United Utilities

Final Water Resources Management Plan 2019: Habitats Regulations Assessment

Screening and Appropriate Assessment

August 2019

Amec Foster Wheeler Environment & Infrastructure UK Limited

Report for

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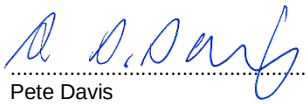

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Document revisions

No.	Details	Date
1	Draft for client review	Nov 2017
2	Consultation version	Nov 2017
3	Final report	Nov 2017
4	Final report published	Feb 2018
5	Revised Draft WRMP HRA Draft for client review	Aug 2018
6	Revised Draft WRMP HRA	Aug 2018
7	Final WRMP HRA	Aug 2019

Executive summary

Background

All water companies in England and Wales must set out their strategy for managing water resources across their supply area over the next 25 years. This statutory requirement is defined under the Water Act 2003, which also sets out how water companies should publish a Water Resources Management Plan (WRMP) for consultation, setting out how they will balance supply and demand over the 25-year planning period. United Utilities (UU) has finalised its WRMP for the period 2020 to 2045 (and beyond).

The WRMP process identifies potential deficits in the future availability of water, taking into account:

- abstraction volumes allowed under current statutory licences, as impacted by actual source yield;
- any future reductions in abstraction expected under environmental improvement regimes (e.g. sustainability reductions required due to the Review of Consents or Water Framework Directive); and
- predicted future demand for water based on government data for population and housing growth plans.

It then proposes solutions ('Preferred Options') for maintaining the balance between water available and future demand for water.

As part of the preparation of WRMP19, UU published its Draft Water Resources Management Plan (Draft WRMP) for consultation between 2nd March and 25th May 2018, following submission to Defra in December 2017. The Draft WRMP set out UU's Preferred Plan for WRMP19, including preferred resource and demand management options designed to enhance leakage reduction; improve levels of service for drought permits and orders; and to support water trading with other water companies. The Preferred Plan also sought to address resilience issues associated with the regional aqueduct system that supplies water from the Lake District to the Greater Manchester and Pennine areas (including parts of Lancashire and south Cumbria) by providing options known as 'Manchester and Pennine Resilience' solution.

UU subsequently selected its preferred Manchester and Pennine Resilience Solution and modified the Preferred Plan for WRMP19, taking into account the consultation responses from regulators, stakeholders and the public on the Draft WRMP, as well as further engagement and environmental assessment. A 'Revised Draft WRMP' was subsequently prepared and, along with the Statement of Response to the consultation, was submitted to the Secretary of State for approval in August 2018. The Revised Draft WRMP included further increases to the leakage reductions contained within the Draft WRMP.

Following a review of the Statement of Response to the consultation and the changes made in the Revised Draft WRMP, Defra requested more information on the plan. United Utilities responded to this request in April 2019. Following the receipt of direction to publish the Final WRMP from the Secretary of State for Environment, Food and Rural Affairs, United Utilities has published the Final WRMP.

The Final WRMP is unchanged from the Revised Draft WRMP, except that the timing of some of the leakage options has altered, bringing forward the leakage savings in order to achieve a 20% leakage reduction by 2025 instead of 15% as set out in the Revised Draft WRMP. Water trading has not been included in the Final WRMP as potential importing companies did not selected imports from the north west in their preferred WRMPs during the core 25-year period of the planning horizon. However, whilst, water trading does not form part of UU's Final Plan, it remains the company's preference to continue to work with others on water trading beyond WRMP19 and into the WRMP24 planning round. The strategy to facilitate a potential future trade has therefore been retained within an adaptive pathway, which could form a future preferred plan if water trading was subsequently required in future.

Regulation 63 of the *Conservation of Habitats and Species Regulations 2017* (the 'Habitats Regulations') states that if a plan or project is "*(a) is likely to have a significant effect on a European site*[1] *or a European offshore marine site*[2] *(either alone or in combination with other plans or projects); and (b) is not directly connected with or necessary to the management of that site*" then the competent authority must "*…make an appropriate assessment of the implications of the plan or project for that site in view of that site's conservation objectives*" before the plan is given effect.

The process by which Regulation 63 is met is known as Habitats Regulations Assessment (HRA)[3]. 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) and, if so, whether these effects will result in any adverse effects on the site's integrity. UU has a statutory duty to prepare its WRMP and is therefore the Competent Authority for any HRA.

UU commissioned Amec Foster Wheeler Environment and Infrastructure UK Ltd (Amec Foster Wheeler, now Wood) to undertake the data collection and interpretation required to support HRA of its WRMP for the period 2020 to 2045, and to determine whether any aspects of the WRMP (alone or in-combination) could have significant or significant adverse effects on the integrity of any European sites. The HRA process (as applied to the WRMP) included the following steps:

i. An initial review of the Feasible Options, to assist UU's selection of Preferred Options.

ii. A formal assessment of the Preferred Options, comprising screening and (where necessary) an 'appropriate assessment', which accompanied the Preferred Options consultation.

iii. A formal assessment of the post-consultation revised Preferred Options, which form the Revised Draft WRMP and which would be intended for adoption.

iv. A formal assessment of the Final WRMP following SoS review (this report).

This report summarises Wood's assessment of UU's Final WRMP 2019 against the conservation objectives of any European sites that may be affected and summarises the iterative HRA process that has been undertaken to support the WRMP and ensure that it meets the requirements of Regulation 63.

Assessment summary

One UU Water Resource Zone (the Strategic Resource Zone) has a very small (~3 Ml/d) baseline deficit towards the end of the planning period, prior to implementing further demand management reductions included in the plan.

UU's Final WRMP 2019 includes the following strategic choices:

- Adopt an enhanced leakage reduction comprising a total of 190 Ml/d over the planning period, a reduction of just over 40% from the baseline position of 448Ml/d. By the end of 2024/25 UU plans to reduce leakage by at least 91 Ml/d, or 20%.

[1] Strictly, 'European sites' are: any Special Area of Conservation (SAC) from the point at which the European Commission and the UK Government agree the site as a 'Site of Community Importance' (SCI); any classified Special Protection Area (SPA); any candidate SAC (cSAC); and (exceptionally) any other site or area that the Commission believes should be considered as an SAC but which has not been identified by the Government. 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') apply; 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 176; TAN5 para 5.1.3) when considering development proposals that may affect them. "European site" is therefore used in this report in its broadest sense, as an umbrella term for all of the above designated sites. Additional information on European site designations is provided in Appendix A.

[2] 'European offshore marine sites' are defined by Regulation 15 of *The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007* (as amended); these regulations cover waters (and hence sites) over 12 nautical miles from the coast.

[3] The term 'Appropriate Assessment' has been historically used to describe the process of assessment; however, the process is now more accurately termed 'Habitats Regulations Assessment' (HRA), with the term 'Appropriate Assessment' limited to the specific stage within the process.

- Improve level of service for drought permits and orders to augment supply from 1 in 20 years to 1 in 40 years (moving from 5% to 2.5% annual average risk).
- Increase resilience to other hazards, specifically for the regional aqueduct system associated with Manchester and Pennines Resilience. This involves completing Solution D, which involves rebuilding all single line sections of the relevant aqueduct.

It should be noted that the Final WRMP 2019 does not include a water trading component. This is because a water trade from the north west is not included in the preferred plans of other water companies at this stage. However, water trading remains a preference for United Utilities and the company will continue to work with others on water trading beyond WRMP19 towards the WRMP24 planning round.

The options included within the Final WRMP are summarised in **Table NTS1**.

Table NTS1 Final Preferred Options

Ref	Option Name	Description	Saving (Ml/d)	Delivery (AMP)
Preferred Manchester and Pennine Resilience Solution D				
112	Manchester and Pennine Aqueduct Outage (4 weeks) for installation of connections	Manchester and Pennine Aqueduct Outage (4 weeks) for installation of connections	N/A	AMP7 – AMP8
37-42	Manchester and Pennine Aqueduct sections T01 to T06	This option would provide protection against structural failure of an existing single pipe section of the Manchester and Pennine Aqueduct and would be used for the conveyance of treated water. This option would involve the construction of new 2.6m diameter conduits and a 2.85m diameter tunnel for a total length of approximately 51.9km, and new connection chambers and isolating penstocks.	N/A	AMP7 – AMP8
Preferred Demand Management Options – Leakage Reduction and Network Metering				
WR500a	Leakage reduction stage 1	Preferred options WR500a to WR500e would involve an increase in leakage detection and repair activity through the installation of PMVs over an 11 year period. Activities for Stages 1 to 5 would be as follows: • Stage 1: A total of 276 leakage surveys, 510 repairs and 10 PMV installations would be undertaken. • Stage 2: An additional 339 leakage surveys, 510 repairs and 13 PMV installations would be undertaken • Stage 3: An additional 332 leakage surveys, 408 repairs and 12 PMV installations would be undertaken. • Stage 4: An additional 520 leakage surveys, 510 repairs and 19 PMV installations would be undertaken. • Stage 5: An additional 692 leakage surveys, 510 repairs and 26 PMV installations would be undertaken.	10	AMP7
WR500b	Leakage reduction stage 2		20 (including Stage 1)	AMP7
WR500c	Leakage reduction stage 3		28 (including Stages 1 and 2)	AMP7
WR500d	Leakage reduction stage 4		38 (including Stages 1 to 3)	AMP8
WR500e	Leakage reduction stage 5		41 (including Stages 1 to 4)	AMP9
WR500f	Leakage reduction stage 6	Preferred options WR500f to WR500k would involve additional leakage detection and repair activity (to that already set out for Stages 1 – 5) through the installation of noise loggers over a six year period. Activities for Stages 6 to11 would be as follows: • Stage 6: A total of 85 leakage surveys, 511 repairs and 4,424 noise logger installations would be undertaken.	4.99	AMP7
WR500g	Leakage reduction stage 7		9.81 (including Stage 6)	AMP7
WR500h	Leakage reduction stage 8		19.81 (including Stages 6 to 7)	AMP7

Ref	Option Name	Description	Saving (Ml/d)	Delivery (AMP)
WR500i	Leakage reduction stage 9	• Stage 7: An additional 104 leakage surveys, 625 repairs and 8,148 noise logger installations would be undertaken. • Stage 8: An additional 225 leakage surveys, 1,350 repairs and 20,083 noise logger installations would be undertaken. • Stage 9: An additional 231 leakage surveys, 1,388 repairs and 25,575 noise logger installations would be undertaken. • Stage 10: An additional 257 leakage surveys, 1,542 repairs and 29,235 noise logger installations would be undertaken. • Stage 11: An additional 112 leakage surveys, 671 repairs and 17,098 noise logger installations would be undertaken.	29.95 (including Stages 6 to 8)	AMP7
WR500j	Leakage reduction stage 10		39.90 (including Stages 6 to 9)	AMP7
WR500k	Leakage reduction stage 11		45.23 (including Stages 6 to 10)	AMP7
WR503	Monitoring of household meters to identify and fix supply pipe leaks	This preferred option would involve the proactive monitoring of all domestic meters to identify and fix supply pipe leaks over a 5 year period.	3.81	AMP7
WR514	Logging of large customers	This preferred option would involve the logging of large customers over a 5 year period (it is assumed that 10% of those temporarily logged would become permanent). This would require the installation of loggers to all customers identified as having high consumption (above 500 l/hr) in either District Metering Areas (DMAs) with poor operability or DMAs with good operability in order to assess which customers have the largest impact on the operability within DMAs. Logged customers would be setup in Netbase and their night use allowances would be updated to reflect the percentage of night use to daily consumption which should have a positive impact on operability and leakage.	1.07	AMP7
WR515	Splitting District Metering Areas	This preferred option includes a study of non-operable DMAs over a 5 year period to determine the reason(s) why a DMA is not currently operable, and subsequently, to carry out appropriate actions to remedy any identified issues and/or constraints. The option scope includes office design, hydraulic modelling and site investigation in addition to the construction of chambers, installation of meters and the repair of pipework and ancillary equipment.	2.15	AMP7
WR517	Upstream tiles enhancements	This preferred option would involve initial desk studies and site visits to determine the validity of identified faults before replacing existing, and installing a mixture of new, full bore meters and probes on existing United Utilities' infrastructure over a 5 year period.	3.57	AMP7
WR907d	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 20% Highest Leakage	This option would involve the survey and repair of customer-side supply pipes and plumbing leaks by Third Party or United Utilities over a 5 year period.	54.0	AMP9
WR907e	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 1.5% Highest Leakage	This preferred option would involve the survey and repair of customer-side supply pipes and plumbing leaks by a Third Party or United Utilities over a 5 year period.	2.12	AMP7
WR907f	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% Highest Leakage	This preferred option would involve the survey and repair of customer-side supply pipes and plumbing leaks by a Third Party or United Utilities over a 5 year period.	10.53	AMP8
WR907g	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% Highest Leakage	This preferred option would involve the survey and repair of customer-side supply pipes and plumbing leaks by a Third Party or United Utilities over a 5 year period.	10.53	AMP9

Ref	Option Name	Description	Saving (Ml/d)	Delivery (AMP)
WR912	Third Party 2 - Proposal to reduce customer water demand for UU by 5 Ml/day across AMP	This option would involve the reduction of customer side leakage at non-household properties.	5.0	AMP7
WR914	Third Party - Cello 4S and Regulo	This preferred option would involve surveys and the installation of pressure management devices by a Third Party over a 5 year period together with ongoing maintenance to be undertaken by United Utilities.	4.0	AMP8

The HRA focuses on the options proposed to resolve predicted deficits and address resilience. It does not assess the existing consents regime: the examination of the potential impacts of existing individual consents on European designated sites was undertaken by the Environment Agency (EA) (NRW in Wales) through the Review of Consents (RoC) process (with abstraction sustainability now considered a a component of Water Framework Directive (WFD) assessments) and the HRA of the WRMP cannot and should not replicate this. Any licence amendments required by RoC or WFD to safeguard European sites are factored into the Deployable Output calculations, and the EA has confirmed that the reviewed consents are valid for the planning period. Consequently, the WRMP will only affect European sites through any new resource and production-side options it advocates to resolves deficits, and not through the existing permissions regime.

Table NTS2 summarises the screening and (where necessary) appropriate assessment of the revised preferred options (note, this is consistent with the recent case law known as 'People Over Wind'[4]).

[4] Case C 323/17 Court of Justice of the European Union: People Over Wind

Table NTS2 Summary of plan-level assessment of options (including 'in combination' effects and incorporated measures)

Option	Aspect	LSE	AE	Summary of Assessment	Key avoidance / mitigation measures
Demand management – demand reduction	Construction	N	-	Demand management options will not involve any construction that could result in significant effects.	-
	Operation	N	-	Options cannot negatively affect European sites.	-
Demand management – leakage reduction and network metering options	Construction	U	N	Potential construction effects of leakage options cannot be identified at the plan-level (no location information) and so any assessment of the effects of individual leakage repairs can only be made at the scheme level.	▶ Established best-practice avoidance and mitigation measures (Appendix G).
	Operation	N	-	Options cannot negatively affect European sites.	-
Option 112	Construction	N	-	No development required under this option (essentially enabling works for Option 37-42).	-
	Operation	N	-	Option is a temporary outage of the Manchester and Pennine Aqueduct to allow connections for Option 37-42; can be timed / managed to ensure that potential supply restrictions do not indirectly affect any European sites through additional exploitation of other sources.	-
Option 37-42	Construction	Y	N	Option is a major construction scheme involving works within 20km of ~22 European sites; however, most sites are not exposed to the environmental changes likely to be associated with the scheme (distance or absence of effect pathways). Adverse effects on those sites that may be exposed (Bowland Fells SPA, River Kent SAC, Morecambe Bay & Duddon Estuary SPA, Morecambe Bay Ramsar, Morecambe Bay SAC) can be avoided using normal best-practice mitigation measures (which are likely to ensure that effects 'alone' are nil, so avoiding the risk of 'in combination' effects). An in combination assessment has not identified any potential effects with other plans, projects or programmes.	▶ Established best-practice avoidance and mitigation measures (Appendix G). ▶ **River Kent SAC**: in addition to normal project-level planning and best-practice, construction of the scheme will avoid the main migration and spawning periods for salmon (which are critical to the lifecycle of the Freshwater mussel feature) to minimise the risk of displacement or barrier effects due to noise, vibration or site-derived pollutants, unless scheme-specific analyses demonstrate that any effects associated with construction works will be 'not significant', or will have no adverse effect on the integrity of the SAC in the absence of these measures.
	Operation	N	-	Option does not require any alterations to abstraction (etc) regimes (improves system resilience only).	

Conclusion

The ‘plan-level’ assessment of the options summarised in the table above incorporates the ‘in combination’ assessment conclusions and takes account of the general and option-specific mitigation or avoidance measures that will be employed at the project-level. The HRA of the Final WRMP 2019 concludes that the plan will have **no adverse effects, alone or in combination**, on any European sites taking into account established scheme-level mitigation and avoidance measures that will clearly be available, achievable and likely to be effective. This conclusion does not remove the need for consideration of Regulation 63 at the project-level, which will be required to address those aspects and uncertainties that cannot be meaningfully assessed at the plan-level, such as potential ‘in combination’ effects with forthcoming plans or projects that may coincide with option delivery.

Contents

1. Introduction

United Utilities (UU) has out its strategy for managing its water resources over the next 25 years in its Water Resources Management Plan (WRMP). This plan is subject to the *Conservation of Habitats and Species Regulations 2017* and so requires an assessment of its effects on European sites, known as 'Habitats Regulations Assessment' (HRA).

1.1 Water Resources Planning

All water companies in England and Wales must set out their strategy for managing water resources across their supply area over the next 25 years. This statutory requirement is defined under the Water Act 2003, which also sets out how water companies should publish a Water Resources Management Plan (WRMP) for consultation, setting out how they will balance supply and demand over the 25-year planning period. United Utilities (UU) has now finalised its WRMP for the period 2020 to 2045 and beyond.

The WRMP process identifies potential deficits in the future availability of water and sets out the possible solutions required to maintain the balance between water available and future demand for water. The process initially reviews as many potential solutions as possible (the 'unconstrained list' of options) to identify 'feasible' options for each Water Resource Zone (WRZ) where deficits are predicted. These 'feasible' options are reviewed according to an industry standard methodology to identify 'Preferred Options' to resolve any supply deficits in relation to financial, environmental and social costing. This preferred list is based on standard assessment methodologies set out in the WRMP, as well as the Strategic Environmental Assessment (SEA) and the Habitats Regulations Assessment (HRA). The WRMP is also linked to other water resource planning and policy documents, including the Drought Plan.

United Utilities Draft and Revised Draft Water Resources Management Plan

As part of the preparation of WRMP19, United Utilities published its Draft Water Resources Management Plan (Draft WRMP) for consultation between 2nd March and 25th May 2018, following submission to Defra in December 2017. The Draft WRMP set out United Utilities preferred resource management and demand management options designed to enhance leakage reduction, improve levels of service for drought permits and orders and support water trading. The Draft WRMP additionally sought to address the risk associated with the regional aqueduct system that supplies water from the Lake District to the Greater Manchester and Pennine areas (including parts of Lancashire and south Cumbria) through a number of options referred to as the 'Manchester and Pennine Resilience' solution.

In developing the Draft WRMP, United Utilities undertook a comprehensive assessment of future available water supplies and the demand for water, extensive stakeholder engagement and a rigorous process of options identification and appraisal. In this context, Amec Foster Wheeler Environment and Infrastructure UK Ltd (Amec Foster Wheeler, now Wood) was commissioned by United Utilities to undertake a Habitats Regulations Assessment[5] (HRA) of the Draft WRMP, the findings of which were presented in a report[6] that was published alongside the Draft WRMP for consultation in March 2018. A further report[7] presenting an assessment of potential Manchester and Pennine Resilience solutions was also prepared and made available to support the consultation.

[5] In fulfilment of Regulation 63 of the Conservation of Habitats and Species Regulations 2017

[6] Amec Foster Wheeler (2018) *Water Resources Management Plan 2019 - Habitats Regulations Assessment of the Draft WRMP*. Report for UU ref. B38671rr101i4. Amec Foster Wheeler, Shrewsbury.

[7] Amec Foster Wheeler (2018) *Technical note: Habitats Regulations Assessment of the Draft Water Resources Management Plan 2019: Resilience Options Initial Assessment*. Report for UU ref. B38671rr097i4. Amec Foster Wheeler, Shrewsbury.

UU subsequently selected its preferred Manchester and Pennine Resilience Solution and modified the Preferred Plan for WRMP19, taking into account the consultation responses from regulators, stakeholders and the public on the Draft WRMP, as well as further engagement and environmental assessment. A 'Revised Draft WRMP' was subsequently prepared and, along with the Statement of Response to the consultation, was submitted to the Secretary of State for approval in August 2018. The Revised Draft WRMP included further increases to the leakage reductions contained within the Draft WRMP.

Following a review of the Statement of Response to the consultation and the changes made in the Revised Draft WRMP, Defra requested more information on the plan. United Utilities responded to this request in April 2019.

The Final WRMP 2019

United Utilities has published the Final WRMP 2019 following the receipt of direction to publish from the Secretary of State for Environment, Food and Rural Affairs. The Final WRMP is unchanged from the Revised Draft WRMP, except that the timing of some of the leakage options has altered, bringing forward the leakage savings in order to achieve a 20% leakage reduction by 2025 instead of 15% as set out in the Revised Draft WRMP. Water trading has not been included in the Final WRMP as potential importing companies did not selected imports from the north west in their preferred WRMPs during the core 25-year period of the planning horizon (which defined the 'needs' in the UU plan, albeit that the plans are tested out to the 2080s). However, whilst water trading does not form part of UU's Final Plan, it remains the company's preference to continue to work with others on water trading beyond WRMP19 and into the WRMP24 planning round. The strategy to facilitate a potential future trade has therefore been retained within an adaptive pathway, which could form a future preferred plan if water trading is required in the future. Appendix H of this report contains a summary of the assessment of the water trading option considered as part of the Draft WRMP, although it should be noted that this is for information only as these proposals are not included in the Final WRMP.

The Final WRMP identifies options to meet the following objectives:

- Adopt an enhanced leakage reduction comprising a total of 190 Ml/d over the planning period, a reduction of just over 40% from the baseline position of 448Ml/d. By the end of 2024/25 UU plans to reduce leakage by at least 91 Ml/d, or 20%.
- Improve level of service for drought permits and orders to augment supply from 1 in 20 years to 1 in 40 years (moving from 5% to 2.5% annual average risk).
- Increase resilience to other hazards, specifically for the regional aqueduct system associated with Manchester and Pennines Resilience. This involves completing Solution D, which involves rebuilding all single line sections of the relevant aqueduct.

As part of the ongoing HRA process, the assessments contained in the HRA reports for the Draft WRMP and Revised Draft WRMP have been reviewed and updated in order to ensure that the effects on European sites of the Final WRMP have been fully characterised and assessed. This updated HRA presents the findings of this assessment.

1.2 Habitats Regulations Assessment

Regulation 63 of the *Conservation of Habitats and Species Regulations 2017* (the 'Habitats Regulations') states that if a plan or project is "*(a) is likely to have a significant effect on a European site*[8] *or a European*

[8] Strictly, 'European sites' are: any Special Area of Conservation (SAC) from the point at which the European Commission and the UK Government agree the site as a 'Site of Community Importance' (SCI); any classified Special Protection Area (SPA); any candidate SAC (cSAC); and (exceptionally) any other site or area that the Commission believes should be considered as an SAC but which has not been identified by the Government. 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') apply; 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. 176; TAN5 para. 5.1.3) when considering development proposals that may affect them. "European site" is therefore used in this report in its

offshore marine site[9] *(either alone or in combination with other plans or projects); and (b) is not directly connected with or necessary to the management of that site*" then the competent authority must "…*make an appropriate assessment of the implications of the plan or project for that site in view of that site's conservation objectives*" before the plan is given effect.

The process by which Regulation 63 is met is known as Habitats Regulations Assessment (HRA)[10]. 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) and, if so, whether these effects will result in any adverse effects on the site's integrity. UU has a statutory duty to prepare its WRMP and is therefore the Competent Authority for any HRA.

1.3 This Report

Regulation 63 essentially provides a test that the final plan must pass; there is no statutory requirement for HRA to be undertaken on draft plans or similar developmental stages (e.g. the unconstrained or Feasible Options). However, it is accepted best-practice for the HRA of strategic planning documents to be run as an iterative process alongside plan development, with the emerging proposals or options assessed for their possible effects on European sites and modified or abandoned (as necessary) to ensure that the subsequently adopted plan is not likely to result in significant or significant adverse effects on any European sites, either alone or 'in combination' with other plans. This is undertaken in consultation with Natural England (NE), Natural Resources Wales (NRW) and other appropriate consultees.

UU commissioned Wood (formerly Amec Foster Wheeler) to undertake the data collection and interpretation required to support an HRA of its WRMP for the period 2020 – 2045, and to determine whether any aspects of the WRMP (alone or in-combination) could have significant or significant adverse effects on the integrity of any European sites. The HRA process (as applied to the WRMP) included the following steps:

i. An initial review of the Feasible Options, to assist UU's selection of Preferred Options.

ii. A formal assessment of the Preferred Options, comprising screening and (where necessary) an 'appropriate assessment', which accompanied the Preferred Options consultation.

iii. A formal assessment of the post-consultation revised Preferred Options, which form the Revised Draft WRMP and which would be intended for adoption.

iv. A formal assessment of the Final WRMP following SoS review (this report).

This report summarises Wood's assessment of UU's Final WRMP 2019 against the conservation objectives of any European sites that may be affected and summarises the iterative HRA process that has been undertaken to support the WRMP and ensure that it meets the requirements of Regulation 63. The report sets out:

- the approach to HRA of WRMPs, including the key issues for these strategic plans (Section 2);
- a summary of the Feasible Options review (Section 3);
- the screening and (where required) appropriate assessment of the Final WRMP options and the WRMP as a whole, including 'in combination' assessments (Section 4);
- the conclusion of the HRA of UU's WRMP 2019 (Section 5).

It should be noted that some of UU's consultation draft Preferred Options (notably, the options required to ensure that 'spare' water is available for trading) have not been included as options in the Final WRMP. In the case of the proposed water trading option, this was because a water trade from the north west was not

broadest sense, as an umbrella term for all of the above designated sites. Additional information on European site designations is provided in Appendix A.

[9] 'European offshore marine sites' are defined by Regulation 15 of *The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007* (as amended); these regulations cover waters (and hence sites) over 12 nautical miles from the coast.

[10] The term 'Appropriate Assessment' has been historically used to describe the process of assessment; however, the process is now more accurately termed 'Habitats Regulations Assessment' (HRA), with the term 'Appropriate Assessment' limited to the specific stage within the process.

included in the revised WRMPs of other water companies. As a result, the options required to facilitate water-trading are not longer included in the Final WRMP or its HRA. However, to support any future work on a potential future trade, Appendix H of this report contains a summary of the assessment of the water trading option considered as part of the Draft WRMP.

2. Approach to HRA of WRMPs

WRMPs identify specific measures for addressing predicted deficits, but the strategic nature of the WRMP creates some challenges for HRA as there are fundamental limitations on the scheme details and data that are available at the plan-level. This section summarises the approach used for HRAs of WRMPs, and the mechanisms employed to address residual uncertainties.

2.1 Plan-Level HRA

An HRA involves determining whether there will be any LSEs on any European sites as a result of a plan's implementation, either on its own or 'in combination' with other plans or projects (referred to as 'screening'); and, if so, whether it can be concluded that these effects will not have an adverse effect on the site's integrity (referred to as 'appropriate assessment'). European Commission guidance[11] suggests a four-stage process for HRA, although not all stages will always be required (see **Box 3**).

Box 1 Stages of Habitats Regulations Assessment

Stage 1 – Screening:
This stage identifies the likely impacts upon a European site of a project or plan, either alone or 'in combination' with other projects or plans, and considers whether these impacts are likely to be significant.

Stage 2 – Appropriate Assessment:
Where there are likely significant effects, or where this is uncertain, this stage considers the effects of the plan or project on the integrity of the relevant European Sites, either alone or 'in combination' with other projects or plans, with respect to the sites' structure and function and their conservation objectives. Where it cannot be concluded that there will be no adverse effects on sites' integrity, it is necessary to consider potential mitigation for these effects.

Stage 3 – Assessment of Alternative Solutions:
Where adverse effects remain after the inclusion of mitigation, this stage examines alternative ways of achieving the objectives of the project or plan that avoid adverse impacts on the integrity of European sites.

Stage 4 – Assessment Where No Alternative Solutions Exist and Where Adverse Impacts Remain:
This stage assesses compensatory measures where it is deemed that 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.

The 'screening' test or 'test of significance' is a low bar: a plan should be considered 'likely' to have an effect if the competent authority (in this case UU) is unable (on the basis of objective information) to exclude the possibility that the plan could have significant effects on any European site, either alone or in combination with other plans or projects; an effect will be 'significant' if it could undermine the site's conservation objectives.

An 'appropriate assessment' stage provides a more detailed examination of the plan (or its components) where the effects are significant or uncertain[12], to determine whether there will be any 'adverse effects on integrity' (AEoI) of any sites as a result of the plan. It should be noted that the approach to the 'appropriate assessment' is not prescribed: it must simply be 'appropriate' to the plan being considered and the scale and nature of the likely effects; and be sufficient to remove any residual uncertainties regarding the effect of the proposals on site and feature integrity.

The approach summarised in **Box 1** works well at the project-level where the scheme design is usually established and possible effects on European sites can be assessed (usually quantitatively) using a stepwise process and detailed scheme-specific data. In contrast, the fundamental nature of the WRMP presents a number of distinct challenges for a 'strategic' HRA and it is therefore important to understand how the WRMP is developed, how it would operate in practice, and hence how it might consequently affect European sites. In particular, there is a potential conflict between the specific nature of the options; the requirement that the

[11] *Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC* (EC 2002).
[12] i.e. 'likely significant effects', where the possibility of significant effects cannot be excluded.

options (and hence the plan) have 'no likely significant effects (LSE)' or 'no adverse effects'; the level of certainty that can be established at the strategic level; and the desirability of not excluding every potential solution which cannot be conclusively investigated within the WRMP development timescales.

2.2 The WRMP

The WRMP process establishes supply and demand balances for the UU WRZs, identifying potential supply deficits between water available and the projected demand within each WRZ. Options are then proposed to resolve these deficits. The estimation of Deployable Output (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 (e.g. sustainability reductions required due to the Review of Consents (see **Appendix B**) or Water Framework Directive); and
- predicted future demand for water based on government data for population and housing growth plans.

Demand forecasts are completed in accordance with the *Water Resources Planning Guidelines* (with the interim update published by the Environment Agency and Natural Resources Wales in July 2018[13]) 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:
  - population changes, including changes in occupancy;
  - changes in water use behaviour (in both household and non-household customers);
  - metering;
  - increasing water efficiency and sustainable water use practices;
  - changing design standards of devices that use water (e.g. more efficient washing machines);
  - changes in .and practices for leakage detection and repair;
  - climate change; and
  - weather patterns.

The WRMP therefore accounts for these demand forecasts based on historical trends, an established growth forecast model, and a thorough review of water resource policy and planning documents.

The WRMP process initially sets out an 'unconstrained list' of possible solutions regardless of cost or technical merit. This is then refined to identify '**Feasible Options**' and subsequently the '**Preferred Options**'. This filtering process is based on a range of assessments including SEA and the principles of Habitats Regulations Assessment. The list of Feasible Options is subject to financial, environmental and social costing, with these options then reviewed and assessed to derive 'Preferred Options' for the zones that are predicted to be in deficit within the planning horizon (25 years).

[13] https://cdn.naturalresources.wales/media/686174/interim-wrpg-update-july18-final-changes-highlighted.pdf [Accessed August 2018].

Options to resolve deficits or forecast deficits can be broadly categorised as follows:

- **Production and Resource Management** - options that vary yield (e.g. new abstractions) or which reduce/ modify usage from where it is abstracted to where it enters the network;
- **Customer-side Management** - options which reduce customers' consumption; and
- **Distribution Management** - options within or affecting the distribution network, such as leakage reduction or new distribution pipelines.

These are also characterised as '**demand management**' measures (options which reduce consumption post-treatment, such as metering or leakage reduction) or '**resource management**' measures (options that vary yield).

The HRA focuses on the resource management options[14] and their potential effects. Resource management options will generally 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 regime (e.g. additional abstraction);
- 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; or
- transferring water from adjacent water companies with a supply / demand surplus.

Following consultation on the Draft WRMP and further work on the supply-demand balance, UU is predicting a very small baseline deficit (~3 Ml/d) in its Strategic WRZ toward the end of the planning period (i.e. 2044/2045) in the Final WRMP.

In addition, WRMPs have a remit to assess non-drought hazards for water supply resilience, to reduce the risk of asset failure. In consequence, UU additionally identified a need to enhance resilience to non-drought hazards; the largest resilience risk being that associated with the regional aqueduct system that supplies water from the Lake District to the Greater Manchester and Pennine areas including parts of Lancashire and south Cumbria. The condition of a particular aqueduct is deteriorating over time and presents a risk in terms of both water quality and water supply. This risk could, in the future, result in a widespread water quality incident (for example, advice to boil water for drinking purposes for over a million properties) or loss of supply to many thousands of properties for an extended period. The development of solutions to address the risks of aqueduct deterioration (and its consequences) to the Strategic Resource Zone is collectively referred to as 'Manchester and Pennine Resilience'.

2.3 HRA of the WRMP

The HRA focuses on the resource management options proposed to resolve predicted deficits, and options for increasing resilience. It does not assess the existing consents regime: the examination of existing individual consents was undertaken by the Environment Agency (EA) (NRW in Wales) through the Review of Consents process[15] and the HRA of the WRMP cannot and should not replicate this. Any licence amendments required by RoC or WFD (see **Appendix B**) are factored into the DO calculations, and the EA has confirmed that these are valid for the planning period. Consequently, the WRMP will only affect

[14] 'Demand management' options (i.e. options designed to reduce water use such as metering or provision of water butts) are considered unlikely to have any significant or adverse effects on any European sites (see Section 2.3).

[15] Abstraction sustainability is now addressed partly through Water Framework Directive assessments.

European sites through any new resource and production-side options it advocates to resolves deficits, or through capital resilience schemes, and not through the existing permissions regime[16].

The various resource management options could affect European sites through their implementation (for example, construction of new pipelines) or operation (e.g. new abstractions), and these effects can broadly be categorised as:

- **direct** (activities that affect a European site directly; for example, construction of a new intake within an SPA reservoir; discharges to an SAC from a desalination plant; new or increased abstractions from an SAC river);
- **indirect** (activities that affect a European site indirectly through an impact pathway; for example, construction affecting a downstream SAC through sediment release; new abstractions entraining SAC fish species away from the SAC itself); or
- **consequential** (for example, adjusting or stopping a bulk transfer between water resource zones, or between water companies, may have indirect 'consequential' effects on distant European sites if this results in additional abstraction to make up a shortfall; this is more typically a type of 'in combination' effect).

The HRA of the WRMP must consider any European sites that could be affected by the implementation of the Plan, whether they are within the geographical boundaries of the UU supply area or not. When determining this it is also necessary to consider potential 'in combination' effects; these are possible cumulative effects on European sites caused by the WRMP, together with the effects of any existing or proposed projects or plans[17]. However, it must be recognised that many of the possible 'in combination' effects (particularly with respect to water resources and land-use plans) are explicitly considered and accounted for as part of the WRMP development process (see below).

As noted, the HRA of the WRMP focuses on the 'resource management' options only. It does not explicitly consider demand- or post-distribution options designed to reduce treated water use (such as metering or provision of water butts), or leakage reduction options, as it is considered that these cannot negatively affect any European sites[18].

The HRA process (as applied to the WRMP) therefore includes the following steps:

i. An initial review of the Feasible Options, to assist UU's selection of Preferred Options.

ii. A formal assessment of the Preferred Options, comprising screening and (where necessary) an 'appropriate assessment', which accompanied the Preferred Options consultation.

iii. A formal assessment of the post-consultation revised Preferred Options, which form the Revised Draft WRMP and which would be intended for adoption.

iv. A formal assessment of the Final WRMP following SoS review (this report).

For each step, the assessment identifies the location and the anticipated outcomes of each option based on the option descriptions provided by UU. GIS is then used to identify all European sites within a precautionary 20km 'zone of influence', with sites beyond this considered where reasonable impact pathways are present based on the scheme description (for example, receptors downstream of significant new abstractions). This is a suitably precautionary approach that has important advantages due to the

[16] It is recognised that, occasionally, the sustainability reductions agreed through the RoC process have been subsequently shown to be insufficient to address the effects of PWS abstraction on some sites (the most notable example is the River Ehen in Cumbria); UU are not aware of any current uncertainties regarding its abstractions or the RoC outcomes, although any such uncertainties that are subsequently identified can be addressed through the five-yearly WRMP review process.

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

[18] The only realistic mechanism for a negative effect would through direct encroachment or proximal effects at the local-level (for example a leaking pipe might be located in or near a SAC), but this cannot be meaningfully assessed at the strategic level since location-specific information on the options is not available without specific investigations, which would form part of the package (i.e. the precise location and severity of most leakages is not known ahead of detection). Any assessment of these effects must necessarily be deferred to the project-level (see 'Mitigating Uncertainty and 'down the line' assessment, below) and the WRMP does not imply any approval for options or remove the need for project-level assessments.

number of Feasible Options and the benefits of a consistent approach[19]. The possible effects of each option on European sites and their interest features is then assessed, based on:

- the anticipated operation of each option and predicted zone of hydrological influence[20];
- any predicted construction works required for each option[21];
- 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).

Data collection

Data on the Feasible and Preferred Options are provided by UU. These data include descriptions of each option; the likely outcomes (design yields/capacities); the scheme requirements; the type and indicative location of any works; and an outline of how the option would function. Further information on general water resources was obtained from UU (e.g. groundwater (GW) and surface water (SW) abstraction locations, source operational parameters, WRZ operation, emergency or drought plan operations) and the EA / NRW.

Data on European site locations; interest features; conservation objectives; and condition assessments were collected from the Joint Nature Conservation Committee (JNCC), Natural Resources Wales (NRW) and Natural England (NE). These data were used to determine the locations of the sites relative to the options; the condition, vulnerabilities and sensitivities of the sites and their interest features; and the approximate locations of the interest features within each site (if reported). European sites within 20km of the UU supply area and their interest features are listed in **Appendix C**, although it should be noted that sites outside this area were also considered where there was a potential risk of effects from an option. **Appendix D** identifies those European site interest features considered 'water resource dependent' by the EA.

Review of Feasible Options

The Feasible Options review is reported in the following Amec Foster Wheeler Technical Notes (see **Appendix E**):

- *UU WRMP 2019: Habitats Regulations Assessment – Initial Review of Feasible Options*. Report Ref. S38671n071i2; and
- *UU WRMP 2019: Habitats Regulations Assessment – Additional Feasible Options Review*. Report Ref. S38671078i1.

The Feasible Options reviews are not 'draft HRAs', 'screening', or similar assessment of the final plan and are not intended to provide a definitive conclusion on the likely effects of the WRMP or its options; rather, the assessment principles that underpin the HRA process are applied to the Feasible Options to:

- guide the selection of Preferred Options by UU; and

[19] 'Arbitrary' buffers are not generally appropriate for HRA. However, as distance is a strong determinant of the scale and likelihood of most effects, the considered use of a suitably precautionary search area as a starting point for the screening (based on a thorough understanding of both the options and European site interest features) has some important advantages. Using buffers allows the systematic identification of European sites using GIS, so minimising the risk of sites or features being overlooked, and also ensures that sites where there are no reasonable impact pathways can be quickly and transparently excluded from any further screening or assessment. When assessing multiple options it also has the significant advantage of providing 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.

[20] Note that for groundwater sources and groundwater fed habitats, the EA consider that significant effects as a result of ground water abstractions are unlikely on 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*). This premise is applied to the option assessments.

[21] Note that the location of some works, particularly pipelines outside UU-owned land, are only tentatively defined by the WRMP. In these instances, the 'to' and 'from' locations were identified and a broad study area used to identify any European sites that could potentially be affected by a route between these locations.

- inform the scope of any further assessments likely to be required as the options are refined and developed, including any data likely to be required to support the selection of an option as a Preferred Option.

A detailed 'in combination' assessment is not undertaken at the Feasible Options stage although the potential for options to operate 'in combination' with each other, and with other UU plans (e.g. the Drought Plan) is considered but not explicitly reported; the 'in combination' assessment is completed at the Preferred Options stage. The review of the Feasible Options assumes that normal best-practice project level planning, avoidance and mitigation measures (see **Appendix G**) will be employed at project delivery (see also 'Assessment Assumptions', below).

Preferred Options assessment

The Preferred Options assessment employs the assessment principles used at the Feasible Option stage, with the addition of an 'in combination' assessment (see below). For each option, the Preferred Options assessment comprises:

- a 'screening' of European sites to identify those sites and features where there will self-evidently be 'no effect' (as opposed to 'no likely significant effects') due to the option[22], and those where significant effects are likely or uncertain; and
- an 'appropriate assessment' of any options where significant effects cannot be excluded.

