation objectives can be challenging to co-opt in a clear and concise manner; the assessments therefore focus on the key conservation objectives that might be undermined by an option, rather than attempting to exhaustively document the assessment of an option against all conservation objectives for all features. Information on the sensitivities of the interest features also informs the assessment.

Water resources baseline data

- 3.3.20 Information on the water resources baseline in the region is drawn from other assessment reports (e.g. the WFD), DCWW (e.g. groundwater (GW) and surface water (SW) abstraction locations, source operational parameters, WRZ operation, emergency or drought plan operations) and the EA (Public Water Supply (PWS) and other GW/ SW abstractions, CAMS documentation).
- 3.3.21 Note, unless otherwise stated by the EA / NRW during the options development process, it is assumed that the relevant Catchment Abstraction Management Strategy (CAMS) documents are correct and reliable, and that there is ‘water available’ where this is confirmed by the CAMS.

Option data

- 3.3.22 Information on the preferred options is provided by DCWW. This includes an outline of how the option will function, including the intended outcomes (design yields/capacities); and the scheme delivery requirements, including the type and indicative location of any permanent or temporary infrastructure.
- 3.3.23 It should be noted that the location of some scheme aspects cannot always be established at the WRMP level: whilst some elements may be clear (for example, new plant will often be located within or close to existing water company assets) the exact routes of pipelines (etc.) cannot be finalised at this stage. In most instances an indicative design route is provided for option costing purposes, which has been informed by the feasible options review process at the stage (i.e. in most cases direct impacts on designated sites would be avoided if possible). However, it should be recognised that the options are not fixed proposals for delivery that cannot be deviated from, and there will be many aspects (particularly relating to construction) that cannot be defined at the strategy level ahead of scheme-specific investigations (e.g. the location of any temporary enabling works; precise locations for additional materials storage; etc.)).

Preferred Options Assessment

Overview

- 3.3.24 For each option (or group of options, as appropriate), the assessment comprises:
- a 'screening' to identify those options that cannot have significant effects due to the fundamental nature of the option (this might include, for example, options that are designed to reduce demand but which do not involve any direct physical changes, such as education programmes to reduce water use);
 - a 'screening' of European sites within the study area to identify those sites and features where there will self-evidently be 'no effect', 'no likely significant effects', or positive effects due to the option²⁹, and those where significant effects are likely or uncertain; and
 - an 'appropriate assessment' of any European sites where significant effects cannot be excluded (this may include 'down-the-line' deferral of some options in accordance with established HRA practice, where appropriate).
- 3.3.25 The conservation objectives are taken into account at the screening and appropriate assessment stages as necessary.

General Assumptions

- 3.3.26 Most environmental changes associated with construction and operation will have an inherent range over which they naturally attenuate³⁰, and many interest features will have little or no sensitivity to the likely magnitude of the environmental changes expected as the result of an option. Broad or universal assumptions that can be robustly applied to the assessments of the individual options or interest features are set out in **Appendix B**.
- 3.3.27 In addition:
- It is assumed that all normal licensing, consenting and management procedures will be employed at option delivery and throughout operation, and that established best-practice avoidance and mitigation measures will be employed throughout scheme design and construction to safeguard environmental receptors, including European site interest features. The HRA will not therefore assess speculative or hypothetical effects based on assumptions of non-compliance (e.g. accidental spillages of treatment chemicals from a new WTW).
 - Guidance from the EA suggests that significant direct effects on groundwater dependent terrestrial ecosystems (GWDTEs) from drawdown associated with abstraction are unlikely for European sites over 5 km from the abstraction (*National EA guidance: Habitats Directive Stage 2 Review: Water Resources Authorisations – Practical Advice for Agency Water Resources Staff*).

Screening

- 3.3.28 The screening identifies possible effects on European sites based on:

²⁹ Note, for options with 'no effects' or positive effects there is no possibility of 'in combination' effects.

³⁰ For example, construction noise will almost invariably be indistinguishable from background levels over 600m from the source due to natural attenuation alone; several studies have demonstrated that visual disturbance of wading birds by construction plant or personnel is inconsequential over ~500m.

- the anticipated operation of each Option and predicted hydrological zone of influence;
- the anticipated scope of any construction or enabling works required for each option;
- the European site interest features and their sensitivities; and
- the exposure of the site or features to the likely effects of the option (i.e. presence of reasonable impact pathways, taking into account species mobility and the likelihood of functional habitats being affected³¹).

3.3.29 The screening therefore identifies:

- those European sites where significant effects are considered likely as the result of an option;
- those European sites where significant effects are considered uncertain as the result of an option;
- those European sites where significant effects were considered unlikely (alone) as the result of an option (but where in combination effects might still be possible); and
- those options that will have no effects on any European sites due to their nature or location (and hence no possibility of ‘in combination’ effects).

3.3.30 The ‘low-bar’ principle is used for the screening of the preferred options³²; in general, unless the possibility of significant effects can be simply and self-evidently excluded then an ‘appropriate assessment’ is completed (rather than a more detailed ‘secondary screening’ or similar). This applies to the options alone and in combination (i.e. unless it is evident that there will be ‘no effects’ from any options the possibility of ‘in combination’ effects is not excluded and these are taken forward to ‘appropriate assessment’). This approach simplifies the overall assessment and ensures procedural clarity.

3.3.31 The ‘low bar’ approach is consistent with the ‘People Over Wind’³³ case law, which requires that mitigation not be considered at screening. Historically, HRAs of plans typically assumed that established best-practice avoidance and mitigation measures (see **Appendix C**) would be employed at the project level to safeguard environmental receptors, including European site interest features, and accounted for this at the screening stage. However, it is arguable that an assumption such as this, albeit in relation to a lower-tier project that would itself be subject to HRA, might constitute an ‘avoidance measure’ that the WRMP is effectively relying on to ensure that significant effects do not occur.

3.3.32 In this instance, therefore, mitigation measures (including the established best-practice avoidance and mitigation measures noted in **Appendix C**) are not taken into account at screening, but are instead introduced at the ‘appropriate assessment’ stage (if required).

Appropriate Assessments

3.3.33 The ‘appropriate assessments’ are an extension of the assessment processes undertaken at the screening stage, with significant effects (or areas of uncertainty) examined to

³¹ With regard to functional habitat, it should be noted that field investigations would not be undertaken for a plan-level assessment except in very exceptional circumstances, and so specific areas of ‘functional habitat’ may not be identifiable for assessment at the plan level unless explicitly noted in the site documentation.

³² The low-bar nature of the screening test is characterised in case-law (*C-258/11 - Sweetman and Others*) as ‘*should we bother to check?*’ – i.e. is a closer examination of possible effects required (i.e. appropriate assessment) or can effects self-evidently be excluded as nil or entirely nugatory?

³³ *Case C 323/17 Court of Justice of the European Union: People Over Wind*

determine whether there will be any adverse effects on the integrity of any European sites taking into account the conservation objectives.

- 3.3.34 The presentation of the assessments depends on the nature of the options and European sites that might be exposed to effects. In this case the assessments are 'European site led' (i.e. each assessment section relates to a specific European site), rather than being 'option by option'; this tends to simplify the 'in combination' assessment and minimises repetition of information relating to the interest features / sensitivities (etc.) of the sites.
- 3.3.35 Shared evidence applicable to multiple sites or features (for example, in relation to birds and construction noise) are provided in appendices to reduce repetition.
- 3.3.36 The appropriate assessments are 'appropriate' to the nature of the WRMP as a strategic plan, the option under consideration, and the scale and likelihood of any effects; for example, exhaustive examination of feature sensitivities and possible effect pathways is not undertaken for options that would have previously been 'screened out with mitigation' if there is a high degree of confidence in the mitigation measures. The assessments include inter-option 'in combination' assessments.

3.4 Plan-Level In Combination Assessments

- 3.4.1 HRA requires that the effects of other projects, plans or programmes be considered for effects on European sites 'in combination' with the WRMP. There is limited guidance on the precise scope of 'in combination' assessments for strategies, particularly with respect to the levels within the planning hierarchy at which 'in combination' effects should be considered, although guidance is provided by the ACWG.
- 3.4.2 Broadly, it is considered that the DCWW WRMP could have the following in combination effects:
- Within-plan effects, i.e. separate options within the WRMP affecting the same European site(s); these are addressed as part of the option assessment process outlined above.
 - Between-plan abstraction effects, i.e. effects with other abstractions, in association with or driven by other plans (for example, other water company WRMPs);
 - Other between-plan effects, i.e. 'in combination' with non-abstraction activities promoted by other plans – for example, with flood risk management plans.
 - Between-project effects, i.e. effects of a specific option with other specific projects and developments.
- 3.4.3 In undertaking the 'in combination' assessment it is important to note the following:
- The WRMP development process explicitly accounts for land-use plans, growth forecasts and population projections when determining future treatment and water management requirements.
 - The detailed examination of non-water company consents for 'in combination' effects can only be undertaken by the EA or NRW through their permitting procedures.
 - Likely water resource demands of known major projects are also taken into account during the development of the WRMPs, unless otherwise noted.
- 3.4.4 Therefore:
- It is considered that (for the HRA) potential 'in combination' effects in respect of water-resource demands associated with known plans or projects will not occur since these

demands are explicitly considered when developing the WRMP and its associated and related plans (including the SROs). The main exception to this is other water company WRMPs, which are developed concurrently.

- With regard to other strategic plans, the list of plans included within the SEA of the emerging DCWW WRMP is used as the basis for a high-level 'in combination' assessment. The SEA is used to provide information on themes, policies and objectives of the 'in combination' plans, with the plans themselves examined in more detail as necessary. Plans are obtained from the SEA datasets or internet sources where possible.
- With regard to projects:
 - ▶ The WRMP development process explicitly accounts for the water-resource demands of known major projects (e.g. power station decommissioning; large-scale housing development) during its development, and so these 'in combination' effects are not considered in detail.
 - ▶ Potential 'in combination' effects between individual options and Nationally Significant Infrastructure Projects (NSIPs) identified by The Planning Inspectorate, and other known major projects, are assessed.
 - ▶ It is not possible to produce a definitive list of minor existing or anticipated planning applications within the zone of influence of each proposed option to review possible local 'in combination' effects. The nature of the WRMP and the timescales over which it operates ensure that generating a list of local planning applications at this stage would be of very little value, and this aspect can only be meaningfully undertaken at the scheme-level.

4. Preferred Options Screening

The ‘screening’ adopts a low-bar approach; in general, unless the possibility of significant effects can be simply and self-evidently excluded then an ‘appropriate assessment’ is completed (rather than a more detailed ‘secondary screening’ or similar). This applies to the options alone and in combination.

4.1 Demand-side options

- 4.1.1 The WRMP includes a range of demand-side measures for household and non-household customers (e.g. leakage / network improvement programmes, metering enhancements, water efficiency audits, grey water recycling, rainwater harvesting, etc.).
- 4.1.2 Many of these measures are of a type that cannot (based on established guidance for similar policies and proposals in strategic planning documents that do not promote development³⁴) have significant effects – for example, water efficiency audits.
- 4.1.3 Other measures may require some form of physical intervention or amendment to the network. The works required for the vast majority of these options will be very minor (e.g. meter installation) with virtually no risk of significant effects on European sites. In some instances effect pathways might be conceivable (for example, a hypothetical leaking pipe might be located in or near a European site) but it is not possible to predict or identify specific locations where such measures might be applied and so effects on specific European sites cannot be identified.
- 4.1.4 Non-specific residual risks such as these can almost always be avoided with established scheme-level mitigation measures and it is very unlikely that significant or significant and adverse effects as the result of a particular demand-side measure would be unavoidable at the scheme level; however, these options are carried forward to the ‘appropriate assessment’ stage for procedural reasons and to avoid potential conflict with the ‘People over Wind’ case.

4.2 Supply-side options

- 4.2.1 The initial ‘alone’ screening assessments for each preferred portfolio option are set out in **Tables 4.2 – 4.5** below. In summary, the assessment aims to identify those European site features that are potentially vulnerable to a particular option – i.e. which have features that are both exposed and sensitive to the likely outcomes (see **Table 4.1**), taking into account the baseline for the site including the conservation objectives. Features that are both exposed and sensitive to an environmental change are assumed to be subject to ‘likely significant effects’ unless there is a clear over-riding reason why significant effects cannot occur.

³⁴ e.g. Tyldesley, D. & Chapman, C. (2021). The Habitats Regulations Assessment Handbook [online]. DTA Publications Limited. Available at: <https://www.dtapublications.co.uk/handbook/>.

Table 4.1 Summary of screening criteria

LSE?	Notes
0	Sites or features that are not exposed to the effects of an option via any reasonable impact pathways and so there will be 'no effect' (hence no risk of 'in combination' effects)
No (N)	Sites or features that are potentially exposed and sensitive to the predicted environmental changes, but where effects are not considered significant (alone) due to their scale, nature etc. based on the information within the EARs and other contextual assessment information.
Uncertain (U)	Sites or features where a potential effect is clear and identifiable, which cannot be self-evidently excluded and which require additional consideration through 'appropriate assessment' (including options relying on mitigation to ensure significant effects do not occur).
Uncertain* (U*)	Sites where a potential effect pathway is evident, but where this is typically minor / precautionary and can be clearly avoided or mitigated at the project-level with the application of established best-practice measures; these sites are taken through AA to avoid potential conflict with PoW.
Yes (Y)	Sites or features where significant effects are very likely or certain due to the scale/nature of the option proposals, or the vulnerability and distribution of the interest features on the European site. Adverse effects may be more likely and there is more certainty that (at scheme level) the option would have to rely on specific mitigation or compensation rather than general / simple environmental avoidance measures.

Table 4.2 Option screening summary – TWG12 Crai Distribution Option

TWG12			
Crai Distribution Option - Upsize Christopher Road WPS			
Option Summary			
In order to reduce demand on Crai resources, GCG SRv (2.4 Ml/d average demand) and Bros SRv (1.7Ml/d average demand) will be rezoned to the Felindre WTW by upsizing Christopher Road PS to reverse flows in the 17" main from Crai and putting two booster PS's to pump to GCG SRv and Bros SRv.			
General Notes			
<p>There are 13 European sites within 20km of the proposed pumping station (Christopher Road) and two booster pumping stations (Brynawel and Rhos). The closest sites are Crymlyn Bog / Cors Crymlyn SAC and Crymlyn Bog Ramsar located 4.2km from the closest element of the proposed works (Christopher Road PS). The construction works are required in the catchment of the Afon Tawe and so there are no down- or upstream European sites. Due to the small scale of the proposed works, located within urban areas, and absence of potential impacts pathways (no hydrological connectivity, disturbance and air quality impacts highly unlikely given standard threshold distances; no risk of effects on 'functional habitats' for any interest features) it is considered that there will be 'no effects' (and hence no possibility of 'in combination' effects) on any European sites during the construction phase.</p> <p>The operational changes are limited to a change in distribution within the existing network. Therefore with no additional abstractions or discharges, there are no operational effects.</p>			
European sites in scope	Dist (km)*	LSE (alone?)	Notes
Crymlyn Bog / Cors Crymlyn SAC	4.2	0	Located 4.2km from the proposed new pumping station at Christopher Road. No likely significant effects during construction from direct habitat loss, habitat degradation, or disruption of supporting processes due to small scale of works and distance to the site. No potential impact pathways identified during operation.
Crymlyn Bog Ramsar	4.2	0	Located 4.2km from the proposed new pumping station. No likely significant effects during construction from direct habitat loss, habitat degradation, or disruption of supporting processes due to small scale of works and distance to the site. No potential impact pathways identified during operation.

European sites in scope	Dist (km)*	LSE (alone?)	Notes
Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd SAC	9.7	0	No potential impact pathways identified for construction or operation due to distance, type, absence of hydrological connectivity, and scale of the proposed works. The proposed works are in the River Tawe catchment with no direct hydrological connectivity to the Carmarthen Bay and Estuaries site.
Burry Inlet Ramsar	10.5	0	No potential impact pathways identified for construction or operation due to distance, type, absence of hydrological connectivity, and scale of the proposed works. The proposed works are in the River Tawe catchment with no direct hydrological connectivity to the Burry Inlet.
Burry Inlet SPA	10.5	0	No potential impact pathways identified for construction or operation due to distance, type, absence of hydrological connectivity, and scale of the proposed works. The proposed works are in the River Tawe catchment with no direct hydrological connectivity to the Burry Inlet.
Gower Commons / Tiroedd Comin Gwyr SAC	11.5	0	No potential impact pathways identified for construction or operation due to distance, type, absence of hydrological connectivity, and scale of the proposed works.
Gower Ash Woods / Coedydd Ynn Gwyr SAC	15.4	0	No potential impact pathways identified for construction or operation due to distance, type, absence of hydrological connectivity, and scale of the proposed works.
Caeau Mynydd Mawr SAC	15.5	0	No potential impact pathways identified for construction or operation due to distance, type, absence of hydrological connectivity, and scale of the proposed works.
Coedydd Nedd a Mellte SAC	16.2	0	No potential impact pathways identified for construction or operation due to distance, type, absence of hydrological connectivity, and scale of the proposed works.
Cernydd Carmel SAC	16.6	0	No potential impact pathways identified for construction or operation due to distance, type, absence of hydrological connectivity, and scale of the proposed works.

