United Utilities

Water Resources Management Plan 2019

Habitats Regulations Assessment of the Draft WRMP

February 2018

Amec Foster Wheeler Environment
& Infrastructure UK Limited

Report for

Water Resources Team
Asset Management
United Utilities
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
Cheshire
WA5 3LP

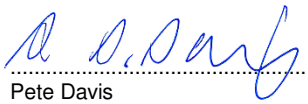
Main contributors

Mike Frost
Esme Hammer

Issued by

Mike Frost

Approved by



Pete Davis

Amec Foster Wheeler

Canon Court
Abbey Lawn
Abbey Foregate
Shrewsbury SY2 5DE
United Kingdom
Tel +44 (0) 1743 342 000

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1	Draft for client review	Nov 2017
2	Consultation version	Nov 2017
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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) is currently preparing 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 proposed solutions ('Preferred Options') for maintaining the balance between water available and future demand for water.

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 has commissioned Amec Foster Wheeler (now Wood) to undertake the data collection and interpretation required to support an 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) includes the following steps:

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

[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; 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.

ii. The assessment of the Preferred Options consultation WRMP, comprising screening and an 'appropriate assessment' (this report).

It should be noted that the assessment and conclusions of this HRA are preliminary, based on the current Preferred Options (which may change following consultation) and the available information. There are some aspects (e.g. 'in combination' effects with other water company WRMPs) that can only be addressed following completion of the consultation and prior to the issue of the final plan, and there are aspects of the plan that still need to be finalised.

Assessment summary

None of UU's WRZs are predicted to be in deficit over the planning period. However, UU has identified a number of 'strategic choices' in order to help protect and, where possible, benefit customers and the environment. The strategic choices considered in developing the Draft WRMP are related to:

- enhanced leakage reduction (80 Ml/d by 2045);
- improved levels of service for drought permits and drought orders;
- increasing resilience to non-drought hazards, in particular asset failure; and
- exploring national water trading.

Using different combinations of these strategic choices, UU has identified four 'alternative plans' for the WRMP; these are:

i. Alternative Plan 1 – Continued demand management.

i. Alternative Plan 2 – Plan 1 plus enhanced leakage reduction and improved levels of service for drought permits and orders.

ii. Alternative Plan 3 – Plan 2 plus 'resilience schemes' to enhance the network.

iii. Alternative Plan 4 – Plan 3 plus national water trading (currently UU's preferred plan).

Alternative Plan 4 is currently UU's preferred plan, and is in line with planning guidelines and the Water UK long term water resources planning study. The plan would comprise all of the components of Alternative Plans 1, 2 and 3 described above (including continued demand management, leakage reduction and Manchester and Pennine Resilience), plus water trading with Thames Water. The water trading would transfer up to 180 Ml/d from Lake Vyrnwy to Thames Water via the River Severn during drought periods (when dry weather means there is a need for the water in the Thames catchment); this would require enabling works to maintain supplies to customers during transfer periods. The pathway will therefore include the following options:

- Demand management:
  - All current demand management measures as per Alternative Pathway 1.
  - WR610b (Education programme): This option would involve UU developing and delivering a water efficiency educational programme for roll-out to KS2 students over a 10-year period.
  - WR620b (Goods and advice on metering): Under this option, newly metered customers would receive advice on increasing their water efficiency in addition to free water efficiency equipment (estimated 34,153 per annum over a 10-year period).
  - WR623b (Home checks on metering): Under this option, a UU representative would offer to conduct a domestic water efficiency audit when installing a meter at a customer's property. This is estimated to result in 34,153 audits per annum over a 10-year period.
  - All leakage reduction options identified for the Alternative Pathway 2.
- Resilience options:

- One or more of the five potential Manchester and Pennine Resilience solutions identified under Alternative Pathway 3 (note, these have not been defined in detail by UU in the draft WRMP and so for the HRA assessment is high-level only).

- Resource management options:
  - B2 (Thames Water Trading enabling works): Asset modifications required to allow the trading option to operate and ensure that supplies to customers are maintained during transfer periods.
  - WR099b (Worsthorne Borehole (Hurstwood IR): Re-instatement of the Worsthorne borehole under the terms of the existing abstraction licence.
  - WR101 (Franklaw Z Site plus increased Franklaw WTW Treatment Capacity): Re-instatement of boreholes under the terms of the existing abstraction licences, and upgrade of WTW treatment capacity.
  - WR102e (Bold Heath Boreholes to Prescot WTW): Recommissioning of existing Bold Heath boreholes with a new raw water transfer main to Prescot open reservoirs for treatment at Prescot WTW. A new abstraction licence would be required.
  - WR113 (Tytherington Boreholes): New treated water main, borehole improvements and WTW modifications under the terms of the existing abstraction licence.
  - WR114 (Python Mill Borehole): Reinstatement of the Python Mill Borehole (licence previously revoked) to provide compensation water to the Rochdale Canal, allowing water from Chelburn reservoir to be used in supply. A new abstraction licence would be required. It should be noted that Option WR100 (Thorncliffe Road Borehole, Barrow-in-Furness) has been identified as an alternative to WR114 and would be brought forward should scheme-level investigations demonstrate that Option WR114 would have adverse effects on European designated nature conservation sites.
  - WR159 (Group 1 - Improved Reservoir Compensation Release Control): This option would involve the installation of automated compensation control to conserve reservoir storage at 76 regional reservoirs; this would allow compensation releases to be more closely controlled whilst meeting the abstraction licence conditions.
  - WR160 (Group 2 - Improved Reservoir Compensation Release Control): This option would involve the installation of automated compensation control to conserve reservoir storage at four impoundment reservoirs; this would allow compensation releases to be more closely controlled whilst meeting the abstraction licence conditions.
  - WR821 (Shropshire Union Canal): This option would involve a new third party 30 Ml/d abstraction from Shropshire Union Canal at Hurleston (Nantwich), increased WTW capacity at Hurleston WTW and a new treated water main to connect into the Mid Cheshire Main.

The HRA focuses on the resource management options proposed to resolve predicted deficits. 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 (RoC) process (now through 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. The screening and (where necessary) appropriate assessment of these options is summarised in the table below.

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 options	Construction	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.	-
Resilience options A – E	Construction	?	?	Options are not sufficiently developed at this stage to allow assessment	-
	Operation	?	?	Options are not sufficiently developed at this stage to allow assessment	-
enabling works				in UU customers being supplied by available water from sources other than Vyrnwy, so enabling the transfer of water from Lake Vyrnwy by Thames Water. This UU option, in isolation, would have no construction-phase effects on any European sites; however, the option relies on delivery of the other options below and so the assessment requires that the mitigation (etc.) for these options is delivered.	▶ Established best-practice avoidance and mitigation measures (Appendix G), including all bespoke measures identified for the options below.
	Operation	-	-	The scheme will involve some increases in abstraction although these will be within the terms of the existing licences, confirmed under the Review of Consents, and so operational effects as a result of the enabling works would not be expected. The operational effects of the transfer scheme downstream of Vyrnwy will be considered by Thames Water as part of its WRMP assessments.	-

Option	Aspect	LSE	AE	Summary of Assessment	Key avoidance / mitigation measures
WR099b Worsthorne Borehole (Hurstwood IR)	Construction	N*	N	Re-instatement of the Worsthorne borehole under the terms of the existing abstraction licence. This scheme will require construction works near the **South Pennine Moors Phase 2 SPA**, which has interest features that use habitats outside the SPA boundary, and which may therefore be exposed to the effects of the scheme. However, it is clear that this option can be delivered with 'no adverse effect' on the integrity of the South Pennine Moors Phase 2 SPA, and in practice the incorporated measures would ensure that 'significant effects' would be avoided entirely at the project-level through project planning or normal best-practice measures. The plan-level conclusion for this option would therefore be '**no likely significant effects alone or in combination**'.	▶ In addition to normal project-level planning and best-practice, construction of the scheme will avoid the breeding period (March – August) to minimise the risk of disturbance to merlin and golden plover, 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 SPA
	Operation	N	-	There will be no operational effects as a result of this scheme (within existing licence confirmed under the Review of Consents, absence of impact pathways).	-
WR101 Franklaw Z Site plus increased Franklaw WTW Treatment Capacity	Construction	N	-	Re-instatement of boreholes under the terms of the existing licences, and upgrade of WTW treatment capacity. This scheme will have no effects on the interest features of any European sites, due to distance, the absence of reasonable impact pathways, and the reliability of best-practice construction measures. The plan-level conclusion for this option would therefore be '**no likely significant effects alone or in combination**'.	▶ Established best-practice avoidance and mitigation measures (Appendix G).
	Operation	N	-	There will be no operational effects as a result of this scheme (within existing licence confirmed under the Review of Consents, absence of impact pathways).	-
WR102e Bold Heath Boreholes to Prescot WTW	Construction			Recommissioning of existing Bold Heath boreholes with a new raw water transfer main to Prescot open reservoirs for treatment at Prescot WTW. This scheme will have no effects on the interest features of any European sites, due to distance, the absence of reasonable impact pathways, and the reliability of best-practice construction measures. The plan-level conclusion for this option would therefore be '**no likely significant effects alone or in combination**'.	▶ Established best-practice avoidance and mitigation measures (Appendix G).
	Operation	N	-	There will be no operational effects as a result of this scheme (absence of impact pathways).	-

Option	Aspect	LSE	AE	Summary of Assessment	Key avoidance / mitigation measures
WR113 Tytherington Boreholes	Construction			New treated water main, borehole improvements and WTW modifications. This scheme will have no effects on the interest features of any European sites, due to distance, the absence of reasonable impact pathways, and the reliability of best-practice construction measures. The plan-level conclusion for this option would therefore be '**no likely significant effects alone or in combination**'.	▶ Established best-practice avoidance and mitigation measures (Appendix G).
	Operation	N	-	There will be no operational effects as a result of this scheme (within existing licence confirmed under the Review of Consents, absence of impact pathways).	-
WR114 Python Mill Borehole	Construction	N	-	Construction of this scheme will have no effects on the interest features of any European sites, due to distance, the absence of reasonable impact pathways, and the reliability of best-practice construction measures. The plan-level conclusion for this option would therefore be '**no likely significant effects alone or in combination**'.	▶ Established best-practice avoidance and mitigation measures (Appendix G).
	Operation	U	U	Reinstatement of the Python Mill Borehole (licence previously revoked) to provide compensation water to the Rochdale Canal, allowing water from Chelburn reservoir to be used in supply. Option WR114 has a number of uncertainties around its operation that ensure that the HRA cannot, at the WRMP-level, exclude the possibility of significant or significant adverse effects on the Rochdale Canal SAC due to differences in the physio-chemical characteristics of the compensation water. It is possible that substantial differences in water quality may not be treatable and that the implementation of the scheme could not then be completed without adverse effects occurring (although adverse effects would appear improbable based on the available data and various moderating factors). Inclusion of the option in the WRMP will allow UU to investigate the residual uncertainties, and so the uncertainty that this introduces is addressed at the WRMP level through the identification of alternative options will be employed should Option WR114 not pass the HRA tests at the project-level. The plan-level conclusion for this option would therefore be '**no likely significant effects alone or in combination**' once the mitigation (alternative option) is applied.	▶ The alternative option proposed is WR100 (Thorncliffe Road Borehole, Barrow-In-Furness) and is assessed in Appendix H.

Option	Aspect	LSE	AE	Summary of Assessment	Key avoidance / mitigation measures
WR159 Group 1 - Improved Reservoir Compensation Release Control	Construction	U	N	This option would involve the installation of automated compensation control to conserve reservoir storage at ~76 regional reservoirs; this would allow compensation releases to be more closely controlled whilst meeting the licence conditions. For most of these sites, established measures can be relied on to ensure significant effects do not occur; however, the Readycon Dean, Warland, Whiteholme and Light Hazzles schemes will involve construction within the **South Pennine Moors SAC and South Pennine Moors Phase 2 SPA** and so the precise effects on the interest features of these sites cannot be determined without scheme-level investigations. Despite this, due to the small scale of the works it is clear that adverse effects on the site interest features can be avoided by appropriate siting (e.g. locating equipment on existing operational areas), and it will be possible to drop particular schemes from the option if project-level investigations demonstrate that adverse effects on the SAC features cannot be avoided. As a result, although the schemes proposed within **South Pennine Moors SAC** have residual uncertainties that cannot be resolved at the plan-level, it is not considered necessary to identify a specific alternative to Option WR159 to mitigate this uncertainty, and it is clear that adverse effects can be avoided at the project-level. The plan-level conclusion for this option would therefore be '**no adverse effects alone or in combination**'	▶ **South Pennine Moors Phase 2 SPA / Peak District Moors (South Pennine Moors Phase 1) SPA**: In addition to normal project-level planning and best-practice, construction of the scheme will avoid the breeding period (March – August) to minimise the risk of disturbance to merlin, golden plover and short-eared owl, 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 SPAs. ▶ **South Pennine Moors SAC**: In addition to normal project-level planning and best-practice, pre-design surveys will be used to identify suitable locations for scheme infrastructure and associated construction. These surveys will determine the location, quality and extent of the SAC interest features around any potential construction locations, and infrastructure (etc.) will be sited to ensure that the interest features of the site are not significantly affected. ▶ **River Eden 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	-	There will be no operational effects as a result of this scheme (within existing licence, absence of impact pathways).	-

Option	Aspect	LSE	AE	Summary of Assessment	Key avoidance / mitigation measures
WR160 Group 2 - Improved Reservoir Compensation Release Control	Construction			This option would involve the installation of automated compensation control to conserve reservoir storage at four impoundment reservoirs; this would allow compensation releases to be more closely controlled whilst meeting the licence conditions. Several European sites are potentially exposed to the effects of the scheme (**Berwyn SPA; Naddle Forest SPA; River Derwent and Bassenthwaite Lake SAC; River Eden SAC**). However, it is clear that this option can be delivered with 'no adverse effect' on the integrity of these sites, and in practice the incorporated measures would ensure that 'significant effects' would be avoided entirely at the project-level. The plan-level conclusion for this option would therefore be '**no likely significant effects alone or in combination**'.	▶ **Berwyn SPA**: In addition to normal project-level planning and best-practice, construction of the scheme will avoid the breeding period (March – August) to minimise the risk of disturbance to Red kite, Merlin, Hen harrier and Peregrine falcon, 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 SPAs. ▶ **River Eden SAC / River Derwent and Bassenthwaite Lake 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	-	There will be no operational effects as a result of this scheme (within existing licence, absence of impact pathways).	-
WR821 Shropshire Union Canal	Construction	N	-	This option would involve a new abstraction from Shropshire Union Canal/Middlewich branch, treatment to potable standards and transfer to treated water storage in the IRZ. This scheme will have no effects on the interest features of any European sites, due to distance, the absence of reasonable impact pathways, and the reliability of best-practice construction measures. The plan-level conclusion for this option would therefore be '**no likely significant effects alone or in combination**'.	▶ Established best-practice avoidance and mitigation measures (Appendix G).
	Operation	N	-	There will be no operational effects as a result of this scheme (within existing licence, absence of impact pathways).	-

Conclusion

The conclusion of the HRA of the consultation draft WRMP is necessarily preliminary as

i. the Resilience Options are not yet fully scoped; and

ii. the content of the final plan may change following consultation.

It is likely, based on the available works information, that the Resilience Options can be delivered with 'no significant effects' on any European sites – although this cannot be confirmed at this point. With regard to the remaining options it is clear that the majority of these will have 'no significant effects alone or in combination' if brought forward as projects; where there are residual uncertainties in the 'plan-level' assessment of these options, mitigation measures are identified to ensure that the WRMP will not result in adverse effects that cannot be avoided with scheme-level measures; this includes the identification of an alternative 'no significant effect' option for WR114 (WR100) which is also subject to assessment. As a result, the preliminary conclusion of the HRA of the consultation draft WRMP is that the plan will have **no adverse effects, alone or in combination**. However, as no detailed information on the 'resilience schemes' is currently available, it is therefore likely that some aspects of the plan (and hence the HRA conclusions) will be revised, and the draft HRA conclusions should be seen as a guide for the plan drafting and WRMP consultation process rather than the definitive assessment of the WRMP.

It should be noted that if the provisional conclusion is confirmed following assessment of the resilience options, this 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) is setting 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 2010* (as amended) and so requires an assessment of its effects on European sites, known as 'Habitat 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) is currently preparing 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, Water Efficiency Strategy and Leakage Strategy.

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*[4] *or a European offshore marine site*[5] *(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)[6]. 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

[4] 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.

[5] '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.

[6] 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.

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 has commissioned 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) includes the following steps:

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

ii. The formal assessment of the Preferred Options, comprising screening and an 'appropriate assessment' (this report).

This report summarises Amec Foster Wheeler's assessment of UU's draft Preferred Options (as they currently stand) 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);
- an outline of the Plan Pathways and the Alternatives (section 4);
- the screening and (where required) appropriate assessment of the known Preferred Options and WRMP as a whole, including 'in combination' assessments (Section 5);
- the proposed conclusion of the HRA of UU's WRMP, based on the consultation version of the plan (Section 6).

It should be noted that some aspects of UU's WRMP cannot be finalised at the consultation draft stage, and will depend on other water company proposals. The consultation draft therefore includes four possible 'plan pathways', one of which will be selected for the final WRMP. The plan pathways are:

i. Alternative Plan 1 – Continued demand management.

ii. Alternative Plan 2 – Plan 1 plus enhanced leakage reduction and improved levels of service for drought permits and orders.

iii. Alternative Plan 3 – Plan 2 plus 'resilience schemes' to enhance the network.

iv. Alternative Plan 4 – Plan 3 plus national water trading.

The HRA assesses the preferred options under these pathways as far as possible, based on the currently available scheme information. However, it should be noted that detailed information on the 'resilience schemes' is not currently available. It is therefore likely that some aspects of the plan (and hence the HRA conclusions) will be revised, and the draft HRA conclusions should be seen as a guide for the plan drafting and WRMP consultation process, rather than the definitive assessment of the 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[7] 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[8], to determine whether there will be any 'adverse effects on integrity' (AEoI) of any sites as a result of the plan.

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 options (and hence the plan) have 'no likely significant effects (LSE)' or 'no adverse effects'; the level of

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

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 *Final Water Resources Planning Guidelines* (published by the Environment Agency and Natural Resources Wales in May 2016) 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).

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[9] 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.

It should be noted that none of UU's WRZs are predicted to be in deficit over the planning period, although UU has identified a number of 'strategic choices' in order to help protect and, where possible, benefit customers and the environment. These are summarised in Section 4.

2.3 HRA of the WRMP

The HRA focuses on the resource management options proposed to resolve predicted deficits. 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 (now through Water Framework Directive assessments) 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 European sites through any new resource and production-side options it advocates to resolves deficits, and not through the existing permissions regime[10].

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

[9] '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).

[10] 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.

- **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[11]. 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[12].

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

i. An initial review of the Feasible Options (resource management only), to assist UU's selection of Preferred Options.

ii. The formal assessment of the Preferred Options (resource management only), comprising screening and an 'appropriate assessment'.

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 number of Feasible Options and the benefits of a consistent approach[13]. 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[14];
- any predicted construction works required for each option[15];

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

[12] 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.

[13] '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.

[14] 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.

[15] 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.

- 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).

Assessment assumptions

Several assumptions are taken into account 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;
- that all normal licensing and consenting procedures will be employed at option delivery, including HRA; and
- that established best-practice avoidance and mitigation measures (see **Appendix G**) will be employed throughout scheme design and construction to safeguard environmental receptors, including European site interest features.