The Preferred Option assessments are set out in Section 4. Note that the 'low-bar' principle has been used for the screening of the Preferred Options; any reasonable impact pathways identified are investigated further in an appropriate assessment rather than through a more detailed 'secondary screening' or similar. Consequently, the appropriate assessment is 'appropriate' to the nature or the WRMP, and the scale and likelihood of any effects. Undertaking an appropriate assessment does not necessarily imply a conclusion of 'significant effects' for those sites or aspects that are 'screened in' since in many cases the assessment is completed due to a residual uncertainty which the assessment is intended to resolve. The 'appropriate assessment' stage may therefore conclude that the proposals are likely to have an adverse effect on the integrity of a site (in which case they should be abandoned, modified, or otherwise mitigated); or that option will have no adverse effects (i.e. an effect pathway exists, but those effects will not undermine site integrity); or that the effects will, if re-screened, be 'not significant' (taking into account the additional assessment or perhaps additional measures proposed for inclusion in the final plan).

Assessment assumptions

Several assumptions are made during the option assessment process; in summary, the assessments assume that

- the existing consents regime (confirmed under the RoC and taking into account any required sustainability reductions) is effectively a 'no adverse effect' baseline and that options that operate within the terms of existing licences will have 'no adverse effect';
- that there is 'water available for use' where this is confirmed by the EA through the relevant Catchment Abstraction Management Strategy; and
- that all normal licensing and consenting procedures will be employed at option delivery, including project-level HRA.

Since the Draft WRMP consultation, it should be noted that recent case law known as 'People Over Wind'[23] has altered how avoidance and mitigation measures are accounted for by the HRA. The 'People Over Wind' judgement states that "…*it is not appropriate, at the screening stage, to take account of the measures intended to avoid or reduce the harmful effects [mitigation] of the plan or project on that site*". This contrasts

[22] Note, for options with 'no effects' there is no possibility of 'in combination' effects.

[23] Case C 323/17 Court of Justice of the European Union: People Over Wind

with established practice in this area (based on the “Dilly Lane” judgment) where avoidance and mitigation measures have typically been accounted for during screening.

There is currently little information on the practical implementation of the ‘People over Wind’ judgement, particularly for strategy-level HRA, although broad guidance has been issued by the Planning Inspectorate (PINS)[24]. In previous WRMP rounds, HRAs of WRMPs typically assumed that established best-practice avoidance and mitigation measures (see **Appendix G**) would be employed at the project level throughout scheme design and construction 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.

In this instance, therefore:

- As the Feasible Options review has no statutory basis[25] the established scheme-level best-practice avoidance and mitigation measures noted in **Appendix G** are accounted for when considering the likelihood of a European site or feature being affected by an option. This is to ensure that the HRA process provides robust, proportionate and pragmatic information for UU to factor in to its consideration of the Feasible Options and choice of Preferred Options.
- For the revised Preferred Options, which constitute the plan being proposed and assessed, the established best-practice avoidance and mitigation measures noted in **Appendix G** are not taken into account at screening, but are instead introduced at the ‘appropriate assessment’ stage (if required).

In combination effects

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. The ‘two-tier’ nature of the WRMP (i.e. a plan with specific schemes) also complicates this assessment.

Broadly, it is considered that the WRMP could have the following in combination effects:

- within-plan effects - i.e. separate options within the WRMP affecting the same European site(s);
- 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.

In undertaking the ‘in combination’ assessment it is critical to note that:

- the Review of Consents (RoC) process has completed an ‘in combination’ assessment for all currently licensed abstractions (and many unlicensed abstractions);
- the RoC underpins the WRMP, which also explicitly accounts for land-use plans, growth forecasts and population projections when calculating future water demand (and hence areas with potential deficits);

[24] PINS Note 05/2018: *Consideration of avoidance and reduction measures in Habitats Regulations Assessment: People over Wind, Peter Sweetman v Coillte Teoranta*.

[25] i.e. there is no statutory requirement for HRA to be undertaken on draft plans or similar developmental stages (e.g. the unconstrained or Feasible Options).

- the detailed examination of non-UU abstraction or discharge consents for 'in combination' effects can only be undertaken by the EA or NRW through their permitting procedures; and
- known major projects that are likely to increase demand (e.g. power station decommissioning) are also taken into account during the development of the WRMP.

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 plans. The main exception to this is other water company WRMPs, which are developed concurrently with the UU WRMP and so cannot necessarily be fully assessed at the Preferred Options stage; for these, the potential for the UU Preferred Options to operate 'in combination' is assessed and (if necessary) conclusions caveated subject to the future review of the consultation versions of the other companies' WRMPs.
- With regard to other strategic plans, the list of plans included within the SEA is used as the basis for a high-level 'in combination' assessment (see **Appendix F**). The SEA is used to provide information on the themes, policies and objectives of the 'in combination' plans, with the plans themselves are examined in more detail as necessary. Plans are obtained from the SEA datasets or internet sources where possible.
- With regard to projects:
  - The WRMP 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.

Uncertainty and determining significant or adverse effects

The WRMP is a high-level strategy for managing water resources across the UU supply area over the next 25 years. Due to its wide geographic scale and long-term outlook there are inevitably many uncertainties inherent within it. It is therefore similar, in this respect, to a typical strategic land-use plan (such as a Core Strategy), which also has inherent uncertainties around its implementation, and hence over its likely effects. Usually, with strategy-level HRAs, uncertainty is addressed by including caveats and 'avoidance measures' or mitigation within the policy text to ensure that significant or adverse effects will not occur. This is possible because the key components of the strategic plan (i.e. the policies) are inherently malleable from the outset, and can be easily abandoned or modified if required.

This approach is more difficult to apply directly to the WRMP because:

- the strategic nature of the WRMP ensures that there are fundamental limitations on the scheme details that are available for the HRA; **but**
- its principal components (the options that are proposed to resolve actual or predicted deficits) are generally specific schemes with a clear spatial component, rather than the broad policies that are characteristic of most strategies.

This means that potential effects on specific European sites are much easier to envisage or identify (due to the specific nature of the options and the known 'sensitivities' of the interest features), but often harder to

quantify and assess (due to the strategic nature of the plan and frequent absence of detailed information on each option; i.e. the 'exposure' of an interest feature to a potential effect cannot necessarily be established).

Normally, where there is uncertainty over likely effects then additional data must be obtained until that uncertainty can be resolved; or 'avoidance measures' or mitigation specified that will remove the uncertainty; or the option should be abandoned and not included in the final plan. However, this can present difficulties for plans such as the WRMP since:

- the options often have to solve specific deficits but are heavily constrained by existing sources and infrastructure, the availability of new resources, and the patterns of customer demand;
- it is possible that there will be several options where the precise effects are unclear, but which UU or the EA would wish to be able to explore in more detail at a later stage (and therefore would wish to include as Preferred Options within the WRMP); and
- the WRMP itself is a key component of the regulatory mechanism by which funding is secured for the detailed design, feasibility studies and investigations required for new resource management measures.

Consequently, for some options there may be uncertainties which cannot be fully resolved at the strategic level, which in some cases would make a conclusion of 'no significant effects' or 'no adverse effects' difficult. Indeed, for some schemes it will only be possible to fully assess any potential effects at the pre-project planning stage or permit/order application stage, when certain specific details are known; for example: construction techniques or site-specific survey information. In addition, it may be several years before an option is employed, during which time other factors may alter the likely effects of the option.

For example, an option that proposes a new water transfer main between existing pumping stations will have a limited number of feasible routes. These can be theoretically assessed at a high-level for potential impacts on European sites, and routes with obvious and unavoidable 'likely significant effects' excluded from the WRMP. However, in most instances a specific route (or even a range of routes) will not be determined at the strategic level and any route would, in any case, be largely determined by design-stage constraints (e.g. land ownership; access; engineering feasibility; and so on). If the route had to cross a SAC river then 'significant effects' (at the strategic level) are clearly conceivable and arguably likely, which would suggest that the option should be abandoned. But it is equally likely that most potential construction effects could almost certainly be avoided or suitably mitigated through project-level design (e.g. ensuring the use of existing road crossings for construction, or using trenchless techniques), which would itself be subject to an HRA at project level.

As a result, the HRA must consider and assess the specific options within the WRMP **appropriately**, whilst recognising (and mitigating) the inherent uncertainties within those options (i.e. the absence of detailed scheme design or parameters) **and** within the plan itself (i.e. so that the WRMP, as a whole, is compliant with the Habitats Regulations even if some residual uncertainty persists with some options). Ultimately, the plan should not create a scenario where adverse effects are possible if these cannot clearly be avoided with appropriate scheme-level measures; these may be established best-practice mitigation and avoidance measures, or bespoke requirements identified at the plan-level.

Mitigating uncertainty and 'down the line' assessment

For most options, even at the strategic level, it will be clear if adverse effects are likely to be unavoidable and in these instances the option should not be included as a Preferred Option within the WRMP since plans should not include proposals which would be likely to fail the Habitats Regulations tests at the project application stage. For other options, however, the effects may be uncertain and it is therefore important that this uncertainty is addressed either through additional investigation or (if this is not possible) through appropriate mitigation measures that ensure that the *plan* is compliant with the Habitats Regulations.

For many options, particularly those involving construction, it is reasonable to assume that established mitigation measures which are typically successful can be employed at the project stage to avoid adverse effects – for example, avoiding works near SPAs at certain times of the year. In these instances it is considered that the option can be included within the WRMP provided that any specific measures that are

likely to be required are identified to ensure that they are appropriately addressed throughout the project planning process (e.g. constraints on the timing of construction activities).

Nevertheless, it is possible that the potential effects (or required mitigation) for some options cannot be clearly determined at the strategic-level. In these instances, current guidance[26] indicates that it may be appropriate and acceptable for some assessment to be undertaken 'down-the-line' at a lower tier in the planning hierarchy, if:

- the higher tier plan appraisal cannot reasonably predict the effects on a European site in a meaningful way; whereas
- the lower tier plan, which will identify more precisely the nature, scale or location of development, and thus its potential effects, retains sufficient flexibility over the exact location, scale or nature of the proposal to enable an adverse effect on site integrity to be ruled out (even if that would mean ultimately deleting the proposal); and
- the later or lower tier appraisal is required as a matter of law or Government policy, so it can be relied upon.

Strictly, this is less appropriate for plans that sit immediately above the project stage, although the WRMP and its options will, in most instances, meet these criteria. For some schemes – particularly those schemes requiring 'new water' or modifications to existing abstraction licences, but also larger construction schemes within or near European sites – there may be insufficient information available to determine 'no likely significant effects' or 'no adverse effects' with certainty at this level (i.e. meaningful assessment cannot be undertaken). All the options included in the Final WRMP will be subject to project-level environmental assessment as part of the normal EIA, planning and/or EA consenting processes, which will necessarily include assessments of their potential to affect European sites during their construction or operation (i.e. HRA is required by law).

It is therefore considered acceptable to include these proposals within the WRMP, but complete the assessment of those options where uncertainty persists at a later stage, provided that:

- the option is not required within the first three years of the plan period, so allowing time for additional investigations to be completed; and
- the uncertainty that this creates is mitigated by the inclusion of alternative options which:
  - will meet the required demand / deficit should the Preferred Option prove to have an unavoidable risk of adverse effects on the European sites in question; **and**
  - will not themselves have any significant or adverse effect on any European sites.

It should be noted that this flexibility is desirable in any case, since it is possible that a 'no LSE' option might be subsequently proven to have significant or adverse effects when brought to the design stage. This approach allows for the WRMP to be compliant with the Habitats Regulations, since certainty for the plan as a whole is provided by the inclusion of alternative options with no LSE.

It is also important to recognise that, in contrast to land-use plans, the statutory framework underpinning the WRMP does not provide the same implicit approval of derived, lower tier plans and projects that are 'in accordance' with it; or have the same influence over the decisions made on projects; or have the same direct or indirect legal effects for the use of land and the regulation of projects. Although the WRMP provides a framework for future water resource management it is not a rigid policy document or a set of proposals that cannot be deviated from once published. Also, the WRMP itself is a key component of the regulatory mechanism by which funding is secured for the detailed design, feasibility studies and investigations required for new resource management measures. Furthermore, the WRMP is (and must be) inherently flexible due to the formal five-yearly review process, which provides a clear mechanism for monitoring performance and an opportunity to adjust the proposals to reflect any changing circumstances. These measures can therefore be relied on to ensure that adverse effects do not occur as a result of the implementation of the WRMP.

[26] e.g SNH (2017). *Guidance for Plan Making Bodies in Scotland*. [Online]. Available at: https://www.snh.scot/planning-and-development/environmental-assessment/habitat-regulations-appraisal/

3. Feasible Options Review

The review of the Feasible Options employed the principles of HRA to help inform UU's selection of its Preferred and Revised Preferred Options, identifying those options that would appear to have an unavoidable risk of adverse effects on European sites. The Feasible Options Review is provided in Appendix F and summarised in this section.

3.1 Approach

The review of the Feasible Options is not a formal stage in the HRA process and is therefore not a 'draft HRA', 'screening', or similar assessment of the final plan. It is not intended to provide a definitive conclusion on the likely effects of the final WRMP but is primarily intended to inform UU's selection of Preferred Options, by identifying:

- those options that would appear to have an unavoidable risk of adverse effects on European sites (and which should therefore be avoided if possible);
- those options where significant or adverse effects would not appear likely, assuming established avoidance and mitigation measures can employed at the scheme level; and
- those options where effects are uncertain, which would require additional data or information on operation / construction to support their inclusion as preferred options.

The review of the Feasible Options therefore takes account of established project-level avoidance and mitigation measures that are known to be achievable, available and likely to be effective – for example, normal construction best-practice or project planning. These measures are identified in **Appendix G** to this report. For the operational aspects of resource management options, potential avoidance measures are considered where these are apparent, although in most instances the mitigation likely to be required for an option (e.g. compensation releases; 'hands-off' flows) cannot necessarily be determined at this stage.

The review also assumes that the existing licensing regime is having no significant effects on any European sites, or if this is not the case, that any necessary licence amendments required (e.g. sustainability reductions etc.) have been included in any deficit modelling. The Feasible Options will therefore only affect European sites through any new resource and production-management options advocated to resolve deficits, and not through the existing permissions regime[27], and it is therefore assumed that options that are 'network solutions' only (i.e. moving spare licensed volumes) will not have operational effects. The availability of water for abstraction is based on EA advice to UU and the Catchment Abstraction Management Plans (CAMS).

The review of each Feasible Option was undertaken as part of the development of the Draft WRMP (and completed in August 2017). The Technical Note containing the review is presented in **Appendix E** which contains a short description of each option and a narrative assessment of its likely effects, with those European sites within 20km that are most vulnerable (i.e. both exposed and sensitive) to the delivery or operation of the scheme noted in the text. It then provides broad 'recommendations' regards progressing the options as Preferred Options based on the anticipated construction and operational effects. The criteria for these recommendations are presented in **Table 3.1** (colour coded for clarity).

[27] It is recognised that, occasionally, agreed sustainability reductions have been subsequently shown to be insufficient to address the effects of PWS abstraction on some sites (the most notable example is the River Ehen in Cumbria).

Table 3.1 Summary of criteria for considering Feasible Options as potential

Recommend as Preferred Option?	Notes
Yes	Option appears unlikely to have any effects on European sites as features are either not exposed or not sensitive to the likely outcomes (i.e. no or no reasonable impact pathways – for example, operational effects for a 'construction only' network solution; 'dry' habitats over (say) 2km from an option; sites in different surface water catchments; upstream sites; etc. (being mindful of mobile species)). In these instances the recommendation is 'Yes', i.e. no reason not to pursue as Preferred Option.
Yes	Options where pathways for effects are clearly identifiable (such that HRA would probably be required at the scheme level) but where the potential effects can obviously be avoided or mitigated using established measures that are known to be effective, for example: ▶ construction near a European site (effects avoidable with normal project planning and best-practice); ▶ minor works within European sites (e.g. works to existing assets where effects unlikely to be adverse due to absence of features); ▶ major works near / within European sites that can be completed without adverse effects (e.g. crossings of SAC rivers using existing roads or directional drilling); ▶ operational effects that are avoidable with established operational mitigation (e.g. licence controls, although at this stage potential operational effects will usually lead to an 'uncertain' recommendation to flag the need for additional information). In these instances the generic measures outlined in Appendix B can be relied on if these are included within the WRMP package, although the final plan may need to include specific measures for potential 'high-impact' options (e.g. commitments to non-invasive river crossings or timing works to avoid sensitive periods).
Uncertain	Options where a potential effect is conceivable and cannot be discounted, and the likely effects are therefore uncertain at the Feasible Options stage. This is typically due to limitations on the information available, either in terms of the operation of the scheme, the mitigation that might be employed, or the data available on the interest features of the sites. These options, if pursued as Preferred Options, may require ▶ additional investigation to determine their effects, and there may be a risk that the risk of effects cannot be quantified satisfactorily at the strategic level (for example, substantial additional modelling or site-specific investigation may be required). ▶ the identification of specific measures or requirements for scheme delivery for inclusion with the WRMP. This category is therefore intended as a flag to identify those options where there is potentially additional 'cost' associated with their inclusion (either related to the data required to support a robust HRA and hence the option, or the need for specific mitigation commitments) which UU should consider when selecting the Preferred Options.
No	Options where significant effects (i.e. not negligible or inconsequential) on a European site are very likely or certain due to the scale/ nature/location of the option proposals, or the vulnerability and distribution of the interest features within /near the European site. Although a full appropriate assessment is not undertaken at this stage, adverse effects may be more likely (or even certain) if the scheme is taken forward as a Preferred Option and it is likely that extensive or unproven mitigation will be required following scheme-level investigations. Feasible Options in this category are not recommended for consideration as Preferred Options (although additional information may allow a re-assessment).

3.2 Summary

UU provisionally identified Feasible Options for all of its four WRZs[28]. Almost all schemes were considered potentially suitable as Preferred Options on the basis of the review, although uncertainties were identified for some options (principally around operation) which would require additional information for assessment if progressed as a Preferred Option. The Feasible Options review was used by UU to help inform the selection of Preferred Options.

[28] The Feasible Options review is necessarily completed prior to the final determination of WRZs with supply-demand deficits (due to the assessment timescales and complexities), and so includes Feasible Options for WRZs subsequently determined to be in surplus. Ultimately, United Utilities identified three WRZs with potential baseline supply-demand balance deficits: Carlisle; Strategic; and North Eden WRZs. No feasible options were assessed for the Barepot WRZ

4. WRMP Options Assessment

One UU WRZ (the Strategic WRZ) has a very small (~3 Ml/d) baseline deficit towards the end of the planning period. UU has therefore selected options to resolve this deficit, deliver reductions in leakage, and to improve the overall resilience of the network. Other options considered at the draft Preferred Options consultation, principally those associated with water trading, are not included as options in the Final WRMP. This section summarises the 'screening' and (where necessary) 'appropriate assessment' of the Final WRMP options.

4.1 Overview

One UU WRZ (the Strategic WRZ) has a very small (~3 Ml/d) baseline deficit towards the end of the planning period. UU's Final WRMP includes the following key elements:

- Continued demand management, including enhanced leakage reductions for the Revised Draft WRMP19 (20% reduction between 2020-2025).
- Improvement in the minimum stated level of service for drought permits.
- Increased resilience to non-drought hazards by addressing the most acute water supply resilience risk (Manchester and Pennines Aqueduct).

It should be noted that some of UU's draft WRMP Preferred Options (notably, the options required to ensure that 'spare' water was available for trading) have not been included as Preferred Options in the Final WRMP. In the case of the proposed water trading option, this was because a water trade from the north west was not included in the revised WRMPs of any other water companies. As a result, the options required to facilitate water trading are no longer included in the WRMP or its HRA.

The options included within the Final WRMP are summarised in **Table 4.1**.

Table 4.1 Final WRMP Options

Ref	Option Name	Description	Saving (Ml/d)	Delivery (AMP)
Preferred Manchester and Pennine Resilience Solution D				
112	Manchester and Pennine Aqueduct Outage (4 weeks) for installation of connections	Manchester and Pennine Aqueduct Outage (4 weeks) for installation of connections	N/A	AMP7 – AMP8
37-42	Manchester and Pennine Aqueduct sections T01 to T06	This option would provide protection against structural failure of an existing single pipe section of the Manchester and Pennine Aqueduct and would be used for the conveyance of treated water. This option would involve the construction of new 2.6m diameter conduits and a 2.85m diameter tunnel for a total length of approximately 51.9km, and new connection chambers and isolating penstocks.	N/A	AMP7 – AMP8
Preferred Demand Management Options – Leakage Reduction and Network Metering				
WR500a	Leakage reduction stage 1	Preferred options WR500a to WR500e would involve an increase in leakage detection and repair activity through the installation of PMVs over an 11 year period. Activities for Stages 1 to 5 would be as follows:	10	AMP7
WR500b	Leakage reduction stage 2		20 (including Stage 1)	AMP7

Ref	Option Name	Description	Saving (Ml/d)	Delivery (AMP)
WR500c	Leakage reduction stage 3	• Stage 1: A total of 276 leakage surveys, 510 repairs and 10 PMV installations would be undertaken. • Stage 2: An additional 339 leakage surveys, 510 repairs and 13 PMV installations would be undertaken • Stage 3: An additional 332 leakage surveys, 408 repairs and 12 PMV installations would be undertaken. • Stage 4: An additional 520 leakage surveys, 510 repairs and 19 PMV installations would be undertaken. • Stage 5: An additional 692 leakage surveys, 510 repairs and 26 PMV installations would be undertaken.	28 (including Stages 1 and 2)	AMP7
WR500d	Leakage reduction stage 4		38 (including Stages 1 to 3)	AMP8
WR500e	Leakage reduction stage 5		41 (including Stages 1 to 4)	AMP9
WR500f	Leakage reduction stage 6	Preferred options WR500f to WR500k would involve additional leakage detection and repair activity (to that already set out for Stages 1 – 5) through the installation of noise loggers over a six year period. Activities for Stages 6 to11 would be as follows: • Stage 6: A total of 85 leakage surveys, 511 repairs and 4,424 noise logger installations would be undertaken. • Stage 7: An additional 104 leakage surveys, 625 repairs and 8,148 noise logger installations would be undertaken. • Stage 8: An additional 225 leakage surveys, 1,350 repairs and 20,083 noise logger installations would be undertaken. • Stage 9: An additional 231 leakage surveys, 1,388 repairs and 25,575 noise logger installations would be undertaken. • Stage 10: An additional 257 leakage surveys, 1,542 repairs and 29,235 noise logger installations would be undertaken. • Stage 11: An additional 112 leakage surveys, 671 repairs and 17,098 noise logger installations would be undertaken.	4.99	AMP7
WR500g	Leakage reduction stage 7		9.81 (including Stage 6)	AMP7
WR500h	Leakage reduction stage 8		19.81 (including Stages 6 to 7)	AMP7
WR500i	Leakage reduction stage 9		29.95 (including Stages 6 to 8)	AMP7
WR500j	Leakage reduction stage 10		39.90 (including Stages 6 to 9)	AMP7
WR500k	Leakage reduction stage 11		45.23 (including Stages 6 to 10)	AMP7
WR503	Monitoring of household meters to identify and fix supply pipe leaks	This preferred option would involve the proactive monitoring of all domestic meters to identify and fix supply pipe leaks over a 5 year period.	3.81	AMP7
WR514	Logging of large customers	This preferred option would involve the logging of large customers over a 5 year period (it is assumed that 10% of those temporarily logged would become permanent). This would require the installation of loggers to all customers identified as having high consumption (above 500 l/hr) in either District Metering Areas (DMAs) with poor operability or DMAs with good operability in order to assess which customers have the largest impact on the operability within DMAs. Logged customers would be setup in Netbase and their night use allowances would be updated to reflect the percentage of night use to daily consumption which should have a positive impact on operability and leakage.	1.07	AMP7
WR515	Splitting District Metering Areas	This preferred option includes a study of non-operable DMAs over a 5 year period to determine the reason(s) why a DMA is not currently operable, and subsequently, to carry out appropriate actions to remedy any identified issues and/or constraints. The option scope includes office design, hydraulic modelling and site investigation in addition to the construction of chambers, installation of meters and the repair of pipework and ancillary equipment.	2.15	AMP7

Ref	Option Name	Description	Saving (Ml/d)	Delivery (AMP)
WR517	Upstream tiles enhancements	This preferred option would involve initial desk studies and site visits to determine the validity of identified faults before replacing existing, and installing a mixture of new, full bore meters and probes on existing United Utilities' infrastructure over a 5 year period.	3.57	AMP7
WR907d	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 20% Highest Leakage	This option would involve the survey and repair of customer-side supply pipes and plumbing leaks by Third Party or United Utilities over a 5 year period.	54.0	AMP9
WR907e	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 1.5% Highest Leakage	This preferred option would involve the survey and repair of customer-side supply pipes and plumbing leaks by a Third Party or United Utilities over a 5 year period.	2.12	AMP7
WR907f	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% Highest Leakage	This preferred option would involve the survey and repair of customer-side supply pipes and plumbing leaks by a Third Party or United Utilities over a 5 year period.	10.53	AMP8
WR907g	Third Party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% Highest Leakage	This preferred option would involve the survey and repair of customer-side supply pipes and plumbing leaks by a Third Party or United Utilities over a 5 year period.	10.53	AMP9
WR912	Third Party 2 - Proposal to reduce customer water demand for UU by 5 Ml/day across AMP	This option would involve the reduction of customer side leakage at non-household properties.	5.0	AMP7
WR914	Third Party - Cello 4S and Regulo	This preferred option would involve surveys and the installation of pressure management devices by a Third Party over a 5 year period together with ongoing maintenance to be undertaken by United Utilities.	4.0	AMP8

The effects of these options on European sites are assessed in the following sections.

4.2 Demand Management / Leakage Reduction Measures

Table 4.1 includes the proposed leakage reduction and distribution management options. These 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 leaks is not available without specific investigations, which would form part of the option package (i.e. 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.

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 G** 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 G will ensure that potential adverse effects can be identified and avoided at the project stage. **The distribution management and leakage-reduction options are therefore excluded from further assessment**.

4.3 Option 112

This option would involve implementing Manchester and Pennine Aqueduct outage for a period of four weeks to facilitate the installation of connections associated with the works required under Option 37-42. As there would be no new development associated with this option, there would be 'no effect' on any European sites (and hence no possibility of 'in combination' effects). Therefore, the screening conclusion for this option is 'no significant effects alone or in combination'.

4.4 Option 37-42

Summary of scheme

This option would provide protection against structural failure of an existing single pipe section of the Manchester and Pennine Aqueduct and would be used for the conveyance of treated water. The principal construction elements of this option would be:

- the construction of new 2.6m diameter conduits and a 2.85m diameter tunnel for a total length of approximately 51.9km (predominantly using directional drill or tunnelling construction techniques; route to be confirmed as part of project design);
- associated temporary above ground construction works at approximately 12 locations, including short (max. 1km) sections of open-cut pipeline;
- new connection chambers and isolating penstocks on the existing Aqueduct at approximately eight locations.

Likely impact pathways

Construction

The precise route of the new conduits and tunnels can only be determined at the project-level, although the route is likely to largely parallel the existing Manchester and Pennine Aqueduct, and assessment has been undertaken on this basis. This would be a substantial construction scheme although most of the works would be some distance from the nearest European sites and the majority of the construction would require non-invasive tunnelling or directional-drill techniques. However, the scheme will require a number of temporary and permanent small-scale above-ground structures and facilities although there are no reasons to assume that these will need to be located in areas where effects on European sites are unavoidable. The principal environmental risks are therefore likely to be:

- contamination of surface waters by site-derived pollutants;
- disturbance of sensitive species (e.g. from site lighting, noise, visual impact, vibration, etc.).

There is a theoretical risk of groundwater bodies being affected by the pipeline, which may then have indirect effects on any groundwater dependent ecosystems that may be associated with European sites, although geological investigations have indicated that this risk is minimal due to the dominance of low-permeability geological formations and the depth of the pipeline.

Operation

The operation of the scheme would be within the terms of the existing abstraction licences, and so no operational effects would be expected.

Screening of European sites

There are 22 European sites downstream or within 20km of the likely locations of the construction works, or otherwise linked by a potential effect pathway. The sites, their interest features, and location relative to the option are set out in **Table 4.1**.

Table 4.2 European sites within 20 km of Option, or otherwise connected

Site and Interest Features	~Distance / Connectivity
River Kent SAC ▸ Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation ▸ Freshwater mussel *Margaritifera margaritifera* ▸ White-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes* ▸ Bullhead *Cottus gobio*	0.6 km
North Pennines Dales Meadows SAC ▸ *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)* ▸ Mountain hay meadows	1.1 km
Bowland Fells SPA ▸ Hen harrier *Circus cyaneus* ▸ Merlin *Falco columbarius* ▸ Lesser black-backed gull *Larus fuscus*	0 km
Morecambe Bay Pavements SAC ▸ Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. ▸ European dry heaths ▸ *Juniperus communis* formations on heaths or calcareous grasslands ▸ Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites) ▸ Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* ▸ Limestone pavements ▸ *Tilio-Acerion* forests of slopes, screes and ravines ▸ Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles ▸ *Taxus baccata* woods of the British Isles ▸ Narrow-mouthed whorl snail *Vertigo angustior*	5.1 km
Rochdale Canal SAC ▸ Floating water-plantain *Luronium natans*	6 km
Calf Hill and Cragg Woods SAC ▸ Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles ▸ Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)*	9.5 km
Morecambe Bay SAC ▸ Sandbanks which are slightly covered by sea water all the time ▸ Estuaries ▸ Mudflats and sandflats not covered by seawater at low tide ▸ Coastal lagoons ▸ Large shallow inlets and bays ▸ Reefs ▸ Perennial vegetation of stony banks ▸ Salicornia and other annuals colonizing mud and sand ▸ Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)* ▸ Embryonic shifting dunes ▸ Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes") ▸ Fixed coastal dunes with herbaceous vegetation ("grey dunes") ▸ Atlantic decalcified fixed dunes (*Calluno-Ulicetea)* ▸ Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae)* ▸ Humid dune slacks ▸ Great crested newt *Triturus cristatus*	10.1 km
Morecambe Bay and Duddon Estuary SPA	10 km /DS

Site and Interest Features	~Distance / Connectivity
▸ Little egret *Egretta garzetta* ▸ Whooper swan *Cygnus cygnus* ▸ Pink-footed goose *Anser brachyrhynchus* ▸ Common shelduck *Tadorna tadorna* ▸ Northern pintail *Anas acuta* ▸ Eurasian oystercatcher *Haematopus ostralegus* ▸ Ringed plover *Charadrius hiaticula* ▸ European golden plover *Pluvialis apricaria* ▸ Grey plover *Pluvialis squatarola* ▸ Red knot *Calidris canutus* ▸ Sanderling *Calidris alba* ▸ Ruff *Philomachus pugnax* ▸ Bar-tailed godwit *Limosa lapponica* ▸ Eurasian curlew *Numenius arquata* ▸ Common redshank *Tringa totanus* ▸ Ruddy turnstone *Arenaria interpres* ▸ Mediterranean gull *Larus melanocephalus* ▸ Lesser black-backed gull *Larus fuscus* ▸ Herring gull *Larus argentatus* ▸ Sandwich tern *Sterna sandvicensis* ▸ Common tern *Sterna hirundo* ▸ Little tern *Sterna albifrons* ▸ Black-tailed godwit *Limosa limosa islandica* ▸ Dunlin *Calidris alpina alpina* ▸ Seabird assemblage Seabird assemblage ▸ Waterfowl assemblage Waterfowl assemblage	
Morecambe Bay Ramsar	10.2 km
▸ 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	
Lake District High Fells SAC	10.3 km
▸ Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea* ▸ Northern Atlantic wet heaths with *Erica tetralix* ▸ European dry heaths ▸ Alpine and Boreal heaths ▸ *Juniperus communis* formations on heaths or calcareous grasslands ▸ Siliceous alpine and boreal grasslands ▸ Species-rich *Nardus* grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe) ▸ Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels ▸ Blanket bogs (* if active bog) ▸ Alkaline fens ▸ Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani)* ▸ Calcareous rocky slopes with chasmophytic vegetation ▸ Siliceous rocky slopes with chasmophytic vegetation ▸ Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles ▸ Slender green feather-moss *Drepanocladus* (*Hamatocaulis) vernicosus*	
Ingleborough Complex SAC	10.6 km
▸ *Juniperus communis* formations on heaths or calcareous grasslands ▸ Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites) ▸ *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)* ▸ Blanket bogs (* if active bog) ▸ Petrifying springs with tufa formation (*Cratoneurion)* ▸ Alkaline fens ▸ Calcareous rocky slopes with chasmophytic vegetation ▸ Limestone pavements ▸ *Tilio-Acerion* forests of slopes, screes and ravines	
South Pennine Moors SAC	10.8 km
▸ Northern Atlantic wet heaths with *Erica tetralix*	

Site and Interest Features	~Distance / Connectivity
▸ European dry heaths ▸ Blanket bogs (* if active bog) ▸ Transition mires and quaking bogs ▸ Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	
South Pennine Moors Phase 2 SPA	11.1 km
▸ Merlin *Falco columbarius* ▸ European golden plover *Pluvialis apricaria* ▸ Short-eared owl *Asio flammeus*	
Witherslack Mosses SAC	12.1 km
▸ Active raised bogs ▸ Degraded raised bogs still capable of natural regeneration	
Leighton Moss Ramsar	12.4 km
▸ 1 - sites containing representative, rare or unique wetland types Crit. 1 - sites containing representative, rare or unique wetland types	
Leighton Moss SPA	13.5 km
▸ Great bittern *Botaurus stellaris* ▸ Eurasian marsh harrier *Circus aeruginosus*	
River Eden SAC	16.1 km
▸ Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea* ▸ Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation ▸ Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)* ▸ White-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes* ▸ Sea lamprey *Petromyzon marinus* ▸ Brook lamprey *Lampetra planeri* ▸ River lamprey *Lampetra fluviatilis* ▸ Atlantic salmon *Salmo salar* ▸ Bullhead *Cottus gobio* ▸ Otter *Lutra lutra*	
Asby Complex SAC	18 km
▸ Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. ▸ European dry heaths ▸ Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites) ▸ *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)* ▸ Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* ▸ Petrifying springs with tufa formation (*Cratoneurion)* ▸ Alkaline fens ▸ Limestone pavements ▸ Geyer`s whorl snail *Vertigo geyeri* ▸ Slender green feather-moss *Drepanocladus* (*Hamatocaulis) vernicosus*	
Esthwaite Water Ramsar	18 km
▸ 1 - sites containing representative, rare or unique wetland types Crit. 1 - sites containing representative, rare or unique wetland types ▸ 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities	
Manchester Mosses SAC	18.1 km
▸ Degraded raised bogs still capable of natural regeneration	
Naddle Forest SAC	18.1 km

Site and Interest Features	~Distance / Connectivity
▸ Northern Atlantic wet heaths with *Erica tetralix* ▸ European dry heaths ▸ Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	
Peak District Moors (South Pennine Moors Phase 1) SPA	19.4 km
▸ Merlin *Falco columbarius* ▸ European golden plover *Pluvialis apricaria* ▸ Short-eared owl *Asio flammeus*	

*Priority features
DS – Downstream site

Sites and interest features must be both exposed and sensitive to potential effects for significant effects to be possible. Sites where all of the interest features are clearly not exposed to the option are identified in **Table 4.2**, and are not considered further within the assessment of this option (note, for these sites it is considered that there will be 'no effects' (as opposed to 'no likely significant effects') and so there will be no possibility of 'in combination' effects).

Table 4.3 Initial screening of European sites

Site	Consider further?	Rationale
River Kent SAC	Yes	Construction required within close proximity; site potentially vulnerable to run-off (etc.).
North Pennine Dales Meadows SAC	No	Closest units SAC (Myttons Meadows SSSI and Bell Sykes Meadows SSSI) are located approximately 2 km from the nearest section of pipeline, although there will be no excavation in this area. The nearest area of above ground construction is approximately 3 km from the SSSIs, adjacent to the River Hodder but downstream of the SAC units, and so there is no hydrological connectivity.
Bowland Fells SPA	Yes	Construction required within close proximity; features potentially vulnerable to disturbance (etc.).
Morecambe Bay Pavements SAC	No	Site/features not exposed to likely outcomes of option (distance, no hydrological connectivity).
Rochdale Canal SAC	No	Site/features not exposed to likely outcomes of option (distance, no hydrological connectivity).
Calf Hill and Cragg Woods SAC	No	Site/features not exposed to likely outcomes of option (distance, no hydrological connectivity).
Morecambe Bay SAC	Yes	Downstream site; small possibility of construction-stage effects although likely to be weak.
Morecambe Bay SPA	Yes	Downstream site; small possibility of construction-stage effects although likely to be weak.
Morecambe Bay Ramsar	Yes	Downstream site; small possibility of construction-stage effects although likely to be weak.
Lake District High Fells SAC	No	Site/feature not exposed and sensitive to likely outcomes of option (upstream site)
Ingleborough Complex SAC	No	Site/feature not exposed and sensitive to likely outcomes of option (upstream site)
South Pennine Moors SAC	No	Site/feature not exposed and sensitive to likely outcomes of option (upstream site)

Site	Consider further?	Rationale
South Pennine Moors Phase 2 SPA	No	Site/feature not exposed and sensitive to likely outcomes of option (distance / upstream site)
Witherslack Mosses SAC	No	Site/features not exposed to likely outcomes of option (distance, no hydrological connectivity).
Leighton Moss Ramsar	No	Site/features not exposed to likely outcomes of option (distance, no hydrological connectivity).
Leighton Moss SPA	No	Site/features not exposed to likely outcomes of option (distance, no hydrological connectivity).
River Eden SAC	No	Site/features not exposed to likely outcomes of option (distance, no hydrological connectivity).
Asby Complex SAC	No	Site/features not exposed to likely outcomes of option (distance, no hydrological connectivity).
Esthwaite Water Ramsar	No	Site/features not exposed to likely outcomes of option (distance, no hydrological connectivity).
Manchester Mosses SAC	No	Site/features not exposed to likely outcomes of option (distance, no hydrological connectivity).
Naddle Forest SAC	No	Site/features not exposed to likely outcomes of option (distance, no hydrological connectivity).
Peak District Moors (South Pennine Moors Phase 1) SPA	No	Site/features not exposed to likely outcomes of option (distance, no hydrological connectivity).

The likely effects of the option on the site where potential impact pathways are identified (i.e. the possibility of significant effects cannot be excluded) are considered in the following sections.

Appropriate Assessment

Incorporated measures

Appropriate site- and feature-specific avoidance measures and development criteria are set out in **Appendix G** of this HRA, and are referenced by the WRMP. The WRMP requires that these measures be employed at the project-level unless scheme-specific HRAs or 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 more appropriate. Additional feature-specific measures are included for the following site:

- **River Kent SAC:** in addition to normal project-level planning and best-practice, construction of the scheme will avoid the main migration and spawning periods for salmon to minimise the risk of displacement or barrier effects due to noise, vibration or site-derived pollutants, unless scheme-specific analyses demonstrate that any effects associated with construction works will be 'not significant' or will have no adverse effect on the integrity of the SAC. **Freshwater mussel** is dependent on salmon for part of its life-cycle.

No specific measures (over the requirements for normal project-level planning and best-practice) are considered necessary at the plan-level for the other European sites potentially exposed to the likely effects of the option.

Bowland Fells SPA

Context

The Bowland Fells are an extensive upland area with summits mostly in the range 450-550 m. It covers extensive tracts of semi-natural moorland habitats including heather-dominated moorland and blanket mire. The geology is millstone grit-capped fells overlying softer Bowland shales, resulting in predominantly acidic vegetation types.

The pipeline will be tunnelled or directionally drilled beneath the Bowland Fells SPA, with above ground works (reception pits etc.) on lower ground either side of the fells; the closest above ground works will be ~2.9 km from the SPA boundary and so the site habitats will not be directly exposed to the likely effects of the scheme (site is 'upstream' of the construction area and normal best-practice measures can be relied on to ensure that habitats are unaffected). There is a theoretical risk of groundwater bodies being affected by the pipeline, which may then have indirect effects on any groundwater dependent ecosystems that may be associated with European sites, however.

Many birds are sensitive to disturbance or displacement due to human activity. Disturbance will typically cause changes in behaviour such as the cessation of feeding and the adoption of a 'heads up' alert posture, with increasing disturbance resulting in short flights or walks away from the affected area; displacement generally refers to longer term or larger scale movements away from areas that would normally be used. Disturbance or displacement can affect bird species by:

- increasing energy expenditure (e.g. due to a flight response, or by reducing the time spent at roosts); and / or by
- reducing energy intake (e.g. by reducing feeding time due to increased vigilance, or by reducing foraging efficiency due to increased competition or unfamiliarity with new foraging areas that birds may be displaced to).

The net effects of disturbance or displacement can be quite variable and will depend on a number of factors, including the type of disturbance; its duration and frequency; the availability, location and quality of alternative habitat; and the bird species involved.