European sites in scope	Dist (km)*	LSE (alone?)	Notes
Limestone Coast of South West Wales / Arfordir Calchfaen De Orllewin Cymru SAC	16.6	0	No potential impact pathways identified for construction or operation due to distance, type, absence of hydrological connectivity, and scale of the proposed works.
Kenfig / Cynffig SAC	19	0	No potential impact pathways identified for construction or operation due to distance, type, absence of hydrological connectivity, and scale of the proposed works.
Afon Tywi / River Tywi SAC	19.5	0	No potential impact pathways identified for construction or operation due to distance, type, absence of hydrological connectivity, and scale of the proposed works. The proposed works are in the River Tawe catchment with no hydrological connectivity to the River Tywi.

Table 4.3 Option screening summary – TWG14 Ystradfellte - Reverse flow through Tonna control valve

TWG14			
Ystradfellte - Reverse flow through Tonna control valve			
Option Summary			
In order to reduce the stress on the resource from Cefn Drysgoed, flows through the Tonna Flow control valve will be reversed so that 2.5Ml/d from the Felindre system can meet some of the demand on the Cefn Drysgoed network. Elements: New Park Field Pumping Station (PS) to pump to the Cefn Drysgoed network (2.5Ml/d - from the model).			
General Assessment Notes			
There are 10 European sites within 20km of the option components. The proposed PS is to be set within an urban area, with potential loss of some woodland habitat, but separated from local watercourses by built up residential areas, road networks and an industrial estate. The PS would be located in the Afon Nedd catchment, and so there are no down- or upstream European sites and so no direct hydrological connectivity for pollution or sedimentation issues. Similarly, all the European sites are at sufficient distances such that they will not be impacted by direct habitat loss, or air quality, noise, visual impacts etc. The habitats affected by the option will not be important to the functional integrity of any sites or the populations of mobile species. Therefore, with no potential impact pathways, it is considered that there will be ‘no effects’ (and hence no possibility of ‘in combination’ effects) on any European sites during the construction phase. The operational changes are limited to a change in distribution within the existing network. Therefore with no additional abstractions or discharges, there are no operational effects.			
European sites in scope	Dist (km)*	LSE (alone?)	Notes
Crymlyn Bog / Cors Crymlyn SAC	7.5	0	No potential impact pathways identified for construction or operation due to distance, type, absence of hydrological pathways, and scale of the proposed works. There are no mobile qualifying features and no hydrological connectivity between the proposed new PS and site.
Crymlyn Bog Ramsar	7.5	0	No potential impact pathways identified for construction or operation due to distance, type, absence of hydrological pathways, and scale of the proposed works. There are no mobile qualifying features and no hydrological connectivity between the proposed new PS and site.

European sites in scope	Dist (km)*	LSE (alone?)	Notes
Coedydd Nedd a Mellte SAC	15.1	0	No potential impact pathways identified for construction or operation due to distance, type, absence of hydrological pathways, and scale of the proposed works. There are no mobile qualifying features and no hydrological connectivity between the proposed new PS and site.
Kenfig SAC	15.7	0	No potential impact pathways identified for construction or operation due to distance, type, absence of hydrological pathways, and scale of the proposed works. There are no mobile qualifying features and no hydrological connectivity between the proposed new PS and site.
Cefn Cribur Grasslands SAC	17.7	0	No potential impact pathways identified for construction or operation due to distance, type, absence of hydrological impact, and scale of the proposed works. The proposed PS location is not within suitable habitat for marsh fritillary butterfly, and is at sufficient distance, such that no Likely Significant Effects have been identified.
Blaen Cynon SAC	18.1	0	No potential impact pathways identified for construction or operation due to distance, type, absence of hydrological impact, and scale of the proposed works. The proposed PS location is not within suitable habitat for marsh fritillary butterfly, and is at sufficient distance, such that no Likely Significant Effects have been identified.
Carmarthen Bay and Estuaries / Bae Caerfyrddin ac Aberoedd SAC	19.3	0	No potential impact pathways identified for operation due to distance, type, absence of hydrological connectivity, and scale of the proposed works. The proposed new PS is located within a predominantly urban area and separated by buildings and road networks from the nearby to River Neath (200m west) and Neath canal (60m west). As such, there is no direct pathway for pollution and sedimentation issues to enter the watercourse and affect downstream receptors.
Blackmill Woodlands SAC	19.7	0	No potential impact pathways identified for construction or operation due to distance, type, absence of hydrological impact, and scale of the proposed works. There are no mobile qualifying features and no hydrological connectivity between the proposed new PS and site.

European sites in scope	Dist (km)*	LSE (alone?)	Notes
Burry Inlet SPA	19.9	0	No potential impact pathways identified for construction or operation due to distance, type, absence of hydrological impact, and scale of the proposed works. There is no suitable off-site supporting habitat within the footprint of the proposed new PS. Therefore no Likely Significant Effects have been identified.
Burry Inlet Ramsar	19.9	0	No potential impact pathways identified for construction or operation due to distance, type, absence of hydrological impact, and scale of the proposed works. There is no suitable off-site supporting habitat within the footprint of the proposed new PS. Therefore no Likely Significant Effects have been identified.

Table 4.4 Option screening summary – SEW166 Memorial and Cefn Mably upgrade

SEW166			
Memorial and Cefn Mably upgrade			
Option Summary			
<p>Providing 47 MI/d peak flows to the Pontsticill Low Level network in order to release the flows from the Pontsticill WTW to enable other WRMP options. In order to be able to supply the combined 47 MI/d, Cilfynydd WPS (21MI/d) will be reinstated to support the Memorial WPS (26 MI/d). The Pumps at Memorial WPS will be replaced with Low suction, high lift pumps to be able to pump to Ty Gwyn SRv. Cefn Mably WPS will be reinstated to provide additional pressure to the supply side of Memorial WPS and Tongwynlais SRv. Installation of a pressure and flow control valve arrangement at the inlet to Tongwynlais SRv to ensure that the service reservoir does not overtop.</p>			
General Assessment Notes			
<p>This option requires minor works at existing operational sites in the south Wales valleys. Cilfynydd WPS and Memorial WPS are located near Pontypridd (River Taff catchment); Tongwynlais SRv is located on the outskirts of Cardiff near the M4; Cefn Mably is located east of Cardiff near the Afon Rhymini. The option is a network resilience solution that will not require ‘new water’ and so will not have any operational effects. The only sites potentially exposed to effects from construction are the Severn estuary sites (downstream sites, may be exposed to site-derived pollutants) and the Cardiff Beech Woods SAC (within approximately 500m of Tongwynlais SRv). Effects on the Severn estuary sites will be avoidable with established measures, although these are necessarily considered through AA; with regard to Tongwynlais SRv and the Cardiff Beech Woods SAC, this site will not be exposed to any effects as a result of the option due to (a) the very small scale of the works at Tongwynlais (modifications to valves); (b) the location of the SAC (up catchment from the SRv location); and (c) the distance to the SAC (~500m, ensuring no risk of air quality changes etc.). The option will have ‘no effect’ on this SAC hence no risk of ‘in combination’ effects.</p>			
European sites in scope	Dist (km)*	LSE (alone?)	Notes
Cardiff Beech Woods SAC	0.5	0	Site relatively close to Tongwynlais SRv (~500m); however, this site will not be exposed to any effects as a result of the option due to (a) the very small scale of the works at Tongwynlais (modifications to valves); (b) the location of the SAC (up catchment from the SRv location); and (c) the distance to the SAC (~500m, ensuring no risk of air quality changes etc.). The option will have ‘no effect’ on this SAC hence no risk of ‘in combination’ effects.

European sites in scope	Dist (km)*	LSE (alone?)	Notes
Severn Estuary Ramsar	5.8/DS	U*	Downstream site, potentially exposed to site-derived pollutants (principally for works at Cefn Mably due to proximity; effects clearly avoidable with established measures although these are necessarily considered through AA for consistency with PoW.
Severn Estuary SPA	5.8/DS	U*	Downstream site, potentially exposed to site-derived pollutants (principally for works at Cefn Mably due to proximity; effects clearly avoidable with established measures although these are necessarily considered through AA for consistency with PoW.
Severn Estuary/ Môr Hafren SAC	5.8/DS	U*	Downstream site, potentially exposed to site-derived pollutants (principally for works at Cefn Mably due to proximity; effects clearly avoidable with established measures although these are necessarily considered through AA for consistency with PoW.
Aberbargoed Grasslands SAC	9.3	0	No pathways for operation- or construction-related effects (distance, separate catchment, minor nature of construction works at existing sites).
River Usk/ Afon Wysg SAC	9.5	0	No operation- or construction-related effects (distance, separate catchment, minor nature of construction works at existing sites). Otters associated with the site may periodically use habitats close to the construction areas but these will not be functionally critical to the integrity of the otter population and will not be affected due to the small-scale of the works.
Blackmill Woodlands SAC	16.5	0	No pathways for operation- or construction-related effects (distance, separate catchment, minor nature of construction works at existing sites).
Blaen Cynon SAC	17.9	0	No pathways for operation- or construction-related effects (distance, up-catchment, minor nature of construction works at existing sites).
Cwm Cadlan SAC	19.9	0	No pathways for operation- or construction-related effects (distance, up-catchment, minor nature of construction works at existing sites).

Table 4.5 Option screening summary – SEW168 Removal of Llwynon Min flow

SEW168			
Removal of Llwynon Min flow			
Option Summary			
Scheme to enable DCWW to stop supplying ~9 MI/d minimum sweetening flow year round into the Llwynon gravity main in order to avoid WQ issues. The scheme comprises installation of new pressure reducing valves (PRVs), meters, burst protection valves and flow control valves.			
General Assessment Notes			
This option requires minor works on or alongside an existing main below Llwynon reservoir (north of Merthyr Tydfil) that runs close to the A470. The option does not require 'new water' and so will not have any operational effects. No sites are considered to be exposed to the environmental changes associated with the option due to the small-scale of the required works, the distance to the European sites and the characteristics of the interest features; the option will have 'no effect' on any European sites and hence no risk of 'in combination' effects.			
European sites in scope	Dist (km)*	LSE (alone?)	Notes
Cwm Cadlan SAC	3.7	0	No pathways for operation- or construction-related effects (distance, separate catchment, minor nature of construction works).
Blaen Cynon SAC	6.8	0	No pathways for operation- or construction-related effects (distance, separate catchment, minor nature of construction works).
Brecon Beacons/ Bannau Brycheiniog SAC	7.2	0	No pathways for operation- or construction-related effects (distance, separate catchment, minor nature of construction works).
Coedydd Nedd a Mellte SAC	7.8	0	No pathways for operation- or construction-related effects (distance, separate catchment, minor nature of construction works).
River Usk/ Afon Wysg SAC	12.5	0	No operation- or construction-related effects (distance, separate catchment, minor nature of construction works at existing sites). Otters associated with the site may periodically use habitats close to the construction areas but these will not be functionally critical to the integrity of the otter population and will not be affected due to the small-scale of the works.

European sites in scope	Dist (km)*	LSE (alone?)	Notes
Usk Bat Sites / Safleodd Ystlumod Wysg SAC	15.7	0	No pathways for operation- or construction-related effects (distance, separate catchment, minor nature of construction works; extremely unlikely to affect 'functional habitat' for bat species).
Llangorse Lake/ Llyn Syfaddan SAC	18.7	0	No pathways for operation- or construction-related effects (distance, separate catchment, minor nature of construction works).
Aberbargoed Grasslands SAC	18.9	0	No pathways for operation- or construction-related effects (distance, separate catchment, minor nature of construction works).
Cwm Clydach Woodlands / Coedydd Cwm Clydach SAC	19.4	0	No pathways for operation- or construction-related effects (distance, separate catchment, minor nature of construction works).
Severn Estuary SPA	DS	0	Downstream site, but is at least 45km down-catchment via the Afon Taff; this option will have 'no effects' on this site (hence no possibility of 'in combination' effects) irrespectively of any scheme level mitigation due to the distance downstream and the very minor nature of the works (hence no possibility of pollution etc. events of sufficient magnitude to be measurable at the estuary).
Severn Estuary Ramsar	DS	0	Downstream site, but is at least 45km down-catchment via the Afon Taff; this option will have 'no effects' on this site (hence no possibility of 'in combination' effects) irrespectively of any scheme level mitigation due to the distance downstream and the very minor nature of the works (hence no possibility of pollution etc. events of sufficient magnitude to be measurable at the estuary).
Severn Estuary/ Môr Hafren SAC	DS	0	Downstream site, but is at least 45km down-catchment via the Afon Taff; this option will have 'no effects' on this site (hence no possibility of 'in combination' effects) irrespectively of any scheme level mitigation due to the distance downstream and the very minor nature of the works (hence no possibility of pollution etc. events of sufficient magnitude to be measurable at the estuary).

Table 4.6 Option screening summary – SEW052 Afon Lwyd

SEW052			
Afon Lwyd to Court Farm			
Option Summary			
Abstraction of maximum 10MI/d from the Afon Lwyd by means of a new intake structure, and pumping the raw water to Court Farm through 400m of 450mm HDPE pipe connecting to the LG Main.			
General Assessment Notes			
<p>The Afon Lwyd is a tributary of the River Usk, joining below the tidal limit. Construction effects on the River Usk / Afon Wsyg SAC are possible but avoidable at the scheme level with established measures. With regard to operation, the ALS suggests that there is water available for use on the Lwyd at some flows (WAFU@Q85=10.9MI/d, WAFU@Q95=6.3MI/d). The confluence of Lwyd with Usk is below Usk tidal limit (so Usk ALS is not relevant), and this would suggest effects on the Usk are likely to be very limited, although mobile species (i.e. diadromous fish associated with Severn Estuary SAC / River Usk SAC, and the Severn Estuary Ramsar) may be exposed to environmental changes either in the Usk or the Lwyd. These environmental changes are likely to be small (esp. relative to tidal influence / main flow of the Usk) but the extent to which the Lwyd might be considered 'functional habitat' for these species is uncertain (although the Lwyd is not noted in the Usk Management Plan). Effects on the Severn Estuary sites are unlikely due to the distance downstream although this will be confirmed through AA.</p>			
European sites in scope	Dist (km)*	LSE (alone?)	Notes
River Usk/ Afon Wysg SAC	2.2/DS	Y	Construction effects unlikely and avoidable with established measures; diadromous fish associated with the Usk may be affected by operation although environmental changes likely to be negligible at confluence of Usk and so any effects likely to relate to the extent to which the Lwyd is considered 'functional habitat'.
Severn Estuary Ramsar	8.6/DS	U	Features potentially exposed to construction effects if foraging / commuting habitat affected; easily avoidable with normal measures; no operational effects on site habitats due to distance downstream / small magnitude of change, but effects on mobile species using the Usk / Lwyd possible.

European sites in scope	Dist (km)*	LSE (alone?)	Notes
Severn Estuary SPA	8.6/DS	U	Features potentially exposed to construction effects if foraging / commuting habitat affected; easily avoidable with normal measures; no operational effects on site habitats due to distance downstream / small magnitude of change, but effects on mobile species using the Usk / Lwyd possible.
Severn Estuary/ Môr Hafren SAC	8.6/DS	U	Features potentially exposed to construction effects if foraging / commuting habitat affected; easily avoidable with normal measures; no operational effects on site habitats due to distance downstream / small magnitude of change, but effects on mobile species using the Usk / Lwyd possible.
Aberbargoed Grasslands SAC	16.3	0	No effect pathways (distance, separate catchment)
Wye Valley and Forest of Dean Bat Sites/ Safleoedd Ystumod Dyffryn Gwy a Fforest y Ddena SAC	16.5	0	No effect pathways (distance, separate catchment) except potentially for bat feature during construction (avoidable with established measures).
Cardiff Beech Woods SAC	18.8	0	No effect pathways (distance, separate catchment)
Usk Bat Sites/ Safleoedd Ystumod Wysg SAC	19.6	0	No effect pathways (distance, separate catchment)

4.2.2 In summary, **only two options** (SEW166 Memorial; and SEW052 Afon Lwyd) **have the potential to affect any European sites; these options are taken to appropriate assessment.**

4.2.3 With regard to screening for 'in combination effects':

- Options **SEW166 Memorial** and **SEW052 Afon Lwyd** have the potential to affect the **Severn Estuary SAC / Ramsar**, principally through indirect effects on diadromous fish species when using functionally associated habitats; these potential effects are considered through the appropriate assessments for these sites / options (see following sections).
- No other European sites are exposed to any effects from one or more options alone, and so no 'in combination' effects are possible (i.e. the options will have 'no effect' on any European sites (there are no reasonable pathways for effects), and so there cannot be 'in combination' LSE between the WRMP options and other plans or projects.

