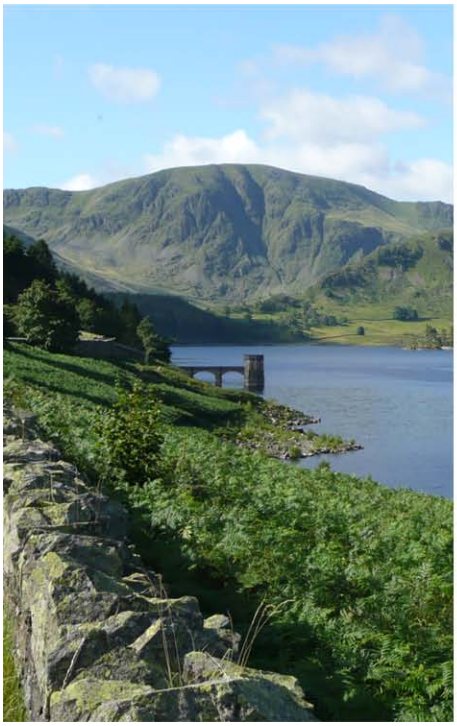
United Utilities

Strategic Environmental Assessment of Draft Water Resources Management Plan

Environmental Report Addendum



AMEC Environment & Infrastructure UK Limited

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Environmental Report Addendum

AMEC Environment & Infrastructure UK Limited

November 2013

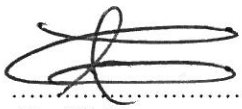
Report for

United Utilities PLC
Haweswater House
Lingley Mere Business Park
Lingley Green Avenue
Great Sankey
Warrington
WA5 3LP

Main Contributors

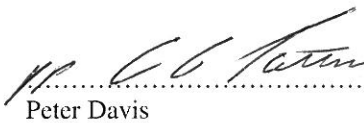
Peter Davis
Alex Melling

Issued by



Alex Melling

Approved by



Peter Davis

AMEC Environment & Infrastructure UK Limited

155 Aztec West, Park Avenue, Almondsbury,
Bristol BS32 4UB, United Kingdom
Tel +44 (0) 1454 822 000
Fax +44 (0) 1454 822 010

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Executive Summary

Purpose of this Report

This document is an addendum to the Environmental Report prepared as part of the Strategic Environmental Assessment (SEA) of United Utilities' Draft Water Resources Management Plan (dWRMP) and which is available on United Utilities' website[1]. This addendum presents the findings of the further assessment of the preferred option and alternatives that were identified to address the deficit in the West Cumbria Water Resource Zone (WRZ). The Addendum also includes an assessment of additional supply-side feasible options following the completion of consultation on the dWRMP and the SEA Environmental Report.

The assessment and Addendum have been completed by AMEC Environment and Infrastructure UK Ltd (AMEC) on behalf of United Utilities.

Background

Along with all water companies in England and Wales, there is a statutory requirement for United Utilities to prepare, maintain and publish a Water Resources Management Plan (WRMP) under the Water Act 2003. Consultation on United Utilities' dWRMP was undertaken between 14th May and 6th August 2013. The dWRMP identified that there will be an imbalance between water supply and demand during the 25 year period up to 2040 within the West Cumbria WRZ.

United Utilities has identified feasible options for resolving the predicted supply/demand deficit within West Cumbria, some of which could help address the deficit on their own and some of which would have to operate conjunctively. The feasible options were assessed in terms of their financial, environmental and social costs. The options were also subject to Strategic Environmental Assessment (SEA) (and Habitats Regulations Assessment (HRA)). SEA is a statutory requirement[2] for plans and programmes that could have significant environmental effects. The SEA process identifies, describes and evaluates potential effects; proposing where appropriate, mitigation and/or enhancement measures. The findings of the SEA were recorded in the Environmental Report that was published for consultation alongside the dWRMP.

Based on the findings of these assessments and informed by ongoing discussion with stakeholders, the following three alternative options were taken forward for further consideration (and assessment as part of the SEA process):

- WC01: Thirlmere Transfer into West Cumbria;
- WC14d: Kielder Water Transfer to West Cumbria (Treated near Carlisle); and

[1] See http://corporate.unitedutilities.com/Water-Resources-Management-Plan.aspx [Accessed October 2013]

[2] *Statutory Instrument 2004 No 1633 – The Environmental Assessment of Plans and Programmes Regulations 2004.*

- Lowest Cost Option, comprising the collective implementation of **all** of the following options: Wastwater (negotiate part abstraction licence) (WC04); Development of New Boreholes in West Cumbria Aquifer (10 Ml/d) (WC05a); Development of Boreholes in North Cumbria Aquifer (WC09)[3]

Option WC01: Thirlmere Transfer into West Cumbria was ultimately taken forward for consultation as the preferred option. Option WC14d (Kielder Water Transfer to West Cumbria (Treated near Carlisle)) and the Lowest Cost Option set were also considered in the consultation exercise as viable alternatives and views were sought on each.

Since consultation on the dWRMP, United Utilities has prepared more detailed (engineering estimates/scopes for the preferred option (WC01: Thirlmere Transfer into West Cumbria) and the two alternative options (Option WC14d and the Lowest Cost Option). These refined scopes include more detailed information concerning infrastructure requirements, such as further consideration of pipeline routes or treatment processes, that would be required if they were to be implemented.

United Utilities has also identified, in conjunction with consultees, additional feasible options that could be used to meet part of the predicted deficit in the West Cumbria WRZ as part of the Lowest Cost Option set. These additional feasible options include:

- WC05b: Development of New Boreholes in West Cumbria Aquifer (comprising the construction of 15 new boreholes in addition to the use of an existing borehole)[4];
- WC05c: Development of New Boreholes in West Cumbria Aquifer (comprising the construction of 11 new boreholes in addition to the use of an existing borehole); and
- WC05d: Development of New Boreholes in West Cumbria Aquifer (comprising the construction of seven new boreholes in addition to the use of an existing borehole).

In addition, Option WC25: Effluent Reuse is a new feasible option that United Utilities has investigated following discussions with the Environment Agency.

Both the revised preferred option and alternatives and additional feasible options have been assessed as part of this Addendum using the approach adopted in the Environmental Report and against a series of SEA objectives. It should be noted that the options have also been subject to HRA with the findings reported in an addendum to the draft HRA report (which is available on United Utilities' website) and used to inform the SEA.

[3] Option WC19 (Crummock Automated Compensation Control) and the pipeline transfer (Option WC24) were originally included in the dWRMP Lowest Cost Option set. However, as a result of additional water resources modelling, United Utilities has identified that Option WC19 and the transfer pipeline to take this water to the areas currently served by Ennerdale are not required.

[4] Note that Option WC05b was identified as part of the preparation of the dWRMP but was not subject to SEA.

The Potential Effects of the Feasible Options

Each new feasible option was assessed against the SEA objectives to identify its potential effects during both construction/implementation and operation. The results were assessed based on the following scale:

Key to the Symbols to be used in the Relationship Column:	
++	Significant positive effect of the Water Resources Management Plan option on this objective
+	Positive effect of the Water Resources Management Plan option on this objective
0	Overall neutral or insignificant effect of the Water Resources Management Plan option on this objective
-	Negative effect of the Water Resources Management Plan option on this objective
--	Significant negative effect of the Water Resources Management Plan option on this objective
?	Uncertain effect of the Water Resources Management Plan option on this objective
++/-	Combination of positive and negative effects of the Water Resources Management Plan option on this objective

A table summarising the assessments of the additional feasible options for the West Cumbria WRZ is presented in **Table S1**. An overview of potential significant (positive and negative) effects identified during the assessment follows.

Table S1 Additional Feasible Option Assessment Summary

Ref	Option Name	Design Capacity (Ml/d)	Construction (C) or Operation (O)	Biodiversity	Land Use/Soils	Water Quantity and Quality	Flooding	Air Quality	Climate Change	Human Health	Economic and Social Well-being	Water Resource Use	Use of Resources	Heritage	Landscape
WC05b	Development of New Boreholes in West Cumbria Aquifer	20	C	--	-	0	-	-	--	-	++	0	--	-	-
			O	?	0	-	0	0	--	++	++	0	--	-	-
WC05c	Development of New Boreholes in West Cumbria Aquifer	20	C	--	-	0	-	-	--	-	++	0	--	-	-
			O	?	0	-	0	0	--	++	++	0	--	-	-
WC05d	Development of New Boreholes in West Cumbria Aquifer	5.4	C	--	-	0	-	-	--	-	++	0	--	-	-
			O	?	0	-	0	0	-	+	+	0	-	-	-
WC25	Effluent Reuse	20	C	--	-	0	-	-	--	-	++	0	--	-	-
			O	0	0	+	0	0	--	?	++	+	--	0	-

The construction of all of the feasible options would represent a large capital investment which is likely to generate a number of employment opportunities and supply chain benefits as well as increased spend in the local economy by contractors and construction workers. This was assessed as having a significant positive effect on economic and social well-being.

All of the feasible options were assessed as having a significant negative effect on biodiversity during the construction phase. This principally reflects the environmental sensitivity of the West Cumbria WRZ and potential for pipeline works in particular to affect several European designated sites including the River Ehen Special Area of Conservation (SAC) (under options WC05b/c/d and WC25) and the River Derwent and Bassenthwaite Lake SAC (under Option WC25). However, it should be noted that the addendum to the draft HRA states that it is likely that the works could be suitably managed to avoid significant or adverse effects (e.g. timing of works to avoid migration periods; routing pipeline to make use of existing road crossings). Furthermore, it would be anticipated that scheme level investigations and appropriate assessment would also be undertaken at the project stage should the options be taken forward. Notwithstanding, all options would result in the loss of greenfield land and in consequence there may be disturbance/habitat loss associated with construction activity and landtake.

Reflecting the scale of construction activity associated with the feasible options, all were assessed as having a significant negative effect on climate change as a result of associated greenhouse gas emissions from HGV movements, construction plant and embodied carbon in raw materials. Material use and energy requirements would also be substantial and therefore these options were assessed as having a significant negative effect on resource use.

No further significant positive or significant negative construction-related effects were identified during the assessment.

During operation, Options WC05b and WC05c were assessed as having a significant positive effect on health (in helping to ensure the continuity of a safe and secure drinking water supply) and economic and social well-being (given the potential for additional supply to support economic/population growth). This reflects their substantial design capacities (20 Ml/d). The design capacity of Option WC05d would be lower (5.4 Ml/d) and positive effects on these objectives were therefore assessed as minor. Whilst Option WC25 would also result in an increased supply of drinking water of 20Ml/d there is uncertainty with respect to the extent to which (using current technologies) the reuse of treated effluent would provide safe drinking water and, in this respect, this option could be perceived negatively by some customers. Therefore, option WC25 was assessed as having a significant positive effect on economic and social well-being but an uncertain effect on health.

With the exception of Option WC05d, all of the feasible options were considered likely to have significant negative effects on climate change and resource use SEA objectives during operation, reflecting additional energy requirements (and related greenhouse gas emissions).

No further significant positive or significant negative operational effects were identified during the assessment. It should be noted that effects associated with the operation of Options WC05b/c/d on biodiversity were assessed as

being uncertain at this stage. Whilst the new boreholes would be outside the surface water catchment of the River Ehen and therefore any localised drawdown would not affect tributaries of the river, it is possible that abstraction under these options could affect groundwater supplies to the Ehen. The addendum to the draft HRA report states that it is not clear what contribution to flow these are likely to make and that any effects are likely to be felt outside of the SAC, but the options may affect mobile species (Atlantic salmon) migrating through the lower reaches.

The Potential Effects of the Preferred Option and Alternatives

Both the preferred option and the alternatives listed above have been reassessed to reflect changes in scope since the publication of the Environmental Report. A summary of the main changes made to the option scopes and the subsequent assessment of effects since the publication of the Environmental Report is provided in **Table S2.** The findings of the detailed assessments are presented in **Table S3** and are discussed in more detail in the following sections.

Table S2 What has changed Since the Previous Assessment?

Option	Key Changes in Option Scope	Changes in Assessment
WC01: Thirlmere Transfer into West Cumbria (**the preferred option**)	A more detailed engineering scope has been prepared, which has provided further details concerning the infrastructure requirements for this option. The main change to this option has been confirmation of the pipeline size and routes, for example, the route now passes to the north and east of Bassenthwaite Lake, and the provision of indicative footprints of key components of the scheme including the proposed new water treatment works at the existing facility at Thirlmere. The construction period has increased from 2.25 to 6 years. Estimated carbon emissions have been updated. Further analysis of the impacts of additional abstraction of water from Thirlmere (particularly in relation to landscape impacts) has also been undertaken.	All potential effects on the SEA objectives have been re-assessed with particular emphasis on biodiversity and landscape (to reflect additional details with respect to the infrastructure requirements associated with the option) and climate change and resource use (to reflect revised carbon and energy use estimates). The revised assessment has identified that the majority of effects on the SEA objectives are similar to those identified in the Environmental Report. Reflecting revised data in respect of energy requirements associated with the operation of the option, effects on resource use have been assessed as neutral due to energy use from the new facilities being offset from closure of water treatment work sites elsewhere (effects on this objective during operation were assessed as being significant negative in the Environmental Report). Based on further information provided by United Utilities in respect of the likely scale of the proposed new water treatment works at the existing Thirlmere facility and service reservoirs, the assessment has identified the potential for significant negative effects on landscape should appropriate mitigation not be implemented.
WC14d: Kielder Water Transfer to West Cumbria (Treated near Carlisle)	A more detailed engineering scope has been prepared, which has provided further details concerning the infrastructure requirements for this option. The main change to this option has been confirmation of the pipeline route from Kielder reservoir to Carlisle. Further clarity has been provided concerning the infrastructure required along the pipeline route. The construction period has increased from 3 to 11 years. Carbon emission estimates have also be revised.	All potential effects on the SEA objectives have been re-assessed with particular emphasis on biodiversity and landscape (to reflect additional details with respect to the infrastructure requirements associated with the option) and climate change and resource use (to reflect revised carbon and energy use estimates). The revised assessment has identified that the majority of effects on the SEA objectives are similar to those identified in the Environmental Report.

Option	Key Changes in Option Scope	Changes in Assessment
		However, under current proposals a new service reservoir would be located near Ennerdale in the Lake District National Park whilst the proposed pipeline would cross this National Park in addition to the Northumberland National Park. In consequence, the option has been assessed as having a significant negative effect on landscape during construction (effects on this objective during construction were assessed as being minor negative in the Environmental Report). Based on further information provided by United Utilities in respect of the likely scale of the proposed new water treatment near Carlisle, the assessment has identified the potential for significant negative effects on landscape during operation should appropriate mitigation not be implemented. Reflecting revised data in respect of energy requirements associated with the operation of the option, effects on resource use have been assessed as minor negative (effects on this objective during operation were assessed as significant negative in the Environmental Report).
Lowest Cost Option	The main change to this option has been an increase in the construction period from 2 to 5 years. Carbon emissions estimates have also been revised. It should be noted that the under the latest scope for the WC05a component of the scheme, one of the borehole locations was changed to However, the number of boreholes required under the Option WC05a component remains the same. Crummock compensation control (Option WC19) and the transfer pipeline (Option WC24) are also now not required.	All potential effects on the SEA objectives have been re-assessed with particular emphasis on climate change and resource use (to reflect revised carbon and energy use estimates) although no substantial changes have been made to the assessment or scoring contained in the Environmental Report as a result.

Table S3 Summary of the Preferred Option and Alternatives Assessment

Ref	Option Name	Design Capacity (Ml/d)	Construction (C) or Operation (O)	Biodiversity	Land Use/Soils	Water Quantity and Quality	Flooding	Air Quality	Climate Change	Human Health	Economic and Social Well-being	Water Resource Use	Use of Resources	Heritage	Landscape
WC01	Thirlmere Transfer into West Cumbria	80	C	-	-	0	-	-	--	-	++/-	0	--	-	--
			O	++	0	++	-	0	--	++	++	0	0	0	-/?
WC14d	Kielder Water Transfer to West Cumbria (Treated near Carlisle)	80	C	-	-	0	-	-	--	-	++/-	0	--	-	--
			O	++	0	++	-	0	--	++	++	0	-	0	-/?
WC04, WC05a, WC09	Lowest Cost Option	24.5	C	-	-	0	-	-	--	-	++/-	0	--	-	-
			O	?	0	-	-	0	--	++	++	0	--	0	-

Preferred Option: Thirlmere Transfer into West Cumbria (WC01)

The preferred WRMP option involves increasing abstraction from Thirlmere reservoir within current licence conditions by enhancing infrastructure capacity. This option represents a large scale scheme comprising several infrastructure components including new service reservoirs, a water treatment works, pumping stations and over 100km of new pipeline together with the decommissioning of five existing water treatment works (near Ennerdale, Cornhow, Quarry Hill, Buttermere and Thirlmere).

Construction Effects

Reflecting the scale of construction activity associated with this option, significant negative effects were identified in respect of climate change (as a result of associated greenhouse gas emissions from HGV movements, construction plant and embodied carbon in raw materials) and resource use. The majority of development sites and approximately half of the new pipeline would be within the Lake District National Park and therefore there was considered to be potential for significant adverse landscape effects associated with construction activity.

The construction of this option would represent a large capital investment which is likely to generate a number of employment opportunities and supply chain benefits as well as increased spend in the local economy by contractors and construction workers. However, HGV movements and pipeline works of the proposed scale may cause traffic disruption. The option was therefore assessed as having a mixed significant positive and minor negative effect on economic and social well-being.

The assessment did not identify any further significant negative or significant positive effects. The HRA identifies that there is potential for significant construction effects on the River Derwent and Bassenthwaite Lake SAC, Clints Quarry SAC, Lake District High Fells SAC and River Ehen SAC, primarily due to pipeline works. However, taking into account scheme specific mitigation, and a commitment for pipeline works to be within or alongside existing roads (or suitable alternatives identified in discussion with Natural England and the Environment Agency), no significant construction-related effects would be anticipated. Notwithstanding, this option would result in the loss of greenfield land at several development sites and in consequence there is potential for localised loss of habitat and, in conjunction with decommissioning works, disturbance which has been assessed as having a minor negative effect on biodiversity. The option may also generate minor negative effects in respect of land use/soils (due to additional land take required under this option), flood risk (as some sites and sections of pipeline are situated within Flood Zones 2/3) and cultural heritage (due to potential effects on the settings of listed buildings and scheduled monuments). Emissions to air from HGV movements and construction plant may also have a minor negative effect on air quality and, together with noise/vibration, human health.

Operational Effects

Similar to the construction phase, the option is likely to have a significant negative effect on climate change. This principally reflects net additional greenhouse gas emissions associated with the treatment and pumping of water.

The scheme is designed to relieve pressure on the River Ehen SAC. Abstraction from Ennerdale Water, which discharges into the Ehen, has been identified for amendments under the Review of Consents programme due to the impact of abstraction on interest features in the SAC (primarily fresh water pearl mussels). The decommissioning of the water treatment works serving Ennerdale and associated abstraction from Ennerdale Water under this option may therefore generate benefits in respect of these features due to increased flows. Additionally, the decommissioning of Quarry Hill water treatment works would result in a reduction in abstraction from Dash Beck and Hause Gill, sources that have been investigated under the Review of Consents programme due to impacts on salmon which are interest features of the River Derwent and Tributaries Site of Special Scientific Interest (SSSI) and River Derwent and Bassenthwaite Lake SAC. Taking into account the potential operational benefits in respect of the River Ehen SAC and River Derwent and Bassenthwaite Lake SAC in particular, this option was assessed as having a significant positive effect on biodiversity. The decommissioning of the five water treatment works has also been assessed as having a significant positive effect on water quantity and quality due to increases in flows in the catchments in which associated abstractions are located (Dash Beck, Bassenthwaite/Derwent, Ellen, Ehen and Cocker).

The option has a design capacity of 80 Ml/d, serving to address deficit within the West Cumbria WRZ. Further, the decommissioning of existing sources may benefit downstream abstractors (where hands off flow constraints are in place) or present opportunities for new abstractions (subject to licensing). This has been assessed as having a significant positive effect on health (in helping to ensure the continuity of a safe and secure drinking water supply) and economic and social well-being (given the potential for additional supply to support economic/population growth).

No further significant negative or significant positive operational effects were identified during the assessment although the option is expected to have minor negative effects on flood risk (owing to the location of assets within Flood Zones 2/3) and landscape (principally reflecting the requirement for new above ground infrastructure within the Lake District National Park).

Alternative Options: Kielder and Lowest Cost Option

The alternatives included the transfer of water from Kielder Water in the Northumbrian Water supply region to the West Cumbria WRZ (Option WC14d) and the Lowest Cost Option that would involve the collective implementation of individual smaller scale schemes.

Construction Effects

Construction related effects across the alternatives were considered to be broadly similar to those identified in respect of the preferred option with significant negative effects assessed against climate change and resource use and significant positive effects identified in respect of economic and social well-being.

Operational Effects

Similar to the preferred option, Option WC14d was assessed as having significant negative operational effects in respect of climate change but significant positive effects on health and economic and social well-being. Like the preferred option, Kielder Water Transfer to West Cumbria (Treated near Carlisle) (Option WC14d) would involve the decommissioning of the water treatment works serving the Ennerdale, Cornhow, Quarry Hill and Buttermere areas. As with Option WC01, this was assessed as having a significant positive effect on biodiversity and water quantity/quality objectives.

The Lowest Cost Option was also assessed as having significant negative operational effects in respect of climate change but significant positive effects on health and economic and social well-being. The operational effects of the Lowest Cost Option on biodiversity, however, were considered to be more uncertain. Whilst the majority of the scheme components are unlikely to have any significant adverse effects on European designated sites, the findings of the HRA in respect of the operation of the new West Cumbria aquifer boreholes, Wastwater transfer and Crummock automated compensation control indicate that effects on several European designated sites are uncertain. Further, new borehole abstractions near Waverton and Thursby have the potential to impact on the nearby River Waverly and River Wampool and may affect water dependent SSSIs downstream of the borehole sites, although no readily available flow data could be found for the River Waverley or Wampool to contextualise the abstraction volumes and current flow. Effects on water quantity/quality associated with the operation of this option were assessed as being negative.

Conclusion and Reasons for Selection of the Preferred Option

United Utilities' preferred option would dedicate a greater proportion of the water available in Thirlmere reservoir to meet the needs of Cumbria. This would require a new water treatment works and a pipeline to transfer the water into West Cumbria, thus linking the population of West Cumbria to the UK's largest interconnected WRZ. This transfer would be of sufficient size to meet all the demand for West Cumbria and would bring a number of benefits for the region, such as:

- Increased confidence in long term supplies in meeting changing demands;
- Support for the developing Britain's Energy Coast economic strategy as it would allow for more water to be available than is currently forecast;
- Allows abstraction from existing sources in West Cumbria to cease and return the habitats to more natural conditions;
- Protects internationally important SACs;
- Future climate change resilience;
- Removes the vulnerability to short duration droughts;

- Longer-term cost savings as existing treatment works can be closed; and
- Removes the vulnerability of West Cumbria to future sustainability reductions.

The implementation of this option would result in a reduction of the surplus in the existing Integrated Resource Zone by a maximum of 42 Ml/d and the zone would still remain in surplus through the planning horizon..

Contents

1. Introduction

1.1 Purpose of this Report

This document is an addendum to the Environmental Report prepared as part of the Strategic Environmental Assessment (SEA) of United Utilities' Draft Water Resources Management Plan (dWRMP). This addendum presents the findings of the further assessment of the preferred option and alternatives that were identified in the dWRMP to address the deficit in the West Cumbria WRZ. The Addendum also includes an assessment of additional supply-side feasible options that have come forward following the completion of consultation on the draft WRMP and the Environmental Report.

United Utilities will produce its revised draft WRMP in November 2013. The assessment documented in this Addendum has been used to help further inform the choice of options within the WRMP to manage the supply and demand of water in the United Utilities area over the 25 year planning period (2015-2040) by ensuring that the environmental effects of any of the options selected by United Utilities for the revised draft version of the WRMP have been considered in a manner consistent with the requirements of the Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment (the SEA Directive).

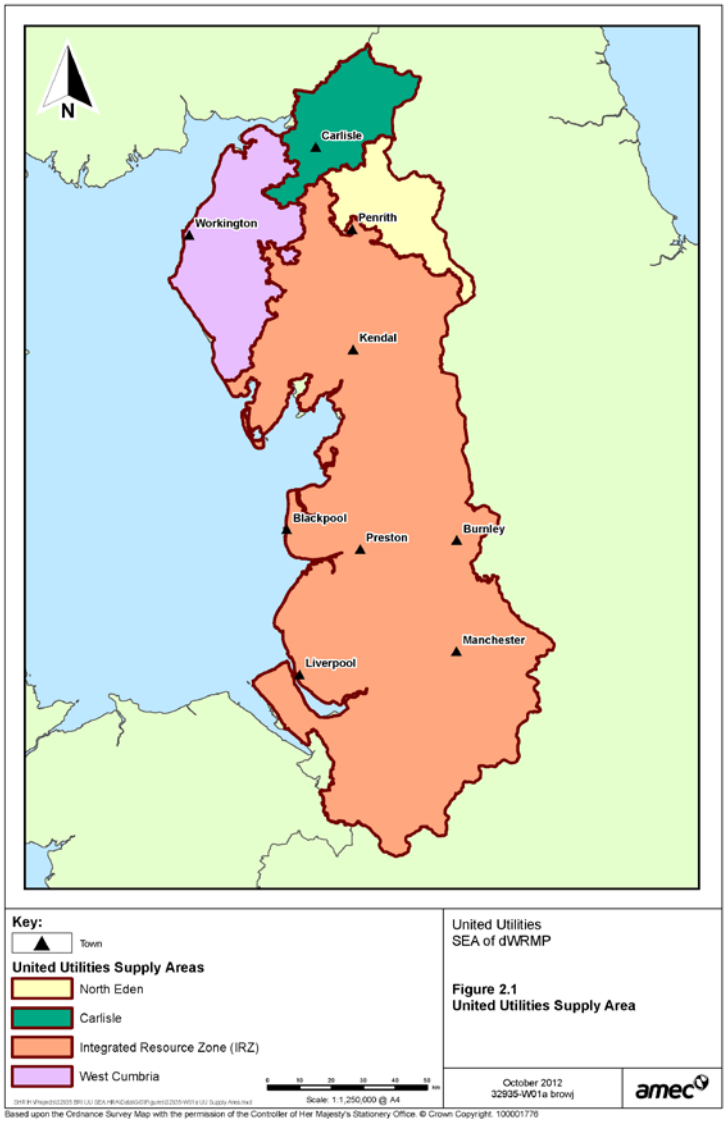
The assessment and Addendum have been completed by AMEC Environment and Infrastructure UK Ltd (AMEC) on behalf of United Utilities. This Addendum should be read in conjunction with the SEA Environmental Report which is available via United Utilities' website.

1.2 Background

1.2.1 Draft Water Resources Management Plan

Along with all water companies in England and Wales, there is a statutory requirement for United Utilities to prepare, maintain and publish a Water Resources Management Plan (WRMP) under the Water Act 2003. Consultation on United Utilities' dWRMP was undertaken between 14th May and 6th August 2013. The dWRMP identified that there will be an imbalance between water supply and demand during the 25 year period up to 2040 within the West Cumbria water resource zone (WRZ) (as shown in **Figure 1.1**). To ensure that adequate water is available, the dWRMP set out a strategy to restore the supply demand balance in this WRZ.

Figure 1.1 United Utilities' Supply Area and the West Cumbria Zone



United Utilities identified feasible options for resolving the predicted supply/demand deficit within this WRZ, some of which could address the deficit on their own and some of which would have to operate conjunctively. The feasible options were assessed in terms of their financial, environmental and social costs and, informed by ongoing discussion with stakeholders and the outcomes of the SEA and Habitats Regulations Assessment (HRA), the following three alternative options were taken forward for further consideration:

- WC01: Thirlmere Transfer into West Cumbria;
- WC14d: Kielder Water Transfer to West Cumbria (Treated near Carlisle); and

- Lowest Cost Option, comprising the collective implementation of **all** of the following options: Wastwater (negotiate part abstraction licence) (WC04); Development of New Boreholes in West Cumbria Aquifer (10 Ml/d) (WC05a); Development of Boreholes in North Cumbria Aquifer (WC09)[5].

Option WC01: Thirlmere Transfer into West Cumbria was ultimately taken forward for consultation as the preferred option. Option WC14d (Kielder Water Transfer to West Cumbria (Treated near Carlisle)) and the Lowest Cost Option set were also considered in the consultation exercise as viable alternatives and views were sought on each.

1.2.2 SEA and the Water Resources Management Plan

SEA is a statutory requirement[6] for plans and programmes that could have significant environmental effects. The SEA process identifies, describes and evaluates potential effects; proposing where appropriate, mitigation and/or enhancement measures. Government, industry and regulator guidance indicates that there is a requirement for water companies, as responsible authorities, to determine whether their WRMPs fall within the scope of the SEA Regulations and whether an SEA must be undertaken. United Utilities concluded that an SEA of the dWRMP is required based on the scope of the potential effects that could arise, particularly given the number of, and area covered by, European designated conservation sites in the North West.

The Environmental Report was the second output of the SEA of the dWRMP and followed consultation on the scope of assessment which was undertaken in October and November 2012. The Environmental Report presented the findings of the assessment of the dWRMP including all feasible options and the resulting three alternatives put forward to address the deficit in the West Cumbria WRZ. The assessment contained in the Environmental Report was informed by ongoing engagement with the statutory SEA consultation bodies.

Further detail in respect of the SEA process and how it relates to the preparation of United Utilities' WRMP is provided in Section 1.5 of the Environmental Report.