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
- 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.

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[16], 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).

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);

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

- 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);
- 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 HRA regulations even if some residual uncertainty persists with some options). Ultimately, the plan should not create a scenario where significant adverse effects are possible ('likely') 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 significant or 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[17] 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 Preferred Options, if included in the Final WRMP, will of course 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.

[17] 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 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 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[18], 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 is presented in **Appendix F** 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[19] 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).

[18] 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).

[19] 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 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 has identified Feasible Options across its four WRZs[20]. 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.

[20] 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.

4. Plan Pathways and Preferred Options

No UU WRZs have a predicted deficit over the planning period. However, the final WRMP is dependent on various factors including other water company requirements and so four 'plan pathways' have been identified for the WRMP consultation stage, with one ('Alternative 4') currently considered the 'preferred pathway'.

4.1 Overview

None of UU's WRZs are predicted to be in deficit over the planning period. However, UU has identified a number of 'strategic choices' in order to help protect and, where possible, benefit customers and the environment. The strategic choices considered in developing the Draft WRMP are related to:

- enhanced leakage reduction (80 Ml/d by 2045);
- improved levels of service for drought permits and drought orders;
- increasing resilience to non-drought hazards, in particular asset failure; and
- exploring national water trading.

Using different combinations of these strategic choices, UU has identified four 'alternative plan' for the WRMP; these are:

i. Alternative Plan 1 – Demand management only.

ii. Alternative Plan 2 – Plan 1 plus enhanced leakage reduction and improved levels of service for drought permits and orders.

iii. Alternative Plan 3 – Plan 2 plus 'resilience schemes' to enhance the network.

iv. Alternative Plan 4 – Plan 3 plus national water trading (currently UU's preferred pathway).

The Preferred Options under these pathways are set out below.

4.2 Alternative Plan 1 – Demand Management Only

Alternative Plan 1 is effectively a 'no change' plan: the plan would maintain the baseline supply demand balance position but not involve any additional investment in resource management or demand management measures beyond that currently planned. This would assume:

- the maintenance of leakage levels at 448.2 Ml/d based on a three year average from 2014/15 to 2016/17;
- water efficiency activities achieving, as a minimum, an annual saving of 1 litre per property per day for the remainder of the period to 2020; and
- the installation of around 180,000 water meters between 2020 and 2045.

4.3 Alternative Plan 2 – Plan 1 Plus Enhanced Leakage Reduction

Improved levels of service for drought permits and drought orders has been identified as a strategic choice for the Draft WRMP. The definition of this strategic choice is to reduce the stated frequency of drought permits and orders from 1 in 20 years on average to 1 in 40 years on average (from 5% to 2.5% risk of happening in any given year). Alternative Plan 2 would involve the implementation of a programme of leakage reduction measures designed to deliver an 80Ml/d benefit over the planning period, which would support this target. The programme would comprise three distinct phases:

- 2020-2025: there would be a large dependency on the leakage options that United Utilities is confident can be delivered, with only a small reliance on innovative approaches;
- 2025-2030: there would be an even balance of reliable and innovative solutions;
- Beyond 2030: there would be a focus on low cost and innovative solutions

This would result in a supply-demand benefit of 30 Ml/d from leakage reduction by 2025, which exceeds the requirement to move to a 1 in 40 year frequency for drought permits and orders. The leakage programme would comprise the following options:

- Leakage Reduction:
  - WR500a / WR500b / WR500c / WR500d (Leakage reduction stages 1 – 4): Options WR500a to WR500d would involve an increase in leakage detection surveys and repairs activity over a 3-year period.
  - WR503 (Monitoring of household meters to identify and fix supply pipe leaks): This option would involve the proactive monitoring of all domestic meters to identify and fix supply pipe leaks over a 5-year period.
  - WR511 (Network metering enhancements): This option would involve enhancing network metering including logger verification, meter verification and meter under/over registration over a 5-year period.
  - WR514 (Logging of large customers): This option would involve the installation of loggers over a 5-year period for customers identified as having high consumption (above 500 l/hr).
  - WR515 (Splitting District Metering Areas): This 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.
  - WR907e (Third party - Scenario 4 - Stop.Watch Light - Targeted at 1.5% 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.
  - WR907f (Third party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% 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.
  - WR907g (Third party - Scenario 4 - Stop.Watch Light - Targeted at 7.5% 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.
  - WR914 (Third party - Cello 4S and Regulo): This option would involve surveys and the installation of pressure management devices by Third party over a 5-year period together with ongoing maintenance to be undertaken by United Utilities.

No resource management options are proposed under this pathway.

4.4 Alternative Plan 3 – Plan 2 Plus 'Resilience Schemes'

Under this alternative, continued demand management (Alternative Plan 1) and the leakage reduction programme (Alternative Plan 2) would be implemented, with the addition of a programme of works designed to enhance the resilience of the network to non-drought hazards. The largest identified resilience risk is associated with numerous potential points of failure on the regional Manchester and Pennines Aqueduct system which supplies water to the Manchester and Pennine areas. The solutions to address this risk to the Strategic Resource Zone are collectively referred to as "Manchester and Pennine Resilience". The Draft WRMP identifies for consultation five potential Manchester and Pennine Resilience solutions:

- Solution A: Partial Tunnel Fix (repairs to Manchester and Pennines Aqueduct to reduce structural and water quality risks to supply resilience).
- Solution B: Partial Tunnel Fix and Partial Treatment (repairs to aqueduct and improvements to water treatment to reduce water quality failures).
- Solution C: Full New Treatment (treatment improvements across the network to solve most water quality risks).
- Solution D: Full Tunnel Fix (full repairs to aqueduct to remove structural and water quality risks).
- Solution E: Full Tunnel Fix and Alternative Supplies (full repairs to aqueduct to remove structural and water quality risks and development of alternative sources to improve resilience)

It should be noted that the specific requirements of these solutions have not yet been fully determined; once this is the case further assessment and appraisal of the options will be required. The assessment of this component of Alternative Plan 3 (and Alternative Plan 4) is necessarily undertaken at a high level, commensurate with the level of information/detail available at this time. Additional HRA analysis will be undertaken once the solutions have been refined and further information of the scope of the options is available, to inform the Final WRMP.

4.5 Alternative Plan 4 – Plan 3 Plus National Water Trading

Alternative Plan 4 is currently UU's preferred pathway, and is in line with planning guidelines and the Water UK long term water resources planning study. The plan would comprise all of the components of Alternative Plans 1, 2 and 3 described above (including continued demand management, leakage reduction and Manchester and Pennine Resilience), plus water trading with Thames Water. The water trading would transfer up to 180 Ml/d from Lake Vyrnwy to Thames Water via the River Severn during drought periods (when dry weather means there is a need for the water in the Thames catchment); this would require enabling works to maintain supplies to customers during transfer periods. The pathway will therefore include the following options:

- Demand management options:
  - All current demand management options as per Alternative Pathway 1.
  - WR610b (Education programme): This option would involve United Utilities developing and delivering a water efficiency educational programme for roll-out to KS2 students over a 10-year period.
  - WR620b (Goods and advice on metering): Under this option, newly metered customers would receive advice on increasing their water efficiency in addition to free water efficiency equipment (estimated 34,153 per annum over a 10-year period).
  - WR623b (Home checks on metering): Under this option, a United Utilities representative would offer to conduct a domestic water efficiency audit when installing a meter at a customer's property. This is estimated to result in 34,153 audits per annum over a 10-year period.
  - All leakage reduction options identified for the Alternative Pathway 2.
- Resilience options:
  - One or more of the five potential Manchester and Pennine Resilience solutions identified under Alternative Pathway 3 (note, these have not been defined at the draft HRA stage and so assessment is high-level only).
- Resource management options:
  - B2 (Thames Water Trading enabling works): Asset modifications required to maintain supplies to UU customers and hence allow the trading option to operate.

- WR099b (Worsthorne Borehole (Hurstwood IR): Re-instatement of the Worsthorne borehole under the terms of the existing abstraction licence.
- WR101 (Franklaw Z Site plus increased Franklaw WTW Treatment Capacity): Re-instatement of boreholes under the terms of the existing abstraction licences, and upgrade of WTW treatment capacity.
- WR102e (Bold Heath Boreholes to Prescot WTW): Recommissioning of existing Bold Heath boreholes with a new raw water transfer main to Prescot open reservoirs for treatment at Prescot WTW. A new abstraction licence would be required.
- WR113 (Tytherington Boreholes): New treated water main, borehole improvements and WTW modifications under the terms of the existing abstraction licence.
- WR114 (Python Mill Borehole): Reinstatement of the Python Mill Borehole (licence previously revoked) to provide compensation water to the Rochdale Canal, allowing water from Chelburn reservoir to be used in supply. A new abstraction licence would be required. It should be noted that Option WR100 (Thorncliffe Road Borehole, Barrow-in-Furness) has been identified as an alternative to WR114 and would be brought forward should scheme-level investigations demonstrate that Option WR114 would have adverse effects on European designated nature conservation sites.
- WR159 (Group 1 - Improved Reservoir Compensation Release Control): This option would involve the installation of automated compensation control to conserve reservoir storage at 76 regional reservoirs; this would allow compensation releases to be better match abstraction licence conditions.
- WR160 (Group 2 - Improved Reservoir Compensation Release Control): This option would involve the installation of automated compensation control to conserve reservoir storage at four impoundment reservoirs; this would allow compensation releases to better match the abstraction licence conditions.
- WR821 (Shropshire Union Canal): This option would involve a new third party 30 Ml/d abstraction from Shropshire Union Canal at Hurleston (Nantwich), increased WTW capacity at Hurleston WTW and a new treated water main to connect into the Mid Cheshire Main.

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

5. Assessment of Preferred Options

UU's 'preferred pathway' is Alternative Plan 4 – the 'trading pathway'. As this incorporates all of the options included in the alternative pathways it is the appropriate to focus on the assessment of this pathway when considering potential effects on European sites. This section summarises the 'screening' and (where necessary) 'appropriate assessment' of the 'preferred pathway' options.

5.1 Demand Management Measures

The demand management and leakage-reduction measures proposed under all four pathways 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 a 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). However, the anticipated works associated with these options are not of a scale that would suggest that effects are likely to be unavoidable at the project stage, and the WRMP requires that the standard avoidance measures in **Appendix G** be employed.

The demand management and leakage-reduction options for all pathways are therefore 'screened out' from further assessment as they will either

i. have no significant effects alone or in combination; or

ii. have potential effects that cannot be assessed at this level (no information on location / scale of any interventions) and so any HRA required must be deferred to the project level.

As a result, Alternative Pathways 1 & 2 are considered 'no significant effect' pathways. The following sections consider the effects of the resilience and resource management options required under Alternatives 3 and 4.

5.2 Resilience Options

No detail on the works required for the resilience options is currently available, and so the assessment is necessarily high-level at this stage. Whilst the location of a key component of the options is known (the Manchester and Pennines Aqueduct), there are several ancillary aspects that are not clear and which cannot be reasonably assessed. The current assessment position is summarised in **Table 5.1**.

Table 5.1 Summary of initial assessment of Resilience Options

Solution	Assessment Summary
Solution A: Partial Tunnel Fix	The scope of the 'partial tunnel fix' is not yet certain (e.g. where the works will occur; whether there will be multiple locations; whether the works will be invasive; etc.). There are approximately 26 European sites within 20km of the Manchester and Pennines Aqueduct, although only 4 sites (Bowland Fells SPA, Naddle Forest SAC, River Kent SAC and Rochdale Canal SAC) are within 1km. The option would presumably be a 'construction only' solution based around the existing aqueduct locations and so operational effects would not be expected. Given the distance of most European sites from the aqueduct it is clear that any works to this will not result in unavoidable adverse effects, and that the measures summarised in Appendix G are likely to be sufficient to ensure that no significant effects occur at the project stage. There is, however, residual uncertainty over the precise scope of the scheme.

Solution	Assessment Summary
Solution B: Partial Tunnel Fix and Partial Treatment	As with Solution A, the scope of the 'partial tunnel fix' and 'partial treatment' is not clear, but would likely involve repairs to the aqueduct and new of upgraded treatment works around the network. The option would presumably be a 'construction only' solution based around the existing aqueduct locations and so operational effects would not be expected. Given the distance of most European sites from the aqueduct it is clear that any works to this will not result in unavoidable adverse effects, and that the measures summarised in Appendix G are likely to be sufficient to ensure that no significant effects occur at the project stage. There is, however, residual uncertainty over the precise scope of the scheme.
Solution C: Full New Treatment	This solution would involve uprating of the treatment at the end of the Manchester and Pennine Aqueduct and at all bulk supply points; however, the scope and locations of these works are not determined. As with Solutions A and B the option would presumably be a 'construction only' solution based around the existing aqueduct locations and so operational effects would not be expected, and the measures summarised in Appendix G are likely to be sufficient to ensure that no significant effects occur at the project stage. There is, however, residual uncertainty over the precise scope of the scheme.
Solution D: Full Tunnel Fix	The scope of the 'full tunnel fix' is not clear (e.g. where the works will occur; whether there will be multiple locations; whether the works will be invasive; etc.). There are approximately 26 European sites within 20km of the Manchester and Pennines Aqueduct, although only 4 are within 1km. The option would presumably be a 'construction only' solution based around the existing aqueduct locations and so operational effects would not be expected. Given the distance of most European sites from the aqueduct it is clear that any works to this will not result in unavoidable adverse effects, and that the measures summarised in Appendix G are likely to be sufficient to ensure that no significant effects occur at the project stage. There is, however, residual uncertainty over the precise scope of the scheme, particularly as it is likely to be a significant construction programme.
Solution E: Full Tunnel Fix and Alternative Supplies	The 'alternative supplies' aspect is not clear, particularly whether this involves new sources or any changes in currently licenced abstraction; as a result, operational effects are possible and cannot be assessed with the available information. Given the distance of most European sites from the aqueduct it is clear that any works to this will not result in unavoidable adverse effects, and that the measures summarised in Appendix G are likely to be sufficient to ensure that no significant effects occur due to construction at the project stage. There is, however, residual uncertainty over the precise scope of the scheme, particularly as it is likely to be a significant construction programme

In summary, the effects of the Resilience Options cannot be robustly assessed with the information currently available, although it is likely that those solutions that do not require new abstractions (essentially Solutions A – D) will be deliverable with 'no adverse effects' based on the likely location of construction activities (probably on or near the aqueduct, and so generally some distance from the nearest European sites) and the likely effectiveness of the general measures summarised in **Appendix G**.

Note, this assessment will be revised when further information on the solutions is made available.

5.3 Option B2: Thames Water Trading Enabling Works

Summary of scheme

United Utilities currently abstracts water from Lake Vyrnwy for treatment at Oswestry WTW and for onward supply to the SRZ. Under this option, water from Vyrnwy would be traded to Thames Water. The output of treated (Lake Vyrnwy) water from Oswestry WTW to UU customers would temporarily cease /reduce when trading is operational, requiring alternative water sources from across the UU supply network; this would require asset modifications to allow water from existing licensed abstractions to be re-directed.

In broad terms, this option would require some enabling works by UU to maintain supplies to customers normally supplied from Vyrnwy; the principal construction elements of this option would be:

- four new PS (locations not determined);
- the relining of existing sections of Line 3 of the Vyrnwy Aqueduct near Oswestry;
- bypasses around break pressure tanks at existing UU facilities;
- modifications to Oswestry WTW.

Operational effects downstream of Vyrnwy will be assessed by Thames Water as part of the preparation of the company's WRMP and are therefore not considered in this HRA.

Likely impact pathways

Construction

The UU enabling works are relatively localised and small-scale, predominantly in and around existing operational sites and assets. The precise locations of the required pumping stations are not known at this stage, but are likely to be around Oswestry, and 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.).

Given the scale of the works, these risks can almost certainly be avoided or controlled through the normal project planning process and standard best-practice measures (see Appendix G).

Operation

The UU enabling works would have no operational effects: water from existing licenced abstractions (principally from the River Dee) would be diverted though asset modifications to ensure continued supply to UU customers (in broad terms replacing the water from Vyrnwy). Increases in abstraction would be required although these will be within the terms of the existing licences. Overall operation of the trading scheme has the potential to affect European sites associated with the Severn and the Thames, as part of the transfer will be on a 'put and take' to these rivers, and will involve an inter-basin water transfer. These elements, and hence the operational effects of the transfer scheme downstream of Vyrnwy, will be assessed by Thames Water as part of the preparation of the company's WRMP and are therefore not considered in this HRA.

Screening of European sites

There are 8 European sites downstream or within 20km of the likely locations of the enabling 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 5.2**.

Table 5.2 European sites within 20 km of Option, or otherwise connected

Site and Interest Features	~Distance / Connectivity
Midland Meres and Mosses Phase 1 Ramsar ▶ Crit. 1 - sites containing representative, rare or unique wetland types ▶ Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities	13.8 km
Midland Meres and Mosses Phase 2 Ramsar ▶ Crit. 1 - sites containing representative, rare or unique wetland types ▶ Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities	5.8 km
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC	7.3 km

Site and Interest Features	~Distance / Connectivity
▶ 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*	
Berwyn a Mynyddoedd de Clwyd/ Berwyn and South Clwyd Mountains SAC ▶ 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	12.7 km
Berwyn SPA ▶ Red kite ▶ Peregrine falcon ▶ Hen harrier ▶ Merlin	12.7 km
Fenn`s, Whixall, Bettisfield, Wem and Cadney Mosses SAC ▶ Active raised bogs ▶ Degraded raised bogs still capable of natural regeneration	19.8 km
Johnstown Newt Sites SAC ▶ Great crested newt *Triturus cristatus*	16.3 km
West Midlands Mosses SAC ▶ Natural dystrophic lakes and ponds ▶ Transition mires and quaking bogs	16.2 km

*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 5.3**, 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 5.3 Initial screening of European sites

Site	Consider further?	Rationale
Midland Meres and Mosses Phase 1 Ramsar	No	No reasonable impact pathways (distance, separate catchment).
Midland Meres and Mosses Phase 2 Ramsar	No	No reasonable impact pathways (distance, separate catchment).
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC	No	Abstraction from the Dee would increase during the periods that trading operates, although these increases are within the existing licenced volumes, confirmed under Review of Consents.

Site	Consider further?	Rationale
Berwyn a Mynyddoedd de Clwyd/ Berwyn and South Clwyd Mountains SAC	No	No reasonable impact pathways (distance, upland / up catchment site).
Berwyn SPA	No	No reasonable impact pathways for effects on site habitats (distance, upland / up catchment site). Mobile species will use habitats outside the SPA boundary but areas likely to be affected by the option will be of little or no value (certainly not 'functionally-linked') and the option will have no effects on the interest features of the site.
Fenn`s, Whixall, Bettisfield, Wem and Cadney Mosses SAC	No	No reasonable impact pathways (distance, separate catchment).
Johnstown Newt Sites SAC	No	No reasonable impact pathways (distance, separate catchment).
West Midlands Mosses SAC	No	No reasonable impact pathways (distance, separate catchment).

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.

Conclusion

In summary, it is considered that this option will have no effects on the interest features of any European sites, due to distance, the absence of reasonable impact pathways, and the reliability of best-practice construction measures.