5. Appropriate Assessment – SEW166

5.1 Screening Summary

- 5.1.1 This option requires minor works at existing operational sites in the south Wales valleys:
- Cilfynydd WPS and Memorial WPS are located near Pontypridd (River Taff catchment);
 - Tongwynlais SRv is located on the outskirts of Cardiff near the M4 (River Taff catchment);
 - Cefn Mably is located east of Cardiff near the Afon Rhymni.
- 5.1.2 The option is a network resilience solution that will not require ‘new water’ and so will not have any operational effects. The only sites potentially exposed to effects from construction are the Severn estuary sites (**Severn Estuary Ramsar, Severn Estuary SPA, Severn Estuary/ Môr Hafren SAC**) which may be exposed to site-derived pollutants (principally from works at Cefn Mably, which is approximately 9km upstream (~5.8km direct) of the Severn estuary via the Afon Rhymni) in the absence of mitigation.
- 5.1.3 Due to the limited scope of the effects the assessment structure is simplified to ensure it is appropriate to the scale and complexity of the potential effects.

5.2 Assessment of Effects – Severn Estuary Ramsar, Severn Estuary SPA, Severn Estuary/ Môr Hafren SAC

Site Features

- 5.2.1 The Severn Estuary is the largest example of a coastal plain estuary in the United Kingdom, comprising an interdependent mosaic of subtidal and intertidal habitats that are closely associated with surrounding terrestrial habitats.
- 5.2.2 The tidal range in the Severn Estuary is the second highest in the world and the scouring of the seabed and strong tidal streams result in natural erosion of the habitats and the presence of high sediment loads. The extreme hydrodynamic and sedimentary conditions essentially determine the type of habitats and species present and result in characteristic animal and plant communities. The predominant unconsolidated sediments are muds and sands which form the basis of the estuarine habitats, which include saltmarshes, intertidal mud and sand flats, subtidal sand banks, mixed mud and sand, rock outcrops, boulder and shingle shores as well as biogenic (worm built) reefs. There are also sandy beaches on the southern shores in the outer part of the estuary, backed by sand dunes.
- 5.2.3 The estuary is vulnerable to large-scale interference, mainly as a result of human actions. These include land-claim, aggregate extraction, physical developments such as barrage construction and other commercial construction activities, flood defences, industrial pollution, oil spillage and tourism-based activities and disturbance.
- 5.2.4 The **Severn Estuary/ Môr Hafren SAC** has the following qualifying features:
- Sandbanks which are slightly covered by sea water all the time;
 - Estuaries;

- Mudflats and sandflats not covered by seawater at low tide;
- Reefs;
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*);
- Sea lamprey *Petromyzon marinus*;
- River lamprey *Lampetra fluviatilis*;
- Twaite shad *Alosa fallax*.

5.2.5 The Regulation 33 advice for the site³⁵ identifies ‘**typical species**’ associated with the qualifying habitats; these are not reproduced here but largely comprise the invertebrate fauna characteristic of the marine habitats; and the plant species that relate to the four principal saltmarsh communities (pioneer, transitional, low to mid-marsh, and mid- to upper-marsh).

5.2.6 With regard to ‘**functional habitat**’, the Regulation 33 advice does not identify specific habitats or areas that are considered important to the integrity of the qualifying features, although generally these are taken to include:

- for the anadromous fish species, the natal rivers supporting the populations associated with the Severn estuary;
- for the habitats, the wider environment of the estuary and Bristol Channel which is important for maintaining hydrodynamic and sediment transport processes, sediment supply and coastal morphology.

5.2.7 The **Severn Estuary SPA** supports the following qualifying features (all non-breeding):

- Tundra swan *Cygnus columbianus bewickii*;
- Common shelduck *Tadorna tadorna*;
- Gadwall *Anas strepera*;
- Common redshank *Tringa tetanus*;
- Greater white-fronted goose *Anser albifrons albifrons*;
- Dunlin *Calidris alpina alpina*;
- Waterbird assemblage.

5.2.8 The ‘**supporting habitats**’ for the SPA features are principally the intertidal mud- and sand-flats and saltmarshes, along with terrestrial areas of freshwater coastal grazing marsh, improved grassland and open standing waters, and that are used for foraging, roosting and shelter. The Regulation 33 advice notes that concentrations of shelduck, dunlin and redshank are often found around the mouth of the Afon Rhymini.

5.2.9 With regard to non-designated ‘**functional habitat**’ for the SPA features, these will predominantly be grazing marshes and similar habitats close to the estuary that provide roosting and foraging habitat (e.g. areas of Wentlooge Levels on the Welsh side), although use of these areas can be variable depending on food availability and the state of the tide.

5.2.10 The site meets the following **Ramsar** criteria:

³⁵ Available at: <http://publications.naturalengland.org.uk/file/3977366>

- Crit. 1 (sites containing representative, rare or unique wetland types): the Annex I habitats characteristic of the high tidal range);
- Crit. 3 (supports populations of plant/animal species important for maintaining regional biodiversity): low diversity / high productivity estuarine communities;
- Crit. 4 (supports plant/animal species at a critical stage in their life cycles, or provides refuge): anadromous fish including the Annex II features plus sea trout *Salmo trutta* and eel *Anguilla Anguilla*, and migratory birds.
- Crit. 5 (regularly supports 20,000 or more waterbirds): assemblage of wintering birds;
- Crit. 6 (regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds):
 - ▶ Tundra swan *Cygnus columbianus bewickii*;
 - ▶ Common shelduck *Tadorna tadorna*;
 - ▶ Gadwall *Anas strepera*;
 - ▶ Common redshank *Tringa tetanus*;
 - ▶ Greater white-fronted goose *Anser albifrons albifrons*;
 - ▶ Dunlin *Calidris alpina alpina*.
- Crit. 8 (important source of food for fishes, spawning ground, nursery and/or migration path).

Effect Pathways and Feature Exposure

5.2.11 The works required for the option will be relatively minor, at existing operational sites located in urban and urban-fringe habitats several kilometres from the estuary. There will be no significant permanent land-take. The only mechanisms for effects on the qualifying features of the sites are therefore as follows:

- short-term effects on the habitats of the designated sites (hence the qualifying species) from construction site-derived pollutants);
- short-term effects on non-designated 'functional habitat' for wintering birds or anadromous fish close to the construction areas from:
 - ▶ noise / vibration or visual disturbance;
 - ▶ site-derived pollutants.

Assessment

5.2.12 With regard to effects from site-derived pollutants, these are likely to be negligible at most locations due to the scale of the works; however, potential effects can be clearly reduced to 'nil' with the application of normal best-practice construction measures (see **Appendix C**) to prevent run-off entering local watercourses. Consequently, there will be no effects on either the habitats of the European sites, or functional habitats associated with the mobile species, through this mechanism.

5.2.13 With regard to noise / vibration / visual disturbance:

- The construction areas are all over 150m from the nearest watercourses (Afon Taff and Afon Rhymini) and so fish species associated with the SAC/Ramsar will not be exposed to noise / vibration effects.
- The construction areas are not located near habitats or land that is likely to be functionally important to wintering birds associated with the SPA/Ramsar, based on topographic mapping and aerial photography (predominantly urban / urban fringe habitats where sight-lines are constrained by buildings and vegetation).

5.2.14 In addition, potential effects through these pathways can be easily avoided at the project level using established avoidance and mitigation approaches, if required. As a result, there will be no effects on the mobile species associated with the Severn estuary sites these pathways.

In combination effects

Other WRMP options

DCWW Options

5.2.15 **Option SEW052 Afon Lywd** has the potential to affect mobile species associated with the Severn Estuary SAC / Ramsar if using the Afon Lwyd (see Section 6); however, as **SEW166 Memorial** will have 'no effect' on the mobile species of these sites (once established best-practice mitigation is accounted for) it can be concluded that there will be no 'in combination' effects from these options.

Other Water Company WRMP Options

5.2.16 The Severn estuary sites are potentially exposed to environmental changes associated with options from Severn Trent Water, South Staffs Water, Bristol Water, and Wessex Water. These plans are currently being finalised and detailed information on the preferred options for these companies is not available. However, as **SEW166 Memorial** will have 'no effect' on the mobile species of these sites (once established best-practice mitigation is accounted for) it can be concluded that there will be no 'in combination' effects from these options.

Options in other DCWW plans

5.2.17 With regard to other DCWW plans:

- The drought options identified in DCWW's revised draft **Drought Plan 2020**³⁶ do not affect these European sites.
- The interaction of the WRMP options with specific schemes derived from the emerging **Drainage and Wastewater Management Plan (DWMP)** can only be assessed at the project level due to the generic nature of the DWMP options.

Severn to Thames Transfer

5.2.18 The STT does not currently appear in any WRMPs and so cannot be reasonably assessed for 'in combination' effects. Notwithstanding this, the information available from the Gate 2 submission suggests that effects on the Severn Estuary will not be adverse,

³⁶ <https://www.dwrcymru.com/en/our-services/water/water-resources/final-drought-plan-2020>

being predominately felt (if at all) in the upper estuary; there is no prospect of this scheme operating 'in combination' with option SEW166 to adversely affect the Severn estuary sites (particularly when mitigation is considered), or the mobile features of these sites.

Minor projects

- 5.2.19 It has not been possible to produce a definitive list of existing (minor) planning applications near the option's zone of influence, and generating a list at this stage would be of little value. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Major Projects

- 5.2.20 Reference has been made to the Planning Inspectorate's National Infrastructure Projects database³⁷; major projects in close proximity to the Severn estuary sites include:
- various tidal lagoons (Cardiff, Newport, West Somerset) that do not currently have applications submitted;
 - Seabank 3 combined cycle gas turbines (CCGT) at Avonmouth (no application yet submitted).
- 5.2.21 Potential 'in combination' effects cannot be assessed in the absence of detail on these schemes; however, it is unlikely that construction associated with the SEW166 option will coincide with these schemes. In practice, WRMP option SEW166 will have 'no effects' on the interest features of the Severn estuary designated sites or functionally-associated habitats with the application of established avoidance and best-practice measures; as a result, no 'in combination' effects with other plans or projects would be expected.

Uncertainties and Conclusion

- 5.2.22 There are no notable uncertainties over either the option or likely exposure / response of site interest features to the likely outcomes of the scheme.
- 5.2.23 In summary:
- there will be no operational effects;
 - potential construction effects will be very minor due to the scale of the works and can be avoided / prevented entirely using established best-practice measures.
- 5.2.24 As a result there will be no adverse effects, alone or in combination, on the integrity of the Severn Estuary Ramsar, Severn Estuary SPA or Severn Estuary/ Môr Hafren SAC.

³⁷ <https://infrastructure.planninginspectorate.gov.uk/projects/>

6. Appropriate Assessment – SEW052

6.1 Screening Summary

6.1.1 This option would require:

- a new intake on the Afon Lwyd near Ponthir;
- pumping facilities;
- a new 400m pipe to transfer abstracted water to the LG main at Court Farm WTW;
- a new 10MI/d abstraction from the Afon Lwyd.

6.1.2 The confluence of the Afon Lwyd and the River Usk is approximately 5.3km downstream from the proposed location of the new intake; this confluence is below the tidal limit for the Usk. The Usk joins the Severn estuary approximately 14km downstream of its confluence with the Afon Lwyd.

6.1.3 The following European sites and features are potentially exposed to environmental changes associated with the option:

- River Usk/ Afon Wysg SAC;
- Severn Estuary/ Môr Hafren SAC;
- Severn Estuary Ramsar;
- Severn Estuary SPA.

6.1.4 These sites or their features may be exposed through the following mechanisms:

- Construction:
 - ▶ Site-derived pollutants from construction directly affecting the European site habitats (principally an issue for the Usk, due to the distance to the Severn estuary and associated attenuation from river flows and tidal turnover).
 - ▶ Construction-related impacts (e.g. site-derived pollutants; noise or vibration) directly affecting habitats of the Afon Lwyd that may be considered ‘functionally linked’ to the **River Usk/ Afon Wysg SAC, Severn Estuary/ Môr Hafren SAC** or **Severn Estuary Ramsar**, or directly affecting the qualifying species of the above sites (notably diadromous fish) when using the Afon Lwyd.
- Operation:
 - ▶ Reduced flow volumes directly affecting the European site habitats (principally an issue for the Usk, due to the distance to the Severn estuary and associated attenuation from river flows and tidal turnover).
 - ▶ Reduced flow volumes in the Afon Lwyd affecting its value as ‘functional linked’ habitat for the diadromous fish species of the **River Usk/ Afon Wysg SAC, Severn Estuary/ Môr Hafren SAC** or **Severn Estuary Ramsar**.
 - ▶ Entrainment of diadromous fish species.

6.1.5 Note that the following aspects are ‘screened out’ as there is no possibility of effects ‘alone’:

- Effects on the exclusively freshwater qualifying features of the **River Usk/ Afon Wysg SAC** (i.e. **Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation; Brook lamprey; Bullhead**), as these are restricted to areas of the site above the tidal limit and so will not be exposed to the environmental changes associated with the option.
- Effects on ‘functionally linked land’ associated with the **Severn Estuary SPA** (as the habitats of the Afon Lwyd and the pipeline route will not provide ‘functionally linked land’ for the SPA qualifying species (urban / semi-urban areas etc.)

6.2 Assessment of Effects - River Usk/ Afon Wysg SAC

Site Features

- 6.2.1 The River Usk is one of the major rivers in south Wales, rising in the Black Mountains and flowing to the Severn estuary at Newport. Its underlying geology results in a natural low to moderate nutrient status, and a moderate base-flow index, although these are significantly modified by land use in the catchment. The river is primarily designated for its freshwater habitats (and the habitat these provide to diadromous fish), although the designation includes the reaches below the tidal limit at Newbridge-on-Usk to the Severn estuary. The designation primarily covers only the river itself, although the riparian habitats (which may not be designated) are identified as being an integral part of the river ecosystem.
- 6.2.2 The SAC includes a number of tributaries of the Usk, although the Afon Lwyd is not part of the SAC; however, this watercourse may be considered ‘functionally linked’ to the SAC as it may provide spawning habitat for the diadromous fish qualifying features of the Usk.
- 6.2.3 The SAC has the following qualifying features:
- Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation
 - Sea lamprey *Petromyzon marinus*
 - Brook lamprey *Lampetra planeri*
 - River lamprey *Lampetra fluviatilis*
 - Allis shad *Alosa alosa*
 - Twaite shad *Alosa fallax*
 - Atlantic salmon *Salmo salar*
 - Bullhead *Cottus gobio*
 - Otter *Lutra lutra*
- 6.2.4 As noted, the exclusively freshwater features of the site **Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation; Brook lamprey; Bullhead**) will not be exposed to the effects of the option and so are not considered further.
- 6.2.5 The Core Management Plan for the site³⁸ identifies ‘**typical species**’ associated with the qualifying habitats; these relate to the **Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation** only.

³⁸ Available at: https://naturalresources.wales/media/673384/river_usk-sac-core-plan.pdf

- 6.2.6 With regard to ‘**functional habitat**’, the Core Management Plan does not identify specific habitats or areas that are considered important to the integrity of the qualifying features, although generally these are taken to include:
- for the diadromous fish species, the natal rivers (designated and non-designated) supporting the populations associated with the Usk;
 - for otter, the wider connectivity of the riparian corridor and the through-catchment linkages with the upper Usk and the Gwent Levels / Severn Estuary.

Effect Pathways and Feature Exposure

- 6.2.7 The zone of hydrological impact is effectively the lower reaches of the Afon Lwyd from Ponthir to the confluence with the Usk (i.e. the lower 5km of the river); the upper reaches of the Afon Lwyd will not be affected. As noted, this SAC or its features may be exposed through the following mechanisms:
- Construction:
 - ▶ Site-derived pollutants from construction directly affecting the European site habitats.
 - ▶ Construction-related impacts (e.g. site-derived pollutants; noise or vibration) directly affecting habitats of the Afon Lwyd that may be considered ‘functionally linked’ to the **River Usk/ Afon Wysg SAC**, or directly affecting the qualifying species of the above sites (notably diadromous fish) when using the Afon Lwyd on migration, or as spawning or nursery habitat.
 - Operation:
 - ▶ Reduced flow volumes directly affecting the European site habitats.
 - ▶ Reduced flow volumes in the Afon Lwyd affecting its value as ‘functional linked’ habitat for the diadromous fish species of the **River Usk/ Afon Wysg SAC**, either directly or through ancillary effects on water quality.
 - ▶ Entrainment of diadromous fish species associated with the **River Usk/ Afon Wysg SAC**.
- 6.2.8 With regard to feature exposure, the only management unit of the **River Usk/ Afon Wysg SAC** potentially exposed to environmental changes as a result of the option is Unit 1 (Lower Usk); the status of the features in this unit is summarised in **Table 6.1**, based on the Core Management Plan.