1.2.3 Changes since the Publication of the Draft Water Resources Management Plan

Since consultation on the dWRMP and the Environmental Report took place, United Utilities has prepared more detailed engineering estimates/scopes for the preferred option (WC01: Thirlmere Transfer into West Cumbria) and the two alternative options (Option WC14d and the Lowest Cost Option). These refined scopes include more detailed information concerning infrastructure requirements, such as further consideration of pipeline routes or treatment processes, for the options to be implemented.

[5] Option WC19 (Crummock Automated Compensation Control) and the pipeline transfer (Option WC24) were originally included in the dWRMP Lowest Cost Option set. However, as a result of additional water resources modelling, United Utilities has identified that Option WC19 and the transfer pipeline to take this water to the areas currently served by Ennerdale are not required.

[6] *Statutory Instrument 2004 No 1633 – The Environmental Assessment of Plans and Programmes Regulations 2004.*

As the revised engineering scopes have some variations from the proposals contained within the dWRMP it was considered necessary to re-assess both the preferred option and alternatives to ensure that the conclusions of the Environmental Report are still valid and to inform the section of options in the revised draft WRMP. These variations are described in more detail in the assessment chapter of this report (**Section 3**).

United Utilities has also identified additional feasible options that could be used to meet part of the predicted deficit in the West Cumbria WRZ as part of the Lowest Cost Option set. These additional feasible options include:

- WC05b: Development of New Boreholes in West Cumbria Aquifer (comprising the construction of 15 new boreholes in addition to the use of an existing borehole)[7];
- WC05c: Development of New Boreholes in West Cumbria Aquifer (comprising the construction of 11 new boreholes in addition to the use of an existing borehole); and
- WC05d: Development of New Boreholes in West Cumbria Aquifer (comprising the construction of seven new boreholes in addition to the use of an existing borehole).

In addition, Option WC25: Effluent Reuse is a new feasible option that United Utilities has investigated following discussions with the Environment Agency.

These additional feasible options have also been assessed as part of this Addendum using the same approach to the assessment of feasible options adopted in the preparation of the Environmental Report. This is to ensure that the assessment is as thorough and complete as possible, although these options are not being considered as preferred options (or components of preferred options for the final WRMP). Further detail in respect of each option is provided in **Section 2**, together with a summary of their potential environmental effects.

It should be noted that all of the options assessed in this report have also been subject to HRA with the findings reported in an addendum to the draft HRA report (which is available on United Utilities' website) and used to inform the SEA.

1.3 Approach to the Assessment

The performance of each of the feasible options and the preferred option and alternatives has been assessed using the same assessment framework as that developed as part of the preparation of the Environmental Report (see **Table 1.1**). This framework comprises 12 assessment objectives. For each objective, guide questions are provided. The guide questions focus the assessment on specific aspects of the objective that reflect issues identified from a review of baseline and contextual information relating to the United Utilities supply/source areas. Indicative significance thresholds have also been developed for each assessment objective (these are reproduced in **Appendix A**).

[7] Note that Option WC05b was identified as part of the preparation of the dWRMP but was not subject to SEA.

Table 1.1 Assessment Objectives and Guide Questions

Topic Area	SEA Objective	Guide Questions
Biodiversity	To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits	*Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)?*
		Will the option protect and enhance non-designated sites and local biodiversity?
		Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process?
		Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity?
Geology and Soils	To ensure the appropriate and efficient use of land and protect soil quality	*Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation?*
		Will the option utilise previously developed land?
		Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity?
		Will the option minimise the loss of best and most versatile soil?
		Will the option minimise conflict with existing land use patterns?
		Will the option minimise land contamination?
Water – Quantity and Quality	To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	*Will the option minimise the demand for water resources?*
		Will the option protect and improve surface, groundwater, estuarine and coastal water quality?
		Will the option result in changes to river flows?
		Will the option result in changes to groundwater levels?
		Will the option affect the ecological status of water bodies?
Water – Flood Risk	To reduce the risk of flooding	*Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future?*
		Will the option have the potential to help alleviate flooding in the catchment area now or in the future?
		Will the option be at risk of flooding now or in the future?
Air Quality	To minimise emissions of pollutant gases and particulates and enhance air quality	*Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates?*
		Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)?
		Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds?
		Will the option reduce the need to travel or encourage sustainable modes of transport?
Climate Change	To limit the causes and potential consequences of climate change	*Will the option reduce or minimise greenhouse gas emissions?*
		Will the option have new infrastructure that is energy efficient or make use of renewable energy sources?
		Will the option contribute positively to adaptation to climate change?

Topic Area	SEA Objective	Guide Questions
		Will the option increase environmental resilience to the effects of climate change?
Human Environment - Health	To ensure the protection and enhancement of human health	*Will the option ensure the continuity of a safe and secure drinking water supply?*
		Will the option affect opportunities for recreation and physical activity?
		Will the option maintain surface water and bathing water quality within statutory standards?
		Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?
Human Environment - Social and Economic Well-Being	To maintain and enhance the economic and social well-being of the local community	*Will the option ensure sufficient infrastructure is in place for predicted population increases?*
		Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists?
		Will the option help to meet the employment needs of local people?
		Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected?
		Will the option improve access to local services and facilities (e.g. sport and recreation)?
		Will the option contribute to sustaining and growing the local and regional economy?
		Will the option avoid disruption through effects on the transport network?
		Will the option be resilient to future changes in resources (both financial and human)?
Material Assets and Resource Use - Water Resources	To ensure the sustainable and efficient use of water resources	*Will the option lead to reduced leakage from the supply network?*
		Will the option improve efficiency in water consumption?
Material Assets and Resource Use - Resource Use	To promote the efficient use of resources	*Will the option seek to minimise the demand for raw materials?*
		Will the option reduce the total amount of waste produced and the proportion of waste sent to landfill?
		Will the option encourage the use of sustainable design and materials?
		Will the option reduce or minimise energy use?
Cultural Heritage	To protect and enhance cultural and historic assets	*Will the option conserve or enhance historic buildings, places, conservation areas and spaces that enhance local distinctiveness, character and the appearance of the public realm?*
		Will the option avoid or minimise damage to archaeologically important sites?
		Will the option affect public access to, or enjoyment of, features of cultural heritage?
Landscape	To protect and enhance landscape character	*Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs?*
		Will the option protect and enhance landscape character, townscape and seascape?
		Will the option affect public access to existing landscape features?
		Will the option minimise adverse visual impacts?

The additional feasible options have been subject to a high level assessment against the 12 SEA objectives above with the findings presented in a summary matrix. Consistent with the approach adopted during the preparation of the Environmental Report, a more detailed assessment of the preferred option and two alternatives has been undertaken. The potential effects (positive, negative or neutral) and the significance of the effects of each of these options against each of the SEA objectives has been recorded, along with commentary setting out the reasons for the assessment results, any assumptions and uncertainties and, where appropriate, potential mitigation measures.

Further information in respect of the approach to the SEA is presented in Section 3 of the Environmental Report.

1.4 Report Structure

The remainder of this Addendum presents:

- the potential effects of additional feasible options for balancing water demand and supply in the West Cumbria WRZ (**Section 2**);
- the more detailed re-assessment of the preferred option (including cumulative effects) and alternatives for balancing water demand and supply in the West Cumbria WRZ, together with mitigation measures and reasons for the selection of the preferred option (**Section 3**); and
- information about the forthcoming WRMP process and activities, including proposed monitoring measures. (**Section 4**).

2. Assessment of Additional Feasible Options

2.1 Introduction

Since the dWRMP was published for consultation in May 2013, United Utilities has identified additional feasible options for the West Cumbria WRZ. Three of the additional feasible options relate to the development of new boreholes in the West Cumbria aquifer (Options WC05b/c/d[8]). These options are essentially further variants of Options WC05 and WC05a (which forms part of the Lowest Cost Option set) that were assessed as part of the Environmental Report. Option WC25: Effluent Reuse, meanwhile, is a new scheme that would involve the transfer of treated final effluent from Whitehaven to Workington waste water treatment works (WwTW) for reuse. **Table 2.1** provides a summary of the additional feasible options assessed as part of this Addendum.

Table 2.1 Descriptions of Additional Feasible Options

Ref*	Option	Design Capacity (Ml/d)*	Description
Supply Side Options			
WC05b	Development of New Boreholes in West Cumbria Aquifer	20	This option would involve the construction of 15 new boreholes in addition to utilising an existing borehole. The exact distribution of the new boreholes between the four sites is to be confirmed. The option would require drilling of a number of boreholes at each site, a new fixed speed borehole pump and a new headworks GRP kiosk for each. The existing site would also require a new break tank, aeration tower and RWPS. A total of 8km of pipeline would be required to interconnect the sites and a 13km pipeline would transfer all raw water to the water treatment works near Ennerdale. A new 1km washout main would also be needed from the existing site to the nearest Egremont sewer.
WC05c	Development of New Boreholes in West Cumbria Aquifer	20	This option would involve the construction of seven new boreholes in addition to utilising an existing borehole site. A further four new boreholes would be developed in the Calder Sandstone. The option would require drilling of boreholes at each site, a new fixed speed borehole pump and a new headworks GRP kiosk for each. The existing site would also require a new break tank, aeration tower and raw water pumping station. A total of 18km of pipeline would be required to interconnect the sites Raw water from all boreholes would be transferred via a new pumping station at an existing site and transferred via a dual 13km pipeline to the water treatment works near Ennerdale. A new 1km washout main would also be required from the existing site to the nearest Egremont sewer. It is envisaged that the existing raw water mixing tank at Ennerdale would be used to blend the additional St Bees boreholes outputs without any extra capacity required.
WC05d	Development of New Boreholes in West Cumbria Aquifer	5.4	This option would involve the construction of seven new boreholes in addition to utilising an existing borehole. The option would require drilling of a borehole at each site, a new fixed speed borehole pump and a new headworks GRP kiosk for each. The existing site would also require a new break tank, aeration tower and raw water pumping station. A total of 18km of pipeline would be required to interconnect the sites Raw water from all boreholes would be transferred via a new pumping station at an existing site and transferred via a dual 13km pipeline to the water treatment works near Ennerdale.. A new 1km washout main would also be required from the existing site to the nearest Egremont sewer.

[8] Note that Option WC05b was identified as part of the preparation of the dWRMP but was not subject to SEA.

Ref*	Option	Design Capacity (Ml/d)*	Description
			It is envisaged that the existing raw water mixing tank at Ennerdale would be used to blend the additional St Bees boreholes outputs without any extra capacity required. To achieve the full 5.4Ml/d yield the output from the boreholes developed at South Egremont during AMP5 would also need to be increased. These boreholes and associated infrastructure were designed to yield 6.4Ml/d, but have been proven to be capable of 11Ml/d.
WC25	Effluent Reuse	20	This option would involve the transfer of treated final effluent from Whitehaven and Workington WwTW for reuse for potable water supply. The option would require a new water treatment works at Workington WwTW and a further new water treatment works including pumping station and associated facilities/equipment in Whitehaven. A new 12.5km long pipeline would be required between Workington and Whitehaven together with a 17km dedicated transfer pipeline between Whitehaven and a service reservoir near Ennerdale.

This section of the report presents the findings of the assessment of the additional feasible options listed above. These feasible options have been assessed using the framework set out in **Section 1.3** of this report. Each feasible option was assessed against the SEA objectives to identify its potential effects in both the short term (during construction) and medium/long term (during operation). The feasible options were assessed based on the nature of the effect, its timing and geographic scale, the sensitivity of the human or environmental receptor that could be affected, and how long any effect might last. Where quantified information was available for the feasible option from United Utilities[9], the assessment was also informed by reference to threshold values set out in the definitions of significance (see **Appendix A**).

2.2 Potential Environmental Effects of the Additional Feasible Options

The findings of the assessment of the additional feasible options during both construction and operation are presented in **Table 2.2** and are discussed in more detail in the sections that follow. Detailed assessment matrices are contained in **Appendix B**.

[9] Where quantitative information has been used to inform the assessment, this has been based on information provided to AMEC by United Utilities and is assumed to be the most up-to-date information available at the time of writing this report.

Table 2.2 Additional Feasible Option Assessment Summary

Ref	Option Name	Design Capacity (Ml/d)	Construction (C) or Operation (O)	Biodiversity	Land Use/Soils	Water Quantity and Quality	Flooding	Air Quality	Climate Change	Human Health	Economic and Social Well-being	Water Resource Use	Use of Resources	Heritage	Landscape
WC05b	Development of New Boreholes in West Cumbria Aquifer	20	C	--	-	0	-	-	--	-	++	0	--	-	-
			O	?	0	-	0	0	--	++	++	0	--	-	-
WC05c	Development of New Boreholes in West Cumbria Aquifer	20	C	--	-	0	-	-	--	-	++	0	--	-	-
			O	?	0	-	0	0	--	++	++	0	--	-	-
WC05d	Development of New Boreholes in West Cumbria Aquifer	5.4	C	--	-	0	-	-	--	-	++	0	--	-	-
			O	?	0	-	0	0	-	+	+	0	-	-	-
WC25	Effluent Reuse	20	C	--	-	0	-	-	--	-	++	0	--	-	-
			O	0	0	+	0	0	--	?	++	+	--	0	-

2.2.1 Construction Effects

Significant construction-related effects were identified against biodiversity, climate change, economic and social well-being and use of resources for all of the additional feasible options. Significant positive effects were identified for economic and social well-being with the remaining effects assessed as being negative.

The construction of all of the feasible options would represent a large capital investment (as defined within the definitions of significance presented in **Appendix A** as being in excess of £10 million) which is likely to generate a number of employment opportunities and supply chain benefits as well as increased spend in the local economy by contractors and construction workers. This was assessed as having a significant positive effect on economic and social well-being. No further significant (or minor) positive construction-related effects were identified during the assessment.

All of the feasible options were assessed as having a significant negative effect on biodiversity during the construction phase. This principally reflects the environmental sensitivity of the West Cumbria WRZ and potential for pipeline works in particular to affect several European designated sites including the River Ehen Special Area of Conservation (SAC) (under options WC05b/c/d and WC25) and the River Derwent and Bassenthwaite Lake SAC (under Option WC25). However, it should be noted that the addendum to the draft HRA states that it is likely that the works could be suitably managed to avoid significant or adverse effects (e.g. timing of works to avoid migration periods; routing pipeline to make use of existing road crossings). Furthermore, it would be anticipated that scheme level investigations and appropriate assessment would also be undertaken at the project stage should the options be taken forward. Notwithstanding, all options would result in the loss of greenfield land and in consequence there may be disturbance/habitat loss associated with construction activity and landtake.

Reflecting the scale of construction activity associated with the feasible options, all were assessed as having a significant negative effect on climate change as a result of associated greenhouse gas emissions from HGV movements, construction plant and embodied carbon in raw materials, taking into account the definitions of significance contained in **Appendix A**. Material use and energy requirements would also be substantial and therefore these options were assessed as having a significant negative effect on resource use.

No further significant negative construction-related effects were identified during the assessment. As noted above, all options would result in the loss of greenfield land and as a result were assessed as having a minor negative effect on land use and soils. Emissions to air from HGV movements and construction plant were also considered likely to have a minor negative effect on air quality and, together with noise/vibration, human health. This reflects both the temporary nature of construction activity, the potential for adverse effects to be minimised through the adoption of good practice, and the remoteness of many of the development sites from larger numbers of sensitive human receptors. Further minor negative effects were identified in respect of flooding (given the location of some sections of pipeline works within Flood Zones 2 and 3).

The location of some borehole sites under Options WC05 b/c/d and pipeline routes would be in close proximity to designated cultural heritage assets such as listed building and scheduled monuments. Under Option WC25, meanwhile, the site of the proposed new water treatment works at Whitehaven is adjacent to a Grade II Listed Building (Milestone to East of Parton Police Station) and in close proximity to Frontiers of the Roman Empire

(Hadrian's Wall) World Heritage Site/Parton Roman fort Scheduled Monument (although the potential for substantial direct/indirect impacts on this asset is considered to be low given the presence of the A595 and residential areas that separate the proposed site). In consequence, all of the feasible options were assessed as having a minor negative effect on cultural heritage.

All of the feasible options would require excavation works in the Lake District National Park to lay new pipeline. In consequence, there is potential for substantial landscape effects associated with pipeline works. However, the majority of the pipeline routes would follow existing linear features (roads) and adverse effects would be over a short timescale with planting and re-seeding likely to return land to a pre-development state within a year (depending on the season in which works are undertaken). The borehole sites under Options WC05b/c/d would be located in predominantly rural areas and on greenfield land whilst the water treatment works at Whitehaven under Option WC25 would be in close proximity to residential receptors and outside the existing built up area near Parton. In consequence, there is the potential for construction activity associated with these options to have adverse landscape and visual amenity impacts. Overall, all of the feasible options were assessed as having a minor negative effect on landscape.

The feasible options were assessed as having a neutral effect in respect of water quantity/quality and water resource use during the construction phase.

2.2.2 Operational Effects

Significant operational effects were identified against climate change, human health, economic and social well-being and use of resources. Significant positive effects were identified for human health and economic and social well-being with the remaining effects assessed as being negative.

Options WC05b and WC05c were assessed as having a significant positive effect on health (in helping to ensure the continuity of a safe and secure drinking water supply) and economic and social well-being (given the potential for additional supply to support economic/population growth). This reflects their substantial design capacities (20 Ml/d) which, in accordance with the definitions of significance (see **Appendix A**), were considered to be significant. The design capacity of Option WC05d would be lower (5.4 Ml/d) and positive effects on these objectives were therefore assessed as minor. Whilst Option WC25 would also result in an increased supply of drinking water of 20Ml/d, there is uncertainty with respect to the extent to which (using current technologies) the reuse of treated effluent would provide safe drinking water and, in this respect, this option could be perceived negatively by some customers. Overall, the option was therefore assessed as having a significant positive effect on economic and social well-being but an uncertain effect on health.

No further significant positive operational effects were identified during the assessment. Option WC25 was assessed as having a minor positive effect in respect of water quantity/quality and resource use due to the potential for this option (through effluent reuse) to deliver increased capacity without the need for additional abstraction.

With the exception of Option WC05d, all of the feasible options were considered likely to have significant negative effects on climate change and resource use SEA objectives during operation, reflecting additional energy requirements (and related greenhouse gas emissions). Energy demand and associated greenhouse gas emissions

related to the operation of Option WC05d would be lower and negative effects on these objectives were therefore assessed as being minor.

No further significant negative effects associated with the operation of the feasible options were identified during the assessment. Options WC05b/c/d were assessed as having a minor negative effect on water quantity, due to associated reductions in surface and groundwater levels. There may also be minor negative effects on cultural heritage and landscape objectives which principally reflects the potential for adverse landscape/visual impacts associated with new above ground infrastructure.

Once construction activity is complete, it was not expected that any of the feasible options would have adverse air quality impacts. Effects on this objective were therefore assessed as neutral. Operational effects on land use/soils were also assessed as neutral for all of the feasible options with any initial loss of land related to the implementation of these schemes being assessed during the construction phase.

Effects associated with the operation of Options WC05b/c/d on biodiversity were assessed as being uncertain at this stage. Whilst the new boreholes are outside the surface water catchment of the River Ehen and therefore any localised drawdown would not affect tributaries of the river, it is possible that abstraction under these options may affect groundwater supplies to the Ehen. The addendum to the draft HRA report states that it is not clear what contribution to flow these are likely to make and that any effects are likely to be felt outside of the SAC, but the options may affect mobile species (Atlantic salmon) migrating through the lower reaches.

2.3 Summary

The additional feasible options have not been considered as potential surrogates within the Lowest Cost option set for the following reasons:

- Although some of the new proposed boreholes are outside the surface water catchment of the River Ehen, the West Cumbria aquifer system has not been modelled in detail and therefore, the groundwater components (WC05b/c/d) have the potential for adverse effects on protected sites, principally the River Ehen, by affecting its baseflow supplies in certain areas. It is likely that these groundwater options would require Habitats Regulation appropriate assessments which introduces considerable uncertainty as to the likelihood of success of the Lowest Cost option;

- The effluent reuse option would require extensive public/stakeholder discussions and public acceptability with the solution may be difficult to obtain. Implementation of this option within the Lowest Cost option set is also reliant on either development of a new groundwater option and/or agreement of a third part abstraction licence transfer. There is uncertainty with the groundwater component (as outlined above) and there remain concerns over whether the third party would require this water for future growth.

3. Assessment of the Preferred Option and Alternatives

3.1 Introduction

A total of three alternative options were taken forward for further assessment as part of the SEA of the dWRMP, with the findings recorded in the Environmental Report. These options included:

- WC01: Thirlmere Transfer into West Cumbria (the preferred dWRMP option);
- WC14d: Kielder Water Transfer to West Cumbria (Treated near Carlisle); and
- Lowest Cost Option, comprising the collective implementation of **all** of the following options: Wastwater (negotiate part abstraction licence) (WC04); Development of New Boreholes in West Cumbria Aquifer (10 Ml/d) (WC05a); Development of Boreholes in North Cumbria Aquifer (WC09).

Since consultation on the dWRMP and Environmental Report took place, United Utilities has prepared more detailed engineering estimates/scopes for the preferred option and the two alternative options. These refined scopes include more detailed information concerning infrastructure requirements, such as further consideration of pipeline routes or treatment processes, for the options to be implemented.

Therefore, both the preferred option and the alternatives listed above have been reassessed and the findings are summarised in this section of the report. Following the summary of the preferred option and alternatives assessments, the potential cumulative or synergistic effects of the implementation of the preferred option with other plans, programmes and projects identified in the Environmental Report are reconsidered.

This section also outlines further mitigation measures that could be incorporated into the design of the preferred option to reduce negative effects or enhance positive effects.

Finally, this section concludes by identifying the reasons for selection of the preferred option and rejection of alternatives.

3.2 Potential Effects of the Preferred Option and Alternatives

The findings of the detailed assessments of the preferred option and the two alternatives during both construction and operation are presented in **Table 3.1** and are discussed in more detail in the sections that follow. The full assessments and potential mitigation measures for the preferred option and alternatives are included in **Appendix C**.

Table 3.1 Summary of the Preferred Option and Alternatives Assessment

Ref	Option Name	Design Capacity (Ml/d)	Construction (C) or Operation (O)	Biodiversity	Land Use/Soils	Water Quantity and Quality	Flooding	Air Quality	Climate Change	Human Health	Economic and Social Well-being	Water Resource Use	Use of Resources	Heritage	Landscape
WC01	Thirlmere Transfer into West Cumbria	80	C	-	-	0	-	-	--	-	++/-	0	--	-	--
			O	++	0	++	-	0	--	++	++	0	0	0	-/?
WC14d	Kielder Water Transfer to West Cumbria (Treated near Carlisle)	80	C	-	-	0	-	-	--	-	++/-	0	--	-	--
			O	++	0	++	-	0	--	++	++	0	-	0	-/?
WC04, WC05a, WC09	Lowest Cost Option	24.5	C	-	-	0	-	-	--	-	++/-	0	--	-	-
			O	?	0	-	-	0	--	++	++	0	--	0	-

3.2.1 Preferred Option: WC01 - Thirlmere Transfer into West Cumbria

The preferred option involves increasing abstraction from Thirlmere reservoir within current licence conditions by enhancing infrastructure capacity. This option represents a large scale scheme comprising several infrastructure components including new service reservoirs, a water treatment works, pumping stations and over 100km of new pipeline. This option would also involve the abandonment of five existing water treatment works in West Cumbria near Quarry Hill, Ennerdale, Cornhow, Buttermere and also Thirlmere. It should be noted that the option would involve the decommissioning of the sources from permanent operational use, although United Utilities may seek to retain some locations as drought contingency sources.

A summary of the main changes to the scope of this option and the subsequent assessment of effects since the publication of the Environmental Report is provided in **Box 1** below.

Box 1	**What has changed since the Previous Assessment?**
Key Changes in Option Scope	
Option WC01 was assessed in the Environmental Report. A more detailed engineering scope has been prepared, which has provided further details concerning the infrastructure requirements for this option. The main change to this option has been confirmation of the pipeline size and routes, for example the route now passes to the north and east of Bassenthwaite Lake, and the provision of indicative footprints of key components of the scheme including the proposed new water treatment works at the existing Thirlmere facility. The construction period has increased from 2.25 to 6 years. Estimated carbon emissions have been updated. Further analysis of the impacts of additional abstraction of water from Thirlmere has also been undertaken.	
Changes in the Assessment	
All potential effects on the SEA objectives have been re-assessed with particular emphasis on biodiversity and landscape (to reflect additional details with respect to the infrastructure requirements associated with the option) and climate change and resource use (to reflect revised carbon and energy use estimates).	
The revised assessment has identified that the majority of effects on the SEA objectives are similar to those identified in the Environmental Report. Reflecting revised data in respect of energy requirements associated with the operation of the option, effects on resource use have been assessed as neutral due to energy use from the new facilities being offset by closure of water treatment works sites elsewhere (effects on this objective during operation were assessed as significant negative in the Environmental Report). Based on further information provided by United Utilities in respect of the likely scale of the proposed new water treatment works at the existing Thirlmere facility and service reservoirs, the assessment has identified the potential for significant negative effects on landscape should appropriate mitigation not be implemented.	

Construction Effects

Reflecting the scale of construction activity associated with this option, significant negative effects were identified in respect of climate change as a result of associated greenhouse gas emissions from HGV movements, construction plant and embodied carbon in raw materials (the option would generate an estimated 331,473 tonnes CO_2e during construction, including the decommissioning of existing water treatment works). Using the embodied carbon associated with the construction phase as a proxy, material use and energy requirements are considered to be substantial and, taking into account waste generation, the option was therefore assessed as having a significant negative effect on resource use.

The majority of development sites (with the exception of that near Bothel Moor) would be located within the Lake District National Park. This would include proposed new service reservoirs near Ennerdale (of footprint approximately 4,900m^2) and near Castle Rigg (of footprint approximately 26,000m^2) and the new water treatment works and pumping station (of footprint approximately 14,400m^2) which, under current proposals, would be in the

vicinity of the existing water treatment works at the northern end of Thirlmere[10]. Approximately 50% of the pipeline length would also lie within the Lake District National Park. In consequence, there is considered to be the potential for substantial landscape effects associated with construction activity. Development may also affect the visual amenity of residential receptors in close proximity to the development sites (and in particular those receptors in close proximity to Castle Rigg and Bothel Moor) and along the pipeline route as well as recreational users. Overall, the option was assessed as having a significant negative effect on landscape.

The construction of this option would represent a large capital investment which is likely to generate a number of employment opportunities and supply chain benefits as well as increased spend in the local economy by contractors and construction workers. However, HGV movements and pipeline works of the proposed scale may cause traffic disruption, particularly if works are undertaken during peak tourist periods when the influx of visitors to the area causes congestion. The option was therefore assessed as having a mixed significant positive and minor negative effect on economic and social well-being.

The assessment did not identify any further significant negative or significant positive construction-related effects. The HRA identifies that there is potential for significant construction effects on the River Derwent and Bassenthwaite Lake SAC, Clints Quarry SAC, Lake District High Fells SAC and River Ehen SAC, primarily due to pipeline works. However, taking into account scheme specific mitigation, and a commitment for pipeline works to be within or adjacent to existing roads (or suitable alternatives identified in discussion with Natural England and the Environment Agency), no significant construction-related effects would be anticipated. It should also be noted that further, scheme level investigations and appropriate assessment would be undertaken at the project stage. Notwithstanding, this option would result in the loss of greenfield land at several development sites and in consequence, there is potential for localised loss of habitat and, in conjunction with decommissioning works, disturbance which has been assessed as having a minor negative effect on biodiversity.

The option may generate minor negative effects in respect of land use/soils (due to additional land take required under this option), flood risk (the Thirlmere and Ennerdale development sites are situated within Flood Zones 2/3 whilst several sections of the pipelines would be routed across Flood Zones 2/3) and cultural heritage (due to potential effects on the settings of listed buildings and scheduled monuments). Emissions to air from HGV movements and construction plant may also have a minor negative effect on air quality and, together with noise/ vibration, human health.

The option was assessed as having a neutral effect in respect of water quantity/quality and water resource use during the construction phase. Whilst there is the potential for contaminants such as silt, concrete or fuel oil to pollute watercourses, it is not expected that construction activity would affect water quality or water resources, provided good practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

[10] Note: footprints are based on the operational footprint of the new facilities (including an allowance for perimeter roads and hardstanding) and are indicative only at this stage.

Operational Effects

Similar to the construction phase, the option is likely to have a significant negative effect on the climate change SEA objective which principally reflects additional greenhouse gas emissions associated with the treatment and pumping of water. Whilst this option would also result in the closure of existing water treatment works (near Quarry Hill, Ennerdale, Cornhow, Buttermere and the existing Thirlmere works) and would therefore generate some carbon emission reductions (an estimated 3,569 tonnes CO_2e/a), overall net operational greenhouse gas emissions are expected to be significant (approximately 1,502 tonnes CO_2e/a).