5.4 Option WR099b: Worsthorne Borehole (Hurstwood IR)

Summary of scheme

This option would involve the re-instatement of UU's existing Worsthorne borehole, approximately 3km east of Burnley. Water would be passed to the Hurstwood Impoundment Reservoir (IR) on the edge of the South Pennine Moors for storage prior to treatment. The principal construction elements of this option are:

- the reinstatement and refurbishment of the borehole; and
- a new raw water main (approx. 1km) and pumping station to pass flows to Hurstwood IR.

The abstraction would be within the terms of the existing licence, which has been through the RoC.

Likely impact pathways

Construction

The construction works required are relatively small-scale, mostly associated with existing assets, and so potential construction-related effects will be localised and short duration. 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.).

Given the scale of the works, these risks can almost certainly be avoided or controlled through the normal project planning process and standard best-practice measures (see **Appendix G**).

Operation

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

Screening of European sites

There are 3 European sites downstream or within 20km of this option, or otherwise linked by a potential effect pathway. The sites, their interest features, and location relative to the option are set out in **Table 5.4**.

Table 5.4 European sites within 20 km of option, or otherwise connected

Site and Interest Features	~Distance / Connectivity
South Pennine Moors Phase 2 SPA ▶ Merlin *Falco columbarius* ▶ European golden plover *Pluvialis apricaria* ▶ Breeding bird assemblage	0.5 km
South Pennine Moors SAC ▶ 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	0.5 km
Rochdale Canal SAC ▶ Floating water-plantain *Luronium natans*	16.4 km

*Priority features
DS – Downstream site

Two of these sites will be unaffected by the option, primarily due to the absence of impact pathways; these sites are identified in **Table 5.5**, 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 5.5 Initial screening of European sites

Site	Consider further?	Rationale
South Pennine Moors Phase 2 SPA	Yes	Mobile species may be sensitive to construction disturbance.
South Pennine Moors SAC	No	Upland site, upstream of the likely construction area. Site approximately 500m from closest point of construction but habitat interest features will not be exposed and sensitive to the likely effects assuming implementation of normal best-practice measures. There will be no operational effects. The option will have no effect on this site.
Rochdale Canal SAC	No	No reasonable impact pathways; site over 16km from borehole and within a separate catchment.

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.

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:

- **South Pennine Moors Phase 2 SPA**: In addition to normal project-level planning and best-practice, construction of the scheme will avoid the breeding period (March – August) to minimise the risk of disturbance to merlin and golden plover, 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 SPA.

No additional 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.

South Pennine Moors Phase 2 SPA

Context / feature screening

The South Pennine Moors Phase 2 SPA includes the major moorland blocks of the South Pennines. It covers extensive tracts of semi-natural moorland habitats including upland heath and blanket mire. The SPA is ~500m from the likely construction areas at the closest point, although the site habitats will not be 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). However, many birds (particularly ground-nesting or foraging species, including **Golden plover**) 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.

The SPA is ~500m 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[21], and established 'flush distances' for birds due to visual disturbance are invariably less than this[22]. However, the principal interest features (breeding **Merlin** and **Golden Plover**) 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. The 2016 SPA Review (JNCC 2016) includes **Golden plover** in a broad group of species that are known to be reliant on cropped habitats, which are under-represented in the SPA network (although the SPA Review suggests

[21] As a guide, a typical long-reach excavator 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.

[22] 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).

that this should be addressed outside the SPA Review process through "*wider countryside measures to preserve and promote permanent pasture as feeding and roosting habitat for the species*"). However, whilst there is evidence of regional site fidelity (i.e. birds associated with the South Pennine Moors Phase 2 SPA will predominantly use available habitats within a few kilometres of the site), this species' use of farmland appears variable according to cropping patterns and rotations, with limited field fidelity from year to year (Mason & MacDonald 1999) except where favoured habitats are consistently or intentionally maintained. There is evidence that certain crops may be favoured, and larger fields are favoured over smaller ones, but distributions will often be variable from year to year. Gillings *et al*. (2007) found that flocks occupied only a fraction of the available fields in a given area, concentrating most in large fields with open boundaries and where manure had been applied. **Merlin** are likely to be less sensitive and less exposed to the potential effects of the scheme due to their behavioural characteristics.

Construction

The main construction-related risk would be the potential disturbance and / or displacement of Merlin or Golden plover from feeding, roosting or nesting sites outside the SPA due to physical disturbance associated with construction activities (e.g. noise and vibration). Construction will be ~500m from the SPA boundary at the closest point, and direct effects on birds within the SPA would not be expected.

The scheme characteristics (mostly within existing operational sites, other than small-scale pipeline construction; short-term only) will help minimise the risk and magnitude of any potential effects on species using habitats outside the SPA boundary. The likely zone of influence for construction effects will be small, and the habitats affected are unlikely to be particularly unique in the local area. It is likely that the accessibility and availability of alternative habitat areas nearby, behavioural avoidance responses, and the short-term nature of any effects would ensure that SPA populations would not be sufficiently exposed to any effects for the integrity of the SPA to be undermined. It may be necessary to undertake scheme-specific surveys once preferred pipeline routes are established, to demonstrate that these do not affect any important 'functionally-linked' habitats (although it is also worth noting that use of farmland by Golden plover appears variable according to annual cropping patterns and rotations); however, any potential displacement effects could easily be avoided through scheme design, construction timing, or established mitigation (e.g. concurrent monitoring of construction areas for use by SPA species). On this basis, adverse effects would not be expected, and effects can in any case be avoided or controlled through the normal project planning process and standard best-practice measures (see **Appendix G**).

Operation

The scheme will operate within the terms of the existing licence, and the interest features are not sensitive to water resource permissions. There are no other operational impact pathways.

Conclusion

Based on the available information it is clear that this option can be delivered with 'no adverse effect' on the integrity of the South Pennine Moors Phase 2 SPA (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.

5.5 Option WR101: Franklaw Z site plus increased Franklaw WTW treatment capacity

Summary of Scheme

This option would involve the re-instatement of two existing non-operational boreholes in UU's Franklaw group, near Garstang, Lancs., the installation of new borehole pumps within 10 existing operational boreholes at Franklaw and Broughton, near Preston, and the uprating of treatment capacity at Franklaw WTW (near Garstang). All works would be within or near existing operational sites. The principal construction elements of this option are:

- the reinstatement and refurbishment of two existing boreholes at the Franklaw Z site;
- new borehole pumps in 10 existing/utilised Franklaw/Broughton boreholes to deliver an additional 12 Ml/d to Franklaw WTW; and
- an additional treatment phase at Franklaw WTW to treat the additional 30 Ml/d from the boreholes.

The abstractions would be within the terms of the existing licences, which have been through the RoC.

Likely impact pathways

Construction

The construction works required are relatively small-scale, associated with existing assets, and so potential construction-related effects will be localised and short duration. 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.).

Given the scale of the works, these risks can almost certainly be avoided or controlled through the normal project planning process and standard best-practice measures (see Appendix G).

Operation

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

Screening of European sites

There are 8 European sites downstream or within 20km of this option, or otherwise linked by a potential effect pathway. The sites, their interest features, and location relative to the option are set out in **Table 5.6**.

Table 5.6 European sites within 20 km of option, or otherwise connected

Site and Interest Features	~Distance / Connectivity
Bowland Fells SPA ▸ Hen harrier *Circus cyaneus* ▸ Merlin *Falco columbarius* ▸ Lesser black-backed gull *Larus fuscus*	4.7 km
Morecambe Bay and Duddon Estuary SPA	7.9 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	7.9 km / DS
▸ 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	
Morecambe Bay SAC	7.9 km / DS
▸ 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*	
Calf Hill and Cragg Woods SAC	16.0 km
▸ 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)*	
Liverpool Bay / Bae Lerpwl SPA	7.9 km
▸ Red-throated diver *Gavia stellata* ▸ Black (common) scoter *Melanitta nigra* ▸ Waterfowl assemblage Waterfowl assemblage	
Ribble and Alt Estuaries Ramsar	7.9 km
▸ Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities ▸ 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	

Site and Interest Features	~Distance / Connectivity
Ribble and Alt Estuaries SPA ▶ Great cormorant *Phalacrocorax carbo* ▶ 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	7.9 km

*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 5.7**, 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 5.7 Initial screening of European sites

Site	Consider further?	Rationale
Bowland Fells SPA	No	Upland site, upstream of the likely construction area; no direct effects on site habitats due to distance / absence of pathways. Mobile species very unlikely to be exposed to construction effects due to distance and small area affected.
Morecambe Bay and Duddon Estuary SPA	No	Site downstream from potential construction areas (~14km) but will not be exposed to potential construction effects (assuming normal best-practice measures, although downstream distance will ensure any incidental effects are attenuated). Mobile species will not be exposed to construction effects due to distance / habitat preferences / small area affected. There will be no operational effects. It is considered that the option will have no effect on this site.
Morecambe Bay Ramsar	No	As for Morecambe Bay and Duddon Estuary SPA
Morecambe Bay SAC	No	As for Morecambe Bay and Duddon Estuary SPA.
Calf Hill and Cragg Woods SAC	No	No reasonable impact pathways (distance, separate catchment, etc.)

Site	Consider further?	Rationale
Liverpool Bay / Bae Lerpwl SPA	No	Site is not a downstream receptor; mobile species will not to be exposed to construction effects due to distance / habitat preferences / small area affected. It is considered that the option will have no effect on this site.
Ribble and Alt Estuaries Ramsar	No	As for Liverpool Bay / Bae Lerpwl SPA.
Ribble and Alt Estuaries SPA	No	As for Liverpool Bay / Bae Lerpwl SPA.

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.

Conclusion

In summary, it is considered that this option will have no effects on the interest features of any European sites, due to distance, the absence of reasonable impact pathways, and the reliability of best-practice construction measures.

5.6 Option WR102e: Bold Heath Boreholes to Prescot WTW

Summary of scheme

This option would involve the recommissioning of existing boreholes at Bold Heath, north east of Widnes, and a new raw water transfer main to Prescot open reservoirs for treatment at Prescot WTW. The principal construction elements of this option are:

- the reinstatement and refurbishment of existing boreholes at the Bold Heath site;
- a new ~10 km transfer pipeline from Bold Heath to Prescot reservoirs, crossing agricultural land between Widnes and Prescot before following roads through Prescot to reach the reservoirs.

The boreholes were licensed historically, but this was revoked around 12 years ago; this revocation was due to the licence not being used rather than any sustainability issues (essentially, a proposal was put forward to supply an industrial customer with non-potable water from Bold Heath around 15 years ago; the original licence was revoked and a replacement abstraction licence issued with a requirement that it would expire if not used within 3 years).

Likely impact pathways

Construction

The construction works required are standard and unexceptional and so potential construction-related effects will be localised and short duration. 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.).

Given the scale and type of works, these risks can almost certainly be avoided or controlled through the normal project planning process and standard best-practice measures (see **Appendix G**).

Operation

In summary, this option will have no effects on the interest features of any European sites, due to distance and the absence of reasonable impact pathways.

Screening of European sites

There are 13 European sites downstream or within 20km of this option, or otherwise linked by a potential effect pathway. The sites, their interest features, and location relative to the option are set out in Table 5.8.

Table 5.8 European sites within 20 km of option, or otherwise connected

Site and Interest Features	~Distance / Connectivity
Mersey Estuary Ramsar ▸ Crit. 5 - regularly supports 20,000 or more waterbirds ▸ Crit. 6 - regularly supports 1% of the individuals in a population of one species/subspecies of waterbirds	4.9 km / DS
Mersey Estuary SPA ▸ Great crested grebe *Podiceps cristatus* ▸ Common shelduck *Tadorna tadorna* ▸ Eurasian wigeon *Anas penelope* ▸ 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	4.9 km / DS
Manchester Mosses SAC ▸ Degraded raised bogs still capable of natural regeneration	14.9 km
Mersey Narrows and North Wirral Foreshore Ramsar ▸ 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	13.9 km
Mersey Narrows and North Wirral Foreshore SPA ▸ 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	13.9 km
Rixton Clay Pits SAC ▸ Great crested newt *Triturus cristatus*	12.4 km
Midland Meres and Mosses Phase 1 Ramsar	16.9 km

Site and Interest Features	~Distance / Connectivity
▶ Crit. 1 - sites containing representative, rare or unique wetland types ▶ Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities	
Midland Meres and Mosses Phase 2 Ramsar ▶ Crit. 1 - sites containing representative, rare or unique wetland types ▶ Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities	19.9 km
Dee Estuary/ Aber Dyfrdwy SAC ▶ 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 ▶ 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*	19.1 km
Liverpool Bay / Bae Lerpwl SPA ▶ Red-throated diver *Gavia stellata* ▶ Black (common) scoter *Melanitta nigra* ▶ Waterfowl assemblage Waterfowl assemblage	16.1 km
Ribble and Alt Estuaries Ramsar ▶ Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities ▶ 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	16.1 km
Ribble and Alt Estuaries SPA ▶ Great cormorant *Phalacrocorax carbo* ▶ 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	16.1 km

Site and Interest Features	~Distance / Connectivity
Sefton Coast SAC ▶ 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*	16.1 km

*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 5.9**, 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 5.9 Initial screening of European sites

Site	Consider further?	Rationale
Mersey Estuary Ramsar	No	Site downstream from potential construction areas (~11 km following most likely hydrological pathway) but will not be exposed to potential construction effects (assuming normal best-practice measures, although downstream distance will ensure any incidental effects are attenuated). Mobile species will not be exposed to construction effects due to distance / habitat preferences / small area affected. There will be no operational effects. It is considered that the option will have no effect on this site.
Mersey Estuary SPA	No	As for Mersey Estuary Ramsar
Manchester Mosses SAC	No	No reasonable impact pathways (distance, separate catchment, etc.)
Mersey Narrows and North Wirral Foreshore Ramsar	No	No reasonable impact pathways (distance, separate catchment, etc.)
Rixton Clay Pits SAC	No	No reasonable impact pathways (distance, separate catchment, etc.)
Mersey Narrows and North Wirral Foreshore SPA	No	No reasonable impact pathways (distance, separate catchment, etc.)
Midland Meres and Mosses Phase 1 Ramsar	No	No reasonable impact pathways (distance, separate catchment, etc.)
Midland Meres and Mosses Phase 2 Ramsar	No	No reasonable impact pathways (distance, separate catchment, etc.)
Ribble and Alt Estuaries Ramsar	No	No reasonable impact pathways (distance, separate catchment, etc.)
Dee Estuary/ Aber Dyfrdwy SAC	No	No reasonable impact pathways (distance, separate catchment, etc.)
Liverpool Bay / Bae Lerpwl SPA	No	No reasonable impact pathways (distance, separate catchment, etc.)
Ribble and Alt Estuaries SPA	No	No reasonable impact pathways (distance, separate catchment, etc.)
Sefton Coast SAC	No	No reasonable impact pathways (distance, separate catchment, etc.)

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.

Conclusion

In summary, it is considered that this option will have no effects on the interest features of any European sites, due to distance, the absence of reasonable impact pathways, and the reliability of best-practice construction measures.

5.7 Option WR113: Tytherington Boreholes

Summary of Scheme

This option would be a network scheme involving improvements to boreholes at Tytherington, Macclesfield and a new treated water transfer main from Tytherington WTW to a treated water storage facility following existing roads. The principal construction elements of this option are:

- a new 2.9 km treated water main between Tytherington WTW and a treater water storage facility;
- minor modifications to existing WTW (if required); and
- new or improved borehole headworks to asset standard design.

There would be an increase in abstractions from the borehole although these would be within the terms of the existing licence, which has been assessed through the RoC.

Likely impact pathways

Construction

The construction works required are standard and unexceptional and so potential construction-related effects will be localised and short duration. 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.).

Given the scale and type of works, these risks can almost certainly be avoided or controlled through the normal project planning process and standard best-practice measures (see Appendix G).

Operation

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

Screening of European sites

There are 5 European sites downstream or within 20km of this option, or otherwise linked by a potential effect pathway. The sites, their interest features, and location relative to the option are set out in **Table 5.10**.

Table 5.10 European sites within 20 km of option, or otherwise connected

Site and Interest Features	~Distance / Connectivity
Peak District Moors (South Pennine Moors Phase 1) SPA ▸ Merlin *Falco columbarius* ▸ European golden plover *Pluvialis apricaria* ▸ Short-eared owl *Asio flammeus*	5.1 km
South Pennine Moors SAC ▸ 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	5.1 km
Peak District Dales SAC ▸ 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*	14.3 km
Midland Meres and Mosses Phase 1 Ramsar ▸ Crit. 1 - sites containing representative, rare or unique wetland types ▸ Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities	16.9 km
Rostherne Mere Ramsar ▸ Crit. 1 - sites containing representative, rare or unique wetland types	19.9 km

*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 5.11**, 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 5.11 Initial screening of European sites

Site	Consider further?	Rationale
Peak District Moors (South Pennine Moors Phase 1) SPA	No	Upland site, upstream of the likely construction area; no direct effects on site habitats due to distance / absence of pathways. Mobile species very unlikely to be exposed to construction effects due to distance / habitat preferences / small area affected.
South Pennine Moors SAC	No	Upland site, upstream of the likely construction area; no reasonable impact pathways.
Peak District Dales SAC	No	No reasonable impact pathways (distance, separate catchment, etc.)

Site	Consider further?	Rationale
Midland Meres and Mosses Phase 1 Ramsar	No	No reasonable impact pathways (distance, separate catchment, etc.)
Rostherne Mere Ramsar	No	No reasonable impact pathways (distance, separate catchment, etc.)

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.

Conclusion

In summary, it is considered that this option will have no effects on the interest features of any European sites, due to distance, the absence of reasonable impact pathways, and the reliability of best-practice construction measures.

5.8 Option WR114: Python Mill Borehole

Summary of scheme

UU currently supplies compensation water to the Rochdale Canal (part of which is an SAC) from a reservoir at Chelburn, near Calderbrook. This option would replace this compensation water with water from the currently unused Python Mill borehole, allowing water from Chelburn reservoir to be conserved which has an improvement to water available for supply. The principal construction elements would be:

- the reinstatement and refurbishment of an existing borehole located at Python Mill, Littleborough;
- a new ~3.1km raw water main between Python Mill and the current discharge point for water from Chelburn into the Rochdale Canal (Calderbrook)
- a new discharge scour into the canal; and
- a new sewer connection at Python Mill.

The scheme would require a new abstraction licence for the Python Mill Borehole as the previous licence was revoked when the source was mothballed (note, this revocation was due to non-use of the source rather than as a sustainability reduction).

Likely impact pathways

Construction

The construction works required are standard and unexceptional and so potential construction-related effects will be localised and short duration. 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.).

Given the scale and type of works, these risks can almost certainly be avoided or controlled through the normal project planning process and standard best-practice measures (see **Appendix G**).

Operation

The scheme will require resumption of abstraction from Python Mill under a new licence, which may affect any groundwater dependent terrestrial ecosystems locally. However, the main effect pathway will be associated with the replacement of compensation water from an impoundment reservoir with groundwater that is likely to have different physio-chemical characteristics.

Screening of European sites

There are 4 European sites downstream or within 20km of this option, or otherwise linked by a potential effect pathway. The sites, their interest features, and location relative to the option are set out in **Table 5.12**.