Table 6.1 Status of SAC features in Management Unit 1 (Lower Usk)

Feature	Status
Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation	Absent
Sea lamprey <i>Petromyzon marinus</i>	KS
Brook lamprey <i>Lampetra planeri</i>	Absent
River lamprey <i>Lampetra fluviatilis</i>	Sym
Allis shad <i>Alosa alosa</i>	Sym

Feature	Status
Twaite shad <i>Alosa fallax</i>	KS
Atlantic salmon <i>Salmo salar</i>	Sym
Bullhead <i>Cottus gobio</i>	Absent
Otter <i>Lutra lutra</i>	KS

KS – key species in the management unit

Sym – Features of importance the unit but are not the main focus of management or monitoring. These features will benefit from management for the key feature(s) identified in the unit.

6.2.9 Therefore:

- As noted the exclusively freshwater features of the site will not be exposed to the effects of the option (i.e. **Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation; Brook lamprey; Bullhead**).
- There are no records of **Allis shad, Twaite shad** or **Sea Lamprey** within or near to the Afon Lwyd³⁹, and so effects on these species are only possible when present in the Usk estuary (i.e. through site-derived pollutants or indirect effects from changes in non-saline water inputs to the Usk estuary).
- Upper reaches of the Afon Lwyd may be used by spawning **Atlantic salmon** but will not be affected; this species will therefore be principally exposed when migrating through the lower reaches as smolts / adults (rather than fry / parr).
- **Otter** are likely to use to Afon Lwyd as a key transit route through the urban areas of the lower Lwyd valley.

Assessment – Construction

- 6.2.10 With regard to effects from site-derived pollutants, construction will be required within the Afon Lwyd; however, potential effects can be clearly rendered ‘nil’ or negligible with the application of normal best-practice construction measures (see **Appendix C**) for works within watercourses, including (for example) silt curtains and appropriate dams / screens, or timing works to avoid key migration periods for **Atlantic salmon**, and pre-construction surveys for **Otter**. Similar measures can be relied on in relation to noise / vibration / visual disturbance of fish species and otter within the Afon Lwyd (particularly timing of works to avoid key migration periods, or selection of appropriate plant and construction approaches at the design stage).
- 6.2.11 Consequently, it is considered that established project-level mitigation can be relied on to ensure that there are no adverse effects on either the habitats of the SAC, functional habitats associated with the mobile species, on on the mobile species themselves.

³⁹ The Afon Lwyd was subject to intensive fisheries monitoring by DCWW in 2011 – 2012, and fisheries monitoring is also undertaken on the Afon Lwyd by NRW.

Assessment – Operation

Key Environmental Changes

Flow changes in the Afon Lwyd

- 6.2.12 The ALS for the Afon Lwyd⁴⁰ indicates that 10.9MI/d are available for licensing at Q85, with this being available for an average of 310 days in the year. The proposed abstraction has been modelled to operate in line with the ALS and the following abstraction conditions set by NRW, with an overall DO gain of 6 – 7MI/d:

Table 6.2 Proposed abstraction conditions relative to river flow

River flow band (MI/d)	Abstraction (MI/d)
>70	10
50 - 70	7
30 – 50	4
<30	0

- 6.2.13 The approximate effect of the option on flows in the Afon Lwyd are summarised in **Table 6.1**, based on the above maximum 10MI/d increase in abstraction and flow records from the Ponthir gauging station (station no. 56005)⁴¹.

Table 6.3 Effects of proposed abstraction volumes at key flow thresholds recorded at the Lwyd at Ponthir gauging station (56005)

Flow Percentile	Current gauged flow (MI/d)	Option Impact (MI/d)	MI/d available based on ALS	Relative flow reduction from option
Mean Flow	271.1	10	Not stated	3.7%
Q95	55.6	7	6.3	12.6%
Q85	77.4	10	10.9	12.9%
Q75	100.7	10	12.5	9.9%
Q70	113.2	10	Not stated	8.8%
Q65	127.6	10	21.7	7.8%
Q50	174.7	10	Not stated	5.7%

⁴⁰ NRW (2017). *South East Valleys Abstraction Licensing Strategy* [online]. Available at: <https://cdn.cyfoethnaturiol.cymru/media/683371/sev-licensing-strategy-final-nov-17.pdf?mode=pad&rnd=131596369490000000>. [Accessed 01/06/2].

⁴¹ <https://nrfa.ceh.ac.uk/data/station/meanflow/56005>

6.2.14 The Core Management Plan for the **River Usk/ Afon Wysg SAC** does not set specific flow targets for Afon Lwyd (since this is not part of the SAC). The SAC flow targets utilise the Habitats Directive Ecological River Flow (HDERF) objective and require that the maximum permissible percentage reduction from naturalised flow levels is as per **Table 6.3** (although note that these flow targets are arguably not entirely appropriate for the Afon Lwyd, given that it is not part of the SAC and will therefore have a lower sensitivity to abstraction):

Table 6.4 River Usk/ Afon Wysg SAC Core Management Plan river flow thresholds

Sensitivity to abstraction	Max. % reduction from daily naturalised flow at flow thresholds		
	>Q50	Q50 – Q95	<Q95
High	15	10	5 – 10
Very high	10	10	1 – 5

6.2.15 The flows provided in **Table 6.2** are gauged rather than naturalised (naturalised flows will usually be higher as abstractions from a catchment are not typically balanced by discharges, and in this instance the major discharge to the catchment is from the WwTW at Ponthir, downstream of the Ponthir gauging station). As noted, these flow targets are arguably too conservative for the Afon Lwyd, although it is clear that they would almost always be met (since the impact of the proposed abstraction is less than 10% of the gauged flows, except potentially at Q85 (depending on the precise difference between gauged and naturalised)).

6.2.16 It should also be noted that the Afon Lwyd receives a significant discharge from the Ponthir WwTW⁴², approximately 250m downstream of the proposed abstraction location and the Ponthir gauging station. This means that the relative flow reductions noted in **Table 6.2** will be the maximum experienced over a relatively short section of the river (approximately 250m).

6.2.17 Therefore, the proposed abstraction will be acceptable in terms of impact on flows in the lowest reaches of the Afon Lwyd, as these might relate to features associated with the SAC.

Flows changes in the tidal River Usk

6.2.18 As noted, the Afon Lwyd receives a significant discharge from Ponthir WwTW downstream of the proposed abstraction location and so the effects of the option on non-saline inputs / flows to the tidal Usk will be notably less than those indicated in **Table 6.2**.

6.2.19 Notwithstanding this, the contribution of the Afon Lywd to non-saline flows in the Usk estuary is relatively small, approximately 10% based on mean gauged flows⁴³, and so the effect of the new abstraction on non-saline inputs to the Usk estuary at the confluence with the Lwyd will almost certainly be <1% at all flows; this is considered negligible, particularly when set against the tidal turnover in the lower Usk estuary, and will not affect the quality or characteristics of the estuarine habitats.

⁴² Ponthir WwTW treats wastewater from the majority of the towns in the Afon Lwyd valley, and Caerleon, and has a permitted DWF of 32.9Ml/d.

⁴³ Mean flows in the Usk based on gauging station data from Olway and Chainbridge are at least ~2650Ml/d (note, this underestimates flows into the estuary as these stations are upstream of other discharges, including the Sôr Brook and several WwTWs), compared to mean flows in the Afon Lwyd of 271.

Effects on water quality

- 6.2.20 Water quality standards for Special Area of Conservation (SAC) rivers are set via agreement at a UK level and presented in the JNCC Common Standards Monitoring (CSM) guidance although the Core Management Plan for the site notes that “*If the WFD standard is more stringent than the CSM standard, then the WFD standard applies*” (recognising that the Afon Lwyd is not part of the SAC or explicitly identified as being functionally linked in the Core Management Plan).
- 6.2.21 In this instance, the Afon Lwyd has ‘good’ status under WFD for water quality (see the WFD report for the WRMP); the only ‘Reason for Not Achieving Good (RNAG)’ for the water body is physical modifications impacting on fish. The baseline water quality is therefore good.
- 6.2.22 As noted, the proposed abstraction conditions have been set by NRW and so an impact on the WFD status of this water body due to changes in water quality would not be expected; furthermore, as the impact of the abstraction on flows / dilution (etc.) within the Usk estuary is so small (see above) the associated effect on water quality is expected to be too small to adversely affect these transitional waters.

Entrainment risk

- 6.2.23 The new abstraction may increase the risk of fish entrainment, including **Atlantic salmon**. However, entrainment risk can be substantially minimised through intake design and there are several known and acceptable methods for entrainment prevention that are used in SAC rivers⁴⁴. This potential effect can therefore be avoided through project-level design measures that can be relied on to ensure that the integrity of fish populations associated with the SAC are not adversely affected by operation of the intake.

Effects on qualifying features

Atlantic salmon / River lamprey

- 6.2.24 **Atlantic salmon** or **River lamprey** may be exposed to the environmental changes associated with the option when migrating through the lower reaches of the river, or when utilising these areas as juveniles.
- 6.2.25 The available data indicate that the environmental changes associated with the option will be negligible; in particular:
- The impact on flows will be within the targets for the SAC (notwithstanding that the Afon Lwyd is not part of the SAC), and this minor impact will not be sufficient to substantially alter the quality, quantity or accessibility of the functionally-associated habitats of the Afon Lwyd.
 - The impact on water quality due to flow reduction within the Afon Lwyd is expected to be nominal.
 - The entrainment risk can be sufficiently minimised using established measures.

⁴⁴ EA (2005). Screening for Intake and Outfalls: a best practice guide [online]. Environment Agency Science Report SC0302311. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291568/scho0205bioc-e-e.pdf [Accessed 06.06.23].

- 6.2.26 The Afon Lwyd will therefore continue to provide functionally-associated habitat that is available to **Atlantic salmon** or **River lamprey** associated with the **River Usk/ Afon Wysg SAC**.

Otter

- 6.2.27 Whilst **Otter** are water-dependent they will be relatively insensitive to the magnitude of the environmental changes anticipated as a result of the option; the effects of the scheme on flows in the Afon Lwyd (and hence water quality) will not alter the availability or quality of the habitats used by otter in the river or the wider catchment, such that the integrity of the SAC population might be affected. The Afon Lwyd will continue to provide functionally-associated habitat that is available to otters associated with the Usk.

Twaite shad / Allis shad / Sea lamprey / River lamprey

- 6.2.28 As noted, these features are only likely to be exposed to the effects of the option when utilising the Usk estuary, either when migrating as adults or if using the estuary as a nursery area for juveniles. However, the environmental changes within the estuary associated with the option will be negligible, and too limited to affect the value of the estuarine Usk to these species; there will therefore be no adverse effects on the integrity of these species' populations.

In combination

Other WRMP options

DCWW Options

- 6.2.29 No other rdWRMP options will affect the **River Usk/ Afon Wysg SAC** or its mobile features.

Other water company options

- 6.2.30 The Severn estuary sites (hence the mobile features of the **River Usk/ Afon Wysg SAC** that utilise the estuary) are potentially exposed to environmental changes associated with options from Severn Trent Water, South Staffs Water, Bristol Water, and Wessex Water. These plans are currently being finalised and detailed information on the preferred options for these companies is not available.
- 6.2.31 However, based on the dWRMPs for these companies and draft information provided on the likely rdWRMP preferred options, and the effect of option SEW052, it is considered that:
- there will be no spatially coincident and hence additive in combination effects (i.e. the zone of environmental change for option SEW052 will not overlap with those for any other water company options);
 - the effects of SEW052 will be too small alone to present any risk of synergistic or temporal (e.g. coincident, sequential or seasonal displacements) in combination effects that might adversely affect the overall value of the estuary for these species, such that the conservation status of the Usk populations might then be adversely affected.
- 6.2.32 Therefore, no adverse effects 'in combination' with other water company WRMPs will occur.

Options in other DCWW plans

6.2.33 With regard to other DCWW plans:

- One option in DCWW's revised draft **Drought Plan 2020**⁴⁵ may affect this European site. This option involves utilisation of the dead storage in Talybont reservoir, which sits above the River Usk SAC. The HRA of the Drought Plan concluded that the effects of this option (if used) on the Usk would be nominal and not significant (essentially the only effect would be a slight delay to the reservoir overflowing following refill, although all compensation flows are maintained). In practice, there is no risk of the zones of influence of the Drought Option and Option SEW052 interacting to affect the SAC.
- The interaction of the WRMP options with specific schemes derived from the emerging **Drainage and Wastewater Management Plan (DWMP)** can only be assessed at the project level due to the generic nature of the DWMP options.

Severn to Thames Transfer

6.2.34 The STT does not currently appear in any WRMPs and so cannot be assessed for 'in combination' effects. Notwithstanding this, the information available from the Gate 2 submission suggests that effects on the Severn Estuary will not be adverse, being predominately felt (if at all) in the upper estuary; there is no prospect of this scheme operating 'in combination' with option SEW052 to adversely affect the Severn estuary sites (particularly when mitigation is considered) or the River Usk/ Afon Wysg SAC, or the mobile features of these sites.

Minor projects

6.2.35 It has not been possible to produce a definitive list of existing (minor) planning applications near the option's zone of influence, and generating a list at this stage would be of little value. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Major Projects

6.2.36 Reference has been made to the Planning Inspectorate's National Infrastructure Projects database⁴⁶; major projects in close proximity to the **River Usk/ Afon Wysg SAC** (or which may affect the mobile qualifying features when away from this SAC) include:

- various tidal lagoons (Cardiff, Newport, West Somerset) that do not currently have applications submitted;
- Seabank 3 combined cycle gas turbines (CCGT) at Avonmouth (no application yet submitted).

6.2.37 Potential 'in combination' effects cannot be assessed in the absence of detail on these schemes; however, it is unlikely that construction associated with the SEW052 option will coincide with these schemes. In practice, the effects of WRMP option SEW052 on the

⁴⁵ <https://www.dwrcymru.com/en/our-services/water/water-resources/final-drought-plan-2020>

⁴⁶ <https://infrastructure.planninginspectorate.gov.uk/projects/>

features of the Usk will be too small for 'in combination' effects with other plans or projects.

Uncertainties and Conclusion

- 6.2.38 There are no notable uncertainties over either the option or likely exposure / response of site qualifying features to the likely outcomes of the scheme.
- 6.2.39 In summary, whilst it will be necessary to complete an HRA for the licence application (which will necessarily consider effects with the benefit of additional hydrological modelling) there is nothing to suggest that the option will have adverse effects on the integrity of the **River Usk/ Afon Wysg SAC** as a result of its construction or operation.

6.3 Assessment of Effects – Severn Estuary Ramsar, Severn Estuary SPA, Severn Estuary/ Môr Hafren SAC

Site Features

- 6.3.1 The site interest features and associated parameters are summarised in Section 5.2.

Effect Pathways and Feature Exposure

- 6.3.2 The boundary of the **Severn Estuary Ramsar, Severn Estuary SPA, Severn Estuary/ Môr Hafren SAC** is approximately 13.7km downstream from the confluence of the Afon Lwyd with the Usk. The negligible impact of the proposed abstraction on non-saline flows within the tidal River Usk (see Section 6.2, above) will be further reduced over this distance due to the increasing influence of the tidal regime, and by additional non-saline inputs from other watercourses and WWTWs; in practice, the impacts of the abstraction will not be detectable at the SAC / SPA / Ramsar boundary. As a result, the habitats of these sites will not be exposed to any environmental changes associated with the operation of the option that may adversely affect site integrity.
- 6.3.3 These sites or their features may therefore be exposed through the following mechanisms:
- Construction:
 - ▶ Site-derived pollutants from construction directly affecting the European site habitats.
 - ▶ Construction-related impacts (e.g. site-derived pollutants; noise or vibration) directly affecting habitats of the Afon Lwyd or the River Usk that may be considered 'functionally linked' to the **Severn Estuary Ramsar, Severn Estuary SPA, Severn Estuary/ Môr Hafren SAC**, or directly affecting the qualifying species of the above sites (notably diadromous fish) when using the Afon Lwyd or River Usk on migration, or as spawning or nursery habitat.
 - Operation:
 - ▶ Reduced flow volumes in the Afon Lwyd affecting its value as 'functionally linked' habitat for the diadromous fish species of the **Severn Estuary Ramsar** or **Severn Estuary/ Môr Hafren SAC**, either directly or through ancillary effects on water quality.

- ▶ Reduced flow volumes in the tidal Usk affecting its value as ‘functionally linked’ habitat for the diadromous fish species of the **Severn Estuary Ramsar** or **Severn Estuary/ Môr Hafren SAC**, either directly or through ancillary effects on water quality, or the bird interest of the **Severn Estuary SPA**.
- ▶ Entrainment of diadromous fish species associated with the **Severn Estuary Ramsar** or **Severn Estuary/ Môr Hafren SAC**.