The scheme is designed to relieve pressure on the River Ehen SAC. Abstraction from Ennerdale Water, which discharges into the Ehen, has been identified for amendments under the Review of Consents (RoC) programme due to the impact of abstraction on interest features in the SAC (primarily fresh water pearl mussels). The decommissioning of the water treatment works serving Ennerdale and associated abstraction from Ennerdale Water under this option may therefore generate benefits in respect of these features due to increased flows. It is assumed that compensation flow to St John's Beck, downstream of Thirlmere, would be maintained in accordance with the existing consent and in consequence no adverse effects on the River Derwent and Bassenthwaite Lake SAC and the River Derwent and Tributaries Site of Special Scientific Interest (SSSI) (which includes the Beck) would be expected. The decommissioning of the water treatment works near Quarry Hill would result in a reduction in abstraction from Dash Beck and Hause Gill, sources that have been investigated under the RoC programme due to impacts on salmon which are interest features of this SSSI and SAC, whilst the decommissioning of the water treatment works near Cornhow and cessation of abstraction from Crummock Water may also lead to benefits in respect of the SSSI and SAC (although this source has not been identified for reduction under the RoC programme). Taking into account the potential operational benefits in respect of the River Ehen SAC and River Derwent and Bassenthwaite Lake SAC in particular, this option was assessed as having a significant positive effect on biodiversity. The decommissioning of the five water treatment works has also been assessed as having a significant positive effect on water quantity and quality due to increases in flows in the catchments in which associated abstractions are located (Dash Beck, Bassenthwaite/Derwent, Ellen, Ehen and Cocker).

The option has a design capacity of 80 Ml/d, serving to meet short term peak demands as well as addressing the deficit within the West Cumbria WRZ which is based on critical period average demand. Furthermore, the decommissioning of existing sources may benefit downstream abstractors (where hands off flow constraints are in place) or present opportunities for new abstractions (subject to licensing). This has been assessed as having a significant positive effect on health (in helping to ensure the continuity of a safe and secure drinking water supply) and economic and social well-being (given the potential for additional supply to support economic/population growth and help sustain the seasonal influx of tourists to the area). It should be noted that the implementation of this option would result in a reduction of the surplus in the existing Integrated Resource Zone by a maximum of 42 Ml/d, but that the zone would still remain in surplus through the planning horizon..

No further significant negative or significant positive operational effects were identified during the assessment. The new water treatment works in the vicinity of the existing Thirlmere facility would constitute a relatively large scale development in the Lake District National Park and a substantial increase in building footprint. In consequence, there is the potential for significant negative effects on landscape and the visual amenity of local receptors during operation. However, mitigation would be implemented to lessen landscape and visual impacts.

Mitigation could include, for example, the adoption of sympathetic design (for example, the use of local materials where possible and/or incorporation of a 'green roof') and it is also anticipated that screening would be provided where appropriate. It is also assumed that, where feasible, new service reservoirs would be buried which, alongside appropriate screening and landscaping, would be likely to lessen the immediate landscape/visual impact over time (as vegetation matures). Overall, assuming that the measures outlined above are implemented to reduce landscape and visual impacts, it is not expected that effects on landscape would be significant in this instance. Notwithstanding, it should be noted that the exact locations of development sites have not yet been determined. This would be established at the project stage when the location of all components of the scheme including pipelines would be determined through a site selection exercise as part of the Environmental Impact Assessment (EIA) process. In this context, any proposal would be subject to full landscape and visual impact assessment whilst landscape and visual impact would be a key consideration in the determination (by the relevant local planning authority) of any Town and Country planning application(s) related to the scheme. Should residual landscape and visual impacts prove to be unacceptable, then alternative locations for the proposed new water treatment works and other above ground infrastructure may need to be considered.

Operation of the option would result in additional draw-down of Thirlmere which may be perceptible to recreational users. Under operation, storage in Thirlmere reservoir would be lower than under current operational practice. Analysis of reservoir levels was completed by United Utilities, taking into account the impact of the transfer along with other factors such as trends in customer demand and climate change. Expressed as a proportion of gross storage capacity, the assessment indicated a reduction of approximately 7% in the average annual minimum storage levels in Thirlmere under normal year conditions. In the driest years, for example 1984 or 1995-1996, minimum storage in Thirlmere could be around 12% lower compared to minimum storage under current operation. Given the national importance of the Lake District National Park, there is potential for effects on landscape and the visual amenity of recreational users due to changes in reservoir levels. However, the change in mean operating level of the reservoir would be limited under this option compared to current operation. Although the minimum level in a dry year would be lower, it is considered that the difference between reservoir levels under current operation and under this option would not substantially affect landscape character or visual amenity.

The operation of this option is expected to have further minor negative effects on flood risk (owing to the location of assets within Flood Zones 2/3).

The option was assessed as having a neutral effect on five objectives during operation, namely soils/land use, water resources, air quality, resource use and cultural heritage.

3.2.2 Option WC14d: Kielder Water Transfer to West Cumbria (Treated near Carlisle)

This option comprises the transfer of water from Kielder Water in the Northumbrian Water supply region to the West Cumbria WRZ. The requirements for this option are set out in **Appendix C**. A summary of the main changes to the scope of this option and the subsequent assessment of effects since the publication of the Environmental Report is provided in **Box 2** below.

Box 2	What has changed since the Previous Assessment?

Key Changes in Option Scope

Option WC14d was assessed in the Environmental Report. A more detailed engineering scope has been prepared, which has provided further details concerning the infrastructure requirements for this option. The main change to this option has been confirmation of the pipeline route from Kielder reservoir to Carlisle. Further clarity has been provided concerning the infrastructure required along the pipeline route. The construction period has increased from 3 to 11 years. Carbon emission estimates have also be revised.

Changes in the Assessment

All potential effects on the SEA objectives have been re-assessed with particular emphasis on biodiversity and landscape (to reflect additional details with respect to the infrastructure requirements associated with the option) and climate change and resource use (to reflect revised carbon and energy use estimates).

The revised assessment has identified that the majority of effects on the SEA objectives are similar to those identified in the Environmental Report. However, under current proposals a new service reservoir would be located near Ennerdale in the Lake District National Park whilst the proposed pipeline would cross this National Park in addition to the Northumberland National Park. In consequence, the option has been assessed as having a significant negative effect on landscape during construction (effects on this objective during construction were assessed as minor negative in the Environmental Report). Based on further information provided by United Utilities in respect of the likely scale of the proposed new water treatment works near Carlisle, the assessment has identified the potential for significant negative effects on landscape during operation should appropriate mitigation not be implemented.

Reflecting revised data in respect of energy requirements associated with the operation of the option, effects on resource use have been assessed as minor negative (effects on this objective during operation were assessed as significant negative in the Environmental Report).

Effects of Construction

This option represents a large scale scheme comprising several infrastructure components including a new intake, water treatment works, pumping station and pipeline together with the decommissioning of four existing water treatment works. Construction activity is therefore expected to have a significant negative effect on climate change as a result of associated greenhouse gas emissions from HGV movements, construction plant and embodied carbon in raw materials (the option would generate 884,257 tonnes CO_2e during construction, including the decommissioning of existing water treatment works). Using the embodied carbon associated with the construction phase as a proxy, material use and energy requirements are considered to be substantial and, taking into account waste generation, the option was therefore assessed as having a significant negative effect on resource use.

The sites serving Cornhow and Ennerdale are within the Lake District National Park. Under current proposals, the pipeline associated with this scheme would also cross the Lake District National Park and Northumberland National Park. Development may also affect the visual amenity of residential receptors in close proximity to the development sites (and in particular those receptors in close proximity to Bothel Moor and the water treatment works near Carlisle) and along the pipeline route, as well as that of recreational users. Overall, the option was assessed as having a significant negative effect on landscape.

The construction of this option would represent a large capital investment which is likely to generate a number of employment opportunities and supply chain benefits as well as increased spend in the local economy by contractors and construction workers. However, HGV movements and pipeline works could result in disruption to roads in the area. Overall, the option was therefore assessed as having a mixed significant positive and minor negative effect on economic and social well-being.

The assessment did not identify any further significant negative or significant positive construction-related effects. There is the potential for construction activity (particularly pipeline works) to affect designated sites including the River Eden SAC, River Derwent and Bassenthwaite Lake SAC and River Ehen SAC. However, the HRA states

that it is likely that these effects could be managed/avoided with scheme specific mitigation and adoption of best practice techniques, for example, by timing construction works near rivers to avoid the key migration periods; and by developing specific silt control plans to manage construction run-off. It should also be noted that scheme level investigations and appropriate assessment would be undertaken at the project stage should the option form part of the final Water Resources Management Plan. Notwithstanding, this option would result in the loss of greenfield land at several development sites and in consequence there is potential for localised loss of habitat and, in conjunction with decommissioning works, disturbance which has been assessed as having a minor negative effect on biodiversity.

The option may generate minor negative effects in respect of land use/soils (due to additional land take required under this option), flood risk (the site of the new intake and some decommissioning works would be within Flood Zones 2/3 whilst the proposed pipeline routes would cross Flood Zones 2/3 at several points) and cultural heritage (due to potential effects on the settings of listed buildings and scheduled monuments). Emissions to air from HGV movements and construction plant may also have a minor negative effect on air quality and, together with noise/ vibration, human health.

The option was assessed as having a neutral effect in respect of water quantity/quality and water resource use during the construction phase. Whilst there is the potential for contaminants such as silt, concrete or fuel oil to pollute watercourses, it is not expected that construction activity would affect water quality or water resources, provided good practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

Effects of Operation

As with Option WC01, this option is likely to have a significant negative effect on the climate change SEA objective which principally reflects additional greenhouse gas emissions associated with the treatment and pumping of water. Whilst this option would also result in the closure of existing water treatment works (near Quarry Hill, Ennerdale, Cornhow and Buttermere) and would therefore generate some carbon emission reductions (an estimated 3,066 tonnes CO_2e/a), overall net operational greenhouse gas emissions are expected to be significant (approximately 10,411 tonnes CO_2e/a).

The HRA identifies that the operation of this option is unlikely to have any adverse effects on designated European sites. Use of water from Kielder would not affect any water resource dependent interest features at sites within its catchment and the only real mechanism for impacts would be indirect, through increases in discharges after useage. However, in reality, it is assumed that the transfer would be tailored to the deficit and any increase in, for example, river flows would be well within natural variation. Although the option does constitute an interbasin transfer of raw water, it would be treated immediately on arrival and risks associated with this (e.g. invasive species transfer) would not be expected. Like Option WC01, this option would involve the decommissioning of the water treatment works near Ennerdale, Cornhow, Quarry Hill and Buttermere. This was assessed as having a significant positive effect on biodiversity and water quantity/quality objectives.

The option has a design capacity of 80 Ml/d, serving to meet short term peak demands as well as addressing the deficit within the West Cumbria WRZ which is based on critical period average demand. Furthermore, the

decommissioning of existing sources may benefit downstream abstractors (where hands off flow constraints are in place) or present opportunities for new abstractions (subject to licensing). This has been assessed as having a significant positive effect on health (in helping to ensure the continuity of a safe and secure drinking water supply) and economic and social well-being (given the potential for additional supply to support economic/population growth and help sustain the seasonal influx of tourists to the area).

No further significant negative or significant positive operational effects have been identified. The new water treatment works near Carlisle would have a footprint of approximately 10,500 m^2 (excluding roads and pumping station) and therefore has the potential to have a significant negative effect on local landscape character and the visual amenity of residential receptors to the north. However, few properties would be located in the vicinity of the water treatment works (approximately 20 buildings within a 0.5km radius) and adverse effects may be lessened by the adoption of appropriate mitigation such as screening, sympathetic design and use of local materials. Overall, assuming that the measures outlined above are implemented to reduce landscape and visual impacts, it is not expected that effects on landscape would be significant in this instance. Notwithstanding, it should be noted that the exact locations of development sites have not yet been determined. This would be established at the project stage when the location of all components of the scheme including pipelines would be determined through a site selection exercise as part of the EIA process. In this context, any proposal would be subject to full landscape and visual impact assessment whilst landscape and visual impact would be a key consideration in the determination (by the relevant local planning authority) of any Town and Country planning application(s) related to the scheme. Should residual landscape and visual impacts prove to be unacceptable, then alternative locations for the proposed new water treatment works and other above ground infrastructure may need to be considered.

The operation of this option is expected to have minor negative effects on flood risk, due to the location of the new pumping station at near Haltwhistle in Flood Zone 3, and on resource use, principally due to resource requirements associated with the treatment of water.

The option was assessed as having a neutral effect on four objectives during operation, namely soils/land use, water resources, air quality and cultural heritage.

3.2.3 Lowest Cost Option

This option would involve the collective implementation of four individual smaller scale options that together would deliver a total scheme capacity 24.5 Ml/d to the West Cumbria WRZ. A summary of each constituent option is provided below:

- Wastwater (negotiate part abstraction licence): This component involves an agreement with third party licence holders for water transfer from a Service Reservoir near Workington to the water treatment works near Ennerdale. It would require the construction of a new 10 Ml/d pumping station at the service reservoir, 13.5km of pipeline and a new mixing tank at Ennerdale;

- Development of New Boreholes in West Cumbria Aquifer (10 Ml/d): This component would involve the construction of seven new boreholes in addition to utilising an existing borehole. The scheme would require drilling of a borehole at each site, a new fixed speed borehole pump and a new headworks GRP kiosk. The existing site would also require a new break tank, aeration tower and raw water pumping station. A total of 8km of pipeline would be required to interconnect the sites and a 13km pipeline would transfer all raw water to the water treatment works near Ennerdale. A new 1km washout main would also be needed from the existing site to the nearest Egremont sewer.

- Development of Boreholes in North Cumbria Aquifer: This component comprises the construction of two new boreholes near Waverton and Thursby for abstraction and transfer to the water treatment works serving Quarry Hill. The scheme would also require a new 23km raw water transfer pipelines from the borehole sites to the water treatment works.

In addition to the above, treated water would be transferred from Quarry Hill via an existing service reservoir at Workington to an existing service reservoir at Whitehaven.

It is important to note that this option relies on the implementation of all of the options outlined above. It would not be possible for individual option elements to be brought forward due to the relatively low design capacities of each component option which would be insufficient in isolation to address the deficit in the WRZ.

A summary of the main changes to the scope of this option and the subsequent assessment of effects since the publication of the Environmental Report is provided in **Box 3** below.

Box 3	**What has changed since the Previous Assessment?**
Key Changes in Option Scope The Lowest Cost Option was assessed in the Environmental Report. The main change to this option has been an increase in the construction period from 2 to 5 years. Carbon emissions estimates have also been revised. It should be noted that the under the latest scope for the WC05a component of the scheme, one of the borehole locations was changed. However, the number of boreholes required under the Option WC05a component remains the same. The Crummock compensation scheme (Option WC19) and the associated pipeline transfer (Option WC24) are also now not required. **Changes in the Assessment** All potential effects on the SEA objectives have been re-assessed with particular emphasis on climate change and resource use (to reflect revised carbon and energy use estimates) although no substantial changes have been made to the assessment or scoring contained in the Environmental Report as a result.	

Effects of Construction

Reflecting the scale of this option, construction activity is expected to have a significant negative effect on climate change as a result of associated greenhouse gas emissions from HGV movements, construction plant and embodied carbon in raw materials (the option would generate 101,428 tonnes CO_2e during construction). Using the embodied carbon associated with the construction phase as a proxy, material use and energy requirements are considered to be substantial and the option was therefore assessed as having a significant negative effect on resource use.

The construction of this option would represent a large capital investment which is likely to generate a number of employment opportunities and supply chain benefits as well as increased spend in the local economy by contractors and construction workers. However, HGV movements and pipeline works of the proposed scale may cause traffic

disruption. Therefore, the option was assessed as having a mixed significant positive and minor negative effect on economic and social well-being.

The assessment has not identified any further significant negative or significant positive construction-related effects. Whilst no development sites are affected by nature conservation designations, pipeline works may affect several European designated sites including the River Ehen SAC and River Derwent and Bassenthwaite Lake SAC. However, the HRA states that it is likely that effects on these sites arising from pipeline works could be managed/avoided with scheme specific mitigation (e.g. re-routing to avoid designated sites). In this respect, it is considered reasonable to assume that pipelines would be routed within or alongside existing carriageways and river crossings (or via suitable alternative routes identified in discussion with Natural England and the Environment Agency). It should also be noted that further, scheme level investigations and appropriate assessment would be undertaken at the project stage. Notwithstanding, this option would result in the loss of greenfield land at several development sites and in consequence there is potential for localised loss of habitat and disturbance which has been assessed as having a minor negative effect on biodiversity.

The option may generate minor negative effects in respect of land use/soils (due to additional land take required under this option), flood risk (the proposed new mixing tank at Ennerdale and sections of the proposed pipelines would be within/cross Flood Zones 2/3) and cultural heritage (due to potential effects on the settings of listed buildings and scheduled monuments). With regard to landscape, the water treatment works serving Ennerdale is located within the Lake District National Park and in consequence there is potential for significant landscape impacts. However, the scale of works would be small (construction of a new mixing tank) and development would be within an existing site. The proposed pipelines would also cross the Lake District National Park although routes would generally follow existing linear features (roads) and adverse effects would be over a short timescale with planting and re-seeding likely to return land to a pre-development state within a year (depending on the season in which works are undertaken). In consequence, effects on this objective were assessed as minor. Emissions to air from HGV movements and construction plant may also have a minor negative effect on air quality and, together with noise/vibration, human health.

The option was assessed as having a neutral effect in respect of water quantity/quality and water resource use during the construction phase. Whilst there is the potential for contaminants such as silt, concrete or fuel oil to pollute watercourses, it is not expected that construction activity would affect water quality or water resources, provided good practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures).

Effects of Operation

Similar to the construction phase, this option is likely to have significant negative effects on climate change and resource use SEA objectives. This principally reflects the additional energy requirements (and related greenhouse gas emissions) associated with the treatment and pumping of water (the combined greenhouse gas emissions associated this option would be an estimated 5,492 tonnes CO_2e/a).

The option has a design capacity of 24.5 Ml/d, serving to address deficit within the West Cumbria WRZ. This was assessed as having a significant positive effect on health (in helping to ensure the continuity of a safe and secure

drinking water supply) and economic and social well-being (given the potential for additional supply to support economic/population growth and help sustain the seasonal influx of tourists to the area). However, it should be noted that this option would not solve West Cumbria's vulnerability to short droughts and limited drought options.

No further significant negative or significant positive operational effects were identified during the assessment. The operation of this option is expected to have minor negative effects on water quantity, due to a minor reduction in river flows and reservoir and groundwater levels, and flood risk, due to the location of the mixing tank near Ennerdale within Flood Zone 2. Also, while the Crummock compensation flow control is now not required, the West Cumbria supply system would become more reliant on Crummock Water (due to the cessation of abstraction from Ennerdale Water and smaller capacity of this option compared to the preferred option and Option WC14d) and abstraction would increase, but only within existing licence conditions. Therefore, no significant negative effect is anticipated.

As noted above, this option would result in new above ground infrastructure within the Lake District National Park and in consequence there would be potential for substantial landscape impacts. However, the new mixing tank at the water treatment works near Ennerdale would be small scale and within an existing site, benefitting from screening. New above ground infrastructure outside the Lake District National Park would be in rural settings and on greenfield land and in consequence, there may be potential for adverse effects on local landscape character (although the pumping station at Workington and works at the existing borehole site in west Cumbria would be within existing sites). Together with potential adverse effects on the visual amenity of residential receptors in close proximity to the development sites, this was assessed as having a minor negative effect on landscape.

The option was assessed as having a neutral effect on four objectives during operation, namely soils/land use, water resources, air quality and cultural heritage.

Effects on biodiversity were assessed as uncertain at this stage. Whilst the majority of the scheme components are unlikely to have any significant adverse effects on European designated sites, the findings of the HRA in respect of the operation of the new West Cumbria aquifer boreholes and Wastwater transfer indicate that effects on several European designated sites including Wastwater SAC, River Ehen SAC and River Derwent and Bassenthwaite Lake SAC are uncertain. Furthermore, new borehole abstractions near Waverton and Thursby have the potential to impact on the nearby River Waverley and River Wampool and may affect water dependent SSSIs downstream of the borehole sites, although no readily available flow data could be found for the River Waverley or Wampool to contextualise the abstraction volumes and current flow.

3.2.4 Summary of the Assessment of the Preferred Option and Alternatives

In the majority of cases effects associated with the construction and operation of the preferred option (Option WC01) and alternatives (Option WC14d and the Lowest Cost Option) on the SEA objectives are similar to those identified in the Environmental Report.

Construction related effects associated with the preferred option and the alternatives are considered to be broadly similar with significant negative effects assessed against climate change and resource use objectives and significant positive effects identified in respect of economic and social well-being. As in the assessment contained in the

Environmental Report, the preferred option was assessed as having a significant negative effect on landscape as the majority of the proposed development sites under this scheme would be located within the Lake District National Park. Based on revised proposals, Option WC14d (Kielder Transfer into West Cumbria (Treated near Carlisle)) has also been assessed as having a significant negative effect on landscape (negative effects on this objective were assessed as minor in the Environmental Report). This reflects the location of the sites near Cornhow and Ennerdale being within the Lake District National Park and pipelines which would cross the Lake District and Northumberland National Parks. In contrast, the Lowest Cost Option has been assessed as having a minor negative effect on landscape.

It should be noted that, whilst all options were assessed as having a significant negative effect against climate change during construction, estimated greenhouse gas emissions do vary between the options. Option WC14d is likely to generate the greatest volume of emissions (an estimated 884,257 tonnes CO_2e) and the Lowest Cost Option the least (101,428 tonnes CO_2e) whilst the Preferred option would generate an estimated 331,473 tonnes CO_2e.

As with construction, significant negative operational effects were identified in respect of the climate change objective for all options, due to additional greenhouse gas emissions associated with the treatment and pumping of water. However, net operational emissions associated with Option WC14d are estimated to be considerably higher than both the preferred option and Lowest Cost Option (10,411 tonnes CO_2e/a for Option WC14d compared to 1,502 tonnes CO_2e/a under Option WC01and 5,492 tonnes CO_2e/a under the Lowest Cost Option). All of the options were also assessed as having a significant positive effect on health and economic and social well-being, reflecting the substantial additional capacity each would deliver, although it should be noted that design capacities of Option WC01 and Option WC14d are substantially greater than the Lowest Cost Option (80Ml/d for both compared to 24.5Ml/d).

As identified in the Environmental Report, there was a marked difference in effects against the biodiversity and water quantity/quality SEA objective across the options for operation. Both the preferred option and Option WC14d would involve the decommissioning of water treatment works near Ennerdale, Cornhow, Quarry Hill and Buttermere (and, in the case of the Preferred option, Thirlmere) which has been assessed as having a significant positive effect on biodiversity and water quantity/quality objectives. Meanwhile, the operational effects of the Lowest Cost Option on biodiversity were considered to be more uncertain particularly as it is not clear at this stage how the operation of several scheme components may affect European designated sites. Effects on water quantity/quality associated with the operation of this option were assessed as being negative.

Revised data provided by United Utilities in respect of energy usage highlights that net energy requirements associated with the preferred option and Option WC14d would be lower than estimated in the Environmental Report, owing principally to the potential energy savings associated with the decommissioning of water treatment works. In consequence, the preferred option has been assessed as having a neutral effect on resource use whilst Option WC14d is considered likely to have a minor negative effect on this objective (negative effects identified in the Environmental Report for both options were considered to be significant). As the Lowest Cost Option would not result in the decommissioning of existing water treatment works, this option has been assessed as having a significant negative effect on resource use.

3.3 Cumulative Effects of Implementing the Preferred Option

The Environmental Report contained an assessment of the cumulative effects of implementing the preferred option. This considered the potential for cumulative effects of the dWRMP and the following:

- population change in the United Utilities area;
- Nationally Significant Infrastructure Projects (NSIPs);
- United Utilities' Draft Statutory Drought Plan 2012; and
- other water company WRMPs.

The preferred WRMP option remains Option WC01: Thirlmere Transfer into West Cumbria and in consequence, cumulative effects are expected to be broadly similar to those identified in the Environmental Report.

It should be noted that since the publication of the Environmental Report United Utilities has published its Final Statutory Drought Plan[11], which provides a comprehensive statement of the actions that may be implemented during drought conditions to safeguard essential water supplies to customers and minimise environmental impact. The drought options identified for the West Cumbria WRZ are the same as those identified in the Draft Drought Plan published for consultation in November 2012 and considered in the Environmental Report, with the exception of those options involving the additional drawdown of Ennerdale Water. These options have not been taken forward in the Final Plan following the issue by the Environment Agency of an Environmental Damage notice (under the Environmental Damage Regulations 2009) in December 2012 to help the freshwater mussel population in the River Ehen to recover.

As set out in the Environmental Report, the WRMP preferred option is designed to relieve pressure on the River Ehen SAC and so no adverse effects on this site would be expected;; likewise, the decommissioning of the water treatment works near Cornhow under the preferred option and cessation of abstraction from Crummock Water will decrease the risk of 'in combination effects' on the River Derwent and Bassenthwaite Lake SAC.

However, it is critical to note that the implementation of the WRMP preferred option would substantially change water resource management in the West Cumbria WRZ, such that the Drought Plan would immediately become irrelevant once the option was brought on-line. This would require a new drought plan to be developed. Therefore, the current Drought Plan cannot have 'in combination' effects with the WRMP as the options and scenarios promoted in the two plans cannot operate together. Notwithstanding, it should be noted that the implementation of the preferred option would help reduce the vulnerability of the West Cumbria WRZ to drought by increasing supply capacity. This is particularly beneficial given the limited number of drought options available within this WRZ.

Since the publication of the Environmental Report, the draft WRMPs of water companies in neighbouring areas (Dŵr Cymru Welsh Water, Severn Trent, Yorkshire Water, Northumbrian Water and Dee Valley Water) have been

[11] United Utilities (2013) Final Drought Plan 2013. Available from http://corporate.unitedutilities.com/documents/Final_Drought_Plan_2013.pdf [Accessed October 2013]

published[12]. However, none include options to draw water supply from resources in the West Cumbria WRZ or from Thirlmere reservoir. In light of this, no cumulative effects are likely to occur.

Any further changes or amendments to these assumptions will need to be considered during the five-yearly reviews of the WRMP and at the planning and implementation phase for the preferred option (e.g. in Environmental Impact Assessments and HRAs) to ensure that the latest and most up to date information is taken into account.

3.4 Preferred Option Proposed Mitigation Measures

The Environmental Report identified a range of measures designed to reduce some of the potential negative effects and enhance positive effects that could arise from the implementation of the preferred option. The re-assessment of the preferred option (see **Appendix C**) has confirmed that all of the measures previously identified in the Environmental Report should be considered further during the planning phases of the scheme. Additionally, further consideration has been given to those measures that could help to address adverse landscape and visual impacts associated in particular with the construction of the proposed new water treatment works and pumping station at the existing Thirlmere facility.

A summary of the proposed mitigation measures is provided below.

Scheme Species Specific Measures

Scheme specific mitigation plans will be required to ensure that any construction related adverse effects on designated sites are avoided and localised effects on biodiversity minimised. With specific regard to the Clints Quarry SAC, mitigation requirements for Great Crested Newts would need to be reviewed at the scheme level. With respect to the River Ehen SAC and River Derwent and Bassenthwaite Lake SAC, the scheme should be designed to ensure that no bankside trees are removed. Construction within 200m of the river should be completed before late summer, prior to the autumn migration period.

The following general measures should also be followed where appropriate 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 should 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 should 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 Natural England;
- Night-time working, or working around dusk/dawn, should be avoided to reduce the likelihood of negative effects on nocturnal species;

[12] Scottish Water's WRMP was published in 2009. At the time of writing, no draft WRMP was available.

- Any lighting required (either temporary or permanent) should be designed with an ecologist to ensure that potential 'displacement' effects on nocturnal animals, particularly bat species, are avoided;
- All compounds/pipe stores etc. should be sited, fenced or otherwise arranged to prevent vulnerable SAC species from accessing them;
- All materials should be stored away from commuting routes/foraging areas that may be used by species that are European site interest features;
- All excavations should have ramps or battered ends to prevent species becoming trapped;
- Pipe-caps should be installed overnight to prevent species entering and becoming trapped in any laid pipe-work.

Scheme Design and Planning

The preferred option will be subject to project-level environmental assessment[13] as it is brought forward, which will include assessments of its potential to affect European sites during 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 space is available for pollution prevention measures to be installed, such as sediment traps; and
- operational regimes required to ensure no adverse effects occur.

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 that 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 relevant to the preferred option:

- Environment Agency Pollution Prevention Guidance Notes [online]. Available at http://www.environment-agency.gov.uk/business/topics/pollution/39083.aspx:
  - PPG1: General guide to the prevention of pollution (May 2001; currently under review);
  - PPG5: Works and maintenance in or near water (October 2007);
  - PPG6: Pollution prevention guidance for working at construction and demolition sites (April 2010);

[13] These will be undertaken as part of the detailed 'investigation schemes' which are funded through inclusion in the WRMP.

- PPG21: Pollution incident response planning (March 2009); and
- PPG22: Dealing with spillages on highways (June 2002; currently under review).

- 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 dWRMP 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.

Effects on Flood Risk, Climate Change and Resource Use

The preferred option has substantial construction and operational energy requirements and associated greenhouse gas emissions. Effects could be in part mitigated through, for example, the use of low emission plant and through the use of on-site energy generation or renewable energy sources where feasible.

In view of the scale of the preferred option, a large volume of materials will be required and construction waste generated. Where significant raw materials are required this can be mitigated by utilising recycled and locally sourced materials. Construction and operational wastes should also be reused/recycled where appropriate, in accordance with a Construction Site Waste Management Plan.

To mitigate the potential effects of flooding, infrastructure should, where possible, be located outside the 1 in 100 year indicative flood plain. Where this is not possible due to operational requirements, the infrastructure should be designed such that it can continue to operate under flood conditions and not increase flood risk elsewhere.

Effects on Human Health and Social and Economic Well-being

Construction activities should be undertaken so as to minimise short term adverse effects on recreational areas, such as footpaths, and on landscape and biodiversity. Noise, traffic disruption and visual impacts should also be considered. Care should also be taken during construction regarding the potential for contaminants such as silt, concrete or fuel oil to pollute water courses via surface run-off. This can be mitigated by undertaking all construction activities in accordance with relevant good practice pollution prevention guidance.