Table 5.12 European sites within 20 km of option, or otherwise connected

Site and Interest Features	~Distance / Connectivity
Rochdale Canal SAC ▶ Floating water-plantain *Luronium natans*	0.2 km
South Pennine Moors Phase 2 SPA ▶ Merlin *Falco columbarius* ▶ European golden plover *Pluvialis apricaria* ▶ Short-eared owl *Asio flammeus*	0.2 km
South Pennine Moors SAC ▶ 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	0.2 km
Peak District Moors (South Pennine Moors Phase 1) SPA ▶ Merlin *Falco columbarius* ▶ European golden plover *Pluvialis apricaria* ▶ Short-eared owl *Asio flammeus*	10.6 km

*Priority features
DS – Downstream site

Three of these sites will be unaffected by the option, primarily due to the absence of impact pathways; these sites are identified in **Table 5.13**, 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 5.13 Initial screening of European sites

Site	Consider further?	Rationale
Rochdale Canal SAC	Yes	Exposed to potential construction and operation effects.
South Pennine Moors Phase 2 SPA	No	Upland site, upstream of the borehole and construction areas and ~80 – 100m higher. There will be no effects on site habitats due to distance / absence of pathways (any groundwater drawdown associated with borehole operation cannot affect groundwater dependent terrestrial ecosystems within the SPA due to elevation differences and geological separation). Mobile species very unlikely to be exposed to construction effects due to distance / habitat preferences (construction within roads) / small area affected.

Site	Consider further?	Rationale
South Pennine Moors SAC	No	Upland site, upstream of the borehole and construction areas and ~80 – 100m higher. There will be no effects on site habitats due to distance / absence of pathways (any groundwater drawdown associated with borehole operation cannot affect groundwater dependent terrestrial ecosystems within the SAC due to elevation differences and geological separation).
Peak District Moors (South Pennine Moors Phase 1) SPA	No	No reasonable impact pathways (distance, separate catchment, etc.)

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. No additional, site- or feature-specific measures are included.

Rochdale Canal SAC

Context / feature screening

Rochdale Canal SAC extends for approximately 20 km from Littleborough to Failsworth through urban parts of Rochdale and Oldham and the intervening areas of agricultural land (mostly pasture). It is predominantly mesotrophic due to its mixed supply of water from reservoirs in the Pennines (acidic, relatively oligotrophic) and other sources with relatively high nutrient loads. It supports a significant population of **Floating water-plantain**, which will be sensitive to changes in water quality, particularly eutrophication.

When built, the canal was supplied predominantly by a series of reservoirs in the South Pennines, including Blackstone Edge, Light Hazzle, White Holme, Warland and Chelburn. These were repurposed for public water supply in the 1920s as canal traffic declined, before its closure in the 1950s. Water supply is therefore a significant challenge for the restored canal: indeed, the consultation document for the Canal and Rivers Trust's Water Resources Strategy (Canal and River Trust 2014) notes that "*When the Rochdale Canal was reopened following restoration in 2002, it was agreed that this canal would not meet the minimum 1 in 20 year standard* [i.e. maintain and operate the canal network so that drought closures are implemented, on average, less than once every twenty years] *and that a lower level of service would be acceptable*" as the existing water supply infrastructure is inadequate to meet these demands. Currently, therefore, the canal is supplied from a range of sources, including reservoirs (including Chelburn), groundwater from boreholes, and various feeder systems.

The northernmost boundary of the SAC is at Ben Healy Bridge, Littleborough; this is approximately 3km 'downstream' of the current discharge point for water from Chelburn reservoir (located near the canal summit at Calderbrook). Data on typical water travel time is not available (and will depend to some extent on the levels of boat traffic), but it is likely that water from the Chelburn discharge will typically take a few days to reach the SAC based on the approximate volumes of the canal locks.

The ecology of Floating water plantain is reviewed in depth by Lansdown & Wade (2003). Their review of the literature suggests that the species is mainly sensitive to competition with more aggressive plant species (and hence factors that support this) rather than physio-chemical conditions *per se*: the species is found in most wetland types (including both still and flowing systems), and in waters with a range of pH and nutrient levels. Indeed, it is noted that "*It appears likely that natural pH levels are rarely, if ever, a constraint on populations*". As a result, Lansdown & Wade (2003) suggest that the maintenance of floating water-plantain populations at a particular site is likely to rely on the suppression of community succession, either through natural processes (e.g. wave action in large upland lakes) or artificial (e.g. disturbance of sediment by light boat traffic).

Construction

The main construction-related risk would be through the discharge of site-derived pollutants to the canal, if these are not appropriately managed. However, this risk can clearly be avoided or controlled through the normal project planning process and standard best-practice measures (see **Appendix G**). Significant effects would not therefore be expected.

Operation

The operation of this scheme would involve the replacement of compensation water from Chelburn reservoir with groundwater from Python Mill. It is likely that these waters will differ in several physio-chemical parameters:

- Temperature: Groundwaters are typically in the 10 - 12˚C range all year, whereas reservoirs can vary considerably depending on the season, the depth of the reservoir (deeper reservoirs can become thermally stratified) and the position of the draw-off. The temperature of the receiving waters will also vary seasonally.
- pH: The pH of abstracted water is determined by a number of factors, although in this instance both the groundwater and reservoir water are likely to be acidic (most groundwater in this area is abstracted from the Pennine Coal Measures, and the Chelburn water will be dominated by run-off from upland peatlands).
- Nutrient status: Water derived from the Pennines (and hence Chelburn) is generally oligotrophic; groundwater can be variable although phosphorous[23] is usually low.
- Other determinands: Groundwater from coal measures can contain elevated levels of other determinands compared to surface waters, including iron and manganese (particularly in waters from coal measures).

Water quality data is not collected for either of these sources as Python Mill is currently closed and Chelburn is used for compensation releases only. Therefore, it is not possible to compare the physio-chemical characteristics of the proposed compensation source with the existing, or with the typical water quality within the canal. These data would be required to support any amendments to the current licensing scenario.

There are a number of factors that are likely to ensure that a switch in compensation source has no adverse effects on the integrity of the SAC:

- It will be possible to apply treatment to the groundwater to ensure that its physio-chemical characteristics are within an acceptable range (e.g. to remove iron, which is sometimes elevated in groundwaters).
- The available information on **Floating water plantain** indicates that the species is tolerant of a range of physio-chemical conditions and not reliant on these being narrowly maintained. Populations are more likely to be sensitive to long-term shifts in water quality if this alters the suitability of the watercourse for competitive species, although this aspect will be determined by factors other than water quality alone (e.g. management / removal of canal sediments to maintain early-sere conditions). There may be an issue if the Python Mill water resulted in significant nutrient enrichment, although is unlikely based on data from other United Utilities boreholes in the coal measures. The availability of soluble iron can sometimes be a limiting factor for plant growth (although this is less of an issue under acid conditions), so inputs of iron-rich groundwater may also affect this; however, soluble iron in groundwater readily oxidises and precipitates into its less-soluble form when exposed to air, and this aspect can be managed with stage treatment of the groundwater.
- The groundwater from Python Mill will be discharged to the canal near the existing Chelburn discharge location, which is over 3km ‘upstream’ of the SAC boundary at Littleborough. Consequently, it is likely that some physio-chemical differences (notably temperature and pH)

[23] Available phosphorus is usually a limiting factor on plant growth in most watercourses.

will be largely attenuated by the waters within the canal and the relatively slow transit time[24] before the SAC boundary.

- The canal currently receives water from a range of sources, including groundwater. Some of these groundwater sources will almost certainly be from the coal measures as these underlie much of the canal between Littleborough and Oldham, and so the addition of new water from this aquifer is unlikely to significantly alter current canal conditions.

Despite this, however, the absence of water quality data from Python Mill and Chelburn ensures that there are potentially significant residual uncertainties associated with this scheme that cannot be fully resolved at the plan-level.

Additional mitigation required to avoid adverse effects

Although unlikely based on the available data and the moderating factors noted above (including treatment options), it is possible that substantial differences in water quality may not be treatable and that the implementation of the scheme cannot be completed without adverse effects. In practice, scheme-level HRA (which would be required for any implementation works and for licence amendments) would ensure that a scheme with adverse effects would not proceed. However, at the plan-level it is necessary to identify appropriate mitigation to ensure that the plan does not support schemes that will have unavoidable adverse effects.

In this instance, substantial additional investigation is not possible at the plan-level within the statutory timescales for delivery of the WRMP. Therefore, the WRMP identifies alternatives to this option that can meet the deficit and which will be employed should unavoidable adverse effects be identified during project-level HRAs. This ensures that the WRMP will have 'no adverse effects'. In this instance the alternative option is Option WR100 (Thorncliffe Road Borehole, Barrow-In-Furness), which will have no likely significant effects on any European site. A summary of the assessment of this option is provided in Appendix H.

Conclusion

Option WR114 has a number of uncertainties around its operation that ensure that the HRA cannot, at the WRMP-level, exclude the possibility of adverse effects on the Rochdale Canal SAC due to differences in the physio-chemical characteristics of the compensation water. It is possible that substantial differences in water quality may not be treatable and that the implementation of the scheme could not then be completed without adverse effects occurring (although adverse effects would appear improbable based on the available data and various moderating factors).

Inclusion of the option in the WRMP will allow UU to investigate the residual uncertainties. The uncertainty that this introduces can be addressed at the WRMP level through the identification of alternative options that will be employed should Option WR114 not pass the HRA tests at the project-level. The alternative option proposed is Option WR100, and is assessed in **Appendix H**.

5.9 Option WR159: Group 1 - Improved Reservoir Compensation Release Control

Summary of scheme

Currently, reservoir compensation releases are managed through a range of operational measures. This option would involve the installation of approximately 76 automated compensation control penstocks at reservoir sites across the UU region. This would allow compensation releases to be better matched to the licence conditions, so conserving reservoir storage. The precise scope of works required at each reservoir

[24] For comparison, modelling and monitoring of the Shropshire Groundwater Scheme (a river recharge scheme involving the discharge of groundwater to local rivers) has broadly shown that river water temperatures return to pre-discharge temperatures within 200m, and usually substantially less (Amec 2013). Obviously discharge to a canal is not directly comparable, but is almost certain that any groundwater will be at ambient temperature by the time it reaches the SAC at Littleborough.

site is not clear at this stage in the planning process (scoping would form part of the works package) but in general the principal construction elements would be very limited, comprising:

- the provision of penstocks for compensation control; and
- installation of a 9m^3 kiosk to house telemetry and controls.

These works would take place within existing operational site boundaries, although the precise locations of kiosks are not known. The reservoirs likely to be subject to this option are noted in **Table 5.14** below:

Table 5.14 Reservoirs subject to Option WR159

Reservoir group	Reservoirs*		Number of kiosks
Mitchells	▶ Mitchells No. 1	▶ Mitchells No. 2	2
South Cumbria	▶ Poaka Beck ▶ Pennington	▶ Harlock ▶ Levers Water	3*
Blackburn	▶ Fishmoor		1
Macclesfield IR	▶ Ridgegate	▶ Trentabank	3
Wet Sleddale	▶ Wet Sleddale		1
Bolton IR's	▶ Wayoh ▶ Entwistle ▶ Jumbles	▶ Delph ▶ Springs Dingle	5
Rochdale	▶ Ashworth Moor ▶ Greenbooth ▶ Naden Lower ▶ Naden Middle	▶ Spring Mill ▶ Watergrove ▶ Cowm	7
Burnley	▶ Hurstwood ▶ Cant Clough ▶ Swinden No. 1 ▶ Swinden No. 2 ▶ Laneshaw	▶ Coldwell Lower ▶ Coldwell Upper ▶ Ogden Lower ▶ Ogden Upper ▶ Churnclough	8*
Stocks	▶ Stocks		1
Oldham	▶ Piethorne ▶ Norman Hill ▶ Kitcliffe ▶ Ogden Milnrow ▶ Hanging Lees ▶ Rooden ▶ Warland ▶ Light Hazzles	▶ Whiteholme ▶ Blackstone Edge ▶ Castleshaw Lower ▶ Castleshaw Upper ▶ Readycon Dean ▶ Crookgate ▶ Dowry ▶ New Year's Bridge	16
Buckton Castle	▶ Greenfield ▶ Yeoman Hey ▶ Dovestone ▶ Chew	▶ Brushes ▶ Walkerwood ▶ Swineshaw Higher ▶ Swineshaw Lower	7*
Wybersley IR's	▶ Kinder ▶ Errwood ▶ Fernilee	▶ Bollinhurst ▶ Horse Coppice	5
Rossendale	▶ Calf Hey ▶ Ogden (Grane) ▶ Holdenwood ▶ Cowpe	▶ Cragg Holes ▶ Scout Moor ▶ Cloughbottom ▶ Clow Bridge	8
Longdendale & Audenshaw	▶ Woodhead ▶ Torside ▶ Rhodeswood ▶ Vale House	▶ Arnfield ▶ Audenshaw No. 1 ▶ Audenshaw No. 2 ▶ Audenshaw No. 3	9

Reservoir group	Reservoirs*	Number of kiosks
	▶ Bottoms	

*Note, 80 reservoirs are identified although only 76 kiosks are required as some reservoirs are operated together.

Likely impact pathways

Construction

The construction works required are relatively small-scale, mostly associated with existing assets, and so potential construction-related effects will be localised and short duration. 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.).

Given the scale of the works, these risks can almost certainly be avoided or controlled through the normal project planning process and standard best-practice measures (see **Appendix G**).

Operation

The operation of the schemes would be within the terms of the existing licences, simply allowing finer control of compensation releases, and so no operational effects would be expected.

Screening of European sites

Due to the number of reservoir sites and the small-scale nature of the works it has been necessary to adopt a slightly different approach to screening European sites. **Table 5.15** identifies those European sites that are within 20km of a reservoir subject to this option (note, interest features are not shown but these are available from **Appendix C**); these sites are then screened based on the likely exposure and sensitivity of the interest features to the individual developments (rather than on a development-by-development basis). The assessment then focuses on the reservoirs closest to the European sites[25]: **Table 5.16** summarises those reservoir sites within 1km of the European sites, or which may be otherwise linked. The assessment also focuses on construction effects only (see above).

[25] Based on the scale and type of construction works required, and the interest features potentially exposed, it is clear that effects from works at more distant reservoirs will clearly be avoidable if they can be avoided for the closer sites.

Table 5.15 Screening of European sites within 20km of reservoirs included in Option WR159

European site	Proximity of nearest reservoir (km)										Consider further?	Rationale
	0km	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 7.5	7.5-10	10-15	15-20		
Asby Complex SAC				Y							No	No reasonable impact pathways (distance, separate catchment, etc.)
Borrowdale Woodland Complex SAC									Y		No	No reasonable impact pathways (distance, separate catchment, habitat-only features etc.)
Bowland Fells SPA				Y							Yes	No reasonable impact pathways for habitat features (distance, separate catchment, etc.). Mobile features may use nearest reservoir site.
Calf Hill and Cragg Woods SAC										Y	No	No reasonable impact pathways (distance, separate catchment, habitat-only features etc.)
Craven Limestone Complex SAC										Y	No	No reasonable impact pathways (distance, separate catchment, etc.)
Drigg Coast SAC										Y	No	No reasonable impact pathways (distance, separate catchment, habitat-only features etc.)
Duddon Estuary Ramsar				Y							Yes	Potential for interest features to be affected if nearby reservoirs provide significant functionally-linked habitats.
Duddon Mosses SAC							Y				No	No reasonable impact pathways (distance, separate catchment, habitat-only features etc.)
Esthwaite Water Ramsar								Y			No	No reasonable impact pathways (distance, separate catchment, etc.)
Ingleborough Complex SAC									Y		No	No reasonable impact pathways (distance, separate catchment, habitat-only features etc.)
Lake District High Fells SAC		Y									No	Site adjacent to reservoir body; however, site is upland and upstream of likely construction areas, and there will be no effects on site habitats due to distance / absence of pathways.
Malham Tarn Ramsar										Y	No	No reasonable impact pathways (distance, separate catchment, habitat-only features etc.)

European site	Proximity of nearest reservoir (km)										Consider further?	Rationale
	0km	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 7.5	7.5-10	10-15	15-20		
Manchester Mosses SAC										Y	No	No reasonable impact pathways (distance, separate catchment, habitat-only features etc.)
Midland Meres and Mosses Phase 1 Ramsar										Y	No	No reasonable impact pathways (distance, separate catchment, habitat-only features etc.)
Morecambe Bay Pavements SAC										Y	No	No reasonable impact pathways (distance, separate catchment, etc.)
Morecambe Bay Ramsar							Y				Yes	Potential for interest features to be affected if nearby reservoirs provide significant functionally-linked habitats.
Morecambe Bay SAC				Y							No	No reasonable impact pathways (distance, habitat-only features etc.)
Morecambe Bay and Duddon Estuary SPA							Y				Yes	Potential for interest features to be affected if nearby reservoirs provide significant functionally-linked habitats.
Naddle Forest SAC							Y				No	No reasonable impact pathways (distance, separate catchment, habitat-only features etc.)
North Pennine Dales Meadows SAC		Y									Yes	Site adjacent to operational site.
North Pennine Moors SAC									Y		No	No reasonable impact pathways (distance, separate catchment, habitat-only features etc.)
North Pennine Moors SPA									Y		No	No reasonable impact pathways (distance, separate catchment, etc.)
Peak District Dales SAC							Y				No	No reasonable impact pathways (distance, separate catchment, etc.)
Peak District Moors (South Pennine Moors Phase 1) SPA		Y									Yes	Potential for interest features to be affected if nearby reservoirs provide significant functionally-linked habitats.
River Derwent and Bassenthwaite Lake SAC									Y		No	No reasonable impact pathways (distance, separate catchment, etc.)
River Eden SAC		Y									Yes	Site adjacent to operational site.

European site	Proximity of nearest reservoir (km)										Consider further?	Rationale
	0km	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 7.5	7.5-10	10-15	15-20		
River Kent SAC								Y			No	No reasonable impact pathways (distance, separate catchment, etc.)
Rochdale Canal SAC				Y							No	No reasonable impact pathways (distance, separate catchment, etc.)
Roudsea Wood and Mosses SAC							Y				No	No reasonable impact pathways (distance, separate catchment, habitat-only features etc.)
South Pennine Moors Phase 2 SPA	Y										Yes	Construction works required within SPA boundaries.
South Pennine Moors SAC	Y										Yes	Construction works required within SPA boundaries.
Subberthwaite, Blawith and Torver Low Commons SAC							Y				No	No reasonable impact pathways (distance, separate catchment, habitat-only features etc.)
Ullswater Oakwoods SAC									Y		No	No reasonable impact pathways (distance, separate catchment, habitat-only features etc.)
Wast Water SAC									Y		No	No reasonable impact pathways (distance, separate catchment, habitat-only features etc.)
Witherslack Mosses SAC										Y	No	No reasonable impact pathways (distance, separate catchment, habitat-only features etc.)
Yewbarrow Woods SAC									Y		No	No reasonable impact pathways (distance, separate catchment, habitat-only features etc.)