Assessment of effects – Disturbance

The SPA is ~2.9km from the likely construction areas at the closest point and so effects on birds using habitats within the SPA would not be expected (most construction noise would naturally attenuate within this distance[29], and established 'flush distances' for birds due to visual disturbance are invariably less than this[30]. However, the principal interest features (breeding **Merlin** and **Lesser black backed gull**) are known to feed outside the SPA on adjacent areas of farmland; these undesignated habitats may be considered 'functionally linked' to the SPA and so important for the maintenance of its integrity, depending on how they are used.

Merlin are likely to be less sensitive and less exposed to the potential effects of the scheme due to their behavioural characteristics and are not considered further.

Recent tracking studies of **Lesser black-backed gulls** in the Bowland Fells SPA (Clewley *et al*. 2017) indicate that tracked gulls forage almost exclusively in terrestrial habitats, principally urban areas and landfill sites to the south and southwest of the SPA (e.g. Preston) with some use of local agricultural areas. It is possible that construction works could result in temporary disturbance or displacement of Lesser black-backed gulls using local non-designated habitats for foraging. However, the proposed above ground works near the SPA will be relatively limited in extent and likely to occur in habitats that are widely available in the

[29] As a guide, a typical long-reach excavator has sound power level of 109 dB(A); drills and saws have sound power levels 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) within 600m due to distance alone, although these figures should be used cautiously as the character of the noise will be as important as the level (if not more so). 60dB(A) is approximately equivalent to a conversation; 50dB(A) is approximately equivalent to the level associated with a quiet suburb or light traffic.

[30] Larger species such as curlew typically have larger '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).

local area; any disturbance or displacement effects will therefore be local only and will be entirely moderated by the availability of similar terrestrial habitats away from the development area. On this basis, adverse effects alone or in combination would not be expected, and potential effects can in any case be avoided or controlled through the normal project planning process and standard best-practice measures (see **Appendix G**).

Assessment of effects – Hydrogeology

There is a theoretical risk of groundwater bodies beneath the SPA being affected by the aqueduct, which may then have indirect effects on any groundwater dependent ecosystems within the European sites that have hydrological connectivity. This could, in theory, result affect the integrity of the SPA by affecting the habitats that support the interest features. However, this risk is considered to be negligible due to:

- the dominance of low-permeability geological formations;
- the nature of the upland habitats (predominantly ombrotrophic mires (etc.) maintained by rainfall and shallow subsurface flows rather than deep groundwater) and the absence of any evidence of significant connectivity with groundwater;
- the depth of the pipeline (at least 50m below the surface at the boundary of the SPA, and more typically in excess of 200m below the surface);
- the absence of any evidence that the existing aqueduct, which also runs beneath the fells, is having any effect on surface habitats.

Summary

Based on the available information it is clear that this option can be delivered with 'no adverse effect' on the integrity of the Bowland Fells SPA 'alone' (recognising that not every potential future 'in combination' effect can be determined at the plan level, and that project-level HRA will still be required), and in practice it is very likely that 'significant effects' could be avoided entirely at the project-level through project planning or normal best-practice.

River Kent SAC

The aqueduct is located approximately 0.6km from the River Kent SAC near Kendal, which may be vulnerable to site-derived pollutants. All of the features of the site (**Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation; Freshwater mussel; White-clawed crayfish;** and **Bullhead**) will be sensitive to construction pollution, as will salmon (which hosts the larval form of the freshwater mussel). Salmon may also be sensitive to noise and vibration during migration (although this would almost certainly be undetectable at 0.6km from the river).

Site-derived pollution of watercourses can be reliably prevented with standard and established best-practice measures that are known to be available, achievable and likely to be effective (see **Appendix G**), although the precise mitigation requirements will depend on the construction proposals. It may be necessary to undertake scheme-specific surveys once construction requirements are established, but any potential effects on the river can be avoided through scheme design, construction timing, and established mitigation. On this basis, adverse effects would not be expected and it is very likely that there would be 'no effect' on the River Kent SAC (and hence no possibility of 'in combination' effects). However, scheme-specific mitigation (including avoiding construction during the key spawning periods) is set out in **Appendix G** and will be employed unless scheme-specific surveys or analyses demonstrate that any potential effects associated with construction works can be avoided, will be 'not significant', or will have no adverse effect on the integrity of the SAC. As a result it can be concluded (based on the information available at the plan-level) that this option will have no adverse effects (alone) on the River Kent SAC.

Morecambe Bay SAC / Morecambe Bay and Duddon Estuary SPA / Morecambe Bay Ramsar

Short sections of open-cut pipeline either cross, or are within the catchment of, minor tributaries of Morecambe Bay (and hence its associated European sites). This includes a probable open-cut crossing of a

tributary of Lupton Beck, near Wyndhammere. However, all of these construction works actions are at least 10km from the European sites, and further when downstream distance is considered, and so any site-derived pollutants that enter the watercourses will be substantially attenuated by the time they reach the European sites. More importantly, site-derived pollution of watercourses can be reliably prevented with standard and established best-practice measures that are known to be available, achievable and likely to be effective and it is very likely that there would be 'no effect' on these European sites (and hence no possibility of 'in combination' effects) due to this scheme.

With regard to the mobile species of the SPA and Ramsar sites, this aspect can only be reliably assessed at the scheme-level through bespoke surveys (should they be considered necessary). However, it is extremely unlikely that species known to use non-designated agricultural land (e.g. golden plover, pink-footed goose) will be 'functionally dependent' on the small areas of habitat affected by construction, due to the distance and wider availability of essentially identical habitat elsewhere, such that significant or significant adverse effects could occur; and, in any case, potential effects would be easily avoidable by timing works to avoid the winter period.

As a result it can be concluded (based on the information available at the plan-level) that this option will have no adverse effects alone on Morecambe Bay SAC, Morecambe Bay and Duddon Estuary SPA or Morecambe Bay Ramsar.

Conclusion

Based on the information available at the plan-level it can be concluded that this option will have no adverse effects alone on any European sites. In combination effects are considered in the following section.

4.5 In Combination Effects

The assessment of 'in combination' effects in the following sections covers potential interactions between the preferred options and other schemes as individual projects, and the wider potential interactions associated with other strategies and plans.

Effects between Options

There will be no between-option 'in combination' effects; the effects of the demand-management and leakage reduction options cannot be assessed at the plan-level, and Option 112 does not itself involve development (it simply facilitates Option R37 – 42).

Effects with major projects

Known major projects that are likely to increase demand have been taken into account during the development of the WRMP and determination of future deficits; this is in addition to the growth scenarios used to determine the effects of local plans/housing growth. By modelling these major projects when determining deficits and proposals, the WRMP can ensure that LSE 'in combination' with these projects is unlikely (in terms of water resources availability). These projects are also unlikely to have 'in combination' effects in relation to construction, assuming normal construction best practice, due to the relative locations of these projects and the Final WRMP Options. The potential for currently identified NSIPs near the UU supply area to operate in combination with the WRMP Options is summarised in **Table 4.3** below; this identifies those European sites that are potentially exposed to both a WRMP option and a known major project. However, it must be noted that many of these projects will have been delivered by the time that specific options are implemented (due to the long-term and phased nature of the WRMP), and so this assessment is necessarily limited and would require repeating for project-level assessments as the Options come forward.

Table 4.4 Summary of 'in combination' assessment for WRMP Options and known major schemes / NSIPs near the UU supply area

NSIP / Major Scheme	Stage	Summary	European sites potentially exposed to project and WRMP Options	'In combination' assessment
A585 Windy Harbour to Skippool Improvement Scheme	Pre-Application	5km two lane dual carriageway road connecting Windy Harbour Junction to Skippool Junction (Poulton-le-Fylde, Blackpool).	None	No 'in combination' effects – European sites near this scheme will be unaffected by the WRMP options.
Hillhouse Enterprise Zone Power Station	Pre-Application	Up to 900MW Megawatt electrical (MWe) Power Plant primarily using combined cycle gas turbine (CCGT) technology and a new gas pipeline, Above Ground Installations at St Michael's on Wyre and Hillhouse, and an electrical cable to Stanah substation.	None	No 'in combination' effects – European sites near this scheme will be unaffected by the WRMP options.
NuGens Moorside Project in West Cumbria	Pre-Application	New Nuclear Power Generating Station (up to 3.6GW), with ancillary and other associated development	▶ Morecambe Bay & Duddon Estuary SPA ▶ Morecambe Bay Ramsar ▶ Morecambe Bay SAC	No 'in combination' effects – WRMP options can be delivered without adverse effects on these sites, and in combination effects can be avoided with normal best-practice (indeed, as the effects of the WRMP options alone are likely to be nil it is arguable that in combination effects cannot occur).
North West Coast Connections Project - N Grid	Pre-Application	Proposed 400kV electricity transmission connections from Moorside (near Sellafield) in West Cumbria to the existing transmission system in Cumbria / Lancashire.	▶ Morecambe Bay & Duddon Estuary SPA ▶ Morecambe Bay Ramsar ▶ Morecambe Bay SAC ▶ Bowland Fells SPA	No 'in combination' effects – WRMP options can be delivered without adverse effects on these sites, and in combination effects can be avoided with normal best-practice (indeed, as the effects of the WRMP options alone are likely to be nil it is arguable that in combination effects cannot occur).
Keuper Gas Storage Project	Decided	Underground Gas Storage Facility - up to 19 underground caverns, gas processing plant and associated development. Located at Holford Brinefield, approximately 3km north of Middlewich, Cheshire.	None	No 'in combination' effects – European sites near this scheme will be unaffected by the WRMP options.
Walney Extension Offshore Wind Farm	Decided	Offshore wind farm extension located to the west and northwest of the existing offshore wind farm together with offshore and onshore electrical infrastructure including cable route from the coast to a new substation located near Middleton, Lancashire.	▶ Bowland Fells SPA ▶ Morecambe Bay & Duddon Estuary SPA ▶ Morecambe Bay Ramsar ▶ Morecambe Bay SAC	No 'in combination' effects – WRMP options can be delivered without adverse effects on these sites, and in combination effects can be avoided with normal best-practice (indeed, as the effects of the WRMP options alone are likely to be nil it is arguable that in combination effects cannot occur).

NSIP / Major Scheme	Stage	Summary	European sites potentially exposed to project and WRMP Options	'In combination' assessment
Preesall Saltfield Underground Gas Storage	Decided	Underground gas storage facility. Located at Preesall Saltfield, Over Wyre, Lancashire.	None	No 'in combination' effects – European sites near this scheme will be unaffected by the WRMP options.
Whitemoss Landfill Western Extension	Decided	The construction of new hazardous waste management facilities at Whitemoss Landfill comprising the construction of new landfill void to the west of the existing landfill site for the disposal of hazardous waste together with associated development. Skelmersdale, Lancashire	None	No 'in combination' effects – European sites near this scheme will be unaffected by the WRMP options.
A556 Knutsford to Bowdon Scheme	Decided	Highway improvements including junction works and new road.	None	No 'in combination' effects – European sites near this scheme will be unaffected by the WRMP options.
Hydrodec Oil Re-Refinery Eastham	Pre-Application	The construction of a new hazardous waste recovery facility at Power House Road, Eastham, Port Wirral, Merseyside comprising the construction and operation of a waste oil re-refining plant together with associated and ancillary development.	None	No 'in combination' effects – European sites near this scheme will be unaffected by the WRMP options.
Burbo Bank Extension offshore wind farm	Decided	Proposed Burbo Bank Extension offshore wind farm located west of the operational Burbo Bank offshore wind farm in Liverpool Bay, around 7 km north of the North Wirral coast, 8.5 km from Crosby beach, and 12.2 km from the Point of Ayr on the Welsh coast.	▶ Morecambe Bay & Duddon Estuary SPA ▶ Morecambe Bay Ramsar	No 'in combination' effects – WRMP options can be delivered without significant effects on these sites, and in combination effects can be avoided with normal best-practice (indeed, as the effects of the WRMP options alone are likely to be nil it is arguable that in combination effects cannot occur). .
Alexandra Dock Biomass Project	Pre-Application	New Biomass energy project (output of between 100 and 150MW) at Alexandra Dock, Liverpool.	None	No 'in combination' effects – European sites near this scheme will be unaffected by the WRMP options.
Heysham to M6 Link Road	Decided	Completion of the Heysham to M6 Link, a new dual carriageway link road, approximately 4.8 kms long, located to the north of Lancaster and connecting the junction of the A683 and A589 by Lancaster and Morecambe College with Junction 34 of the M6 motorway	▶ Bowland Fells SPA ▶ Morecambe Bay & Duddon Estuary SPA ▶ Morecambe Bay Ramsar	No 'in combination' effects – WRMP options can be delivered without significant effects on these sites, and in combination effects can be avoided with normal best-practice (indeed, as the effects of the WRMP options alone are likely to be nil it is arguable that in combination effects cannot occur).

Minor projects

It has not been possible to produce a definitive list of existing (minor) planning applications near the likely zones of influence of the WRMP options, and in reality the timescales for construction of the Final WRMP options are such that generating a list at this stage would be of little value. Since the WRMP has been based on the most recent ONS growth projections and developed with reference to local plans, the combined effect of any minor developments on water demand has been accounted for within the WRMP projections. As a result, it is considered that there will be no impacts in terms of water resource availability (i.e. it is unlikely that a substantial water-using development or industry would come online that had not been considered by the WRMP). It is possible that there will be 'in combination' scheme-specific construction effects associated with future planning applications, although this can only be assessed nearer the time of construction.

Effects with other strategic plans and water resource demand

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. 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).

Obviously 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.

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

Effects with other strategic plans and development pressure

Regional and local plans have been reviewed at a high level to determine whether there are any likely significant 'in combination' effects (see **Appendix F**), 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 Final WRMP options and the absence of detail on allocation proposals makes any 'in combination' assessment difficult and potentially meaningless. However, the Final WRMP options are not of a scale or type that would make 'in combination' effects likely.

New water and existing consents

Where 'new water' is required (i.e. a new or modified abstraction) 'in combination' water-resource demands are possible with existing abstractions. As noted, the WRMP does not explicitly consider the potential 'in combination' effects of non-UU abstraction or discharge consents since this is addressed by the EA Review of Consents process or the licence application process (which will be subject to HRA). However, it must be

recognised that the water potentially available from a source is determined by the EA, NRW and UU, based on various assessments and data sources including the relevant CAMS; options are only proposed where there is a reasonable likelihood of water being available. In most instances the potential 'in combination' effects can only be meaningfully assessed as part of the investigation works that are required for a new licence or amendment (for example, if new boreholes are required to assist with the modelling of a groundwater resource). However, none of the options would require the development of a new resource.

UU's Drought Plan

As the WRMP options will reduce demand / leakage and improve system resilience it is unlikely that there will be any adverse effects with the Drought Plan (DP).

Notwithstanding this it should be noted that Drought Plan is only ever deployed *in extremis*, when conditions are such that European sites are likely to be affected independently of the Drought Plan's operation. UU has published its Drought Plan 2018, which is also subject to HRA. Whilst the Drought Plan and WRMP are written to complement each other, the Drought Plan may result in significant or adverse effects on water resource sensitive sites on its own due to the fundamental nature of the plan and the options.

However, the WRMP options cannot, in theory, operate in combination with the DP options: if the WRMP options are implemented then they will become a part of the baseline against which the effects of the DP options will be assessed (with the DP options then permitted or not at the application stage); until the point of implementation, the DP options would operate 'alone' in a drought situation. Furthermore, the implementation of a WRMP option will invariably require that the DP for that WRZ be revised, since the fundamental operational parameters of the WRZ will have changed. Finally, the impacts will depend entirely on the nature of the drought situation.

In theory, if a WRMP option results in less 'spare' water being available to water-resource sensitive sites then drought conditions may occur more frequently, and require a longer period for recovery from any temporary effects (depending on the hydrological functioning of the system); however, this type of effect is managed through licence conditions and minimum flow requirements which are designed to protect sites under a range of conditions, and DP options to alter such flow requirements would only be deployed after substantial additional study.

Other Water Company WRMPs

The other water company WRMPs have been reviewed to identify potential in combination effects. Given the nature of UU's options there is no possibility of 'in combination' effects with other WRMPs.

5. Summary and Conclusions

UU has completed its modelling of the supply-demand balance for WRMP planning period (2020-2045). One UU WRZ (the Strategic WRZ) has a very small (~3 Ml/d) baseline deficit towards the end of the planning period, which will be resolved through demand management and leakage reduction; the overall resilience of the network will also be improved through the Manchester and Pennine Resilience solution. This section summarises the conclusions of the HRA of the Final WRMP 2019.

5.1 Summary

The 'plan-level' assessment of the options is summarised in **Table 5.1**. This incorporates the 'in combination' assessment conclusions and takes account of the general and option-specific mitigation or avoidance measures that will be employed at the project-level. **Table 5.1** also provides a conclusion for the effects of each option. In summary, the conclusions for all of the options is 'no adverse effect alone or in combination' as there is no evidence to suggest that the Preferred Options will have any effects that are of a scale or type that cannot be reliably avoided or mitigated using the normal project-level controls identified.

5.2 Conclusion

The conclusion of the HRA of the Final WRMP 2019 is that the plan will have **no adverse effects, alone or in combination**, on any European sites taking into account established scheme-level mitigation and avoidance measures that will clearly be available, achievable and likely to be effective. This conclusion does not remove the need for consideration of Regulation 63 at the project-level, which will be required to address those aspects and uncertainties that cannot be meaningfully assessed at the plan-level, such as potential 'in combination' effects with forthcoming plans or projects that may coincide with option delivery.

Table 5.1 Summary of plan-level assessment of options (including 'in combination' effects and incorporated measures)

Option	Aspect	LSE	AE	Summary of Assessment	Key avoidance / mitigation measures
Demand management – demand reduction	Construction	U	-	Demand management options will not involve any construction that could result in significant effects.	-
	Operation	U	-	Options cannot negatively affect European sites.	-
Demand management – leakage options	Construction	U	N	Potential construction effects of leakage options cannot be identified at the plan-level (no location information) and so any assessment of the effects of individual leakage repairs can only be made at the scheme level.	▶ Established best-practice avoidance and mitigation measures (Appendix G).
	Operation	N	-	Options cannot negatively affect European sites.	-
Option 112	Construction	N	-	No development required under this option (essentially enabling works for Option 37-42).	-
	Operation	N	-	Option is a temporary outage of the Manchester and Pennine Aqueduct to allow connections for Option 37-42; can be timed / managed to ensure that potential supply restrictions do not indirectly affect any European sites through additional exploitation of other sources.	-
Option 37-42	Construction	Y	N	Option is a major construction scheme involving works within 20km of ~22 European sites; however, most sites are not exposed to the environmental changes likely to be associated with the scheme (distance or absence of effect pathways). Adverse effects on those sites that may be exposed (Bowland Fells SPA, River Kent SAC, Morecambe Bay & Duddon Estuary SPA, Morecambe Bay Ramsar, Morecambe Bay SAC) can be avoided using normal best-practice mitigation measures (which are likely to ensure that effects 'alone' are nil, so avoiding the risk of 'in combination' effects). An in combination assessment has not identified any potential effects with other plans, projects or programmes.	▶ Established best-practice avoidance and mitigation measures (Appendix G). ▶ **River Kent SAC**: in addition to normal project-level planning and best-practice, construction of the scheme will avoid the main migration and spawning periods for salmon and lamprey species (late October – April) to minimise the risk of displacement or barrier effects due to noise, vibration or site-derived pollutants, unless scheme-specific analyses demonstrate that any effects associated with construction works will be 'not significant' or will have no adverse effect on the integrity of the SAC.
	Operation	N	-	Option does not require any alterations to abstraction (etc) regimes (improves system resilience only).	

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Appendix A
Summary of European Site Designations

Table A1 European sites and associated designations

Designation	Abbreviation	Summary
European sites	-	Strictly, 'European sites' are: any Special Area of Conservation (SAC) from the point at which the European Commission and the UK Government agree the site as a 'Site of Community Importance' (SCI); any classified Special Protection Area (SPA); any candidate SAC (cSAC); and (exceptionally) any other site or area that the Commission believes should be considered as an SAC but which has not been identified by the Government. 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') apply; and to possible SACs (pSACs) and listed Ramsar Sites, to which the provisions of the Habitats Regulations are applied a matter of Government policy when considering development proposals that may affect them. "European site" is therefore used as an umbrella term for all of the above designated sites.
Special Area of Conservation	SAC	Designated under the EU *Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora*, and implemented in the UK through the *Conservation of Habitats and Species Regulations 2017,* and the *Conservation (Natural Habitats, & c.) Regulations (Northern Ireland) 1995* (as amended).
Site of Community Importance	SCI	Sites of Community Importance (SCIs) are sites that have been adopted by the European Commission but not yet formally designated by the government of each country. Although not formally designated they are nevertheless fully protected by *Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora*, the *Conservation of Habitats and Species Regulations 2017,* and the *Conservation (Natural Habitats, & c.) Regulations (Northern Ireland) 1995* (as amended).
Candidate SAC	cSAC	Candidate SACs (cSACs) are sites that have been submitted to the European Commission, but not yet formally adopted. Although these sites are still undergoing designation and adoption they are still fully protected by *Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora*, the *Conservation of Habitats and Species Regulations 2017* and the *Conservation (Natural Habitats, & c.) Regulations (Northern Ireland) 1995* (as amended).
Possible SACs	pSAC	Sites that have been formally advised to UK Government, but not yet submitted to the European Commission. The Governments in England, Scotland and Wales extend the same protection to these sites in respect of new development as that afforded to SACs as a matter of policy.
Draft SACs	dSAC	Areas that have been formally advised to UK government as suitable for selection as SACs, but have not been formally approved by government as sites for public consultation. These are not protected (unless covered by some other designation) and it is likely that their existence will not be established through desk study except through direct contact with the relevant statutory authority; however, the statutory authority is likely to take into account the proposed reasons for designation when considering potential impacts on them.
Special Protection Area	SPA	Designated under *EU Council Directive 79/409/EEC on the Conservation of Wild Birds* (the 'old Wild Birds Directive') and *Directive 2009/147/EC on the Conservation of Wild Birds* (the 'new Wild Birds Directive, which repeals the 'old Wild Birds Directive'), and protected by Article 6 of *Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora.* These directives are implemented in the UK through the *Wildlife & Countryside Act 1981* (as amended), the *Conservation of Habitats and Species Regulations 2017*, the *Wildlife (Northern Ireland) Order 1985*, the *Nature Conservation and Amenity Lands (Northern Ireland) Order 1985* and *The Conservation (Natural Habitats, &C.) (Northern Ireland) Regulations 1995* (as amended) and the *Offshore Marine Conservation (Natural Habitats & c.) Regulations 2007*.

Designation	Abbreviation	Summary
Potential SPA	pSPA	These are sites that are still undergoing designation and have not been designated by the Secretary of State; however, ECJ case law indicates that these sites are protected under Article 4(4) of *Directive 2009/147/EC* (which in theory provides a higher level of protection than the Habitats Directive, which does not apply until the sites are designated as SPAs), and as a matter of policy the Governments in England, Scotland and Wales extend the same protection to these sites in respect of new development as that afforded to SPAs, and they may be protected by some other designation (e.g. SSSI).
Ramsar	-	The *Convention on Wetlands of International Importance especially as Waterfowl Habitat* (Ramsar Convention or Wetlands Convention) was adopted in Ramsar, Iran in February 1971. The UK ratified the Convention in 1976. In the UK Ramsar sites are generally underpinned by notification of these areas as Sites of Special Scientific Interest (SSSIs) (or Areas of Special Scientific Interest (ASSIs) in Northern Ireland). Ramsar sites therefore receive statutory protection under the *Wildlife & Countryside Act 1981* (as amended), and the *Nature Conservation and Amenity Lands (Northern Ireland) Order 1985*. However, as a matter of policy the Governments in England, Scotland and Wales extend the same protection to listed Ramsar sites in respect of new development as that afforded to SPAs and SACs.

Appendix B
Sustainability Reductions and the Review of Consents

The WRMP accounts for any reductions or alterations to licences that are required under the Review of Consents (or the Water Framework Directive) when calculating 'Deployable Output' (DO). The Review of Consents (RoC) process was a detailed evidence-led examination of the effects (alone and in combination) of all abstraction licences and discharge consents that potentially affect European designated sites and features. This was then used as a basis for affirming or, if necessary, varying or revoking the existing consents (known as 'sustainability reductions') to protect these sites from adverse effects.

The sustainability reductions required by the RoC are fully accounted for within the modelled scenarios underpinning the WRMP (i.e. they explicitly form part of the assessment that determines which zones are in deficit). Under the RoC process and the WRMP process, the RoC changes (and non-changes to licences) are considered to be valid over the planning period (to 2045). UU use Water Available for Use (WAFU) from existing licences only (reduced through RoC and not reduced) when assessing the supply-demand balance over the planning period, incorporating increases in demand (the methods by which this is established are outlined in the WRMP). If deficits are shown, intervention options are required and implemented accordingly in the planning period.

This means that the Plan (and its underlying assumptions regarding the availability of water and sustainability of existing consents) is compliant with the RoC and so the Plan will only affect European sites through any new resource and production management options it advocates to resolves deficits, and not through the existing permissions regime[31]. The examination of existing individual consents can only be undertaken by NRW (in Wales) or the Environment Agency (EA) through the RoC process and the HRA of the WRMP cannot and should not replicate this.

Having said that, new permissions could obviously operate 'in combination' with the existing regime. The water potentially available from a source is determined by the EA, NRW and UU, based on various assessments and set out in the Catchment Abstraction Management Strategies, and UU must rely on these assessments when identifying options as in most cases the detailed examination of a resources can only be undertaken as part of preparatory works for a new licence (for example, if new boreholes are required to assist with the modelling of a groundwater resource). In short, options are only proposed where there is a reasonable likelihood of water being available, based on information from NRW and the EA.

UU has received formal indication of the sustainability reductions and measures that NRW and the EA consider necessary to prevent the risk of any abstraction-related significant adverse effects on certain European sites, and has factored these into its calculations of deployable output.

[31] It is recognised that, occasionally, the sustainability reductions agreed through the RoC process have been subsequently shown to be insufficient to address the effects of PWS abstraction on some sites (the most notable example is the River Ehen in Cumbria); UU are not aware of any current uncertainties regarding its abstractions or the RoC outcomes, although any such uncertainties that are subsequently identified can be addressed through the five-yearly WRMP review process.

Appendix C
European sites within 20km of the UU supply area

Sites within 20km and Interest Features	Within UU Area?
Asby Complex SAC	Y
Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.	
European dry heaths	
Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites)	
Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)*	
Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*	
Petrifying springs with tufa formation (*Cratoneurion)*	
Alkaline fens	
Limestone pavements	
Geyer`s whorl snail *Vertigo geyeri*	
Slender green feather-moss *Drepanocladus* (*Hamatocaulis) vernicosus*	
Bolton Fell Moss SAC	Y
Degraded raised bogs still capable of natural regeneration	
Border Mires, Kielder - Butterburn SAC	Y
Northern Atlantic wet heaths with *Erica tetralix*	
European dry heaths	
Blanket bogs (* if active bog)	
Transition mires and quaking bogs	
Petrifying springs with tufa formation (*Cratoneurion)*	
Borrowdale Woodland Complex SAC	Y
Siliceous rocky slopes with chasmophytic vegetation	
Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	
Bog woodland	
Bowland Fells SPA	Y
Hen harrier *Circus cyaneus*	
Merlin *Falco columbarius*	
Lesser black-backed gull *Larus fuscus*	
Calf Hill and Cragg Woods SAC	Y
Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	
Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)*	
Clints Quarry SAC	Y
Great crested newt *Triturus cristatus*	
Cumbrian Marsh Fritillary Site SAC	Y
Marsh fritillary butterfly *Euphydryas* (*Eurodryas, Hypodryas) aurinia*	
Dee Estuary/ Aber Dyfrdwy SAC	Y
Estuaries	
Mudflats and sandflats not covered by seawater at low tide	
Annual vegetation of drift lines	
Vegetated sea cliffs of the Atlantic and Baltic Coasts	
Salicornia and other annuals colonizing mud and sand	
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*	
Embryonic shifting dunes	

Sites within 20km and Interest Features	Within UU Area?
Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")	
Fixed coastal dunes with herbaceous vegetation ("grey dunes")	
Humid dune slacks	
Sea lamprey *Petromyzon marinus*	
River lamprey *Lampetra fluviatilis*	
Petalwort *Petalophyllum ralfsii*	
Drigg Coast SAC	Y
Estuaries	
Mudflats and sandflats not covered by seawater at low tide	
Salicornia and other annuals colonizing mud and sand	
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*	
Embryonic shifting dunes	
Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")	
Fixed coastal dunes with herbaceous vegetation ("grey dunes")	
Atlantic decalcified fixed dunes (*Calluno-Ulicetea)*	
Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae)*	
Humid dune slacks	
Duddon Estuary Ramsar	Y
2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities 4 - supports plant/animal species at a critical stage in their life cycles, or provides refuge Crit. 4 - supports plant/animal species at a critical stage in their life cycles, or provides refuge 5 - regularly supports 20,000 or more waterbirds Crit. 5 - regularly supports 20,000 or more waterbirds	
6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds	
Duddon Estuary SPA	Y
Northern pintail *Anas acuta*	
Red knot *Calidris canutus*	
Common redshank *Tringa totanus*	
Sandwich tern *Sterna sandvicensis*	
Waterfowl assemblage Waterfowl assemblage	
Duddon Mosses SAC	Y
Active raised bogs	
Degraded raised bogs still capable of natural regeneration	
Esthwaite Water Ramsar	Y
1 - sites containing representative, rare or unique wetland types Crit. 1 - sites containing representative, rare or unique wetland types 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities	
Helbeck and Swindale Woods SAC	Y
Tilio-Acerion forests of slopes, screes and ravines	
Ingleborough Complex SAC	Y
Juniperus communis formations on heaths or calcareous grasslands	
Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites)	
Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)*	
Blanket bogs (* if active bog)	
Petrifying springs with tufa formation (*Cratoneurion)*	
Alkaline fens	
Calcareous rocky slopes with chasmophytic vegetation	
Limestone pavements	
Tilio-Acerion forests of slopes, screes and ravines	
Irthinghead Mires Ramsar	Y

Sites within 20km and Interest Features	Within UU Area?
1 - sites containing representative, rare or unique wetland types Crit. 1 - sites containing representative, rare or unique wetland types 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities 3 - supports populations of plant/animal species important for maintaining regional biodiversity Crit. 3 - supports populations of plant/animal species important for maintaining regional biodiversity	
Lake District High Fells SAC	Y
Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*	
Northern Atlantic wet heaths with *Erica tetralix*	
European dry heaths	
Alpine and Boreal heaths	
Juniperus communis formations on heaths or calcareous grasslands	
Siliceous alpine and boreal grasslands	
Species-rich *Nardus* grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe)	
Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	
Blanket bogs (* if active bog)	
Alkaline fens	
Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani)*	
Calcareous rocky slopes with chasmophytic vegetation	
Siliceous rocky slopes with chasmophytic vegetation	
Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	
Slender green feather-moss *Drepanocladus* (*Hamatocaulis) vernicosus*	
Leighton Moss Ramsar	Y
1 - sites containing representative, rare or unique wetland types Crit. 1 - sites containing representative, rare or unique wetland types	
Leighton Moss SPA	Y
Great bittern *Botaurus stellaris*	
Eurasian marsh harrier *Circus aeruginosus*	
Liverpool Bay / Bae Lerpwl SPA	Y
Red-throated diver *Gavia stellata*	
Black (common) scoter *Melanitta nigra*	
Waterfowl assemblage Waterfowl assemblage	
Manchester Mosses SAC	Y
Degraded raised bogs still capable of natural regeneration	
Martin Mere Ramsar	Y
5 - regularly supports 20,000 or more waterbirds Crit. 5 - regularly supports 20,000 or more waterbirds	
6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds	
Martin Mere SPA	Y
Tundra swan *Cygnus columbianus bewickii*	
Whooper swan *Cygnus cygnus*	
Pink-footed goose *Anser brachyrhynchus*	
Eurasian wigeon *Anas penelope*	
Northern pintail *Anas acuta*	
Waterfowl assemblage Waterfowl assemblage	
Mersey Estuary Ramsar	Y
5 - regularly supports 20,000 or more waterbirds Crit. 5 - regularly supports 20,000 or more waterbirds	
6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds	
Mersey Estuary SPA	Y
Great crested grebe *Podiceps cristatus*	
Common shelduck *Tadorna tadorna*	
Eurasian wigeon *Anas penelope*	

Sites within 20km and Interest Features	Within UU Area?
Eurasian teal *Anas crecca*	
Northern pintail *Anas acuta*	
Ringed plover *Charadrius hiaticula*	
European golden plover *Pluvialis apricaria*	
Grey plover *Pluvialis squatarola*	
Northern lapwing *Vanellus vanellus*	
Eurasian curlew *Numenius arquata*	
Common redshank *Tringa totanus*	
Black-tailed godwit *Limosa limosa islandica*	
Dunlin *Calidris alpina alpina*	
Waterfowl assemblage Waterfowl assemblage	
Mersey Narrows and North Wirral Foreshore Ramsar	Y
4 - supports plant/animal species at a critical stage in their life cycles, or provides refuge Crit. 4 - supports plant/animal species at a critical stage in their life cycles, or provides refuge 5 - regularly supports 20,000 or more waterbirds Crit. 5 - regularly supports 20,000 or more waterbirds	
6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds	
Mersey Narrows and North Wirral Foreshore SPA	Y
Great cormorant *Phalacrocorax carbo*	
Eurasian oystercatcher *Haematopus ostralegus*	
Grey plover *Pluvialis squatarola*	
Sanderling *Calidris alba*	
Bar-tailed godwit *Limosa lapponica*	
Common redshank *Tringa totanus*	
Little gull *Larus minutus*	
Common tern *Sterna hirundo*	
red knot *Calidris canutus islandica*	
Dunlin *Calidris alpina alpina*	
Waterfowl assemblage Waterfowl assemblage	
Midland Meres and Mosses Phase 1 Ramsar	Y
1 - sites containing representative, rare or unique wetland types Crit. 1 - sites containing representative, rare or unique wetland types 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities	
Midland Meres and Mosses Phase 2 Ramsar	Y
1 - sites containing representative, rare or unique wetland types Crit. 1 - sites containing representative, rare or unique wetland types 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities	
Moor House - Upper Teesdale SAC	Y
Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.	
European dry heaths	
Alpine and Boreal heaths	
Juniperus communis formations on heaths or calcareous grasslands	
Calaminarian grasslands of the *Violetalia calaminariae*	
Siliceous alpine and boreal grasslands	
Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites)	
Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)*	
Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	
Mountain hay meadows	
Blanket bogs (* if active bog)	
Petrifying springs with tufa formation (*Cratoneurion)*	
Alkaline fens	

Sites within 20km and Interest Features	Within UU Area?
Alpine pioneer formations of the *Caricion bicoloris-atrofuscae*	
Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani)*	
Calcareous and calcshist screes of the montane to alpine levels (*Thlaspietea rotundifolii)*	
Calcareous rocky slopes with chasmophytic vegetation	
Siliceous rocky slopes with chasmophytic vegetation	
Limestone pavements	
Round-mouthed whorl snail *Vertigo genesii*	
Marsh saxifrage *Saxifraga hirculus*	
Morecambe Bay Pavements SAC	Y
Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.	
European dry heaths	
Juniperus communis formations on heaths or calcareous grasslands	
Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites)	
Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*	
Limestone pavements	
Tilio-Acerion forests of slopes, screes and ravines	
Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	
Taxus baccata woods of the British Isles	
Narrow-mouthed whorl snail *Vertigo angustior*	
Morecambe Bay Ramsar	Y
4 - supports plant/animal species at a critical stage in their life cycles, or provides refuge Crit. 4 - supports plant/animal species at a critical stage in their life cycles, or provides refuge 5 - regularly supports 20,000 or more waterbirds Crit. 5 - regularly supports 20,000 or more waterbirds	
6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds	
Morecambe Bay SAC	Y
Sandbanks which are slightly covered by sea water all the time	
Estuaries	
Mudflats and sandflats not covered by seawater at low tide	
Coastal lagoons	
Large shallow inlets and bays	
Reefs	
Perennial vegetation of stony banks	
Salicornia and other annuals colonizing mud and sand	
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*	
Embryonic shifting dunes	
Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")	
Fixed coastal dunes with herbaceous vegetation ("grey dunes")	
Atlantic decalcified fixed dunes (*Calluno-Ulicetea)*	
Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae)*	
Humid dune slacks	
Great crested newt *Triturus cristatus*	
Morecambe Bay SPA	Y
Pink-footed goose *Anser brachyrhynchus*	
Common shelduck *Tadorna tadorna*	
Northern pintail *Anas acuta*	
Eurasian oystercatcher *Haematopus ostralegus*	
Ringed plover *Charadrius hiaticula*	
Grey plover *Pluvialis squatarola*	
Red knot *Calidris canutus*	

Sites within 20km and Interest Features	Within UU Area?
Bar-tailed godwit *Limosa lapponica*	
Eurasian curlew *Numenius arquata*	
Common redshank *Tringa totanus*	
Ruddy turnstone *Arenaria interpres*	
Sandwich tern *Sterna sandvicensis*	
Dunlin *Calidris alpina alpina*	
Seabird assemblage Seabird assemblage	
Waterfowl assemblage Waterfowl assemblage	
Naddle Forest SAC	Y
Northern Atlantic wet heaths with *Erica tetralix*	
European dry heaths	
Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	
North Pennine Dales Meadows SAC	Y
Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)*	
Mountain hay meadows	
North Pennine Moors SAC	Y
Northern Atlantic wet heaths with *Erica tetralix*	
European dry heaths	
Juniperus communis formations on heaths or calcareous grasslands	
Calaminarian grasslands of the *Violetalia calaminariae*	
Siliceous alpine and boreal grasslands	
Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites)	
Blanket bogs (* if active bog)	
Petrifying springs with tufa formation (*Cratoneurion)*	
Alkaline fens	
Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani)*	
Calcareous rocky slopes with chasmophytic vegetation	
Siliceous rocky slopes with chasmophytic vegetation	
Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	
Marsh saxifrage *Saxifraga hirculus*	
North Pennine Moors SPA	Y
Hen harrier *Circus cyaneus*	
Merlin *Falco columbarius*	
Peregrine falcon *Falco peregrinus*	
European golden plover *Pluvialis apricaria*	
Oak Mere SAC	Y
Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae)*	
Transition mires and quaking bogs	
Peak District Moors (South Pennine Moors Phase 1) SPA	Y
Merlin *Falco columbarius*	
European golden plover *Pluvialis apricaria*	
Short-eared owl *Asio flammeus*	
Ribble and Alt Estuaries Ramsar	Y
2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities 5 - regularly supports 20,000 or more waterbirds Crit. 5 - regularly supports 20,000 or more waterbirds	
6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds	
Ribble and Alt Estuaries SPA	Y
Great cormorant *Phalacrocorax carbo*	

Sites within 20km and Interest Features	Within UU Area?
Tundra swan *Cygnus columbianus bewickii*	
Whooper swan *Cygnus cygnus*	
Pink-footed goose *Anser brachyrhynchus*	
Common shelduck *Tadorna tadorna*	
Eurasian wigeon *Anas penelope*	
Eurasian teal *Anas crecca*	
Northern pintail *Anas acuta*	
Greater scaup *Aythya marila*	
Black (common) scoter *Melanitta nigra*	
Eurasian oystercatcher *Haematopus ostralegus*	
Ringed plover *Charadrius hiaticula*	
European golden plover *Pluvialis apricaria*	
Grey plover *Pluvialis squatarola*	
Northern lapwing *Vanellus vanellus*	
Red knot *Calidris canutus*	
Sanderling *Calidris alba*	
Ruff *Philomachus pugnax*	
Bar-tailed godwit *Limosa lapponica*	
Whimbrel *Numenius phaeopus*	
Eurasian curlew *Numenius arquata*	
Common redshank *Tringa totanus*	
Black-headed gull *Larus ridibundus*	
Lesser black-backed gull *Larus fuscus*	
Common tern *Sterna hirundo*	
Black-tailed godwit *Limosa limosa islandica*	
Dunlin *Calidris alpina alpina*	
Seabird assemblage Seabird assemblage	
Waterfowl assemblage Waterfowl assemblage	
River Derwent and Bassenthwaite Lake SAC	Y
Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*	
Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	
Marsh fritillary butterfly *Euphydryas (Eurodryas, Hypodryas) aurinia*	
Sea lamprey *Petromyzon marinus*	
Brook lamprey *Lampetra planeri*	
River lamprey *Lampetra fluviatilis*	
Atlantic salmon *Salmo salar*	
Otter *Lutra lutra*	
Floating water-plantain *Luronium natans*	
River Eden SAC	Y
Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*	
Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	
Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)*	
White-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes*	
Sea lamprey *Petromyzon marinus*	
Brook lamprey *Lampetra planeri*	
River lamprey *Lampetra fluviatilis*	
Atlantic salmon *Salmo salar*	
Bullhead *Cottus gobio*	
Otter *Lutra lutra*	