To maximise economic benefits in the United Utilities area, it is recommended that, where possible, work is carried out by local firms and contractors or by those with a policy for training and skills development that could help contribute to the local economy and meet local employment needs.

Effects on Cultural Heritage and Landscape

Effects on landscape character and visual amenity should be considered at an early stage in the design process, particularly given the potential for adverse effects on the Lake District National Park during the construction and

operational phase of the preferred option. Potential mitigation includes, for example, the adoption of high quality design principles and landscaping/screening.

It should be noted that the exact locations of development sites that comprise the preferred option have not yet been determined. These would be established at the project stage when the location of all components of the scheme including pipelines would be determined through a site selection exercise as part of the EIA process. In this context, any proposal would be subject to full landscape and visual impact assessment whilst landscape and visual impact would be a key consideration in the determination (by the relevant local planning authority) of any Town and Country planning application(s) related to the scheme. Should residual landscape and visual impacts prove to be unacceptable, then alternative locations for the proposed new water treatment works and other above ground infrastructure may need to be considered.

The potential for adverse impacts to the settings of cultural heritage assets should also be considered early in the design process and as part of the EIA and any adverse effects minimised for example through micro-siting/alternative pipeline routes to avoid designated sites.

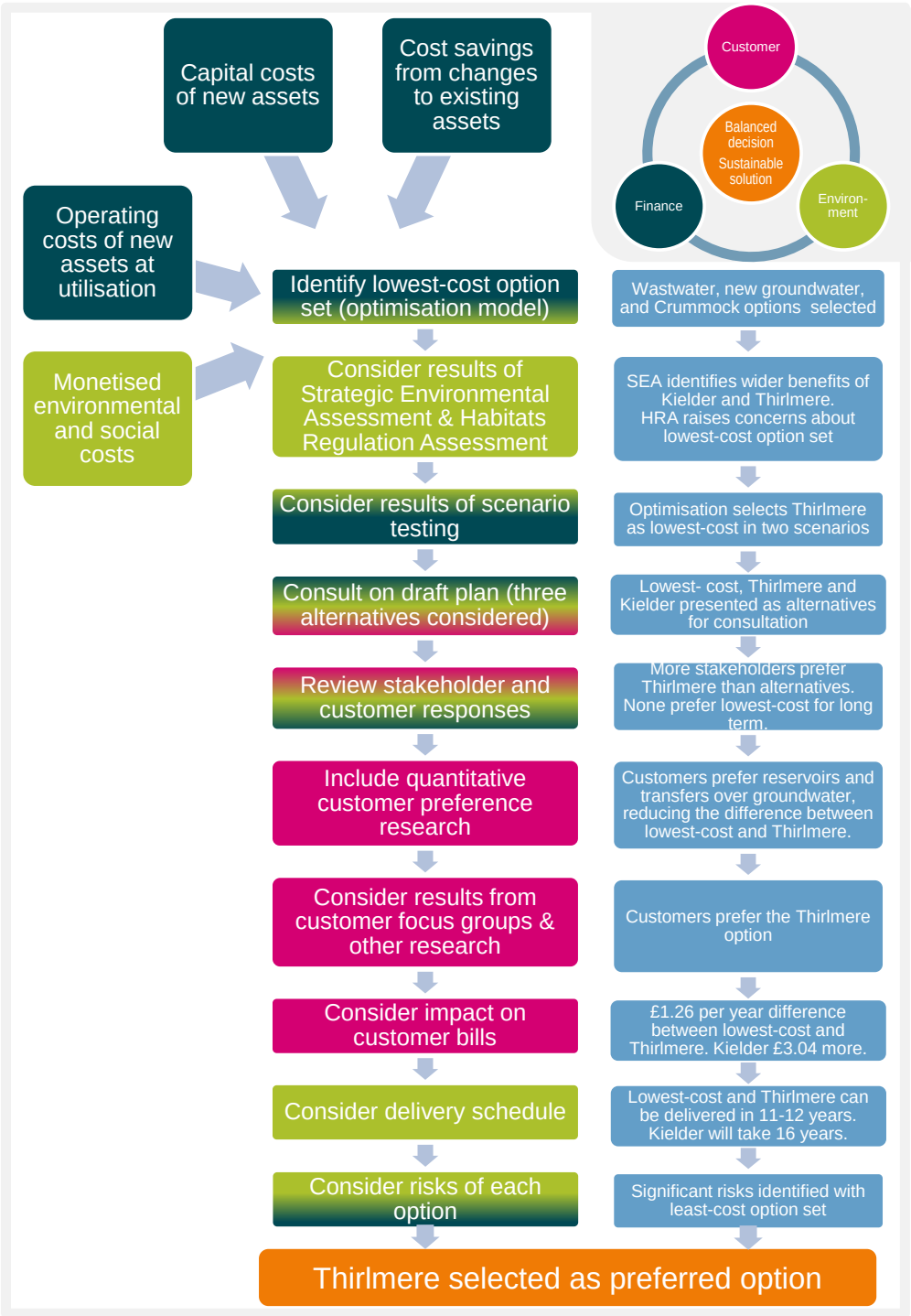
3.5 Reasons for Selection of the Preferred Option and Rejection of Alternatives

3.5.1 Reasons for the Selection of the Preferred Option

United Utilities chose the preferred option using a standard industry method that includes consideration of technical feasibility, financial costs and benefits, and quantified impacts on the environment and community, taking into account the findings of the SEA and HRA as well as input from key stakeholders and customers.

Since the publication of the dWRMP and Environmental Report, further consideration has been given to customer and stakeholder views about the three alternatives put forward in the dWRMP. More detailed engineering assessments of the cost and delivery time of the options has also been undertaken which have informed the re-assessment of the options as part of this Addendum and the HRA. The time schedule and costs of the Thirlmere (and Lowest Cost) options were then scrutinised by the Environment Agency and United Utilities has also considered the risks associated with the alternative options. A comprehensive decision making process has been applied consistent with the Water Resources Planning Guidelines, as summarised in **Figure 3.1**.

Figure 3.1 United Utilities' Decision Making Process



Source: United Utilities (2013) Revised Draft Water Resources Management Plan

United Utilities consider that Option WC01: Thirlmere Transfer into West Cumbria is the only way demand can be confidently met in the West Cumbria WRZ. It also comprises the most flexible solution for the West Cumbria WRZ which will be able to meet the requirements of the people, the economy and the environment over the next 25 years. Customers' opinions have also heavily influenced the selection of the preferred option. Of the three alternative options put forward, focus group work identified that building a new pipeline from Thirlmere reservoir to serve the West Cumbrian region was the most popular.

The preferred option would dedicate a greater proportion of the water available in Thirlmere reservoir to meet the needs of Cumbria. This would require a new water treatment works and a pipeline to transfer the water into West Cumbria, thus linking the population of West Cumbria to the UK's largest interconnected water resource zone. This transfer would be of sufficient size to meet all the demand for West Cumbria and would bring a number of benefits for the region, such as:

- Increased confidence in long term supplies in meeting changing demands;
- Support for the developing Britain's Energy Coast economic strategy as it would allow for more water to be available than is currently forecast;
- Allows abstraction from existing sources in West Cumbria to cease and return the habitats to more natural conditions;
- Protects internationally important SACs;
- Future climate change resilience;
- Removes the vulnerability to short duration droughts;
- Longer-term cost savings as existing treatment works can be closed; and
- Removes the vulnerability of West Cumbria to future sustainability reductions.

The implementation of this option would result in a reduction of the surplus in the existing Integrated Resource Zone by a maximum of 42 Ml/d, but the zone would still remain in surplus through the planning horizon.. Reasons for the Rejection of Alternatives

Two alternative options were considered during the preparation of the WRMP, Option WC14d: Kielder Water Transfer to West Cumbria (Treated near Carlisle) and the Lowest Cost Option.

The Kielder alternative has the same benefits as the preferred option. However, United Utilities has decided not to pursue this option as it is estimated to take 11 years to complete the scheme (compared to 6 years for the preferred option) which would not be compatible with the aim of complying with United Utilities' legal obligations under the Conservation of Habitats and Species Regulations as fast as practicable. Also, United Utilities cannot justify the considerable additional cost of this option given the lack of widespread customer and stakeholder support.

The Lowest Cost Option was considered to have the following benefits:

- Having local solutions can be one of the most environmentally friendly solutions in the short term due to the lower levels of construction required;
- The surface water components are within existing licences and would not need new licences;
- It is the lowest cost set of options, resulting in the smallest relative increase in customer bills.

However, the implementation of the option also raised a number of concerns:

- It is reliant on the agreement of a third party abstraction licence holder. In their consultation response to the dWRMP, the licence holder stated that their future water needs were uncertain and that it would not be sensible for United Utilities to assume that this could be a preferred option. This leaves very significant uncertainty about the viability of a major component of this option set;
- The HRA identified that the operation of the Wastwater component could have a significant negative effect on biodiversity whilst groundwater components had the potential for adverse effects on protected sites. This creates uncertainty as to the viability of the option which cannot be resolved without significant further investigation. In their representation on the dWRMP, Natural England stated that the current uncertainty regarding impacts of the groundwater option could have excluded this option from the plan. These abstractions would require Habitats Regulations appropriate assessments which introduces considerable uncertainty and potential delays to delivery of the option;
- If there are further sustainability changes in West Cumbria the option would no longer meet future demand; one more sustainability change has been confirmed by the Environment Agency following publication of the dWRMP. Following further discussion with the Environment Agency, United Utilities estimate that the likelihood of, as yet unknown, future sustainability reductions in West Cumbria is around 25%;
- The option would not solve West Cumbria's reliance on abstraction from SACs;
- This option would not solve West Cumbria's vulnerability to short droughts and limited drought options. This vulnerability has caused United Utilities to start revising its Drought Plan for West Cumbria only three months after publishing a final plan. Under this alternative, drought orders from Crummock Water would be the only supply side drought option available. Crummock Water is part of a SAC;
- No consultation respondents stated that they preferred the option as a long-term solution to meeting water supply needs in West Cumbria; and
- In customer focus group research, once the relative costs and benefits of the alternatives were explained, fewer customers favoured this alternative.

On the basis on these concerns, United Utilities consider that the Lowest Cost Option cannot be taken forward as the preferred option. United Utilities has considered whether it would be in customers' and the environment's best interest to continue working on this option set in parallel with the preferred option. There are high levels of uncertainty as to whether the solution could be delivered, because of the third party licence holder's concerns, the potential for new licences not becoming available due to Habitats Directive concerns and lack of stakeholder support. The long-term viability of the option is also uncertain, as shown by scenario testing. There is also a

significant probability of inefficiently using customers' money to pursue an ultimately unviable option. For these reasons United Utilities does not consider that this would be in the interests of its customers or the environment.

4. Next Steps and Proposals for Monitoring

4.1 Next Steps

This Addendum will be submitted to the Secretary of State alongside the revised draft WRMP. Subject to the approval of the Secretary of State, United Utilities expects to publish the Final WRMP on their website in 2014.

Once the WRMP has been agreed, the preferred option for managing water supply and demand contained within it will need to be implemented. As part of this process, the scheme will be subject to further assessment to understand and manage its potential environmental and social impacts. These assessments will take account of the issues discussed in this Addendum and the Environmental Report but will also be informed by the greater detail available as the work progresses about construction techniques, building materials, and agreed locations and routes.

One form of assessment that is likely to be required in support of the implementation of the preferred option is an appropriate assessment, required by the Habitats Regulations 2010 (as amended). The HRA prepared in support of the dWRMP has highlighted that appropriate assessment is likely to be required to assess whether the scheme could have a significant effect (during construction and operation) on internationally important nature conservation sites, and in particular Clints Quarry SAC, River Ehen SAC and River Derwent and Bassenthwaite Lake SAC (although the findings of the HRA of the dWRMP indicate that significant adverse effects on these sites are unlikely). Appropriate assessment will be undertaken alongside an EIA, which is the requirement of separate legislation. The EIA will assess the potential positive and negative effects of the scheme, and identify opportunities to enhance the positive and mitigate the negative effects.

The implementation of the preferred option would also require an amendment to the existing abstraction licence. In considering whether to grant the amendment, the Environment Agency considers any potential impacts on the status of the water bodies (for example their chemical and biological quality, the volumes and flows of water, and the impacts on the structure of the water bodies) and on wildlife that might be affected by construction or operation.

4.2 Monitoring the Effects of the WRMP

Once the WRMP is implemented its effects on the environment and people will need to be taken into account. United Utilities expect to monitor the effects of the WRMP alongside the other impacts of their operations, and as such, are likely to rely on existing sources of information that are collected either by United Utilities or by other relevant organisations such as the Environment Agency. For example, United Utilities already collects information for a robust annual review process (the June Return) that is submitted to the Office of Water Services (Ofwat). United Utilities updates their WRMP and Drought Plan every five and three years respectively and there are a number of statutory controls which must be monitored. In addition, United Utilities collects information on an annual basis for reporting to Water UK for inclusion in Water UK sustainability reporting. Much of this information is based on June Return data that is reported to Ofwat, however additional sustainability criteria outside of this is also collated.

4.2.1 Monitoring Requirements

Monitoring the sustainability effects of the WRMP can help to answer questions such as:

- Were the SEA predictions of effects accurate?
- Is the WRMP contributing to the achievement of the SEA objectives?
- Are mitigation measures performing as well as expected?
- Are there any adverse effects? Are these within acceptable limits, or is remedial action desirable?

It is not necessary to monitor everything or monitor an effect indefinitely. Instead monitoring should be focussed on:

- significant effects that may give rise to irreversible damage, with a view to identifying trends before such damage is caused; and
- significant effects where there was uncertainty in the SEA and where monitoring would enable preventative or mitigation measures to be undertaken.

United Utilities will need to take a broad view of the findings of their ongoing monitoring processes to identify whether the WRMP has any significant unforeseen effects. Where these are identified, United Utilities may be required to put in place specific monitoring arrangements and will consider how best to mitigate or avoid the adverse consequences. The Environmental Report highlighted some of the issues currently monitored and how they relate to the objectives considered in the SEA of the dWRMP. This is reproduced in **Table 4.1**.

Table 4.1 Potential Indicators for Monitoring Effects

Objective	Indicator	Source of Information	Commentary
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits	Condition of specific protected sites (e.g. SACs and SPAs)	Natural England (NE), Natural Resources Wales (NRW)	Open communication between NE, NRW and United Utilities results in up-to-date information and identification of any potential issues.
	Condition of SSSIs on water industry land holdings	NE, NRW United Utilities	Condition assessment of designated land on United Utilities' landholdings, both area and condition may change.
	Biological monitoring (macroinvertebrates, macrophytes, fisheries, bird surveys)	Environment Agency (EA),NRW, United Utilities, Angling clubs, BTO	Using these data sets and comparing them against other monitored information such as levels and flows will assist in identifying whether there are any adverse effects and if mitigation measures are performing as well as expected.
2. To ensure the appropriate and efficient use of land and protect soil quality	Number/floorspace of water infrastructure built on previously developed land	United Utilities	United Utilities could record the number and floorspace of new buildings that are built on previously developed land.

Objective	Indicator	Source of Information	Commentary
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	River flow and level characteristics	United Utilities, EA, NRW	Monitoring can be compared to historic records.
	River flows, river levels, lake and reservoir levels. Water quality of surface waters.	United Utilities, EA, NRW	At sensitive sites previous studies should be used to inform monitoring and assessment. For example RoC documentation and any Drought Permit (DP) Environmental Assessments and associated environmental monitoring plans.
	Groundwater levels, recharge characteristics and abstracted groundwater quality	United Utilities, EA, NRW	At sensitive sites previous studies should be used to inform monitoring and assessment. For example RoC documentation and any Drought Permit (DP) Environmental Assessments and associated environmental monitoring plans.
4. To reduce the risk of flooding	Number of properties that experience internal flooding from public sewers. Number of properties that experience internal flooding from public sewers.	United Utilities, EA, NW	United Utilities report these data to Ofwat as part of the regulatory returns process.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Number of vehicle movements/distance travelled	United Utilities	United Utilities could record the number of vehicle movements and distance travelled as an indicator of air quality impacts.
6. To limit the causes and potential consequences of climate change	Quantity of greenhouse gas emissions per Megalitre of water supplied. Energy use used in the operational phase of water treatment and supply.	United Utilities	United Utilities' energy managers can use company data, and guidance from the UKWIR greenhouse gas workbook and BERR (Department for Business, Enterprise & Regulatory Reform) conversion factors to derive this information.
	Renewable energy generated; renewable energy purchased.	United Utilities	
7. To ensure the protection and enhancement of human health	Compliance with drinking water standards at customers' taps (%).	United Utilities – drinking water quality report	United Utilities report these data to Ofwat as part of the statutory returns process (June Return) and to the Drinking Water Inspectorate.
	Compliance with water quality standards under the EC Bathing Waters Directive.	EA	The EA monitors the compliance of bathing waters and reports this annually.
	Number of United Utilities sites with public access which provide sporting, recreational and leisure resources and number of visits per year.	United Utilities	United Utilities hold information on the number of annual visitors to sites where specific visitor facilities are provided.
8. To maintain and enhance the economic and social well-being of the local community	Population and projected population change over time (per WRZ)	United Utilities	United Utilities report these data to Ofwat as part of the regulatory returns process and as part of the Strategic Business Plan.
	Proportion of customers who pay more than 3% of their income on water and sewerage	United Utilities	United Utilities could identify the proportion of customers who pay more than 3% of their income on water and sewerage.
9. To ensure the sustainable and efficient use of water resources	Reduction in leakage	United Utilities	United Utilities report these data to Ofwat as part of the regulatory returns process.

Objective	Indicator	Source of Information	Commentary
	Water saved through demand management/water efficiency measures	United Utilities	United Utilities report these data to Ofwat as part of the regulatory returns process.
10. To promote the efficient use of resources	Amount of primary and recycled aggregates used.	United Utilities	Information on aggregate use and recycling should be held by construction managers and accounts (contractors/consultants accounts, waste or procurement records).
	Chemicals used in water supply	United Utilities	Information on chemical use should be held in accounts.
11. To protect and enhance cultural and historic assets	Loss/damage or discovery/protection of cultural, historic and industrial heritage features. Including loss of landscapes of historic Interest and natural heritage features (including for example field systems, field boundaries) that contribute to the cultural and historic distinctiveness of the area	United Utilities, Cadw, English Heritage	English Heritage/Cadw's field monument wardens monitor the condition of all statutorily protected monuments.
12. To protect and enhance landscape character	Loss or damage to landscape character and features of designated sites.	United Utilities	United Utilities could record the number and floorspace of new buildings that are built within designated landscape sites.

Further information and specific details about the monitoring proposals for the effects of the WRMP on the objectives and targets identified in the Environmental Report and this Addendum will be presented in the Post Adoption Statement (to be issued after the Final WRMP) and, where appropriate, will take into account any comments reveived during consultation on the dWRMP and Environmental Report. United Utilities will continue to liaise with the Environment Agency, Natural England, Natural Resources Wales, English Heritage, Cadw and the Welsh Government, as well as other stakeholders.

Progress on the implementation of the WRMP and identification of any issues arising will be reported in the water resources plan review that is part of Ofwat’s annual June Return process.

Appendix A
Definitions of Significance

November 2013
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Definitions of Significance

Objective	Key Questions	Effect	Description	Illustrative Guidance
1. To protect and enhance biodiversity, key habitats and species	Will the option avoid damage to the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)?	++	Significant Positive	The option would result in a major enhancement of the quality of designated habitats due to changes in flow or groundwater levels or water quality. The option would result in a major increase in the population of a priority species.
		+	Positive	The option would result in a minor enhancement of the quality of designated and/or non-designated habitats due to changes in flow or groundwater levels or water quality. The option would result in a minor increase in the population of a priority species.
	Will the option protect and enhance non-designated sites and local biodiversity?	0	Neutral	The option would not result in any effects on European, national designated or non designated sites and/or species.
	Will the option protect and enhance biodiversity, and provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process?	-	Negative	The option would result in minor, short term negative effects on non-designated sites (e.g. through decreases in flows/water quality, or some loss of habitat leading to a temporary loss of ecosystem structure and function).
		--	Significant Negative	The option would have a negative effect on European or national designated sites and/or protected species (i.e. on the interest features and integrity of the site, by preventing any of the conservation objectives from being achieved or resulting in a long term decrease in the population of a priority species). These effects could not be reasonably mitigated. The option will result in major, long term negative effects on non-designated sites (e.g. through decreases in flows/water quality, or significant loss of habitat leading to a long term loss of ecosystem structure and function).
	Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity?	?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain
2. To ensure the appropriate and efficient use of land and protect soil quality	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation?	++	Significant Positive	No option is expected to have a significant positive effect on achieving this objective.
		+	Positive	The option is located on a brownfield site and has no effect on soils or existing land use. The option results in the remediation of contaminated land.
	Will the option utilise previously developed land?	0	Neutral	The option has no effect on soils or land use.
	Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity?	-	Negative	The option is not located on a brownfield site and/or results in a minor loss of best and most versatile soils, or is in conflict with existing land use. The option results in land contamination.
	Will the option minimise the loss of best and most versatile soil?	--	Significant Negative	The option is not located on a brownfield site and/or results in a major loss of best and most versatile soils, or is in conflict with existing land use. The option results in land contamination.
	Will the option minimise conflict with existing land use patterns?	?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain.
	Will the option minimise land contamination?			
3. To protect and enhance the quantity and quality of surface and groundwater resources	Will the option minimise the demand for water resources?	++	Significant Positive	Option results in addressing failure of WFD Good Ecological Status/Good Ecological Potential.
	Will the option protect and improve surface, groundwater, estuarine and coastal water quality?	+	Positive	The option achieves savings through demand management and does not require abstraction to achieve design capacity.
		0	Neutral	The option would have no discernable effect on river flows or surface/coastal water quality or on groundwater quality or levels. The option will not lead to a change in WFD classification.

Objective	Key Questions	Effect	Description	Illustrative Guidance
	Will the option result in changes to river flows? Will the option result in changes to groundwater levels?	-	Negative	The option would result in minor decreases in river flows. River and/or coastal water quality may be affected and lead to short term or intermittent effects on receptors (e.g. designated habitats, protected species or recreational users of rivers and the coastline) that could not be avoided but could be mitigated. The option would result in minor decreases in groundwater quality or levels.
		--	Significant Negative	The option would result in major decreases in river flows. River and/or coastal water quality may be affected and lead to long term or continuous effects on receptors (e.g. designated habitats, protected species or recreational users of rivers and the coastline) that could not reasonably be mitigated. The option results in the deterioration of WFW classification. The option would result in major decreases in groundwater quality or levels.
		?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain.
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	++	Significant Positive	No options are expected to have a significant positive effect on achieving this objective.
		+	Positive	The option has the potential to help alleviate flooding in the catchment.
		0	Neutral	The option involves the construction of above-ground water supply infrastructure, but is located outside floodplain areas. It is anticipated that the option will neither cause nor exacerbate flooding in the catchment.
		-	Negative	The option involves the construction of above-ground water supply infrastructure and is located within the 1 in 1000 year floodplain.
		--	Significant Negative	The option involves the construction of above-ground water supply infrastructure and is located within the 1 in 100 year floodplain.
		?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	++	Significant Positive	No options are expected to result in a significant positive effect on achieving this objective.
		+	Positive	The option will lead to a minor improvement in local air quality from a reduction in concentrations of pollutants identified in the national air quality objectives and/or have a positive effect on local communities and biodiversity due to a reduction in air and odour pollution and particulate deposition.
		0	Neutral	The option will have no discernable effect on air quality.
		-	Negative	The option will result in a minor decrease in local air quality and/or have a negative effect on local communities and biodiversity due to an increase in air and odour pollution and particulate deposition.
		--	Significant Negative	The option will cause a significant decrease in local air quality (e.g. leading to an exceedence of Air Quality Objectives for designated pollutants and the designation of a new Air Quality Management Area). The option will have a strong and sustained negative effect on local communities and biodiversity due to significant increase in air and odour pollution and particulate deposition.
		?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain.
6. To limit the causes, and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions?	++	Significant Positive	No options are expected to result in a significant positive effect on achieving this objective.
		+	Positive	The option will result in a sustained decrease in greenhouse gas emissions (100-999 tonnes CO_2e/a) and will increase resilience/decrease vulnerability to climate change effects.

Objective	Key Questions	Effect	Description	Illustrative Guidance
	Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option contribute positively to adaptation to climate change?	0	Neutral	The option would have no discernable effect on greenhouse gas emissions, nor would the option increase resilience/decrease vulnerability to climate change effects.
		-	Negative	The option will result in a minor or temporary major increase in greenhouse gas emissions (100-999 tonnes CO_2e) or the option does not increase resilience/decrease vulnerability to climate change effects.
		--	Significant Negative	The option will result in major or long term increases in greenhouse gas emissions (>1000 tonnes CO_2e) and the option does not increase resilience/decrease vulnerability to climate change effects.
		?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply?	++	Significant Positive	The option leads to a major increase in design capacity (>10 Ml/d) of drinking water, has a sustained positive effect on the health of local communities and will ensure that surface water and bathing water quality is maintained within statutory limits.
	Will the option affect opportunities for recreation and physical activity?	+	Positive	The option leads to a minor increase in design capacity (5-10 Ml/d) of drinking water, has a temporary positive effect on the health of local communities and will ensure that surface water and bathing water quality is maintained within statutory limits.
	Will the option maintain surface water and bathing water quality within statutory standards?	0	Neutral	No option is expected to have a neutral effect on achieving this objective.
	Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	-	Negative	The option results in the deterioration of surface water or bathing water quality and has a temporary effect on human health (e.g. noise).
		--	Significant Negative	The option results in the deterioration of surface water or bathing water quality and has a long term effect on human health (e.g. noise).
		?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases?	++	Significant Positive	The option results in a significant increase in construction jobs (capital spend of >£10m). The option creates new, and significantly enhances existing recreational facilities within the operational area. The option provides an additional design capacity of >10 Ml/d.
	Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists?	+	Positive	The option results in an increase in construction jobs (capital spend £5-9.9m). The option enhances existing recreational facilities within the operational area. The option provides an additional design capacity of 1-10 Ml/d.
	Will the option help to meet the employment needs of local people?	0	Neutral	The option has no effect on local employment opportunities, the regional or local economy, or on recreational facilities. The option provides an additional design capacity of <1 Ml/d.
	Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected?	-	Negative	The option reduces the availability and quality of existing recreational facilities within the operational area. It is not expected that any options will have a negative effect on employment opportunities, the economy or design capacity.
	Will the option improve access to local services and facilities (e.g. sport and recreation)?	--	Significant Negative	The option results in the removal of existing recreational facilities within the operational area. It is not expected that any options will have a negative effect on employment opportunities, the economy or design capacity.
	Will the option contribute to sustaining and growing the local and regional economy?	?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain.
	Will the option avoid disruption through effects on the transport network?			

Objective	Key Questions	Effect	Description	Illustrative Guidance
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption? Will the option seek to minimise the demand for raw materials?	++	Significant Positive	The option involves reducing leakage from the supply network or is a water efficiency option with a design capacity of >5 Ml/d.
		+	Positive	The option involves reducing leakage from the supply network or is a water efficiency option with a design capacity of <5 Ml/d.
		0	Neutral	The option is not a leakage reduction or water efficiency option.
		-	Negative	No options are expected to result in a negative effect on achieving this objective.
		--	Significant Negative	No options are expected to result in a significant negative effect on achieving this objective.
		?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain.
10. To promote the efficient use of resources.	Will the option seek to minimise the demand for raw materials? Will the option reduce the total amount of waste produced and the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	++	Significant Positive	No options are expected to result in a significant positive effect on achieving this objective.
		+	Positive	The option will re-use or recycle substantial quantities of waste materials and any new infrastructure will incorporate substantial sustainable design measures and materials. There will be no increase in energy consumption.
		0	Neutral	The option will largely rely on existing infrastructure and only require small quantities of additional materials to realise design capacity. No additional energy use required.
		-	Negative	The option will require new infrastructure with only limited opportunities for the re-use or recycling of waste materials. There are limited opportunities for sustainable design or the use of sustainable materials. The option results in a minor increase in energy consumption.
		--	Significant Negative	The option will require significant new infrastructure that can not be provided through the re-use or recycling of waste materials. There are no opportunities for sustainable design or the use of sustainable materials. The option results in a major increase in energy consumption.
		?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain.
11. To protect and enhance cultural and historic assets	Will the option conserve or enhance historic buildings, places, conservation areas and spaces that enhance local distinctiveness, character and the appearance of the public realm? Will the option avoid or minimise damage to archaeologically important sites? Will the option affect public access to, or enjoyment of, features of cultural heritage?	++	Significant Positive	The option will result in enhancements to designated heritage assets and/or their setting, fully realising the significance and value of the asset, such as: • Securing repairs or improvements to heritage assets, especially those identified in the English Heritage Buildings/Monuments at Risk Register; • Improving interpretation and public access to important heritage assets. There will be no damage to known archaeology or geologically important sites.
		+	Positive	The option will result in enhancements to heritage assets and/or their setting, whether designated or not. There will be no damage to known archaeology or geologically important sites.
		0	Neutral	The option will have no effect on cultural heritage assets or archaeology.
		-	Negative	The option will result in the loss of significance of undesignated heritage assets and/or their setting, notwithstanding remedial recording of any elements affected. There will be limited damage to known, undesignated archaeology or geologically important sites with a consequent loss of significance only partly mitigated by archaeological investigation.