Table 5.16 Reservoirs with European sites within 1km

Reservoir	Coincident European sites	European sites within 1km	Notes / other sites potentially exposed
Blackstone Edge	▶ South Pennine Moors SAC ▶ South Pennine Moors Phase 2 SPA	-	Reservoir covered by SAC / SPA designations.
Readycon Dean	▶ South Pennine Moors SAC ▶ South Pennine Moors Phase 2 SPA	-	Reservoir and associated operational land covered by SAC / SPA designations.
Warland	▶ South Pennine Moors SAC ▶ South Pennine Moors Phase 2 SPA	-	Reservoir and associated operational land covered by SAC / SPA designations.
Whiteholme	▶ South Pennine Moors SAC ▶ South Pennine Moors Phase 2 SPA	-	Reservoir and associated operational land covered by SAC / SPA designations.
Light Hazzles	▶ South Pennine Moors SAC ▶ South Pennine Moors Phase 2 SPA	-	Reservoir and associated operational land covered by SAC / SPA designations.
Bottoms (Longdendale)		▶ South Pennine Moors SAC ▶ Peak District Moors (South Pennine Moors Phase 1) SPA	-
Cant Clough	-	▶ South Pennine Moors SAC ▶ South Pennine Moors Phase 2 SPA	SPA / SAC is immediately adjacent to reservoir body.
Castleshaw Upper	-	▶ South Pennine Moors SAC ▶ South Pennine Moors Phase 2 SPA	-
Chew	-	▶ South Pennine Moors SAC ▶ Peak District Moors (South Pennine Moors Phase 1) SPA	The reservoir is surrounded by the designated sites although the dam and associated operational areas are not within the SAC / SPA.
Coldwell Lower		▶ South Pennine Moors SAC ▶ South Pennine Moors Phase 2 SPA	-
Coldwell Upper	-	▶ South Pennine Moors SAC ▶ South Pennine Moors Phase 2 SPA	-
Crookgate		▶ South Pennine Moors SAC ▶ South Pennine Moors Phase 2 SPA	-
Dovestone	-	▶ South Pennine Moors SAC ▶ Peak District Moors (South Pennine Moors Phase 1) SPA	-
Dowry	-	▶ South Pennine Moors SAC ▶ South Pennine Moors Phase 2 SPA	-

Reservoir	Coincident European sites	European sites within 1km	Notes / other sites potentially exposed
Errwood	-	▶ South Pennine Moors SAC ▶ Peak District Moors (South Pennine Moors Phase 1) SPA	-
Fernilee	-	▶ South Pennine Moors SAC ▶ Peak District Moors (South Pennine Moors Phase 1) SPA	-
Greenfield	-	▶ South Pennine Moors SAC ▶ Peak District Moors (South Pennine Moors Phase 1) SPA	SPA / SAC is immediately adjacent to reservoir body.
Harlock	-	-	Morcambe Bay and Duddon Estuary SPA / Duddon Estuary Ramsar / Morcambe Bay Ramsar (within 3km; may be functionally linked).
Hanging Lees	-	▶ South Pennine Moors SAC ▶ South Pennine Moors Phase 2 SPA	-
Hurstwood	-	▶ South Pennine Moors SAC ▶ South Pennine Moors Phase 2 SPA	-
Kinder	-	▶ South Pennine Moors SAC ▶ Peak District Moors (South Pennine Moors Phase 1) SPA	SPA / SAC is immediately adjacent to reservoir body.
Laneshaw	-	▶ South Pennine Moors SAC ▶ South Pennine Moors Phase 2 SPA	-
New Years Bridge	-	▶ South Pennine Moors SAC ▶ South Pennine Moors Phase 2 SPA	-
Norman Hill	-	▶ South Pennine Moors SAC ▶ South Pennine Moors Phase 2 SPA	-
Pennington	-	-	Morcambe Bay and Duddon Estuary SPA / Duddon Estuary Ramsar / Morcambe Bay Ramsar (within 3km; may be functionally linked).
Piethorne	-	▶ South Pennine Moors SAC ▶ South Pennine Moors Phase 2 SPA	-
Poaka Beck	-	-	Morcambe Bay and Duddon Estuary SPA / Duddon Estuary Ramsar / Morcambe Bay Ramsar (within 3km; may be functionally linked).
Rhodeswood	-	▶ South Pennine Moors SAC ▶ Peak District Moors (South Pennine Moors Phase 1) SPA	-

Reservoir	Coincident European sites	European sites within 1km	Notes / other sites potentially exposed
Rooden	-	▶ South Pennine Moors SAC ▶ South Pennine Moors Phase 2 SPA	-
Stocks	-	-	Bowland Fells SPA (within 3km of reservoir; may be functionally linked).
Swinden 1	-	▶ South Pennine Moors SAC ▶ South Pennine Moors Phase 2 SPA	-
Swinden 2	-	▶ South Pennine Moors SAC ▶ South Pennine Moors Phase 2 SPA	-
Swineshaw Higher (Buckton Castle)	-	▶ South Pennine Moors SAC ▶ Peak District Moors (South Pennine Moors Phase 1) SPA	SPA / SAC is immediately adjacent to reservoir body.
Swineshaw Lower (Buckton Castle)	-	▶ South Pennine Moors SAC ▶ Peak District Moors (South Pennine Moors Phase 1) SPA	-
Torside	-	▶ South Pennine Moors SAC ▶ Peak District Moors (South Pennine Moors Phase 1) SPA	-
Valehouse	-	▶ South Pennine Moors SAC ▶ Peak District Moors (South Pennine Moors Phase 1) SPA	-
Wet Sleddale	-	▶ Lake District High Fells SAC ▶ River Eden SAC ▶ North Pennines Dales Meadows SAC	Lake District High Fells SAC is immediately adjacent to reservoir body; River Eden SAC starts adjacent to dam area; unit of North Pennines Dales Meadows SAC also located beneath dam.
Woodhead	-	▶ South Pennine Moors SAC ▶ Peak District Moors (South Pennine Moors Phase 1) SPA	-
Yeoman Hey	-	▶ South Pennine Moors SAC ▶ Peak District Moors (South Pennine Moors Phase 1) SPA	SPA / SAC is immediately adjacent to reservoir body.

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 sites:

- **South Pennine Moors Phase 2 SPA / Peak District Moors (South Pennine Moors Phase 1) SPA**: In addition to normal project-level planning and best-practice, construction of the scheme will avoid the breeding period (March – August) to minimise the risk of disturbance to merlin, golden plover and short-eared owl, 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 SPAs.
- **South Pennine Moors SAC**: In addition to normal project-level planning and best-practice, pre-design surveys will be used to identify suitable locations for scheme infrastructure and associated construction. These surveys will determine the location, quality and extent of the SAC interest features around any potential construction locations, and infrastructure (etc.) will be sited to ensure that the interest features of the site are not significantly affected.
- **River Eden 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.

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

Stocks reservoir is approximately 2.1km from the Bowland Fells SPA at its closest point, and is periodically used by **Lesser black-backed gulls** from the SPA's large colony during the breeding season and over winter. The extent of the functional linkages between Stocks reservoir and the SPA is not certain, but the SPA population does not appear to be dependent on the reservoir, with other gull species (e.g. black-headed gull) being dominant throughout the year. Recent tracking studies of black-backed gulls in the Bowland Fells SPA (Clewley *et al*. 2017) does not suggest that Stocks reservoir is especially important for these gulls during the breeding season: tracked gulls foraged almost exclusively in terrestrial habitats, principally urban areas and landfill sites to the south and southwest of the SPA with some use of local agricultural areas.

It is possible that construction works at Stocks reservoir could result in disturbance or displacement of Lesser black-backed gulls using the reservoir, resulting in increased energy expenditure and reduced energy intake (see Section 4.4 above). However, the reservoir covers over 130 ha. and it is extremely unlikely that the proposed works, which will be a small-scale, short-term undertaking within the operational area near the dam, will result in disturbance or displacements that significantly affect the species' use of the reservoir. Any effects will be local only and will be entirely moderated by the availability of terrestrial and open-water habitats away from the development area (see also Section 4.4 for notes on noise transmission). On this basis, adverse effects 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**). The other features of the SPA (**Merlin** and **Hen Harrier**) will not be particularly exposed or sensitive to works at Stocks reservoir due to their behavioural characteristics.

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

Pennington, Poaka Beck and Harlock reservoirs are located on an upland area between the Duddon Estuary and Morecambe Bay. Waterbodies that are close to estuarine SPAs can sometimes provide high-tide or night-time roosting sites for some SPA / Ramsar interest features, and may provide moulting sites. It is possible that construction works at these reservoirs could therefore result in disturbance or displacement of birds using the reservoir, resulting in increased energy expenditure and reduced energy intake (see Section 4.4 above). However, there is little evidence of any functional linkages with the nearby designated sites (based on reviews of ornithological records), so whilst it is likely that individual birds from the SPA / Ramsar periodically use the reservoirs, they are unlikely to provide a significant functionally-linked habitat resource that is important for the integrity of the SPA / Ramsar or its bird populations. On this basis, adverse effects 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**).

North Pennine Dales Meadows SAC

A unit of the North Pennine Dales Meadows SAC (Wet Sleddale Meadows SSSI) is located approximately 120m from the dam of the Wet Sleddale reservoir, and so construction is likely to take place in relatively close proximity to this site. The site has two fields containing the 'northern' hay meadow (sweet vernal-grass/wood crane's-bill) neutral grassland community (which contributes to the **Mountain hay meadows** feature) and an associated area of acidic marshy grassland (which may contribute to the ***Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae)*** feature, although this is not clear from the available data). The SSSI is classed as 'unfavourable declining' due to the meadow species composition, which is related to its management. The precise hydrological functioning of the SSSI is not clear, but it is likely to have some degree of hydrological connectivity with the adjacent headwaters of the River Lowther, although hay meadows are not 'inundation communities'.

Despite the proximity there will not be any direct construction effects on the SAC, and the potential indirect effects associated with construction (e.g. run-off, etc.) can clearly be avoided or controlled through the normal project planning process and standard best-practice measures (see Appendix G). On this basis, adverse effects would not be expected.

Peak District Moors (South Pennine Moors Phase 1) SPA

Twelve reservoir sites subject to Option WR159 are within ~1km of the Peak District Moors (South Pennine Moors Phase 1) SPA; these are Bottoms (Longdendale); Chew; Dovestone; Errwood; Fernilee; Greenfield; Kinder; Rhodeswood; Swineshaw Higher (Buckton); Swineshaw Lower (Buckton Castle); Torside; and Valehouse. Four of these sites have waterbodies immediately adjacent to the SPA (Chew, Greenfield, Kinder and Swineshaw Higher), with Chew being entirely surrounded by the SPA (although the designation does not cover the operational areas of the site).

The Peak District Moors (South Pennine Moors Phase 1) SPA is designated for its breeding populations of **Merlin, Golden plover** and **Short-eared owl** and includes the major moorland blocks of the South Pennines, including it covers extensive tracts of semi-natural moorland habitats. The operational areas of the reservoirs are outside the SPA (including for Chew, although the SPA surrounds this site) and so the site habitats will not be directly exposed to the likely effects of the scheme (in most instances the SPA is 'upstream' of the likely construction areas near the dams), and normal best-practice measures can be relied on to ensure that the site habitats are unaffected. The main risk of significant effects will be associated with the possible disturbance or displacement of breeding birds using habitats near the reservoirs (either within the SPA, or on functionally-linked land outside the designated site), resulting in increased energy expenditure and reduced energy intake (see also Section 4.4 above).

The scheme characteristics (within existing operational sites, small-scale, short-term only) will minimise the risk and magnitude of any potential effects on species using habitats outside the SPA boundary. The likely zone of influence for construction effects will be small, and the habitats affected are unlikely to be particularly important to the interest features. It is likely that the accessibility and availability of alternative habitat areas nearby, behavioural avoidance responses, and the short-term nature of any effects would ensure that SPA populations would not be sufficiently exposed to any effects for the integrity of the SPA to be undermined.

The possible exception to this is Chew, where the operational site is surrounded by the SPA, and so specific additional mitigation (avoidance of works during the breeding season) is identified. It may be necessary to undertake scheme-specific surveys, to demonstrate that these do not affect any important 'functionally-linked' habitats (although it is also worth noting that use of farmland by golden plover appears variable according to annual cropping patterns and rotations); however, any potential displacement effects could easily be avoided through scheme design, construction timing, or established mitigation (e.g. concurrent monitoring of construction areas for use by SPA species). On this basis, adverse effects would not be expected, and effects can in any case be avoided or controlled through the normal project planning process and standard best-practice measures (see Appendix G).

River Eden SAC

The River Lowther (which starts beneath the Wet Sleddale dam) forms part of the River Eden SAC. The 'River Lowther' unit of the River Eden and Tributaries SSSI (which underpins the SAC) is classified as being in 'unfavourable recovering' condition due to channel modifications that require addressing; the locations of these modifications are not identified, although the reaches immediately below the dam will be heavily influenced by the dam operation in any case.

The interest features likely to be present in the upper reaches of the Lowther are **Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation**; **Brook lamprey**; **Atlantic salmon**; **Bullhead**; **White-clawed (or Atlantic stream) crayfish**; **Otter**; and, potentially, **River lamprey**. The Lowther is known as one of the main salmon spawning rivers and supports populations of white-clawed crayfish. The other interest features of the SAC (**Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*** and **Sea lamprey**) are unlikely to be exposed to any effects due to their locations within the SAC.

The boundary of the SAC is ~110m from dam, and so the site is potentially vulnerable to construction effects if these are not appropriately controlled, particularly if works are required around the existing dam discharge location. The precise mitigation requirements will depend on the construction proposals, although the scheme characteristics (within existing operational site; short-term only) will help minimise the risk and magnitude of any potential effects on the interest features of the SAC. It may be necessary to undertake scheme-specific surveys once construction requirements are established, although 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; however, scheme-specific mitigation (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.

South Pennine Moors SAC

The site is the largest area of unenclosed moorland within West Yorkshire, and supports extensive areas of blanket bog with species-rich acidic flushes and mires. There are also wet and dry heaths and acid grasslands, and blocks of old sessile oak woods on the sloping fringes of the upland areas. The primary interest features of the site are **European dry heaths**; **Blanket bogs**; and **Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles. Northern Atlantic wet heaths with *Erica tetralix*** and **Transition mires and quaking bogs** are qualifying features.

Thirty-four reservoir sites subject to Option WR159 are within or within ~1km of this SAC. Most of these reservoir sites are outside the SAC although six are within:

- Chew (which is surrounded by the SAC, although the designation does not cover the operational areas of the reservoir site);
- Blackstone Edge (the SAC covers the reservoir itself but not the operational areas below the dam); and
- Readycon Dean, Warland, Whiteholme and Light Hazzles, which are entirely covered by the SAC designation.

At most reservoir sites (including Chew and Blackstone Edge) the SAC interest features will not be directly exposed to the likely effects of the scheme (in most instances the SAC is 'up-catchment' of the likely construction areas near the dams), and the scheme characteristics (within existing operational sites, small-scale, short-term only) and normal best-practice measures can be relied on to ensure that the SAC habitats are unaffected. The exception to this is the four reservoirs covered by the SAC designation, where all works will be within the SAC boundary.

The precise locations of construction works at these reservoirs is not certain, although works are likely to be in and around existing operational structures, including the dams. Any works will directly affect the area covered by the SAC and the siting of new structures will be dependent on a range of scheme-level investigations; as a result, and in the absence of specific survey data on feature distributions around the reservoirs, it is not possible (at the plan level) to definitively exclude the possibility that SAC interest features will be affected by the proposals (with the exception of the **Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles** feature, which is clearly absent from this area based on aerial photography). Scheme-level HRA will certainly be required, probably including appropriate assessment.

However, the SAC designation includes areas around the reservoirs from which the SAC interest features are clearly absent, and which are not otherwise important for the maintenance of site integrity – for example, access roads or tracks, hardstanding, or the dam structures and embankments. Furthermore, the scale of the installations (e.g. a $9m^3$ kiosk would have a footprint of ~3 – $5m^2$) is likely to ensure that the required installations can be sited in areas that are not critical to the integrity of the SAC.

It should also be noted that the DO gain for Option WR159 is achieved cumulatively through modifications at approximately 76 reservoir sites; consequently, it will be possible to drop particular schemes if project-level investigations demonstrate that adverse effects on the SAC features cannot be avoided. As a result, although the schemes proposed within this SAC have residual uncertainties that cannot be resolved at the plan-level, it is not considered necessary to identify a specific alternative to Option WR159 to mitigate this uncertainty and it is clear that adverse effects can be avoided at the project-level.

South Pennine Moors Phase 2 SPA

This site forms part of the Southern Pennines lying between Ilkley in the north and the Peak District National Park boundary in the south. The interest features and supporting habitats are as for the Peak District Moors (South Pennine Moors Phase 1) SPA (breeding populations of **Merlin, Golden plover** and **Short-eared owl**) and the South Pennine Moors SAC. In terms of impacts, the assessments for these sites (above) are both relevant; in summary:

- Works at 20 reservoir sites will be within or near the SPA; disturbance and displacement effects on the SPA interest features are possible but can be avoided with the incorporated measures (including the commitment to avoid works in the breeding period unless scheme-level investigation demonstrates that this is not required).
- Works at four reservoir sites (see South Pennine Moors SAC above) may directly affect supporting habitats for the SPA features, although the effect on this on SPA integrity are unlikely to be considered adverse due to the minimal scale of any impacts and the likelihood that any habitat loss will have no effect on breeding (etc.) success of the interest features due to the wide availability of similar habitat locally[26].

Consequently, although the schemes proposed within this SPA have residual uncertainties that cannot be resolved at the plan-level, it is not considered necessary to identify a specific alternative to Option WR159 to mitigate this uncertainty and it is clear that adverse effects on the SPA can be avoided at the project-level.

Conclusion

Option WR159 will involve minor works at a large number of reservoir sites, some of which are in or near European sites. For the vast majority of sites there will be either no effects, or no significant effects as any potential effects can clearly be avoided using standard best-practice measures at the project-level.

[26] Note, this is in contrast to the SAC where the permanent loss of any area of interest feature habitat (regardless of sisze) could be considered as being 'adverse' based on case law.

However, there are six reservoirs in relatively close proximity to European sites where there is a marginally greater risk of significant effects:

- Chew (surrounded by the South Pennine Moors SAC / Peak District Moors (South Pennine Moors Phase 1) SPA, although the designation does not cover the operational areas of the reservoir site);
- Blackstone Edge (the South Pennine Moors SAC and South Pennine Moors Phase 2 SPA cover the reservoir itself but not the operational areas below the dam);
- Readycon Dean, Warland, Whiteholme and Light Hazzles (covered by the South Pennine Moors SAC and South Pennine Moors Phase 2 SPA designated sites).

For most of these sites, established measures (e.g. avoiding works in the breeding season) can be relied on to ensure significant effects do not occur; however, the Readycon Dean, Warland, Whiteholme and Light Hazzles schemes will involve construction within the SAC and SPA and so the precise effects cannot be determined without scheme-level investigations. Despite this, due to the small scale of the works it is very likely that significant or adverse effects on the site interest features can be avoided by appropriate siting, and it will be possible to drop particular schemes from the option if project-level investigations demonstrate that adverse effects on the SAC features cannot be avoided. As a result, although the schemes proposed within South Pennine Moors SAC have residual uncertainties that cannot be resolved at the plan-level, it is not considered necessary to identify a specific alternative to Option WR159 to mitigate this uncertainty and it is clear that adverse effects can be avoided at the project-level.

5.10 Option WR160: Group 2 - Improved Reservoir Compensation Release Control

Summary of scheme

This option is similar to WR159, but would only be applied to four larger reservoirs (Thirlmere, Vyrnwy, Haweswater and Rivington). As with WR159, the option would allow compensation releases to be better matched to the licence conditions, so conserving reservoir storage. The precise scope of works required at each reservoir site is not clear at this stage in the planning process (scoping would form part of the works package) but in general the principal construction elements would be very limited, comprising:

- the provision of penstocks for compensation control; and
- installation of a 9m^3 kiosk to house telemetry and controls.

These works would take place within existing operational site boundaries, although the precise locations of kiosks are not known.

Likely impact pathways

Construction

The construction works required are relatively small-scale, mostly associated with existing assets, and so potential construction-related effects will be localised and short duration. 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.).