Sites within 20km and Interest Features	Within UU Area?
River Ehen SAC	Y
Freshwater mussel *Margaritifera margaritifera*	
Atlantic salmon *Salmo salar*	
River Kent SAC	Y
Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	
Freshwater mussel *Margaritifera margaritifera*	
White-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes*	
Bullhead *Cottus gobio*	
Rixton Clay Pits SAC	Y
Great crested newt *Triturus cristatus*	
Rochdale Canal SAC	Y
Floating water-plantain *Luronium natans*	
Rostherne Mere Ramsar	Y
I - sites containing representative, rare or unique wetland types Crit. I - sites containing representative, rare or unique wetland types	
Sefton Coast SAC	Y
Embryonic shifting dunes	
Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")	
Fixed coastal dunes with herbaceous vegetation ("grey dunes")	
Atlantic decalcified fixed dunes (*Calluno-Ulicetea)*	
Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae)*	
Humid dune slacks	
Great crested newt *Triturus cristatus*	
Petalwort *Petalophyllum ralfsii*	
Solway Firth SAC	Y
Sandbanks which are slightly covered by sea water all the time	
Estuaries	
Mudflats and sandflats not covered by seawater at low tide	
Reefs	
Perennial vegetation of stony banks	
Salicornia and other annuals colonizing mud and sand	
Atlantic salt meadows (*Glauco-Puccinellietalia maritimae)*	
Fixed coastal dunes with herbaceous vegetation ("grey dunes")	
Sea lamprey *Petromyzon marinus*	
River lamprey *Lampetra fluviatilis*	
South Pennine Moors Phase 2 SPA	Y
Merlin *Falco columbarius*	
European golden plover *Pluvialis apricaria*	
Short-eared owl *Asio flammeus*	
South Pennine Moors SAC	Y
Northern Atlantic wet heaths with *Erica tetralix*	
European dry heaths	
Blanket bogs (* if active bog)	
Transition mires and quaking bogs	
Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	
South Solway Mosses SAC	Y
Active raised bogs	
Degraded raised bogs still capable of natural regeneration	
Subberthwaite, Blawith and Torver Low Commons SAC	Y
Transition mires and quaking bogs	

Sites within 20km and Interest Features	Within UU Area?
Depressions on peat substrates of the *Rhynchosporion*	
Tarn Moss SAC	Y
Transition mires and quaking bogs	
The Dee Estuary Ramsar	Y
1 - sites containing representative, rare or unique wetland types Crit. 1 - sites containing representative, rare or unique wetland types 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities 5 - regularly supports 20,000 or more waterbirds Crit. 5 - regularly supports 20,000 or more waterbirds	
6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds	
The Dee Estuary SPA	Y
Common shelduck *Tadorna tadorna*	
Eurasian teal *Anas crecca*	
Northern pintail *Anas acuta*	
Eurasian oystercatcher *Haematopus ostralegus*	
Grey plover *Pluvialis squatarola*	
Red knot *Calidris canutus*	
Bar-tailed godwit *Limosa lapponica*	
Eurasian curlew *Numenius arquata*	
Common redshank *Tringa totanus*	
Sandwich tern *Sterna sandvicensis*	
Common tern *Sterna hirundo*	
Little tern *Sterna albifrons*	
Black-tailed godwit *Limosa limosa islandica*	
Dunlin *Calidris alpina alpina*	
Waterfowl assemblage Waterfowl assemblage	
Tyne and Nent SAC	Y
Calaminarian grasslands of the *Violetalia calaminariae*	
Ullswater Oakwoods SAC	Y
Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	
Upper Solway Flats and Marshes Ramsar	Y
2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities 5 - regularly supports 20,000 or more waterbirds Crit. 5 - regularly supports 20,000 or more waterbirds	
6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds	
Upper Solway Flats and Marshes SPA	Y
Whooper swan *Cygnus cygnus*	
Pink-footed goose *Anser brachyrhynchus*	
Barnacle goose *Branta leucopsis* [Svalbard/Denmark/UK]	
Common shelduck *Tadorna tadorna*	
Eurasian teal *Anas crecca*	
Northern pintail *Anas acuta*	
Northern shoveler *Anas clypeata*	
Greater scaup *Aythya marila*	
Common goldeneye *Bucephala clangula*	
Eurasian oystercatcher *Haematopus ostralegus*	
European golden plover *Pluvialis apricaria*	
Grey plover *Pluvialis squatarola*	
Red knot *Calidris canutus*	
Sanderling *Calidris alba*	

Sites within 20km and Interest Features	Within UU Area?
Bar-tailed godwit *Limosa lapponica*	
Eurasian curlew *Numenius arquata*	
Common redshank *Tringa totanus*	
Ruddy turnstone *Arenaria interpres*	
Dunlin *Calidris alpina alpina*	
Waterfowl assemblage Waterfowl assemblage	
Walton Moss SAC	Y
Active raised bogs	
Degraded raised bogs still capable of natural regeneration	
Wast Water SAC	Y
Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*	
West Midlands Mosses SAC	Y
Natural dystrophic lakes and ponds	
Transition mires and quaking bogs	
Witherslack Mosses SAC	Y
Active raised bogs	
Degraded raised bogs still capable of natural regeneration	
Yewbarrow Woods SAC	Y
Juniperus communis formations on heaths or calcareous grasslands	
Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	
Taxus baccata woods of the British Isles	
Alyn Valley Woods/ Coedwigoedd Dyffryn Alun SAC	N
Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites)	
Tilio-Acerion forests of slopes, screes and ravines	
Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae)*	
Berwyn a Mynyddoedd de Clwyd/ Berwyn and South Clwyd Mountains SAC	N
European dry heaths	
Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites)	
Blanket bogs (* if active bog)	
Transition mires and quaking bogs	
Calcareous and calcshist screes of the montane to alpine levels (*Thlaspietea rotundifolii)*	
Calcareous rocky slopes with chasmophytic vegetation	
Borders Woods SAC	N
Tilio-Acerion forests of slopes, screes and ravines	
Brown Moss SAC	N
Floating water-plantain *Luronium natans*	
Craven Limestone Complex SAC	N
Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.	
Calaminarian grasslands of the *Violetalia calaminariae*	
Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites)	
Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)*	
Active raised bogs	
Petrifying springs with tufa formation (*Cratoneurion)*	
Alkaline fens	
Limestone pavements	
Tilio-Acerion forests of slopes, screes and ravines	
White-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes*	
Bullhead *Cottus gobio*	
Lady`s-slipper orchid *Cypripedium calceolus*	

Sites within 20km and Interest Features	Within UU Area?
Deeside and Buckley Newt Sites SAC	N
Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	
Great crested newt *Triturus cristatus*	
Fenn`s, Whixall, Bettisfield, Wem and Cadney Mosses SAC	N
Active raised bogs	
Degraded raised bogs still capable of natural regeneration	
Halkyn Mountain/ Mynydd Helygain SAC	N
European dry heaths	
Calaminarian grasslands of the *Violetalia calaminariae*	
Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites)	
Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)*	
Great crested newt *Triturus cristatus*	
Johnstown Newt Sites SAC	N
Great crested newt *Triturus cristatus*	
Langholm - Newcastleton Hills SPA	N
Hen harrier *Circus cyaneus*	
Malham Tarn Ramsar	N
1 - sites containing representative, rare or unique wetland types Crit. 1 - sites containing representative, rare or unique wetland types 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities	
Ox Close SAC	N
Calaminarian grasslands of the *Violetalia calaminariae*	
Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites)	
Tilio-Acerion forests of slopes, screes and ravines	
Peak District Dales SAC	N
European dry heaths	
Calaminarian grasslands of the *Violetalia calaminariae*	
Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia)* (* important orchid sites)	
Alkaline fens	
Calcareous and calcshist screes of the montane to alpine levels (*Thlaspietea rotundifolii)*	
Calcareous rocky slopes with chasmophytic vegetation	
Tilio-Acerion forests of slopes, screes and ravines	
White-clawed (or Atlantic stream) crayfish *Austropotamobius pallipes*	
Brook lamprey *Lampetra planeri*	
Bullhead *Cottus gobio*	
Raeburn Flow SAC	N
Active raised bogs	
Degraded raised bogs still capable of natural regeneration	
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC	N
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*	
Atlantic salmon *Salmo salar*	
Bullhead *Cottus gobio*	
Otter *Lutra lutra*	
Floating water-plantain *Luronium natans*	
River Tweed SAC	N
Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	

Sites within 20km and Interest Features	Within UU Area?
Sea lamprey *Petromyzon marinus*	
Brook lamprey *Lampetra planeri*	
River lamprey *Lampetra fluviatilis*	
Atlantic salmon *Salmo salar*	
Otter *Lutra lutra*	
Roman Wall Loughs SAC	N
Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* - type vegetation	
Roudsea Wood and Mosses SAC	N
Active raised bogs	
Degraded raised bogs still capable of natural regeneration	
Tilio-Acerion forests of slopes, screes and ravines	
Taxus baccata woods of the British Isles	
Shell Flat and Lune Deep SCI	N
Sandbanks which are slightly covered by sea water all the time	
Reefs	
Solway Mosses North SAC	N
Active raised bogs	
Degraded raised bogs still capable of natural regeneration	
Tyne and Allen River Gravels SAC	N
Calaminarian grasslands of the *Violetalia calaminariae*	

Appendix D
Water-resource Dependent Interest Features

EA Class Name	WR Sensitive?	Change in water levels or table	Change in flow or velocity regime	Change in surface flooding	Changed water chemistry	Change in FW flow to estuary	Change in salinity regime	Reduced dilution capacity	Habitat loss	Entrapment
Fens and wet habitats										
Alkaline fens	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Inland salt meadows	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Molinia meadows on calcareous, peaty or clayey silt laden soils (Molinion caeruleae)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Northern Atlantic wet heaths with Erica tetralix	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno Padion, Alnion incanae, Salicion albae)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Temperate Atlantic wet heaths with Erica ciliaris and Erica tetralix	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Coastal Habitats										
Annual vegetation of drift lines	N									
Embryonic shifting dunes	N									
Decalcified fixed dunes with Empetrum nigrum	N									
Fixed coastal dunes with herbaceous vegetation (grey dunes)	N									
Mediterranean and thermo Atlantic halophilous scrubs (Sarcocornetea fruticosi)	N									
Inland dunes with open Corynephorus and Agrostis grasslands	N									
Perennial vegetation of stony banks	N									
Shifting dunes along the shoreline with Ammophila arenaria (white dunes)	N									
Coastal habitats (sensitive to abstraction)										
Dunes with Salix repens ssp. argentea (Salicion arenariae)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Humid dune slacks	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Coastal lagoons	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mediterranean and thermo Atlantic halophilous scrubs (Sarcocornetea fruticosi)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Vegetated sea cliffs of the Atlantic and Baltic Coasts	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Estuarine & intertidal habitats										
Atlantic salt meadows (Glauco Puccinellietalia maritimae)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Estuaries	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Large shallow inlets and bays	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mudflats and sandflats not covered by seawater at low tide	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Reefs	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Salicornia and other annuals colonizing mud and sand	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Spartina swards (Spartinion maritimae)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Submerged marine habitats										
Reefs	N									
Sandbanks which are slightly covered by sea water all the time	N									
Submerged or partially submerged sea caves	N									
Bogs and wet habitats										
Active raised bogs	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Blanket bogs (if active bog)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bog woodland	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Calcareous fens with Cladium mariscus and species of the Caricion davallianae	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Degraded raised bogs still capable of natural regeneration	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Depressions on peat substrates of the Rhynchosporion	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Transition mires and quaking bogs	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Riverine habitats & running waters										

EA Class Name	WR Sensitive?	Change in water levels or table	Change in flow or velocity regime	Change in surface flooding	Changed water chemistry	Change in FW flow to estuary	Change in salinity regime	Reduced dilution capacity	Habitat loss	Entrapment
Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho Batrachion vegetation	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Petrifying springs with tufa formation (Cratoneurion)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Standing Waters (sensitive to acidification)										
Natural dystrophic lakes and ponds	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mediterranean temporary ponds	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Hard oligo mesotrophic waters with benthic vegetation of Chara spp.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Natural eutrophic lakes with Magnopotamion or Hydrocharition type vegetation	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Turloughs	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dry Woodlands & scrub										
Asperulo Fagetum beech forests	N									
Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrublayer (Quercion robori petraeae or Ilici Fagenio	N									
Old acidophilous oak woods with Quercus robur on sandy plains	N									
Old sessile oak woods with Ilex and Blechnum in the British Isles	N									
Stable xerothermophilous formations with Buxus sempervirens on rock slopes (Berberidion p.p.)	N									
Sub Atlantic and medio European oak or oak hornbeam forests of the Carpinion betuli	N									
Taxus baccata woods of the British Isles	N									
Tilio Acerion forests of slopes, screes and ravines	N									
Dry grassland										
Calaminarian grasslands of the Violetalia calaminariae	N									
Semi natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia) (important orchid sites)	N									
Semi natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia) (important orchid sites)	N									
Dry heathland habitats										
Dry Atlantic coastal heaths with Erica vagans	N									
European dry heaths	N									
Juniperus communis formations on heaths or calcareous grasslands	N									
Upland		N								
Alpine and Boreal heaths		N								
Alpine pioneer formations of the Caricion bicoloris atrofuscae		N								
Calcareous rocky slopes with chasmophytic vegetation		N								
Siliceous rocky slopes with chasmophytic vegetation		N								
Calcareous and calcshist screes of the montane to alpine levels (Thlaspietea rotundifolii)		N								
Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels		N								
Limestone pavements		N								
Mountain hay meadows		N								
Siliceous alpine and boreal grasslands		N								
Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani)										
Vascular plants of aquatic habitats										
Floating water plantain Luronium natans	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Amphibia										
Great crested newt Triturus cristatus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Coastal plants										
Shore dock Rumex rupestris	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Marine mammals										

EA Class Name	WR Sensitive?	Change in water levels or table	Change in flow or velocity regime	Change in surface flooding	Changed water chemistry	Change in FW flow to estuary	Change in salinity regime	Reduced dilution capacity	Habitat loss	Entrapment
Bottlenose dolphin Tursiops truncatus	N									
Common seal Phoca vitulina	N									
Grey seal Halichoerus grypus	N									
Vascular plants lower plants and invertebrates of wet habitats										
Creeping marshwort Apium repens	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Depressions on peat substrates of the Rhynchosporion	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fen orchid Liparis loeselii	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Freshwater pearl mussel Margaritifera margaritifera	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Marsh fritillary butterfly Euphydryas (Eurodryas, Hypodryas) aurinia	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Narrow mouthed whorl snail Vertigo angustior	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Round-mouthed whorl snail Vertigo genesii	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Southern damselfly Coenagrion mercuriale	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Marsh saxifrage Saxifraga hirculus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Vascular plants of grassland										
Early gentian Gentianella anglica	N									
Killarney fern Trichomanes speciosum	N									
Mosses and Liverworts										
Petalwort Petalophyllum ralfsii	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Slender green feather moss Drepanocladus (Hamatocaulis) vernicosus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Western rustwort Marsupella profunda	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Anadromous fish										
Allis shad Alosa alosa	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Atlantic salmon Salmo salar	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
River lamprey Lampetra fluviatilis	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Sea lamprey Petromyzon marinus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Twaite shad Alosa fallax	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Non-migratory fish & invertebrates of rivers										
White clawed (or Atlantic stream) crayfish Austropotamobius pallipes	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Brook lamprey Lampetra planeri	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bullhead Cottus gobio	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Freshwater pearl mussel Margaritifera margaritifera	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Spined loach Cobitis taenia	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Invertebrates of wooded habitats										
Stag beetle Lucanus cervus	N									
Violet click beetle Limoniscus violaceus	N									
Mammals of wooded habitats										
Barbastelle Barbastella barbastellus	N									
Calcareous and calcshist screes of the montane to alpine levels (Thlaspietea rotundifolii)	N									
Greater horseshoe bat Rhinolophus ferrumequinum	N									
Lesser horseshoe bat Rhinolophus hipposideros	N									
Mammals of riverine habitats										
Otter Lutra lutra	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Birds of uplands										
Eurasian curlew Numenius arquata	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

EA Class Name	WR Sensitive?	Change in water levels or table	Change in flow or velocity regime	Change in surface flooding	Changed water chemistry	Change in FW flow to estuary	Change in salinity regime	Reduced dilution capacity	Habitat loss	Entrapment
European golden plover Pluvialis apricaria	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Hen harrier Circus cyaneus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Black legged kittiwake Rissa tridactyla	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Northern lapwing Vanellus vanellus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Lesser black backed gull Larus fuscus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Manx shearwater Puffinus puffinus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Merlin Falco columbarius	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Peregrine falcon Falco peregrinus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Razorbill Alca torda	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red kite Milvus milvus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Short eared owl Asio flammeus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Common snipe Gallinago gallinago	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
European storm petrel Hydrobates pelagicus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Birds of open sea and offshore rocks										
Arctic tern Sterna paradisaea	N									
Black (common) scoter Melanitta nigra	N									
Common tern Sterna hirundo	N									
Great cormorant Phalacrocorax carbo	N									
Northern gannet Morus bassanus	N									
Common guillemot Uria aalge	N									
Herring gull Larus argentatus	N									
Lesser black backed gull Larus fuscus	N									
Little tern Sterna albifrons	N									
Atlantic puffin Fratercula arctica	N									
Red-throated diver Gavia stellata	N									
Roseate tern Sterna dougalli	N									
Sandwich tern Sterna sandvicensis	N									
Greater scaup Aythya marila	N									
Seabird assemblage Seabird assemblage	N									
Birds of woodland & scrub										
European honey buzzard Pernis apivorus	N									
European nightjar Caprimulgus europaeus	N									
Red kite Milvus milvus	N									
Wood lark Lullula arborea	N									
Birds of lowland heaths & brecks										
Dartford warbler Sylvia undata	N									
Hen harrier Circus cyaneus	N									
European honey buzzard Pernis apivorus	N									
European nightjar Caprimulgus europaeus	N									
Stone curlew Burhinus oedicnemus	N									
Wood lark Lullula arborea	N									
Birds of lowland wet grassland										
Barnacle goose Branta leucopsis [Eastern Greenland/Scotland/Ireland]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bar tailed godwit Limosa lapponica	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

EA Class Name	WR Sensitive?	Change in water levels or table	Change in flow or velocity regime	Change in surface flooding	Changed water chemistry	Change in FW flow to estuary	Change in salinity regime	Reduced dilution capacity	Habitat loss	Entrapment
Tundra swan Cygnus columbianus bewickii	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Black tailed godwit Limosa limosa islandica	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dark bellied brent goose Branta bernicla bernicla	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Light bellied brent goose Branta bernicla hrota [Canada/Ireland]	N									
Eurasian curlew Numenius arquata	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dunlin Calidris alpina alpina	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dunlin Calidris alpina schinzii	N									
European golden plover Pluvialis apricaria	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Greylag goose Anser anser [Iceland/UK/Ireland]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Grey plover Pluvialis squatarola	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Hen harrier Circus cyaneus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red knot Calidris canutus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Northern lapwing Vanellus vanellus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Eurasian oystercatcher Haematopus ostralegus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pink footed goose Anser brachyrhynchus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Common redshank Tringa totanus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ruff Philomachus pugnax	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Common snipe Gallinago gallinago	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Eurasian teal Anas crecca	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Whooper swan Cygnus cygnus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Birds of lowland dry grassland										
Stone curlew Burhinus oedicnemus	N									
Birds of lowland freshwaters & their margins										
Pied avocet Recurvirostra avosetta	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Tundra swan Cygnus columbianus bewickii	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Great bittern Botaurus stellaris	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Common tern Sterna hirundo	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Great cormorant Phalacrocorax carbo	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Gadwall Anas strepera	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Great crested grebe Podiceps cristatus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Greylag goose Anser anser [Iceland/UK/Ireland]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Hen harrier Circus cyaneus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Lesser black backed gull Larus fuscus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Little egret Egretta garzetta	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Eurasian marsh harrier Circus aeruginosus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mediterranean gull Larus melanocephalus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pink footed goose Anser brachyrhynchus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Northern pintail Anas acuta	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red-throated diver Gavia stellata	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ringed plover Charadrius hiaticula	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ruff Philomachus pugnax	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Common shelduck Tadorna tadorna	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Northern shoveler Anas clypeata	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Common snipe Gallinago gallinago	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

EA Class Name	WR Sensitive?	Change in water levels or table	Change in flow or velocity regime	Change in surface flooding	Changed water chemistry	Change in FW flow to estuary	Change in salinity regime	Reduced dilution capacity	Habitat loss	Entrapment
Eurasian teal Anas crecca	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Tufted duck Aythya fuligula	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Greater white fronted goose Anser albifrons albifrons	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Greenland white fronted goose Anser albifrons flavirostris	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Whooper swan Cygnus cygnus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Eurasian wigeon Anas penelope	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Waterfowl assemblage Waterfowl assemblage	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Farmland Birds										
Barnacle goose Branta leucopsis [Eastern Greenland/Scotland/Ireland]	N									
Bar tailed godwit Limosa lapponica	N									
Tundra swan Cygnus columbianus bewickii	N									
Dark bellied brent goose Branta bernicla bernicla	N									
Light bellied brent goose Branta bernicla hrota [Canada/Ireland]	N									
Eurasian curlew Numenius arquata	N									
Dunlin Calidris alpina alpina	N									
Dunlin Calidris alpina schinzii	N									
European golden plover Pluvialis apricaria	N									
Greylag goose Anser anser [Iceland/UK/Ireland]	N									
Grey plover Pluvialis squatarola	N									
Hen harrier Circus cyaneus	N									
Red knot Calidris canutus	N									
Northern lapwing Vanellus vanellus	N									
Eurasian marsh harrier Circus aeruginosus	N									
Eurasian oystercatcher Haematopus ostralegus	N									
Pink footed goose Anser brachyrhynchus	N									
Red kite Milvus milvus	N									
Common redshank Tringa totanus	N									
Stone curlew Burhinus oedicnemus	N									
Greater white fronted goose Anser albifrons albifrons	N									
Greenland white fronted goose Anser albifrons flavirostris	N									
Whooper swan Cygnus cygnus	N									
Eurasian wigeon Anas penelope	N									
Birds of coastal habitats										
Arctic tern Sterna paradisaea	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pied avocet Recurvirostra avosetta	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Barnacle goose Branta leucopsis [Eastern Greenland/Scotland/Ireland]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bar tailed godwit Limosa lapponica	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Tundra swan Cygnus columbianus bewickii	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Black tailed godwit Limosa limosa islandica	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dark bellied brent goose Branta bernicla bernicla	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Light bellied brent goose Branta bernicla hrota [Canada/Ireland]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red-billed chough Pyrrhocorax pyrrhocorax	N									
Black (common) scoter Melanitta nigra	N									
Common tern Sterna hirundo	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

EA Class Name	WR Sensitive?	Change in water levels or table	Change in flow or velocity regime	Change in surface flooding	Changed water chemistry	Change in FW flow to estuary	Change in salinity regime	Reduced dilution capacity	Habitat loss	Entrapment
Great cormorant Phalacrocorax carbo	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Eurasian curlew Numenius arquata	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dunlin Calidris alpina alpina	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dunlin Calidris alpina schinzii	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Northern gannet Morus bassanus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
European golden plover Pluvialis apricaria	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Great crested grebe Podiceps cristatus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Grey plover Pluvialis squatarola	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Common guillemot Uria aalge	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Hen harrier Circus cyaneus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Herring gull Larus argentatus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red knot Calidris canutus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Lesser black backed gull Larus fuscus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Little egret Egretta garzetta	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Little tern Sterna albifrons	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Eurasian marsh harrier Circus aeruginosus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mediterranean gull Larus melanocephalus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Merlin Falco columbarius	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Eurasian oystercatcher Haematopus ostralegus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Peregrine falcon Falco peregrinus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pink footed goose Anser brachyrhynchus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Northern pintail Anas acuta	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Atlantic puffin Fratercula arctica	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Purple sandpiper Calidris maritima	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Common redshank Tringa totanus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ringed plover Charadrius hiaticula	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Roseate tern Sterna dougalli	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ruff Philomachus pugnax	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Sanderling Calidris alba	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Sandwich tern Sterna sandvicensis	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Greater scaup Aythya marila	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Common shelduck Tadorna tadorna	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Short eared owl Asio flammeus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Slavonian grebe Podiceps auritus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Eurasian teal Anas crecca	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ruddy turnstone Arenaria interpres	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Greater white fronted goose Anser albifrons albifrons	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Greenland white fronted goose Anser albifrons flavirostris	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Whooper swan Cygnus cygnus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Eurasian wigeon Anas penelope	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Waterfowl assemblage Waterfowl assemblage	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Seabird assemblage Seabird assemblage	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Birds of estuarine habitats										
Arctic tern Sterna paradisaea	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

EA Class Name	WR Sensitive?	Change in water levels or table	Change in flow or velocity regime	Change in surface flooding	Changed water chemistry	Change in FW flow to estuary	Change in salinity regime	Reduced dilution capacity	Habitat loss	Entrapment
Pied avocet Recurvirostra avosetta	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Barnacle goose Branta leucopsis [Eastern Greenland/Scotland/Ireland]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bar tailed godwit Limosa lapponica	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Black tailed godwit Limosa limosa islandica	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dark bellied brent goose Branta bernicla bernicla	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Light bellied brent goose Branta bernicla hrota [Canada/Ireland]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Black (common) scoter Melanitta nigra	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Common tern Sterna hirundo	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Great cormorant Phalacrocorax carbo	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Eurasian curlew Numenius arquata	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dunlin Calidris alpina alpina	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Dunlin Calidris alpina schinzii	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
European golden plover Pluvialis apricaria	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Great crested grebe Podiceps cristatus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Grey plover Pluvialis squatarola	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Hen harrier Circus cyaneus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Herring gull Larus argentatus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red knot Calidris canutus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Northern lapwing Vanellus vanellus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Lesser black backed gull Larus fuscus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Little egret Egretta garzetta	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Little tern Sterna albifrons	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mediterranean gull Larus melanocephalus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Merlin Falco columbarius	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Eurasian oystercatcher Haematopus ostralegus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Peregrine falcon Falco peregrinus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Pink footed goose Anser brachyrhynchus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Northern pintail Anas acuta	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Purple sandpiper Calidris maritima	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Common redshank Tringa totanus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ringed plover Charadrius hiaticula	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ruff Philomachus pugnax	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Sanderling Calidris alba	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Sandwich tern Sterna sandvicensis	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Greater scaup Aythya marila	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Common shelduck Tadorna tadorna	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Northern shoveler Anas clypeata	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Slavonian grebe Podiceps auritus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Common snipe Gallinago gallinago	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Eurasian teal Anas crecca	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ruddy turnstone Arenaria interpres	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Greater white fronted goose Anser albifrons albifrons	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Greenland white fronted goose Anser albifrons flavirostris	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Eurasian wigeon Anas penelope	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

EA Class Name	WR Sensitive?	Change in water levels or table	Change in flow or velocity regime	Change in surface flooding	Changed water chemistry	Change in FW flow to estuary	Change in salinity regime	Reduced dilution capacity	Habitat loss	Entrapment
Waterfowl assemblage Waterfowl assemblage	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Seabird assemblage Seabird assemblage	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Not classified by EA										
Submarine structures made by leaking gases	N									
Atlantic decalcified fixed dunes (Calluno Ulicetea)	N									
Dunes with Hippopha rhamnoides	N									
Machairs (in Ireland)	Y									
Coastal dunes with Juniperus spp.	N									
Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto Nanojuncetea	Y									
Sub Arctic Salix spp. scrub	N									
Alpine and subalpine calcareous grasslands	N									
Species rich Nardus grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe)	N									
Caves not open to the public	N									
Caledonian forest	N									
Harbour porpoise Phocoena phocoena	N									
Green shield-moss Buxbaumia viridis	Y									
Killarney fern Trichomanes speciosum	Y									
Slender naiad Najas flexilis	Y									
Ramshorn snail Anisus vorticulus	Y									

Appendix E
Feasible Options Review

United Utilities WRMP 2019
Habitats Regulations Assessment – Initial Review of Feasible Options

1. Introduction

1.1 The WRMP

All water companies in England and Wales must set out their strategy for managing water resources across their supply area over the next 25 years. This statutory requirement is defined under the Water Act 2003, which also sets out how water companies should publish a Water Resources Management Plan (WRMP) for consultation, setting out how they will balance supply and demand over the 25 year planning period. The WRMP is linked to other water resource planning and policy documents, including the Drought Plan, Water Efficiency Strategy and Leakage Strategy.

The WRMP process identifies potential shortages in the future availability of water and sets out the possible solutions required to maintain the balance between water available and future demand for water. The process initially reviews as many potential solutions as possible (the 'unconstrained list' of options) to identify 'feasible' options for each Water Resource Zone (WRZ) where deficits are predicted. These 'feasible' options are reviewed according to an industry standard methodology to identify 'preferred options' to resolve any supply deficits in relation to financial, environmental and social costing. This preferred list is based on standard assessment methodologies set out in the WRMP, as well as the Strategic Environmental Assessment (SEA) and the Habitats Regulations Assessment. United Utilities (UU) is currently preparing its WRMP for the period 2019 – 2044.

1.2 Habitats Regulations Assessment

Regulation 61 of the *Conservation of Habitats and Species Regulations 2010* (as amended) (the 'Habitats Regulations') states that if a plan or project is "*(a) is likely to have a significant effect on a European site*[1] *or a European offshore marine site*[2] *(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 plan is given effect.

[1] Strictly, 'European sites' are: any Special Area of Conservation (SAC) from the point at which the European Commission and the UK Government agree the site as a 'Site of Community Importance' (SCI); any classified Special Protection Area (SPA); any candidate SAC (cSAC); and (exceptionally) any other site or area that the Commission believes should be considered as an SAC but which has not been identified by the Government. 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') apply; 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. 118) when considering development proposals that may affect them. "European site" is therefore used in this report in its broadest sense, as an umbrella term for all of the above designated sites. Additional information on European site designations is provided in Appendix A.

[2] 'European offshore marine sites' are defined by Regulation 15 of *The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007* (as amended); these regulations cover waters (and hence sites) over 12 nautical miles from the coast.

The process by which Regulation 61 is met is known as Habitats Regulations Assessment (HRA)[3]. 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) and, if so, whether these effects will result in any adverse effects on the site's integrity. UU has a statutory duty to prepare its WRMP and is therefore the Competent Authority for any HRA.

1.3 This Technical Note

UU has commissioned Amec Foster Wheeler (AFW) to undertake the data collection and interpretation required to support an HRA of its WRMP, and to determine whether any aspects of the WRMP (alone or in-combination) could have significant or adverse effects on the integrity of any European sites. As part of this process AFW has undertaken an initial review of the 'feasible options' identified by UU; this technical note summarises this review.

The note may be used to support consultations with the statutory authorities although it is not a 'draft HRA', 'screening', or similar assessment of the final plan and is not intended to provide a definitive conclusion on the likely effects of the final WRMP. Rather, it is primarily intended to inform UU's selection of preferred options, by identifying:

- those options that would appear to have an unavoidable risk of adverse effects on European sites (and which should therefore be avoided if possible);
- those options where significant or adverse effects would not appear likely, assuming established avoidance and mitigation measures can employed at the scheme level; and
- those options where effects are currently uncertain, which would require additional data or information on operation / construction to support a robust HRA of the WRMP.

2. Approach

2.1 Overview of Plan-Level HRA

Regulation 61 essentially provides a test that the final plan must pass; there is no statutory requirement for HRA to be undertaken on draft plans or similar developmental stages (e.g. the unconstrained or feasible options). However, it is accepted best-practice for the HRA of strategic planning documents to be run as an iterative process alongside plan development, with the emerging proposals or options continually assessed for their possible effects on European sites and modified or abandoned (as necessary) to ensure that the subsequently adopted plan is not likely to result in significant or adverse effects on any European sites, either alone or 'in combination' with other plans. This is undertaken in consultation with NE, NRW, the EA and other appropriate consultees. Therefore, the principles of Regulation 61 are typically applied to the emerging components of strategic plans – in this case the feasible options.

The HRA process is a staged assessment to determine 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 (referred to as 'screening'); and, if so, whether these effects will adversely affect the site's integrity (referred to as 'appropriate assessment').

The 'screening' test or 'test of significance' is a low bar: a plan should be considered 'likely' to have an effect if the competent authority (in this case UU) is unable (on the basis of objective information) to exclude the possibility that the plan could have significant effects on any European site, either alone or in combination with other plans or projects; an effect will be 'significant' if it could undermine the site's conservation objectives. Screening can be used to 'screen-out' or exclude European sites or plan components from further assessment, if it is possible to determine that significant effects will not occur (e.g. if sites or interest

[3] The term 'Appropriate Assessment' has been historically used to describe the process of assessment; however, the process is now more accurately termed 'Habitats Regulations Assessment' (HRA), with the term 'Appropriate Assessment' limited to the specific stage within the process.

features are clearly not vulnerable (both exposed and sensitive) to the outcomes of a plan). Screening can take account of any measures included in the WRMP to avoid significant effects.

An 'appropriate assessment' stage provides a more detailed examination of the plan (or its components) where the effects are significant or uncertain[4]. Note that undertaking a more detailed assessment does not necessarily imply a conclusion of 'significant effects' for those sites or aspects that are 'screened in' since in many cases the assessment is completed due to a residual uncertainty which the assessment is intended to resolve. The 'appropriate assessment' stage may therefore conclude that the proposals are likely to have an adverse effect on the integrity of a site (in which case they should be abandoned or modified); or that the effects will be significant but not adverse (i.e. an effect pathway exists, but those effects will not undermine site integrity); or that the effects will, if re-screened, be 'not significant' (taking into account the additional assessment or perhaps additional measures proposed for inclusion in the final plan).

2.2 Review of the Feasible Options

The review of the feasible options is not a 'formal' component of the HRA process as the key assessment stages (screening / appropriate assessment) can only be strictly applied to the proposed final version of the plan (i.e. the preferred options). However, the assessment principles that underpin screening and appropriate assessment are applied to the emerging feasible options to:

- guide the selection of preferred options by UU;
- inform the scope of any further assessments likely to be required as the options are refined and developed, including any data likely to be required to support the selection of an option as a preferred option; and
- provide an opportunity for the statutory consultees to review the HRA methods and assumptions, and identify any other potential effects they are aware of that that may need consideration in relation to particular options[5].

Approach

For the HRA, the initial assessment of the feasible options focuses on the 79 'supply-side' options only, i.e.

- the development of new surface or groundwater sources, or desalination of sea water;
- modification of an existing licence to alter the operational regime;
- 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;
- capital works to the network or assets;
- transferring water to/from adjacent water companies; or
- transferring water or licences from other third parties.

It does not explicitly consider demand- or post-distribution options designed to reduce treated water use (such as metering or provision of water butts) or leakage reduction options as these cannot negatively affect any European sites[6].

[4] i.e. 'likely significant effects', where the possibility of significant effects cannot be excluded.

[5] Depending the consultation proposals for the feasible options stage.

[6] The only realistic mechanism for a negative effect would be through direct encroachment at the local-level (for example a leaking pipe might be located in or near a SAC), but this cannot be meaningfully assessed at the strategic level since location-specific information is not available without specific investigations, which would form part of the package (i.e. the precise location and severity of most leakages is not known ahead of detection).

The feasible options review identifies the location and the anticipated outcomes of each option through construction and operation, based on the option descriptions provided by UU. GIS is then used to identify all European sites within a precautionary 20km 'zone of influence', with sites beyond this considered where reasonable impact pathways are present based on the scheme description (for example, receptors downstream of significant new abstractions). The possible effects of each option on European sites and their interest features is then assessed, based on

- the anticipated operation of each option and predicted zone of hydrological influence;
- any predicted construction works required for each option;
- the European site interest features and their sensitivities; and
- the presence of reasonable impact pathways.

Assumptions

The review of the feasible options takes account of established project-level avoidance and mitigation measures that are known to be achievable, available and likely to be effective – for example, normal construction best-practice or project planning. These measures are identified in Appendix B to this technical note and it is assumed that this list will be incorporated as appropriate into the WRMP or its supporting documentation. It is considered (based on professional experience) that most potential construction effects can almost certainly be avoided or mitigated at the project-level using these measures or similar construction best practice[7]. For the operational aspects of supply-side options, potential avoidance measures will be considered where these are apparent, although in most instances the mitigation likely to be required for an option (e.g. compensation releases; 'hands-off' flows) cannot necessarily be determined at this stage, and may not be identifiable without substantial additional investigation or input from UU.

The review also assumes that the existing licensing regime is having no significant effects on any European sites, or if this is not the case, that any necessary licence amendments required (e.g. sustainability reductions etc.) have been included in any deficit modelling. The feasible options will therefore only affect European sites through any new resource and production-side options advocated to resolve deficits, and not through the existing permissions regime[8], and it is therefore assumed that options that are 'network solutions' only (i.e. moving spare licensed volumes) will not have operational effects. It is also assumed that there is a reasonable prospect or evidence that the proposed abstraction volumes are available for those 'new water' options.

In combination effects

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. It should also be noted that the WRMP explicitly accounts for predicted water demand changes due to other plans and major projects in its modelling scenarios, which effectively contributes to the 'in combination' assessment.

The review of the feasible options does not include an assessment of the potential 'in combination' effects, either between options or with other plans, projects or programmes. This is due to the large number of options and the level of detail provided on them; any assessment would be speculative and mostly abortive. The potential for in combination effects will be reviewed as the preferred options are selected, with a full 'in combination' assessment undertaken of the preferred options. However, UU should be aware of the risks of in combination effects between options and with other plans (e.g. the Drought Plan) when selecting preferred options, particularly where options affect the same catchments or water resources.

[7] Although note that this does not remove the need for project-level HRA.

[8] It is recognised that, occasionally, agreed sustainability reductions have been subsequently shown to be insufficient to address the effects of PWS abstraction on some sites (the most notable example is the River Ehen in Cumbria).

Outputs

The review of the feasible options is summarised in Appendix A. This provides a short description of each option and a narrative assessment of its likely effects, with those European sites within 20km that are most vulnerable (i.e. both exposed and sensitive) to the delivery or operation of the scheme[9] noted in the text. It then provides broad 'recommendations' regards progressing the options as preferred options based on the anticipated construction and operational effects; the criteria for these recommendations are as follows (colour coded for clarity):

Table 2.1 Summary of criteria for considering feasible options as potential

Recommend as preferred option?	Notes
Yes	Option appears unlikely to have any effects on European sites as features are either not exposed or not sensitive to the likely outcomes (i.e. no or no reasonable impact pathways for example, operational effects for a 'construction only network solution; dry habitats over (say) 2km from an option; sites in different surface water catchments; upstream sites; etc. (being mindful of mobile species)). In these instances, the recommendation is 'Yes', i.e. no reason not to pursue as preferred option.
Yes	Options where pathways for effects are clearly identifiable (such that HRA would probably be required at the scheme level) but where the potential effects can obviously be avoided or mitigated using established measures that are known to be effective, for example: ▸ construction near a European site (effects avoidable with normal project planning and best-practice); ▸ minor works within European sites (e.g. works to existing assets where effects unlikely to be adverse due to absence of features); ▸ major works near / within European sites that can be completed without adverse effects (e.g. crossings of SAC rivers using existing roads or directional drilling); ▸ operational effects that are avoidable with established operational mitigation (e.g. licence controls, although at this stage potential operational effects will usually lead to an 'uncertain' recommendation to flag the need for additional information). In these instances the generic measures outlined in Appendix B can be relied on if these are included within the WRMP package, although the final plan may need to include specific measures for potential 'high-impact' options (e.g. commitments to non-invasive river crossings or timing works to avoid sensitive periods).
Uncertain	Options where a potential effect is conceivable and cannot be discounted, and the likely effects are therefore uncertain at the feasible options stage. This is typically due to limitations on the information available, either in terms of the operation of the scheme, the mitigation that might be employed, or the data available on the interest features of the sites. These options, if pursued as preferred options, may require ▸ additional investigation to determine their effects, and there may be a risk that the risk of effects cannot be quantified satisfactorily at the strategic level (for example, substantial additional modelling or site-specific investigation may be required). ▸ the identification of specific measures or requirements for scheme delivery for inclusion with the WRMP. This category is therefore intended as a flag to identify those options where there is potentially additional 'cost' associated with their inclusion (either related to the data required to support a robust HRA and hence the option, or the need for specific mitigation commitments) which UU should consider when selecting the preferred options.
No	Options where significant effects (i.e. not negligible or inconsequential) on a European site are very likely or certain due to the scale/ nature/location of the option proposals, or the vulnerability and distribution of the interest features within /near the European site. Although a full appropriate assessment is not undertaken at this stage, adverse effects may be more likely (or even certain) if the scheme is taken forward as a preferred option and it is likely that extensive or unproven mitigation will be required following scheme-level investigations. Feasible options in this category are not recommended for consideration as preferred options (although additional information may allow a re-assessment).