Objective	Key Questions	Effect	Description	Illustrative Guidance
		--	Significant Negative	The option will diminish the significance of designated heritage assets and/or their setting such as: • Demolition or further deterioration in the condition of designated heritage assets especially those identified in the English Heritage Buildings/Monuments at Risk Register; • Loss of public access to important heritage assets and lack of appropriate interpretation. There will be major damage to known, designated archaeology or geologically important sites with a consequent loss of significance only partly mitigated by archaeological investigation.
		?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain.
12. To protect and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	++	Significant Positive	The option results in new, above ground infrastructure that significantly enhances the local landscape, townscape or seascape.
		+	Positive	The option results in new, above ground infrastructure that has a minor positive effect on the local landscape, townscape or seascape.
		0	Neutral	The option results in new, above ground infrastructure but is not located within or visible from a protected/designated landscape, townscape or seascape and has no effect on the character or public amenity value of its setting.
		-	Negative	The option results in new, above ground infrastructure that has a minor negative effect on the local landscape, townscape or seascape.
		--	Significant Negative	The option would have a negative effect on designated landscape or feature (i.e. significant visually intrusive infrastructure) whose effects could not be reasonably mitigated. The option results in new, above ground infrastructure that has a major negative effect on the local landscape, townscape or seascape.
		?	Uncertain	From the level of information available the effect that the option would have on this objective is uncertain.

Appendix B
Feasible Options Assessment Matrices

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Feasible Options Assessment Matrices

This appendix presents the findings of the assessment of the following additional feasible options for the West Cumbria WRZ:

- WC05b: Development of New Boreholes in West Cumbria Aquifer
- WC05c: Development of New Boreholes in West Cumbria Aquifer
- WC05d: Development of New Boreholes in West Cumbria Aquifer
- WC25: Effluent Reuse

The following matrices present the findings of the assessment.

		1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits	2. To ensure the appropriate and efficient use of land and protect soil quality	3. To protect and enhance the quantity and quality of surface and groundwater resource and the ecological status of water bodies	4. To reduce the risk of flooding	5. To minimise emissions of pollutant gases and particulates and enhance air quality	6. To limit the causes and potential consequences of climate change	7.To ensure the protection and enhancement of human health	8.To maintain and enhance the economic and social well-being of the local community	9. To ensure the sustainable and efficient use of water resources	10. To promote the efficient use of resources	11. To protect and enhance cultural and historic assets	12. To protect and enhance landscape character	Commentary
WC05b Development of New Boreholes in West Cumbria Aquifer (Design Capacity 20 Ml/d)	**Construction / Implementation**	--	-	0	-	-	--	-	++	0	--	-	-	This option would involve the construction of 15 new boreholes on three new sites in addition to utilising an existing borehole. The exact distribution of the new boreholes between the four sites is to be confirmed. The option would require drilling of a borehole at each site, a new fixed speed borehole pump and a new headworks GRP kiosk. The existing site would also require a new break tank, aeration tower and RWPS. A total of 8km of pipeline would be required to interconnect the sites and an additional 13km pipeline would transfer all raw water to the WTW near Ennerdale. A new 1km washout main would also be needed from the existing site to the nearest Egremont sewer. The borehole sites are not affected by any biodiversity designations but development would occur on greenfield land and in consequence, there may be disturbance/habitat loss associated with, for example, the drilling of boreholes and other construction activity. The HRA identifies that the construction of the scheme could potentially affect the River Ehen SAC as it is likely that this would be crossed by the transfer pipeline. In consequence, the option has been assessed as having a significant negative effect on biodiversity. However, the HRA states that potential effects on the SAC could be avoided / mitigated by using existing road crossings and by (for example) appropriate timing of works / mitigation. In this respect, should this option be taken forward to the preferred options stage, impacts on those features of the SAC that may be significantly affected will be considered in more detail and mitigation measures identified. Further, scheme level investigations and appropriate assessment would also be undertaken at the project stage should the option form part of the final Water Resources Management Plan. As development would be undertaken on greenfield land to accommodate the new boreholes and associated infrastructure, the option has been assessed as having a minor negative effect on soils/land use. Additionally, temporary loss of land would occur during the pipeline works, although it is assumed that any soil displaced during excavations would be returned following completion of construction. It is not expected that construction of this option would affect water quality or water resources, provided good practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). Sections of the proposed pipelines cross Flood Zones 2 and 3. In consequence, construction activity may be at risk of flooding (subject to timing). The option would require approximately 1,250 HGV movements during the circa 1.75 year construction period which, together with emissions to air from plant, may have a minor negative effect on local air quality. The option would generate 5,012 tonnes of CO_2e which has been assessed as having a significant negative effect on Objective 6 (and Objective 10). Construction could affect human health through noise disturbance and air quality impacts, particularly as the proposed pipeline would be routed through Egremont and other settlements such as St Bees. There may also be temporary impacts during construction to public footpaths, however, these are considered to be short in duration and suitable diversions could be put in place. Overall, the option has been assessed as having a minor negative effect on health. The option would involve a high capital expenditure which may provide additional local jobs, generate supply chain benefits and boost spending in the local economy (by construction workers). However, local congestion may occur during construction works along roads. On balance, the option has been assessed as having a significant positive effect on Objective 8. The option would not affect water efficiency. The option would require additional resources, increase energy demand and generate waste which has been assessed as having a significant negative effect on Objective 10. The borehole sites do not contain, and are not within close proximity to, any designated cultural heritage assets with the exception of one which would be adjacent to a Grade II Listed Building, the setting of which may be affected by construction activity. The pipeline is expected to pass through Egremont, close to the Scheduled Monument and Grade I Listed Building, Egremont Castle although works are unlikely to affect its setting. There are also a number of listed buildings along the route of the proposed pipelines, the settings of which may be temporarily affected by the works. Overall, the option has been assessed as having a minor negative effect on Objective 11. The borehole sites are in a rural setting and with the exception of the existing site, would be located on greenfield land such that construction activity may have adverse landscape/visual impacts. The option also requires 21km of new transfer pipeline to be laid which would cross the Lake District National Park for approximately 6km. In consequence, there is potential for substantial landscape effects associated with pipeline works. However, the majority of the route (including the 6km pipeline across the Lake District National Park) would follow existing linear features (roads) and adverse effects would be over a short timescale with planting and re-seeding likely to return land to a pre-development state within a year (depending on the season in which works are undertaken). Overall, whilst landscape effects associated with construction activity would be temporary, the location of pipeline works within the Lake District National Park has been assessed as having a minor negative effect on landscape.

	1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits	2. To ensure the appropriate and efficient use of land and protect soil quality	3. To protect and enhance the quantity and quality of surface and groundwater resource and the ecological status of water bodies	4. To reduce the risk of flooding	5. To minimise emissions of pollutant gases and particulates and enhance air quality	6. To limit the causes and potential consequences of climate change	7.To ensure the protection and enhancement of human health	8.To maintain and enhance the economic and social well-being of the local community	9. To ensure the sustainable and efficient use of water resources	10. To promote the efficient use of resources	11. To protect and enhance cultural and historic assets	12. To protect and enhance landscape character	Commentary
Operation	?	0	-	0	0	--	++	++	0	--	-	-	Whilst the new boreholes are outside the surface water catchment of the River Ehen and therefore any localised drawdown would not affect tributaries of the river, it is possible that abstraction under this option may affect groundwater supplies to the Ehen. The HRA states that it is not clear what contribution to flow these are likely to make and that any effects are likely to be felt outside of the SAC, but the option may affect mobile species (Atlantic salmon) migrating through the lower reaches. Overall, the option has been assessed as having an uncertain effect on biodiversity at this stage and should this option be taken forward, further investigation in respect of potential effects on the River Ehen SAC is likely to be required. During operation, no effects on land use or soils are expected (discounting the loss of land during construction). This option would result in increased abstraction of groundwater (which may result in reductions in river flows, although this is currently uncertain). The option has therefore been assessed as having a minor negative effect on Objective 3. The option is not expected to cause or exacerbate flooding. No effects on air quality are anticipated. The ongoing energy requirement would be 1,523 kWh/Ml and the option would generate 6,565 tonnes of CO_2e/a. This has been assessed as having a significant negative effect on Objectives 6 and 10. The option would result in an increased supply of safe, secure drinking water of 20Ml/d which would benefit human health and support economic/population growth in West Cumbria (the reduction in river flows is not expected to be perceptible to recreational users or anglers). Overall, the option has been assessed as having a significant positive effect on Objectives 7 and 8. The option would have no impact on water efficiency. As noted above, one site is adjacent to a Grade II Listed Building, the setting of which may be affected by new above ground infrastructure (although any adverse effects could be mitigated by adequate screening). The borehole sites are in a rural setting and with the exception of the existing site, would be located on greenfield land. In consequence, there is potential for minor landscape and visual impacts from new above ground infrastructure.

		1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits	2. To ensure the appropriate and efficient use of land and protect soil quality	3. To protect and enhance the quantity and quality of surface and groundwater resource and the ecological status of water bodies	4. To reduce the risk of flooding	5. To minimise emissions of pollutant gases and particulates and enhance air quality	6. To limit the causes and potential consequences of climate change	7.To ensure the protection and enhancement of human health	8.To maintain and enhance the economic and social well-being of the local community	9. To ensure the sustainable and efficient use of water resources	10. To promote the efficient use of resources	11. To protect and enhance cultural and historic assets	12. To protect and enhance landscape character	Commentary
WC05c Development of New Boreholes in West Cumbria Aquifer (Design Capacity 20 Ml/d)	**Construction / Implementation**	--	-	0	-	-	--	-	++	0	--	-	-	This option would involve the construction of seven new boreholes in addition to utilising an existing borehole. A further four new boreholes would be developed in the Calder Sandstone. The option would require drilling of a borehole at each site, a new fixed speed borehole pump and a new headworks GRP kiosk. The existing site would also require a new break tank, aeration tower and RWPS. A total of 18km of pipeline would be required to interconnect the sites. Raw water from all boreholes would be transferred via a new pumping station at an existing site and transferred via a dual 13km pipeline to the WTW near Ennerdale. A new 1km washout main would also be required from the existing borehole site to the nearest Egremont sewer. It is envisaged that the existing raw water mixing tank at Ennerdale would be used to blend the additional St Bees boreholes outputs without any extra capacity required. The development sites are not affected by any biodiversity designations but the majority of development would occur on greenfield land and in consequence, there may be disturbance/habitat loss associated with, for example, the drilling of boreholes and other construction activity. The HRA identifies that the construction of the scheme could potentially affect the River Ehen SAC as it is likely that this would be crossed by the transfer pipeline. In consequence, the option has been assessed as having a significant negative effect on biodiversity. However, the HRA states that potential effects on the SAC could be avoided / mitigated by using existing road crossings and by (for example) appropriate timing of works / mitigation. In this respect, should this option be taken forward to the preferred options stage, impacts on those features of the SAC that may be significantly affected will be considered in more detail and mitigation measures identified. Further, scheme level investigations and appropriate assessment would also be undertaken at the project stage should the option form part of the final Water Resources Management Plan. As the majority of development would be undertaken on greenfield land to accommodate the new boreholes and associated infrastructure, the option has been assessed as having a minor negative effect on soils/land use. Additionally, temporary loss of land would occur during the pipeline works, although it is assumed that any soil displaced during excavations would be returned following completion of construction. It is not expected that construction of this option would affect water quality or water resources, provided good practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). Sections of the proposed pipelines cross Flood Zones 2 and 3 whilst some borehole sites would be in close proximity to Flood Zones 2 and 3. In consequence, construction activity may be at risk of flooding (subject to timing). The option would require approximately 1,875 HGV movements during the circa 5 year construction period which, together with emissions to air from plant, may have a minor negative effect on local air quality. The option would generate 37,584 tonnes of CO_2e which has been assessed as having a significant negative effect on Objective 6 (and Objective 10). Construction could affect human health through noise disturbance and air quality impacts. However, under this option the proposed pipeline would be routed so as to avoid Egremont and other settlements such as St Bees. There may also be temporary impacts during construction to public footpaths, however, these are considered to be short in duration and suitable diversions could be put in place. Overall, the option has been assessed as having a minor negative effect on health. The option would involve a high capital expenditure which may provide additional local jobs, generate supply chain benefits and boost spending in the local economy (by construction workers). However, local congestion may occur during construction works along roads. On balance, the option has been assessed as having a significant positive effect on Objective 8. The option would not affect water efficiency. The option would require additional resources, increase energy demand and generate waste which has been assessed as having a significant negative effect on Objective 10. The borehole sites do not contain any designated cultural heritage assets. The proposed Calder boreholes are located in relative close proximity to a number of listed buildings although in view of the distance between the boreholes and buildings and also the presence of physical barriers such as roads, effects on their settings are not expected to be significant. One proposed site is adjacent to a Grade II Listed Building , the setting of which may be affected by construction activity. Overall, the option has been assessed as having a minor negative effect on Objective 11. The development sites are in a rural setting and with the exception of a new borehole on an existing site and pumping station on another, would be located on greenfield land such that construction activity may have adverse landscape/visual impacts. The Calder boreholes would be adjacent to the boundary of the Lake District National Park. However, taking into account the scale of construction activity at each borehole site and the fact that the sites are separated from the National Park by a road, effects are not expected to be significant. The option also requires 21km of new transfer piping to be laid which would cross the Lake District National Park for approximately 6km. In consequence, there is potential for substantial landscape effects associated with pipeline works. However, the majority of the route (including the 6km pipeline across the Lake District National Park) would follow existing linear features (roads) and adverse effects would be over a short timescale with planting and re-seeding likely to return land to a pre-development state within a year (depending on the season in which works are undertaken). Overall, whilst landscape effects associated with construction activity would be temporary, the location of pipeline works within the Lake District National Park has been assessed as having a minor negative effect on landscape.

	1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits	2. To ensure the appropriate and efficient use of land and protect soil quality	3. To protect and enhance the quantity and quality of surface and groundwater resource and the ecological status of water bodies	4. To reduce the risk of flooding	5. To minimise emissions of pollutant gases and particulates and enhance air quality	6. To limit the causes and potential consequences of climate change	7.To ensure the protection and enhancement of human health	8.To maintain and enhance the economic and social well-being of the local community	9. To ensure the sustainable and efficient use of water resources	10. To promote the efficient use of resources	11. To protect and enhance cultural and historic assets	12. To protect and enhance landscape character	Commentary
Operation	?	0	-	0	0	--	++	++	0	--	-	-	Whilst the new boreholes are outside the surface water catchment of the River Ehen and therefore any localised drawdown would not affect tributaries of the river, it is possible that abstraction under this option may affect groundwater supplies to the Ehen. The HRA states that it is not clear what contribution to flow these are likely to make and that any effects are likely to be felt outside of the SAC, but the option may affect mobile species (Atlantic salmon) migrating through the lower reaches. Overall, the option has been assessed as having an uncertain effect on biodiversity at this stage and should this option be taken forward, further investigation in respect of potential effects on the River Ehen SAC is likely to be required. During operation, no effects on land use or soils are expected (discounting the loss of land during construction). This option would result in increased abstraction of groundwater (which may result in reductions in river flows, although this is currently uncertain). However, the Derwent and West Cumbria Catchment Abstraction Management Strategy (CAMS) indicates that there is water available for abstraction from groundwater resources in the area (approximately 45Ml/d from the West Cumbria Groundwater Management Unit). Further, the sites identified for abstraction have been selected through discussion with the Environment Agency. Overall, the option has been assessed as having a minor negative effect on Objective 3. The option is not expected to cause or exacerbate flooding. No effects on air quality are anticipated. The ongoing energy requirement would be 624 kWh/Ml and the option would generate 2,691 tonnes of CO_2e/a. This has been assessed as having a significant negative effect on Objectives 6 and 10. The option would result in an increased supply of safe, secure drinking water of 20Ml/d which would benefit human health and support economic/population growth in West Cumbria (the reduction in river flows is not expected to be perceptible to recreational users or anglers). Overall, the option has been assessed as having a significant positive effect on Objectives 7 and 8. The option would have no impact on water efficiency. As noted above, one proposed site is adjacent to a Grade II Listed Building, the setting of which may be affected by new above ground infrastructure (although any adverse effects could be mitigated by adequate screening). The borehole sites are in a rural setting and with the exception of the existing borehole site and the site of the new pumping station would be located on greenfield land. In consequence, there is potential for minor landscape and visual impacts from new above ground infrastructure. The Calder boreholes would be adjacent to the boundary of the Lake District National Park. However, taking into account the scale of development at each borehole site and the fact that the sites are separated from the National Park by a road, effects are not expected to be significant.

		1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits	2. To ensure the appropriate and efficient use of land and protect soil quality	3. To protect and enhance the quantity and quality of surface and groundwater resource and the ecological status of water bodies	4. To reduce the risk of flooding	5. To minimise emissions of pollutant gases and particulates and enhance air quality	6. To limit the causes and potential consequences of climate change	7.To ensure the protection and enhancement of human health	8.To maintain and enhance the economic and social well-being of the local community	9. To ensure the sustainable and efficient use of water resources	10. To promote the efficient use of resources	11. To protect and enhance cultural and historic assets	12. To protect and enhance landscape character	Commentary
WC05d Development of New Boreholes in West Cumbria Aquifer (Design Capacity 5.4 Ml/d)	**Construction / Implementation**	--	-	0	-	-	--	-	++	0	--	-	-	This option would involve the construction of seven new boreholes at four sites in addition to utilising an existing borehole at an existing site. The option would require drilling of a borehole at each site, a new fixed speed borehole pump and a new headworks GRP kiosk. The existing site would also require a new break tank, aeration tower and RWPS. A total of 18km of pipeline would be required to interconnect the borehole sites to a new pumping station on an existing site. Raw water from all boreholes would be transferred via the new pumping station and transferred via a dual 13km pipeline to the WTW near Ennerdale. A new 1km washout main would also be required from the existing borehole site to the nearest Egremont sewer. It is envisaged that the existing raw water mixing tank near Ennerdale would be used to blend the additional St Bees boreholes outputs without any extra capacity required. To achieve the full 5.4Ml/d yield the output from the boreholes developed at South Egremont during AMP5 would also need to be increased. These boreholes and associated infrastructure were designed to yield 6.4Ml/d, but have been proven to be capable of 11Ml/d. The development sites are not affected by any biodiversity designations but the majority of development would occur on greenfield land and in consequence, there may be disturbance/habitat loss associated with, for example, the drilling of boreholes and other construction activity. The HRA identifies that the construction of the scheme could potentially affect the River Ehen SAC as it is likely that this would be crossed by the transfer pipeline. In consequence, the option has been assessed as having a significant negative effect on biodiversity. However, the HRA states that potential effects on the SAC could be avoided / mitigated by using existing road crossings and by (for example) appropriate timing of works / mitigation. In this respect, should this option be taken forward to the preferred options stage, impacts on those features of the SAC that may be significantly affected will be considered in more detail and mitigation measures identified. Further, scheme level investigations and appropriate assessment would also be undertaken at the project stage should the option form part of the final Water Resources Management Plan. As the majority of development would be undertaken on greenfield land to accommodate the new boreholes and associated infrastructure, the option has been assessed as having a minor negative effect on soils/land use. Additionally, temporary loss of land would occur during the pipeline works, although it is assumed that any soil displaced during excavations would be returned following completion of construction. It is not expected that construction of this option would affect water quality or water resources, provided good practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). Sections of the proposed pipelines cross Flood Zones 2 and 3 whilst some borehole sites would be in close proximity to Flood Zones 2 and 3. In consequence, construction activity may be at risk of flooding (subject to timing). The option would require approximately 1,300 HGV movements during the circa 5 year construction period which, together with emissions to air from plant, may have a minor negative effect on local air quality. The option would generate 13,568 tonnes of CO_2e which has been assessed as having a significant negative effect on Objective 6 (and Objective 10). Construction could affect human health through noise disturbance and air quality impacts. However, under this option the proposed pipeline would be routed so as to avoid Egremont and other settlements such as St Bees. There may also be temporary impacts during construction to public footpaths, however, these are considered to be short in duration and suitable diversions could be put in place. Overall, the option has been assessed as having a minor negative effect on health. The option would involve a high capital expenditure which may provide additional local jobs, generate supply chain benefits and boost spending in the local economy (by construction workers). However, local congestion may occur during construction works along roads. On balance, the option has been assessed as having a significant positive effect on Objective 8. The option would not affect water efficiency. The option would require additional resources, increase energy demand and generate waste which has been assessed as having a significant negative effect on Objective 10. The borehole sites do not contain any designated cultural heritage assets. Boreholes at one proposed site would be adjacent to a Grade II Listed Building, the setting of which may be affected by construction activity. Overall, the option has been assessed as having a minor negative effect on Objective 11. The development sites are in a rural setting and with the exception of a new borehole at the existing site and the new pumping station on an existing site, would be located on greenfield land such that construction activity may have adverse landscape/visual impacts. The Calder boreholes would be adjacent to the boundary of the Lake District National Park. However, taking into account the scale of construction activity at each borehole site and the fact that the sites are separated from the National Park by a road, effects are not expected to be significant. The option also requires 21km of new transfer piping to be laid which would cross the Lake District National Park for approximately 6km. In consequence, there is potential for substantial landscape effects associated with pipeline works. However, the majority of the route (including the 6km pipeline across the Lake District National Park) would follow existing linear features (roads) and adverse effects would be over a short timescale with planting and re-seeding likely to return land to a pre-development state within a year (depending on the season in which works are undertaken). Overall, whilst landscape effects associated with construction activity would be temporary, the location of pipeline works within the Lake District National Park has been assessed as having a minor negative effect on landscape.

	1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits	2. To ensure the appropriate and efficient use of land and protect soil quality	3. To protect and enhance the quantity and quality of surface and groundwater resource and the ecological status of water bodies	4. To reduce the risk of flooding	5. To minimise emissions of pollutant gases and particulates and enhance air quality	6. To limit the causes and potential consequences of climate change	7.To ensure the protection and enhancement of human health	8.To maintain and enhance the economic and social well-being of the local community	9. To ensure the sustainable and efficient use of water resources	10. To promote the efficient use of resources	11. To protect and enhance cultural and historic assets	12. To protect and enhance landscape character	Commentary
Operation	?	0	-	0	0	-	+	+	0	-	-	-	Whilst the new boreholes are outside the surface water catchment of the River Ehen and therefore any localised drawdown would not affect tributaries of the river, it is possible that abstraction under this option may affect groundwater supplies to the Ehen. The HRA states that it is not clear what contribution to flow these are likely to make and that any effects are likely to be felt outside of the SAC, but the option may affect mobile species (Atlantic salmon) migrating through the lower reaches. Overall, the option has been assessed as having an uncertain effect on biodiversity at this stage and should this option be taken forward, further investigation in respect of potential effects on the River Ehen SAC is likely to be required. During operation, no effects on land use or soils are expected (discounting the loss of land during construction). This option would result in increased abstraction of groundwater (which may result in reductions in river flows, although this is currently uncertain). However, the Derwent and West Cumbria Catchment Abstraction Management Strategy (CAMS) indicates that there is water available for abstraction from groundwater resources in the area (approximately 45Ml/d from the West Cumbria Groundwater Management Unit). Further, the sites identified for abstraction have been selected through discussion with the Environment Agency. Overall, the option has been assessed as having a minor negative effect on Objective 3. The option is not expected to cause or exacerbate flooding. No effects on air quality are anticipated. The ongoing energy requirement would be 836 kWh/Ml and the option would generate 975 tonnes of CO_2e/a. This has been assessed as having a minor negative effect on Objectives 6 and 10. The option would result in an increased supply of safe, secure drinking water of 5.4Ml/d which would benefit human health and support economic/population growth in West Cumbria (the reduction in river flows is not expected to be perceptible to recreational users or anglers). Overall, the option has been assessed as having a minor positive effect on Objectives 7 and 8. The option would have no impact on water efficiency. As noted above, one proposed borehole site is adjacent to a Grade II Listed Building, the setting of which may be affected by new above ground infrastructure (although any adverse effects could be mitigated by adequate screening). The borehole sites are in a rural setting and with the exception of the existing borehole and new pumping station sites, would be located on greenfield land. In consequence, there is potential for minor landscape and visual impacts from new above ground infrastructure.

		1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits	2. To ensure the appropriate and efficient use of land and protect soil quality	3. To protect and enhance the quantity and quality of surface and groundwater resource and the ecological status of water bodies	4. To reduce the risk of flooding	5. To minimise emissions of pollutant gases and particulates and enhance air quality	6. To limit the causes and potential consequences of climate change	7.To ensure the protection and enhancement of human health	8.To maintain and enhance the economic and social well-being of the local community	9. To ensure the sustainable and efficient use of water resources	10. To promote the efficient use of resources	11. To protect and enhance cultural and historic assets	12. To protect and enhance landscape character	Commentary
WC25 Effluent Re-use (Design Capacity 20 Ml/d)	**Construction / Implementation**	--	-	0	-	-	--	-	++	0	--	-	-	This option would involve the transfer of treated final effluent from Whitehaven to Workington WwTW for reuse for potable water supply. The option would require a new WTW at Workington WwTW and a further new WTW including PS and associated facilities/equipment in Whitehaven. A new 12.5km long pipeline would be required between Workington and Whitehaven together with a 17km dedicated transfer pipeline between Whitehaven and the SR near Ennerdale. The development sites are not affected by any biodiversity designations although construction of the new WTW at Whitehaven would result in the loss of greenfield land and in consequence, there is the potential for disturbance/habitat loss. Pipeline works would also cross open countryside and the findings of the HRA indicate that construction of the option would require that the River Derwent and Bassenthwaite Lake SAC and the River Ehen SAC be crossed. As a result, the option has been assessed as having a significant negative effect on biodiversity. However, the HRA states that it is likely that the works could be suitably managed to avoid significant or adverse effects (e.g. timing of works to avoid migration periods; routing pipeline to make use of existing road crossings). Under this option the WTW at Workington would be located at an existing site although development of a WTW at Whitehven would result in the loss of greenfield land (albeit of poor agricultural land quality). This has been assessed as having a minor negative effect on soils/land use. Additionally, temporary loss of land would occur during the pipeline works, although it is assumed that any soil displaced during excavations would be returned following completion of construction. It is not expected that construction of this option would affect water quality or water resources, provided good practices are adhered to and mitigation implemented (such as dust suppression, soil containment and emergency response procedures). The development sites are within Flood Zone 1 although sections of the proposed pipelines cross Flood Zones 2 and 3. In consequence, construction activity may be at risk of flooding (subject to timing). The option would require approximately 1,875 HGV movements during the circa 5 year construction period which, together with emissions to air from plant, may have a minor negative effect on local air quality. The option would generate 65,539 tonnes of CO_2e which has been assessed as having a significant negative effect on Objective 6 (and Objective 10). Construction could affect human health through noise disturbance and air quality impacts. The new WTW near Workington would be located at an existing site and would not be in close proximity to sensitive receptors. The site of the new WTW near Whitehaven would, however, be in close proximity to residential receptors to the north and west which could be affected by construction activity and associated HGV movements. Pipeline works may also affect receptors along the proposed route and in particular where it passes through or is in close proximity to settlements such as Workington, Whitehaven and Cleator Moor. Overall, the option has been assessed as having a minor negative effect on health. The option would involve a high capital expenditure which may provide additional local jobs, generate supply chain benefits and boost spending in the local economy (by construction workers). However, local congestion may occur during construction works along roads including the A595. On balance, the option has been assessed as having a significant positive effect on Objective 8. The option would not affect water efficiency. The option would require additional resources, increase energy demand and generate waste which has been assessed as having a significant negative effect on Objective 10. The development sites do not contain any designated cultural heritage assets. A Grade II Listed Building is located adjacent to the eastern boundary of the Whitehaven site, the setting of which could be temporarily affected by construction activity. Frontiers of the Roman Empire (Hadrian's Wall) World Heritage Site is located less than 100m to the north west of the site. However, the potential for direct/indirect impacts on this asset is considered to be low given the presence of the A595 and residential areas that separate the Whitehaven site from this asset. Overall, the option has been assessed as having a minor negative effect on Objective 11. As noted above, whilst the WTW at Workington would be located at an existing site and away from potentially sensitive receptors, the WTW at Whitehaven would be located on greenfield land in close proximity to residential receptors and outside the existing built up area near Parton. In consequence, there is the potential for construction activity to have adverse landscape and visual amenity impacts. Pipeline works may also have temporary adverse effects on landscape and visual receptors. In this respect, the pipeline to Ennerdale would require excavation in the Lake District National Park (for approximately 6km). However, the majority of the route (including the 6km pipeline across the Lake District National Park) would follow existing linear features (roads) and adverse effects would be over a short timescale with planting and re-seeding likely to return land to a pre-development state within a year (depending on the season in which works are undertaken). Overall, the option has been assessed as having a minor negative effect on landscape.