6.3.4 With regard to feature exposure:

- As noted, the habitats of the **Severn Estuary Ramsar**, **Severn Estuary SPA**, or **Severn Estuary/ Môr Hafren SAC** will not be exposed to potentially notable environmental changes associated with operation.
- There are no records of **Twaite shad** or **Sea Lamprey** within or near to the Afon Lwyd, and so effects on these species are only possible when present in the Usk estuary (i.e. through site-derived pollutants or indirect effects from changes in non-saline water inputs to the Usk estuary).
- The Afon Lwyd is used by **Eel** that may be considered associated with the **Severn Estuary Ramsar**).
- The Afon Lwyd will not provide ‘functionally linked’ habitat for the qualifying features of the SPA.

Assessment – Construction

6.3.5 As with the **River Usk/ Afon Wysg SAC**, potential effects from construction on the habitats of the SAC/SPA/Ramsar or the mobile species can be clearly rendered ‘nil’ or negligible with the application of normal best-practice construction measures (see **Appendix C**) for works within watercourses, including (for example) silt curtains and appropriate dams / screens, or timing works to avoid key migration periods. Consequently, it is considered that established project-level mitigation can be relied on to ensure that there are no adverse effects on either the habitats of the **Severn Estuary Ramsar**, **Severn Estuary SPA**, or **Severn Estuary/ Môr Hafren SAC**, functional habitats associated with the mobile species, on on the mobile species themselves.

Assessment – Operation

Key Environmental Changes

Flows changes in the tidal River Usk

- 6.3.6 As noted, the Afon Lwyd receives a significant discharge from Ponthir WwTW downstream of the proposed abstraction location and so the effects of the option on non-saline inputs / flows to the tidal Usk will be notably less than those indicated in **Table 6.2**.
- 6.3.7 Notwithstanding this, the contribution of the Afon Lywd to non-saline flows in the Usk estuary is relatively small, approximately 10% based on mean gauged flows⁴⁷, and so the effect of the new abstraction on non-saline inputs to the Usk estuary at the confluence with the Lwyd will almost certainly be <1% at all flows; this is considered negligible, particularly when set against the tidal turnover in the lower Usk estuary, and will not affect

⁴⁷ Mean flows in the Usk based on gauging station data from Olway and Chainbridge are at least ~2650Ml/d (note, this underestimates flows into the estuary as these stations are some way upstream of other discharges, including the Sôr Brook and several WwTWs), compared to mean flows in the Afon Lwyd of 271.

the quality or characteristics of the estuarine habitats, or their value to or use by the mobile species of the **Severn Estuary Ramsar**, **Severn Estuary SPA**, or **Severn Estuary/ Môr Hafren SAC**.

Effects on water quality

- 6.3.8 The assessment of this aspect is essentially as per that for the **River Usk/ Afon Wysg SAC**, i.e. the effect on non-saline flows and hence water quality within the tidal waterbodies will be minimal, and negligible at the confluence with the Severn estuary.

Entrainment risk

- 6.3.9 The new abstraction may increase the risk of fish entrainment, including **Eel** associated with the **Severn Estuary Ramsar** and **River Lamprey** associated with the Ramsar and the **Severn Estuary/ Môr Hafren SAC**. However, entrainment risk can be substantially minimised through intake design and there are several known and acceptable methods for entrainment prevention that are used in SAC rivers⁴⁸. This potential effect can therefore be avoided through project-level design measures that can be relied on to ensure that the integrity of fish populations associated with the Ramsar / SAC are not adversely affected by operation of the intake.

Effects on qualifying features

Eel / River Lamprey

- 6.3.10 **River Lamprey** are a feature of the SAC and Ramsar; **Eel** are a feature of the Ramsar. These species may be exposed to the environmental changes associated with the option when migrating through the lower reaches of the river, or when utilising these areas as juveniles.
- 6.3.11 The available data indicate that the environmental changes associated with the option will be negligible; in particular:
- The impact on flows will be within the targets for the **River Usk/ Afon Wysg SAC** (notwithstanding that the Afon Lwyd is not part of this SAC), and this minor impact will not be sufficient to substantially alter the quality, quantity or accessibility of the habitats of the Afon Lwyd or the River Usk that may be functionally-associated with the **Severn Estuary Ramsar** or **Severn Estuary/ Môr Hafren SAC**.
 - The impact on water quality in the Afon Lwyd or the estuary will be negligible.
 - The entrainment risk can be sufficiently minimised using established measures.
- 6.3.12 The Afon Lwyd will therefore continue to provide functionally-associated habitat that is available to River lamprey and Eel that may be associated with the **Severn Estuary Ramsar** or **Severn Estuary/ Môr Hafren SAC**.

Twaite shad / Allis shad / Sea lamprey

- 6.3.13 As noted, these features are only likely to be exposed to the effects of the option when utilising the Usk estuary, either when migrating as adults or if using the estuary as a

⁴⁸ EA (2005). Screening for Intake and Outfalls: a best practice guide [online]. Environment Agency Science Report SC0302311. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291568/scho0205bioc-e-e.pdf [Accessed 06.06.23].

nursery area for juveniles. However, the environmental changes within the estuary associated with the option will be negligible, and too limited to affect the value of the estuarine Usk to these species; there will therefore be no adverse effects on the integrity of these species' populations that are associated with the **Severn Estuary Ramsar** or **Severn Estuary/ Môr Hafren SAC**.

SPA qualifying features / Ramsar bird features

- 6.3.14 Several studies have suggested that the number and densities of wintering waterbirds around estuarine freshwater channels are consistently greater than across associated mudflats, and that several bird species show significant preferences for freshwater flow areas over mudflats (e.g. Ravenscroft *et al.* (1997), Ravenscroft (1998, 1999), Ravenscroft & Beardall (2002) & Ravenscroft & Emes (2004)), although other studies have indicated that deeply incised channels associated with large volume inflows (such as the Usk) are less attractive to birds (Ravenscroft & Beardall, 2002).
- 6.3.15 Further background on this aspect is provided in **Appendix B** although the broad consensus position appears to be that it is not freshwater flow volumes *per se* that are critical to the bird / intertidal channel relationship, rather the presence of some flows within channels to maintain morphology, and that bird distributions are often influenced instead by regional factors (e.g. changes in disturbance levels, reductions in bird populations altering estuary usage, proximity of roost sites), local factors (e.g. the role of creek morphology or substrate penetrability) and small-scale interactions (e.g. inter and intra-specific bird relationships, or prey availability associated with behavioural or physiological responses to intertidal exposure). The SACO advice relating to estuarine sites typically reflects this to some extent, in that the targets only refer to maintaining the 'availability' of freshwater in feeding and resting areas, not specific flow volumes / rates and so on.
- 6.3.16 As noted, it is considered that the reduction in non-saline inputs to the Severn estuary sites due to this option will be inconsequential in relation to other non-saline volumes from the Usk and tidal turnover, and well within natural variability, so adverse effects on the integrity of the habitats of the SPA/Ramsar will not occur due to reduction in flow volumes associated with this option.
- 6.3.17 The qualifying features of the SPA and bird features of the Ramsar may periodically use habitats within the tidal Usk that are potentially exposed to the effects of the scheme, although these areas are not heavily used by these species (based on WeBS Low Tide Count visualisations⁴⁹) due to the constrained characteristics of the Usk channel compared to the open flats of the SPA/Ramsar (which affects sightlines and hence attractiveness to some species).
- 6.3.18 Furthermore, the environmental changes within the Usk estuary associated with the option will be negligible (see Section 6), and too limited to affect the value of the estuarine Usk to these species; there will therefore be no adverse effects on the integrity of these species' populations that are associated with the **Severn Estuary Ramsar** or **Severn Estuary SPA**.

⁴⁹ <https://app.bto.org/webs-reporting/lowtides.jsp>

In combination

Other WRMP options

DCWW options

- 6.3.19 As **SEW166 Memorial** will have ‘no effect’ on the mobile species of these sites (once established best-practice mitigation is accounted for) it can be concluded that there will be no ‘in combination’ effects between **SEW166** and **SEW052**.

Other water company options

- 6.3.20 The Severn estuary sites (hence the mobile features of the **Severn Estuary SAC / Ramsar** that utilise the River Usk) are potentially exposed to environmental changes associated with options from Severn Trent Water, South Staffs Water, Bristol Water, and Wessex Water. These plans are currently being finalised and detailed information on the preferred options for these companies is not available.
- 6.3.21 However, based on the dWRMPs for these companies and draft information provided on the likely rdWRMP preferred options, and the effect of option **SEW052**, it is considered that:
- there will be no spatially coincident and hence additive in combination effects (i.e. the zone of environmental change for option **SEW052** will not overlap with those for any other water company options);
 - the effects of SEW052 will be too small alone to present any risk of synergistic or temporal (e.g. coincident, sequential or seasonal displacements) in combination effects that might adversely affect the overall value of the estuary for these species, such that the conservation status of the Usk populations might then be adversely affected.
- 6.3.22 Therefore, no adverse effects ‘in combination’ with other water company WRMPs will occur.

Options in other DCWW plans

- 6.3.23 With regard to other DCWW plans:
- One option in DCWW’s revised draft **Drought Plan 2020**⁵⁰ is within the catchment of the Severn estuary; this option involves utilisation of the dead storage in Talybont reservoir, which sits above the River Usk SAC. The HRA of the Drought Plan concluded that the effects of this option (if used) on the Usk would be nominal and not significant (essentially the only effect would be a slight delay to the reservoir overflowing following refill, although all compensation flows are maintained) and so there is no risk of this drought option interacting with Option SEW052 to affect the Severn estuary sites.
 - The interaction of the WRMP options with specific schemes derived from the emerging **Drainage and Wastewater Management Plan (DWMP)** can only be assessed at the project level due to the generic nature of the DWMP options.

⁵⁰ <https://www.dwrcymru.com/en/our-services/water/water-resources/final-drought-plan-2020>

Severn to Thames Transfer

- 6.3.24 The STT does not currently appear in any WRMPs and so cannot be reasonably assessed for ‘in combination’ effects. Notwithstanding this, the information available from the Gate 2 submission suggests that effects on the Severn Estuary will not be adverse, being predominately felt (if at all) in the upper estuary; there is no prospect of this scheme operating ‘in combination’ with option SEW052 to adversely affect the Severn estuary sites (particularly when mitigation is considered) or the River Usk/ Afon Wysg SAC, or the mobile features of these sites.

Minor projects

- 6.3.25 It has not been possible to produce a definitive list of existing (minor) planning applications near the option’s zone of influence, and generating a list at this stage would be of little value. It is possible that there will be ‘in combination’ project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Major Projects

- 6.3.26 Reference has been made to the Planning Inspectorate’s National Infrastructure Projects database⁵¹; major projects in close proximity to the Severn estuary sites include:
- various tidal lagoons (Cardiff, Newport, West Somerset) that do not currently have applications submitted;
 - Seabank 3 combined cycle gas turbines (CCGT) at Avonmouth (no application yet submitted).
- 6.3.27 Potential ‘in combination’ effects cannot be assessed in the absence of detail on these schemes; however, it is unlikely that construction associated with the SEW052 option will coincide with these schemes. In practice, WRMP option SEW052 will have no effects on the interest features of the Severn estuary designated sites or functionally-associated habitats with the application of established avoidance and best-practice measures; as a result, no ‘in combination’ effects with other plans or projects would be expected.

Uncertainties and Conclusion

- 6.3.28 There are no notable uncertainties over either the option or likely exposure / response of site qualifying features to the likely outcomes of the scheme.
- 6.3.29 In summary, whilst it will be necessary to complete an HRA for the licence application (which will necessarily consider effects with the benefit of additional hydrological modelling) there is nothing to suggest that the option will have adverse effects on the integrity of the **Severn Estuary Ramsar, Severn Estuary SPA or Severn Estuary/ Môr Hafren SAC** as a result of its construction or operation.

⁵¹ <https://infrastructure.planninginspectorate.gov.uk/projects/>

7. Appropriate Assessment – Demand Side Measures

7.1 Screening Summary

- 7.1.1 Some demand-side options may involve physical interventions in the network (e.g. meter installation; pipe lining; etc.), with the remaining options essentially providing support for direct and indirect measures to improve water efficiency (e.g. household visits). The 'water efficiency support' options cannot have significant effects due to the nature of the option (based on established guidance for similar policies and proposals in strategic planning documents that do not promote development).
- 7.1.2 The physical works required for the remaining demand-side options will typically be very minor (e.g. meter installation) with virtually no risk of significant effects on European sites. In some instances effect pathways might be conceivable (for example, a hypothetical leaking pipe might be located in or near a European site) but it is not possible to predict or identify specific locations where such measures might be applied and so effects on specific European sites cannot be identified.
- 7.1.3 Non-specific residual risks such as these can almost always be avoided with established scheme-level mitigation measures and it is very unlikely that significant or significant and adverse effects as the result of a particular demand-side measure would be unavoidable at the scheme level; however, these options are carried forward to the 'appropriate assessment' stage for procedural reasons and to avoid potential conflict with the 'People over Wind' case.

7.2 Appropriate Assessment

- 7.2.1 Demand-side options will have no negative operational effects on European sites as they will reduce treated water use. The only realistic mechanism for a negative effect would be through any construction required (for example, the leakage reduction programme may require repair of a pipe in or near an SAC), but this cannot be meaningfully assessed at the strategic level since information on the location of specific intervention requirements (e.g. leaks; households requesting meters) is not available without specific investigations, which would form part of the option package (e.g. the precise location and severity of most leakages is not known ahead of detection), and there is consequently no information on the scale (etc.) of any construction required. Therefore, from an HRA perspective, the options are 'screened in' (as an effect pathway is conceivable) but as a meaningful appropriate assessment is not possible, the assessment is necessarily deferred to the project level.
- 7.2.2 However, it is clear that the anticipated works associated with these options are not of a scale that would suggest that effects are potentially unavoidable at the project stage, and the WRMP requires that the standard avoidance measures in **Appendix C** be employed (which includes a requirement for the potential for European sites to be affected to be considered at the planning stage). The WRMP does not imply any approval for schemes that come forward under these options or remove the need for project-level assessments, although the measures noted in **Appendix C** will ensure that potential adverse effects can be identified and avoided at the project stage. **The demand-management measures will therefore have no adverse effects (alone or in combination) on any European site that cannot be avoided through normal project-level measures.**

8. Strategic In Combination Assessment

8.1 Between-option 'in combination' effects

- 8.1.1 The effects of the WRMP options operating 'in combination' have been explored through the screening and appropriate assessment phases (see **Sections 4 – 5**). These assessments indicate that adverse 'in combination' effects are not likely to occur for any European sites or features.

8.2 'In combination' effects with other DCWW Plans

Drought Plan

- 8.2.1 None of the European sites potentially exposed to environmental changes associated with the WRMP options are also exposed to changes associated with the Drought Plan; there will consequently be no 'in combination' effects between these plans.

Drainage and Wastewater Management Plan (DWMP)

- 8.2.2 For this initial iteration of the DWMP Welsh Water has prioritised solutions for catchments with the highest 'levels of service' risk, reflecting catchments where there are multiple incidents of internal property flooding or significant spills to European sites. Through this process, Welsh Water has identified 18 prioritised TPUs (covering 19 Level 4 (L4) drainage areas) which are the focus of the first iteration of the DWMP.
- 8.2.3 Within each L4 catchment the DWMP process identifies specific locations where internal property flooding or spills to European sites have triggered the development of an option to resolve this; these are the **Level 7 (L7) risk areas**. Consequently, the options developed for this iteration of the DWMP are fundamentally addressing relatively small-scale local flow-management issues, typically associated with pinch-points within the system.
- 8.2.4 The objectives of the options are therefore relatively narrow: to reduce spills or flooding at a particular location (the L7 risk area) through various interventions and ensure that these volumes can be passed to the relevant WwTW for treatment⁵² in accordance with the WwTW's permits. They are not aiming to prevent all flooding and spills that may occur within an L4 catchment, nor solve wider drainage, wastewater and water quality issues within the L4 area or the associated surface water catchment.
- 8.2.5 Whilst a range of interventions (see above) are considered, in very broad terms all the options in this iteration of the plan aim to directly or indirectly increase the capacity of the network locally to pass flows for treatment⁵³; this is typically achieved using measures that temporarily store or attenuate peak flows in the local sewerage network. The options are categorised as either '**sustainable options**', which seek to redirect flows of water from the wastewater/sewer network by mimicking more natural drainage regimes (e.g. SuDS); '**traditional options**', which involve established hard-engineering measures to increase

⁵² In some instances SuDS (e.g. with reedbeds) may be able to provide a suitable level of treatment for discharge without flows being passed forward to a WwTW.

⁵³ i.e. the proposed DWMP does not include locationally 'non-specific' options that necessarily work cumulatively at a catchment or greater scale, such as policy interventions or customer side management.

the capacity of the drainage and wastewater network (e.g. sewer upsizing; provision of additional offline storage; separation of surface run-off from the foul system; reducing infiltration); or ‘**combination options**’, involving a mix of sustainable and traditional options.