3. Next steps

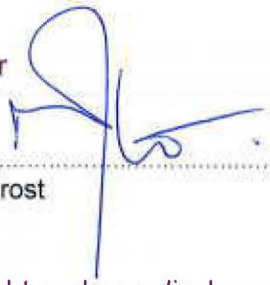
The initial assessments provided for the feasible options are not formal screening assessments or definitive conclusions; further examination of the likely effects of the preferred options will be required to clearly demonstrate 'no likely significant effects' (screening) or 'no adverse effects on integrity' (appropriate assessment), including 'in combination'. The review of the feasible options therefore provides a framework

[9] For clarity, the summary tables do not explicitly identify or assess every European site within 20km; this will be set out in more comprehensive 'screening proformas' that will accompany the final HRA which will be used to transparently document the screening process.

for the selection of the preferred options, identifies areas where further information may be required from UU, and allows UU to demonstrate a robust iterative approach to the HRA.

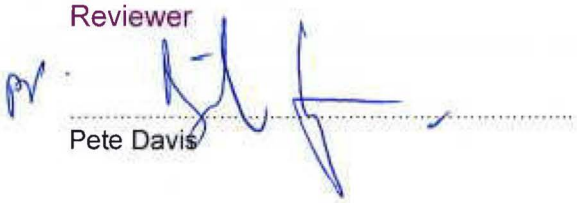
The review of the feasible options will be one factor in the preferred options selection process, and it is very possible that UU will wish to pursue options that are currently flagged as 'uncertain'. In these instances it will be necessary to determine the information requirements that would allow a robust conclusion of 'no significant effects' or 'no adverse effects' to be drawn, and hence allow the WRMP to pass the Regulation 61 tests. This needs to be undertaken in conjunction with UU and its engineers, and may require additional supporting evidence or data from other organisations (e.g. Natural England; the Environment Agency), particularly where the uncertainty relates to operational effects and the availability of new water.

Author



Mike Frost

Reviewer



Pete Davis

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Appendix A

Summary of Feasible Options Review

Appendix A - Summary of Feasible Options Review

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR001	River Alt to Prescott WTW	The scheme would require: • New river abstraction on the River Alt • Raw water transfer PS to Prescot WTW , c.13km long • New WTW located at Prescot to treat up to 20 Ml/d river water • Transfer to existing SR storage located at Prescot	The Ribble and Alt Estuaries SPA / Ramsar sites and Sefton Coast SAC are downstream receptors (via the River Alt) located ~6km downstream of the proposed abstraction. Construction effects can be avoided with established measures although the availability of the abstraction volumes would need to be confirmed by the EA, and the acceptability of this option viz effects on European sites would need to be established if pursued as a preferred option (and so operational effects are 'uncertain' at this stage).	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation
WR003	Fisher Tarn	Fisher Tarn is an existing UU reservoir that is not in current use. It does not have an abstraction licence. It is assumed that a new licence would be granted for use of this source, up to 5 Ml/d. The option would require: • Construction of a new raw water transfer pipeline between the outlet of Fisher Tarn IR to connect to and discharge to Mint South Well making modifications to the Well as appropriate • A preliminary view of this indicates that the raw water pipeline would be c.1.75km in length and would need to transfer up to 5 Ml/d of raw water to Mint South Well • This may be achieved under gravity conditions but the need for a raw water pumping station needs to be considered as part of the design	The closest sites to this option are the Morecambe Bay Pavements SAC (not vulnerable to construction or operation) and the Morecambe Bay SAC / SPA / Ramsar sites, which are downstream receptors via the St. Sunday Beck and River Bela. The current operation of the reservoir is not set out (e.g. frequency / volume of overflows; compensation releases etc.) but is clear that a 5Mld abstraction from this source will be inconsequential compared to other inputs to the River Bela and hence this section of Morecambe Bay.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - effects possible but significant or significant adverse effects avoidable with established operational mitigation (e.g. licence controls)
WR004	Longsleddale Reservoir	The scheme would require: • New impounding reservoir in Longsleddale Valley, located u/s of Sadgill between Shipman Knotts and Great Howe, raw water transfer to inlet of Watchgate WTW to allow for impoundment, compensation, draw-off of water that meets the necessary design and safety criteria for statutory impoundment reservoir structures • Proposed reservoir dimensions based on historical data retrieved: 22.5m height, giving a gross capacity of 1897 Ml. • Based on these measurements, it is assumed that the reservoir would be contained within the 240 mAOD, with the base of the reservoir at 215 mAOD • Raw water pipeline and pumping station (likely required), c.10km long between Longsleddale IR and inlet of Watchgate WTW • Transfer capacity of the scheme assumed to be 25 Ml/d maximum with a calculated yield of 16 Ml/d	The River Sprint forms part of the River Kent SAC (the SAC starts approximately 2km downstream of the proposed reservoir location) and therefore significant effects are likely, both during construction and operation. Some potential operational effects may be avoidable using established measures (e.g. compensation releases, notwithstanding temperature issues) but the potential for adverse effects is substantial. Construction would be a significant undertaking and there is a risk of unmitigatable effects due to e.g. sediment release.	Construction: Uncertain - significant effects cannot be excluded and may require the identification of bespoke mitigation measures or amendments to scheme design at the plan level	Operation: No - significant effects certain and adverse effects potentially unavoidable.

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR006	Glaze Brook	The scheme would require: • New lowland river raw water abstraction from Glaze Brook, assumed capacity 15 Ml/d • New c.11km raw water transfer to Lightshaw WTW • New WTW process for river water; output blended with existing groundwater sources from Lightshaw WTW • Transfer to existing SR storage at Lightshaw	New abstraction licence required with EA to confirm WAFU, although nearest downstream receptor is some distance away so effects unlikely to be significant depending on abstraction volumes. Potential operational effects. Pipeline route through / directly adjacent to a component of the Manchester Mosses SAC - significant effects on the current pipeline alignment would be likely and therefore a re-route would be required to support selection as a preferred option.	Construction: Uncertain - significant effects cannot be excluded and may require the identification of bespoke mitigation measures or amendments to	Operation: Yes - effects possible but significant or significant adverse effects avoidable with established operational mitigation (e.g. licence controls)
WR007	Sankey Brook	The scheme would require: • New lowland river raw water abstraction from Sankey Brook, capacity 10 Ml/d based on CEH gauge data from upstream at Causey Bridges. Q95 flow data at this point = 0.733 m3/s, equates to 63.3 Ml/d. Assume that 10 Ml/d available for abstraction (would need to be discussed with EA) • New c.5.5km raw water transfer to Hill Cliffe SR and new WTW at same location • Transfer to existing treated water storage at Hill Cliffe SR	This scheme could presumably reduce flows into the Mersey Estuary SPA / Ramsar via the Sankey Brook, although effects likely to be minor. Construction effects avoidable assuming established measures. New abstraction licence required EA to confirm is WAFU; additional investigation would be required to confirm effects on the estuary and permitted abstraction volumes (hence operational effects uncertain).	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR009	River Rawthey to Watchgate WTW	This option would require a new abstraction from the River Rawthey (new licence required, licenced volumes TBC but anticipated 10 - 20 Mld). The principal construction elements of this option are: • New river abstraction and intake on the River Rawthey near Sedbergh • New PS (assumed needed) to transfer raw water transfer to Watchgate WTW, possible pipeline route c. 15.5km long • Treatment work modifications to the existing WTW facility to accommodate a river abstraction, including provision of appropriate mitigation for the transfer of Invasive Non-Native Species (INNS) between catchments.	The closest sites to this option are the Morecambe Bay Pavements SAC (not vulnerable to construction or operation) and the River Kent SAC (likely to be crossed by the pipe); effects on the River Kent SAC can almost certainly be avoided with established avoidance and mitigation measures (e.g. timing works to avoid fish migration periods; construction best practice). The Morecambe Bay SAC / SPA / Ramsar sites are downstream receptors (via the River Rawthey and hence the River Lune) but are located almost 40km downstream, and so it is unlikely that abstraction volumes of 10 - 20 Mld would significantly affect discharges to the Bay via the Lune (although this would need to be confirmed by the EA).	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - effects possible but significant or significant adverse effects avoidable with established operational mitigation (e.g. licence controls)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR012	Borrow Beck Reservoir	The scheme would require: • New impounding reservoir in Borrow Beck between Shooter Howe and Belt Howe, raw water transfer to inlet of Watchgate WTW. • Proposed reservoir dimensions based on scope originally costed for AMP4: 30m high earth embankment giving a gross capacity of 33,000 Ml • Based on these dimensions, it is assumed that the reservoir would be contained within the 230 mAOD, with the base of the reservoir at about 200 mAOD. • Raw water pipeline and pumping station required between Borrow Beck and inlet of Watchgate WTW • Transfer capacity of the scheme assumed to be half of the yield as calculated (124 Ml/d – which includes abstraction and compensation), i.e. 60 Ml/d • It is assumed that modifications to Watchgate WTW process and capacity will not be required for this option in order to treat the additional water.	Construction of the impounding reservoir would be a significant undertaking although no European sites are likely to be directly affected by this component. The current route of the pipeline crosses Bannisdale Beck, which is part of the Kent River SAC; significant effects are possible but likely to be avoidable with established measures. No operational effects anticipated.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR026a	River Ribble (Stocks Reservoir)	This option would require a new abstraction from the River Ribble (new licence required, licenced volumes TBC but anticipated 5 - 10 Mld). The principal construction elements of this option are: • New river abstraction and intake on the River Ribble near Clitheroe • New PS to transfer raw water transfer to Stocks IR, c. 15km long • Possible treatment work modifications to the existing WTW facility to accommodate a river abstraction, including provision of appropriate mitigation for the transfer of Invasive Non-Native Species (INNS) between catchments.	The closest sites to this option are the North Pennines Dales Meadows SAC and the Bowland Fells SPA. North Pennines Dales Meadows SAC are within 100m of the currently proposed pipeline route, but effects on these sites would not be expected with use of established avoidance and mitigation measures. The Ribble and Alt Estuaries SPA / Ramsar sites are downstream receptors (via the River Ribble) but are located almost 30km downstream, and so it is unlikely that abstraction volumes of 5 - 10 Mld would significantly affect discharges to these sites (although this would need to be confirmed by the EA, and so operational effects are 'uncertain' at this stage).	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR037a	Haweswater IR 0.5m	This option would involve an increase in the capacity of the Haweswater Reservoir by raising the top water level (TWL) by 0.5m. This would require a modification to the impoundment licence. The principal construction elements of this option are: • increase TWL by 0.5m through installation of a steel weir plate across the spillway crest, whilst still keeping the PMF plus wave surcharge below wave wall height.	The River Eden SAC is fed directly from Haweswater Reservoir and this site will be particularly vulnerable to construction or operation effects. Assuming that operation of the reservoir would be as per current situation (i.e. any compensation releases etc maintained) then adverse effects would not necessarily be expected (although there may be changes in spill frequency particularly during the filling period); similarly, construction impacts can be avoided with established measures although the proximity of the SAC will require that this be clearly established at the scheme level. The main impact will be on the Naddle Forest SAC, which is immediately adjacent to the southern edge of the reservoir (~2.6 km directly on the water's edge, based on GIS) and which would be directly affected as a result of increased reservoir levels. Precise effects cannot be determined without micro-topographical analysis, but a 0.5m increase in levels would likely reduce the SAC area by at least 0.13 ha and potentially more depending on local topography; this would certainly be a significant effect and potentially adverse, and would be unavoidable.	Construction: Uncertain - significant effects cannot be excluded and may require the identification of bespoke mitigation measures or amendments to scheme design at the plan level	Operation: No - significant effects certain and adverse effects potentially unavoidable.

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR037b	Haweswater IR 1m	This option would involve an increase in the capacity of the Haweswater Reservoir by raising the top water level (TWL) by 1m. This would require a modification to the impoundment licence. The principal construction elements of this option are: • increase TWL by 1m without spillway modifications by use of the Fusegate system.	The River Eden SAC is fed directly from Haweswater and this site will be particularly vulnerable to construction or operation effects. Assuming that operation of would be as per current situation (i.e. any compensation releases etc maintained) then adverse effects would not necessarily be expected (although there may be changes in spill frequency, particularly during the filling period); similarly, construction impacts can be avoided with established measures although the proximity of the SAC will require that this be clearly established at the scheme level. The main impact will be on the Naddle Forest SAC, which is immediately adjacent to the southern edge of the reservoir (~2.6 km directly on the water's edge, based on GIS) and which would be directly affected as a result of increased reservoir levels. Precise effects cannot be determined without micro-topographical analysis, but a 0.5m increase in levels would likely reduce the SAC area by at least 0.13 ha and potentially more depending on local topography; this would certainly be a significant effect and potentially adverse, and would be unavoidable.	Construction: Uncertain - significant effects cannot be excluded and may require the identification of bespoke mitigation measures or amendments to scheme design at the plan level	Operation: No - significant effects certain and adverse effects potentially unavoidable.
WR039a	River Eden (Temple Sowerby) to Watchgate	The scheme would require: • New river abstraction and intake on the River Eden in the vicinity of Temple Sowerby, sized at flows of 25 and 50 Ml/d, the exact quantities available for abstraction will need to be confirmed with the Environment Agency • New PS and raw water transfer pipeline to Watchgate WTW • Modifications to existing WTW process or a new upfront WTW to adapt to the River Eden water. No change to maximum WTW output is proposed.	Abstraction is from River Eden SAC - significant effects are likely and so additional investigation would be required to confirm effects on the river and permitted abstraction volumes if selected as a preferred option (hence operational effects uncertain). Other operational effects are likely (fish entrainment etc). New pipeline runs under River Eden SAC in two locations (effects probably avoidable with standard measures) and through Asby Complex SAC - substantial significant construction effects likely without route modification (essential to support option as preferred).	Construction: Uncertain - significant effects cannot be excluded and may require the identification of bespoke mitigation measures or amendments to	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation
WR041	River Irthing to Cumwhinton plus Castle Carrock Link	The scheme would require: • New river abstraction on River Irthing at Newby East, near Warwick Bridge • New raw water transfer pumping station, 6.5 Ml/d maximum • New c.6 km raw water pipeline to Cumwhinton WTW • WTW modifications, if required, to treat the new water source at Cumwhinton WTW (current normal operation at 27 Ml/d; design maximum 40 Ml/d). No change to maximum WTW output is proposed. • New treated water transfer pipeline and pumping station (if needed) between Cumwhinton and Castle Carrock SR, sized at 6.5 Ml/d max flow	The scheme would require a new abstraction from River Irthing which is part of the River Eden SAC; significant effects are likely and so additional investigation would be required to confirm effects on the river and permitted abstraction volumes if selected as a preferred option (hence operational effects uncertain). Other operational effects are likely (fish entrainment etc). Construction would require new abstraction in the SAC and pipeline crossings; adverse effects likely to be avoidable through scheme-specific detailed design and established measures but more information required on these aspects.	Construction: Uncertain - significant effects cannot be excluded and may require the identification of bespoke mitigation measures or amendments to scheme design at the plan level	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR047a	Milwr Tunnel, Bagillt (Transfer to Huntington)	The scheme would require: • New abstraction from the outfall of the Milwr tunnel at Bagillt (up to 20 Ml/d even in dry summers should be available, possibly more at other times) • Transfer of raw water from Bagillt via a new raw water pipeline to Huntington WTW • Treatment at upgraded and upsized Huntington WTW • Transfer pumps to deliver increased flows up Dee LDTM to Prescot • Utilisation of increased flows up the existing WELM • There may be a benefit to the option without the need for WELM pumping to Woodgate Hill.	This option would utilise an existing mine water discharge. This would presumably reduce flows into the Dee Estuary SPA / Ramsar. Significant effects are likely and so additional investigation would be required to confirm effects on the estuary and permitted abstraction volumes if selected as a preferred option (hence operational effects uncertain), although it is likely that adverse effects would not occur. Construction would require works within the Dee catchment although significant effects likely to be avoidable through established measures. The new pipeline passes through the edge of Deeside and Buckley Newt Sites SAC - significant construction effects likely, unless re-routed (but likely to be achievable).	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR049b	River Ribble (Transfer to Anglezarke IR)	This option would require a new abstraction from the River Ribble (new licence required, licenced volumes TBC but anticipated 20 Mld) and transfer to an existing impoundment reservoir. The principal construction elements of this option are: • New river intake, screens and pumping station on River Ribble • 1.67km of 630mm OD raw water transfer main to Anglezarke IR The proposed capacity of the option is that was costed for the previous WRMP was 20 Ml/d. However, there may be more water available from the River Ribble for abstraction licensing based on the latest Environment Agency	The Ribble and Alt Estuaries SPA / Ramsar sites are downstream receptors (via the River Ribble) located ~10km downstream of the proposed abstraction; it is noted that the latest EA data suggests 20Mld may be available, although this would need to be confirmed by the EA, and so operational effects are 'uncertain' at this stage. Construction effects are avoidable with established measures.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR062a	Worthington WTW (Prospect SR)	The scheme would require: • Utilise existing raw water intake system from Worthington impounding reservoirs • Re-commission the existing WTW facility re-using existing filters or assume existing process is not fit for refurbishment and should be replaced for this Level 1 study • Utilise existing treated water mains to provide supplies to Prospect SR	No European sites or features are exposed to the likely effects of this scheme.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR062b	Worthington WTW (Rivington)	The scheme would require: • Utilise existing raw water intake system from Worthington impounding reservoirs • Raw water or partially treated pumped transfer of raw water transfer to connect to Rivington WTW for treatment alongside Rivington IR waters along a new pipeline.	No European sites or features are exposed to the likely effects of this scheme.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR074	River Darwen (Transfer to Fishmoor WTW)	The scheme would require: • New river intake, screens and pumping station on River Darwen in the vicinity of Roach Bridge • New raw water PS and pipeline transfer to Fishmoor IR • Assumed no changes to Fishmoor WTW process would be required unless there is a water quality risk that river water from the Darwen could compromise the existing WTW process for the upland sources, Process Engineering to advise.	The Ribble and Alt Estuaries SPA / Ramsar sites are downstream receptors (via the River Ribble) of the proposed abstraction. Construction effects can be avoided with established measures although the availability of the abstraction volumes would need to be confirmed by the EA, and the acceptability of this option viz effects on European sites would need to be established if pursued as a preferred option (and so operational effects are 'uncertain' at this stage).	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation
WR076	River Bollin	This scheme would require: • New river abstraction on the River Bollin near Lymm, sized at capacity of 25 Ml/d • New WTW at same location, sized at 25 Ml/d • New pumping station and c.6.5km treated water main between Lymm and Manchester DMZ, following the line of the existing treated water main from Lymm WTW • It is assumed that there will need to be some new network reinforcement in the receiving area around Manchester (Altrincham/Rivers Lane tile) but without detailed network modelling, this cannot be determined at present. • Assumed for this scope that the treated water mains connect to the site of Dunham SR for onward distribution into existing Manchester treated water system using the pumping stations at this location	The Mersey Estuary SPA / Ramsar sites are downstream receptors (via the River Mersey / Ship Canal) of the proposed abstraction. Construction effects can be avoided with established measures although the availability of the abstraction volumes would need to be confirmed by the EA, and the acceptability of this option viz effects on European sites would need to be established if pursued as a preferred option (although the contribution of the Bollin to flows in the Mersey will be limited and dominated by other inputs).	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - effects possible but significant or significant adverse effects avoidable with established operational mitigation (e.g. licence controls)
WR079b	Appleton Reservoir, Warrington	Appleton Reservoir is only used as an emergency fire-fighting supply for an industrial customer in Warrington. The scheme would require: • Reinstate Appleton IR with a new or refurbished point of abstraction from the draw-off tower located on the northern embankment • New raw water pumping station to deliver 6 Ml/d • New raw water pipeline between Appleton IR and Hill Cliffe SR site • New WTW facility built on the Hill Cliffe SR site to Appleton IR water • Likely requirement for sewer connection to discharge WTW waste product	No European sites or features are exposed to the likely effects of this scheme.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR079c	Appleton Reservoir, Warrington	As for WR079b, but delivering 9 Ml/d.	No European sites or features are exposed to the likely effects of this scheme.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR079d	Appleton Reservoir, Warrington	As for WR079b, but delivering 12 Ml/d.	No European sites or features are exposed to the likely effects of this scheme.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare
WR095	Roughton Gill	The scheme would require: • Reinstate Roughton Gill mine source, capacity 1.5 Ml/d • Utilise existing RW transfer pipelines between intake and Fellside village and then onwards to Caldbeck; new 300m of RW pipeline to site of Caldbeck SR • New WTW at Caldbeck • Treated water transfer to Caldbeck SR and new TW main between Caldbeck and Roundhills; assume 50/50 split between each SR	This option would require a new pipeline across a tributary of the River Caldew (part of the River Eden SAC; pipeline would be located approximately 1km upstream of the SAC boundary, and construction of a new WTW in the same area / catchment. Significant effects are possible although likely to be avoidable with established measures. The current licensing position is unclear from the scheme description and so further information is required to determine operational effects; however, as the source is located within the Lake District High Fells SAC it is possible that some features may be sensitive to the scheme operation.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR099a	Worsthorne Borehole (Compensation)	The scheme would require: • Reinstate and refurbish Worsthorne BH raw water abstraction borehole • Utilise existing raw water main and divert into surface water source with new length of pipeline (375m) to River Brun • New pump in BH, rising main in each BH (assumed 100m long), M&E. New or improved headworks borehole to asset standard design.	Abstraction licence abstraction in place and therefore it is assumed no significant operational effects on European sites are likely from the reinstatement of the borehole. No impact pathway for construction works.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR099b	Worsthorne Borehole (Hurstwood Ir)	This option would involve the re-instatement of the Worsthorne borehole with flow passed to Hurstwood IR. This would be within the terms of the existing licence. The principal construction elements of this option are: • Reinstate and refurbish Worsthorne BH raw water abstraction borehole • New raw water main and pump flows into Hurstwood IR	Abstraction licence already in place so it is assumed that no operational effects on European sites will occur. The scheme would involve construction works within 500m of the South Pennine Moors SAC and South Pennine Moors Phase 2 SPA, although effects on the features of these sites can be avoided with established measures, such as construction best-practice or timing works to avoid breeding / migration periods.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR099c	Worsthorne Borehole (Worsthorne WTW)	The scheme would require: • Reinstate and refurbish Worsthorne BH raw water abstraction borehole • Utilise existing raw water main to Worsthorne WTW • Modify existing WTW process accordingly to accept borehole water • New pump in BH, rising main in each BH (assumed 100m long), M&E. New or improved headworks borehole to asset standard design.	Abstraction licence abstraction in place and therefore it is assumed no significant operational effects on European sites are likely. The scheme would involve construction works within 1km of the South Pennine Moors SAC and South Pennine Moors Phase 2 SPA, although effects on the features of these sites can be avoided with established measures, such as construction best-practice or timing works to avoid breeding / migration periods.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR100	Thorncliffe Road Borehole, Barrow-In-Furness	The scheme would require: • Construct a new duplicate borehole at the Thorncliffe Road WTW site • Borehole construction: 0-10 metres (18") 457 mm diameter plain casing; 1.0-23.0 metres (15") 380 mm diameter plain casing. Total depth: 100 metres, borehole pump rising main needed: 50 metres • New pumping equipment to provide up to 4.5 Ml/d capacity, new WTW to replicate the existing Thorncliffe Road WTW facility, new inlet to Thorncliffe Road SR for the combined flow from the existing BH and new BH (9 Ml/d maximum). New borehole can run duty/assist with existing borehole. • Suggested new WTW facility built on the Thorncliffe SR site • As part of this scheme, a negotiated reduction from Schneider Road boreholes would be required in order to ensure no deterioration in WFD objectives for the Furness aquifer.	This option would require a new borehole duplicating an existing borehole; it is assumed that this would replace the existing borehole and utilise the abstraction licence (in which case no operational effects would be anticipated) although this is not clear from the description. The borehole is within 1km of the Morecambe Bay SAC and Duddon Estuary SPA / Ramsar site and so further information on the hydrological effects is required to fully determine effects of scheme.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR101	Franklaw Z Site plus Increased Franklaw WTW Treatment Capacity	The scheme would require: • Reinstate and refurbish two existing boreholes at Franklaw Z site with maximum output of 10 and 8 Ml/d • Utilise existing 27" RW pipeline between Z site and Franklaw WTW (NB: Another possibility is to T into the existing Rive Wyre RW main which could be looked at for a Level 2 scope) • New BH pumps @10 existing/utilised Franklaw/Broughton boreholes to deliver an additional 12 Ml/d RW to Franklaw WTW; assumed capacity of replacement pumps is 4 Ml/d each for costing purposes • Additional WTW phase at Franklaw WTW to treat the additional 30 Ml/d RW from boreholes.	No European sites or features are exposed to the likely effects of this scheme.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR102a	Widnes Boreholes to Prescot WTW	The scheme would require: • Refurbishment of existing Belle Vale, Netherley, Greensbridge Lane, Water Lane, Stockswell and Pex Hill borehole sites [note Bold Heath not included in this group under scope of WR102a and is considered separately under WR102e] • Utilisation of existing treated water mains from Widnes BH group to Pex Hill as raw water mains (note Stockswell is on a separate raw water main) • Refurbishment of Cronton Booster PS as appropriate to permit required flow transfer to Pex Hill • New break tank and pumping station located at Pex Hill • New raw water main between Pex Hill and Prescot WTW, most appropriate route • New WTW plant located at Prescot to treat the blended water from the open reservoirs and boreholes (refer to previous IRZ21 scope document for details of proposed PBD) to be sized between minimum and maximum capacities – see below. • New treated water main from Pex Hill to feed customers in DMA 127-1 who are fed from the treated water main now utilised as a raw water main • New headworks, pumps, M&E, civils, kiosks/buildings on all borehole sites, not including Stockswell which were refurbished in AMP4. 11 BHs in total require refurbishment.	Recommissioning existing boreholes / licences; no operational effects on European sites. No impact pathways for construction effects.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR102ai	Widnes Boreholes to Prescot WTW	The scheme would require: • Refurbishment of existing Belle Vale, Netherley, Greensbridge Lane, Water Lane, Stockswell and Pex Hill borehole sites [note Bold Heath not included in this group under scope of WR102a and is considered separately under WR102e] • Utilisation of existing treated water mains from Widnes BH group to Pex Hill as raw water mains (note Stockswell is on a separate raw water main) • Refurbishment of Cronton Booster PS as appropriate to permit required flow transfer to Pex Hill • New break tank and pumping station located at Pex Hill • New raw water main between Pex Hill and Prescot WTW, most appropriate route • New WTW plant located at Prescot to treat the blended water from the open reservoirs and boreholes (refer to previous IRZ21 scope document for details of proposed PBD) to be sized between minimum and maximum capacities – see below. • New treated water main from Pex Hill to feed customers in DMA 127-1 who are fed from the treated water main now utilised as a raw water main • New headworks, pumps, M&E, civils, kiosks/buildings on all borehole sites, not including Stockswell which were refurbished in AMP4. 11 BHs in total require refurbishment. • Addition of ion exchange.	Recommissioning existing boreholes / licences; no operational effects on European sites. No impact pathways for construction effects.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR102b	Widnes Boreholes to Liverpool and Warrington Dmzs	Recommission existing Widnes BH group, upgraded WTWs at Netherley, Stockswell and Pex Hill, treated water transfer to Liverpool and Warrington DMZs.	Recommissioning existing boreholes / licences; no operational effects on European sites. No impact pathways for construction effects.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare
WR102c	WIDNES BOREHOLES TO RUNCORN AND WARRINGTON Dmzs	Recommission existing Widnes BH group, new WTW at Hale Bank and upgraded WTW at Pex Hill, transfer of treated water to Runcorn and Warrington DMZs	Recommissioning existing boreholes / licences; no operational effects. Pipeline construction works required close to the Mersey Estuary SPA / Ramsar sites but effects avoidable with established measures.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare
WR102d	Eccleston Hill Borehole to Prescot WTW	Recommission existing Eccleston Hill borehole, new raw water transfer main to Prescot open reservoirs for treatment at Prescot WTW	Recommissioning existing boreholes / licences; no operational effects on European sites. No impact pathways for construction effects.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare
WR102e	Bold Heath Boreholes to Prescot WTW	Recommission existing Bold Heath boreholes, new raw water transfer main to Prescot open reservoirs for treatment at Prescot WTW	Recommissioning existing boreholes / licences; no operational effects on European sites. No impact pathways for construction effects.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR105a	Lymm Boreholes (Abandonment of Existing WTW Facility; New WTW at Sow Brook)	The scheme would require: • Abandon existing WTW functionality at Lymm WTW, retaining both boreholes (both of which are operational) • Transfer full licensed capacity of raw water (9Ml/d) from Lymm boreholes (Quarry and Dingle) using existing pumping main to new WTW located in vicinity of Sow Brook. It may be possible to abandon the raw water pumping station at Lymm WTW if the borehole pumps can be used to transfer raw water to the new Sow Brook WTW. Other locations for a new WTW may be suitable with further engineering assessment and this location is indicative for costing purposes. • New WTW facility (based on WRMP15 scope previously costed)	No European sites or features are exposed to the likely effects of this scheme.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR105ai	Lymm Boreholes (Abandonment of Existing WTW Facility; New WTW at Sow Brook)	The scheme would require: • Abandon existing WTW functionality at Lymm WTW, retaining both boreholes (both of which are operational) • Transfer full licensed capacity of raw water (9Ml/d) from Lymm boreholes (Quarry and Dingle) using existing pumping main to new WTW located in vicinity of Sow Brook. It may be possible to abandon the raw water pumping station at Lymm WTW if the borehole pumps can be used to transfer raw water to the new Sow Brook WTW. Other locations for a new WTW may be suitable with further engineering assessment and this location is indicative for costing purposes. • New WTW facility (based on WRMP15 scope previously costed). • Addition of water softening.	No European sites or features are exposed to the likely effects of this scheme.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR105b	Lymm Boreholes (Abandonment of Existing WTW Facility; New WTW at Hill Cliffe)	The scheme would require: • Abandon existing WTW functionality at Lymm WTW, retaining boreholes (both of which are operational) • Transfer full licensed capacity of raw water (9Ml/d) from Lymm boreholes (Quarry and Dingle) to Hill Cliffe SR site and new WTW using new pumping main • New WTW located at Hill Cliffe to treat 9 Ml/d from Lymm • Options for treatment of water at Lymm need to consider risks to water quality compliance and whether the boreholes need to be treated for arsenic or can blend 50:50 with regional water from Vyrnwy. Variations to include with or without arsenic treatment should be presented in the PBD. • New WTW facility (based on WRMP15 scope previously costed) to include: raw water break tank, GFH for arsenic treatment (if required) to treat 9 Ml/d combined from both boreholes, bypass valve arrangement for GFH • All WTW components to be housed in new building.	No European sites or features are exposed to the likely effects of this scheme.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR105bi	Lymm Boreholes (Abandonment of Existing WTW Facility; New WTW at Hill Cliffe)	As per WR105b with the addition of water softening.	No European sites or features are exposed to the likely effects of this scheme.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare
WR106	Walton and Daresbury Boreholes	The scheme would require: • Reinstate and refurbish two boreholes at Walton (duty/standby), one borehole at Daresbury, south Warrington • Three new borehole pumps, rising main • New raw water main to connect Daresbury to Walton borehole sites (straight line distance 3600m); then utilise 15"AC treated water main from Walton as a raw water main (upgrade if required to transfer the combined flow) • Prior to connection between 15" and 30" main, new 500m raw water main to connect to Hill Cliffe site and new WTW facility (although land may need to be purchased). • New WTW facility built on the Hill Cliffe SR site	No European sites or features are exposed to the likely effects of this scheme.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR107a	Aughton Park & Moss End Boreholes (Royal Oak WTW)	This scheme would require: • Fully commission two existing boreholes located at Aughton Park and Moss End • New raw water transfer main/s from the two sites to connect into Royal Oak WTW process. • Modified Royal Oak WTW process to allow the additional 10 Ml/d to be treated, either as a separate stream or amalgamated with the existing raw water sources. • Modifications to the WTW output and network as appropriate in order to permit utilisation of the increased WTW capacity to function within the Southport and Liverpool DMZs	Closest European sites are Martin Mere SPA / Ramsar approximately 5km from the borehole so operational effects unlikely. No pathways for construction effects.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - effects possible but significant or significant adverse effects avoidable with established operational mitigation (e.g. licence controls)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR107ai	Aughton Park & Moss End Boreholes (Royal Oak WTW)	This scheme would require: • Fully commission two existing boreholes located at Aughton Park and Moss End • New raw water transfer main/s from the two sites to connect into Royal Oak WTW process. • Modified Royal Oak WTW process to allow the additional 10 Ml/d to be treated, either as a separate stream or amalgamated with the existing raw water sources. • Modifications to the WTW output and network as appropriate in order to permit utilisation of the increased WTW capacity to function within the Southport and Liverpool DMZs • Addition of ion exchange.	Closest European sites are Martin Mere SPA / Ramsar approximately 5km from the borehole so operational effects unlikely. No pathways for construction effects.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - effects possible but significant or significant adverse effects avoidable with established operational mitigation (e.g. licence controls)
WR107b	Randles Bridge, Knowsley, Primrose Hill	The scheme would require: • NB: WR107b assumes that WR107a has already been constructed to take the WTW capacity from 44 to 54 Ml/d. • Commission existing boreholes located at 2No. Randles Bridge, 2No. Knowsley and 1No. Primrose Hill • New raw water transfer mains from the three sites to connect into Royal Oak WTW process. • Primrose Hill to Royal Oak = 8 km • Randles Bridge to Royal Oak = 8.3 km • Knowsley (to connect to Randles Bridge RW main) = 2km	Existing licence; no operational effects anticipated (subject to EA confirming extension of abstraction licence). No significant construction effects anticipated due lack of impact pathway (distance).	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR109	Swineshaw Boreholes (Buckton Castle WTW)	This option involves the reinstatement of 3No. boreholes on the Swineshaw catchment and transfer of raw water to Buckton Castle WTW for treatment alongside the existing reservoir sources via existing pipelines. The principal construction elements of this option are: • Reinstate and refurbish raw water abstraction boreholes located on the Swineshaw catchments that feed Buckton Castle WTW, • No.2 and No.3 boreholes are accessible, No.1 is not currently accessible but could be made accessible with track improvements.	This option would require minor construction works within 500m of the Peak District Moors SAC and South Pennine Moors Phase 1 SPA, although effects on the features of these sites can be avoided with established measures, such as construction best-practice or timing works to avoid breeding / migration periods. Operational effects uncertain - there is no existing licence and surveys in connection with a drought order have suggested there may be some groundwater connectivity between the source and the SAC features. This is subject to further survey.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR110	Increased Abstraction from the M&EC Carboniferous Aquifers, Treatment to Potable Standards and Transfer to Treated Water Storage In IRZ	This option would involve increasing the licenced abstraction from the Rushton Spencer boreholes and passing this to the Hug Bridge WTW for treatment; no new infrastructure required.	No European sites or features are exposed to the likely effects of this scheme.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR111	Woodford Borehole	This option involves increasing abstraction from Woodford BH from 9Mld to 12 Mld. The principal construction elements of this option are: • Increase the output of Woodford BH from the current installed capacity of 9 Ml/d to 12 Ml/d, • Use existing, or upgraded raw water main (current capacity 15", known history of bursts) between Woodford and Hazel Grove SR • New WTW located at Hazel Grove SR site, blending in existing storage.	No impact pathways; EA would need to confirm increase in abstraction but no receptors likely to be significantly affected.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR112	Bramhall Borehole	This option involves a new borehole located at Bramhall; raw water transfer to new Hazel Grove WTW; and combined treatment of Woodford and Bramhall BH. The principal construction elements of this option are: • New 5 Ml/d borehole located at Bramhall • New c.5.3km raw water main from Bramhall to Hazel Grove SR site. • New WTW located at Hazel Grove SR site to treat combined output of Woodford BH (WR111) plus Bramhall BH (peak capacity 12+5 = 17 Ml/d), blending in existing storage.	No impact pathways; EA would need to confirm increase in abstraction but no receptors likely to be significantly affected.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR113	Tytherington Boreholes	The scheme would require: • New TW main 2.9km 315mmOD between Tytherington WTW and Hurdsfield SR • Modifications to existing WTW if required • New or improved headworks borehole to asset standard design.	No significant effects anticipated assuming established measures (distance)	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR114	Python Mill Borehole	The scheme would require: • Reinstate and refurbish a raw water abstraction borehole located at Python Mill • New raw water main between Python Mill and Rochdale Canal • New discharge scour into canal • New sewer connection at Python Mill	The operational purpose of this scheme is not entirely clear from the description although it is assumed to be a type of compensation scheme allowing use of alternative sources. However, the scheme would involve discharges to the Rochdale Canal (part of which is an SAC) and so there is clearly scope for significant and potentially adverse effects. It is noted that the previous licence was revoked by the EA. Construction effects are likely to be avoidable with established measures.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation
WR119a	Egremont Boreholes (Existing)	From 2022, South Egremont boreholes and Ennerdale WTW will be abandoned when the new Thirlmere supply to West Cumbria is completed. This option seeks to retain the abstraction and utilise the raw water to a new WTW near Nannycatch SR. The principal construction elements of this option are: • New WTW located at the Nannycatch site sized at 11 Ml/d • New treated water main between Nannycatch WTW and High Leys SR	Scheme is within terms of existing licences so operational effects no expected. Construction would require new WTW and pipeline crossing of the River Ehen SAC although effects on the features of this site can be avoided with established measures, such as construction best practice or timing works to avoid breeding / migration periods.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR119b	Egremont Boreholes (New)	From 2022, South Egremont boreholes and Ennerdale WTW will be abandoned when the new Thirlmere supply to West Cumbria is completed. This option seeks to further enhance abstraction from the West Cumbria aquifer with four new boreholes (10 Ml/d) to supplement the existing sources (11 Ml/d - see option WR119a). The principal construction elements of this option are: • New BH at Sandwith, 150m deep, 2.5 Ml/d capacity • New BH at Rottington, 150m deep, 2.5 Ml/d capacity • New BH at Moor Platts, 150m deep, 2.5 Ml/d capacity • Refurbish existing borehole at Catgill, 2.5 Ml/d capacity • New break tank and RWPS (10 Ml/d) located at Catgill site • New RW main between Catgill and the site of Nannycatch SR • New WTW located at the Nannycatch site sized at 21 Ml/d to treat existing boreholes from WR119a plus the four new boreholes from WR119b • New treated water main between Nannycatch WTW and High Leys SR, 21 Ml/d.	Construction would require new WTW and pipeline crossing of the River Ehen SAC although effects on the features of this site can be avoided with established measures, such as construction best practice or timing works to avoid breeding / migration periods. Operation would require increased exploitation of the West Cumbria aquifer; the proposed boreholes are over 3km from the River Ehen so significant effects on this site due to drawdown (etc) would not necessarily be expected although additional investigation would be required to confirm this (hence operational effects uncertain).	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR120	Cross Hill Boreholes, Wirral	This option involves three new boreholes at Cross Hill SR site, Wirral., with a new WTW on the same site. The principal construction elements of this option are: • Construct three new 150m deep boreholes at Cross Hill SR, installed capacity 5 Ml/d each • Raw water main to connect all three boreholes together prior to treatment stage • New WTW facility built on the Cross Hill SR site. Proposal would be for asset rationalisation on the Wirral to include revocation of existing abstraction licences at: Hooton, Gorston and Springhill.	Construction would require a new WTW and boreholes within 4km of the Dee Estuary SAC / SPA / Ramsar sites and 6.5km of the Mersey Estuary SPA although construction effects on the features of these sites can be avoided with established measures, such as construction best-practice or timing works to avoid breeding / migration periods. Operation would require increased exploitation of the Wirral aquifer Cumbria aquifer, although the precise operation is not clear as the option will also involve revocation of some licences. The proposed abstractions may affect spring (etc) flows into the Dee Estuary although significant effects would not necessarily be expected; additional investigation would be required to confirm this hence operational effects uncertain.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR120i	Cross Hill Boreholes, Wirral	This option involves three new boreholes at Cross Hill SR site, Wirral., with a new WTW on the same site. The principal construction elements of this option are: • Construct three new 150m deep boreholes at Cross Hill SR, installed capacity 5 Ml/d each • Raw water main to connect all three boreholes together prior to treatment stage • New WTW facility built on the Cross Hill SR site. • Additional water softening. Proposal would be for asset rationalisation on the Wirral to include revocation of existing abstraction licences at: Hooton, Gorston and Springhill.	Construction would require a new WTW and boreholes within 4km of the Dee Estuary SAC / SPA / Ramsar sites and 6.5km of the Mersey Estuary SPA although construction effects on the features of these sites can be avoided with established measures, such as construction best-practice or timing works to avoid breeding / migration periods. Operation would require increased exploitation of the Wirral aquifer Cumbria aquifer, although the precise operation is not clear as the option will also involve revocation of some licences. The proposed abstractions may affect spring (etc) flows into the Dee Estuary although significant effects would not necessarily be expected; additional investigation would be required to confirm this hence operational effects uncertain.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR121a	Eaton Boreholes (Hollins Hill)	This option involves the reinstatement of the Eaton boreholes, Cheshire (existing licence) with an upgraded water treatment works facility, transfer of treated water to storage at Hollins Hill SR using an existing treated water main, or upgraded treated water main if required.	No impact pathways; within terms of existing licence; nearest site (Oak Mere SAC / Midland Meres and Mosses Phase 2 Ramsar) over 4km away.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare
WR121b	Eaton Boreholes (Mid Cheshire Main)	This option involves the reinstatement of the Eaton boreholes, Cheshire (existing licence) with an upgraded water treatment works facility, transfer of treated water to the Mid Cheshire Main near Eaton WTW using existing main. The principal construction elements of this option are: • Reinstate and refurbish two Eaton boreholes and WTW facility, Sapling Lane, Eaton • New WTW facility built on the Eaton site • Transfer treated water to Mid Cheshire Main in the vicinity of Eaton WTW, utilising abandoned 18" steel main as appropriate, or laying new sections if needed.	No impact pathways; within terms of existing licence; nearest site (Oak Mere SAC / Midland Meres and Mosses Phase 2 Ramsar) over 4km away.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR122	Newton Hollows Boreholes	This option involves the reinstatement of the Newton Hollows boreholes, Cheshire (existing licence) with an upgraded water treatment works facility, transfer of treated water to using existing main. The principal construction elements of this option are: • Reinstate and refurbish three boreholes at Newton Hollows • New WTW within existing WTW site.	No impact pathways; within terms of existing licence; nearest site (Mersey Estuary SPA / Ramsar) over 5km away.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare
WR125	Bearstone Boreholes	This option involves the reinstatement of the Bearstone boreholes, Cheshire (existing licence) with a new water treatment works facility, transfer of treated water toto storage at Woore Ash SR using an existing treated water main, or upgraded treated water main if required. The principal construction elements of this option are: • Reinstate and refurbish two of the three Bearstone boreholes and existing WTW facility, south of Woore • New or upgraded WTW facility built on the Bearstone site.	No impact pathways; within terms of existing licence; nearest site (Midland Meres and Mosses Phase 1 Ramsar) over 9km away.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR128	Tarn Wood (North Eden to Carlisle)	This option involves increased abstraction from the Tarn Wood boreholes from 2.3 Ml/d to 4 Ml/d, and a new raw water connection between Tarn Wood WTW and Cumwhinton WTW to connect North Eden and Carlisle Resource Zones. The principal construction elements of this option are: • New pumping station • New c.14.2 km, 225 mmOD polyethylene main to Cumwhinton WTW inlet.	This option would increase abstraction from a borehole approximately 1.5km from the River Eden SAC, and construction of a pipeline within the catchment of this site. Construction effects are likely to be avoidable with established measures but more analysis of the potential operational effects is required, particularly regards any connectivity between the aquifer and the river. The increase in abstraction volumes would seem to be unlikely to affect the river, although this would need to be confirmed by the EA, and so operational effects are 'uncertain' at this stage.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation
WR129	North Cumbria Boreholes	From 2022, Scales boreholes and Quarry Hill WTW will be abandoned when the new Thirlmere supply to West Cumbria is completed. This option seeks to retain the abstraction from Scales and combine with new boreholes at Waverton and Thursby. The principal construction elements of this option are: • New borehole located at Waverton, 150m deep, 2 Ml/d capacity • New borehole located at Thursby, 150m deep, 2 Ml/d capacity • RW transfer from Waverton to Thursby to Quarry Hill WTW (4 Ml/d) • New WTW to treat 10 Ml/d from all boreholes • New treated water main between Quarry Hill WTW and Moota Hill SR	Construction would require new boreholes approximately 5km from the River Caldew (River Eden SAC) although these (and other construction elements) would be outside the River Eden SW catchment. Construction effects can be avoided with established measures, such as construction best-practice or timing works to avoid breeding / migration periods. Operation would require increased exploitation of the North Cumbria aquifer; the proposed boreholes are over 5km from the River Caldew in a separate surface water catchment so significant effects on this site due to drawdown (etc) would not be expected although additional investigation would be required to confirm this and permitted abstraction volumes (hence operational effects uncertain).	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR140	Horwich WwTW Final Effluent Reuse	The scheme would require: • New abstraction from Pearl Brook/River Douglas, downstream of Horwich WwTW, capacity maximum 5 Ml/d • New pumping station and transfer of raw water to Rivington WTW using most appropriate pipeline route, c.1.7km route proposed • New front end Rivington WTW process to treat new river water source, then transfer through existing Rivington WTW process to potable WQ standards • Treated water to be transferred into existing distribution system	No European sites or features are exposed to the likely effects of this scheme.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR141	Rossendale WwTW - Final Effluent Reuse	The scheme would require: • New abstraction from the River Irwell, downstream of Rossendale WwtW • New pumping station and transfer of raw water to existing site of Townsend Fold WTW, 10 Ml/d using most appropriate pipeline route • Treated water to be transferred into existing distribution system	No European sites or features are exposed to the likely effects of this scheme.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare
WR142	Hyndburn WwTW - Final Effluent Reuse	This scheme would involve effluent reuse using flows from Hyndburn WwTW and treatment at Martholme WTW (new WTW). The principal construction elements of this option are: • New abstraction from the River Calder, downstream of Hyndburn WwtW 10 Ml/d using most appropriate pipeline route New PS and transfer of raw water to existing site of Martholme WTW• • New WTW process to treat new river water source to potable WQ standards. • Treated water to be transferred into existing distribution system using existing system from Martholme WTW • Calculations based on 50% of DWF from Hyndburn WwTW 20.9 Ml/d, more maybe be possibly available	This scheme would presumably reduce flows into the River Ribble and hence the Ribble and Alt Estuaries SPA / Ramsar; additional investigation would be required to confirm effects on the estuary and permitted abstraction volumes (hence operational effects uncertain), although it is unlikely that there would be significant / adverse based on available information. No construction effects likely.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR144	Saddleworth and Mossley top Final Effluent Reuse	The scheme would require: • New abstraction from the River Tame, downstream of Mossley Top WwtW, utilising discharges from both Mossley Top and Saddleworth WwTWs • New pumping station and transfer of raw water to Buckton Castle WTW, 5 Ml/d using most appropriate pipeline route • New upfront WTW process to treat river water in order to treat final effluent to potable WQ standards. Buckton Castle WTW capacity increase by 5 Ml/d.	No European sites or features are exposed to the likely effects of this scheme.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)