	1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits	2. To ensure the appropriate and efficient use of land and protect soil quality	3. To protect and enhance the quantity and quality of surface and groundwater resource and the ecological status of water bodies	4. To reduce the risk of flooding	5. To minimise emissions of pollutant gases and particulates and enhance air quality	6. To limit the causes and potential consequences of climate change	7.To ensure the protection and enhancement of human health	8.To maintain and enhance the economic and social well-being of the local community	9. To ensure the sustainable and efficient use of water resources	10. To promote the efficient use of resources	11. To protect and enhance cultural and historic assets	12. To protect and enhance landscape character	Commentary
Operation	0	0	+	0	0	--	?	++	+	--	0	-	The operation of this option would reduce the volume of wastewater discharged to sea through outfalls. This may lead to minor improvements in coastal water, aquatic species and habitats, although this is likely to be negligible compared to other influences on coastal water quality. The findings of the HRA indicate that there are no European sites close to the outfalls and no effects on mobile species would be reasonably expected as a result of operation. During operation, no effects on land use or soils are expected (discounting the loss of land during construction). This option would have a design capacity of 20 Ml/d without the need for additional abstraction. This has been assessed as having a positive effect on Objectives 3 and 9. As noted above, the operation of this option would reduce the volume of wastewater discharged to sea through outfalls although any benefit to coastal water quality is likely to be negligible. The option is not expected to cause or exacerbate flooding. No operational effects on air quality are anticipated. The ongoing energy requirement would be 1,182 kWh/Ml and the option would generate 5,097 tonnes of CO_2e/a. This has been assessed as having a significant negative effect on Objectives 6 and 10. The option would result in an increased supply of drinking water of 20Ml/d which could support economic/population growth in West Cumbria. However, there is uncertainty with respect to the extent to which (using current technologies) the reuse of treated effluent would provide safe drinking water and, in this respect, this option would be likely to be perceived negatively by some customers. Overall, the option has been assessed as having a significant positive effect on Objective 8 but an uncertain effect on Objective 7. As noted above, a Grade II Listed Building is located adjacent to the eastern boundary of the Whitehaven site. Frontiers of the Roman Empire (Hadrian's Wall) World Heritage Site is also located less than 100m to the north west of the site. However, with appropriate screening, the risk of adverse impacts on the settings of these assets is considered to be low and the option has therefore been assessed as having a neutral effect on Objective 11. The WTW at Whitehven would be located on greenfield land in close proximity to residential receptors and outside the existing built up area of Parton. In consequence, there is the potential for the development to have adverse landscape and visual amenity impacts. Overall, the option has been assessed as having a minor negative effect on landscape.

Appendix C
Preferred Option and Alternatives Assessment Matrices

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Preferred Option and Alternatives Assessment

This appendix presents the findings of the detailed assessments of the preferred option for the West Cumbria WRZ and alternatives. These options are:

- WC01: Thirlmere Transfer into West Cumbria (the preferred WRMP option);
- WC14d: Kielder Water Transfer to West Cumbria (Cumwhinton Treated);
- Lowest Cost Option, comprising: Wastwater (negotiate part abstraction licence) (WC04); Development of New Boreholes in West Cumbria Aquifer (10 Ml/d) (WC05a); Development of Boreholes in North Cumbria Aquifer (WC09).

The following matrices present the findings of the assessment.

WC01: Thirlmere Transfer into West Cumbria (Design Capacity - 80 Ml/d)

Option Summary

A new treatment works would be required at Thirlmere to produce an average output of 60Ml/d, with a maximum capacity of 80 Ml/d. Through a series of service reservoirs and transfer pipelines (pumped and gravity) this output will replace the output from existing works near Thirlmere, Ennerdale, Cornhow, Quarry Hill and Buttermere. These works will be abandoned but secondary chemical dosing points will be retained as required.

- Water would be pumped into the new WTW and treated water transferred to a new SR near Castle Rigg (60Ml capacity).
- New dual treated water mains to Cockermouth to then feed via new treated water mains to feed existing demands of Quarry Hill, Cornhow, Ennerdale, Buttermere WTW, new chemical dosing, new service reservoirs near Bothel Moor and Ennerdale.
- Abandon existing WTWs near Thirlmere, Buttermere, Quarry Hill, Ennerdale and Cornhow.

It should be noted that the exact location of the WTW and other infrastructure including pipeline routes would be the subject of a site selection exercise at the project level. Effects would be considered further through the EIA process.

Option Assessment

The assessment of Option WC01: Thirlmere Transfer into West Cumbria is presented in **Table C.1** below.

Table C.1 WC01: Thirlmere Transfer into West Cumbria

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity?	-	++	**Effects of Construction** Several of the proposed development sites are adjacent, or in close proximity, to designated conservation sites. These include: Thirlmere (adjacent to River Derwent and Bassenthwaite Lake SAC and River Derwent and Tributaries SSSI and in close proximity to Thirlmere Woods SSSI/Ancient Woodland); Ennerdale (adjacent to River Ehen SAC/SSSI to the east and in close proximity to Lake District High Fells SAC, Pillar and Ennerdale Fells SSSI and Ennerdale SSSI); Cornhow (adjacent to River Derwent and Tributaries SSSI and River Derwent and Bassenthwaite Lake SAC); and Buttermere (adjacent to Lake District High Fells SAC and Buttermere Fells SSSI). Pipeline sections would cross/run adjacent to the River Ehen SAC whilst other pipeline sections would be in close proximity to other designated sites (for example: the River Derwent and Bassenthwaite Lake SAC, Lake District High Fells SAC, Clints Quarry SAC and North Pennine Dales Meadows SAC). The HRA identifies that there is potential for significant construction effects on the River Derwent and Bassenthwaite Lake SAC, Clints Quarry SAC, Lake District High Fells SAC and River Ehen SAC if the works are not managed appropriately. Clints Quarry supports great crested newts (GCN) within a number of pools, with the closest unit of this SAC within 200m from a pipeline route within the A595. The HRA states that works entirely within the road would not affect any suitable habitat for this species, although it is possible that mitigation (exclusion fencing) may be required if the pipe trench is open during the key migration periods. Works outside the carriageway may affect habitats that are suitable for this species but are not anticipated at this stage. However, the risk of effects can be easily managed with established mitigation and no significant effects would be anticipated. The proposed pipeline to the SR near Buttermere would run immediately adjacent to the Buttermere Fells SSSI unit of the Lake District High Fells SAC, where the pipe runs up the Buttermere valley. The HRA notes that it is not possible to determine exactly which interest features are present adjacent to the road in this sector of the SAC based on the available data but it concludes that the rocky features adjacent to the road are unlikely to be especially sensitive to indirect effects (e.g. dust deposition etc.) and that assuming all the works are retained within or alongside the existing carriageway, then the scheme would not be expected to have any effects on the SAC. The proposed pipeline to a new SR near Ennerdale would cross the River Ehen at least once and possibly (depending on the route) up to three times. It is likely that these crossings would be by existing road bridges but it is possible that a new pipe bridge or sub-surface lay may be required. Atlantic salmon and freshwater pearl mussel are present throughout the SAC and works anywhere near the river could potentially affect these species directly or indirectly. However, the HRA concludes that mitigation (e.g. a

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
				specific sediment control regime and commitment to not remove any bankside trees) will ensure that significant sediment discharges do not occur. United Utilities have also stated that they intend to keep the pipeline works to existing roads and crossings where possible. The pearl mussel is also dependent on Atlantic salmon for part of its lifecycle and so any effects on this species would negatively affect the pearl mussel also. Atlantic salmon will be vulnerable to the same potential effects as freshwater pearl mussel, particularly with regard to sedimentation, and the same monitoring/mitigation measures would apply. Additionally, salmon will be sensitive to noise and vibration disturbance, particularly during the key migration periods and so construction works must be timed to avoid possible effects on migrating salmon (construction within 200m of the river should be completed before late summer, prior to the autumn migration period). Significant construction effects on the River Derwent and Bassenthwaite Lake SAC are possible due to the proximity of the works to the St. Johns Beck tributary, which is known to provide spawning areas for Atlantic salmon. However, as with other construction works it is considered that any effects can be avoided with appropriate timing of works and construction control measures. UU have stated that pipelines will be routed within or alongside existing carriageways and river crossings (or via suitable alternative routes identified in discussion with Natural England and the Environment Agency). In addition, it is likely that any potential effects can be avoided or mitigated with suitable measures – for example, by timing construction works near rivers to avoid the key migration periods for salmon; and by developing specific silt control plans to manage construction run-off. On this basis, there is nothing to suggest that the scheme could not be accommodated without significant construction-related effects occurring. It should also be noted that further, scheme level investigations and appropriate assessment would be required at the project stage in any case. Notwithstanding the above, this option would result in the loss of greenfield land at several development sites and in consequence there is potential for localised loss of habitat and, in conjunction with decommissioning works, disturbance which has been assessed as having a minor negative effect on biodiversity. **Effects of Operation** The scheme is designed to relieve pressure on the River Ehen SAC. Abstraction from Ennerdale Water, which discharges into the Ehen, has been identified for amendments under the Review of Consents programme due to the impact of abstraction on interest features in the SAC (primarily fresh water pearl mussels). The decommissioning of the WTW near Ennerdale and associated abstraction from Ennerdale Water under this option may therefore generate benefits in respect of these features due to increased flows. In this respect, the HRA identifies that, whilst the interest features of European designated sites are not directly exposed to the likely operational effects of the scheme, increased flows within the Ehen would benefit the interest features of the SAC. It is assumed that compensation flow to St John's Beck would be maintained in accordance with the existing consent and in consequence no adverse effects on the River Derwent and Bassenthwaite Lake SAC and the River Derwent and Tributaries SSSI (which includes the Beck) would be expected. The decommissioning of the WTW near Quarry Hill would result in a reduction in abstraction from Dash Beck and Hause Gill,

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
				sources that have been investigated under the Review of Consents programme due to impacts on salmon, which are interest features of the River Derwent and Tributaries SSSI and River Derwent and Bassenthwaite Lake SAC. The decommissioning of hthe WTW near Quarry Hill and associated reduction in abstraction from Overwater Reservoir may also benefit Overwater Reservoir SSSI, which has previously been identified for reductions by the Environment Agency. The decommissioning of the WTW near Cornhow and cessation of abstraction from Crummock Water may also lead to benefits in respect of the River Derwent and Tributaries SSSI and River Derwent and Bassenthwaite Lake SAC, although this source has not been identified for reduction under the Review of Consents programme. Changes in operating levels of the reservoir may affect local biodiversity in the reservoir although effects are not expected to be significant as mean levels would be similar to current operation in normal years. Taking into account the potential operational benefits in respect of the River Ehen SAC and River Derwent and Bassenthwaite Lake SAC in particular, this option has been assessed as having a significant positive effect on biodiversity. **Mitigation** • Scheme specific mitigation plans will be required to ensure that any construction related adverse effects on designated sites are avoided and localised effects on biodiversity minimised. With specific regard to the Clints Quarry SAC, mitigation requirements for GCN would need to be reviewed at the scheme level. With respect to the River Ehen SAC and River Derwent and Bassenthwaite Lake SAC, the scheme should be designed to ensure that no bank side trees are removed. Construction within 200m of the river should be completed before late summer, prior to the autumn migration period. • The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural England. • Bio-security measures should be implemented during construction and operational phases. **Assumptions** • It has been assumed that the new pipeline would be predominantly routed within or alongside existing roads. Where this is not possible, alternative solutions will be discussed with Natural England and the Environment Agency to mitigate any impact of those alternatives. • It is assumed that compensation flow to St John's Beck would be maintained in accordance with the existing consent. **Uncertainty** • None identified.

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
2. To ensure the appropriate and efficient use of land and protect soil quality	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity? Will the option minimise the loss of best and most versatile soil? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination?	-	0	**Effects of Construction** This option would involve upgrading/replacing facilities at a number of existing sites. These sites include: • Thirlmere (replacement of existing WTW) • Cornhow (Fluoride storage & dosing on existing SR outlets). It is expected that several option components would be located on greenfield land. These components would include SRs near Bothel Moor and Castle Rigg. Further, for some of those elements that involve the upgrade of existing facilities (specifically the SR near Ennerdale and new WTW and PS at Thirlmere), it is assumed that some additional land take would be required. It is assumed that new pipeline would predominantly be routed within or alongside existing roads and in consequence, no substantial adverse effects on land use/soils are expected. Further, it is anticipated that any soils displaced during excavation associated with pipeline works would be replaced, supported by a revegetation scheme such that any adverse effects would be temporary. The majority of development sites are situated within areas of poor agricultural land quality (defined as grades 4/5 under Defra's Agricultural Land Classification system) or non-agricultural areas. Development of the SR near Bothel Moor may result in the loss of Grade 3 (good to moderate) agricultural land, dependent on the exact location of the sites. No loss of agricultural land classified as grade 1 (excellent) or grade 2 (very good) is anticipated. As the majority of development would be located at, or adjacent to, existing sites owned/operated by United Utilities, the option is not expected to result in substantial conflict with existing land use patterns. It is not expected that geologically protected sites would be adversely affected by the construction of this scheme. Overall, the construction of this option has been assessed as having a minor negative effect on this objective which principally reflects the loss of greenfield land required to accommodate the development of new (and upgrade of existing) facilities. **Effects of Operation** Once construction activity is complete, no ongoing impact on land use/soils is expected (initial loss of land during construction has been assessed under construction). At sites where existing WTWs are decommissioned, land use benefits are likely to be negligible as other water infrastructure such as PSs and SRs would be retained on site. Overall, operational effects have therefore been assessed as neutral. **Mitigation** • Appropriate construction methods should be employed to minimise the risk of contamination.

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
				Assumptions • It has been assumed that development sites are not contaminated. • It has been assumed that any decommissioned sites would be fully remediated, as required. • It has been assumed that the new pipeline would be predominantly routed within or alongside existing roads. • It is expected that soils displaced during excavation associated with pipeline works would be replaced following the completion of construction activity and re-vegetated if appropriate. **Uncertainty** • The exact location and footprint of new infrastructure required under this option is unknown at this stage.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option affect the ecological status of water bodies?	**0**	**++**	**Effects of Construction** During construction (and decommissioning), there is the potential for contaminants such as silt, concrete or fuel oil to pollute watercourses, particularly given that several development sites and pipeline works would be in close proximity to/cross rivers including the Derwent, Ehen and Eden. Contaminants may also affect Thirlmere and Ennerdale via surface run off from construction given the proximity of the proposed development sites to these reservoirs. However, it is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). In consequence, the option has been assessed as having a neutral effect on this objective during construction. **Effects of Operation** Under operation, storage in Thirlmere reservoir would be lower than under current operational practice. Analysis of reservoir levels was completed by UU, taking into account the impact of the transfer along with other factors such as trends in customer demand and climate change. Expressed as a proportion of gross storage capacity, the assessment indicated a reduction of approximately 7% in the average annual minimum storage levels in Thirlmere under normal year conditions. In the driest years, for example 1984 or 1995-1996, minimum storage in Thirlmere could be around 12% lower compared to minimum storage under current operation. Higher flows in St Johns Beck would be impacted as a result of the reservoir being drawn down more and not spilling as frequently. However, it is assumed that low flows in St Johns Beck would be unchanged compared to current operation as compensation flow would be maintained in accordance with the existing consent. Further, the reservoir and downstream river sections are located in the Upper Derwent Water Resources Management Unit which has a water resource availability status of 'water available'.

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
				The decommissioning of WTWs near Quarry Hill, Ennerdale and Cornhow may increase flows in the catchments in which associated abstractions are located (Dash Beck, Bassenthwaite/Derwent, Ellen, Ehen and Cocker). Taking into account the associated benefits in respect of the River Ehen SAC and River Derwent and Bassenthwaite Lake SAC in particular, on balance the option has been assessed as having a potentially significant positive effect on this objective. **Mitigation** • None identified. **Assumptions** • It is assumed that construction activities would be under taken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). **Uncertainty** • None identified.
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	-	-	**Effects of Construction** The Thirlmere and Ennerdale sites are situated within Flood Zones 2/3. Further, as proposed, several sections of the pipelines would be routed across Flood Zones 2/3. In consequence, construction activity may be affected by flooding (dependent on timing). However, it is not expected that construction activity would increase the risk of flooding offsite. **Effects of Operation** The new WTW and PS near Thirlmere and any above ground infrastructure associated with the new SR near Ennerdale may be at risk of flooding during operation. Being located on greenfield land, there is potential that increased surface run off could increase flood risk elsewhere, although this is currently uncertain. **Mitigation** • Appropriate flood alleviation measures should be incorporated such as bunding and locating power and electrical equipment above flood level where possible. • Measures should be considered to reduce surface water runoff. **Assumptions** • It is assumed that an appropriate Flood Risk Assessment (FRA) would be undertaken prior to the implementation of this option with appropriate mitigation measures identified to ensure that flood risk is minimised. **Uncertainty** • The extent to which development may affect flooding elsewhere is unknown (although it is expected that this would be considered as part of any FRA).

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	-	0	**Effects of Construction** The option would require 5,315 HGV movements over a 6 year construction period (including decommissioning of existing WTWs) which, together with emissions to air from plant, may have a minor negative effect on local air quality. Pipeline works of the proposed scale (the proposed pipeline route exceeds 100 km in length) could also result in substantial disruption to roads in the area (the roads under which new pipes would be installed or existing pipes upgraded include approximately 56.5 km of A-road and 15 km of B-road), increasing congestion and associated emissions to air, particularly where the route passes through or is within close proximity to the larger settlements of Cockermouth and Keswick. Impacts may be more substantial should works take place during peak tourist periods given existing traffic congestion issues in the area caused by the large seasonal influx of visitors. However, the development sites and pipeline route are not within designated Air Quality Management Areas (AQMAs) and therefore the option has been assessed as having a minor negative effect on air quality. **Effects of Operation** Operational emissions to air are expected to be negligible and in this respect, the option would generate only a small number of vehicle movements per week. In consequence, the option has been assessed as having a neutral effect on air quality. **Mitigation** • HGV movements and pipeline works should, where possible, be timed so as to avoid peak traffic periods (e.g. between 7am-9am and 4pm-6pm). • Measures to mitigate air quality impacts arising from construction activities should be considered within a Construction and Environmental Management Plan. These measures may include, for example, dust suppression, use of lower emissions plant, and monitoring. • Detailed air quality and transport assessments should be undertaken as part of the Environmental Impact Assessment (EIA) process. **Assumptions** • None identified. **Uncertainty** • None identified.
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option contribute positively to adaptation to climate change? Will the option increase environmental resilience to the effects of climate change?	--	--	**Effects of Construction** During the construction phase, the use of plant on-site and transportation of materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. This option would generate 331,473 tonnes CO_2e during constructions (comprising both embodied carbon in construction materials and emissions from HGV movements and emissions from decommissioning existing WTWs) which has been assessed as having a significant negative effect on this objective.

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
				Effects of Operation During operation, this option would involve the treatment and pumping of water which would result in a long term increase in energy use and associated emissions (there would also be embodied carbon in chemicals used to treat water). Operational vehicle movements would also contribute to emissions, although the number of HGV movements associated with the operation of this option would be small. Operational emissions would be 5,071 tonnes CO_2e/a. However, this option would also result in the closure of existing WTWs (near Thirlmere, Quarry Hill, Buttermere, Ennerdale, and Cornhow) and may therefore generate some energy savings, reducing carbon emissions. In this respect, emissions savings associated with this option are estimated to be 3,569 tonnes CO_2e/a. The predicted effects of climate change (including drier summers) mean that this option would contribute positively to climate change adaptation by increasing water supply/storage. Overall, net operational greenhouse gas emissions are expected to be high (1,502 tonnes CO_2e/a) and whilst the option may generate benefits in respect of climate change adaptation, on balance it has been assessed as having a significant negative effect on climate change. **Mitigation** • Measures to reduce greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. • Where appropriate, the design of new infrastructure should incorporate the use of energy efficient materials and building techniques and, if appropriate, renewable energy provision. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	-	++	**Effects of Construction** Construction activity and decommissioning works may have an adverse effect on health as a result of air quality/noise impacts, particularly larger scale works in close proximity to residential receptors (e.g. new/upgraded SRs near Castle Rigg and Bothel Moor). The proposed pipeline would also pass through/be adjacent to a number of settlements including Cockermouth and Keswick and associated works/HGV movements may therefore affect receptors along this route. Works may affect the amenity recreational users such as walkers, particularly in respect of those sites located within the Lake District National Park. Notwithstanding the above, works would be temporary and associated effects are expected to be felt in the short term only (i.e. over the 6 year construction period). Further, it is likely that impacts would be managed/mitigated where possible using best practice (e.g. Considerate Constructors' Scheme).

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
				Overall, the option has been assessed as having a minor negative effect on health. **Effects of Operation** Once operational, the option is not expected to have any substantial adverse effects on health as a result of noise or air quality impacts. Under operation, storage in Thirlmere reservoir would be lower than under current operational practice. Analysis of reservoir levels was completed by UU, taking into account the impact of the transfer along with other factors such as trends in customer demand and climate change. Expressed as a proportion of gross storage capacity, the assessment indicated a reduction of approximately 7% in the average annual minimum storage levels in Thirlmere under normal year conditions. In the driest years, for example 1984 or 1995-1996, minimum storage in Thirlmere could be around 12% lower compared to minimum storage under current operation. Given the national importance of the Lake District National Park, there is potential for adverse effects on the visual amenity of recreational users due to changes in reservoir levels. However, the change in mean operating level of the reservoir would be limited under this option compared to current operation. Although the minimum level in a dry year would be lower, it is considered the difference between reservoir levels under current operation and under this option would not affect informal recreation. Impacts on higher flows in St Johns Beck may affect angling and in-stream recreation such as canoeing. However, given that the option is only likely to affect higher flows, effects are not expected to be significant. Further, reductions in abstraction associated with the closure of the five WTWs (near Buttermere, Quarry Hill, Ennerdale and Cornhow) may generate potential benefits for riverusers such as canoeists and also anglers (primarily due to changes in flow in the catchments in which the abstractions are located, which contain watercourses that are important spawning/breeding grounds for salmonids). The option has a design capacity of 80 Ml/d, helping to ensure the continuity of a safe and secure drinking water supply and serving to address the deficit within the West Cumbrian WRZ. The option may also remove the vulnerability to short duration droughts within this zone. Further, the decommissioning of existing sources may benefit downstream abstractors (where hands off flow constraints are in place) or present opportunities for new abstractions (subject to licensing). Overall, the option has been assessed as having a significant positive effect on health. **Mitigation** • No additional mitigation identified. **Assumptions** • It is assumed that construction would adopt practices which seek to reduce noise/air quality impacts (such as those practices outlined under the Considerate Constructors' Scheme). **Uncertainty** • None identified.

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	++/-	++	**Effects of Construction** The construction of this option would represent a large capital investment. This is likely to generate a number of employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works). Whilst the degree to which this would benefit the local labour market and local businesses would depend to a large extent on the recruitment practices of contractors appointed to undertake the works, skills within the local labour market and the procurement policies of both United Utilities and any sub-contractors, benefits are expected to be substantial. HGV movements and pipeline works of the proposed scale (exceeding 100 km in length) and duration (6 years) could result in disruption to roads in the area (the roads under which new pipes would be installed or existing pipes upgraded include approximately 56.5 km of A-road and 15 km of B-road). Impacts may be more substantial should works take place during peak tourist periods given existing traffic congestion issues in the area caused by the large seasonal influx of visitors. However, any effects would be temporary and felt in the short term only whilst the magnitude of effects are likely to be lessened by the adoption of mitigation measures at the project level, informed by a detailed transport assessment. Works may affect the amenity of recreational users particularly in respect of those sites located within the Lake District National Park. However, construction activity is not expected to have a substantial adverse impact on the local tourist economy given that works would be temporary and impacts are likely to be managed/mitigated where possible using best practice (e.g. Considerate Constructors' Scheme). Taking into account the potential for substantial economic benefits to arise during construction but the likelihood of traffic disruption in particular, the option has been as having a mixed significant positive and minor negative effect on this objective. **Effects of Operation** As noted above (under Objective 7), no significant adverse effects on recreation are anticipated. Reductions in abstraction associated with the closure of the five WTWs (near Buttermere, Quarry Hill, Ennerdale and Cornhow) may generate potential benefits to river users such as canoeists and anglers (primarily due to changes in flow in the catchments in which the abstractions are located, which contain watercourses that are important spawning/breeding grounds for salmonids). The option has a design capacity of 80 Ml/d, serving to meet short term peak demands as well as addressing the deficit within the West Cumbria WRZ which is based on critical period average demand. Further, the decommissioning of existing sources may benefit downstream abstractors (where hands of flow constraints are in place) or present opportunities for new abstractions (subject to licensing). This may support economic and population growth in the West Cumbria area and help sustain the seasonal influx of tourists to the area. The additional supply may also help to ensure that an affordable supply of water is maintained in the long term, serving to protect vulnerable customers.

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
				This option would not require significant levels of additional resource (financial or human) during operation and in consequence, it is likely to be resilient to any future changes in these resources. New above ground infrastructure would (with the exception of that near Bothel Moor) be located within the Lake District National Park which may affect the tourist economy (due to associated visual amenity impacts). However, a number of new assets would be located within/adjacent to existing sites which, alongside the implementation of appropriate mitigation such as sympathetic design and use of local materials, is likely to reduce the magnitude of visual impacts such that no adverse effects on the tourist economy are expected during the operational phase. Overall, the operation of this option has been assessed as having a significant positive effect on this objective. **Mitigation** • Where possible, United Utilities and any contractors should seek to utilise local labour. • Where possible, United Utilities and any contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. **Assumptions** • None identified. **Uncertainty** • The extent to which the construction of this option would benefit the local economy/local labour market is uncertain. However, given the scale of investment, benefits are nonetheless expected to be significant. • A detailed transport assessment should be undertaken as part of the EIA process.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	**0**	**0**	**Effects of Construction and Operation** The option would not lead to a reduction in losses from the supply network. There are no measures in the option that would improve water efficiency. In consequence, the option has been assessed as having a neutral effect on this objective during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
10. To promote the efficient use of resources	Will the option seek to minimise the demand for raw materials? Will the option reduce the total amount of waste produced and the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	--	0	**Effects of Construction** This option comprises several infrastructure components including new/upgraded SRs, a WTW and PSs as well as over 100km of new pipeline that would require a large volume of raw materials and energy to construct. Using the embodied carbon associated with the construction phase (331,473 tonnes of CO_2e) as a proxy, material use and energy requirements are considered to be substantial and the option has therefore been assessed as having a significant negative effect on this objective. This option would generate construction wastes which may include excavation waste, replaced infrastructure components and, potentially, demolition waste associated with the closure of five existing WTWs. Overall, this option has been assessed as having a significant negative effect on resource use during construction. **Effects of Operation** The operation of this option would require additional resources such as chemicals used in the treatment of raw water although this increase would be partially offset by the closure of the five existing WTWs. The treatment and pumping of water would also result in a long term increase in energy use (operational energy usage is estimated to be approximately 293 KWh/Ml). However, this option would also result in the closure of existing WTWs (near Bridge End, Quarry Hill, Buttermere, Ennerdale and Cornhow) and may therefore generate some energy savings. In this respect, energy savings associated with this option are estimated to be 308 kWh/Ml. The treatment of water would generate waste (e.g. sludge), although quantities are uncertain at this stage. On balance, the operation of this option has been assessed as having a neutral effect on resource use. **Mitigation** • Opportunities to utilise reused/recycled materials during construction should be considered where appropriate. • Construction and operational wastes should be reused/recycled where possible. • Measures to reduce energy usage during construction should be considered including, for example, the use of low energy usage plant. • Where appropriate, the design of new infrastructure should incorporate the use of energy efficient materials and building techniques and, if appropriate, renewable energy provision. **Assumptions** • None identified.

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • Opportunities to reduce waste, reuse materials and use recycled materials for construction are unknown at this stage. • The requirement for disposal of redundant WTW infrastructure is uncertain at this stage. • The exact resource requirements (e.g. volumes of specific materials) associated with the construction/operation of this option are unknown at this stage. • The volume of waste generated under operation of this option is uncertain at this stage.
11. To protect and enhance cultural and historic assets	Will the option conserve or enhance historic buildings, places, conservation areas and spaces that enhance local distinctiveness, character and the appearance of the public realm? Will the option avoid or minimise damage to archaeologically important sites? Will the option affect public access to, or enjoyment of, features of cultural heritage?	-	0	**Effects of Construction** The majority of the proposed development sites do not contain, and are not within close proximity to, designated cultural heritage assets. However, works associated with the construction of a new SR near Bothel Moor may affect the settings of listed buildings in Bothel. Pipeline works may also affect the settings of listed buildings and scheduled monuments along the proposed route (e.g. Castle How Hillfort and assets at Papcastle) and excavations could disturb unknown archaeological assets (although this is currently uncertain). However, any impacts would be temporary and it is assumed that mitigation would be adopted where possible to avoid significant adverse effects (e.g. pipeline routing to avoid direct impacts on assets). In consequence, the option has been assessed as having a minor negative effect on this objective. **Effects of Operation** As noted above, the development of the new SR near Bothel Moor may affect the settings of listed buildings in Bothel. However, as the SR would be buried with planting and re-seeding minimising any visual impacts in the medium to long term (i.e. within a year, depending on the season in which works are undertaken), effects are expected to be negligible. It is also expected that new pipeline would be buried with planting and re-seeding likely to return land to a pre-development state within a year (depending on the season in which works are undertaken) such that there would be no long term adverse effects on the settings of designated cultural heritage assets along the route. In consequence, the option has been assessed as having a neutral effect on this objective during operation. **Mitigation** • Pipelines should be routed so as to avoid direct impacts on cultural heritage assets. **Assumptions** • None identified. **Uncertainty** • The presence of undiscovered items of archaeological interest is currently uncertain.