Given the scale of the works, these risks can almost certainly be avoided or controlled through the normal project planning process and standard best-practice measures (see **Appendix G**).

Operation

The operation of the schemes would be within the terms of the existing licences, simply allowing finer control of compensation releases, and so no operational effects would be expected.

Screening of European sites

The screening approach for Option WR159 is employed for this option also. **Table 5.17** identifies those European sites that are within 20km of a reservoir subject to this option (note, interest features are not shown but these are available from **Appendix C**); these sites are then screened based on the likely exposure and sensitivity of the interest features to the individual developments (rather than on a development-by-development basis).

Table 5.17 Screening of European sites within 20km of reservoirs included in Option WR160

European site	Proximity of nearest reservoir (km)										Consider further?	Rationale
	0km	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 7.5	7.5-10	10-15	15-20		
Asby Complex SAC								Y			No	No reasonable impact pathways (distance, separate catchment, etc.)
Berwyn a Mynyddoedd de Clwyd/ Berwyn and South Clwyd Mountains SAC			Y								No	No reasonable impact pathways (site is upland and up catchment of likely construction areas, and there will be no effects on site habitats due to distance / absence of pathways).
Berwyn SPA			Y								Yes	Mobile species may use habitats around construction area.
Borrowdale Woodland Complex SAC					Y						No	No reasonable impact pathways for habitat features (distance, separate catchment, etc.).
Lake District High Fells SAC		Y									No	No reasonable impact pathways (site is upland and up catchment of likely construction areas, and there will be no effects on site habitats due to absence of pathways).
Manchester Mosses SAC										Y	No	No reasonable impact pathways (distance, separate catchment, habitat-only features etc.)
Martin Mere Ramsar										Y	No	No reasonable impact pathways (distance, separate catchment, etc.)
Martin Mere SPA										Y	No	No reasonable impact pathways (distance, separate catchment, etc.)
Naddle Forest SAC		Y									Yes	Part of site at base of Haweswater dam.
North Pennine Dales Meadows SAC				Y							No	No reasonable impact pathways (distance, separate catchment, habitat-only features etc.)
Ribble and Alt Estuaries Ramsar										Y	No	No reasonable impact pathways (distance, separate catchment, etc.)
Ribble and Alt Estuaries SPA										Y	No	No reasonable impact pathways (distance, separate catchment, etc.)

European site	Proximity of nearest reservoir (km)										Consider further?	Rationale
	0km	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 7.5	7.5-10	10-15	15-20		
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC										Y	No	No reasonable impact pathways (distance, separate catchment, etc.)
River Derwent and Bassenthwaite Lake SAC		Y									Yes	Site starts at Thirlmere.
River Eden SAC			Y								Yes	Site covers Haweswater Beck below reservoir.
River Kent SAC								Y			No	No reasonable impact pathways (distance, separate catchment, etc.)
Tarn Moss SAC									Y		No	No reasonable impact pathways (distance, separate catchment, habitat-only features etc.)
Ullswater Oakwoods SAC							Y				No	No reasonable impact pathways (distance, separate catchment, habitat-only features etc.)
Wast Water SAC										Y	No	No reasonable impact pathways (distance, separate catchment, habitat-only features etc.)

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 sites:

- **Berwyn SPA**: In addition to normal project-level planning and best-practice, construction of the scheme will avoid the breeding period (March – August) to minimise the risk of disturbance to Red kite, Merlin, Hen harrier and Peregrine falcon, 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 SPAs.
- **River Eden SAC / River Derwent and Bassenthwaite Lake 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.

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.

Berwyn SPA

Berwyn SPA covers the uplands around Lake Vyrnwy. The SPA is designated for its breeding populations of **Red kite**, **Merlin, Hen harrier** and **Peregrine falcon** and is an extensive area of acidic upland, comprising blanket mire and heather-dominated heath. The operational areas of the reservoir is outside the SPA and so the site habitats will not be directly exposed to the likely effects of the scheme (the SPA is 'up catchment' of the likely construction areas near the dams), and normal best-practice measures can be relied on to ensure that the site habitats are unaffected. The main risk of significant effects will be associated with the possible disturbance or displacement of breeding birds using habitats near the reservoirs (either within the SPA, or on functionally-linked land outside the designated site), resulting in increased energy expenditure and reduced energy intake (see also Section 4.4 above).

The scheme characteristics (within the existing operational sites, small-scale, short-term only) will minimise the risk and magnitude of any potential effects on species using habitats outside the SPA boundary. The likely zone of influence for construction effects will be small, and the habitats affected are unlikely to be particularly important to the interest features. It is likely that the accessibility and availability of alternative habitat areas nearby, behavioural avoidance responses, and the short-term nature of any effects would ensure that SPA populations would not be sufficiently exposed to any effects for the integrity of the SPA to be undermined. On this basis, adverse effects would not be expected, and effects can in any case be avoided or controlled through the normal project planning process and standard best-practice measures (see **Appendix G**).

Naddle Forest SAC

The Naddle Forest SAC is an ancient relict forest with a diverse range of semi-natural woodland types due to the wide variation in soils, drainage, topography and altitude across the site. The majority of the woodland is located on the slopes and uplands to the east of the reservoir, although small section is present below the dam, adjacent to existing operational areas. The wet peaty soils of this area below the dam support stands of alder and willow carr; drier land away from the river has mixed deciduous woodland in which sessile oak is dominant with ash, hazel and birch. The interest feature present in this area of the SAC is therefore **Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles**. The other interest features of the site (**Northern Atlantic wet heaths with *Erica tetralix*** and **European dry heaths**) are associated with the upland areas of the site and so will not be exposed to construction effects. The SSSI units associated with

the area of woodland beneath the dam are in 'unfavourable – recovering' condition, principally due to variable regeneration; the Site Improvement Plan indicates that the main threat to the site is overgrazing by deer, with air pollution (nitrogen deposition) being a pressure.

The SAC covers the river below the dam although aquatic habitats are not a key component of the SAC. Despite the proximity there will not be any direct construction effects on the SAC, and the potential indirect effects associated with construction (e.g. run-off, etc.) can clearly be avoided or controlled through the normal project planning process and standard best-practice measures (see **Appendix G**). On this basis, adverse effects would not be expected.

River Derwent and Bassenthwaite Lake SAC

The St. John's Beck (which starts beneath the Thirlmere dam) forms part of the River Derwent and Bassenthwaite Lake SAC. It joins the River Greta approximately 6.7km downstream of Thirlmere; Bassenthwaite Lake is approximately 11.5km further downstream. The interest features likely to be present in the upper reaches of St John's Beck are **Brook lamprey**; **Atlantic salmon and River lamprey** (known to spawn in the beck); and **Otter.**

The remaining features are unlikely to be exposed to the scheme due to the distances downstream and likely attenuation of any construction effects. Bassenthwaite Lake (downstream of St John's Beck) forms part of the **Oligotrophic to mesotrophic standing waters** feature and also supports the **Floating water-plantain** feature. The SSSI citation indicates that **Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation** is present between Derwent Water and Bassenthwaite. The remaining feature (**Marsh fritillary butterfly**) have localised distributions and will not be exposed the effects of the scheme).

The boundary of the SAC is ~175m from dam, near the edge of the operational site, and so is potentially vulnerable to construction effects if these are not appropriately controlled, particularly if works are required around the existing dam discharge location. The precise mitigation requirements will depend on the construction proposals, although the scheme characteristics (within existing operational site; short-term only) will help minimise the risk and magnitude of any potential effects on the interest features of the SAC. It may be necessary to undertake scheme-specific surveys once construction requirements are established, although 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; however, scheme-specific mitigation (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

River Eden SAC

The Haweswater Beck (which starts beneath the Haweswater Dam) forms part of the River Eden SAC. The Haweswater Beck is part of the 'River Lowther' unit of the River Eden and Tributaries SSSI (which underpins the SAC) and is classified as being in 'unfavourable recovering' condition due to channel modifications that require addressing; the locations of these modifications are not identified, although the reaches immediately below the dam will be heavily influenced by the dam operation in any case.

The interest features likely to be present in the upper reaches of the Lowther are **Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation**; **Brook lamprey**; **Atlantic salmon**; **Bullhead**; **White-clawed (or Atlantic stream) crayfish**; **Otter**; and, potentially, **River lamprey**. The Lowther is known as one of the main salmon spawning rivers and supports populations of white-clawed crayfish. The other interest features of the SAC (**Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*** and **Sea lamprey**) are unlikely to be exposed to any effects due to their locations within the SAC.

The boundary of the SAC is ~875m from dam, and so the site is potentially vulnerable to construction effects if these are not appropriately controlled, particularly if works are required around the existing dam discharge location. The precise mitigation requirements will depend on the construction proposals, although the scheme characteristics (within existing operational site; short-term only) will help minimise the risk and

magnitude of any potential effects on the interest features of the SAC. It may be necessary to undertake scheme-specific surveys once construction requirements are established, although 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; however, scheme-specific mitigation (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.

Conclusion

Based on the available information it is clear that this option can be delivered with 'no adverse effect' on the integrity of the designated sites most exposed to the potential effects of the scheme (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.

5.11 Option WR821: Shropshire Union Canal

Summary of scheme

This option would involve a new abstraction from Shropshire Union Canal (Middlewich branch) at Hurleston Junction (Nantwich) and treatment to potable standards followed by transfer to existing treated water storage in the IRZ. The principal construction elements of this option are:

- increased abstraction volume at existing abstraction pumps on the Shropshire Union Canal (located at Hurleston WTW) by 30 Ml/d;
- install fish screens at abstraction point;
- increased treatment capacity at Hurleston WTW (either within existing site, or on new second works near the existing WTW); and
- a ~6km treated water pipeline connection to the mid-Cheshire main, from Hurleston to Nanneys Bridge.

The option would require an increased abstraction licence from the Environment Agency for the canal abstraction. The DO gain is achieved by utilising surplus water in the Birmingham Canal Navigation to either supplement the inputs at Hurleston WTW or be used in conjunction with the existing Llangollen transfer. The option would not involve any alterations to abstractions that supply the canal.

Likely impact pathways

Construction

The construction works required are unexceptional, involving construction of a 6km pipeline (partly cross-country, partly within roads), alternations to the canal intake / pumps, and a new treatment plant either within the existing operational site at Hurlestone, or on a new site on nearby agricultural land. 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.).

Given the scale of the works, these risks can almost certainly be avoided or controlled through the normal project planning process and standard best-practice measures (see **Appendix G**).

Operation

The existing abstraction licence for the canal would be increased to allow the additional 30 Ml/d abstraction. This increase would be serviced by surplus water from the Birmingham Canal Navigation, which would not require any changes to licence conditions. The increased abstraction may increase fish entrainment from the canal, but other operational effects would not be expected. The canal eventually links to the Manchester Ship Canal at Ellesmere port.

Screening of European sites

There are 6 European sites downstream or within 20km of this option, or otherwise linked by a potential effect pathway. The sites, their interest features, and location relative to the option are set out in **Table 5.18**.

Table 5.18 European sites within 20 km of option, or otherwise connected

Site and Interest Features	~Distance / Connectivity
Midland Meres and Mosses Phase 1 Ramsar ▸ Crit. 1 - sites containing representative, rare or unique wetland types ▸ Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities	7.6km
Midland Meres and Mosses Phase 2 Ramsar ▸ Crit. 1 - sites containing representative, rare or unique wetland types ▸ Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities	9.0 km
Oak Mere SAC ▸ Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae)* ▸ Transition mires and quaking bogs	11.8 km
West Midlands Mosses SAC ▸ Natural dystrophic lakes and ponds ▸ Transition mires and quaking bogs	7.6km
Brown Moss SAC ▸ Floating water-plantain *Luronium natans*	16.1km
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC ▸ 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*	19.9km

*Priority features
DS – Downstream site

These sites will be unaffected by the option, primarily due to the absence of impact pathways; these sites are identified in **Table 5.19**, 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 5.19 Initial screening of European sites

Site	Consider further?	Rationale
Midland Meres and Mosses Phase 1 Ramsar	No	No reasonable impact pathways (distance, separate catchment, etc.)
Midland Meres and Mosses Phase 2 Ramsar	No	No reasonable impact pathways (distance, separate catchment, etc.)
Oak Mere SAC	No	No reasonable impact pathways (distance, separate catchment, etc.)
West Midlands Mosses SAC	No	No reasonable impact pathways (distance, separate catchment, etc.)
Brown Moss SAC	No	No reasonable impact pathways (distance, separate catchment, etc.)
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC	No	No reasonable impact pathways (distance, separate catchment, etc.)

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.

Conclusion

In summary, it is considered that this option will have no effects on the interest features of any European sites, due to distance, the absence of reasonable impact pathways, and the reliability of best-practice construction measures.

5.12 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 Preferred Options

The assessment of between-option 'in combination' effects focuses on Alternative Plan 4, since this incorporates all of the options included under the other plans and is the preferred plan. The 'in combination' assessment does not include 'demand management' options (as these will not negatively affect any European sites) or 'leakage' options (as works that may be required under these options cannot be identified at the plan-level). The assessment therefore focuses on:

- Options B2, WR099b, WR101, WR102e, WR113, WR114, WR159, WR160 and WR821; and
- The Resilience Options A – E, recognising that these are not yet defined and so cannot be assessed in detail.

Table 5.21 summarises all of the European sites that are within 20km of at least two options, and which were therefore included in the screening process. It then indicates the conclusion of the screening and appropriate assessment stages detailed above for each option. The sites / options are then screened for potential for 'in combination' effects, again taking into account established project-level measures that are known to be effective. The colour key of the table is as follows:

Table 5.20 Key to Table 5.21

Key	
0	Options with no effect (alone) on any European sites (as opposed to 'no significant effect') due to absence of impact pathways.
N	Options with effect pathways but which will clearly have no significant effect alone at project-level.
N	Options with effect pathways but which can clearly avoid adverse effects at project-level with mitigation / avoidance measures.
U	Options where adverse effects cannot be categorically excluded at the plan-level.
?	Uncertain effect options – resilience options that are not defined.
	European sites where there will be no 'in combination' effects between options.
	European sites where potential 'in combination' effect pathways exist, but which are clearly avoidable at the project-level.
	European sites where in combination effects between options cannot be categorically excluded at the plan-level.
	European sites where there are likely to be significant adverse in combination effects between options.

Note, for the Resilience Options **Table 5.21** only includes those European sites within 1km of the route of the Manchester and Pennine Aqueduct (rather than 20km); this is likely to be representative of the sites potentially exposed to the types of activities expected under these options although this aspect will be reviewed once the Resilience Options are fully defined.

In addition, it should be noted that the assessment of Option B2 should technically adopt the conclusion of the 'worst' other option, as Option B2 relies on the delivery of the other options.

Table 5.21 Between-option 'in combination' assessment

European site	Effects of options 'alone' on each site													In combination effects?
	B2	WR099B	WR101	WR102e	WR113	WR114	WR159	WR160	WR821	Resilience A	Resilience B	Resilience C	Resilience D	Resilience E	
Asby Complex SAC							0	0							Options will have no effect on this site so no in combination effects
Berwyn a Mynyddoedd de Clwyd/ Berwyn and South Clwyd Mountains SAC	0							0							Options will have no effect on this site so no in combination effects
Berwyn SPA	0							N							Option B2 will have no effects on this site so no in combination effects.
Borrowdale Woodland Complex SAC							0	0							Options will have no effect on this site so no in combination effects
Bowland Fells SPA			0				N			?	?		?	?	Potential in combination effects if options constructed simultaneously but avoidable with normal measures.
Calf Hill and Cragg Woods SAC			0				0								Options will have no effect on this site so no in combination effects
Lake District High Fells SAC							0	0							Options will have no effect on this site so no in combination effects
Liverpool Bay / Bae Lerpwl SPA			0	0											Options will have no effect on this site so no in combination effects
Manchester Mosses SAC				0			0	0							Options will have no effect on this site so no in combination effects
Midland Meres and Mosses Phase 1 Ramsar	0			0	0		0		0						Options will have no effect on this site so no in combination effects
Midland Meres and Mosses Phase 2 Ramsar	0			0					0						Options will have no effect on this site so no in combination effects

European site	Effects of options 'alone' on each site														In combination effects?
	B2	WR099B	WR101	WR102e	WR113	WR114	WR159	WR160	WR821	Resilience A	Resilience B	Resilience C	Resilience D	Resilience E	
Morecambe Bay Ramsar			0				N								Option WR099b will have no effects on this site so no in combination effects.
Morecambe Bay SAC			0				0								Options will have no effect on this site so no in combination effects
Morecambe Bay & Duddon Estuary SPA			0				N								Option WR099b will have no effects on this site so no in combination effects.
Naddle Forest SAC							0	N		?	?	?	?	?	Potential in combination effects if options constructed simultaneously but avoidable with normal measures.
North Pennine Dales Meadows SAC							N	0							Option WR160 will have no effects on this site so no in combination effects.
Peak District Dales SAC					0		0								Options will have no effect on this site so no in combination effects
Peak District Moors (South Pennine Moors Phase 1) SPA					N	N	N								Potential in combination effects if options constructed simultaneously but avoidable with normal measures.
Ribble and Alt Estuaries Ramsar			0	0				0							Options will have no effect on this site so no in combination effects
Ribble and Alt Estuaries SPA			0	0				0							Options will have no effect on this site so no in combination effects
River Dee and Bala Lake/ Afon Dyfrdwy a Llyn Tegid SAC	0							0	0						Options will have no effect on this site so no in combination effects
River Derwent and Bassenthwaite Lake SAC							N	N							Potential in combination effects if options constructed simultaneously but avoidable with normal measures.

European site	Effects of options 'alone' on each site														In combination effects?
	B2	WR099B	WR101	WR102e	WR113	WR114	WR159	WR160	WR821	Resilience A	Resilience B	Resilience C	Resilience D	Resilience E	
River Eden SAC							N	N							Potential in combination effects if options constructed simultaneously but avoidable with normal measures.
River Kent SAC							0	0		?	?		?	?	Options WR159/160 will have no effects on this site so no in combination effects (assuming one resilience option).
Rochdale Canal SAC		0				0	U			?	?		?	?	Potential in combination effects if options constructed simultaneously but avoidable with normal measures.
South Pennine Moors Phase 2 SPA		N				0	N								Potential in combination effects if options constructed simultaneously but avoidable with normal measures.
South Pennine Moors SAC		0			0	0	U								Options WR099b/113/114 will have no effects on this site so no in combination effects.
Ullswater Oakwoods SAC							0	0							Options will have no effect on this site so no in combination effects
Wast Water SAC							0	0							Options will have no effect on this site so no in combination effects
West Midlands Mosses SAC	0								0						Options will have no effect on this site so no in combination effects

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 (etc). 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 Preferred Options. The potential for currently identified NSIPs to operate in combination with the WRMP Options is summarised in **Table 5.22** 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 5.22 Summary of 'in combination' assessment for WRMP Options and known major schemes / NSIPs

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 ▶ River Derwent and Bassenthwaite Lake SAC ▶ River Eden SAC	No 'in combination' effects – WRMP options can be avoided with normal best-practice.
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 ▶ River Derwent and Bassenthwaite Lake SAC ▶ Bowland Fells SPA	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.
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	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.
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.

NSIP / Major Scheme	Stage	Summary	European sites potentially exposed to project and WRMP Options	'In combination' assessment
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.
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.

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 Preferred 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 managementmanagement 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. It is also informally reviewed on an annual basis.