- 8.2.6 However, whilst the DWMP development process identifies specific issues at relatively specific locations (i.e. the L7 catchments), and models potential solutions to resolve these, **the options themselves are essentially indicative**: they are used to generate metrics to help identify the most appropriate type of solution in a given area but **are not intended to be definitive plans for schemes**. In practice there will be several further stages of investigation, detailed design and assessment to determine the precise nature of an intervention at a given location, particularly as there is a substantial lead time for the delivery of some options and not all options will be implemented within this 5-year plan cycle.
- 8.2.7 In most instances the environmental changes associated with the DWMP options will almost certainly be manageable or avoidable at the scheme level, although this relies on mitigation assumptions and so some options and L4 areas have been ‘screened in’ for appropriate assessment (to avoid potential conflict with ‘People over Wind’). ‘Appropriate assessments’ of the options in these L4 areas were undertaken based on the information available at the plan-level. In summary:
- Whilst options are identified, the proposals are not intended to be definitive plans for schemes that cannot be deviated from; in practice, none of the options are of a scale or type where adverse effects (through construction or operation) are likely to be an unavoidable consequence of their delivery.
 - For all options the environmental changes associated with construction will be manageable or avoidable at the scheme level using standard project-level avoidance and mitigation measures that known to be available, achievable and effective.
 - With regard to operation, the options within the current iteration of the DWMP are fundamentally addressing relatively small-scale local flow-management issues to reduce spills or flooding at a particular location and ensure that these volumes can be passed to the relevant WwTW for treatment in accordance with the WwTW’s permits. Their operational effect on receiving waters is therefore likely to be positive (or at least neutral) compared to the status quo.
- 8.2.8 Consequently, the interaction of the WRMP options with specific schemes derived from the DWMP can only be assessed at the project level (although there is nothing to suggest that adverse effects will be unavoidable); and overall water quality within the receiving waterbodies (including European sites potentially affected by the WRMP) will be positive as a result of the DWMP (so adverse in combination effects would not occur).

8.3 Between-company ‘in combination’ effects

WRMPs

- 8.3.1 Only the European sites associated with the Severn estuary have the potential to be exposed to effects associated with both the DCWW WRMP and one or more other WRMPs. The Severn estuary sites (hence the mobile features of the **Severn Estuary SAC / Ramsar** that utilise the River Usk) are potentially exposed to environmental changes associated with options from Severn Trent Water, South Staffs Water, Bristol Water, and Wessex Water. These plans are currently being finalised and detailed information on the preferred options for these companies is not available.

- 8.3.2 However, based on the dWRMPs for these companies and draft information provided on the likely rdWRMP preferred options, and the effect of DCWW's rdWRMP options, it is considered that:
- there will be no spatially coincident and hence additive in combination effects (i.e. the zone of environmental change for options **SEW052** and **SEW166** will not overlap with those for any other water company options);
 - the effects of SEW052 will be too small alone to present any risk of synergistic or temporal (e.g. coincident, sequential or seasonal displacements) in combination effects that might adversely affect the overall value of the estuary for these species, such that the conservation status of the Usk populations might then be adversely affected (note, the effects of SEW166 will be 'nil', once mitigation is taken into account).
- 8.3.3 Therefore, no adverse effects 'in combination' with other water company WRMPs will occur.

Drought Plans

- 8.3.4 As with the WRMPs, only the sites associated with the Severn estuary have the potential to be exposed to effects associated with more than one plan, and the DCWW WRMP options will have very marginal or no effects on these sites; consequently in combination effects with other water company Drought Plans will not occur.

8.4 In combination effects with other plans and programmes

Effects with other strategic plans and water resource demand

- 8.4.1 The WRMP explicitly accounts for growth forecasts when calculating future water demand (and hence areas with potential deficits). This means that 'in combination' water-resource effects with growth promoted by other plans or projects are considered and accounted for during the WRMP development process and its deficit calculations.
- 8.4.2 Potential 'in combination' effects in respect of water-resource demands due to other plans or projects are therefore unlikely since these demands are explicitly modelled when determining deficit zones and hence developing Feasible Options. As a result (in respect of water resources) the WRMP is not likely to make non-significant effects in other plans significant (indeed, other plans are arguably the 'source' of any potential effects in respect of water demand, with the WRMP having to manage potential effects that are not generated by the WRMP itself).
- 8.4.3 Local plans are not all consistent with regard to planned growth and this arguably introduces some uncertainty. However, with regard to water resources and planning uncertainty it is important to note the following:
- The WRMP safeguards against uncertainty in option yield and timing through 'Target Headroom'; this is an allowance provided in the planning process (i.e. designed-in spare capacity) that ensures that any supply-demand deficit will still be met if there is an underperforming demand management measure or growth exceeds predicted levels. It is therefore extremely unlikely that additional demand or a poorly-performing option would 'suddenly' result in a deficit that might affect a European site; and (in any case);
 - The WRMP is revised on a five-yearly cycle, which allows any changes in demand forecasts (e.g. as new plans come forward) to be accounted for, and for timely

intervention should a measure not be performing as expected. Delivery is also formally reviewed on an annual basis.

- 8.4.4 It is therefore considered that the WRMP options will not have significant 'in combination' effects with local plans in respect of water resources.

Effects with major projects

- 8.4.5 Known major projects that are likely to increase demand have been taken into account during the development of DCWW's WRMP and determination of future deficits.
- 8.4.6 With regard to individual projects interacting with specific options to affect particular sites, this is addressed in **Sections 4 – 5**.
- 8.4.7 In summary, reference has been made to the Planning Inspectorates National Infrastructure Projects database⁵⁴ which includes major projects, subject to the requirements of the Planning Act 2008. It includes projects:
- where the developer has advised the Planning Inspectorate in writing that they intend to submit an application in the future;
 - where an application has already been made to the Planning Inspectorate and is undergoing the development consent process;
 - where a Development Consent Order (DCO) application has been determined.
- 8.4.8 This exercise did not identify any major projects likely to adversely affect the integrity of any sites in combination with the WRMP.

Minor projects

- 8.4.9 It has not been possible to produce a definitive list of existing (minor) planning applications near each option's zone of influence and, generating a list at this stage would be of little value. It is possible that there will be 'in combination' project-specific construction effects associated with future planning applications, although this can only be assessed at the time of any application. This is consistent with the ACWG guidance on cumulative/in combination assessments.

Effects with strategic development pressure

- 8.4.10 Regional and local plans have been reviewed at a high level to determine whether there are any likely significant 'in combination' effects, with allocation sites identified where possible. This review has not indicated any potential or likely 'in combination' effects that could occur as a result of cumulative development pressure, and in reality the timescales involved in the implementation of the options and the absence of detail on allocation proposals makes any 'in combination' assessment difficult and potentially meaningless. In addition, the construction works required for the WRMP options are temporary and not of a scale or type that would make 'in combination' effects likely.

⁵⁴ <https://infrastructure.planninginspectorate.gov.uk/projects/>

9. HRA Conclusions

9.1 Overview

- 9.1.1 Water company WRMPs are subject to the provisions of the *Conservation of Habitats and Species Regulations 2017* (as amended). DCWW has a statutory duty to prepare a WRMP and is therefore the Competent Authority for the HRA of that plan. This HRA report accompanies the rdWRMP24 that has been published for consultation, and summarises the current assessment of DCWW's preferred portfolio of options against the requirements of the Habitats Regulations. It also documents the iterative HRA process that has been applied through the development of the draft WRMP24.
- 9.1.2 For each option (or group of options, as appropriate), the assessment comprises:
- a 'screening' of European sites within the study area to identify those sites and features where there will self-evidently be 'no effect', 'no likely significant effects', or positive effects due to the option⁵⁵, and those where significant effects are likely or uncertain; and
 - an 'appropriate assessment' of any European sites where significant effects cannot be excluded (this may include 'down-the-line' deferral of some options in accordance with established HRA practice, where appropriate).
- 9.1.3 The conservation objectives are taken into account at the screening and appropriate assessment stages as necessary.

9.2 Screening

- 9.2.1 The screening has concluded that two options (**SEW166 Memorial and Cefn Mably upgrade**; and **SEW052 Afon Lwyd**) will or may significantly affect European sites, specifically:
- SEW166 Memorial and Cefn Mably upgrade:
 - ▶ Severn Estuary Ramsar;
 - ▶ Severn Estuary SPA;
 - ▶ Severn Estuary/ Môr Hafren SAC.
 - SEW052 Afon Lwyd:
 - ▶ River Usk/ Afon Wysg SAC;
 - ▶ Severn Estuary Ramsar;
 - ▶ Severn Estuary SPA;
 - ▶ Severn Estuary/ Môr Hafren SAC.
- 9.2.2 These options and sites have therefore been considered through appropriate assessment.
- 9.2.3 For the remaining options:

⁵⁵ Note, for options with 'no effects' or positive effects there is no possibility of 'in combination' effects.

- The demand-side options will either have:
 - ▶ ‘no effects’ or ‘no significant effects’ on any European sites or features due to nature of the option (e.g. water efficiency advice) or inherent scale/location of any physical interventions (e.g. water meter installation);
 - ▶ effects that must necessarily be assessed ‘down the line’ at the project level (e.g. leakage repairs), but which can self-evidently be delivered without unavoidable adverse effects due to the likely scale of the works, and the availability and reliability of project-level measures for such schemes.
- The other supply-side options will have ‘no effect’ on any European sites or features due to the absence of pathways for effects.

9.2.4 As the options will (with the exception of those noted above) have ‘no effect’ on any European sites (i.e. there are no reasonable pathways for effects), there will not be ‘in combination’ effects between the WRMP options and other plans or projects that require screening. In combination effects are only therefore possible for the European sites taken forward to appropriate assessment.

9.3 Appropriate Assessment

9.3.1 Appropriate assessments were undertaken for those European sites that may be significantly affected by WRMP options (or where there was uncertainty at the screening stage), alone or in combination.

9.3.2 In summary:

- For Option **SEW166** and the **Severn Estuary Ramsar, Severn Estuary SPA or Severn Estuary/ Môr Hafren SAC**:
 - ▶ There will be no operational effects.
 - ▶ Potential construction effects will be very minor due to the scale of the works and can be avoided / prevented entirely using established best-practice measures.
- For Option **SEW052** Afon Lwyd and the **River Usk/ Afon Wysg SAC**:
 - ▶ Potential operational effects on flows (and hence ancillary aspects such as sedimentation, geomorphology or water quality in the Usk estuary) will be negligible and within the favourable conservation status flow thresholds identified in the Core Management Plan for the Usk (notwithstanding that the Afon Lwyd is not part of the SAC); the ALS indicates that water is available for abstraction at the levels proposed by DCWW. The integrity of the populations of the mobile features of the Usk will not therefore be adversely affected if utilising the Afon Lwyd or the tidal Usk as a result of this option.
 - ▶ Potential construction effects will be very minor due to the scale of the works and can be avoided / prevented entirely using established best-practice measures.
- For Option **SEW052** Afon Lwyd and the **Severn Estuary Ramsar, Severn Estuary SPA or Severn Estuary/ Môr Hafren SAC**:
 - ▶ Potential construction effects will be very minor due to the scale of the works and can be avoided / prevented entirely using established best-practice measures.
 - ▶ Potential operational effects on flows (and hence ancillary aspects such as sedimentation, geomorphology or water quality in the Severn estuary or) will be

essentially nil due to the small magnitude of the hydrological impacts relative to non-saline inputs from the Usk catchment and the tidal turnover.

- ▶ The integrity of the populations of the mobile features of these sites will not be adversely affected if utilising the Afon Lwyd or the tidal Usk as a result of this option for the reasons noted above for the **River Usk/ Afon Wysg SAC**.

9.3.3 With regard to 'in combination' effects, the Severn estuary sites (hence the mobile features of the **Severn Estuary SAC / Ramsar** that utilise the River Usk) are potentially exposed to environmental changes associated with options from Severn Trent Water, South Staffs Water, Bristol Water, and Wessex Water. These plans are currently being finalised and detailed information on the preferred options for these companies is not available.

9.3.4 However, based on the dWRMPs for these companies and draft information provided on the likely rdWRMP preferred options, and the effect of DCWW's rdWRMP options, it is considered that:

- there will be no spatially coincident and hence additive in combination effects (i.e. the zone of environmental change for options **SEW052** and **SEW166** will not overlap with those for any other water company options);
- the effects of **SEW052** will be too small alone to present any risk of synergistic or temporal (e.g. coincident, sequential or seasonal displacements) in combination effects that might adversely affect the overall value of the estuary for these species, such that the conservation status of the Usk populations might then be adversely affected (note, the effects of **SEW166** will be 'nil', once mitigation is taken into account).

9.3.5 Therefore, no adverse effects 'in combination' with other water company WRMPs will occur, although it will be necessary to review this aspect prior to finalisation of the rdWRMP and its HRA.

9.3.6 The potential for the WRMP (as a strategic plan) to operate with other strategic plans to have 'in combination' effects on European sites was also considered; no 'in combination' effects were identified.

9.3.7 **Therefore it can be concluded that the WRMP will have no adverse effects, alone or in combination, on the integrity of any European sites.** Note that this conclusion relates to the WRMP-level assessment only and does not remove the need for project-level HRA as the options are developed and delivered. Note, it will be necessary to review this conclusion as part of the finalisation of the rdWRMP and its HRA.

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Appendix A

European sites considered by the HRA process

The table below lists the European sites and their features considered for the assessment of the supply-side options (i.e. sites within 20km of an option, or downstream, or upstream sites supporting fish that may use affected reaches of rivers). Note, all European sites within or close to the DCWW supply area might theoretically be exposed to effects of some demand-side options, but these sites are not listed here for clarity.

Aberbargoed Grasslands SAC

Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)

Marsh fritillary butterfly *Euphydryas* (*Eurodryas*, *Hypodryas*) *aurinia*

Afon Tywi/ River Tywi SAC

Sea lamprey *Petromyzon marinus*

Brook lamprey *Lampetra planeri*

River lamprey *Lampetra fluviatilis*

Allis shad *Alosa alosa*

Twaite shad *Alosa fallax*

Bullhead *Cottus gobio*

Otter *Lutra lutra*

Blackmill Woodlands SAC

Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles

Blaen Cynon SAC

Marsh fritillary butterfly *Euphydryas* (*Eurodryas*, *Hypodryas*) *aurinia*

Brecon Beacons/ Bannau Brycheiniog SAC

European dry heaths

Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels

Calcareous rocky slopes with chasmophytic vegetation

Siliceous rocky slopes with chasmophytic vegetation

Burry Inlet Ramsar

Crit. 5 - regularly supports 20,000 or more waterbirds

Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds

Burry Inlet SPA

Common shelduck *Tadorna tadorna*
 Eurasian wigeon *Anas penelope*
 Eurasian teal *Anas crecca*
 Northern pintail *Anas acuta*
 Northern shoveler *Anas clypeata*
 Eurasian oystercatcher *Haematopus ostralegus*
 Grey plover *Pluvialis squatarola*
 Red knot *Calidris canutus*
 Eurasian curlew *Numenius arquata*
 Common redshank *Tringa totanus*
 Ruddy turnstone *Arenaria interpres*
 Dunlin *Calidris alpina alpina*
 Waterbird assemblage

Caeau Mynydd Mawr SAC

Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)
 Marsh fritillary butterfly *Euphydryas* (*Eurodryas*, *Hypodryas*) *aurinia*

Cardiff Beech Woods SAC

Asperulo-Fagetum beech forests
Tilio-Acerion forests of slopes, screes and ravines

Carmarthen Bay and Estuaries/ Bae Caerfyrddin ac Aberoedd SAC

Sandbanks which are slightly covered by sea water all the time
 Estuaries
 Mudflats and sandflats not covered by seawater at low tide
 Large shallow inlets and bays
Salicornia and other annuals colonizing mud and sand
 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
 Sea lamprey *Petromyzon marinus*
 River lamprey *Lampetra fluviatilis*

Allis shad *Alosa alosa*

Twaite shad *Alosa fallax*

Otter *Lutra lutra*

Cernydd Carmel SAC

Turloughs

Northern Atlantic wet heaths with *Erica tetralix*

European dry heaths

Active raised bogs

Tilio-Acerion forests of slopes, screes and ravines

Coedydd Nedd a Mellte SAC

Tilio-Acerion forests of slopes, screes and ravines

Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles

Crymlyn Bog Ramsar

Crit. 1 - sites containing representative, rare or unique wetland types

Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities

Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity

Crymlyn Bog/ Cors Crymlyn SAC

Transition mires and quaking bogs

Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*

Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)

Cwm Cadlan SAC

Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)

Alkaline fens

Cwm Clydach Woodlands / Coedydd Cwm Clydach SAC

Atlantic acidophilous beech forests with *Ilex* and sometimes also *Taxus* in the shrublayer (*Quercion roboretanae* or *Illici-Fagenion*)

Asperulo-Fagetum beech forests

Glaswelltiroedd Cefn Cribwr/ Cefn Cribwr Grasslands SAC

Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)

Marsh fritillary butterfly *Euphydryas* (*Eurodryas*, *Hypodryas*) *aurinia*

Gower Ash Woods/ Coedydd Ynn Gwyr SAC

Tilio-Acerion forests of slopes, screes and ravines

Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)

Gower Commons/ Tiroedd Comin Gwyr SAC

Northern Atlantic wet heaths with *Erica tetralix*

European dry heaths

Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)

Southern damselfly *Coenagrion mercuriale*

Marsh fritillary butterfly *Euphydryas* (*Eurodryas*, *Hypodryas*) *aurinia*

Kenfig/ Cynffig SAC

Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

Fixed coastal dunes with herbaceous vegetation ("grey dunes")

Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*)

Humid dune slacks

Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.