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WR146	Davyhulme – Final Effluent Reuse	This scheme would involve effluent reuse using flows from Davyhulme WwTW; new treatment works; new service reservoir and transfer to existing potable network The principal construction elements of this option are: • New direct final effluent reuse scheme from the outfall of Davyhulme WwTW • New WTW sized at maximum 100 Ml/d • New SR and transfer to existing treated water network for Manchester • Scheme capacity sized at 100 Ml/d (based on Manchester Resilience project scope – located as option number 034	This scheme would presumably reduce flows into the Mersey Estuary SPA / Ramsar via the Manchester Ship Canal; additional investigation would be required to confirm effects on the estuary and permitted abstraction volumes (hence operational effects uncertain) although it is unlikely that there would be significant / adverse based on available information. Construction effects likely to be avoidable through established measures.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR148	Cumwhinton Boreholes plus Castle Carrock Link	This option would involve two new boreholes located at Cumwhinton WTW; modifications to Cumwhinton WTW process; and a treated water link to Castle Carrock SR. The principal construction elements of this option are: • Two new boreholes located at Cumwhinton WTW, operating in duty/duty mode to deliver up to 6.5 Ml/day total • WTW modifications, if required, to treat the borehole water at Cumwhinton WTW (current normal operation at 27 Ml/d; design maximum 40 Ml/d) • New treated water transfer pipeline and pumping station (if needed) between Cumwhinton and Castle Carrock SR, sized at 6.5 Ml/d max flow.	This option would increase abstraction from a borehole approximately 1km from the River Eden SAC, and construction of a pipeline within the catchment of this site. Construction effects are likely to be avoidable with established measures but more analysis of the potential operational effects is required, particularly regards any connectivity between the aquifer and the river. The increase in abstraction volumes would need to be confirmed by the EA, and so operational effects are 'uncertain' at this stage.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR150	Castle Carrock Dead Water Storage	This option would utilise the dead water within Carrock IR. This would involve either the utilisation of existing pipework that enables the dead water to be drained to the river in the case of an emergency, perhaps with the addition of pumping if necessary.	No construction effects would be anticipated (existing assets used). The option was a included in the drought plan, which concluded no LSE due to operation and this is likely to be the case if utilised as a preferred option (although the frequency of operation would vary).	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare
WR153	Simmonds Hill – Increased WTW Capacity	The scope of WR153 builds on the scope of WR123 (Helsby and Foxhill Boreholes) as one of the components. The principal construction elements of option WR153 in addition to those from WR123 are: • Foxhill BHs: Reinstate Foxhill BH1 • Combined pumping of 14 Ml/d (11 Ml/d Foxhill; 3 Ml/d Helsby) through existing 16" main to blend with water from Simmonds Hill WTW • Mouldsworth/Manley Common/Manley Quarry/Five Crosses BHs: Increase raw water production capability by 5 Ml/d from existing borehole sources. • Simmonds Hill WTW: Increase raw water source availability by a further 8 Ml/d of treatment capacity (from the existing 27 Ml/d to 35 Ml/d)	Construction would require works within 4km of the Mersey Estuary SPA although effects on the features of these sites can be avoided with established measures, such as construction best practice or timing works to avoid breeding / migration periods. Operation would require increased exploitation of the aquifer, although the precise effects of operation is uncertain - it is assumed that the option has the potential to reduce flows into the estuary via (for example) the Hornsmill Brook. Additional investigation would be required to confirm this hence operational effects uncertain.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures

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WR154	Sandiford – Increased WTW Capacity	This option would involve improvements in WTW treatment and capacity to fully utilise existing licenced volumes. The principal construction elements of option are: • Increase raw water production capability by 10 Ml/d from existing borehole sources (Organsdale, Delamere No.3, Delamere No.4, Eddisbury, Cotebrook 40, Cotebrook 15, Sandiford BHs) with new borehole pumps. • Delamere WTW: Assume that the arsenic removal plant remains the same and treats the same source waters (Organsdale, Delamere No.3, Delamere No.4, Eddisbury) but with an increase in capacity of 5 Ml/d arsenic removal GFH • Sandiford WTW: Increase WTW capacity by 10 Ml/d; consider conversion of membrane treatment plant to UV; new partial nitrate removal plant (10 Ml/d) to ensure final water compliance (example raw water data provided) • Transfer of treated water to Hollins Hill SR via existing infrastructure	No operational effects (within terms of existing licence). The boreholes and WTW sites are within 1km of Oak Mere SAC and the Midlands Meres and Mosses Phase 2 Ramsar site but construction works would be minor at existing assets and significant effects would not be expected.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR800	River Bela to Thirlmere Aqueduct	This option would involve an abstraction trade from existing non-water industry abstraction licence holder abstracting from River Bela - possible transfer of raw water to IRZ via Thirlmere Aqueduct. The principal construction elements of this option are: • New river abstraction and intake on the River Bela at Bela Mill • Raw water pumping station • Raw water transfer to Thirlmere Aqueduct at suitable connection point (e.g. Lupton North Well 6.6km)	This option would require construction works within the near catchment of the Morecambe Bay SAC / SPA / Ramsar sites and near to other European sites (e.g. Morecambe Bay Pavements) but effects on these sites will be avoidable with established measures. With regard to operation, the scheme will utilise existing licenced volumes and so hydrological effects would not be anticipated; the scheme would be a transfer of raw water between catchments although established treatment standards for INNS should avoid any risk of effects (and no European sites would be exposed to the raw water).	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR810	Cow Green IR to Haweswater via Heltondale Aqueduct	This option would involve a 40 Ml/d transfer from the Northumbrian Water Cow Green IR to discharge into Heltondale aqueduct and hence discharge into Haweswater for use in IRZ. The principal construction elements of this option are: • New intake structure and screen at Cow Green (invasive species protection required) • New Raw water pumping station at Cow Green and break tanks as required • New raw water transfer main from Cow Green and connection into the Heltondale aqueduct (pressure will need to managed).	This option, as currently proposed, would require a pipeline crossing several branches of the River Eden SAC and, more significantly, construction across the North Pennine Moors SPA and the Moorhouse - Upper Teesdale SAC (no roads available on the currently proposed route). This would have significant and almost certainly adverse effects. A road route, avoiding the SAC, would involve a significant detour with cost implications. With regard to operation, it is not clear whether the scheme will utilise existing licenced volumes and so hydrological effects may occur on downstream sites in Teesdale; the scheme would be a transfer of raw water between catchments which may risk the transfer of invasive species to the Eden catchment although established treatment standards for INNS should prevent any effects. There will also be a risk of effects due to hydrological and chemical variations.	Construction: Uncertain - significant effects cannot be excluded and may require the identification of bespoke mitigation measures or amendments to scheme design at the plan level	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures

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WR812	Kielder Water IR Transfer	This option would involve a 100 Ml/d transfer of raw water from Kielder Water IR (Northumbrian Water) to the IRZ at Haweswater. The principal construction elements of this option are: • New raw water intake structure and screens located at Kielder Water • New raw water pumping station • New transfer into Heltondale Aqueduct. • Invasive species protection will need to be provided.	There are a number of major uncertainties around the scheme which will determine the likelihood of significant effects - not least the uncertainty regarding pipeline routes from Kielder to the United Utilities network. At the moment, the primary pipeline from Kielder to United Utilities is assumed to be a straight line across Kielder Forest (and hence across the Border Mires, Kielder Butterburn SAC). This would have significant and almost certainly adverse effects. A road route, avoiding the SAC, would involve a significant detour with cost implications. At the moment, it is likely that the scheme will have significant construction effects on the Border Mires, Kielder – Butterburn SAC and (probably) the River Eden SAC (since several tributaries are crossed, not at existing crossing points). With regard to operation, the scheme would be a transfer of raw water between catchments requiring a discharge to the Haweswater Reservoir via the Heltondale Aqueduct, which directly supplies the River Eden SAC; there will be significant effects and a substantial risk of adverse effects (e.g. invasive species transfer (avoidable), or water chemistry differences). It is also not clear whether the scheme will utilise existing licenced volumes and so hydrological effects may occur on downstream sites in Teesdale. Additional analysis is likely to be required for the HRA if this is selected as a preferred option.	Construction: Uncertain - significant effects cannot be excluded and may require the identification of bespoke mitigation measures or amendments to scheme design at the plan level	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR813	Scammonden IR to Buckton Castle via Huddersfield Narrows Canal	This option would involve the transfer of water from Yorkshire Water (Scammonden IR) into Huddersfield Narrow Canal, flowing through Standedge Tunnel, with UU abstraction and transfer to Buckton Castle WTW and into IRZ The principal construction elements of this option are: • New raw water abstraction point and pumping station at Scammonden IR • New raw water transfer pipeline to break tank and discharge point into the Huddersfield Narrow Canal • New raw water abstraction point and pumping station on the Huddersfield Narrow Canal near Mossley • New raw water transfer pipeline to inlet of Buckton Castle WTW • Invasive species protection will need to be applied at Scammonden	No European sites or features are exposed to the likely effects of this scheme.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR814a	Increased Abstraction Capacity at Heronbridge	This option would involve a negotiated reduction in industrial supply from Heronbridge PS on River Dee, releasing additional abstraction capacity for UU to abstract and treat at Huntington WTW. The principal construction elements of this option are: • Increase the size of Huntington WTWs by 24 Mld, taking account of abstraction, transfer, treatment assets, and off site pumping.	The scheme will utilise existing licenced volumes and so no operational effects would be anticipated (although licence transfer would need to be confirmed by the EA). Construction works will take place within an existing WTW near the River Dee and Bala Lake SAC, although effects on the features of this site will be avoidable with established measures, such as construction best practice or timing works to avoid breeding / migration periods.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)

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WR814b	Increased Abstraction Capacity at Heronbridge	This option would involve a negotiated reduction in industrial supply from Heronbridge PS on River Dee, releasing additional abstraction capacity for UU to abstract and treat at Hurleston WTW. The principal construction elements of this option are: • Increased water abstraction @ Dee / Llangollen Canal for Hurleston WTW • Increased raw water transfer via the Llangollen Canal (Canal and Rivers Trust will charge for this) • Increased raw water abstraction capacity at Hurleston • Increased water treatment capacity at Hurleston or second WTWs • Increased potable water pumping • Connection into the Mid-Cheshire Main located close to Nanneys Bridge, sized at 24 Ml/d	It is understood that this scheme will effectively transfer the licenced volume upstream on the Dee from the current abstraction at Heronbridge to a location near the Dee / Llangollen Canal intersection (presumably around the Froncysyllte intake), with transfer of the water to Hurleston via the Llangollen Canal (and presumably the Shropshire Union). The shift in abstraction location will have significant effects on the River Dee and Bala Lake SAC, which may be adverse and additional investigation will be required to support any HRA of a preferred option. Construction effects will be avoidable with established measures.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR814c	Increased Abstraction Capacity at Heronbridge	This option would involve a negotiated reduction in industrial supply from Heronbridge PS on River Dee, releasing additional abstraction capacity for UU to abstract and treat at Hurleston WTW. The principal construction elements of this option are: • Increased water abstraction @ Dee / Llangollen Canal for Hurleston WTW • New raw water transfer main from Dee / Llangollen confluence to Hurleston WTWs (or second new WTWs) • Increased raw water abstraction capacity at Hurleston or second WTWs • Increased water treatment capacity at Hurleston or second WTWs • Increased potable water pumping • Connection into the Mid-Cheshire Main located close to Nanneys Bridge, sized at 24 Ml/d	It is understood that this scheme will effectively transfer the licenced volume upstream on the Dee from the current abstraction at Heronbridge to a location near the Dee / Llangollen Canal intersection (presumably around the Froncysyllte intake), with transfer of the water to Hurleston via the Llangollen Canal (and presumably the Shropshire Union). The shift in abstraction location will have significant effects on the River Dee and Bala Lake SAC, which may be adverse and additional investigation will be required to support any HRA of a preferred option. Construction works will require pipe crossings of the River Dee and Bala Lake SAC, although effects on the features of this site will be avoidable with established measures, such as construction best practice or timing works to avoid breeding / migration periods.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR815	Lancaster Canal to Thirlmere Aqueduct	This option would involve a new abstraction from the Lancaster Canal and transfer into Thirlmere Aqueduct for subsequent treatment. Lancaster canal is fed from Killington Lake & Peasey Beck The principal construction elements of this option are: • New water abstraction point on Peasey Beck/Lancaster Canal in vicinity of Killington Lake • Raw water transfer between abstraction point and discharge point (may require pumping station depending upon choose abstraction point) • Connection to TA e.g. at Beehive South Well • Treatment of new water source long with Thirlmere water at Lostock WTW. No proposed change to WTW process assumed not required.	The scheme will require a new 15Mld abstraction from the Peasy Beck / Lancaster canal; there are no European sites locally that are likely to be affected by the operation of the scheme, although the Peasy Beck feeds the Morecambe Bay SAC / SPA / Ramsar sites via the River Bela (approx. 15km downstream) and so effects are possible (although unlikely). Construction effects are likely to be avoidable with established measures.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - effects possible but significant or significant adverse effects avoidable with established operational mitigation (e.g. licence controls)

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WR816	Manchester Bolton Bury Canal to Integrated Zone	This option would involve a new abstraction from Manchester, Bolton & Bury Canal, treatment to potable standards and transfer to treated water storage in IRZ (canal system supplied from River Irwell into Elton Reservoir). The principal construction elements of this option are: • New water abstraction from Manchester, Bolton & Bury Canal from Elton Reservoir, • New WTW at same location, treatment to potable standards • New PS and pipeline to connect to Integrated Resource Zone storage at Woodgate Hill SR	The scheme will require a new 10Mld abstraction; there are no European sites within 10km. No operational or construction effects anticipated, assuming WAFU.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR817	Carr Mill Dam to Integrated Resource Zone	This option would involve a new abstraction from St Helens Canal, treatment to potable standards and transfer to treated water storage in IRZ (canal system supplied from Carr Mill Dam, potential to also feed Manchester, Bolton & Bury canal or Sankey Brook so a number of abstraction options). The principal construction elements of this option are: • New water abstraction from St Helens Canal at Carr Mill Dam • New WTW at same location, treatment to potable standard • New pumping station and treated water main between Carr Mill Dam and Montrey SR	The scheme will require a new 23Mld abstraction; there are no European sites within 10km. The Mersey Estuary SPA / Ramsar sites are downstream receptors but effects would not be anticipated given the distance and scale / nature of abstraction. No operational or construction effects anticipated, assuming WAFU.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR820	Shropshire Union Canal to Integrated Resource Zone	This option would involve a new abstraction from Shropshire Union Canal/Middlewich branch, direct canal abstraction, treatment to potable standards at Hurleston WTW and transfer to treated water storage in IRZ - based on surplus capacity from Birmingham Canal navigation. The principal construction elements of this option are: • Increased abstraction volume at existing abstraction pumps on the Shropshire Union canal by 15.5 Mld (located at Hurleston WTW) • Fish screens (currently none on site so abstraction point not used) • Increased treatment capacity at Hurleston (15.5 Ml/d) • Sufficient treatment to reliably treat larger volumes of canal water (Shropshire union regarded as poorer WQ than Llangollen) • Connection into the Mid-Cheshire Main located close to Nanneys Bridge, sized at 15.5 Ml/d	The scheme will require a new 15.5Mld abstraction; it is understood that this surplus is conjunctively supported by Bradley borehole and Chasewater resource. The nearest European sites (components of the Midlands Meres and Mosses Phase 1 Ramsar) are all located over 8km from the option and not linked hydrologically. No operational or construction effects anticipated, assuming WAFU.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR821	Shropshire Union Canal + Llangollen	This option would involve a new abstraction from Shropshire Union Canal/Middlewich branch, treatment to potable standards and transfer to treated water storage in IRZ (potentially Congleton area) - based on surplus from Birmingham canal navigation but supplemented by additional feed(s) from Belvide Reservoir and/or Llangollen Canal/River Dee. The principal construction elements of this option are: • Increased abstraction volume at existing abstraction pumps on the Shropshire Union canal by 30 Mld (located at Hurleston WTW) • Fish screens (currently none on site so abstraction point not used) • Increased treatment capacity at Hurleston (30 mld) or build second works • Connection into the Mid-Cheshire Main located close to Nanneys Bridge, sized at 30 Ml/d Increased abstraction licence would be required from the Environment Agency.	No construction effects are anticipated due to distances from European sites (closest over 8km away) and absence of impact pathways. With regard to operation and increased abstraction, there is the possibility of direct effects on the River Dee and Bala SAC depending on scheme operation, so operational effects are considered 'uncertain' at this stage.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR824	Blenkinsopp Mine	The scheme would require: • New water abstraction from Blenkinsopp mine • Raw water transfer to Castle Carrock raw water collection main as shown on map (pumping required) • Treatment to potable standard through existing WTW facility and distribution into existing potable storage	Pipeline passes through North Pennine Moors SAC - significant construction effects possible without re-routing. Easily avoided by directing around the SAC. Pipeline crosses River Eden SAC. No operational effects anticipated (no impact pathway)	Construction: Uncertain - significant effects cannot be excluded and may require the identification of bespoke mitigation measures or amendments to scheme design at the	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)

Appendix B

Established / Assumed Avoidance and Mitigation 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 scheme-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 regimes required to ensure no adverse effects occur (e.g. compensation releases - although note that these measures can only be identified through detailed investigation schemes).

Pollution Prevention

The habitats of European sites are most likely to be affected indirectly, through construction-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 current industry best-practices in construction that are likely to be relevant to the proposed schemes:

- Environment Agency Pollution Prevention Guidance Notes[10], including:
  - PPG1: General guide to the prevention of pollution (May 2001);
  - PPG5: Works and maintenance in or near water (October 2007);

[10] 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.

- 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 WRMP 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 (WRMP) 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 NE;
- 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.

Option-Specific Measures

Option specific measures (if required) will be determined as the preferred options are identified. However, it is assumed that the lowest-impact solution will be pursued, particularly regards construction solutions – for example, directional drilling beneath sensitive rivers rather than open cut; etc.

Appendix C

Review of Other Options (not considered as feasible options)

The tables below summarise the review of those additional options that have not been included in the list of 79 Feasible Options (Appendix A). These options were identified as 'possibilities' for inclusion as Feasible Options by UU (based on the unconstrained list), but have since been discarded for a range of reasons; the HRA review was completed prior to the options being formally rejected (and hence is reported here for completeness) although the results of this review were not a primary driver for the exclusion of the options.