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
12. To protect and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	--	-/?	**Effects of Construction** Under current proposals, the majority of development sites (with the exception of Bothel Moor) would be located within the Lake District National Park and in consequence there is the potential for significant landscape impacts. The proposed new SRs and associated infrastructure such as access roads would constitute relatively large scale development in the Lake District National Park. The approximate operational footprint of the proposed new SRs in the National Park would be as follows: • Ennerdale: 70m x 70m • Castle Rigg: 200m x 130m The new WTW which, under current proposals, would be in the vicinity of the existing Thirlmere WTW would also constitute a relatively large scale development in the Lake District National Park. The footprint of the new WTW and PS is anticipated to be approximately nine times that of the current structure. This constitutes a substantial increase in building footprint and in consequence, there is the potential for construction activities to generate significant negative effects on landscape. Approximately 50% of the pipeline length would also lie within the Lake District National Park and therefore there is potential for substantial landscape effects associated with pipeline works. However, the majority of the route would follow existing linear features (roads) and adverse effects would be over a short timescale with planting and re-seeding likely to return land to a pre-development state within a year (depending on the season in which works are undertaken). Development sites outside the Lake District National Park include Bothel Moor which is within a rural area. Construction activity associated with a new SR near Bothel Moor in particular would be relatively large scale (the SR would have an operational footprint of approximately 50m x 60m) and would take place on greenfield land in a relatively open setting and may therefore affect local landscape character. Pipeline works outside the Lake District National Park may also affect local landscape character as well as townscapes (where the route is through/adjacent to Keswick and Cockermouth). Whilst development would be within the Lake District National Park, it is not expected that construction activity would affect public access to the area. Construction activity may affect the visual amenity of residential receptors in close proximity to the development sites. However, under current proposals the majority of sites would be in rural and remote locations with few residential receptors likely to experience adverse effects. Notwithstanding, the proposed sites near Castle Rigg and Bothel Moor may be in close proximity to residential receptors (depending on final location) whilst the proposed WTW and PS near Thirlmere would be in close proximity to a residential property and farm and campsite, the visual amenity of which may be affected during construction particularly given the relatively large scale of works likely to be required in these locations. Further, the visual amenity of receptors along the route of the proposed pipeline as well as along transport corridors may be affected.

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
				In view of the location of several development sites and sections of pipeline with the Lake District National Park, there is potential for construction activity to affect the visual amenity of recreational receptors such as walkers. Taking into account the scale of the scheme and location of components within the Lake District National Park, this option has been assessed as having a significant negative effect on landscape. Notwithstanding, it should be noted that the exact locations of development sites have not yet been determined. This would be established at the project stage when the location of all components of the scheme including pipelines would be determined through a site selection exercise as part of the EIA process. In this context, any proposal would be subject to full landscape and visual impact assessment whilst landscape and visual impact would be a key consideration in the determination (by the relevant local planning authority) of any Town and Country planning application(s) related to the scheme. Should residual landscape and visual impacts associated with construction prove to be unacceptable, then alternative locations for the proposed new WTW and other above ground infrastructure would need to be considered. **Effects of Operation** Under current proposals, new infrastructure would (with the exception of Bothel Moor) be located within the Lake District National Park and in consequence there is potential for significant landscape effects during operation. New assets may also affect the visual amenity of residential receptors in close proximity to the development sites (and in particular receptors to the north of Castle Rigg and Bothel Moor) as well as recreational users. As noted above, the proposed new SRs and associated infrastructure such as access roads would constitute relatively large scale development. However, it is anticipated that, where feasible, SRs would be buried which, alongside, appropriate screening and landscaping would be likely to lessen the immediate landscape/visual impact over time (as vegetation matures). The new WTW near Thirlmere would represent a substantial increase in building footprint and in consequence, there is the potential for significant negative effects on landscape and the visual amenity of local receptors. However, mitigation would be implemented to lessen landscape and visual impacts. Mitigation could include, for example, the adoption of sympathetic design (for example, the use of local materials where possible or incorporation of a 'green roof') and it is also anticipated that screening would be provided where appropriate. It is expected that the pipeline would be buried and that planting and re-seeding would minimise any landscape effects associated with these assets in the longer term (i.e. within a year, depending on the season in which works are undertaken). Operation of the option would result in additional drawdown of Thirlmere which may be perceptible to recreational users. Analysis of reservoir levels was completed by UU, taking into account the impact of the transfer along with other factors such as trends in customer demand and climate change. Expressed as a proportion of gross storage capacity, the assessment indicated a reduction of approximately 7% in the average annual minimum storage levels in Thirlmere under normal year conditions. In the driest

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
				years, for example 1984 or 1995-1996, minimum storage in Thirlmere could be around 12% lower compared to minimum storage under current operation. Given the national importance of the Lake District National Park, there is potential for effect on landscape and the visual amenity of recreational users due to changes in reservoir levels. However, the change in mean operating level of the reservoir would be fairly limited under this option compared to current operation. Although the minimum level in a dry year would be lower, it is considered the difference between reservoir levels under current operation and under this option would not substantial affect landscape character or visual amenity. At sites where existing WTWs are decommissioned there may be landscape benefits associated with the removal of infrastructure. Effects may be particularly positive in respect of the decommissioning of those sites located in the Lake District National Park, especially if sites are restored to a greenfield state. However, the end use of decommissioned sites has yet to be determined and in consequence effects in this regard are uncertain at this stage. Overall, assuming that the measures outlined above are implemented to reduce landscape and visual impacts, it is not expected that residual effects on landscape would be significant in this instance, although it is recognised that there would be the potential for landscape effects to be significant if mitigation is not feasible. Notwithstanding, it should be noted that the exact locations of development sites have not yet been determined. This would be established at the project stage when the location of all components of the scheme including pipelines would be determined through a site selection exercise as part of the EIA process. In this context, any proposal would be subject to full landscape and visual impact assessment whilst landscape and visual impact would be a key consideration in the determination (by the relevant local planning authority) of any Town and Country planning application(s) related to the scheme. Should residual landscape and visual impacts prove to be unacceptable, then alternative locations for the proposed new WTW and other above ground infrastructure would need to be considered. **Mitigation** • Construction activity should be screened where possible so as to avoid/minimise adverse landscape/visual impacts. • New above ground infrastructure should adopt high quality design principles (e.g. use of local materials). • Landscaping/screening measures should be utilised to minimise adverse landscape/visual amenity impacts. • Where possible new SRs should be buried and blended into the local landscape. **Assumptions** • It is assumed that the land above the pipeline would be restored to its former quality after construction works have finished.

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • The exact location, design and scale of new infrastructure required under this option is unknown at this stage. • The end use of those WTWs to be decommissioned is unknown at this stage.
Summary	**Effects of Construction** This option represents a large scale scheme comprising several infrastructure components including new/upgraded SRs, a WTW, PSs and over 100km of new pipeline together with the decommissioning of five existing WTWs. Construction (including decommissioning) activity is therefore expected to have a significant negative effect on climate change as a result of associated greenhouse gas emissions from HGV movements, construction plant and embodied carbon in raw materials (the option would generate 331,473 tonnes CO_2e during construction). Using the embodied carbon associated with the construction phase as a proxy, material use and energy requirements are considered to be substantial and, taking into account waste generation, the option has therefore been assessed as having a significant negative effect on resource use. The majority of development sites (with the exception of Bothel Moor) are located within the Lake District National Park. Approximately 50% of the pipeline length would also lie within the Lake District National Park and therefore there is potential for substantial landscape effects associated with construction activity. Development may also affect the visual amenity of residential receptors in close proximity to the development sites (and in particular those receptors in close proximity to the sites near Castle Rigg and Bothel Moor) and along the pipeline route as well as recreational users. Overall, the option has been assessed as having a significant negative effect on landscape. The construction of this option would represent a large capital investment which is likely to generate a number of employment opportunities and supply chain benefits as well as increased spend in the local economy by contractors and construction workers. However, HGV movements and pipeline works of the proposed scale may cause traffic disruption. The option has therefore been as having a mixed significant positive and minor negative effect on economic and social wellbeing. The assessment has not identified any further significant negative or significant positive effects. The HRA identifies that there is potential for significant construction effects on the River Derwent and Bassenthwaite Lake SAC, Clints Quarry SAC, Lake District High Fells SAC and River Ehen SAC, primarily due to pipeline works. However, taking into account scheme specific mitigation that can be relied on, and a commitment for pipeline works to be within or alongside existing roads (or suitable alternatives identified in discussion with Natural England and the Environment Agency), no significant construction-related effects would be anticipated. It should also be noted that further, scheme level investigations and appropriate assessment would be undertaken at the project stage. Notwithstanding, this option would result in the loss of greenfield land at several development sites and in consequence there is potential for localised loss of habitat and, in conjunction with decommissioning works, disturbance which has been assessed as having a minor negative effect on biodiversity. The option may also generate minor negative effects in respect of land use/soils (due to additional land take required under this option), flood risk (the sites near Bridge End and Ennerdale are situated within Flood Zones 2/3 whilst several sections of the pipelines would be routed across Flood Zones 2/3) and cultural heritage (due to potential effects on the settings of listed buildings and scheduled monuments). Emissions to air from HGV movements and construction plant may also have a minor negative effect on air quality and, together with noise/vibration, human health. Neutral effects have been identified in respect of two objectives during construction relating to water quality/resources (Objectives 3 and 9). **Effects of Operation** Similar to the construction phase, the option is likely to have a significant negative effect on climate change. This principally reflects the net additional greenhouse gas emissions associated with the treatment and pumping of water. The scheme is designed to relieve pressure on the River Ehen SAC. Abstraction from Ennerdale Water, which discharges into the Ehen, has been identified for amendments under the Review of Consents programme due to the impact of abstraction on interest features in the SAC (primarily fresh water pearl mussels). The decommissioning of the WTW near Ennerdale and associated abstraction from Ennerdale Water under this option may therefore generate benefits in respect of these features due to increased flows. Additionally, the decommissioning of the WTW near Quarry Hill would result in a reduction in abstraction from Dash Beck and Hause Gill, sources that have been investigated under the Review of Consents programme due to impacts on salmon which are interest features of the River Derwent and Tributaries SSSI and River Derwent and Bassenthwaite Lake SAC, whilst the decommissioning of the WTW near Cornhow and cessation of abstraction from Crummock Water may also lead to benefits in respect of the SSSI and SAC (although this source has not been identified for reduction under the Review of Consents programme). Taking into account the potential operational benefits in respect of the River Ehen SAC and River Derwent and Bassenthwaite Lake SAC in particular, this option has been assessed as having a significant positive effect on biodiversity. The decommissioning of the WTWs near Quarry Hill, Ennerdale and Cornhow has also been assessed as having a significant positive effect on water quantity and quality due to increases in flows in the catchments in which associated abstractions are located (Dash Beck, Bassenthwaite/Derwent, Ellen, Ehen and Cocker). The option has a design capacity of 80 Ml/d, serving to address deficit within the West			

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
	Cumbrian WRZ. Further, the decommissioning of existing sources may benefit downstream abstractors (where hands off flow constraints are in place) or present opportunities for new abstractions (subject to licensing). This has been assessed as having a significant positive effect on health (in helping to ensure the continuity of a safe and secure drinking water supply) and economic and social wellbeing (given the potential for additional supply to support economic/population growth). No further significant negative or significant positive effects have been identified. The new WTW in the vicinity of the existing WTW near Bridge End would constitute a relatively large scale development in the Lake District National Park. The new WTW and PS is anticipated to be approximately nine times that of the current structure This constitutes a substantial increase in building footprint and in consequence, there is the potential for significant negative effects on landscape. Mitigation could include, for example, the adoption of sympathetic design (for example, the use of local materials where possible or incorporation of a 'green roof') and it is also anticipated that screening would be provided where appropriate. It is also assumed that, where feasible, new service reservoirs would be buried which, alongside, appropriate screening and landscaping would be likely to lessen the immediate landscape/visual impact over time (as vegetation matures). Overall, assuming that the measures outlined above are implemented to reduce landscape and visual impacts, it is not expected that effects on landscape would be significant in this instance. Notwithstanding, the proposal would be subject to full landscape and visual impact assessment as part of the EIA process at the project stage. Should these assessments conclude that residual landscape impacts would be significant, and then alternative locations for the WTW would need to be considered. The operation of this option is expected to have minor negative effects on flood risk owing to the location of assets within Flood Zones 2/3. Neutral effects have been identified in respect of five objectives during operation. These objectives relate to soils/land use (Objective 2), water resources (Objective 9), air quality (Objective 5), resource use (Objective 10) and cultural heritage (Objective 11). **Mitigation** Adverse environmental effects associated with the construction/operation of this option could be reduced, and positive effects enhanced, through the adoption of the following mitigation measures: • Scheme specific mitigation plans will be required to ensure that any construction related adverse effects on designated sites are avoided and localised effects on biodiversity minimised. With specific regard to the Clints Quarry SAC, mitigation requirements for GCN would need to be reviewed at the scheme level. With respect to the River Ehen SAC, the scheme should be designed to ensure that no bankside trees are removed. Construction within 200m of the river should be completed before late summer, prior to the autumn migration period. • The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural England. • Bio-security measures should be implemented during construction and operational phases. • Appropriate construction methods should be employed to minimise the risk of contamination. • Appropriate flood alleviation measures should be incorporated such as bunding, elevation and locating power and electrical equipment above flood level where possible. • Measures should be considered to reduce surface water runoff. • HGV movements and pipeline works should, where possible, be timed so as to avoid peak traffic periods (e.g. between 7am-9am and 4pm-6pm). • Measures to mitigate air quality impacts arising from construction activities should be considered within a Construction and Environmental Management Plan. These measures may include, for example, dust suppression, use of lower emissions plant, and monitoring. • Detailed air quality and transport assessments should be undertaken as part of the Environmental Impact Assessment (EIA) process. • Measures to reduce greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. • Where appropriate, the design of new infrastructure should incorporate the use of energy efficient materials and building techniques and, if appropriate, renewable energy provision. • Where possible, United Utilities and any contractors should seek to utilise local labour. • Where possible, United Utilities and any contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials.			

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
	• Opportunities to utilise reused/recycled materials during construction should be considered where appropriate. • Construction and operational wastes should be reused/recycled where possible. • Pipelines should be routed so as to avoid direct impacts on cultural heritage assets. • Construction activity should be screened where possible so as to avoid/minimise adverse landscape/visual impacts. • New above ground infrastructure should adopt high quality design principles (e.g. use of local materials). • Landscaping/screening measures should be utilised to minimise adverse landscape/visual amenity impacts. • Where possible new SRs should be buried and blended into the local landscape.			

WC14d: Kielder Water Transfer to West Cumbria (Treated near Carlisle) (Design Capacity – 80 Ml/d)

Option Summary

- New intake structure and screening at Kielder Water reservoir sized at 80Ml/d;
- New 80Ml/d raw water pumping station at Kielder Water reservoir;
- New twin raw water transfer pipeline from Kielder Water to Carlisle (80Ml/d) including new pressure break tanks and intermediate raw water pumping stations
- New WTW facility located near Carlisle (average output 60Ml/d). The new works will include three stage treatment, full sludge treatment and all ancillary services, including a 80Ml/d treated water transfer pumping station;
- New twin 80Ml/d treated water main from Carlisle to West Cumbria including new intermediate treated water pumping stations, new treated water mains to feed existing demands of Quarry Hill, Cornhow, Ennerdale, Buttermere, new chemical dosing, new service reservoirs near Bothel Moor and Ennerdale.
- Abandon WTWs near Buttermere, Quarry Hill, Ennerdale and Cornhow. (Retain existing WTW near Thirlmere which will continue to supply the Keswick area).

It should be noted that the exact location of the WTW and other infrastructure including pipeline routes would be the subject of a site selection exercise at the project level. Effects would be considered further through the EIA process.

Option Assessment

The assessment of Option WC14d Kielder Water Transfer to West Cumbria (Treated near Carlisle) is presented in **Table C.2** below.

Table C.2 WC14d: Kielder Water Transfer to West Cumbria (Treated near Carlisle)

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity?	-	++	**Effects of Construction** The site of the proposed SR near Ennerdale is adjacent to River Ehen SAC/SSSI to the east and in close proximity to Lake District High Fells SAC, Pillar and Ennerdale Fells SSSI and Ennerdale SSSI. The sites at or near Kielder Water Reservoir, Haltwhistle, Bothel Moor, Carlisle and near Pattenfoot do not contain any statutory or non-statutory designations. Two SSSIs, Kielder Mires and Kielderhead Moors, lie around 0.5km to the south and north of Kielder Reservoir. The River Eden SAC/SSSI is 1km to the east of Cumwhinton and Cotehill Pastures and Ponds SSSI is 1km to the south. Construction of new infrastructure may have short term negative effects on biodiversity due to disturbance/habitat loss, although significant adverse effects on designated sites are not anticipated given distance to the sites listed above and the scale of works. The WTWs proposed for decommissioning include those near Ennerdale (adjacent to River Ehen SAC/SSSI to the east and in close proximity to Lake District High Fells SAC, Pillar and Ennerdale Fells SSSI and Ennerdale SSSI) and Cornhow (adjacent to River Derwent and Tributaries SSSI and River Derwent and Bassenthwaite Lake SAC. There is therefore potential for construction effects on these sites if the works are not managed appropriately. The transfer pipeline route passes through a number of designated sites including: • Hesleyside Park (SSSI, approximately 10 km downstream of the reservoir). The pipeline would be routed along existing road. • Gelt Woods SSSI, the River Eden and Tributaries SSSI and River Eden SAC via the A69 approximately 2 km to the south west of Brampton • River Eden and Tributaries SSSI and River Eden SAC via the A69 approximately 0.5 km to the west of Warwick Bridge. • River Derwent and Tributaries SSSI and River Derwent and Bassenthwaite Lake SAC via the A595 approximately 2km to the west of Cockermouth. • River Derwent and Tributaries SSSI and River Derwent and Bassenthwaite Lake SAC (over the River Cocker) approximately 0.5 km south of Southwaite Bridge. This is not a road-crossing of the river. • River Derwent and Tributaries SSSI and River Derwent and Bassenthwaite Lake SAC (over the River Marron) approximately 2km south of Ullock. This is not a road-crossing of the river • River Ehen SAC would also be crossed at around 0.5km east of Cleator Moor.

Objective	Guide Questions	Relationship		Commentary
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				Additionally, a number of designated sites would be in close proximity to the pipeline including, Roman Wall Loughs SAC, Drigg Coast SAC, North Pennine Dale Meadows SAC, North Pennine Moors SAC/SPA, South Solway Mosses SAC and Tyne and Allen Gravels SAC. However, the HRA states that it is likely that these effects could be managed/avoided with scheme specific mitigation and adoption of best practice techniques, for example, by timing construction works near rivers to avoid the key migration periods; and by developing specific silt control plans to manage construction run-off. It should also be noted that scheme level investigations and appropriate assessment would be undertaken at the project stage should the option form part of the final Water Resources Management Plan. Notwithstanding the above, this option would result in the loss of greenfield land at several development sites and in consequence there is potential for localised loss of habitat and, in conjunction with decommissioning works, disturbance which has been assessed as having a minor negative effect on biodiversity. **Effects of Operation** An additional abstraction of up to 80 Ml/d from Kielder Water would impact upon water levels in the reservoir compared to current operation. Effects on biodiversity of additional drawdown of the reservoir would depend on the storage fluctuations under the current abstraction regime but are not expected to be significant. Compensation releases from the reservoir would remain unchanged from current operation, and therefore downstream impacts on conservation features in the River North Tyne are not expected. Two SSSIs, Kielder Mires and Kielderhead Moors, lie around 0.5km to the south and north of Kielder Reservoir. Being away from the reservoir shoreline, it is not thought drawdown fluctuations would impact these SSSIs. The HRA identifies that the operation of this option is unlikely to have any adverse effects on designated European sites. Use of water from Kielder would not affect any water resource dependent (WRD) interest features at sites within its catchment and the only real mechanism for impacts would be indirect, through increases in discharges after usage (in theory, 80 Ml/d could be entering the West Cumbria WRZ). In reality, however, it is assumed that the transfer would be tailored to the deficit and any increase in, for example, river flows would be well within natural variation (and arguably providing additional support). Although the option constitutes an interbasin transfer of raw water, it would be treated immediately on arrival and risks associated with this (e.g. invasive species transfer) would not be expected. Abstraction from Ennerdale Water, which discharges into the Ehen, has been identified for amendments under the Review of Consents programme due to the impact of abstraction on interest features in the SAC (primarily fresh water pearl mussels). The decommissioning of the WTW near Ennerdale and associated abstraction from Ennerdale Water under this option may therefore generate benefits in respect of these features due to increased flows. In this respect, the HRA identifies that, whilst the interest features of European designated sites are not directly exposed to the likely operational effects of the scheme, increased flows within the Ehen would benefit the interest features of the SAC.

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				It is assumed that the current abstraction levels from, and compensation releases to, the River Derwent would be maintained in accordance with the existing consent (i.e. there would be no change in flows in the upper Derwent). The decommissioning of the WTW near Quarry Hill would result in a reduction in abstraction from Dash Beck and Hause Gill, sources that have been investigated under the Review of Consents programme due to impacts on salmon, which are interest features of the River Derwent and Tributaries SSSI and River Derwent and Bassenthwaite Lake SAC. The decommissioning of the WTW near Quarry Hill and associated reduction in abstraction from Overwater Reservoir may also benefit Overwater Reservoir SSSI, which has previously been identified for reductions by the Environment Agency. The decommissioning of the WTW near Cornhow and cessation of abstraction from Crummock Water may also lead to benefits in respect of the River Derwent and Tributaries SSSI and River Derwent and Bassenthwaite Lake SAC, although this source has not been identified for reduction under the Review of Consents programme. Taking into account the potential operational benefits in respect of the River Ehen SAC and River Derwent and Bassenthwaite Lake SAC in particular, this option has been assessed as having a significant positive effect on biodiversity. **Mitigation** • Scheme specific mitigation plans will be required to ensure that any construction related adverse effects on designated sites are avoided and localised effects on biodiversity minimised. • The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural England. • Bio-security measures should be implemented during construction and operational phases. **Assumptions** • It has been assumed that the new pipeline would be predominantly routed within or alongside existing roads. Where this is not possible, alternative solutions will be discussed with Natural England and the Environment Agency to mitigate any impact of those alternatives. **Uncertainty** • None identified.
2. To ensure the appropriate and efficient use of land and protect soil quality	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity?	**-**	**0**	**Effects of Construction** The new intake structure, PSs and SR near Bothel Moor would be built on undeveloped land and whilst some components of the scheme would be located on/adjacent to existing sites (including the WTW near Carlisle and SR near Ennerdale), it is assumed that some additional land take would be required. It is assumed that new pipeline would predominantly be routed within or alongside existing roads and in consequence, no substantial adverse effects on land use/soils are expected.

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	Will the option minimise the loss of best and most versatile soil? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination?			Further, it is anticipated that any soils displaced during excavation associated with pipeline works would be replaced, supported by a revegetation scheme such that any adverse effects would be temporary. Works at Kielder would be situated within an area of poor agricultural land quality (defined as grades 4/ 5 under Defra's Agricultural Land Classification system). However, development near Carlisle, Bothel Moor and near Haltwhistle and Pattenfoot may result in the loss of Grade 3 (good to moderate) agricultural land. No loss of agricultural land classified as grade 1 (excellent) or grade 2 (very good) is anticipated. As the majority of development would be located at , or adjacent to, existing sites owned/operated by United Utilities, the option is not expected to result in substantial conflict with existing land use patterns. It is not expected that geologically protected sites would be adversely affected by the construction of this scheme. Overall, the construction of this option has been assessed as having a minor negative effect on this objective which principally reflects the loss of greenfield land required to accommodate new infrastructure. **Effects of Operation** Once construction activity is complete, no ongoing impact on land use/soils is expected (initial loss of land during construction has been assessed under construction). Overall, operational effects have therefore been assessed as neutral. **Mitigation** • Appropriate construction methods should be employed to minimise the risk of contamination. **Assumptions** • It has been assumed that development sites are not contaminated. • It is expected that soils displaced during excavation associated with pipeline works would be replaced following the completion of construction activity and revegetated if appropriate. • It has been assumed that any decommissioned sites would be fully remediated, as required. **Uncertainty** • The exact location and footprint of new infrastructure required under this option is unknown at this stage.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels?	**0**	**++**	**Effects of Construction** During construction, there is the potential for contaminants such as silt, concrete or fuel oil to pollute watercourses, particularly given that several development (and decommissioning) sites and pipeline works would be in close proximity to/cross rivers including the Eden, Ehen and Derwent. Contaminants may also affect Kielder as works would be required within/adjacent to the reservoir. However, it is assumed that construction activities would be undertaken in accordance with relevant best practice

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	Will the option affect the ecological status of water bodies?			pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). In consequence, the option has been assessed as having a neutral effect on this objective during construction. **Effects of Operation** The abstraction of up to 80 Ml/d would impact upon water levels in Kielder reservoir compared to current operation. However, compensation releases from the reservoir would remain unchanged from current operation. The decommissioning of WTWs near Quarry Hill, Buttermere, Ennerdale and Cornhows may increase flows in the catchments in which associated abstractions are located (Dash Beck, Bassenthwaite/Derwent, Ellen, Ehen and Cocker). Taking into account the associated benefits in respect of the River Ehen SAC and River Derwent and Bassenthwaite Lake SAC in particular, on balance the option has been assessed as having a potentially significant positive effect on this objective. **Mitigation** • None identified. **Assumptions** • It is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). **Uncertainty** • None identified.
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	-	-	**Effects of Construction** The site of the new intake and PS near Haltwhistle would be within Flood Zone 3 whilst the proposed pipeline routes would cross Flood Zones 2/3 at several points. The WTW near Ennerdale is also situated within Flood Zones 2/3. As a result, construction/ decommissioning activity may be affected by flooding (depending on timing) although the option would not cause or significantly exacerbate flooding in the area. **Effects of Operation** During operation, this option is not expected to cause or exacerbate flooding in the area. However, whilst the new SR near Ennerdale and intake at Kielder are not considered to be vulnerable to flooding, the new PS near Haltwhistle may be at risk of flooding being located within Flood Zone 3. In consequence, the option has been assessed as having a minor negative effect on this objective. **Mitigation** • None identified.

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				Assumptions • It is assumed that an appropriate Flood Risk Assessment (FRA) would be undertaken prior to the implementation of this option with appropriate mitigation measures identified to ensure that flood risk is minimised. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds? Will the option reduce the need to travel or encourage sustainable modes of transport?	-	0	**Effects of Construction** The option would require 5,313 HGV movements over an 11 year construction period (including decommissioning of existing WTWs) which, together with emissions to air from plant, may have a minor negative effect on local air quality. Pipeline works could also result in disruption to roads in the area, increasing congestion and associated emissions to air, particularly where the route passes within close proximity to Carlisle, Cockermouth, Hexham and Workington (the pipeline route covers approximately 93km of A-roads). Impacts may be more substantial should works take place during peak tourist periods given existing traffic congestion issues in the area caused by the large seasonal influx of visitors. However, the development sites and pipeline route are not within designated Air Quality Management Areas (AQMAs) (although there are several designated AQMAs within the urban area of Carlisle) and therefore the option has been assessed as having a minor negative effect on air quality. **Effects of Operation** Operational emissions to air are expected to be negligible and in this respect, the option would generate only a small number of vehicle movements. In consequence, the option has been assessed as having a neutral effect on air quality. **Mitigation** • HGV movements and pipeline works should, where possible, be timed so as to avoid peak traffic periods e.g. between 7am-9am and 4pm-6pm. • Measures to mitigate air quality impacts arising from construction activities should be considered within a Construction and Environmental Management Plan. These measures may include, for example, dust suppression, use of lower emissions plant, and monitoring. • Detailed air quality and transport assessments should be undertaken as part of the Environmental Impact Assessment (EIA) process. **Assumptions** • None identified. **Uncertainty** • None identified.

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6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option contribute positively to adaptation to climate change? Will the option increase environmental resilience to the effects of climate change?	--	--	**Effects of Construction** During the construction phase, the use of plant on-site and transportation of materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. This option would generate 884,257 tonnes CO_2e during construction/decommissioning (comprising both embodied carbon in construction materials and emissions from HGV movements) which has been assessed as having a significant negative effect on this objective. **Effects of Operation** During operation, this option would involve the treatment and pumping of water which would result in a long term increase in energy use (approximately 781 KWh/Ml) and associated emissions (there would also be embodied carbon in chemicals used to treat water). Operational vehicle movements would also contribute to emissions, although the number of HGV movements associated with the operation of this option would be small. Operational emissions would be 13,477 tonnes CO_2e/a. However, this option would also result in the closure of existing WTWs (near Quarry Hill, Buttermere, Ennerdale and Cornhow) and may therefore generate some energy savings, reducing carbon emissions. In this respect, emissions savings associated with this option are estimated to be 3,066 tonnes CO_2e/a. The predicted effects of climate change (including drier summers) mean that this option would contribute positively to climate change adaptation by increasing water supply/storage. Overall, net operational greenhouse gas emissions are expected to be high and whilst the option may generate benefits in respect of climate change adaptation, on balance it has been assessed as having a significant negative effect on climate change. **Mitigation** • Measures to reduce greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. • Where appropriate, the design of new infrastructure should incorporate the use of energy efficient materials and building techniques and, if appropriate, renewable energy provision. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	-	++	**Effects of Construction** Construction activity and decommissioning works may have an adverse effect on health as a result of air quality/noise impacts, particularly larger scale works in close proximity to residential receptors (e.g. new SR near Bothel Moor and WTW near Carlisle). Further, the proposed pipeline would also pass through/be adjacent to a number of settlements including Hexham, Carlisle, Cockermouth and Workington and associated works/HGV movements may therefore affect receptors along this route. Notwithstanding the above, works would be temporary and would not be over a long duration in any one location. Further, it is likely that impacts would managed/mitigated where possible using best practice (e.g. Considerate Constructors' Scheme).