Petalwort *Petalophyllum ralfsii*

Fen orchid *Liparis loeselii*

Limestone Coast of South West Wales/ Arfordir Calchfaen de Orllewin Cymru SAC

Vegetated sea cliffs of the Atlantic and Baltic Coasts

Fixed coastal dunes with herbaceous vegetation ("grey dunes")

European dry heaths

Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*) (* important orchid sites)

Caves not open to the public

Submerged or partially submerged sea caves

Greater horseshoe bat *Rhinolophus ferrumequinum*

Petalwort *Petalophyllum ralfsii*

Early gentian *Gentianella anglica*

Llangorse Lake/ Llyn Syfaddan SAC

Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* - type vegetation

River Usk/ Afon Wysg SAC

Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitriche-Batrachion* vegetation

Sea lamprey *Petromyzon marinus*

Brook lamprey *Lampetra planeri*

River lamprey *Lampetra fluviatilis*

Allis shad *Alosa alosa*

Twaite shad *Alosa fallax*

Atlantic salmon *Salmo salar*

Bullhead *Cottus gobio*

Otter *Lutra lutra*

Severn Estuary Ramsar

Crit. 1 - sites containing representative, rare or unique wetland types

Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity

Crit. 4 - supports plant/animal species at a critical stage in their life cycles, or provides refuge

Crit. 5 - regularly supports 20,000 or more waterbirds

Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds

Crit. 8 - important source of food for fishes, spawning ground, nursery and/or migration path

Severn Estuary SPA

Tundra swan *Cygnus columbianus bewickii*

Common shelduck *Tadorna tadorna*

Gadwall *Anas strepera*

Common redshank *Tringa totanus*

Greater white-fronted goose *Anser albifrons albifrons*

Dunlin *Calidris alpina alpina*

Waterbird assemblage

Severn Estuary/ Môr Hafren SAC

Sandbanks which are slightly covered by sea water all the time

Estuaries

Mudflats and sandflats not covered by seawater at low tide

Reefs

Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

Sea lamprey *Petromyzon marinus*

River lamprey *Lampetra fluviatilis*

Twaite shad *Alosa fallax*

[Usk Bat Sites/ Safleoedd Ystlumod Wysg SAC](#)

European dry heaths

Degraded raised bogs still capable of natural regeneration

Blanket bogs (* if active bog)

Calcareous rocky slopes with chasmophytic vegetation

Caves not open to the public

Tilio-Acerion forests of slopes, screes and ravines

Lesser horseshoe bat *Rhinolophus hipposideros*

Appendix B

Notes on Effect Pathways

Table B1 (from UKWIR 2021) and the following paragraphs outline some of the general assumptions that are typically (and reliably) applied to plan-level assessments where effect pathways are imaginable but not quantifiable at the plan level. These are applied cautiously, recognising that there is always a risk of atypical scenarios, but have been proved to be generally robust across a wide range of scenarios.

Table B1 Potential Impacts of Plan Options (from UKWIR 2021)

Broad categories of potential impacts on European sites, with examples	Examples of operations responsible for impacts (distance assumptions in italics)
<p>Physical loss:</p> <ul style="list-style-type: none"> Removal (including offsite effects, e.g. foraging habitat, and removal of supporting habitat within boundary of a SPA) Smothering 	<p>Development of infrastructure associated with scheme, e.g. new or temporary pipelines, transport infrastructure, temporary weirs.</p> <p>Indirect effects from a reduction in flows e.g. drying out marginal habitat.</p> <p>Physical loss is most likely to be significant where the boundary of the scheme extends within the boundary of the European site, or within an offsite area of known foraging, roosting, breeding habitat (that supports species for which a European site is designated).</p>
<p>Physical damage:</p> <ul style="list-style-type: none"> Sedimentation / silting Prevention of natural processes including coastal and fluvial bank stabilisation, prevention of long-shore drift etc. Habitat degradation Erosion Fragmentation Severance/barrier effect Edge effects 	<p>Reduction in river flow leading to permanent and/or temporary loss of available habitat, sedimentation/siltation, fragmentation, etc.</p> <p>Physical damage is likely to be significant where the boundary of the scheme extends within or is directly adjacent to the boundary of the European site, or within/adjacent to an offsite area of known foraging, roosting, breeding habitat (that supports species for which a European site is designated, or where natural processes link the scheme to the site, such as through hydrological connectivity downstream of a scheme, long shore drift along the coast, or the scheme impacts the linking habitat).</p>
<p>Non-physical disturbance:</p> <ul style="list-style-type: none"> Noise (incl. underwater) Visual presence Human presence Light pollution Vibration (incl. underwater). 	<p>Noise from temporary construction or temporary pumping activities.</p> <p>Taking into consideration the noise level generated from general building activity (c. 122dB(A)) and considering the lowest noise level identified in appropriate guidance as likely to cause disturbance to bird species, it is concluded that noise impacts</p>

Broad categories of potential impacts on European sites, with examples	Examples of operations responsible for impacts (distance assumptions in italics)
	<p>could be significant up to 1km from the boundary of the European site⁵⁶.</p> <p>Noise from vehicular traffic during operation of a scheme.</p> <p>Noise from construction traffic is only likely to be significant where the transport route to and from the scheme is within 3-5km of the boundary of the European site.</p> <p>Plant and personnel involved in in operation of the scheme.</p> <p>These effects (noise, visual/human presence) are only likely to be significant where the boundary of the scheme extends within or is directly adjacent to the boundary of the European site, or within/adjacent to an offsite area of known foraging, roosting, breeding habitat (that supports species for which a European site is designated).</p> <p>Schemes which might include artificial lighting, e.g. for security around a temporary pumping station.</p> <p>Effects from light pollution are only likely to be significant where the boundary of the scheme is within 500m of the boundary of the European site.</p> <p>Vibration from temporary construction</p> <p>From a review of Environment Agency internal guidance on HRA and various websites/sources^{57,58,59} it is considered that effects of vibration are more likely to be significant if development is within 500m of a European site.</p>
<p>Water table/availability:</p> <ul style="list-style-type: none"> • Drying • Flooding / stormwater • Changes to surface water levels and flows including both increases and reductions. • Changes in groundwater levels and flows • Changes to coastal water movement 	<p>Changes to water levels and flows due to increased water abstraction, reduced storage or reduced flow releases from reservoirs to river systems.</p> <p>These effects are only likely to be significant where the boundary of the scheme extends within the same ground or surface water catchment as the European site. However, these effects are dependent on hydrological continuity between the scheme and the European site, and sometimes, whether the scheme is up or down stream from the European site.</p>

⁵⁶ British Standards Institute (BSI) (2009) BS5228 - Noise and Vibration Control on Construction and Open Sites. BSI, London.

⁵⁷ Institute of Lighting Professionals (2011) Guidance Notes for the Reduction of Obtrusive Light GN01:2011

⁵⁸ Environment Agency (2013) Bird Disturbance from Flood and Coastal Risk Management Construction Activities. Overarching Interpretive Summary Report. Prepared by Cascade Consulting and Institute of Estuarine and Coastal Studies.

⁵⁹ Cutts N, Hemingway K and Spencer J (2013) The Waterbird Disturbance Mitigation Toolkit Informing Estuarine Planning and Construction Projects. Produced by the Institute of Estuarine and Coastal Studies (IECS). Version 3.2.

Broad categories of potential impacts on European sites, with examples

Examples of operations responsible for impacts (distance assumptions in italics)

<p>Toxic contamination:</p> <ul style="list-style-type: none"> • Water pollution • Soil contamination • Air Pollution 	<p>Reduced dilution in downstream or receiving waterbodies due to changes in abstraction or reduced compensation flow releases to river systems.</p> <p>These effects are only likely to be significant where the boundary of the scheme extends within the same ground or surface water catchment as the European site. However, these effects are dependent on hydrological continuity between the scheme and the European site, and sometimes, whether the scheme is up or down stream from the European site.</p> <p>Air emissions associated with plant and vehicular traffic during construction and operation of schemes.</p> <p>The effect of dust is only likely to be significant where site is within or in proximity to the boundary of the European site^{60,61}. Without mitigation, dust and dirt from the construction site may be transported onto the public road network and then deposited/spread by vehicles on roads up to 500m from large sites, 200m from medium sites, and 50m from small sites as measured from the site exit.</p> <p>Effects of road traffic emissions from the transport route to be taken by the project traffic are only likely to be significant where the protected site falls within 200 metres of the edge of a road affected⁶².</p>
<p>Non-toxic contamination:</p> <ul style="list-style-type: none"> • Nutrient enrichment (e.g. of soils and water) • Algal blooms • Changes in salinity • Changes in water chemistry (e.g. pH, calcium balance etc) • Changes in thermal regime • Changes in turbidity <p>Changes in sedimentation/silting</p>	<p>Changes to water salinity, nutrient levels, turbidity, thermal regime due to increased water abstraction, storage, or reduced compensation flow releases to river systems.</p> <p>These effects are only likely to be significant where the boundary of the scheme extends within the same ground or surface water catchment as the European Site. However, these effects are dependent on hydrological continuity between the scheme and the European site, and sometimes, whether the scheme is up or down stream from the European site.</p>
<p>Biological disturbance:</p> <ul style="list-style-type: none"> • Direct mortality • Changes to habitat availability • Out-competition by non-native species • Selective extraction of species • Introduction of disease 	<p>Potential for changes to habitat availability, for example reductions in wetted width of rivers leading to desiccation of macrophyte beds due to changes in abstraction or reduced compensation flow releases to river systems. In addition, via removal of vegetation (including hedgerows and trees) used by based as foraging, roosting and hibernation sites and birds as roosting and nesting sites.</p> <p>Creation of new pathway of non-native invasive species.</p>

⁶⁰ Highways Agency (2003) Design Manual for Roads and Bridges (DMRB), Volume 11.

⁶¹ Institute of Air Quality Management (2014) Guidance on the assessment of dust from demolition and construction v1.1.

⁶² NE Internal Guidance – Approach to Advising Competent Authorities on Road Traffic Emissions and HRAs V1.4 Final - June 2018

Broad categories of potential impacts on European sites, with examples	Examples of operations responsible for impacts (distance assumptions in italics)
<ul style="list-style-type: none"> Rapid population fluctuations Natural succession	<p>This effect is only likely to be significant where the scheme is situated within the European site or an upstream tributary of the European site (or affects groundwater levels supporting these sites or tributaries)</p> <p>Entrapment during in-river or terrestrial construction works causing injury and/or mortality of mobile species</p> <p>Likely to be a risk of entrapment, injury and/or mortality where the boundary of the option extends within or is directly adjacent to the boundary of a European site or within/adjacent to offsite functionally linked habitat. Mobile species could include fish, bats and European otters for example.</p> <p>Potential for changes to habitat availability via removal of vegetation (including hedgerows and trees) to facilitate construction activities and potential entrapment, injury and/or mortality of breeding birds and roosting/hibernating bats.</p> <p>This effect is dependent on the requirement to remove vegetation (if it cannot be avoided), ecological surveys to determine species presence and timing of removal based on species specific ecological considerations.</p>

In addition:

Water resource sensitive features

The EA has previously published advice on qualifying species and habitats that it considers to be water-resource dependent (*National EA guidance: Habitats Directive Stage 2 Review: Water Resources Authorisations – Practical Advice for Agency Water Resources Staff*). This is not reproduced here, but as a general rule most species are not considered water resource dependent with the exception of aquatic features (fish, otter) and wildfowl and waders associated with estuarine and wetland sites. Wide-ranging marine / marine dependent species associated with marine sites that are not directly connected to the hydrological zone of influence are not typically considered to be both sensitive and exposed to the effects of the options (except in certain relatively unique circumstances, such as some desalination schemes).

Estuarine birds and freshwater flows

Several studies have suggested that the number and densities of wintering waterbirds around estuarine freshwater channels are consistently greater than across associated mudflats, and that several bird species show significant preferences for freshwater flow areas over mudflats (e.g. Ravenscroft et al. (1997), Ravenscroft (1998, 1999), Ravenscroft & Beardall (2002) & Ravenscroft & Emes (2004)), although other studies have indicated that deeply incised channels associated with large volume inflows are less attractive to birds (Ravenscroft & Beardall, 2002).

There are a number of possible mechanisms for this. Correlations between freshwater flow and particle size (e.g. Ravenscroft & Emes (2004)), and substrate particle size distribution and invertebrate distribution have been recognised (e.g. Goss-Custard et al. (1991), Colwell and Landrum (1993), Yates et al. (1993)). Freshwater flow, salinity and invertebrate distribution have also been correlated (Kelly (2001)).

These physical relationships between invertebrate distributions and freshwater flows are important since there are numerous studies detailing relationships between overwintering waterbirds and the densities or distributions of their invertebrate prey (e.g. Goss-Custard et al. (1991), Colwell (1993), Colwell and Landrum (1993), Yates et al. (1993), Dierschke et al. (1999), Ravenscroft et al. (2002, 2004). Associations between bird densities and particle size (Granadeiro et al. 2004) have also been recognised.

Possible relationships between birds and freshwater flows were investigated in detail through a series of studies in The Swale SPA/Ramsar and the Medway Estuary and Marshes SPA/Ramsar (RPS 2004a, 2004b, 2004c, 2005a; Humpheryes & Kellett 2003). These studies found few consistent patterns, however; for example:

- Whilst the general relationship of birds and creek corridors (rather than channels) was usually replicated between watercourses and embayments, the species assemblage was variable between creeks and years, suggesting that creek-specific variables may be less important for determining the community composition than environmental or community processes operating in the wider estuary or beyond. Most species (67%) displayed no, or a negative, association with creeks (70% when feeding behaviour only was considered).
- Latitudinal relationships between creeks and invertebrates were inconsistent, with only a slight tendency for invertebrate biomass to be higher within the creek corridor than the channel or surrounding mudflats.
- Significant decreases in invertebrate abundance and biomass down longitudinal gradients (potentially related to greater exposure to tidal processes) were recorded, although bird numbers showed the opposite (i.e. greater numbers towards the sea), perhaps reflecting greater foraging accessibility due to interstitial water, or less disturbance.

Furthermore, no significant differences in the usage of creeks by birds were recorded between freshwater creeks and those that were predominantly saline.

A broad consensus position appears to be that it is not freshwater flow volumes *per se* that are critical to the bird / intertidal channel relationship, rather the presence of some flows within channels to maintain morphology, and that bird distributions are often influenced instead by estuary-wide factors (e.g. changes in disturbance levels, reductions in bird populations altering estuary usage, proximity of roost sites), local factors (e.g. the role of creek morphology or substrate penetrability) and small-scale interactions (e.g. inter and intra-specific bird relationships, or prey availability associated with behavioural or physiological responses to intertidal exposure).

Bat species and functional land

Bat species associated with UK SACs are not considered 'water resource sensitive' and so (in the absence of substantial habitat changes caused by operational aspects (e.g. draining of a wetland or replacement of extensive foraging habitat with a reservoir; or introduction of light etc. sources that may disrupt commuting or seasonal movements), their exposure to the outcomes of the WRMP will be limited to incidental effects from construction. In most instances potential effects will not be specifically identifiable or quantifiable (as the locations of works are not necessarily defined, and field surveys would not typically be undertaken at plan level).

UK bat species do not typically travel substantial distances (i.e. tens of kilometres) when foraging and the Bat Conservation Trust has therefore identified Core Sustenance Zones (CSZs) – defined as *“the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the resilience and conservation status of the roost”* – for UK bat species; the CSZs for all UK species have a radius of 4km or less, with the exception of the CSZ for barbastelle (6km). This can be cautiously applied to bat SACs, although it is recognised that

many roosts used by SAC bat populations will not be within the boundaries of the SAC. In general, therefore, unavoidable adverse effects would not be expected unless significant permanent land-take within those zones is likely; virtually all other potential effects are avoidable with normal good practice in planning and design, and with established mitigation measures that are known to be effective – although these inevitably cannot be defined above the project level.

Birds and construction noise / visual disturbance

The **exposure** of any birds using the reservoir to **noise** and **visual disturbance** associated with the development will depend on several factors, including:

- the sound power level of the machinery;
- the principal habitats and locations used by the birds species (and hence the distance from the source of any disturbance);
- attenuating factors (such as screening by topography, buildings or vegetation);
- the seasonal timing of the works;
- background noise levels in this area⁶³.