It is therefore considered that the Preferred 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 Preferred Options and the absence of detail on allocation proposals makes any 'in combination' assessment difficult and potentially meaningless. However, the Preferred 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 (although new licences for mothballed sources may be required, e.g. WR114).

UU's Drought Plan

The Drought Plan identifies those European sites that may be at risk and provides a mechanism for additional studies to quantify this risk and identify potential solutions that avoid or minimise adverse effects. However, it must be recognised that the 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 is currently revising its Drought Plan, 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, potential 'in combination' effects between the Drought Plan 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); 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[27]. 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

There is potential for UU's WRMP to have 'in combination' effects with the WRMPs of other water companies. These WRMPs are being reviewed and updated on the same statutory timescale as the UU's WRMP and therefore 'in combination' effects with the new WRMPs cannot be fully assessed until after the plans are published for consultation and the Preferred Options identified.

[27] In addition, it should be noted that many of the Drought Plan options are essentially the same as WRMP options, and therefore are mutually exclusive.

6. Summary and Conclusions

UU has completed its modelling of the supply-demand balance for WRMP planning period, and no WRZs have a predicted deficit. UU has identified four 'alternative plans' for the consultation draft of the WRMP consultation stage; the options of these plans have been subject to HRA. This section summarises the conclusions of the HRA of the consultation draft of the WRMP; these will be reviewed prior to the issue of the final WRMP.

6.1 Summary

The 'plan-level' assessment of the options in summarised in **Table 6.1**. 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 6.1** also provides a 'conclusion' for the effects of each option. In summary, the conclusions for all of the options is 'no likely significant 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, except for:

- Option WR114 (Python Mill), where there is residual uncertainty regards the operational effects of the scheme on the Rochdale Canal SAC; and
- Option WR159 as it relates to the Readycon Dean, Warland, Whiteholme and Light Hazzles reservoirs as this will involve construction within the South Pennine Moors SAC and South Pennine Moors Phase 2 SPA.

Plan-level mitigation measures have been identified for these options to ensure that they can be delivered with no adverse effects on any sites or (if project-level HRA demonstrates this is not possible) that a 'no significant effect' alternatives are available. It is considered that Option WR159 can clearly be delivered without adverse effects on site integrity, based on the scale of the works required and the characteristics of the sites. There is some residual uncertainty regards the effects of Option WR114, which is resolve (at the plan-level) by the identification of Option WR100 as an alternative to be deployed should scheme-level investigations demonstrate that adverse effects will occur.

6.2 Conclusion

The conclusion of the HRA of the consultation draft WRMP is necessarily preliminary as

i. the Resilience Options are not yet fully scoped; and

ii. the content of the final plan may change following consultation.

It is likely, based on the available works information, that the Resilience Options can be delivered with 'no significant effects' on any European sites – although this cannot be confirmed at this point. With regard to the remaining options it is clear that the majority of these will have 'no significant effects alone or in combination' if brought forward as projects; where there are residual uncertainties in the 'plan-level' assessment of these options, mitigation measures are identified to ensure that the WRMP will not result in adverse effects that cannot be avoided with scheme-level measures; this includes the identification of an alternative 'no significant effect' option for WR114. As a result, the preliminary conclusion of the HRA of the consultation draft WRMP is that the plan will have **no adverse effects, alone or in combination**. 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 6.1 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	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 options	Construction	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.	-
Resilience options A – E	Construction	?	?	Options are not sufficiently developed at this stage to allow assessment	-
	Operation	?	?	Options are not sufficiently developed at this stage to allow assessment	-
enabling works				in UU customers being supplied by available water from sources other than Vyrnwy, so enabling the transfer of water from Lake Vyrnwy by Thames Water. The enabling works would have no construction-phase effects on any European sites; however, the option relies on delivery of the other options below and so the assessment requires that the mitigation (etc.) for these options is delivered.	▶ Established best-practice avoidance and mitigation measures (Appendix G), including all bespoke measures identified for the options below.
	Operation	-	-	The scheme will involve some increases in abstraction although these will be within the terms of the existing licences, confirmed under the Review of Consents, and so operational effects as a result of the enabling works would not be expected. The operational effects of the transfer scheme downstream of Vyrnwy will be considered by Thames Water as part of its WRMP assessments.	-

Option	Aspect	LSE	AE	Summary of Assessment	Key avoidance / mitigation measures
WR099b Worsthorne Borehole (Hurstwood IR)	Construction	N*	N	Re-instatement of the Worsthorne borehole under the terms of the existing abstraction licence. This scheme will require construction works near the **South Pennine Moors Phase 2 SPA**, which has interest features that use habitats outside the SPA boundary, and which may therefore be exposed to the effects of the scheme. However, it is clear that this option can be delivered with 'no adverse effect' on the integrity of the South Pennine Moors Phase 2 SPA, and in practice the incorporated measures would ensure that 'significant effects' would be avoided entirely at the project-level through project planning or normal best-practice measures. The plan-level conclusion for this option would therefore be '**no likely significant effects alone or in combination**'.	▶ In addition to normal project-level planning and best-practice, construction of the scheme will avoid the breeding period (March – August) to minimise the risk of disturbance to merlin and golden plover, 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 SPA
	Operation	N	-	There will be no operational effects as a result of this scheme (within existing licence confirmed under the Review of Consents, absence of impact pathways).	-
WR101 Franklaw Z Site plus increased Franklaw WTW Treatment Capacity	Construction	N	-	Re-instatement of boreholes under the terms of the existing licences, and upgrade of WTW treatment capacity. This scheme will have no effects on the interest features of any European sites, due to distance, the absence of reasonable impact pathways, and the reliability of best-practice construction measures. The plan-level conclusion for this option would therefore be '**no likely significant effects alone or in combination**'.	▶ Established best-practice avoidance and mitigation measures (Appendix G).
	Operation	N	-	There will be no operational effects as a result of this scheme (within existing licence confirmed under the Review of Consents, absence of impact pathways).	-
WR102e Bold Heath Boreholes to Prescot WTW	Construction			Recommissioning of existing Bold Heath boreholes with a new raw water transfer main to Prescot open reservoirs for treatment at Prescot WTW. This scheme will have no effects on the interest features of any European sites, due to distance, the absence of reasonable impact pathways, and the reliability of best-practice construction measures. The plan-level conclusion for this option would therefore be '**no likely significant effects alone or in combination**'.	▶ Established best-practice avoidance and mitigation measures (Appendix G).
	Operation	N	-	There will be no operational effects as a result of this scheme (absence of impact pathways).	-
WR113 Tytherington Boreholes	Construction			New treated water main, borehole improvements and WTW modifications. This scheme will have no effects on the interest features of any European sites, due to distance, the absence of reasonable impact pathways, and the reliability of best-practice construction measures. The plan-level conclusion for this option would therefore be '**no likely significant effects alone or in combination**'.	▶ Established best-practice avoidance and mitigation measures (Appendix G).

Option	Aspect	LSE	AE	Summary of Assessment	Key avoidance / mitigation measures
	Operation	N	-	There will be no operational effects as a result of this scheme (within existing licence confirmed under the Review of Consents, absence of impact pathways).	-
WR114 Python Mill Borehole	Construction	N	-	Construction of this scheme will have no effects on the interest features of any European sites, due to distance, the absence of reasonable impact pathways, and the reliability of best-practice construction measures. The plan-level conclusion for this option would therefore be '**no likely significant effects alone or in combination**'.	▶ Established best-practice avoidance and mitigation measures (Appendix G).
	Operation	U	U	Reinstatement of the Python Mill Borehole (licence previously revoked) to provide compensation water to the Rochdale Canal, allowing water from Chelburn reservoir to be used in supply. Option WR114 has a number of uncertainties around its operation that ensure that the HRA cannot, at the WRMP-level, exclude the possibility of significant or significant adverse effects on the Rochdale Canal SAC due to differences in the physio-chemical characteristics of the compensation water. It is possible that substantial differences in water quality may not be treatable and that the implementation of the scheme could not then be completed without adverse effects occurring (although adverse effects would appear improbable based on the available data and various moderating factors). Inclusion of the option in the WRMP will allow UU to investigate the residual uncertainties, and so the uncertainty that this introduces is addressed at the WRMP level through the identification of alternative options will be employed should Option WR114 not pass the HRA tests at the project-level. The plan-level conclusion for this option would therefore be '**no likely significant effects alone or in combination**' once the mitigation (alternative option) is applied.	▶ The alternative option proposed is WR100 (Thorncliffe Road Borehole, Barrow-In-Furness, and is assessed in Appendix H.

Option	Aspect	LSE	AE	Summary of Assessment	Key avoidance / mitigation measures
WR159 Group 1 - Improved Reservoir Compensation Release Control	Construction	U	N	This option would involve the installation of automated compensation control to conserve reservoir storage at ~76 regional reservoirs; this would allow compensation releases to be more closely controlled whilst meeting the licence conditions. For most of these sites, established measures can be relied on to ensure significant effects do not occur; however, the Readycon Dean, Warland, Whiteholme and Light Hazzles schemes will involve construction within the **South Pennine Moors SAC and South Pennine Moors Phase 2 SPA** and so the precise effects on the interest features of these sites cannot be determined without scheme-level investigations. Despite this, due to the small scale of the works it is clear that adverse effects on the site interest features can be avoided by appropriate siting (e.g. locating equipment on existing operational areas), and it will be possible to drop particular schemes from the option if project-level investigations demonstrate that adverse effects on the SAC features cannot be avoided. As a result, although the schemes proposed within **South Pennine Moors SAC** have residual uncertainties that cannot be resolved at the plan-level, it is not considered necessary to identify a specific alternative to Option WR159 to mitigate this uncertainty, and it is clear that adverse effects can be avoided at the project-level. The plan-level conclusion for this option would therefore be '**no adverse effects alone or in combination**'	▶ **South Pennine Moors Phase 2 SPA / Peak District Moors (South Pennine Moors Phase 1) SPA**: In addition to normal project-level planning and best-practice, construction of the scheme will avoid the breeding period (March – August) to minimise the risk of disturbance to merlin, golden plover and short-eared owl, 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 SPAs. ▶ **South Pennine Moors SAC**: In addition to normal project-level planning and best-practice, pre-design surveys will be used to identify suitable locations for scheme infrastructure and associated construction. These surveys will determine the location, quality and extent of the SAC interest features around any potential construction locations, and infrastructure (etc.) will be sited to ensure that the interest features of the site are not significantly affected. ▶ **River Eden 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	-	There will be no operational effects as a result of this scheme (within existing licence, absence of impact pathways).	-

Option	Aspect	LSE	AE	Summary of Assessment	Key avoidance / mitigation measures
WR160 Compensation Over Release Control	Construction			This option would involve the installation of automated compensation control to conserve reservoir storage at four impoundment reservoirs; this would allow compensation releases to be more closely controlled whilst meeting the licence conditions. Several European sites are potentially exposed to the effects of the scheme (**Berwyn SPA; Naddle Forest SPA; River Derwent and Bassenthwaite Lake SAC; River Eden SAC**). However, it is clear that this option can be delivered with 'no adverse effect' on the integrity of these sites, and in practice the incorporated measures would ensure that 'significant effects' would be avoided entirely at the project-level. The plan-level conclusion for this option would therefore be '**no likely significant effects alone or in combination**'.	▶ **Berwyn SPA**: In addition to normal project-level planning and best-practice, construction of the scheme will avoid the breeding period (March – August) to minimise the risk of disturbance to Red kite, Merlin, Hen harrier and Peregrine falcon, 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 SPAs. ▶ **River Eden SAC / River Derwent and Bassenthwaite Lake 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	-	There will be no operational effects as a result of this scheme (within existing licence, absence of impact pathways).	-
WR821 Shropshire Union Canal	Construction	N	-	This option would involve a new abstraction from Shropshire Union Canal/Middlewich branch, treatment to potable standards and transfer to treated water storage in the IRZ. This scheme will have no effects on the interest features of any European sites, due to distance, the absence of reasonable impact pathways, and the reliability of best-practice construction measures. The plan-level conclusion for this option would therefore be '**no likely significant effects alone or in combination**'.	▶ Established best-practice avoidance and mitigation measures (Appendix G).
	Operation	N	-	There will be no operational effects as a result of this scheme (within existing licence, absence of impact pathways).	-

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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[28]. 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.

[28] 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)*	

Sites within 20km and Interest Features	Within UU Area?
Embryonic shifting dunes	
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	

Sites within 20km and Interest Features	Within UU Area?
Tilio-Acerion forests of slopes, screes and ravines	
Irthinghead Mires 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 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

Sites within 20km and Interest Features	Within UU Area?
Great crested grebe *Podiceps cristatus*	
Common shelduck *Tadorna tadorna*	
Eurasian wigeon *Anas penelope*	
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	

Sites within 20km and Interest Features	Within UU Area?
Mountain hay meadows	
Blanket bogs (if active bog)	
Petrifying springs with tufa formation (*Cratoneurion)*	
Alkaline fens	
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*	

Sites within 20km and Interest Features	Within UU Area?
Northern pintail *Anas acuta*	
Eurasian oystercatcher *Haematopus ostralegus*	
Ringed plover *Charadrius hiaticula*	
Grey plover *Pluvialis squatarola*	
Red knot *Calidris canutus*	
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

Sites within 20km and Interest Features	Within UU Area?
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*	
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)*	

Sites within 20km and Interest Features	Within UU Area?
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*	
River Ehen SAC	Y
Freshwater pearl 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 pearl 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	

Sites within 20km and Interest Features	Within UU Area?
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	
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*	

Sites within 20km and Interest Features	Within UU Area?
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*	
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*	

Sites within 20km and Interest Features	Within UU Area?
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*	
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	

Sites within 20km and Interest Features	Within UU Area?
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	
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	Reviewer
.....	.....
Mike Frost	Pete Davis

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Management systems

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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 treated water storage facility.	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 an existing treated water storage facility.	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 treated water storage facility and new WTW at same location • Transfer to existing treated water storage facility.	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
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)
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.)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
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.
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.

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
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 existing treated water storage sites, 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
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

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR062a	Worthington WTW	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 treated water storage facility.	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
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
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 existing treated water storage site and 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)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
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 existing treated water storage site • New WTW facility built at existing treated water storage 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;
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;
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 a treated water storage site • New WTW at Caldbeck • Treated water transfer to existing treated water storage site and new TW main between two treated water storage sites; assume 50/50 split between each	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
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

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
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
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 treated water storage facility 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 existing treated water storage 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

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
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.)
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	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)
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.)
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;
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;

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
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;
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;
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.)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
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 treated water storage 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.)
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;
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 at existing treated water storage 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.)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
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)
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.)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
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
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 treated water storage site • New WTW located at treated water storage 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 treated water storage site • New WTW located at treated water storage 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.)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR113	Tytherington Boreholes	The scheme would require: • New TW main 2.9km 315mmOD between Tytherington WTW and treated water storage site • 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 water; etc.)
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 an existing treated water storage site. 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 treated water storage site.	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.)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
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 treated water storage facility • 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 treated water storage site, 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
WR120	Cross Hill Boreholes, Wirral	This option involves three new boreholes at an existing treated water storage site, with a new WTW on the same site. The principal construction elements of this option are: • Construct three new 150m deep boreholes at existing treated water storage site, 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 treated water storage 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 an existing treated water storage site, with a new WTW on the same site. The principal construction elements of this option are: • Construct three new 150m deep boreholes at existing treated water storage site, 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 treated water storage 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

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
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 an existing site, 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;
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.)
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 a treated water storage site 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.)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
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 treated water storage site.	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
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

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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 • New PS and transfer of raw water to existing site of Martholme WTW, 10 Ml/d using most appropriate pipeline route • 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.)
WR146	Davyhulme – Final Effluent Reuse	This scheme would involve effluent reuse using flows from Davyhulme WwTW; new treatment works; new treated water storage facility 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 treated water storage facility 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

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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 an existing treated water storage site. 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 treated water storage, 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	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence;
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 treated water storage site 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

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
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.)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
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)

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
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 a treated water storage site.	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 treated water storage sites.	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.)

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
.....	.....
Mike Frost	Alex Melling

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Appendix A

Summary of review of new Feasible Option

Report rr078i2 Appendix A - Summary of Review of Additional 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

Report rr078i2 Appendix A - Summary of Review of Additional Feasible Option

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;
WR113	Tytherington Boreholes	The scheme would require: • New TW main 2.9km 315mmOD between Tytherington WTW and treated water storage site • 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 water; etc.)

Report rr078i2 Appendix A - Summary of Review of Additional Feasible Option

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 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.

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 an exising treated water storage facility.	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 treated water storage site; new WTW to treat river water; transfer to existing treated water storage	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 an existing treated water storage site • New WTW process for lowland river water; output blended with existing water at a treated water storage facility • 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_WR013	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 Environment Agency.	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 two existing treated water storage sites 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 Treated Water Storage Site	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 treated water storage site (with assumed demands): • (115mAOD) 1 Ml/d • (65mAOD) 2.5 Ml/d • (176mAOD) 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 treated water storage facilities at 172mAOD and 110mAOD which are small, 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 Treated Water Storage Site	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 treated water storage (with assumed demands): • (115mAOD) 1 Ml/d • (65mAOD) 2.5 Ml/d • (176mAOD) 2 Ml/d • (135mAOD) 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+C16 quantities available for abstraction will need to be confirmed with the Environment Agency • It should be possible to supply treated water storage facilities at 172mAOD and 110mAOD which are small 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 Treated Water Storage Site	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 treated water storage (54mAOD)	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.)
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 Weaver , 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

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
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 treated water storage sized at between 2.5 and 5 Ml/d and transfer to existing treated water 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 Existing Treated Water Storage Site	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 existing treated water storage facility.	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 existing treated water storage sites, 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
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 existing treated water storage sites, 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

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR044	River Waver to Existing Treated Water Storage Site	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 existing treated water storage facility • New WTW at same site as treated water storage sized at between 2.5-5.0 Ml/d and transfer to existing treated water storage facility. 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 Existing Treated Water Storage Site	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 existing treated water storage facility • New WTW at same site as treated water storage sized at between 2.5 and 5 Ml/d and transfer to existing treated water storage facility. 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
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 two existing treated water storage sites, 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

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
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	Operation: Uncertain - significant effects cannot be excluded without additional analysis (modelling etc) of scheme operation and / or identification of acceptable operational mitigation measures
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 facilities; (4 Ml/d) and (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. 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 at an existing treated water storage	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 31 1m 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)

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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 existing treated water storage site • New WTW facility built at existing treated water storage 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 existing treated water storage facility.	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-WR126	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 existing treated water storage facility • New WTW • New connection to existing treated water storage facility.	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 Existing Treated Water Storage Site	The scheme would require: • New borehole sized at 2 Ml/d at Durdar, new WTW (located at either of two existing treated water storage sites), new pipeline to treated water storage facility • 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 at either of two existing treated water storage sites.	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

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WR097	Kirklinton Boreholes	This option would involve new boreholes located at Scaleby and Newtown, new WTW, a treated water transfer to existing treated water storage site, and an upsized treated water connection to further treated water storage site. 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 two treated water storage sites • New WTW located at Waygill Hill site to treat up to 5 Ml/d, transfer to existing treated water storage • New increased capacity treated water main between two treated water storage sites.	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 two existing treated water storage sites. 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 (treated water storage).	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 two treated water storage sites using existing raw water transfers • Treated water to two existing treated water storage sites.	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 redundant treated water storage site to transfer up to 3 Ml/d raw water • New c.1.6km raw water main between site of redundant treated water storage site 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.)
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 treated water storage facility.	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.