Appendix C - Summary of Review of Additional (Non-Feasible) Options

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR005	Ditton Brook	The scheme would require: • New lowland river raw water abstraction from Ditton Brook, assumed capacity 5 Ml/d • New Ditton WTW at same location • New c.6.2km treated water transfer between Ditton WTW and Speke SR treated water storage	This scheme could presumably reduce flows into the Mersey Estuary SPA / Ramsar via the Ditton Brook. Construction effects avoidable assuming established measures. New abstraction licence required - EA to confirm WAFU; additional investigation would be required to confirm effects on the estuary and permitted abstraction volumes (hence operational effects uncertain).	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation
WR008	New surface water abstraction from Arrowe Brook/Birket; Raw water transfer to Grange WTW and SR site; new WTW to treat river water; transfer to existing treated water storage at Grange SR	This option would require a new raw water abstraction from confluence of Arrowe Brook/Birket, assumed capacity is de-minimis 1.7 Ml/d. There may be more water at certain times. The principal construction elements of this option are: • New c.6km raw water transfer to Grange WTW and SR site • New WTW process for lowland river water; output blended with existing water in Grange SR • Ensure treated water meets all internal requirements (e.g. start up to waste), water quality regulations and abstraction licence conditions • Ensure that flooding risks due to inundation of assets are considered in the proposed design	The Arrowe Brook is a minor stream the ultimately discharges to the Mersey Estuary; this scheme could presumably reduce flows into the Mersey Estuary SPA / Ramsar although effects likely to be very minor. Construction effects avoidable assuming established measures. New abstraction licence required - EA to confirm is WAFU; additional investigation would be required to confirm effects on the estuary and permitted abstraction volumes (hence operational effects uncertain, although likely to be acceptable).	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR010_W	River Greta and River Wenning to Lancaster Raw Water Storage and Lancaster WTW	The scheme would require: • New river abstraction and intake on the River Greta, Burton in Lonsdale sized at 10 Ml/d • Raw water transfer, assume a new PS needed, to combine with a new river abstraction and intake on the River Wenning, Low Bentham, also sized at 10 Ml/d • New PS (assumed needed) to transfer the combined raw water (up to 20 Ml/d) to Lancaster WTW raw water storage, e.g. Langthwaite Reservoir • Modifications as required to Lancaster WTW to enable the new river sources to be treated. No change to maximum WTW output is proposed. • Possible pipeline route shown on map, c. 20km long and would need to transfer between 10 and 20 Ml/d of raw water to Lancaster WTW RW storage, but the exact quantities available for abstraction will need to be confirmed with	The scheme will involve new abstractions from the River Greta and River Wenning with pipeline transfer to Lancaster WTW for storage and treatment. The rivers are tributaries of the Lune and hence the Morecambe Bay SAC / SPA / Ramsar, although operational effects are likely to be avoidable if the EA confirm WAFU. The pipeline route is uncertain but all construction effects can be avoided with standard established measures.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - effects possible but significant or significant adverse effects avoidable with established operational mitigation (e.g. licence controls)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR026b	River Ribble, Clitheroe	This option would require a new abstraction from the River Ribble (new licence required, licenced volumes TBC but anticipated 5 - 10 Mld). The principal construction elements of this option are: • New river abstraction on the River Ribble at Clitheroe • New WTW located at New Lane • Treated water mains to Lowcocks SR and Waddington High Level SR with new PS and new TW mains.	The closest sites to this option are the North Pennines Dales Meadows SAC and the Bowland Fells SPA, although there are no impact pathways to these sites. The Ribble and Alt Estuaries SPA / Ramsar sites are downstream receptors (via the River Ribble) but are located almost 30km downstream, and so it is unlikely that abstraction volumes of 5 - 10 Mld would substantially affect discharges to these sites (although this would need to be confirmed by the EA, and so operational effects are 'uncertain' at this stage).	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation
WR029	River Mite, New Abstraction, WTW and Transfer to Existing SR Storage	The scheme would require: • New river abstraction and intake on the River Mite, maximum abstraction 6 Ml/d, the exact quantities available for abstraction will need to be confirmed with the Environment Agency. Possible new abstraction location shown. • Raw water transfer to new WTW facility at same location • Treated water transfer, pumping station/s, to existing SR storage (with assumed demands): • Muncaster SR 1 Ml/d • Calder SR 2.5 Ml/d • Wilton SR 2 Ml/d It is assumed that the existing treated water infrastructure can be utilised as much as possible to transfer water north. There may need to be some reinforcement between Muncaster and the supplies at Gosforth which should be assessed as part of this solution as well as the impacts of reversing the flow. • It should be possible to supply Blengfell SR 172mAOD and Boonwood Gosforth SR 110mAOD which are small SRs en-route using existing PS and treated water infrastructure.	This scheme would require a new abstraction from the River Mite immediately above the Drigg Coast SAC. The proximity of the works will require bespoke construction-stage mitigation, although construction effects are likely to be avoidable with established measures. Abstraction location needs to be confirmed and EA to determine WAFU; additional investigation would be required to confirm effects on the estuary and permitted abstraction volumes if selected as a preferred option (hence operational effects uncertain).	Construction: Uncertain - significant effects cannot be excluded and may require the identification of bespoke mitigation measures or amendments to scheme design at the plan level	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR030	River Esk New Abstraction, WTW and Transfer to Existing SR Storage	The scheme would require: • New river abstraction and intake on the River Esk, maximum abstraction 5-10 Ml/d, the exact quantities available for abstraction will need to be confirmed with the Environment Agency. Possible new abstraction location shown. • Raw water transfer to new WTW facility, • Treated water transfer, pumping station/s, to existing SR storage (with assumed demands): • Muncaster SR 1 Ml/d • Calder SR 2.5 Ml/d • Wilton SR 2 Ml/d • Nannycatch 10-11 Ml/d • It is assumed that the existing treated water infrastructure can be utilised as much as possible to transfer water north. There may need to be some reinforcement between Muncaster and the supplies at Gosforth which should be assessed as part of this solution as well as the impacts of reversing the flow • Flows should be to transfer 5 and up to 10 Ml/d, but the exact quantities available for abstraction will need to be confirmed with the Environment Agency • It should be possible to supply Blengfell SR 172mAOD and Boonwood Gosforth SR 110mAOD which are small SRs en-route using existing PS and treated water infrastructure.	Effects uncertain - further information of exact quantities to be abstracted required. Drigg Coast SAC lies downstream of abstraction on the River Esk. New WTW facility to receive raw water is adjacent to Drigg Coast SAC - scheme-specific detailed design required to avoid construction effects. Scheme-specific modelling required to determine potential operational effect on Drigg Coast SAC, additional investigation would be required to confirm effects on the estuary and permitted abstraction volumes if selected as a preferred option (hence operational effects uncertain).	Construction: Uncertain - significant effects cannot be excluded and may require the identification of bespoke mitigation measures or amendments to scheme design at the plan level	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR031	River Annas; New Abstraction, WTW and Transfer to Existing SR Storage	The scheme would require: • New river abstraction and intake on the River Annas at Bootle, sized at 3 Ml/d, the exact quantities available for abstraction will need to be confirmed with the Environment Agency • Raw water transfer to new WTW facility at same location • New c.14km treated water transfer, pumping station, to existing SR storage at Lowhouse SR	Construction would be required within the Morecambe Bay SAC / SPA / Ramsar catchment but not effects anticipated with established measures. No impact pathways for operational effects (distance / downstream).	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR032_ WR080	River Dane, River Wheelock, River Weaver	This option would require a new abstractions from the Rivers Dane and Weaver (new licence required, licenced volumes TBC but anticipated 5 Mld from each abstraction). The principal construction elements of this option are: • New river abstraction and intake close to the River Dane confluence with the River Weave, sized at 5 Ml/d • Raw water transfer along c.9km pipeline to combine with a new abstraction from the River Weaver, sized at 5 Ml/d • Transfer of combined flow to new WTW located close to Nanneys Bridge, sized at 10 Ml/d • WTW output pumped into Mid Cheshire Main	The closest sites to this option are the Midlands Meres and Mosses Phase 2 Ramsar sites and their associated SACs (West Midlands Mosses SAC; Oak Mere SAC); these sites are over 8km from the proposed pipeline and abstraction, and so will not be affected by construction or operation. The Mersey Estuary SAC / SPA / Ramsar sites are downstream receptors (via the River Weaver) but are located almost 30km downstream, and so it is unlikely that abstraction volumes of 5 - 10 Mld would substantially affect discharges to these sites (although this would need to be confirmed by the EA, and so operational effects are 'uncertain' at this stage).	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR036	River Caldew	The scheme would require: • New river abstraction and intake on the River Caldew at Cummersdale • Raw water transfer to High Brownelson • New WTW at same site as SR sized at between 2.5 and 5 Ml/d and transfer to existing SR storage. The exact quantities available for abstraction will need to be confirmed with the Environment Agency	River Caldew is part of River Eden SAC; likely significant effects from abstraction, require EA to confirm WAFU. Construction works would require scheme-specific detailed design to avoid effects.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation
WR039b	River Eden (Temple Sowerby) to Demmings Moss SR	The scheme would require: • New river abstraction and intake on the River Eden in the vicinity of Temple Sowerby, sized at up to 16 Ml/d, the exact quantities available for abstraction will need to be confirmed with the Environment Agency • New WTW at Temple Sowerby, PS and treated water transfer pipeline (c.21km) to Demmings Moss SR	Abstraction is from River Eden SAC - EA to confirm WAFU. Likely substantial significant effects of abstraction, additional investigation would be required to confirm effects on the river and permitted abstraction volumes if selected as a preferred option (hence operational effects uncertain). Scheme-specific detailed design to avoid effects during construction. New pipeline runs through Asby Complex SAC and Lake District High Fells SAC - substantial significant construction effects likely without route modification (essential to support option as preferred).	Construction: Uncertain - significant effects cannot be excluded and may require the identification of bespoke mitigation measures or amendments to	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation
WR042	River Esk to Cumwinton plus Castle Carrock Link	The scheme would require: • New river abstraction on River Esk at Longtown • New raw water transfer pumping station, 6.5 Ml/d maximum • New c.18 km raw water pipeline to Cumwhinton WTW • WTW modifications, if required, to treat the new water source at Cumwhinton WTW (current normal operation at 27 Ml/d; design maximum 40 Ml/d). No change to maximum WTW output is proposed. • New treated water transfer pipeline and pumping station (if needed) between Cumwhinton and Castle Carrock SR, sized at 6.5 Ml/d max flow	The Solway Firth SAC and Upper Solway Flats and Marshes SPA / Ramsar sites are downstream receptors (via the River Esk) located ~2km downstream of the proposed abstraction. Construction effects can be avoided with established measures although the availability of the abstraction volumes would need to be confirmed by the EA, and the acceptability of this option viz effects on European sites would need to be established if pursued as a preferred option (and so operational effects are 'uncertain' at this stage). The pipeline crosses River Eden SAC - construction effects probably avoidable with scheme-specific detailed design.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR043	River Petteril to Cumwhinton plus Castle Carrock Link	The principal construction elements of this option are: • New river abstraction on River Petteril at Carleton • New raw water transfer pumping station, sized at 3.0-6.5 Ml/d maximum • New c.4 km raw water pipeline to Cumwhinton WTW • WTW modifications, if required, to treat the new water source at Cumwhinton WTW (current normal operation at 27 Ml/d; design maximum 40 Ml/d). No change to maximum WTW output is proposed. • New treated water transfer pipeline and pumping station (if needed) between Cumwhinton and Castle Carrock SR, sized at 6.5 Ml/d max flow	The scheme would require a new abstraction from River Petteril which is a tributary of the River Eden SAC; significant effects are likely and so additional investigation would be required to confirm effects on the river and permitted abstraction volumes if selected as a preferred option (hence operational effects uncertain). Other operational effects are possible (fish entrainment etc). Construction would require pipeline crossings of the SAC; adverse effects likely to be avoidable through scheme-specific detailed design and established measures but more information required on these aspects.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR044	River Waver to Church Hill SR	This option would require a new abstraction from the River Waver (new licence required, licenced volumes TBC but anticipated 2.5 - 5 Mld) and transfer for treatment at a new WTW. The principal construction elements of this option are: • New river abstraction and intake on the River Waver at Waverbridge, near Wigton • Raw water transfer to Church Hill SR • New WTW at same site as SR sized at between 2.5-5.0 Ml/d and transfer to existing SR storage. The exact quantities available for abstraction will need to be confirmed with the Environment Agency.	The River Waver runs along the southern edge of the Wedholme Flow SSSI component of the South Solway Mosses SAC; this is a raised mire and so connectivity with the River Waver will be limited, although further investigation will be required to establish the operational effects of abstraction from the Waver on this site. The Solway Firth SAC and Upper Solway Flats and Marshes SPA / Ramsar sites are downstream receptors (via the River Waver) and will be vulnerable to operational effects.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR045	River Wampool to High Brownelson SR	This option would require a new abstraction from the River Wampool (new licence required, licenced volumes TBC but anticipated 2.5 - 5 Mld) and transfer for treatment at a new WTW. The principal construction elements of this option are: • New river abstraction and intake on the River Wampool at Powhill • Raw water transfer to High Brownelson SR • New WTW at same site as SR sized at between 2.5 and 5 Ml/d and transfer to existing SR storage. The exact quantities available for abstraction will need to be confirmed with the Environment Agency.	The abstraction would be approximately 3km upstream of the Solway Firth SAC and Upper Solway Flats and Marshes SPA / Ramsar sites, which may be vulnerable to construction and operation. Construction effects can be avoided with established measures although the availability of the abstraction volumes would need to be confirmed by the EA, and so operational effects are 'uncertain' at this stage. The pipeline route is uncertain but likely to cross other tributaries of the Solway SAC / SPA / Ramsar sites. The Wedholme Flow SSSI component of the South Solway Mosses SAC is approximately 2-3km from the abstraction but will not be exposed to the effects of operation (upstream).	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR049a	River Ribble (Thirlmere Aqueduct and Lostock)	This option would require a new abstraction from the River Ribble (new licence required, licenced volumes TBC but anticipated 20 Mld). The principal construction elements of this option are: • New river intake, screens and pumping station on River Ribble • 5.1km of 630mmOD raw water transfer pipeline to intersect Thirlmere Aqueduct South Well, using the most appropriate route for a new pipeline • Modifications to Lostock WTW process and capacity will be required in order to treat the additional water. • Lostock WTW site capacity to be maintained at 180 Ml/d to account for additional water source.	The Ribble and Alt Estuaries SPA / Ramsar sites are downstream receptors (via the River Ribble) located ~10km downstream of the proposed abstraction; it is noted that the latest EA data suggests 20Mld may be available, although this would need to be confirmed by the EA, and so operational effects are 'uncertain' at this stage. Construction effects are avoidable with established measures.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR055	Cumwhinton WTW Enhancements	The scheme would require: • Modify the abstraction licence for the River Eden at Cumwhinton in order to permit continued abstraction at 32 Ml/d throughout the year (the current abstraction licence has a peak abstraction limit of 32 Ml/d, with an average daily abstraction of 22 Ml/d) • New treated water transfer pipeline and pumping station (if needed) between Cumwhinton and Castle Carrock SR, sized at 6.5 Ml/d max flow	The scheme would require a modification of the abstraction licence and would directly affect the River Eden SAC; significant effects are likely and so additional investigation would be required to confirm effects on the river and permitted abstraction volumes if selected as a preferred option (hence operational effects uncertain). Construction would require a crossing of the SAC; adverse effects likely to be avoidable through scheme-specific detailed design and established measures but more information required on these aspects.	Construction: Uncertain - significant effects cannot be excluded and may require the identification of bespoke mitigation measures or amendments to	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation
WR056a	River Eden (Cumwhinton) to Watchgate	The scheme would require: • New river abstraction on the River Eden at Cumwhinton, adjacent to existing intakes, sized at flows of 25 and 50 Ml/d, the exact quantities available for abstraction will need to be discussed with the Environment Agency • New pumping station and raw water transfer pipeline to Cumwhinton WTW • New WTW to treat between 25-50 Ml/d River Eden water • New pumping station and treated water pipeline between Cumwhinton and Watchgate WTW	The scheme would require a new abstraction from River Eden SAC - significant operational effects are likely and so additional investigation would be required to confirm effects on the river and permitted abstraction volumes if selected as a preferred option (hence operational effects uncertain). Other operational effects are possible (fish entrainment etc). The new pipeline runs under River Eden SAC in two locations (effects probably avoidable with standard measures) and through Lake District High Fells SAC (substantial significant construction effects likely without route modification (essential to support option as preferred)).	Construction: Uncertain - significant effects cannot be excluded and may require the identification of bespoke mitigation measures or amendments to scheme design at the plan level	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR056b	River Eden (Cumwhinton) to Haweswater Gravity	The scheme would require: • New river abstraction on the River Eden at Cumwhinton, adjacent to existing intakes, sized at flows of 25 and 50 Ml/d, the exact quantities available for abstraction will need to be discussed with the Environment Agency • New PS and raw water transfer pipeline to intersect with Haweswater gravity pipeline • Transfer to Watchgate using existing RW transfer pipeline • Modifications to Watchgate WTW to treat the additional 25-50 Ml/d River Eden water	The scheme would require a new abstraction from River Eden SAC - significant operational effects are likely and so additional investigation would be required to confirm effects on the river and permitted abstraction volumes if selected as a preferred option (hence operational effects uncertain). Other operational effects are possible (fish entrainment etc). The new pipeline crosses the River Eden SAC (effects probably avoidable with established measures) and through Naddle Forest SAC (substantial significant construction effects likely without route modification (essential to support option as preferred)).	Construction: Uncertain - significant effects cannot be excluded and may require the identification of bespoke mitigation measures or amendments to scheme design at the plan level	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR063	River Yarrow and River Lostock	The scheme would require: • New lowland river abstraction at the confluence of the River Yarrow and River Lostock • New WTW, maximum capacity 10 Ml/d, pumping station and treated water transfer to existing treated water storage at Harrock Hill SR (4 Ml/d) and Prospect SR (6 Ml/d)	The Ribble and Alt Estuaries SPA / Ramsar sites are downstream receptors (via the River Asland Dougles) of the proposed abstraction. Construction effects can be avoided with established measures although the availability of the abstraction volumes would need to be confirmed by the EA, and the acceptability of this option viz effects on European sites would need to be established if pursued as a preferred option (and so operational effects are 'uncertain' at this stage).	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation
WR064	Entwistle Reservoir - Raise Embankment Structure	This option would involve an increase in the capacity of the Entwistle Reservoir. This would require a modification to the impoundment licence. The principal construction elements of this option are: • Raise the existing overflow weir by 1m (with addition of steel weir plate across the spillway weir, bolted to the existing weir base), making the new weir level 211.10 mAOD. Length of new weir is 22m. Increasing storage by approximately 376,810m3. • Remove the wave wall, footpath and crest road from dam. Raise the height of the puddle clay core by 1m (puddle 1m deep, by 1.5m wide by 325m long). Provide tarmac or similar crest protection. Install a new reinforced concrete wave wall, standing 1.00m above the new raised crest of the dam, and tie the base of the wall to the top of the new clay core. Wave wall to be 325m long.	No European sites or features are exposed to the likely effects of this scheme.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR065a	Watergrove Reservoir	This option would involve an increase in the capacity of the Watergrove Reservoir. This would require a modification to the impoundment licence. The principal construction elements of this option are: • Replace the existing spillway weir level through addition of a steel weir plate, with new plate 1m, making the new weir level 238.82m AOD. Length of new weir is 21m. Increasing storage by approximately 388,000 m3 (388 Ml). • Remove the wave wall from dam. Raise the height of the puddle clay core by 1m (puddle 823m long) making a new dam crest height of 239.85m AOD. Install a new reinforced concrete wave wall, standing 1.30m above the new raised crest of the dam, and tie the base of the wall to the top of the new clay core. Wave wall to be 823m long. • Add additional material to the downstream embankment to maintain the bank gradient. Dam is 823m long by 26.5m high. Extend tunnel to accommodate larger embankment. • Increase the walls of the spillway channel by 1m. • Increase the height of the bridge serving the access road to the WTW, to maintain height above the spillway channel. • Increase the height of the footbridge serving the access track running across the crest of the dam, to maintain height above the spillway channel.	No European sites or features are exposed to the likely effects of this scheme.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR065b	Whiteholme Reservoir - Raise Embankment Structure	This option would involve restoration the design capacity of the Whiteholme Reservoir (Whiteholme was subject to an 'In The Interests Of Safety' recommendation in 2015 made under section 10 of the Reservoir Act 1975. This recommendation related to insufficient freeboard in flood conditions, and led to the reservoir top water level being reduced by 1.07m from 382.86m AOD to 381.79m AOD). The principal construction elements of this option are: • Reinstate the reinforced concrete weir section, restoring the previous top water level of 382.86m AOD. Weir is 8.2m long by 1.07m high. This would result in an increase in storage volume of approximately 418,700m3. • Install a reinforced concrete water retaining wavewall along the crest of the dam. Top of the wavewall should stand 1.30m above the level of the dam crest (top of wave wall 384.70m AOD). This is a homogenous dam, and there is therefore no clay core to which to tie the base of the wall to form a continuous watertight element. The exact depth to which the wavewall should extend will need to be agreed with a QCE, however assume that it will be at least down to TWL (total height from buried foundation to top of wall at least 1.84m). Wavewall to be 800m long.	This reservoir is located within (and is covered by) the South Pennine Moors SAC and South Pennine Moors Phase 2 SPA; construction is likely to be a relatively substantial undertaking but significant / adverse effects would not necessarily occur provided works were kept to existing operational etc areas and established avoidance / mitigation measures were used. The SPA and SAC will be directly affected as a result of increased reservoir levels. Precise effects cannot be determined without micro-topographical analysis, although it is recognised that the scheme would restore the reservoir to its pre-2015 levels and therefore it is extremely unlikely that the interest features of the SAC and SPA will be adversely affected (although effects are considered 'uncertain' at this stage as additional analysis will be required.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR066	River Medlock	This option would require a new abstraction from the River Medlock (new licence required, licenced volumes TBC but anticipated 6 Mld); raw water transfer to Denton WTW; new WTW and transfer to existing treated water storage at Denton SR. The principal construction elements of this option are: • New lowland/urban river abstraction from the River Medlock • New raw water transfer, sized at 6 Ml/d, to site of Denton WTW • New separate WTW at Denton to treat River Medlock water, maximum 6 Ml/d • Transfer to existing potable storage in Denton SR	No European sites or features are exposed to the likely effects of this scheme. The Mersey Estuary SAC / SPA / Ramsar sites are downstream receptors (via the Ship Canal) but are located almost 40km downstream, and so it is unlikely that abstraction volumes of 6 Mld would substantially affect discharges to these sites (although this would need to be confirmed by the EA, and so operational effects are 'uncertain' at this stage)	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - effects possible but significant or significant adverse effects avoidable with established operational mitigation (e.g. licence controls)
WR075	Stocks Reservoir Raise Weir Structure	This option would involve an increase in the capacity of the Stocks Reservoir by raising the weir height by 570mm. This would require a modification to the impoundment licence.	The closest sites to this option are the North Pennines Dales Meadows SAC and the Bowland Fells SPA. However, effects on these sites would not be expected with use of established avoidance and mitigation measures. No other sites will be affected.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare
WR077a	Dovestone Reservoir - Raise Embankment Structure	This option would involve an increase in the capacity of the Dovestone Reservoir by raising the weir height by 1m. This would require a modification to the impoundment licence. The principal construction elements of this option are: • Raise the existing bellmouth overflow weir by 1m in reinforced concrete • Raise the height of the weir of the auxiliary spillway by 1m. • Raise the walls of the auxiliary spillway by 1m in reinforced concrete, with earthfill behind the raised walls. • Remove the wave wall and crest road from dam. • Raise the height of the puddle clay core by 1m (puddle 1m deep, by 2m wide by 540m long). • Provide waterproof mass concrete fill to the upstream side of the raised core, to crest level. • Provide tarmac or similar crest protection. • Install a new reinforced concrete wave wall, standing 1.07m above the new raised crest of the dam, 540m long. • Add additional material to the downstream embankment to maintain a bank gradient of 2:1. Dam is 540m long by 33m high. Extend tunnel to accommodate larger embankment.	This reservoir is located near the South Pennine Moors SAC and South Pennine Moors Phase 1 SPA, and whilst these will not be directly affected by construction or operation the construction will be a substantial undertaking with the potential for significant effects on these sites (particularly breeding birds) if not suitably mitigated. Adverse effects would not necessarily occur however. All downstream receptors are a substantial distance away, and no operational effects would be anticipated although there is a theoretical risk of local microclimate changes depending on the precise storage parameters.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - effects possible but significant or significant adverse effects avoidable with established operational mitigation (e.g. licence controls)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR077b	Errwood Reservoir - Raise Embankment Structure	This option would involve an increase in the capacity of the Errwood Reservoir by raising the weir height by 1m. This would require a modification to the impoundment licence. The principal construction elements of this option are: • Remove the wave wall, footpath and crest road from dam. Raise the height of the puddle clay core by 1m (puddle 1m deep, by 2m wide by 311m long). Provide waterproof mass concrete fill to the upstream side of the raised core, to crest level. Provide tarmac or similar crest protection. Install a new reinforced concrete wave wall, standing 1.07m above the new raised crest of the dam, and tie the base of the wall to the top of the new clay core. Wave wall to be 311m long. • Raise the existing bellmouth overflow weir by 1m • Reinstate the public highway across the dam, at the new crest elevation. . • Add additional material to the downstream embankment to maintain the bank gradient. Dam is 311m long by 32m high. Extend tunnel to accommodate larger embankment.	This reservoir is located near the South Pennine Moors SAC and the Peak District Moors (South Pennine Moors Phase 1) SPA, which overlap with the tributary channels at the southern end of the reservoir. Precise effects cannot be determined without micro-topographical analysis and site survey, but any raising of reservoir height will directly affect the geographical extent of the SPA and SAC (although interest features may not be affected); this would certainly be a significant effect and potentially adverse, and would be unavoidable - however, it would appear unlikely that a substantial area of the sites would be affected. Construction will be a substantial undertaking with the potential for significant effects on these sites (particularly breeding birds) if not suitably mitigated. All downstream receptors are a substantial distance away, and no operational effects would be anticipated although there is a theoretical risk of local microclimate changes depending on the precise storage parameters.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR077c	Fernilee Reservoir - Raise Embankment Structure	This option would involve an increase in the capacity of the Fernilee Reservoir by raising the weir height by 1m. This would require a modification to the impoundment licence. The principal construction elements of this option are: • Replace the existing cast iron weir plate, with new plate 1m taller, increasing storage by approximately 351,649m3. • Remove the wave wall and crest road from dam. Raise the height of the puddle clay core by 1m (puddle 1m deep, by 1.5m wide by 230m long). Provide tarmac or similar crest protection. Install a new reinforced concrete wave wall, standing 1.38m above the new raised crest of the dam, and tie the base of the wall to the top of the new clay core. Wave wall to be 230m long. • Reinstate the public highway across the dam • Add additional material to the downstream embankment to maintain the bank gradient. Extend tunnel to accommodate larger embankment. Relocate downstream valve house. • Increase the height of the 'flood protection berm' by 1m, which runs alongside the west side of the overflow channel. • Increase the height of the access road by 1m to maintain height of the road above top water level, including embankment section over the inlet. Road runs for 1.8km along the eastern shoreline of the reservoir. • Replace the road bridge which runs over the spillway channel at the right abutment. This is a very substantial masonry structure with multiple arches. Replace with single span structure, set at new crest level.	This reservoir is located near the South Pennine Moors SAC and the Peak District Moors (South Pennine Moors Phase 1) SPA. Construction will be a substantial undertaking with the potential for significant effects on these sites (particularly breeding birds) if not suitably mitigated. All downstream receptors are a substantial distance away, and no operational effects would be anticipated although there is a theoretical risk of local microclimate changes depending on the precise storage parameters.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - effects possible but significant or significant adverse effects avoidable with established operational mitigation (e.g. licence controls)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR079a	Appleton Reservoir, Warrington	Appleton Reservoir is only used as an emergency fire-fighting supply for an industrial customer in Warrington. The scheme would require: • Reinstate Appleton IR with a new or refurbished point of abstraction from the draw-off tower located on the northern embankment • New raw water pumping station to deliver 3 Ml/d • New raw water pipeline between Appleton IR and Hill Cliffe SR site • New WTW facility built on the Hill Cliffe SR site to Appleton IR water • Likely requirement for sewer connection to discharge WTW waste product	No European sites or features are exposed to the likely effects of this scheme.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR088	Alsager Boreholes	The scheme would require:- • New duty/standby boreholes (2No.) located at Alsager located in South Cheshire and North Staffordshire Permo-Triassic Sandstone Aquifer Unit, max output 3 Ml/d • Boreholes constructed to 150m depth, two new borehole pumps (BH1 and BH2), rising main (assumed 100m long in each borehole), mechanical and electrical equipment to deliver up to 3 Ml/d (duty/standby). New headworks on both boreholes to asset standard design. • New WTW facility located at Alsager site • New treated water transfer main to connect to Alsager SR	The closest sites to this option are the Midlands Meres and Mosses Phase 2 Ramsar sites; the closest unit of this site is 3.5km from the proposed boreholes (Oakhanger Moss) so theoretically vulnerable to groundwater abstractions although the nature of the site ensures it is unlikely to have significant hydrological connectivity with the underlying aquifer. It is unlikely that abstraction volumes of 3 Mld would substantially affect these sites (although this would need to be confirmed). No construction effects.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR092-W	High Brownelson Bh	This option would involve a new borehole in the Carlisle Basin Triassic and Jurassic aquifer at High Brownelson and a new WTW. The principal construction elements of this option are: • New borehole sized at 1 Ml/d at High Brownelson SR • New WTW • New connection to High Brownelson SR	The new borehole would be located adjacent to the River Caldew, which is part of the River Eden SAC. Construction effects are likely to be avoidable with established measures but more analysis of the potential operational effects is required, particularly regards any connectivity between the aquifer and the river. The yield (1Mld) would seem to be unlikely to affect the river, although this would need to be confirmed by the EA, and so operational effects are 'uncertain' at this stage.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation
WR096	Durdar Borehole to High Brownelson SR	The scheme would require: • New borehole sized at 2 Ml/d at Durdar, new WTW (located either at Durdar or High Brownelson SR), new pipeline to High Brownelson SR • Borehole constructed to 150m depth, one new borehole pump, rising main (assumed 100m long), mechanical and electrical equipment to deliver up to 2 Ml/d. New headworks on both boreholes to asset standard design • New WTW facility located either at Durdar or High Brownelson SR	This option will require a new borehole abstraction within 2km of the River Eden SAC and pipeline crossings of the same river. The SAC will be vulnerable to construction effects although these are likely to be avoidable with established measures, such as construction best practice or timing works to avoid breeding / migration periods. The operation of the scheme may affect flows within the Eden depending on connectivity and so additional information would be required to support this as a preferred option. Operational effects are therefore 'uncertain' at this stage.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR097	Kirklinton Boreholes	This option would involve new boreholes located at Scaleby and Newtown, new WTW, a treated water transfer to Waygill Hill SR, and an upsized treated water connection to Prior Rigg SR. The principal construction elements of this option are: • New boreholes (2No.) located in the Scaleby area , to deliver up to 2.5 Ml/d output operating in duty/standby mode • New raw water transfer pipeline between Scaleby to combine with two new boreholes in the Newtown area, • New boreholes (2No.) located at Newtown, to deliver up to 2.5 Ml/d output operating in duty/standby mode • Combined raw water main (capacity 5 Ml/d) between Newtown and Waygill Hill SR • New WTW located at Waygill Hill site to treat up to 5 Ml/d, transfer to existing Waygill Hill SR storage • New increased capacity treated water main between Waygill Hill SR and Prior Rigg SR	This option will require the construction of boreholes and pipelines near several European sites, including the River Eden SAC (borehole within 1km of River Irthing; pipeline crossings); Walton Moss SAC (borehole within 3km; pipeline within 2km); Bolton Fell Moss SAC (pipeline within 2km); and the North Pennine Moors SAC and SPA (WTW within 100m). Of these, the River Eden SAC and the North Pennine Moors SAC and SPA will be most vulnerable to construction effects (although these are likely to be avoidable with established measures, such as construction best-practice or timing works to avoid breeding / migration periods). With regard to operation, the aquifer is not fully understood and whilst water is likely to be available based on EA data, the use of the boreholes has the potential to affect the River Irthing or its tributaries (and hence the River Eden SAC) depending on the connectivity with the aquifer; and potentially Walton Moss (although this is a raised ombrotrophic mire so significant connectivity would not be expected). Operational effects are 'uncertain' at this stage.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR098	Threapwood Boreholes	This option would involve new boreholes located at Threapwood, a new WTW, treated water transfer to the Vyrnwy main and Malpas SR. The principal construction elements of this option are: • New duty/standby boreholes (2No.) located at Threapwood located in Middle Dee GW Unit, max output 2 Ml/d, new WTW, new treated water transfer main to connect to Vyrnwy LDTM BSPs.	This option will require the construction of a borehole and pipeline ~3km from the River Dee and Bala Lake SAC. Construction effects are likely to be avoidable with established measures, such as construction best practice or timing works to avoid breeding / migration periods). With regard to operation, direct effect on the River Dee are unlikely due to the distance but the new borehole will be adjacent to a minor tributary; therefore, although significant adverse effects are unlikely operational effects are considered 'uncertain' at this stage.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation
WR103	Croft Boreholes	This scheme would require: • Reinstate and refurbish two boreholes at Croft • Two new borehole pumps, rising main, headworks on each borehole to deliver 5 Ml/d peak from each borehole (duty/standby) • New WTW within existing WTW site sized at output of maximum 5 Ml/d • New 5.5km treated water main between Croft and Lightshaw to blend with output of existing WTW in Lightshaw SR	No significant effects anticipated assuming established measures (distance). Existing abstraction licence,	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR108	Mow Cop Borehole	This option would involve the reinstatement of Mow Cop borehole, Cheshire, with an upgraded water treatment works facility. The principal construction elements of this option are: • Reinstate and refurbish Mow Cop borehole and WTW located to the north of Congleton • New or upgraded WTW facility built within the Mow Cop WTW building	No impact pathways; within terms of existing licence; nearest site over 7km away.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare

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WR117	Grindleton (Lowcocks) and Waddington Springs	This option involves a new WTW to treat licensed volumes from Grindleton and Waddington Springs using existing pipelines. The principal construction elements of this option are: • Collection of raw water from Grindleton Springs and Waddington Spring • new WTW located at Waddington High Level SR and Lowcocks SR using existing raw water transfers • Treated water to Lowcocks SR and Waddington High Level SR	No impact pathways; within terms of existing licence; nearest site over 8km away.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR123	Helsby and Foxhill Boreholes	The scheme would require: • Reinstate and refurbish Helsby boreholes; new borehole pumps, M&E, headworks, all located on the existing Helsby WTW site (redundant), max capacity 3 Ml/d • Utilise existing 6" CI pipeline (redundant) between Helsby and Helsby SR (redundant) to transfer up to 3 Ml/d raw water to • New c.1.6km raw water main between site of redundant Helsby SR to Foxhill WTW • Blend with existing Foxhill BH water (8 Ml/d), modify existing disinfection for additional 3 Ml/d at Foxhill WTW • Combined pumping of 11 Ml/d through existing 16" main to blend with water from Simmonds Hill WTW	Construction would require works within 4km of the Mersey Estuary SPA although effects on the features of these sites can be avoided with established measures, such as construction best practice or timing works to avoid breeding / migration periods. Operation would require increased exploitation of the aquifer, although the precise effects of operation is uncertain - it is assumed that the option has the potential to reduce flows into the estuary via (for example) the Hornsmill Brook. Additional investigation would be required to confirm this hence operational effects uncertain.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR124	Ashton Boreholes	This option involves the reinstatement of the Ashton borehole, Cheshire (existing licence) with a new water treatment works facility, transfer of treated water to Duddon Common Booster site using existing main. The principal construction elements of this option are: • Reinstate and refurbish the existing borehole at Ashton; • New WTW designed at maximum abstraction licence limit of 4.5 Ml/d • Utilise existing main to connect to site of Duddon Common Booster and blend with Dee treated water	No impact pathways; within terms of existing licence; nearest site (Oak Mere SAC / Midland Meres and Mosses Phase 2 Ramsar) over 6km away.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)

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WR130	Desalination - Carlisle	The scheme would require: • New abstraction from the River Eden in the vicinity of New Sandsfield – indicative location only • New desalination plant WTW located in the same area as the abstraction point, sized for a capacity of 5 Ml/d • Connection of waste stream to existing sewer • New treated water pipeline to connect to High Brownelson SR	This scheme would require an intake from the River Eden SAC (less than 1k upstream of the Solway Firth SAC and Solway Flats and Marshes SPA / Ramsar sites). Scheme operation would certainly have significant effects on the supporting habitats and interest features of these sites and a strong possibility of adverse effects (e.g. fish entrainment, water intake, brine discharge (depending on waste stream process). Construction of the scheme will also have significant effects. Substantial additional investigation is likely to be required to support this option as a preferred option.	Construction: Uncertain - significant effects cannot be excluded and may require the identification of bespoke mitigation measures or amendments to	Operation: No - significant effects certain and adverse effects potentially unavoidable.
WR131	Desalination - Wirral	This scheme would involve a new desalination plant on the Wirral peninsula; a new WTW; and transfer of treated water to Cross Hill SR. The principal construction elements of this option are: • New abstraction from the Mersey estuary in the vicinity of Alfred Dock • New WTW at the same location, sized at 20 Ml/d, connection of waste stream to sewer • New treated water pipeline to connect to Cross Hill SR	Construction would be required within the catchments of the Dee Estuary SAC / SPA / Ramsar sites and (notably) the Mersey Estuary SPA / Ramsar, although effects on the features of these sites are likely to be avoidable with established measures, such as construction best practice or timing works to avoid breeding / migration periods. Operation would require abstraction from the Mersey Estuary and (presumably) the discharge of brine to the same site; the operation would almost certainly have significant effects on the supporting habitats and interest features of the Mersey Estuary SPA / Ramsar and potentially adverse effects. Substantial additional investigation is likely to be required to support this option as a preferred option.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: No - significant effects certain and adverse effects potentially unavoidable.
WR132	Desalination - Liverpool	This scheme would involve a new desalination plant; a new WTW; and transfer of treated water to Prescott SR. The principal construction elements of this option are: • New abstraction from the River Mersey estuary in the vicinity of Seaforth Dock, indicative location only • New WTW at the same location, sized at 20 Ml/d and 50 Ml/d, connection of waste stream to sewer • New treated water pipeline to connect to Prescot SR	Construction would be required within the catchment of the Mersey Estuary SPA / Ramsar, although effects on the features of these sites are likely to be avoidable with established measures, such as construction best practice or timing works to avoid breeding / migration periods. Operation would require abstraction from the Mersey Estuary and (presumably) the discharge of brine to the same site; the operation would almost certainly have significant effects on the supporting habitats and interest features of the Mersey Estuary SPA / Ramsar and potentially adverse effects. Substantial additional investigation is likely to be required to support this option as a preferred option.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR133	Desalination - Workington	The scheme would require: • New abstraction from the Solway Firth in the Workington area, indicative location, sized at a capacity of 20 Ml/d • New WTW at Workington, connection of waste stream to existing sewer • New treated water pipeline to connect to Moota Hill SR which will be available following completion of the Thirlmere transfer scheme in 2022	This scheme would require an intake from the estuary of the River Derwent (immediately downstream of the River Derwent and Bassenthwaite Lake SAC). Scheme operation would certainly have significant effects on the mobile interest features of this sites and a strong possibility of adverse effects (e.g. fish entrainment, water intake, brine discharge (depending on waste stream process)). Construction of the scheme may also have significant effects. Substantial additional investigation is likely to be required to support this option as a preferred option.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: No - significant effects certain and adverse effects potentially unavoidable.

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR138	Ellesmere Port WwTW - Final Effluent Reuse	This scheme would involve effluent reuse using flows from Ellesmere Port WwTW and treatment at Little Stanney WTW for non-potable supplies. The principal construction elements of this option are: • New WTW to treat final effluent to non-potable standards Existing infrastructure will be used to transfer into non-potable network.	This scheme would presumably reduce flows into the Mersey Estuary SPA / Ramsar via the River Gowy (which discharges at Stanlow Point); additional investigation would be required to confirm effects on the estuary and permitted abstraction volumes (hence operational effects uncertain). Construction effects likely to be avoidable through established measures.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation
WR139	Castle Carrock WwTW – Final Effluent Reuse	The scheme would require: • Utilisation of final effluent from Castle Carrock WwTW, transfer to Castle Carrock WTW inlet • Modifications to existing WTW process to account of new proportion of effluent. • From analysis of DWF data, this was reported as 69 m3/d. 50% of DWF taken as maximum option capacity. • Utilisation of existing infrastructure to transfer into potable network.	This scheme would presumably reduce flows into the River Gelt (part of the River Eden SAC); additional investigation would be required to confirm effects on the estuary and permitted abstraction volumes (hence operational effects uncertain). Construction effects likely to be avoidable through established measures.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation
WR145	Whitehaven and Workington Final Effluent Reuse	The scheme would require: • New abstraction from outfall of Whitehaven WwTW and pumping station for up to 6 Ml/d transfer • New pipeline between Whitehaven WwTW and Workington WwTW • New abstraction from outfall of Workington WwtW, sized at 10 Ml/d • New pumping station and pipeline between Workington WwTW and new Williamsgate WTW	This scheme would presumably alter flows into the River Derwent estuary, which may affect mobile features from the River Derwent and Bassenthwaite Lake SAC. This is likely to be relatively minor although additional investigation would be required to confirm effects on the estuary and permitted abstraction volumes (hence operational effects uncertain). Pipelines would be near the River Derwent SAC but construction effects likely to be avoidable through established measures.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR149	Lightshaw Increased WTW Capacity	The scheme would require: • Reinstate and refurbish two existing boreholes at Croft as raw water sources; transfer to Lightshaw WTW using new RW main together with RW from Kenyon boreholes (no Kenyon refurbishment needed as site currently in use and RW main between Kenyon and Croft is used) • Reinstate and refurbish one existing borehole at Landside as raw water source; transfer to Lightshaw along existing RW main • Reinstate and refurbish one existing borehole at Lightshaw as raw water source; transfer to Lightshaw using existing RW main • Refurbish existing WTW to treat full 32 Ml/d (including Landside and Lightshaw) and extend to 35 Ml/d (to include Croft and Kenyon) NB: The BH capacities are greater than the WTW capacity, this is intentional to allow rotation of boreholes to minimise WQ risks • Utilise existing 5.5km treated water main between Lightshaw and Croft SR	Risk borehole will effect Manchester Mosses SAC due to distance of 3.5km; however adverse effects unlikely. Assumed covered by currently licence but needs to be confirmed. Construction effects can be avoided through scheme-level mitigation/avoidance.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR151	Reduction in Raw Water Losses	This option would involve refurbishment (etc) to raw water mains supplying five WTWs (Fishmoor, Royal Oak, Lancaster, Watchgate, Wybersley. The scope and extent of the mains replacement is not clear at this point.	There will be no operational effects (DO achieved by reduced leakage). Construction effects cannot be assessed without details on mains locations / extent of replacement works but it is likely that significant effects on European sites will be avoidable with established measures.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare
WR159	Compensation Over Release Control Group 2 Regional Reservoirs	This option would involve the installation of automated compensation control to conserve reservoir storage at a number of reservoirs (~76); this would allow releases to be more closely controlled whilst maintaining the compensation releases. The principal construction elements of this option are: • Construction of new automated penstock arrangements at the reservoir sites, in order to control compensation to licence requirements.	The works are minor and construction effects are likely to be avoidable with established measures. Operation within terms of existing licences.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare
WR160	Compensation Over Release Control Group 1 Reservoir Groups	This option would involve the installation of automated compensation control to conserve reservoir storage at a four impoundment reservoirs (Thirlemere, Haweswater, Vyrnwy and Rivington); this would allow releases to be more closely controlled whilst maintaining the compensation releases. The principal construction elements of this option are construction of new automated penstock arrangements at the reservoir sites, in order to control compensation to licence requirements.	The works are minor and construction effects are likely to be avoidable with established measures. Operation within terms of existing licences.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR162	Reduction in outages by refurbishment (Enhanced Maintenance) of Raw Water Infrastructure	This option would involve refurbishment (etc) to raw water mains to reduce leakage. The pipelines included in this option are as follows: • Windermere to Watchgate WTW • Ullswater to Haweswater Reservoir • River Lune to River Wyre and River Wyre to Franklaw WTW The principal elements of work required are estimated as requiring the refurbishment of 42.7km of raw water pipelines. The method of refurbishment is assumed to be 90% structural lining and 10% open cut.	There will be no operational effects (DO achieved by reduced leakage). Construction effects cannot be assessed without details on mains locations / extent of open cut replacement works but it is likely that significant effects on European sites will be avoidable with established measures.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR163	Reduction in outages of Raw Water Transfer Systems (Windermere & Ullswater)	This option would involve reductions in outages of raw water transfer systems through pro-active asset condition assessment and smart operation of non-infrastructure assets (Windermere & Ullswater). The raw water transfers included in this option are Windermere to Watchgate WTW and Ullswater to Haweswater Res. The option would be to install pro-active asset condition assessment tools (temperature, vibration, pressure) so that a condition / performance based maintenance regime can be implemented at pumping stations, to improve asset availability. Option also includes full remote operation and automation of pump assets linked to gauging stations, to enable automation of pumping above "hands-off flow".	There will be no operational effects (DO achieved by improved asset operational management). Construction effects cannot be assessed without details on locations of uprated assets but these will all be minor works within existing operational sites and so significant effects on European sites will be avoidable with established measures.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR165	Maximise Pumping from Windermere and Ullswater Between March-October.	This option would operate within the existing licence terms but maximise pumping from Windermere and Ullswater between March-October (subject to all existing constraints and only when Haweswater is below 95% storage).	Assuming that all existing licence conditions regarding compensation flows etc are met then there will be no significant operational effects as a result of this option. No construction required.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR166	Penrith Boreholes to Demmings Moss SR	This option would involve the installation of new boreholes in the Eden Valley near Penrith; new raw water pipeline to new Brougham Castle WTW; new PS and treated water transfer to Demmings Moss SR. The principal construction elements of this option are: • 5No. new boreholes located to abstract from the Penrith Sandstone aquifer in the vicinity of Penrith • • • • • • New raw water main between each site (from north to south) to deliver combined flow: #1 to #2: 3 Mld; #2 to #3: 6 Ml/d; #3 to #4: 9 Ml/d; #4 to #5: 12 Ml/d plus #5 combined flow 15 Ml/d • New WTW at Brougham Castle to treat 15 Ml/d • New PS and TW main between Brougham Castle WTW and Demmings Moss SR	This option would involve the installation of five new boreholes within 1 - 2km of the River Eden SAC, and long-distance pipelines crossing the River Eden SAC and running near the Lake District High Fells SAC and the Asby Complex SAC. Despite the scale of the works it is likely that most construction effects can be avoided with established measures. With regard to operation, this would require increased exploitation of the Penrith Sandstone aquifer and so the potential effects of this on the River Eden SAC (and downstream receptors) would need to be fully understood for the HRA. The quantity of water available needed for abstraction is uncertain and would need to be discussed with the Environment Agency.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR167	Delph Reservoir	Drought permit allows compensation flow to be reduced from 3.7 to 1.0M Ml/d	The Drought Plan considers there to be no impact pathway between the scheme and any European sites within the vicinity.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare
WR168	Dovestone Reservoir	Drought permit allows compensation flow to be reduced from 15.9 to 10.0 or 5.0 Ml/d. There is no construction phase associated with this drought option.	Rochdale Canal SAC is the only downstream European site from the Scheme. The Drought Plan states no adverse operation impacts on the Rochdale Canal SAC were reported from previous assessments. And therefore, no likely significant effects of the operation of the drought option on this site are antcipated, either alone or in combination. Further assessment advised if Scheme is selected as preferred option, however unlikely to cause significant effects.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation

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WR169	Jumbles Reservoir	Drought permit allows reduced compensation flow from 19.9 to 12.0 or 6.0 Ml/d	The Drought Plan considers there to be no European sites within the zone of influence of the Scheme. There are two SAC's within 20km, however there is no impact pathway.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare
WR170	Longdendale Reservoirs	Drought permit allows reduced compensation flow from 45.5 to 22.5 or 15.0 Ml/d. There is no construction phase associated with this drought option.	The Drought Plan reports there to be no adverse operational impacts on the South Pennine Moors SAC. And, therefore no likely significant effects of the operation of the drought option on this site are anticipated, either alone or in combination. Further assessment advised if Scheme is selected as preferred option, however unlikely to cause adverse effects.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation
WR171	River Lune LCUS Abstraction	Drough permit allows prescribed flow to be reduced from 365.0 to a minimum of 200Ml/d. There is no construction phase associated with this drought option.	The Drought Plan reports: "The River Lune is one of the five major freshwater sources to Morecambe Bay which also include the Rivers Level, Kent, Keer, Wyre. It is noted that the River Lune was not considered within the Environment Agency's Review of Consents process. It is acknowledged that the Review of Consents was carried out on the existing licence and not the drought option proposed. An Environmental Assessment Report has been prepared for the drought option for drought contingency planning purposes in 2016. The report concluded no adverse operational impacts on the Morecambe Bay SAC/SPA. Therefore, no likely significant effects of the operation of the drought option on this site are anticipated, either alone or in combination." However, effects are likely to vary if the option is employed 'permanently' rather than as a temporary option during drought periods and so further information on operation would be required if considered as a preferred option.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR172	Rivington Reservoirs - Brinscall Brook	Drought permit allows for compensation flow to be reduced from 3.9 to 2.0 Ml/d	The Drought Plan confirms that there are no European sites within the zone of influence of the scheme. There are no impact pathways to the European sites within 20km.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare

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WR173	Rivington Reservoirs - White Coppice	Drought permit allows compensation flow to be reduced from 3.9 to 2.0 Ml/d	The Drought Plan confirms that there are no European sites within the zone of influence of the scheme. There are no impact pathways to the European sites within 20km.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare
WR174	Ullswater	Drought permit allows the reduction of hands-off flow conditions to a minimum of 95Ml/d and a relaxed 12-month rolling abstraction licence limit.	The Ullswater drought option has been the subject of previous environmental assessment studies. The only ecological feature screened in for further assessment in the 2016 report was the upstream migration of Atlantic salmon and sea trout, as agreed following extensive stakeholder consultation. The assessment has concluded that there is a negligible impact on lake level and a negligible impact on river flows as a result of implementing the drought permit. Consequently, there are negligible impacts on the physical environment of the river, including water quality. The assessment concluded that the impacts of drought permit implementation on upstream migration of adult salmon and sea trout are negligible. The short term and very small magnitude of changes in river flows in the River Eamont (less than 10% within the study area from the outflow of Ullswater to the confluence with Dacre Beck only) are considered unlikely to result in significant changes in migratory opportunity to adult fish. It is also noted that during a period of natural environmental drought, adult fish waiting to migrate are considered more likely to be present lower in the catchment and, therefore, adult fish are less likely to be present within the reach of the river under the influence of the drought permit. Therefore, no likely significant effects of the operation of the drought option on these sites are anticipated, either alone or in combination. However, effects are likely to vary if the option is employed 'permanently' rather than as a temporary option during drought periods and so further information on operation would be required if considered as a preferred option.	Construction: Uncertain - significant effects cannot be excluded and may require the identification of bespoke mitigation measures or amendments to scheme design at the plan level	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures

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WR175	Lake Vyrnwy	Drought permit allows reduced compensation flow from 45.0 to 25.0 Ml/d. There is no construction phase associated with the drought option	An Environmental Report has been prepared for the drought option for drought contingency planning purposes. No adverse impacts on the Severn Estuary SAC or SPA were reported. The Environment Agency has confirmed that the Vyrnwy abstraction was scoped out of the Review of Consents before Stage 3 (although it is noted that the Review of Consents was carried out on the existing abstraction licence, and not the drought option). The Vyrnwy Aqueduct on the Montgomery Canal is the aqueduct that carries the canal over the River Vyrnwy and belongs to British Waterways. This is distinct from the aqueduct which transfers raw water from Vyrnwy to UU's Oswestry water treatment works. Information from British Waterways is that the Montgomery Canal is fed indirectly by the Llangollen Canal via Frankton Locks; by controlled feeds from the River Severn at Penarth (upstream of the confluence with the River Vyrnwy), the River Morda at Maesbury Mill, the River Tanat just upstream of Carreghofa Locks and the Lledan Brook at Welshpool; and an uncontrolled feed at Rednal Moss near Aston. There is no connectivity of the Montgomery Canal with UU's Vyrnwy Reservoir, UU's Vyrnwy aqueduct or the Afon Vyrnwy. The findings of the Environmental Report confirm that the operation of the drought option will not result in likely significant effects. However, further details of scheme and assessment and scheme-specific detailed modelling required to determine effects of scheme and operation of the option is concluded as uncertain at this stage.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR176	Lake Windermere: Scenario 1	Drought permit reduces hands-off flow conditions to a minimum of 95 Ml/d and a relaxed 12-month rolling abstraction licence limit.	The Drought Report states: "The hydrological influence of the scenarios on the Morecambe Bay SAC, SPA and Ramsar are likely to be insignificant given the relative volumes of water involved and the large attenuation volumes available in Morecambe Bay (Confirmed by Environment Agency and Natural England). In addition, it is noted that the site is primarily designated for features of interest associated with coastal habitats alone. Therefore, no likely significant effects of the operation of the drought option on these sites are anticipated, either alone or in combination." However, effects are likely to vary if the option is employed 'permanently' rather than as a temporary option during drought periods and so further information on operation would be required if considered as a preferred option.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures

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WR177	Lake Windermere: Scenario 2	Drought Permit allows rolling abstraction limit. Permits drawndown of lake level (up to a maximum of 0.5m below weir crest). There is no construction phase of the drought option	Scenario 2 includes a relaxation of 12-month rolling abstraction licence limit and permit drawdown of lake level (up to a maximum of 0.5 m below weir crest). During periods of lake drawdown, releases to the River Leven would be made by the EA through their fisheries sluice depending on the prevailing requirements of the river. The hydrological influence of the scenarios on the Morecambe Bay SAC, SPA and Ramsar are likely to be insignificant given the relative volumes of water involved and the large attenuation volumes available in Morecambe Bay (confirmed by Environment Agency and Natural England) In addition, it is noted that the site is primarily designated for features of interest associated with coastal habitats alone. Therefore, no likely significant effects of the operation of the drought option on these sites are anticipated, either alone or in combination. However, effects are likely to vary if the option is employed permanently rather than as a temporary option during drought periods and so further information on operation would be required if considered as a preferred option.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR178	Swineshaw Boreholes	Drought Plan allows abstraction of up to 4Ml/d from Swineshaw Boreholes 2 and 3	The Drought Permit report states there is only a small potential intersection between the estimated recharge zone and Pennine Moors SAC, and that no likely significant effects of the operation of the drought option on this site are anticipated, either alone or in combination. The report states that UU will commission a walkover survey to take place during spring / summer 2017 to confirm this (it is not clear whether this has been undertaken, or the results of this). Minor construction works are required to bring the boreholes back online as a drought source option although significant effects can be avoided with normal measures. Operational effects are considered uncertain at this stage although additional data may be available to determine this.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures

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WR179	Bowscar; Gamblesby; Tarn Wood Boreholes	Increase annual licence limit to enable continuation of the maximum daily abstraction rate as annual limit constrains abstraction. There is no construction phase associated with this drought option.	The Drought Plan states that the Environmental Report has been prepared for drought contingency planning at the Eden Valley boreholes sites which report concluded that the reduction in water level under the proposed drought permit will not be significantly lower than the predicted water level in a drought under the normal abstraction scenario. Similarly, no major changes in average velocity, depth, wetted width or wetted area are predicted. The results of the hydrogeological assessment indicate that the drought option at Bowscar is unlikely to have a measurable impact on flows in the River Eden SAC (due to the large size of the river at this point). Therefore, no likely significant effects of the operation of the drought option on European designated sites are anticipated, either alone or in combination. It can be extrapolated that it is unlikely that an increase in licence limits would have an adverse effect. However, effects are likely to vary if the option is employed 'permanently' rather than as a temporary option during drought periods and so further information on operation would be required if considered as a preferred option.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR801	Townhead Farm to Demmings Moss	This option would involve an abstraction trade from existing non-water industry abstraction licence holder Lagoon at Townhead Farm with unused abstraction licence of 1M gallons/day. The principal construction elements of this option are: • New intake and abstraction at Townhead Farm • New WTW, sized at 5 Ml/d maximum capacity • New pumping station and treated water transfer to Demmings Moss SR	The scheme will utilise existing licenced volumes and so no operational effects would be anticipated. Construction of the pipeline is likely to pass within 1km of several European sites, notably a unit of the North Pennine Dales Meadows SAC, which lies on both sides of a minor road that is currently proposed for the pipe; however, effects on these sites will be avoidable with established measures.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare
WR802	Abstraction Trade Bromborough	This option would involve an abstraction trade from existing non-water industry abstraction licence holder on the Wirral (Bromborough). The principal construction elements of this option are: • Refurbishment of existing industrial boreholes • New borehole WTWs situated at Bromborough • New raw water main between Bromborough and Cross Hill SR • New WTW located at Cross Hill SR, transfer of water to existing treated water storage	The scheme will utilise existing licenced volumes and so no operational effects would be anticipated (although available volumes need to be confirmed by the EA). Construction works will take place near the Dee Estuary SAC / SPA / Ramsar sites and the Mersey Estuary SPA / Ramsar, although effects on the features of these sites are likely to be avoidable with established measures, such as construction best-practice or timing works to avoid breeding / migration periods.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)

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WR811	Cow Green IR to River Eden and Cumwhinton WTW	This option would involve a 40 Ml/d transfer from the Northumbrian Water Cow Green IR to discharge10 Ml/d into River Eden to be re-abstracted downstream, treated and transferred into CRZ. The principal construction elements of this option are: • New intake structure and screens at Cow Green (invasive species protection required) • New Raw water pumping station at Cow Green • New raw water transfer main from Cow Green to Appleby Booster PS • New gravity main (10 Ml/d) to suitable River Eden discharge point • New abstraction intake on River Eden near Cumwhinton WTW • WTW modifications, if required, to treat the additional new water source at Cumwhinton WTW • New treated water transfer pipeline and pumping station (if needed) between Cumwhinton and Castle Carrock SR, sized at 10 Ml/d max flow	This option, as currently proposed, would require a pipeline across the North Pennine Moors SPA and the Moorhouse - Upper Teesdale SAC (no roads available on the currently proposed route). This would have significant and almost certainly adverse effects. A road route, avoiding the SAC, would involve a significant detour with cost implications. With regard to operation, the scheme would be a transfer of raw water between catchments requiring a discharge of raw water to the River Eden SAC which will have significant effects and a substantial risk of adverse effects (e.g. invasive species transfer). It is also not clear whether the scheme will utilise existing licenced volumes and so hydrological effects may occur on downstream sites in Teesdale. Substantial additional analysis is likely to be required for the HRA if this is selected as a preferred option.	Construction: Uncertain - significant effects cannot be excluded and may require the identification of bespoke mitigation measures or amendments to scheme design at the plan level	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
WR823	Aspull Sough Mine	The scheme would require: • New water abstraction from Aspull Sough mine • New WTW, treatment to potable standard • Transfer to IRZ storage at Aspull SR • A new abstraction licence will be granted by the Environment Agency	No significant effects anticipated assuming established measures (over 3km to nearest site; no impact pathways). New abstraction licence required from Environment Agency.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare
WR825	Bridgewater Canal Mine	The scheme would require: • New water abstraction from Bridgewater canal mine • Treatment to potable standards • Connection to trunk main system (15" main) at Worsley basin area • A new abstraction licence from the Environment Agency	The closest site to this option is the Manchester Mosses SAC (over 5 km away). The SAC is not vulnerable to construction and no operational effects are anticipated (no impact pathway) from this option. New abstraction licence required from Environment Agency, hence 'uncertain' operational effects.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare

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WR826	Clough Foot (WR826), Deerplay (WR827) and Old Meadows (WR832) minewater transfer to existing raw water storage.	This scheme would involve new abstractions from existing Coal Authority mine discharges at Clough Foot, Deerplay and Old Meadows; transfer via combined raw water system to existing UU impounding reservoir; treatment and transfer into existing potable storage. The principal construction elements of this option are: • New water abstraction from Clough Foot mine, average flow 21 l/s (equivalent 1.8 Ml/d) • New water abstraction from Deerplay mine, average flow 23 l/s (equivalent 2.0 Ml/d), already exists as scope WR827 • New abstraction from Old Meadows mine, average flow 39 l/s (equivalent 3.4 Ml/d), already exists as scope WR832 • Raw water transfer to discharge to Clough Bottom IR via new raw water pumping stations and new raw water mains • Raw water transfer systems to utilise gravity for pipeline routes as much as possible (Deerplay and Old Meadows) in order to minimise pumping costs • Treatment through existing WTW system.	Minewater currently treated and discharged to environment so scheme would affect flows in local watercourses; however no WR dependent European sites vulnerable. No construction impacts.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR831	Hockery Brook Mine	This scheme would involve new abstractions from Hockery Brook mine; a new WTW; and transfer into existing potable storage. The principal construction elements of this option are: • Raw water abstraction from Hockery Brook mine. • New WTW and treatment to potable standards • Transfer to Aspull SR	Minewater currently treated and discharged to environment so scheme would affect flows in local watercourses; however no WR dependent European sites vulnerable. No construction impacts.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR833	Silverdale Mine	Water from the disused mine would be treated to a standard to permit discharge to the environment. The principle construction elements include: • Raw water abstraction from Silverdale Mine. Assumed 2.7 Ml/d capacity. • New PS transfer to Alsager SR. • New WTW located at Alsager SR and into potable storage.	No European sites within 3km; no pathways for construction or operational effects, although a new abstraction licence is required from the Environment Agency.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR845	Dalston BH to High Brownelson SR	The principal construction elements of this option are: • Existing BH abstraction at Nestle factory – Dalston • Raw water transfer main to High Brownelson SR (pumping required) • Treatment to potable standard • Transfer to treated water storage in High Brownelson SR	Construction likely to be required near the River Eden SAC but effects likely to be avoidable with established measures. No significant operational effects anticipated (existing abstraction licence).	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare

United Utilities WRMP 2019
Habitats Regulations Assessment – Review of Additional Feasible Options

1. Introduction

United Utilities (UU) has commissioned Amec Foster Wheeler (AFW) to undertake the data collection and interpretation required to support a Habitats Regulations Assessment (HRA) of its WRMP, and to determine whether any aspects of the WRMP (alone or in-combination) could have significant or adverse effects on the integrity of any European sites. As part of this process AFW undertook an initial review of the 'feasible options' identified by UU[1]; this review was not intended to provide a definitive conclusion on the likely effects of the final WRMP, but to inform UU's selection of preferred options, by identifying:

- those options that would appear to have an unavoidable risk of adverse effects on European sites (and which should therefore be avoided if possible);
- those options where significant or adverse effects would not appear likely, assuming established avoidance and mitigation measures can employed at the scheme level; and
- those options where effects are currently uncertain, which would require additional data or information on operation / construction to support a robust HRA of the WRMP.