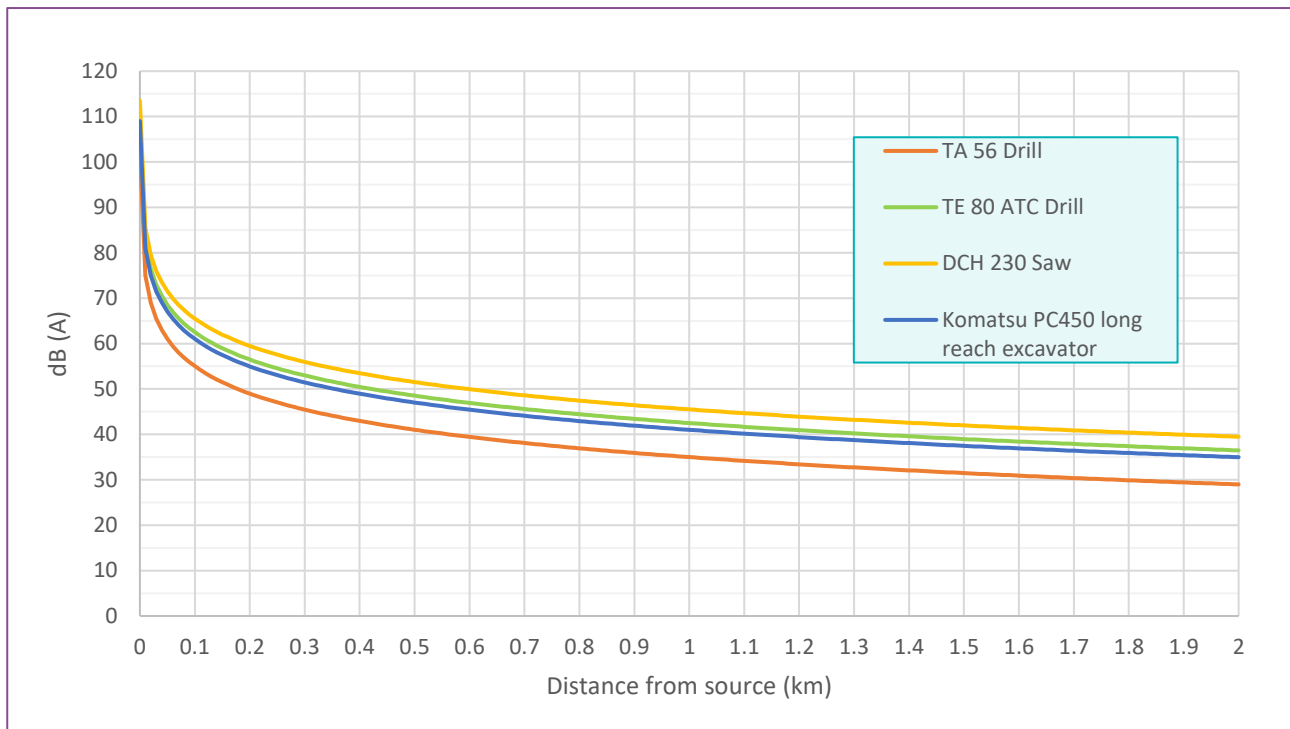
The sensitivity of the interest features will depend on their behavioural characteristics, their general tolerance / habituation to existing or new activities at a site, and the extent to which avoidance behaviours are achievable. This may also vary during the year (for example, most bird species will be more sensitive when nesting as avoidance behaviours are more constrained).

With regard to noise, a typical long-reach excavator has sound power level of ~109 dB(A); drills and saws have sound power level between 103 dB(A) and 114 dB(A). Without any barriers, the noise level of the loudest equipment used would attenuate to around 55dB(A) within 300m, and to 50 dB(A)⁶⁴ within 600m due to distance alone (see Figure B1).

⁶³ Noise levels do not operate additively, so the dB levels in an area are not the sum of the component sources.

⁶⁴ As a guide, 60dB(A) is approximately equivalent to a conversation; 50dB(A) is approximately equivalent to the level associated with a quiet suburb or light traffic (which is unlikely to be reached except at night in this area).

Figure 9.1 Approximate attenuation of equipment noise with no barriers



With regard to visual disturbance, sensitivity may be broadly correlated with size, with larger species typically having greater ‘flush distances’ (the distances at which birds typically move when approached by people). Laursen *et al.* (2005) determined that the mean flush distance for shelduck was 225 m; 319 m for brent geese; but only 70 m for dunlin (a much smaller species).

Cutts *et al.* (2009)⁶⁵ provide a useful review of available data on bird disturbance. It makes particular reference to noise and disturbance investigations studies undertaken during sea defence works, which included piling works. These studies identified disturbance levels for various activities associated with construction, based on observations of bird responses, which are summarised in **Table B2** below.

Table B2 Construction activities and disturbance of estuarine birds (Cutts *et al.* 2009)

Activity	Observed Disturbance Level
Personnel and plant on mudflat	High
Personnel and plant on seaward toe and face	High to Moderate
Intermittent plant and personnel on crest	High to Moderate
Irregular piling noise (above 70 dB)	High to Moderate
Long term plant and personnel on crest	Moderate

⁶⁵ Cutts N., Phelps A. & Burdon D. (2009) *Construction and waterfowl: defining sensitivity, response, impacts and guidance*. Report to Humber INCA by the Institute of Estuarine and Coastal Studies, University of Hull

Activity	Observed Disturbance Level
Regular piling noise (below 70dB)	Moderate
Irregular noise (50-70 dB)	Moderate
Regular noise (50-70dB)	Moderate to low
Occasional movement of the crane jib and load above sight-line	Moderate to low
Noise below 50 dB	Low
Long-term plant only on crest	Low
Activity behind flood bank (inland)	Low

Key:	
High	} Maximum response; preparing to fly away and flying away, may leave area altogether
Moderate-high	
Moderate	
Moderate-low	} Head turning, scanning behaviour, reduced feeding, movement to other areas close by (decreasing response)
Low	
	} No effect

The study also records the following observations from other construction schemes on the Humber:

- Piling activity on the landward side of the sea wall at Pyewipe (southern shore), associated with construction of a pumping station, had no disturbance effect on birds in January, February and March; the numbers and distributions of birds were similar during periods with and without piling. Disturbance only occurred when construction was moved to the seaward-side of the sea wall in April.
- Six years of bird monitoring associated with the construction of the Humber International Terminal (HIT) concluded that most disturbance only caused birds to move over a small area, and that the HIT development did not have a significant effect on usage of the area by birds.

In general, therefore, effects from noise and visual disturbance during construction typically have a limited range and duration, are reversible, and do not result in long-term adjustments in bird behaviours (such that they might constitute an adverse effect).

Air Quality Effects from Construction Schemes

A number of pollutants have a negative effect on air quality; however, the most significant and relevant to habitats and species (particularly plant species) are the primary pollutants sulphur dioxide (SO₂, typically from combustion of coal and heavy fuel oils although this has declined substantially), nitrogen oxides (NO_x, mainly from vehicles) and ammonia (NH₃, principally from agriculture), which (together with secondary aerosol pollutants⁶⁶) are deposited as wet or dry deposits. These pollutants affect habitats and species mainly through acidification and eutrophication.

⁶⁶ Secondary pollutants are not emitted, but are formed following further reactions in the atmosphere; for example, SO₂ and NO_x are oxidised to form SO₄²⁻ and NO₂⁻ compounds; ozone is formed by the reaction of other pollutants (e.g. NO_x or volatile organic compounds) with UV light; ammonia reacts with SO₄²⁻ and NO₂⁻ to form ammonium (NH₄⁺).

Acidification increases the acidity of soils, which can directly affect some organisms and which also promotes leaching of some important base chemicals (e.g. calcium), and mobilisation and uptake by plants of toxins (especially metals such as aluminium).

Air pollution contributes to eutrophication within ecosystems by increasing the amounts of available nitrogen (N)⁶⁷. This is a particular problem in low-nutrient habitats, where available nitrogen is frequently the limiting factor on plant growth, and results in slow-growing low-nutrient species being out-competed by faster growing species that can take advantage of the increased amounts of available N.

Overall in the UK, there has been a significant decline in SO_x and NO_x emissions in recent years and a consequential decrease in acid deposition. In England, SO_x and NO_x have declined by 97% and 72% respectively since 1970 (Defra, 2018) which is the result of a switch from coal to gas, nuclear and renewables for energy generation, and increased efficiency and emissions standards for cars. These emissions are expected to decline further in future years with the transition to electric vehicles. In contrast, emissions of ammonia have remained largely unchanged; they have declined by 10% in England since 1980 (Defra, 2018), but since 2008 have started to increase slightly.

The effect of SO_x and NO_x decreases on ecosystems has been marked, particularly in respect of acidification; the key contributor to acidification is now thought to be deposited nitrogen, for which the major source (ammonia emissions) has not decreased significantly. Indeed, eutrophication from N-deposition (again, primarily from ammonia) is now considered the most significant air quality issue for many habitats.

In terms of the exposure of designated sites to air quality changes associated with construction, this tends to be considered on a case-by-case basis. However, the Department of Transport's *Transport Analysis Guidance*⁶⁸ states that "**beyond 200m, the contribution of vehicle emissions from the roadside to local pollution levels is not significant**" and this distance is typically applied to construction schemes also when considering the potential for European sites to be exposed to any local effects associated with emissions to air. However, it should be noted that concentrations and deposition of traffic-generated pollutants do not decline linearly with distance from the road; typically, air pollution levels fall sharply within the first 20 – 30m before declining more slowly with increased distance⁶⁹. Concentrations and deposition will also be affected by physical parameters, such as local topography or vegetation structure.

Highways England's *Design Manual for Roads and Bridges* (DMRB) sets out an approach for assessing the effect of emissions from specific road schemes on designated sites; this suggests that a quantitative air quality assessment may be required if a European site is within 200m of an affected road and the predicted change in annual average daily traffic (AADT) is over 1000. It should be noted that this is 'in combination' with other projects (etc.), but this is a relatively large increase which

- would not be met by the vast majority of construction schemes when considering either vehicle access to the site / deliveries, or the equivalent movement / use of construction plant); and
- is assumed to be permanent (which is not the case for most construction).

Although it is not simple to apply 'rule of thumb' estimates to relationships between traffic volumes and N-deposition (as this is influenced by a number of factors), it is worth noting that the DMRB

⁶⁷ Nitrogen that is in a form that can be absorbed and used by plants.

⁶⁸ See <http://www.dft.gov.uk/webtag/documents/expert/unit3.3.3.php#013>; accessed 15/06/14.

⁶⁹ For example, recent air quality modelling by Wood of a new link road at an MoD establishment in the UK found that an Average Annual Daily Traffic (AADT) increase of ~7,000 increased nitrogen deposition by 0.21 kg N/ha/yr at the worst receptor point (at the immediate kerbside), and that by 25m from the road the increase in N-deposition was zero.

guidance regarding air quality thresholds is based on the assumption that 1,000 extra vehicles is equivalent to ~0.01 kg N/ha/yr (this is obviously a coarse figure and there are other factors that come into play such as the emissions factors used for opening year/ wind direction / number of HGVs / speed etc.). The EA-accepted threshold for 'significant effects' on habitats to be possible is an increase of >1% of the minimum critical load⁷⁰.

Air quality modelling and assessment is unlikely to be achievable at the WRMP level due to the absence of information on scheme design and construction approaches; and arguably not proportionate. However, it is clear that in the vast majority of cases emissions associated with construction schemes are of a magnitude that (a) will not exceed the thresholds for significant or significant adverse effects (even if relatively close to a site), and which (b) can be reliably managed or avoided using standard and unexceptional avoidance and mitigation measures, if required.

⁷⁰ The 1% threshold is used as it is accepted that levels below this are difficult to measure and not typically distinguishable from background fluctuations. An exceedance of 1% of the critical load should be seen as a 'starting point' for assessing the significance of any effects; the Institute of Air Quality Management (IAQM) position statement on air quality effects notes that "*it is the position of the IAQM that the use of a criterion of 1% of an assessment level in the context of habitats should be used only to screen out impacts that will have an insignificant effect. It should not be used as a threshold above which damage is implied and is therefore used to conclude that a significant effect is likely.*"

Appendix C

Standard Mitigation and Avoidance Measures

Overview

The 'avoidance measures' that may be applied to the options are detailed below, and are grouped as follows:

- General Measures (established construction best-practice, etc.) which will be applied to all options;
- Option-specific Measures (established and reliable measures identified to avoid specific potential effects on European sites, such as in relation to mobile species from the sites).

These measures will be applied unless project-level HRAs or project-specific environmental studies demonstrate that they are not required (i.e. the anticipated effect will not occur), not appropriate, or that alternative or additional measures are necessary or more appropriate.

Note that these measures are not exhaustive or exclusive and must be reviewed at the project stage, taking into account any changes in best-practice as well as scheme-specific survey information or studies.

General Measures and Principles

Scheme Design and Planning

All options will be subject to project-level environmental assessment as they are brought forward, which will include assessments of their potential to affect European sites during their construction or operation. These assessments will consider or identify (inter alia):

- opportunities for avoiding potential effects on European sites through design (e.g. alternative pipeline routes; micro siting; etc);
- construction measures that need to be incorporated into scheme design and/or planning to avoid or mitigate potential effects - for example, ensuring that sufficient working area is available for pollution prevention measures to be installed, such as sediment traps;
- operational designs required to ensure no adverse effects occur (e.g. screening, additional treatment, etc.) – although note that these measures can only be identified through detailed investigation schemes and agreed through the project-level HRA process.

Pollution Prevention

The habitats of European sites are most likely to be affected indirectly, through site-derived pollutants, rather than through direct encroachment. There is a substantial body of general construction good-practice which is likely to be applicable to all of the proposed options and can be

relied on (at this level) to prevent significant or adverse effects on a European site occurring as a result of construction site-derived pollutants. The following guidance documents detail the industry best-practices in construction that are likely to be relevant to the proposed schemes:

- Environment Agency Pollution Prevention Guidance Notes⁷¹, including:
 - ▶ PPG1: General guide to the prevention of pollution (May 2001);
 - ▶ PPG5: Works and maintenance in or near water (October 2007);
 - ▶ PPG6: Pollution prevention guidance for working at construction and demolition sites (April 2010);
 - ▶ PPG21: Pollution incident response planning (March 2009);
 - ▶ PPG22: Dealing with spillages on highways (June 2002);
- Environment Agency (2001) Preventing pollution from major pipelines [online]. Available at www.environment-agency.gov.uk/static/documents/Business/pipes.pdf. [Accessed 1 March 2011];
- Venables R. et al. (2000) Environmental Handbook for Building and Civil Engineering Projects. 2nd Edition. Construction Industry Research and Information Association (CIRIA), London.

The best-practice procedures and measures detailed in these documents will be followed for all construction works derived from the DWMP as a minimum standard, unless scheme-specific investigations identify additional measures and/or more appropriate non-standard approaches for dealing with potential site-derived pollutants.

General measures for species

Most species-specific avoidance or mitigation measures can only be determined at the scheme level, following scheme-specific surveys, and 'best-practice' mitigation for a species will vary according to a range of factors that cannot be determined at the strategic (DP) level. In addition, some general 'best-practice' measures may not be relevant or appropriate to the interest features of the European sites concerned (for example, clearing vegetation over winter is usually advocated to avoid impacts on nesting birds; however, this is unlikely to be necessary to avoid effects on some SPA species (such as overwintering estuarine birds) and the winter removal of vegetation might actually have a negative effect on these species through disturbance). However, the following general measures will be followed to minimise the potential for impacts on species that are European site interest features unless project level environmental studies or HRA indicate that they are not required or not appropriate, or that alternative or additional measures are more appropriate/necessary:

- Scheme design will aim to minimise the environmental effects by 'designing to avoid' potential habitat features that may be used by species that are European site interest features when outside the site boundary (e.g. linear features such as hedges or stream corridors; large areas of scrub or woodland; mature trees; etc.) through scheme-specific routing studies.
- The works programme and requirements for each option will be determined at the earliest opportunity to allow investigation schemes, surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with NRW/NE.

⁷¹ Note, the Environment Agency Pollution Prevention Guidance Notes have been withdrawn by the Government, although the principles within them are sound and form a reasonable basis for pollution prevention measures.

- Night-time working, or working around dusk/dawn, should be avoided to reduce the likelihood of negative effects on nocturnal species.
- Any lighting required (either temporary or permanent) will be designed with an ecologist to ensure that potential 'displacement' effects on nocturnal animals, particularly SAC bat species, are avoided.
- All compounds/pipe stores etc. will be sited, fenced or otherwise arranged to prevent vulnerable SAC species (notably otters) from accessing them.
- All materials will be stored away from commuting routes/foraging areas that may be used by species that are European site interest features.
- All excavations will have ramps or battered ends to prevent species becoming trapped.

Pipe-caps must be installed overnight to prevent species entering and becoming trapped in any laid pipe-work.