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WR131	Desalination - Wirral	This scheme would involve a new desalination plant on the Wirral peninsula; a new WTW; and transfer of treated water to a treated water storage site. 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 treated water storage facility.	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 a treated water storage site. 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 treated water storage facility.	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 treated water storage site 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.
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

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
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
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 two treated water storage sites.	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	Operation: Yes - no effects or clearly no LSE alone or in combination (e.g. no impact pathways; features not sensitive; within existing licence;

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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
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.)

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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;
WR166	Penrith Boreholes to Treated Water Storage Site	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 an existing treated water storage facility. 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 a treated water storage site.	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;
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;
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;

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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;
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	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
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

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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 a treated water storage facility.	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 water; etc.)
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 a treated water storage site • New WTW located at an existing treated water storage facility, 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.)
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 a treated water storage site, 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 treated water storage site • 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

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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
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 treated water storage facility.	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 treated water storage facility. • New WTW located treated water storage site 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

Number	Name	Summary (from proforma)	General Assessment	Recommend option?	Recommend option? (Operation)
WR845	Dalston BH to Existing Treated Water Storage Site	The principal construction elements of this option are: • Existing BH abstraction at Nestle factory – Dalston • Raw water transfer main to a treated water storage site (pumping required) • Treatment to potable standard • Transfer to treated water storage.	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

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[29], including:
  - PPG1: General guide to the prevention of pollution (May 2001);
  - PPG5: Works and maintenance in or near water (October 2007);

[29] 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

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 WR099b

Site	Feature	Avoidance Measures (in addition to general measures)
South Pennine Moors Phase 2 SPA	▶ Merlin ▶ Golden plover ▶ Short-eared owl	Construction of the scheme will avoid the breeding period (March – August) to minimise the risk of disturbance to merlin and golden plover, unless scheme-specific surveys or analyses demonstrate that any potential effects associated with construction works can be avoided (e.g. through construction site supervision / monitoring), will be 'not significant' (i.e. birds will not be exposed to construction effects), or will have no adverse effect on the integrity of the SPA.

Table G2 Receptor-specific avoidance measures for Option WR159

Site	Feature	Avoidance Measures (in addition to general measures)
South Pennine Moors Phase 2 SPA **Peak District Moors (South Pennine Moors Phase 1) SPA**	▶ Merlin ▶ Golden plover ▶ Short-eared owl	Construction of the scheme will avoid the breeding period (March – August) to minimise the risk of disturbance to merlin and golden plover, unless scheme-specific surveys or analyses demonstrate that any potential effects associated with construction works can be avoided (e.g. through construction site supervision / monitoring), will be 'not significant' (i.e. birds will not be exposed to construction effects), or will have no adverse effect on the integrity of the SPA.
South Pennine Moors SAC	▶ Northern Atlantic wet heaths with *Erica tetralix* ▶ European dry heaths ▶ Blanket bogs (* if active bog) ▶ Transition mires and quaking bogs Note, Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles are not exposed to option.	Pre-design surveys will be used to identify suitable locations for scheme infrastructure and associated construction. These surveys will determine the location, quality and extent of the SAC interest features around any potential construction locations, and infrastructure (etc.) will be sited to ensure that the interest features of the site are not significantly affected.

Site	Feature	Avoidance Measures (in addition to general measures)
River Eden SAC	▶ Atlantic salmon ▶ Brook lamprey ▶ River lamprey	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.

Table G2 Receptor-specific avoidance measures for Option WR160

Site	Feature	Avoidance Measures (in addition to general measures)
Berwyn SPA	▶ Red kite ▶ Merlin ▶ Hen harrier ▶ Peregrine falcon	Construction of the scheme will avoid the breeding period (March – August) to minimise the risk of disturbance to breeding birds, unless scheme-specific surveys or analyses demonstrate that any potential effects associated with construction works can be avoided (e.g. through construction site supervision / monitoring), will be 'not significant' (i.e. birds will not be exposed to construction effects), or will have no adverse effect on the integrity of the SPA.
River Eden SAC **River Derwent and Bassenthwaite Lake SAC**	▶ Atlantic salmon ▶ Brook lamprey ▶ River lamprey	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.

Appendix H
Assessment of Alternative Option WR100

Option WR100: Thorncliffe Road Borehole, Barrow-In-Furness

Summary of Scheme

This option would require a new borehole duplicating an existing borehole. The proposed borehole at Thorncliffe Road is within 1km of the Morecambe Bay SAC and Duddon Estuary SPA / Duddon Estuary Ramsar site. The option seeks an increase in the licence quantity at the Thorncliffe Road BH site in Barrow, but there would be no net increase in the abstraction licensed quantity from the Furness aquifer as this would effectively utilise spare licence capacity from the Schneider Road BHs (approx. 600m to the west of the Thorncliffe Road boreholes). In practice there may be a slight decrease in the annual licensed quantity and the utilisation will be around 50% or less. The negotiated reduction from the Schneider Road boreholes would be implemented to ensure no deterioration in WFD objectives for the Furness aquifer. The scheme would require:

- a new duplicate borehole at the Thorncliffe Road WTW site;
- new pumping equipment to provide up to 4.5 Ml/d capacity;
- a new WTW at the Thorncliffe Road WTW site, replicating the existing Thorncliffe Road WTW facility;
- a new inlet to a treated for the combined flow from the existing BH and new BH (9 Ml/d maximum). New borehole can run duty/assist with existing borehole.

Likely Impact Pathways

Construction

The construction works required are small-scale, mostly associated with existing assets within an urban area, and so potential construction-related effects will be localised and short duration. 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.).

Given the scale of the works, these risks can almost certainly be avoided or controlled through the normal project planning process and standard best-practice measures (see **Appendix G**).

Operation

The option seeks an increase in the licence quantity at the Thorncliffe Road BH site in Barrow, but there would be no net increase in the abstraction licensed quantity from the Furness aquifer as this would effectively utilise spare licence capacity from the Schneider Road BHs. The negotiated reduction from the Schneider Road boreholes would be implemented to ensure no deterioration in WFD objectives for the Furness aquifer.

Screening of European Sites

There are 7 European sites downstream or within 20km of this option, or otherwise linked by a potential effect pathway. The sites, their interest features, and location relative to the option are set out in **Table H1**.

Table H1 European sites within 20 km of option, or otherwise connected

Site and Interest Features	~Distance / Connectivity
Duddon Estuary Ramsar ▸ Crit. 2 - supports vulnerable, endangered, or critically endangered species or threatened eco. communities ▸ 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	1.2 km
Morecambe Bay and Duddon Estuary SPA ▸ 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	1.2 km
Morecambe Bay Ramsar ▸ 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	1.2 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*	1.2 km
Duddon Mosses SAC ▸ Active raised bogs	13.4 km
Roudsea Wood and Mosses SAC	16.8 km

Site and Interest Features	~Distance / Connectivity
▸ 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	
Subberthwaite, Blawith and Torver Low Commons SAC ▸ Transition mires and quaking bogs ▸ Depressions on peat substrates of the *Rhynchosporion*	15.3 km

*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 H2**, 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 H2 Initial screening of European sites

Site	Consider further?	Rationale
Morecambe Bay and Duddon Estuary SPA	Yes	Habitats of the site may be affected by alterations to freshwater inputs that may be associated with spring flows from the Furness aquifer, with potential consequent effects for estuarine birds.
Duddon Estuary Ramsar	Yes	As for Morecambe Bay and Duddon Estuary SPA
Morecambe Bay Ramsar	Yes	As for Morecambe Bay and Duddon Estuary SPA
Morecambe Bay SAC	Yes	As for Morecambe Bay and Duddon Estuary SPA (re. habitats).
Duddon Mosses SAC	No	No reasonable impact pathways (distance, separate catchment, etc.)
Roudsea Wood and Mosses SAC	No	No reasonable impact pathways (distance, separate catchment, etc.)
Subberthwaite, Blawith and Torver Low Commons SAC	No	No reasonable impact pathways (distance, separate catchment, etc.)

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. No specific avoidance measures are considered necessary for this option.

Morecambe Bay SAC / Morecambe Bay Ramsar / Duddon Estuary Ramsar

Context / Feature Screening

Morecambe Bay is the confluence of four principal estuaries, the Leven, Kent, Lune and Wyre, together with other smaller examples such as the Keer. Collectively these form the largest single area of continuous intertidal mudflats and sandflats in the UK and the best example of muddy sandflats on the west coast. The features of the site could be affected by the scheme if there are significant alterations in freshwater flows

from the Furness aquifer to the estuary as a result of the scheme (e.g. due to reductions in spring flows etc. that may enter the estuary).

There are a number of SAC features potential sensitive to changes in water resource permissions, including:

- **Estuaries**
- **Mudflats and sandflats not covered by seawater at low tide**
- **Coastal lagoons**
- **Reefs**
- **Salicornia and other annuals colonizing mud and sand**
- **Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)**
- **Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*)**
- **Humid dune slacks**
- **Great crested newt *Triturus cristatus***

The remaining features (**Sandbanks which are slightly covered by sea water all the time; Large shallow inlets and bays; Perennial vegetation of stony banks; Embryonic shifting dunes; Fixed coastal dunes with herbaceous vegetation ("grey dunes"); Atlantic decalcified fixed dunes (*Calluno-Ulicetea*); Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")**) are not sensitive to water resource permissions and so are screened out of further assessment.

With regard to the proposed boreholes, examples of most of these features will be present within 5km (i.e. the distance within which the EA generally consider effects possible due to groundwater abstractions) with the exception of the **Reefs** feature:

- **Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*); Humid dune slacks; Great crested newt *Triturus cristatus***: these features are found in the major dune systems at the entrance to Morecambe Bay on Walney Island and (particularly) the Duddon Estuary at Sandscale Haws (approximately 3.5km from the borehole location). These features will be sensitive to abstractions from the Furness aquifer (although exposure depends on the precise nature of any hydrological connectivity with the aquifer).
- **Coastal lagoons**: Cavendish Dock is a medium sized artificial coastal lagoon situated adjacent to Barrow and on the northern edge of Piel Channel. It has slightly brackish water which is relatively warm because it is a source of cooling water for a nearby power station. The warm water provides increased plant growth rates and so more food for waterfowl. It is important as a habitat in itself and for supporting important plant and bird species. Smaller artificial lagoons also occur on South Walney, the result of sand and gravel winning.
- **Salicornia and other annuals colonizing mud and sand; Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)**: Saltmarsh occurs intermittently along the coastline of the bay, with **Salicornia and other annuals colonizing mud and sand** forming a transition from the extensive intertidal sand and mudflats to the distinctive **Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)** at this site, which are present around (for example) Walney Island.
- **Estuaries; Mudflats and sandflats not covered by seawater at low tide:** the intertidal areas around Barrow all contribute to these features.

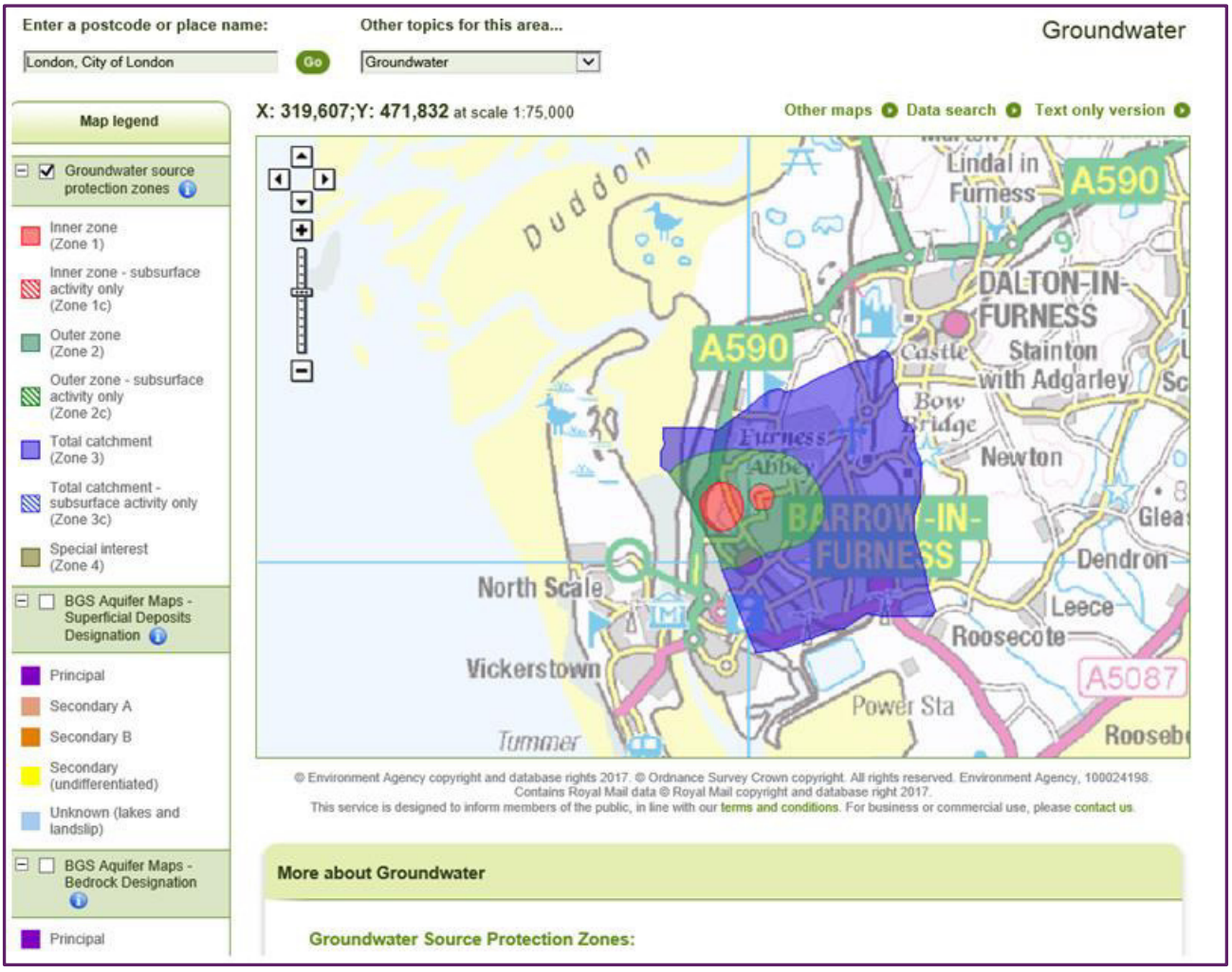
Construction

The construction works required are small-scale, mostly associated with existing assets within an urban area, and so potential construction-related effects will be localised and short duration. Given the scale of the works, these risks can almost certainly be avoided or controlled through the normal project planning process and standard best-practice measures (see **Appendix G**) and so it is certain that a project-level assessment could conclude 'no likely significant effects'.

Operation

The effects of scheme operation are likely to be neutral and not significant. Essentially the scheme will not result in any substantial changes in the behaviour of the aquifer that are likely to have consequent effects on groundwater-dependent interest features locally. The UU abstraction licences from the Furness aquifer were assessed under the Review of Consents and were not found to be affecting the abstraction-sensitive features of the SAC, including the dune systems of Sandscale Haws. The shift in abstraction location (i.e. from Schneider to Thorncliffe) will not affect this; the new borehole will not be significantly closer to the dune systems and UU data demonstrates that the Thorncliffe Road boreholes are very efficient (in abstraction terms), with little drawdown. The EA groundwater source protection zone maps, indicating borehole catchments, provide useful data in this regard (see Figure H1, below); this illustrates the estimated catchment of the boreholes based on BGS data. In addition, in practice, it is likely that the scheme will allow for a reduction in abstraction from the aquifer. On this basis is considered that a project-level assessment could conclude 'no likely significant effects'.

Figure H1 Extract from EA groundwater protection zone maps



Morecambe Bay and Duddon Estuary SPA / Duddon Estuary Ramsar

Context / Feature Screening

The capacity of Morecambe Bay to support large numbers of birds derives from the rich intertidal food sources together with adjacent freshwater wetlands, fringing saltmarshes and saline lagoons, as well as dock structures and shingle banks that provide secure roosts at high tide. The site is important throughout the year for a wide range of bird species. In summer, areas of shingle and sand hold breeding populations of

terns, whilst very large numbers of geese, ducks and waders not only overwinter, but (especially for waders) also use the site in spring and autumn migration periods. The bay is of particular importance during migration periods for waders moving up the west coast of Britain.

The principal mechanism for effects would be if the change in abstraction location alters freshwater inputs to the estuary, resulting in changes to habitats (etc.) that affect the behaviour of the interest features.

A number of the interest features are not considered sensitive to water-resource permissions, including Mediterranean **gull, Lesser black-backed gull, Herring gull, Sandwich tern, Common tern and Little tern**. These are not considered further.

The remaining waterfowl and waders are theoretically sensitive to alterations in freshwater inputs. Past work at other estuary sites in the UK has suggested that there may be a relationship between certain waterbirds and intertidal freshwater flows or channels (Ravenscroft et al. (1997), Ravenscroft (1998, 1999), Ravenscroft & Beardall (2002) & Ravenscroft & Emes (2004)). Broadly, these studies concluded that the number and densities of waterbirds around some freshwater flows were consistently greater than across associated mudflats and that several species showed significant preferences for freshwater flow areas over mudflats. However, the causal relationships between bird distributions and freshwater flows are not clear. Research suggests that association of birds with creeks cannot be explained simply by food availability and the exact mechanism appears relatively complex, involving intricate and often indirect relationships between the SPA birds, their behaviour, their invertebrate prey, the tidal and freshwater flow regimes, geomorphological processes, substrate characteristics, the geographical location, roost sites, and the degree of disturbance by predators or human activity. There is also much evidence that the association may be with the creek rather than the freshwater *per se*. A reduction in flow or increase in flow could, in theory, affect SPA interest features if the outfall is an important resource for them within the harbour (e.g. for preening), although there is little evidence to suggest that the exact volume of flow is critical to the SPA birds or their invertebrate prey.

Construction

The construction works required are small-scale, mostly associated with existing assets within an urban area, and so potential construction-related effects will be localised and short duration. Given the scale of the works, these risks can almost certainly be avoided or controlled through the normal project planning process and standard best-practice measures (see **Appendix G**) and so it is certain that a project-level assessment could conclude ‘no likely significant effects’.

Operation

The only mechanism for an effect would be if the altered abstraction location resulted in alterations in surface-water flows locally to the estuary. However, there are few surface-water inputs along this section of coast. The watercourse most likely to be exposed to any changes is the Mill Beck, approximately 1.5km from Thorncliffe Road. The relative importance of groundwater inputs to this watercourse is unclear (it sits more or less on a change in underlying geology, and will receive most of its flow from upland surface waters); however, any effects are likely to be negligible (based on the borehole information noted above). More significantly, the beck does not enter the estuary directly, but via Cavendish Dock, and so effects on birds would not be expected. As noted, the association of waders with freshwater flows appears to be with the creek rather than the freshwater *per se*, and there is little evidence to suggest that the exact volume of flow is critical to the SPA birds or their invertebrate prey. On this basis, any effects on local surface waters are likely to be negligible, and this will not then result in significant effects on the features of the SPA / Ramsar.

Conclusion

Based on the available information it is clear that this option can be delivered with ‘no adverse effect’ on the integrity of the Morecambe Bay and Duddon Estuary SPA and associated the Ramsar sites (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.