UU has subsequently identified additional feasible options that it may pursue, including one option (B2) designed to enable the transfer of water from the Lake Vyrnwy aqueduct near Oswestry to the Thames Water region via the River Severn and cross-country pipelines to the River Thames. The operational and construction effects of the transfer itself (i.e. pipeline construction from Oswestry to the Severn; inter-basin water transfer to the Thames region) will be assessed by Thames Water as part of the HRA of its WRMP. This technical note provides a brief review of the likely effects of the UU enabling works for this option on European sites.

2. Approach

The approach is as per that set out in the *Review of Feasible Options* technical note[2], with the results of the review summarised in Appendix A. This provides a short description of the option and a narrative assessment of its likely effects, with those European sites within 20km that are most vulnerable (i.e. both exposed and sensitive) to the delivery or operation of the scheme[3] noted in the text. It then provides broad 'recommendations' regards progressing the option as preferred options based on the anticipated construction and operational effects; the criteria for these recommendations are as follows (colour coded for clarity):

[1] Amec Foster Wheeler (2017) United Utilities WRMP 2019 Habitats Regulations Assessment – Review of Feasible Options. Report for UU, Ref. 38671N071i2. Amec Foster Wheeler, Shrewsbury.
[2] *ibid.* footnote 1
[3] For clarity, the summary tables do not explicitly identify or assess every European site within 20km; this will be set out in more comprehensive 'screening proformas' that will accompany the final HRA which will be used to transparently document the screening process.

Table 2.1 Summary of criteria for considering feasible options as potential

Recommend as preferred option?	Notes
Yes	Option appears unlikely to have any effects on European sites as features are either not exposed or not sensitive to the likely outcomes (i.e. no or no reasonable impact pathways – for example, operational effects for a 'construction only' network solution; 'dry' habitats over (say) 2km from an option; sites in different surface water catchments; upstream sites; etc. (being mindful of mobile species)). In these instances, the recommendation is 'Yes', i.e. no reason not to pursue as preferred option.
Yes	Options where pathways for effects are clearly identifiable (such that HRA would probably be required at the scheme level) but where the potential effects can obviously be avoided or mitigated using established measures that are known to be effective, for example: ▶ construction near a European site (effects avoidable with normal project planning and best-practice); ▶ minor works within European sites (e.g. works to existing assets where effects unlikely to be adverse due to absence of features); ▶ major works near / within European sites that can be completed without adverse effects (e.g. crossings of SAC rivers using existing roads or directional drilling); ▶ operational effects that are avoidable with established operational mitigation (e.g. licence controls, although at this stage potential operational effects will usually lead to an 'uncertain' recommendation to flag the need for additional information). In these instances the generic measures outlined in Appendix B can be relied on if these are included within the WRMP package, although the final plan may need to include specific measures for potential 'high-impact' options (e.g. commitments to non-invasive river crossings or timing works to avoid sensitive periods).
Uncertain	Options where a potential effect is conceivable and cannot be discounted, and the likely effects are therefore uncertain at the feasible options stage. This is typically due to limitations on the information available, either in terms of the operation of the scheme, the mitigation that might be employed, or the data available on the interest features of the sites. These options, if pursued as preferred options, may require ▶ additional investigation to determine their effects, and there may be a risk that the risk of effects cannot be quantified satisfactorily at the strategic level (for example, substantial additional modelling or site-specific investigation may be required). ▶ the identification of specific measures or requirements for scheme delivery for inclusion with the WRMP. This category is therefore intended as a flag to identify those options where there is potentially additional 'cost' associated with their inclusion (either related to the data required to support a robust HRA and hence the option, or the need for specific mitigation commitments) which UU should consider when selecting the preferred options.
No	Options where significant effects (i.e. not negligible or inconsequential) on a European site are very likely or certain due to the scale/ nature/location of the option proposals, or the vulnerability and distribution of the interest features within /near the European site. Although a full appropriate assessment is not undertaken at this stage, adverse effects may be more likely (or even certain) if the scheme is taken forward as a preferred option and it is likely that extensive or unproven mitigation will be required following scheme-level investigations. Feasible options in this category are not recommended for consideration as preferred options (although additional information may allow a re-assessment).

Note, the new feasible option B2 would require the implementation of previously assessed feasible supply-side options (Options WR099b, WR101, WR102e, WR113, WR114, WR159, WR160 and WR821) to compensate for the transfer of water from Vyrnwy; the results of the previous reviews of these options are therefore included in Appendix A also.

3. Summary and Next Steps

The review indicates that the new feasible option (enabling works for a transfer) is unlikely to have significant effects on European sites themselves, assuming normal scheme planning and best-practice measures are employed. However, as the option would rely on the implementation of other options, it is appropriate to consider these also as part of the proposals. In summary, the reviews of Options WR821 (Shropshire Union Canal + Llangollen) and WR114 (Python Mill Borehole) identified operational effects on European sites are currently considered 'uncertain'. Therefore, the operational effects of the scheme overall are uncertain and additional information on the operation of Options WR821 and WR114 would be required to support a preferred option assessment.

Author	Reviewer
…….	…….
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Appendix A

Summary of review of new Feasible Option

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
B2	Thames Water Trading enabling works	United Utilities currently abstracts water from Lake Vyrnwy for treatment at Oswestry WTW and for onward supply to the SRZ. Under this option, the output of treated (Lake Vyrnwy) water from Oswestry WTW would temporarily cease, requiring alternative water sources from across the United Utilities supply network (this would require, inter alia, delivery of Options WR099b, WR101, WR102e, WR113, WR114, WR159, WR160 and WR821). The principal construction element of this option would be: • four new PS (locations not determined); • relining of exsiting sections of Line 3 of the Vyrnwy Aqueduct; • bypasses around break pressure tanks at existing UU facilities; • modifications to Ostwestry WTW. It should be noted that Thames Water would provide the additional infrastructure required to transfer water from Llanforda IR to the River Severn for the subsequent abstraction and to transfer water from the River Severn to the River Thames. These elements will be assessed by Thames Water as part of the preparation of the company's WRMP and are therefore not considered in this HRA.	The enabling works component of this option would have no operational effects for UU to assess (the operational effects of an inter-basin water transfer are assessed by Thames Water as part of the HRA of its WRMP, and the transfer would involve existing licenced volumes. However, the scheme would require implementation of other options, including WR821 and WR114 where operational effects on European sites are currently considered 'uncertain'. Therefore, the operational effects of the scheme overall are uncertain and additional information would be required to support a preferred option assessment. With regard to construction, the infrastructure required for the transfer of water from Llanforda IR to the Thames supply area will be assessed by Thames Water. The locations of the new pumping stations are not defined although is is certain that effects on European sites can be avoided with normal project planning and best-practice; this applies to the asset modification works also (pipe relining / WTW upgrade).	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR099b	Worsthorne Borehole (Hurstwood Ir)	This option would involve the re-instatement of the Worsthorne borehole with flow passed to Hurstwood IR. This would be within the terms of the existing licence. The principal construction elements of this option are: • Reinstate and refurbish Worsthorne BH raw water abstraction borehole • New raw water main and pump flows into Hurstwood IR	Abstraction licence already in place so it is assumed that no operational effects on European sites will occur. The scheme would involve construction works within 500m of the South Pennine Moors SAC and South Pennine Moors Phase 2 SPA, although effects on the features of these sites can be avoided with established measures, such as construction best-practice or timing works to avoid breeding / migration periods.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare
WR101	Franklaw Z Site plus Increased Franklaw WTW Treatment Capacity	The scheme would require: • Reinstate and refurbish two existing boreholes at Franklaw Z site with maximum output of 10 and 8 Ml/d • Utilise existing 27" RW pipeline between Z site and Franklaw WTW (NB: Another possibility is to T into the existing Rive Wyre RW main which could be looked at for a Level 2 scope) • New BH pumps @10 existing/utilised Franklaw/Broughton boreholes to deliver an additional 12 Ml/d RW to Franklaw WTW; assumed capacity of replacement pumps is 4 Ml/d each for costing purposes • Additional WTW phase at Franklaw WTW to treat the additional 30 Ml/d RW from boreholes.	No European sites or features are exposed to the likely effects of this scheme.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare water; etc.)
WR102e	Bold Heath Boreholes to Prescot WTW	Recommission existing Bold Heath boreholes, new raw water transfer main to Prescot open reservoirs for treatment at Prescot WTW	Recommissioning existing boreholes / licences; no operational effects on European sites. No impact pathways for construction effects.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare
WR113	Tytherington Boreholes	The scheme would require: • New TW main 2.9km 315mmOD between Tytherington WTW and Hurdsfield SR • Modifications to existing WTW if required • New or improved headworks borehole to asset standard design.	No significant effects anticipated assuming established measures (distance)	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR114	Python Mill Borehole	The scheme would require: • Reinstate and refurbish a raw water abstraction borehole located at Python Mill • New raw water main between Python Mill and Rochdale Canal • New discharge scour into canal • New sewer connection at Python Mill	The operational purpose of this scheme is not entirely clear from the description although it is assumed to be a type of compensation scheme allowing use of alternative sources. However, the scheme would involve discharges to the Rochdale Canal (part of which is an SAC) and so there is clearly scope for significant and potentially adverse effects. It is noted that the previous licence was revoked by the EA. Construction effects are likely to be avoidable with established measures.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation
WR159	Compensation Over Release Control Group 2 - Regional Reservoirs	This option would involve the installation of automated compensation control to conserve reservoir storage at a number of reservoirs (~76); this would allow releases to be more closely controlled whilst maintaining the compensation releases. The principal construction elements of this option are: • Construction of new automated penstock arrangements at the reservoir sites, in order to control compensation to licence requirements.	The works are minor and construction effects are likely to be avoidable with established measures. Operation within terms of existing licences.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare
WR160	Compensation Over Release Control Group 1 - Reservoir Groups	This option would involve the installation of automated compensation control to conserve reservoir storage at a four impoundment reservoirs (Thirlemere, Haweswater, Vyrnwy and Rivington); this would allow releases to be more closely controlled whilst maintaining the compensation releases. The principal construction elements of this option are construction of new automated penstock arrangements at the reservoir sites, in order to control compensation to licence requirements.	The works are minor and construction effects are likely to be avoidable with established measures. Operation within terms of existing licences.	Construction: Yes - effects possible but significant or significant adverse effects clearly avoidable with established scheme-level avoidance or mitigation measures	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence; transfer of spare
WR821	Shropshire Union Canal + Llangollen	This option would involve a new abstraction from Shropshire Union Canal/Middlewich branch, treatment to potable standards and transfer to treated water storage in IRZ (potentially Congleton area) - based on surplus from Birmingham canal navigation but supplemented by additional feed(s) from Belvide Reservoir and/or Llangollen Canal/River Dee. The principal construction elements of this option are: • Increased abstraction volume at existing abstraction pumps on the Shropshire Union canal by 30 Mld (located at Hurleston WTW) • Fish screens (currently none on site so abstraction point not used) • Increased treatment capacity at Hurleston (30 mld) or build second works • Connection into the Mid-Cheshire Main located close to Nanneys Bridge sized at 30 Ml/d Increased abstraction licence would be required from the Environment Agency.	No construction effects are anticipated due to distances from European sites (closest over 8km away) and absence of impact pathways. With regard to operation and increased abstraction, there is the possibility of direct effects on the River Dee and Bala SAC depending on scheme operation, so operational effects are considered 'uncertain' at this stage.	Construction: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive)	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures

Appendix B

Established / Assumed Avoidance and Mitigation 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 scheme-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 regimes required to ensure no adverse effects occur (e.g. compensation releases - although note that these measures can only be identified through detailed investigation schemes).

Pollution Prevention

The habitats of European sites are most likely to be affected indirectly, through construction-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 current industry best-practices in construction that are likely to be relevant to the proposed schemes:

- Environment Agency Pollution Prevention Guidance Notes[4], including:
  - PPG1: General guide to the prevention of pollution (May 2001);
  - PPG5: Works and maintenance in or near water (October 2007);

[4] 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.

- 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 WRMP 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 (WRMP) 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 NE;
- 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.

Option-Specific Measures

Option specific measures (if required) will be determined as the preferred options are identified. However, it is assumed that the lowest-impact solution will be pursued, particularly regards construction solutions – for example, directional drilling beneath sensitive rivers rather than open cut; etc.

Appendix F
Summary of 'In Combination' Assessment with other Strategic Plans

Appendix F: Plans reviewed for potential 'in combination' effects

Plan	Summary	In combination effects with Preferred	In combination effects with WRMP	Conclusion
Environment Agency (various) Drought Plans	Drought Plans prepared by the EA: - outline how the EA will manage water resources during a drought and defines their role and responsibilities; - aim to reconcile the competing interests of the environment, the need for public water supply and other abstractions; - show what additional environmental monitoring the EA will carry out; - provide a framework for liaison with water companies, awareness campaigns and determination of drought permits; - range from high-level activities where they co-ordinate drought management over England and Wales to a local level where they outline specific operational activities. Those plans particularly relevant to the Welsh Water area include the Head Office Drought Plan (covering England and Wales), Drought Plans for Wales and the Midlands as well as area plans for south east, south west and north Wales and the west Midlands.	Potential in combination effects between other Drought Plans and the WRMP options cannot be meaningfully identified and assessed at this level. This is because the WRMP options cannot, in theory, operate in combination with the DP options: if the WRMP options are implemented then they will become a part of the baseline against which the effects of the DP options will be assessed (with the DP options then permitted or not at the application stage).	Potential 'in combination' effects between the Drought Plans and the WRMP options cannot be meaningfully identified and assessed at this level. This is because the WRMP options cannot, in theory, operate in combination with the DP options: if the WRMP options are implemented then they will become a part of the baseline against which the effects of the DP options will be assessed (with the DP options then permitted or not at the application stage).	No likely significant effects.
Welsh Government (2015) The Welsh National Marine Plan – Initial Draft	This draft plan sets out how the Welsh Government will achieve sustainable development in the Welsh marine area through the sustainable management of marine natural resources. It covers both Welsh inshore and offshore waters and sets out the following vision, which will be achieved through the plan's objectives and policies: • By 2036, Welsh seas are clean, healthy, safe, productive and biologically diverse: • Through an ecosystem based approach, our seas are healthy and resilient and support a sustainable and thriving economy. • Through access to and enjoyment of the marine environment, health and wellbeing are improving. • Blue growth is creating more jobs and wealth; and, is helping coastal communities become more resilient, prosperous and equitable with a vibrant culture. The Welsh marine area is making a strong contribution to energy security and climate change emissions targets through the responsible deployment of low carbon technologies.	The WNMP is a high level policy document that does not identify specific schemes (etc) that could be reviewed for possible interactions with the WRMP options, and so assessment is not possible at the plan-level.	The WNMP is a high-level policy document that does not identify specific schemes (etc) and which has limited possibilities for interaction with the WRMP and so assessment is not possible at the plan-level.	No likely significant effects.
Water Company (various) Drought Plans	developing drought, drought, severe drought and recovery from drought to ensure their supply of water resources. Drought Plans must be produced by all water companies to fulfil their requirements under the Water Act 2003. Those Drought Plans relevant to the WRMP are: - United Utilities Drought Plan; - Dee Valley Water Drought Plan; - Welsh Water Drought Plan - Severn Trent Water Drought Plan; - Yorkshire Water Drought Plan. - Northumbrian Water Drought Plan A brief overview of those plans currently publicly available is provided below.	None of the options are likely to interact significantly with the drought plan options, although it should be noted that this assessment can only be made at the project level when the DP option is implemented. It should be noted that in theory, operate in combination with the DP options: if the WRMP options are implemented then they will become a part of the baseline against which the effects of the DP options will be assessed (with the DP options then permitted or not at the application stage).	Potential 'in combination' effects between the Drought Plans and the WRMP cannot be meaningfully identified and assessed at this level. This is because the WRMP options cannot, in theory, operate in combination with the DP options: if the WRMP options are implemented then they will become a part of the baseline against which the effects of the DP options will be assessed (with the DP options then permitted or not at the application stage).	No likely significant effects.

Appendix F: Plans reviewed for potential 'in combination' effects

Plan	Summary	In combination effects with Preferred	In combination effects with WRMP	Conclusion
United Utilities Drought Plan	United Utilities Drought Plan (2014): The Plan identifies that the West Cumbria Resource Zone is the most sensitive to drought due to its short (2-3 months) critical period. For all resource zones (except Carlisle where the need for drought permits/orders is unlikely) applications for drought permits/orders would be made following the commencement of voluntary water use restrictions. Additionally, water use restrictions will occur earlier at Ennerdale Water in the West Cumbria Resource Zone than for other zones. This is to ensure demand restrictions are in place before applying for a drought order due to the sensitivity of the site. The assessment of water supply security indicates that with a repeat of the worst drought on record, even taking into account the forecast impacts of climate change, reservoirs will not empty but will reach very low levels. Before reaching these very low levels, the Plan highlights that it is necessary to take action to conserve water supplies in case the drought is more severe than any previously recorded. Consequently, water use restrictions and drought permits/orders need to be implemented before reaching the very lowest reservoir levels to safeguard water supplies. A revised Drought Plan was consulted upon in 2016 due to less water being available for abstraction from Crummock Water, West Cumbria. This is due to be adopted in 2017 and would replace the 2014 version.	None of the options are likely to interact significantly with the drought plan options, although it should be noted that this assessment can only be made at the project level when the DP option is implemented. It should be noted that in theory, operate in combination with the DP options: if the WRMP options are implemented then they will become a part of the baseline against which the effects of the DP options will be assessed (with the DP options then permitted or not at the application stage).	Potential 'in combination' effects between the Drought Plans and the WRMP cannot be meaningfully identified and assessed at this level. This is because the WRMP options cannot, in theory, operate in combination with the DP options: if the WRMP options are implemented then they will become a part of the baseline against which the effects of the DP options will be assessed (with the DP options then permitted or not at the application stage).	
Severn Trent Water Drought Plan;	Severn Trent Water Drought Plan (2014): Lake Vyrnwy is owned by Severn Trent Water. UU have an abstraction licence allowing them to abstract water from the reservoir to supply customers in Merseyside and parts of Cheshire. Lake Vyrnwy is also used to regulate the River Severn. Severn Trent Water also has a bulk supply agreement with UU to receive up to 16 Ml/d of treated water sourced from Vyrnwy. However this is for emergency use only up to a maximum period of 28 days in any instance. Severn Trent has identified five locations where drought permits will be requested including the Tittesworth Reservoir and River Churnet close the boundary with the United Utilities area. A variation to the compensation requirements from Tittesworth Reservoir and Deep Haye Valley will be requested, along with a variation to the Leek Groundwater Unit abstraction licences to assist the refill of Tittesworth. Severn Trent is in the pre-consultation phase for the next Drought Plan, which is expected to be published for consultation in 2018.	None of the options are likely to interact significantly with the drought plan options, although it should be noted that this assessment can only be made at the project level when the DP option is implemented. It should be noted that in theory, operate in combination with the DP options: if the WRMP options are implemented then they will become a part of the baseline against which the effects of the DP options will be assessed (with the DP options then permitted or not at the application stage).	Potential 'in combination' effects between the Drought Plans and the WRMP cannot be meaningfully identified and assessed at this level. This is because the WRMP options cannot, in theory, operate in combination with the DP options: if the WRMP options are implemented then they will become a part of the baseline against which the effects of the DP options will be assessed (with the DP options then permitted or not at the application stage).	

Appendix F: Plans reviewed for potential 'in combination' effects

Plan	Summary	In combination effects with Preferred	In combination effects with WRMP	Conclusion
Northumbrian Water Drought Plan	Northumbrian Water Drought Plan (2013): The overall conclusions are that Northumbrian Water do not anticipate any major problems as the Kielder Supply Scheme ensures there is sufficient raw water available to the majority of water treatment sites, and where this is not the case actions are proposed which will provide potable water to all customers. This means that Northumbrian Water do not anticipate requiring any Drought Orders or Permits. The Plan also notes the ability to transfer raw water around the area to manage resources such as reservoir or river levels. Northumbrian Water's Drought Plan does not rely on receiving increased supplies from any of the neighbouring water companies. UU has a bulk supply agreement with Northumbrian Water to supply treated water to the Alston area of Cumbria (North Eden Resource Zone). The agreement is for Northumbrian Water to provide a bulk supply of non-fluoridated, potable water up to a maximum of 1.3 Ml/d. Discussions with Northumbrian Water have confirmed that the full import volume is reliably available under drought conditions. Northumbrian Water has consulted on the next draft Drought Plan, which is expected to be adopted in 2018 and would replace the current 2013 version.	None of the options are likely to interact significantly with the drought plan options, although it should be noted that this assessment can only be made at the project level when the DP option is implemented. It should be noted that in theory, operate in combination with the DP options: if the WRMP options are implemented then they will become a part of the baseline against which the effects of the DP options will be assessed (with the DP options then permitted or not at the application stage).	Potential 'in combination' effects between the Drought Plans and the WRMP cannot be meaningfully identified and assessed at this level. This is because the WRMP options cannot, in theory, operate in combination with the DP options: if the WRMP options are implemented then they will become a part of the baseline against which the effects of the DP options will be assessed (with the DP options then permitted or not at the application stage).	
Dee Valley Water Drought Plan	Dee Valley Water Drought Plan (2015): UU abstracts water from the River Dee at various locations to supply both potable and non-potable customers. In addition to UU, other abstractors from the River Dee include Dee Valley Water among others. The drought triggers for Dee Valley Water are dictated by the availability of water within the Dee Storage System as the River Dee is their main source of water. Dee Valley Water's drought management actions are therefore dictated by the Dee General Directions which govern the Dee Storage System, which is regulated by Natural Resources Wales. Dee Valley Water do not envisage needing to carry out drought management actions for their upland and groundwater sources as they only provide a small contribution to the overall supply.	None of the options are likely to interact significantly with the drought plan options, although it should be noted that this assessment can only be made at the project level when the DP option is implemented. It should be noted that in theory, operate in combination with the DP options: if the WRMP options are implemented then they will become a part of the baseline against which the effects of the DP options will be assessed (with the DP options then permitted or not at the application stage).	Potential 'in combination' effects between the Drought Plans and the WRMP cannot be meaningfully identified and assessed at this level. This is because the WRMP options cannot, in theory, operate in combination with the DP options: if the WRMP options are implemented then they will become a part of the baseline against which the effects of the DP options will be assessed (with the DP options then permitted or not at the application stage).	

Appendix F: Plans reviewed for potential 'in combination' effects

Plan	Summary	In combination effects with Preferred	In combination effects with WRMP	Conclusion
Yorkshire Water Drought Plan	Yorkshire Water Drought Plan (2013): The Yorkshire Water region is bordered by four water companies; Anglian Water, Severn Trent Water, United Utilities and Northumbrian Water. They maintain a routine dialogue with each of these companies and in the event of drought would contact the relevant company water resource managers regarding their water supply situation and options for cross border support. The opportunities between Yorkshire Water, Anglian Water and United Utilities are minimal. Yorkshire has identified two sites in relative close proximity to the borders of the United Utilities area where drought permits may be requested. Silsden Reservoir (not currently used for supply) where an application for drought order or permit to allow abstraction up to 10Ml/d which could be transferred via a pipeline, into the Nidd Aqueduct. There is also a drought option to reduce the compensation release from Silsden Reservoir. At Boshaw Whams Reservoir (not currently in use) an existing licence authorises a daily average transfer of 0.151 Ml/d (max 0.45 Ml/d) to Holme Styes reservoir. This licence is not currently in use but is an option in a drought to provide compensation to rivers affected by other drought options. A drought order or permit application would be required for an increased daily maximum abstraction to 7.0Ml/d.	None of the options are likely to interact significantly with the drought plan options, although it should be noted that this assessment can only be made at the project level when the DP option is implemented. It should be noted that in theory, operate in combination with the DP options: if the WRMP options are implemented then they will become a part of the baseline against which the effects of the DP options will be assessed (with the DP options then permitted or not at the application stage).	Potential 'in combination' effects between the Drought Plans and the WRMP cannot be meaningfully identified and assessed at this level. This is because the WRMP options cannot, in theory, operate in combination with the DP options: if the WRMP options are implemented then they will become a part of the baseline against which the effects of the DP options will be assessed (with the DP options then permitted or not at the application stage).	
Welsh Water Drought Plan	Welsh Water Drought Plan (2015): The Plan identifies that, because of the topography of Wales, Welsh Water has a high number of Water Resource Zones (24). There is limited opportunity to transfer water across zonal boundaries, which results in less flexibility to manage potential drought impacts and may require local measures to be put in place even if the overall position with regard to water availability in Wales is healthy. A reliance on surface water, with 95% of Welsh Water's water resources originating from reservoirs or river abstractions, also increases vulnerability to short periods of low rainfall as rivers levels change more quickly than groundwater levels. Welsh Water would intend to use Drought Permits and Drought Orders that would allow them to reduce compensation and regulation releases only at the stage of 'Severe Drought'. Potential drought orders and permits are identified at locations across Wales.	None of the options are likely to interact significantly with the drought plan options, although it should be noted that this assessment can only be made at the project level when the DP option is implemented. It should be noted that in theory, operate in combination with the DP options: if the WRMP options are implemented then they will become a part of the baseline against which the effects of the DP options will be assessed (with the DP options then permitted or not at the application stage).	Potential 'in combination' effects between the Drought Plans and the WRMP cannot be meaningfully identified and assessed at this level. This is because the WRMP options cannot, in theory, operate in combination with the DP options: if the WRMP options are implemented then they will become a part of the baseline against which the effects of the DP options will be assessed (with the DP options then permitted or not at the application stage).	

Appendix F: Plans reviewed for potential 'in combination' effects

Plan	Summary	In combination effects with Preferred	In combination effects with WRMP	Conclusion
Water Company (various) Water Resources Management Plans	Water companies in England and Wales, are required to prepare, maintain and publish a WRMP under the Water Industry Act 1991, updated by the provisions in section 37A-D of the Water Act 2003 and the Water Act 2014 and the Environment (Wales) Act 2016. The plan must set out how a water company intends to maintain the balance between supply and demand for water over a minimum of a 25 year period. This is complemented by a water company drought plan, which sets out the short-term operational steps a company will take as a drought progresses. Those neighbouring Water Resource Management Plans relevant to the plan are: - Dee Valley Water - Welsh Water - Severn Trent Water - Yorkshire Water - Northumbrian Water - Thames Water.	These cannot be reviewed at this stage - however, there is little risk of option-level in combination effects with other WRMPs based on the locations of the UU options.	No additional interactions with these plans would be expected at the plan-level. Water company plans are catchment-specific, and designed to be complemetary, so in combination effects (e.g. two companies aiming to exploit the same resource) are very unlikely; this can only be confirmed when the options are finalised. It is possible that two proposed abstraction increases could affect the same European site at different locations (e.g. UU and Dee Valley could both have options that affect the River Dee and Bassenthwaite Lake SAC) but this can only be analysed following consultation on the preferrred options.	-
Environment Agency / Natural Resources Wales (various) Flood Risk Management Plans	Flood Risk Management Plans (FRMPs) give an overview of the flood risk across each river catchment. They recommend ways of managing those risks now and over the next 50-100 years. FRMPs consider all types of inland flooding, from rivers, ground water, surface water and tidal flooding, but not flooding directly from the sea, (coastal flooding), which is covered in Shoreline Management Plans. They also take into account the likely impacts of climate change, the effects of how we use and manage the land, and how areas could be developed to meet our present day needs without compromising the ability of future generations to meet their own needs. Those FRMPs relevant to the UU area area are: • North West river basin district flood risk management plan; • Dee river basin district flood risk management plan; and • Solway Tweed river basin district flood risk management plan.	The preferred options only have the potential to interact with the North West FRMP, and the Dee FRMP. Based on a review of these FRMPs it is not possible to identify specfic in combination risks (the FRMPs have broad policy positions for sections of river (e.g. Maintain existing defences and inspection regime) but do not idenitfy specific schemes); and in reality the WRMP options are of a scale whereby significant effects in combination effects would not be expected.	No additional interactions with these plans would be expected at the plan-level.	No likely significant effects.

Appendix F: Plans reviewed for potential 'in combination' effects

Plan	Summary	In combination effects with Preferred	In combination effects with WRMP	Conclusion
Environment Agency / Natural Resources Wales (various) River Basin Management Plans	River Basin Management Plans (RBMPs) set out how the water environment will be managed and provide a framework for more detailed decisions to be made. RBMPs set out a more integrated approach to river basin management based on the following principles: - Integrate and streamline plans and processes; - Set out a clear, transparent and accessible process of analysis and decision-making; - Focus at the river basin district level; - Work in partnership with other regulators; - Encourage active involvement of a broad cross-section of stakeholders; - Make use of the alternative objectives to deliver sustainable development; - Use Better Regulation principles and consider the cost-effectiveness of the full range of possible measures; - Seek to be even handed across different sectors of society and sectors of industry; - Seek to be even handed and transparent in the management of uncertainty; - Develop methodologies and refine analyses as more information becomes available. RBMPs in the United Utilities area are the North West, Solway Tweed and Dee.	The preferred options only have the potential to interact with the North West RBMP and the Dee RBMP. Based on a review of RBMPs it is not possible to identify specfic in combination risks (the RBMPs have broad policy positions but do not idenitfy specific schemes, and the HRA of the RBMPs concluded that project detail was not sufficient for meaningful assessment). In reality the WRMP options are of a scale whereby significant effects in combination effects would not be expected.	No additional interactions with these plans would be expected at the plan-level.	No likely significant effects.
Environment Agency / Natural Resources Wales (various) Catchment Abstraction Management Strategies	Catchment Abstraction Management Strategies (CAMS) set out how water resources will be managed in each catchment and provide information on how existing abstraction licenses are managed and the availability of water for further abstraction. Within each CAMS, river flows and groundwater levels are monitored and assessed alongside the amount of water which has been abstracted on average over the previous six years and the situation if all abstraction licences were used to full capacity. This data is used to determine the water availability for each water body. CAMS within the United Utilities area include: - Derwent and West Cumbria - Eden and Esk - South Cumbria - Lune and Wyre - Ribble, Douglas and Crossens - Lower Mersey and Alt - Northern Manchester - Upper Mersey - Weaver and Dane - Dee	The CAMS do not necessarily provide a mechanism for 'in combination' effects with the Options, but are used to guide the choice of options particularly where 'new water' may be required.	The WRMP explicitly accounts for the CAMS when calculating future water availability (and hence areas with potential deficits). This means that 'in combination' water-resource effects with the CAMS will not occur.	No likely significant effects.

Appendix F: Plans reviewed for potential 'in combination' effects

Plan	Summary	In combination effects with Preferred	In combination effects with WRMP	Conclusion
Local Planning Authority (various) Land Use Plans	The UU area includes around 52 Local Planning Authorities (see Appendix B of the SEA for a full list). Additionally, Local Development Plans prepared by local authorities in Wales may also be relevant to the WRMP and SEA. Those plans of particular relevance include, for example: - Wrexham County Borough Council; - Flintshire County Council; - Powys County Council; and - Denbighshire County Council. The main objectives of the existing and emerging Land Use Plans in these areas are related to the sustainable development of the area.	Based on a brief review of these plans there are no specific measures (e.g. allocations (etc)) that are likely to interact significantly with the WRMP options, and in reality the options are of a scale whereby significant in combiantion effects would not be expected. This aspect can only be fully determined at the project level.	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. Potential in combination' effects in respect of water-resource demands due to other plans or projects are unlikely since these demands are explicitly modelled when determining deficit	No likely significant effects.
North West of England and North Wales Shoreline Management Plans SMP2	Shore Lline Management Plans are prepared in England and Wales. They are developed by Coastal Groups with members drawn from local authorities and other stakeholders. They identify the most sustainable approach to managing the flood and coastal risks to the coastline in the short term (up to 20 years), medium term (20 to 50 years) and long term (50 to 100 years).	The preferred options have the potential to interact with North West of England and North Wales Shoreline Management Plans SMP2. Based on a review of these plans it is not possible to identify specfic in combination risks (the SMPs have broad policy positions for sections of coast (e.g. hold the line; managed re-alignment) but do not idenitfy specific schemes); and in reality the WRMP options are of a scale whereby significant effects in combination effects would not be expected as the SMPs cover shoreline areas that are some distance from the location of the options.	No additional plan-level interactions with the SMPs would be expected.	No likely significant effects.

Appendix G
Standard Avoidance Measures and Best-practice

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 scheme-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 regimes required to ensure no adverse effects occur (e.g. compensation releases - although note that these measures can only be identified through detailed investigation schemes and agreed through the abstraction licensing process).

Pollution Prevention

The habitats of European sites are most likely to be affected indirectly, through construction-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 current industry best-practices in construction that are likely to be relevant to the proposed schemes:

- Environment Agency Pollution Prevention Guidance Notes[32], including:
  - PPG1: General guide to the prevention of pollution (May 2001);
  - PPG5: Works and maintenance in or near water (October 2007);

[32] 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.

- 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 WRMP 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 (WRMP) 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 NE.
- 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.

Preferred Option-Specific Measures

The following tables summarise the Option-specific measures that will be employed (in addition to the general measures outlined above) to avoid specific potential effects on European sites that have been identified during the assessment process.

The interest features will be taken into account during the design-phase for the schemes, and it may be possible to design the scheme such that these measures are not required; otherwise, **these measures will be refined during the scheme design and employed during construction/operation unless project-level HRAs or scheme-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 more appropriate/required.** Agreement on appropriate measures will be made with NRW / NE where potential significant effects are identified at the project-level.

Note that only those European sites for which specific measures have been identified are noted in the following sections; all other sites potentially affected by each Option will be protected by use of the general measures outlined above.

Table G1 Receptor-specific measures for Option 37-42

Site	Feature	Avoidance Measures (in addition to general measures)
River Kent SAC	▶ Freshwater mussel *Margaritifera margaritifera*	Construction of the scheme will avoid the main migration and spawning periods for salmon to minimise the risk of displacement or barrier effects due to noise, vibration or site-derived pollutants, unless scheme-specific analyses demonstrate that any effects associated with construction works will be 'not significant' or will have no adverse effect on the integrity of the SAC.

Appendix H
Summary of Draft WRMP HRA (inc. Water Trading)

The following sections are the Executive Summary of the HRA of the Draft WRMP 2019, which was subject to consultation in February 2018. The Draft WRMP included several options linked to water trading; these are no longer preferred options for the WRMP (as no other water companies identified a requirement for imports from UU within their WRMPs), although UU will continue to explore possibilities for future water trading as an adaptive pathway. The summary of the HRA of the Draft WRMP 2019 is therefore included to provide background information for future reviews. The full assessment (Amec Report Reference B38761rr101i4) is available from UU.

It should be noted that the HRA of the Draft WRMP 2019 was completed prior to the 'People over Wind' judgement, and so established best-practice mitigation and avoidance measures are considered at the screening stage, in accordance with established practice (after 'Dilly Lane') at the time of publication. The effect of this is to 'screen out' some European sites and options from 'appropriate assessment' due to the likely effectiveness of standard mitigation, and the largely inconsequential nature of the effects. The assessment has been briefly reviewed (but not amended); if formally revised it is likely that more options and sites would proceed to 'appropriate assessment'; however, there would invariably be 'no adverse effects' due to these options and so the overall conclusions of the HRA (if re-assessed) would remain the same.