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				Kielder Reservoir is a regionally/nationally important recreation site and therefore the amenity of visitors may be affected during construction. However, any negative effects on these receptors would be temporary and are likely to be minimised through the adoption of best practice construction techniques. Works may also affect the amenity of recreational users such as walkers, particularly in respect of those sites located within the Lake District National Park. Overall, the option has been assessed as having a minor negative effect on health during construction. **Effects of Operation** Once operational, the option is not expected to have any adverse effects on health as a result of noise or air quality impacts. As noted above Kielder Reservoir is a regionally/nationally important recreation site and there are a wide range of recreational activities that take place in and around the lake including walking, cycling, sailing/water sports and fishing. The east end of the reservoir also lies within the Northumberland National Park. In this context, there may be the potential for impacts on the recreational use of Kielder reservoir due to changes in water levels as a result of abstraction. However, reductions in abstraction associated with the closure of the four WTWs may generate potential benefits to river users such as canoeists and also anglers (primarily due to changes in flow in the catchments in which the abstractions are located, which contain watercourses that are important spawning/breeding grounds for salmonids). The option has a design capacity of 80 Ml/d, helping to ensure the continuity of a safe and secure drinking water supply and serving to address the deficit within the West Cumbrian WRZ. The option may also remove the vulnerability to short duration droughts within this zone. On balance, the option has therefore been assessed as having a significant positive effect on health. **Mitigation** • No additional mitigation identified. **Assumptions** • It is assumed that construction would adopt practices which seek to reduce noise/air quality impacts (such as those practices outlined under the Considerate Constructors' Scheme). **Uncertainty** • None identified.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected?	++/-	++	**Effects of Construction** The construction of this option would represent a large capital investment. This is likely to generate a number of employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works). Whilst the degree to which this would benefit the local labour market and local businesses would depend to an extent on the recruitment practices of contractors appointed to undertake the works, skills within the local labour market and the procurement policies of both United Utilities and any sub-contractors, benefits are expected to be substantial.

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	Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?			Works may affect the amenity of recreational users particularly in respect of the new SR near Ennerdale which would be located within the Lake District National Park, a popular tourist destination. However, development of the new SR would be on the site of an existing WTW which, alongside the implementation of appropriate mitigation such as sympathetic design and use of local materials, is likely to reduce the magnitude of visual impacts such that no substantial adverse effects on the tourist economy are expected during the operational phase HGV movements and pipeline works could result in disruption to roads in the area although any effects would be temporary and felt in the short term only at any one location whilst the magnitude of effects are likely to be lessened by the adoption of mitigation measures at the project level, informed by a detailed transport assessment. Taking into account the potential for substantial economic benefits to arise during construction but the potential for short term disruption to roads, the option has been assessed as having a mixed significant positive and minor negative effect on this objective. **Effects of Operation** As noted above (under Objective 7), Kielder Reservoir is a regionally/nationally important recreation site and there are a wide range of recreational activities that take place in and around the lake including walking, cycling, sailing/water sports and fishing. The east end of the reservoir also lies within the Northumberland National Park. In this context, there may be the potential for impacts on the recreational use of Kielder reservoir due to changes in water levels as a result of abstraction. However, reductions in abstraction associated with the closure of the four WTWs may generate potential benefits to river users such as canoeists and also anglers (primarily due to changes in flow in the catchments in which the abstractions are located, which contain watercourses that are important spawning/breeding grounds for salmonids). The option has a design capacity of 80 Ml/d, serving to meet short term peak demands as well as addressing the deficit within the West Cumbria WRZ which is based on critical period average demand. This may support economic and population growth in the West Cumbria area and help sustain the seasonal influx of tourists. The additional supply may also help to ensure that an affordable supply of water is maintained in the long term, serving to protect vulnerable customers. This option would not require significant levels of additional resource (financial or human) during operation and in consequence, it is likely to be resilient to any future changes in these resources. Overall, in view of the substantial capacity of this option, effects on this objective have been assessed as significant. **Mitigation** • Where possible, United Utilities and any contractors should seek to utilise local labour.

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				• Where possible, United Utilities and any contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. **Assumptions** • None identified. **Uncertainty** • The extent to which the construction of this option would benefit the local economy/local labour market is uncertain. However, given the scale of investment, benefits are nonetheless expected to be significant. • A detailed transport assessment should be undertaken as part of the EIA process.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	**0**	**0**	**Effects of Construction and Operation** The option would not lead to a reduction in losses from the supply network. There are no measures in the option that would improve water efficiency. In consequence, the option has been assessed as having a neutral effect on this objective during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified. **Uncertainty** • None identified.
10. To promote the efficient use of resources	Will the option seek to minimise the demand for raw materials? Will the option reduce the total amount of waste produced and the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	**--**	**-**	**Effects of Construction** This option comprises several infrastructure components including an intake, PSs, new WTW, SRs and pipeline that would require a large volume of raw materials and energy to construct. Using the embodied carbon associated with the construction phase (884,257 tonnes of CO_2e) as a proxy, material use and energy requirements are considered to be substantial and the option has therefore been assessed as having a significant negative effect on this objective. This option would generate construction wastes which may include excavation waste and, potentially, demolition waste associated with the closure of four existing WTWs. Overall, this option has been assessed as having a significant negative effect on resource use during construction. **Effects of Operation** The operation of this option would require additional resources such as chemicals used in the treatment of raw water, although this increase would be partially offset by the closure of the four existing WTWs. The treatment and pumping of water would also result in a long term increase in energy use (operation energy usage is estimated to be approximately 781 KWh/Ml). However, this option would also result in the closure of

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				existing WTWs (near Quarry Hill, Buttermere, Ennerdale and Cornhow) and may therefore generate some energy savings. In this respect, energy savings associated with this option are estimated to be 283 KWh/Ml. The treatment of water would generate waste (e.g. sludge), although quantities are uncertain at this stage. Overall, the operation of this option has been assessed as having a minor negative effect on resource use. **Mitigation** • Opportunities to utilise reused/recycled materials during construction should be considered where appropriate. • Construction and operational wastes should be reused/recycled where possible. • Measures to reduce energy usage during construction should be considered including, for example, the use of low energy usage plant. • Where appropriate, the design of new infrastructure should incorporate the use of energy efficient materials and building techniques and, if appropriate, renewable energy provision. **Assumptions** • None identified. **Uncertainty** • Opportunities to reduce waste, reuse materials and use recycled materials for construction are unknown at this stage. • The exact resource requirements (e.g. volumes of specific materials) associated with the construction/operation of this option are unknown at this stage. • The volume of waste generated under operation of this option is uncertain at this stage.
11. To protect and enhance cultural and historic assets	Will the option conserve or enhance historic buildings, places, conservation areas and spaces that enhance local distinctiveness, character and the appearance of the public realm? Will the option avoid or minimise damage to archaeologically important sites? Will the option affect public access to, or enjoyment of, features of cultural heritage?	-	0	**Effects of Construction** There are several heritage and archaeological sites around the shoreline of Kielder Water (Haw Hill Camp, a Romano-British settlement located on the south shoreline), although these would be unaffected by construction activity. The WTW site near Carlisle, meanwhile, is a few hundred metres from Corby Castle Registered Park and Garden, although no effects on the setting of this asset are expected due to distance from the site and the presence of physical barriers (e.g. woodland). Works associated with the construction of a new SR near Bothel Moor may affect the settings of listed buildings in Bothel whilst the new PS near Pattenfoot may affect the settings of a Grade III listed building adjacent to the site and the Roman road, Waverbridge to Pattenfoot Scheduled Monument to the north, although impacts are unlikely to be substantial due to the presence of the A595. There are a number of heritage features on the transfer pipeline routes and in particular Hadrian's Wall at Walwick. Hadrian's Wall forms part of the 'Frontiers of the Roman

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				Empire (Hadrian's Wall)' World Heritage Site, although it is assumed that adverse impacts on these features would be avoided as the pipeline would be routed along the road. Notwithstanding, the settings of some assets may be temporarily affected during the works. There is also the potential for unknown archaeology to be encountered on the route due to the number of ancient monuments present in the area and the length of the pipeline route. Overall, the option has been assessed as having a minor negative effect on this objective. **Effects of Operation** As noted above, development of the new SR near Bothel Moor and PS near Pattenfoot may affect the settings of a listed building. However, as the SR would be buried with planting and re-seeding minimising any visual impacts in the medium to long term (i.e. within a year, depending on the season in which works are undertaken), and with appropriate screening of the PS, effects are expected to be negligible. It is also expected that new pipeline would be buried with planting and re-seeding likely to return land to a pre-development state within a year (depending on the season in which works are undertaken) such that there would be no long term adverse effects on the settings of designated cultural heritage assets along the route. In consequence, the option has been assessed as having a neutral effect on this objective during operation. **Mitigation** • Pipelines should be routed so as to avoid direct impacts on cultural heritage assets. • Where appropriate, above ground infrastructure should be screened so as to avoid adverse impacts of the settings of heritage assets. **Assumptions** • None identified. **Uncertainty** • The presence of undiscovered items of archaeological interest is currently uncertain.
12. To protect and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	--	-/?	**Effects of Construction** The Cornhow and Ennerdale sites are within the Lake District National Park. Whilst works at these locations would be within or adjacent to existing operational sites, there is the potential for substantial landscape impacts. Other development sites are not affected by any national landscape designations. However, the sites are generally within more rural locations and new infrastructure would be constructed on greenfield land such that there is potential for adverse landscape impacts. The construction of a new bank side intake structure and PS at Kielder in particular may have adverse effects on this aspect of the objective given the existing landscape character, although it is noted that existing vegetation around the bankside may offer opportunities for screening works. Construction activity associated with the new WTW near Carlisle would be relatively substantial (the new WTW would have an operational footprint of approximately 10,500 m^2) although this would be adjacent to an existing site such that significant landscape impacts are not anticipated. Construction of a

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				new SR near Bothel Moor in particular would be relatively large scale and would take place on greenfield land in a relatively open setting and may therefore affect local landscape character. Works at the other development sites may also have temporary landscape impacts although construction activity would be of a smaller scale, would be adjacent to existing facilities and may benefit from existing screening (e.g. trees/hedgerows). Alongside the implementation of appropriate mitigation, this would be likely to reduce the magnitude of landscape impacts associated with development of these sites. Pipeline works may also affect landscape character, albeit temporarily. Approximately 13km of pipeline would cross the Northumberland National Park whilst pipeline between Cockermouth and Ennerdale and Cockermouth and Cornhow would cross the Lake District National Park and therefore there is potential for substantial landscape effects associated with pipeline works. However, the pipeline routes would predominantly follow existing linear features (roads) and adverse effects would be over a short timescale in any one location with planting and re-seeding likely to return land to a pre-development state within a year (depending on the season in which works are undertaken). Works associated with other sections of the pipeline may also affect local landscape character as well as townscapes (where the route is through/adjacent to Carlisle, Cockermouth and Hexham and Workington for example). Whilst development would be within the Lake District National Park, it is not expected that construction activity would affect public access to the area. Construction activity may affect the visual amenity of residential receptors in close proximity to the development sites. However, the majority of sites are in rural and remote locations with few residential receptors likely to experience adverse effects. Notwithstanding, development of a new WTW near Carlisle may affect the visual amenity of a limited number of residential receptors to the north of the site. The proposed SR near Bothel Moor may also be in close proximity to residential receptors (depending on final location), the visual amenity of which may be affected during construction particularly given the relatively large scale of works likely to be required at this location. Further, the visual amenity of receptors along the route of the proposed pipeline as well as along transport corridors may be affected. Construction activity associated with the new intake and PS at Kielder may affect the visual amenity of recreational receptors such as walkers and lake users, particularly given that the reservoir is a regionally/nationally important recreation site. However, any adverse effects would be temporary and are not expected to be significant. In view of the location of several development sites and sections of pipeline with the Lake District National Park, there is potential for construction activity to affect the visual amenity of recreational receptors such as walkers. Taking into account the scale of the scheme and location of components within the Lake District National Park and Northumberland National Park, this option has been assessed as having a significant negative effect on landscape.

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				Effects of Operation The new bankside intake structure and pumping station at Kielder may have adverse effects on landscape character and the visual amenity of recreational users. The east end of reservoir lies within the Northumberland National Park and whilst new above ground infrastructure would not be expected to affect its character, additional drawdown of the reservoir may be perceptible. The new WTW near Carlisle would have a footprint of approximately 10,500 m^2 (excluding roads and PS) and therefore has the potential to have a significant negative effect on local landscape character and the visual amenity of residential receptors to the north. However, few properties would be located in the vicinity of the water treatment works (approximately 20 buildings within a 0.5km radius) and adverse effects may be lessened by the adoption of appropriate mitigation such as screening, sympathetic design and use of local materials. Overall, assuming that the measures outlined above are implemented to reduce landscape and visual impacts, it is not expected that effects on landscape would be significant in this instance. Some new above ground infrastructure would be located within the Lake District National Park (namely, the PS near Cornhow) and in consequence there is potential for significant landscape impacts. New assets may also affect the visual amenity of residential receptors in close proximity to the development sites. However, the scale of above ground infrastructure in the National Park would be small and, as noted above, a number of new assets would be located within/adjacent to existing sites. Alongside the implementation of appropriate mitigation such as sympathetic design and use of local materials, this is likely to reduce the magnitude of landscape impacts. Further, appropriate screening and landscaping would be likely to lessen the immediate landscape/visual impact over time (as vegetation matures). As noted above, the proposed new SRs and associated infrastructure such as access roads would constitute relatively large scale development. However, it is anticipated that, where feasible, SRs would be buried which, alongside appropriate screening and landscaping, would be likely to lessen the immediate landscape/visual impact over time (as vegetation matures). At sites where existing WTWs are decommissioned there may be landscape benefits associated with the removal of infrastructure. Effects may be particularly positive in respect of the decommissioning of those sites located in the Lake District National Park, especially if sites are restored to a greenfield state. However, the end use of decommissioned sites has yet to be determined and in consequence effects in this regard are uncertain at this stage. Overall, the option has been assessed as having a minor negative effect on landscape during operation. Notwithstanding, it should be noted that the exact locations of development sites have not yet been determined. This would be established at the project stage when the location of all components of the scheme including pipelines would be determined through a site selection exercise as part of the EIA process. In this context, any proposal would be subject to full landscape and visual impact assessment whilst landscape and visual impact would be a key consideration in the determination (by the relevant local planning authority) of any Town and Country planning application(s) related

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				to the scheme. Should residual landscape and visual impacts prove to be unacceptable, then alternative locations for above ground infrastructure would need to be considered. **Mitigation** • Construction activity should be screened where possible so as to avoid/minimise adverse landscape/visual impacts. • New above ground infrastructure should adopt high quality design principles (e.g. use of local materials). • Landscaping/screening measures should be utilised to minimise adverse landscape/visual amenity impacts. • Where possible new SRs should be buried and blended into the local landscape. **Assumptions** • It is assumed that the land above the pipeline would be restored to its former quality after construction works have finished. **Uncertainty** • The exact design and scale of new infrastructure required under this option is unknown at this stage.
Summary	**Effects of Construction** This option represents a large scale scheme comprising several infrastructure components including a new intake, SRs, WTW, PSs and pipeline together with the decommissioning of four existing WTWs. Construction (including decommissioning) activity is therefore expected to have a significant negative effect on climate change as a result of associated greenhouse gas emissions from HGV movements, construction plant and embodied carbon in raw materials (the option would generate 884,257 tonnes CO_2e during construction). Using the embodied carbon associated with the construction phase as a proxy, material use and energy requirements are considered to be substantial and, taking into account waste generation, the option has therefore been assessed as having a significant negative effect on resource use. The construction of this option would represent a large capital investment which is likely to generate a number of employment opportunities and supply chain benefits as well as increased spend in the local economy by contractors and construction workers. However, HGV movements and pipeline works could result in disruption to roads in the area. Overall, the option has therefore been as having a mixed significant positive and minor negative effect on economic and social wellbeing. The Cornhow and Ennerdale sites are within the Lake District National Park whilst pipeline would cross the Lake District and Northumberland National Parks. Development may also affect the visual amenity of residential receptors in close proximity to the development sites (and in particular those receptors in close proximity to Bothel Moor and the WTW near Carlisle) and along the pipeline route as well as recreational users. Overall, the option has been assessed as having a significant negative effect on landscape. The assessment has not identified any further significant negative or significant positive effects. There is the potential for construction activity (particularly pipeline works) to affect designated sites including the River Eden SAC, River Derwent and Bassenthwaite Lake SAC and River Ehen SAC. However, the HRA states that it is likely that these effects could be managed/avoided with scheme specific mitigation and adoption of best practice techniques, for example, by timing construction works near rivers to avoid the key migration periods; and by developing site specific silt control plans to manage construction run-off. It should also be noted that scheme level investigations and appropriate assessment would be undertaken at the project stage should the option form part of the final Water Resources Management Plan. Notwithstanding, this option would result in the loss of greenfield land at several development sites and in consequence there is potential for localised loss of habitat and, in conjunction with decommissioning works, disturbance which has been assessed as having a minor negative effect on biodiversity. The option may also generate minor negative effects in respect of land use/soils (due to additional land take required under this option), flood risk (several sites are within Flood Zones 2/3 whilst the proposed pipeline routes would cross Flood Zones 2/3 at various points) and cultural heritage (due to potential effects on the settings of listed buildings and scheduled monuments). Emissions to air from HGV movements and construction plant may also have a minor negative effect on air quality and, together with noise/vibration, human health. Neutral effects have been identified in respect of two objectives during construction relating to water quality/resources (Objectives 3 and 9).			

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
	Effects of Operation Similar to the construction phase, the option is likely to have significant negative effects on climate change. This principally reflects the net additional greenhouse gas emissions associated with the treatment and pumping of water. Abstraction from Ennerdale Water, which discharges into the Ehen, has been identified for amendments under the Review of Consents programme due to the impact of abstraction on interest features in the SAC (primarily fresh water pearl mussels). The decommissioning of the WTW near Ennerdale and associated abstraction from Ennerdale Water under this option may therefore generate benefits in respect of these features due to increased flows. Additionally, the decommissioning of the WTW near Quarry Hill would result in a reduction in abstraction from Dash Beck and Hause Gill, sources that have been investigated under the Review of Consents programme due to impacts on salmon which are interest features of the River Derwent and Tributaries SSSI and River Derwent and Bassenthwaite Lake SAC whilst the decommissioning of the WTW near Cornhow and cessation of abstraction from Crummock Water may also lead to benefits in respect of the SSSI and SAC (although this source has not been identified for reduction under the Review of Consents programme). Taking into account the potential operational benefits in respect of the River Ehen SAC and River Derwent and Bassenthwaite Lake SAC in particular, this option has been assessed as having a significant positive effect on biodiversity. The decommissioning of the WTWs near Quarry Hill, Ennerdale and Cornhow has also been assessed as having a significant positive effect on water quantity and quality due to increases in flows in the catchments in which associated abstractions are located (Dash Beck, Bassenthwaite/Derwent, Ellen, Ehen and Cocker). The option has a design capacity of 80 Ml/d, serving to address the deficit within the West Cumbrian WRZ. This has been assessed as having a significant positive effect on health (in helping to ensure the continuity of a safe and secure drinking water supply) and economic and social wellbeing (given the potential for additional supply to support economic/population growth). No further significant negative or significant positive effects have been identified. The new WTW near Carlisle would have a footprint of approximately 10,500 m^2 (excluding roads and PS) and therefore has the potential to have a significant negative effect on local landscape character and the visual amenity of residential receptors to the north. However, few properties are adjacent to the site (approximately 20 buildings within a 0.5km radius) and adverse effects may be lessened by the adoption of appropriate mitigation such as screening, sympathetic design and use of local materials, although the WTW would be situated on a hill and could be visible from the village nearby. Overall, assuming that the measures outlined above are implemented to reduce landscape and visual impacts, it is not expected that effects on landscape would be significant in this instance. Notwithstanding, any proposal would be subject to full landscape and visual impact assessment as part of the EIA process at the project stage. Should these assessments conclude that residual landscape impacts would be significant, then alternative locations for the WTW would need to be considered. The operation of this option is expected to have minor negative effects on flood risk, due to the location of the new PS near Haltwhistle in Flood Zone 3, and resource use, principally due to resource requirements associated with the treatment of water. Neutral effects have been identified in respect of the following objectives: soils/land use (Objective 2); water resources (Objective 9); air quality (Objective 5); and cultural heritage (Objective 11). **Mitigation** Adverse environmental effects associated with the construction/operation of this option could be reduced, and positive effects enhanced, through the adoption of the following mitigation measures: • Scheme specific mitigation plans will be required to ensure that any construction related adverse effects on designated sites are avoided and localised effects on biodiversity minimised. • The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural England. • Bio-security measures should be implemented during construction and operational phases. • Appropriate construction methods should be employed to minimise the risk of contamination. • HGV movements and pipeline works should, where possible, be timed so as to avoid peak traffic periods e.g. between 7am-9am and 4pm-6pm. • Measures to mitigate air quality impacts arising from construction activities should be considered within a Construction and Environmental Management Plan. These measures may include, for example, dust suppression, use of lower emissions plant, and monitoring. • Detailed air quality and transport assessments should be undertaken as part of the Environmental Impact Assessment (EIA) process.			

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
	• Measures to reduce energy demand/greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. • Where appropriate, the design of new infrastructure should incorporate the use of energy efficient materials and building techniques and, if appropriate, renewable energy provision. • Where possible, United Utilities and any contractors should seek to utilise local labour. • Where possible, United Utilities and any contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. • Opportunities to utilise reused/recycled materials during construction should be considered where appropriate. • Construction and operational wastes should be reused/recycled where possible. • Pipelines should be routed so as to avoid direct impacts on cultural heritage assets. • Where appropriate, above ground infrastructure should be screened so as to avoid adverse impacts of the settings of heritage assets. • New above ground infrastructure should adopt high quality design principles (e.g. use of local materials). • Landscaping/screening measures should be utilised to minimise adverse landscape/visual amenity impacts. • Where possible new SRs should be buried and blended into the local landscape.			

Lowest Cost Option: Wastwater (negotiate part abstraction licence) (WC04); Development of New Boreholes in West Cumbria Aquifer (WC05a); Development of Boreholes in North Cumbria Aquifer (WC09) (Design Capacity – 24.5 Ml/d)

Option Summary

This option would involve the collective implementation of four individual smaller scale options (assessed during the feasible options stage) that together would deliver 24.5 Ml/d to the West Cumbria WRZ. A summary of each constituent option is provided below:

- Wastwater (negotiate part abstraction licence): This component involves an agreement with third party licence holders for water transfer from a Service Reservoir at Workington to the WTW near Ennerdale. It would require the construction of a new 10 Ml/d pumping station (PS) at the SR site, 13.5km pipeline and a new mixing tank at the Ennerdale site.

- Development of new boreholes in West Cumbria aquifer (10 Ml/d): This component would involve the construction of seven new boreholes at 3 new sites in addition to utilising an existing borehole site. The scheme would require drilling of a borehole at each site, a new fixed speed borehole pump and a new headworks GRP kiosk. The existing site would also require a new break tank, aeration tower and raw water PS. A total of 8km of pipeline would be required to interconnect the sites and a 13km pipeline would transfer all raw water to the WTW near Ennerdale A new 1km washout main would also be needed from the existing site to the nearest Egremont sewer. The assessment of this option is based on discussions with the Environment Agency that have indicated that this amount of water is available for licensing from the West Cumbria Aquifer. However, it should be highlighted that confirmation that a scheme capacity of 10 Ml/d is viable can only be confirmed once a detailed investigation has been completed.

- Development of Boreholes in North Cumbria aquifer: This component comprises the construction of two new boreholes near Waverton and Thursby for abstraction and transfer to the WTW near Quarry Hill. The scheme would also require a new 8km raw water transfer pipe from Waverton to the WTW and a 15km transfer pipe from Thursby to the WTW.

In addition to the above, treated water would be transferred to a SR at Whitehaven (linked to Option WC09) from the WTW near Quarry Hill via a SR at Workington.

It should be noted that the exact location of the WTW and other infrastructure including pipeline routes would be the subject of a site selection exercise at the project level. Effects would be considered further through the EIA process.

Option Assessment

The assessment of the Lowest Cost Option is presented in **Table C.3** below.

Table C.3 Lowest Cost Option

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
1. To protect and enhance biodiversity, key habitats and species, working within environmental capacities and limits	Will the option protect and enhance where possible the most important sites for nature conservation (e.g. internationally or nationally designated conservation sites such as SACs, SPAs, Ramsar and SSSIs)? Will the option protect and enhance non-designated sites and local biodiversity? Will the option provide opportunities for new habitat creation or restoration and link existing habitats as part of the development process? Will the option lead to a change in the ecological quality of habitats due to changes in groundwater/river water quality and/or quantity?	-	?	**Effects of Construction** No other development sites are affected by nature conservation designations. The HRA indicates that pipeline works may affect several European designated sites including the River Ehen SAC and River Derwent and Bassenthwaite Lake SAC/SSSI. The River Ehen SAC would be crossed by the new transfer pipelines associated with the Workington transfer to Ennerdale and construction of seven new boreholes at 3 new sites. The pipeline from Quarry Hill to Whitehaven would run adjacent to the River Derwent and Bassenthwaite Lake SAC/SSSI for part of its route and would cross the SAC/SSSI at Cockermouth. However, the HRA states that it is likely that these effects could be managed/avoided with scheme specific mitigation (e.g. re-routing to avoid designated sites). In this respect, it is considered reasonable to assume that pipelines will be routed within or alongside existing carriageways and river crossings (or via suitable alternative routes identified in discussion with Natural England and the Environment Agency). In addition, it is likely that any potential effects can be avoided or mitigated with suitable measures – for example, by timing construction works near rivers to avoid the key migration periods; and by developing specific silt control plans to manage construction run-off. It should also be noted that scheme level investigations and appropriate assessment would be undertaken at the project stage should the option form part of the final Water Resources Management Plan. Whilst the development sites are not affected by any nature conservation designations, works associated with the new boreholes would take place on greenfield land whilst some pipeline works would cross fields and in consequence, there would be potential for disturbance/habitat loss (e.g. from the drilling of new boreholes). Overall, the construction of this option has been assessed as having a minor negative effect on biodiversity. **Effects of Operation** Under the Option WC04 component of this scheme, water would be taken from Wastwater, which is designated as a SSSI and SAC. A 3km stretch of the River Irt downstream of Wastwater has the potential for reduced flows. Whilst the option would be under an existing license, additional abstraction would result in reservoir levels being lower than the current average which may impact on Wastwater SAC/SSSI, although this is currently uncertain. Whilst the new West Cumbria aquifer boreholes are outside the surface water catchment of the River Ehen and therefore any localised drawdown would not affect tributaries of the river, it is possible that abstraction may affect groundwater supplies to the Ehen. The HRA states that it is not clear what contribution to flow these are likely to make and that whilst any effects are likely to be felt outside of the SAC, reduced flow may affect mobile species (Atlantic salmon) migrating through the lower reaches.

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
				New borehole abstractions near Waverton and Thursby have the potential to impact on the nearby River Waverly and River Wampool, which discharges into the Solway Firth. The site near Waverton is located approximately 12 km up stream of Solway Firth, whilst Thursby is around 17 km upstream of the same site (SAC, SPA and Ramsar site). It has been assumed that a 1.5km reach downstream of the abstraction could be impacted however, and therefore the HRA concludes that significant effects would not be expected. All other European designated sites are almost certainly too distant for the abstraction to have a significant direct effect, including the River Eden SAC and the South Solway Mosses SAC which are both over 5km from the nearest borehole. However, abstraction may affect water dependent SSSIs downstream of the borehole sites although no readily available flow data could be found for the River Waverley or Wampool to contextualise the abstraction volumes and current flow. Whilst the majority of the scheme components are unlikely to have any significant adverse effects on European designated in view of the findings of the HRA, this option has been assessed as having an uncertain effect on biodiversity at this stage. Should this option be taken forward, further investigation in respect of potential effects on European designated sites is likely to be required. **Mitigation** • Scheme specific mitigation plans will be required to ensure that any construction related adverse effects on designated sites are avoided and localised effects on biodiversity minimised. • The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural England. • Bio-security measures should be implemented during construction and operational phases. • Potential operational effects associated with the operation of the new West Cumbria aquifer boreholes should be investigated further if this option is taken forward. **Assumptions** • It has been assumed that the new pipeline would be predominantly routed within or alongside existing roads. Where this is not possible, alternative solutions will be discussed with Natural England and the Environment Agency to mitigate any impact of those alternatives. **Uncertainty** • None identified.
2. To ensure the appropriate and efficient use of land and protect soil quality	Will additional land be required for the development or implementation of the option or will the option require below ground works leading to land sterilisation? Will the option utilise previously developed land? Will the option protect and enhance protected sites designated for their geological interest and wider geodiversity?	**-**	**0**	**Effects of Construction** The new PS and mixing tank required to support the Workington transfer to Ennerdale would be located on existing sites. However, new boreholes and associated infrastructure would be situated on greenfield land. Additionally, temporary loss of land would occur during the pipeline works, although it is assumed that any soil displaced during excavations would be returned following completion of construction supported by a revegetation scheme such that adverse effects would be temporary.

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
	Will the option minimise the loss of best and most versatile soil? Will the option minimise conflict with existing land use patterns? Will the option minimise land contamination?			Development at several sites would result in the loss of Grade 3 agricultural land (as defined under Defra's Agricultural Land Classification system). The remaining sites would be within areas of Grade 5/non-agricultural land. Sections of pipeline would also cross Grade 3 agricultural land. However, no loss of agricultural land classified as grade 1 (excellent) or grade 2 (very good) is anticipated. Whilst this option would involve the development of greenfield sites, the scale of works at each location would be relatively small and in consequence are considered unlikely to result in substantial conflicts with existing land use patterns. It is not expected that geologically protected sites would be adversely affected by the construction of this scheme. Overall, the construction of this option has been assessed as having a minor negative effect on this objective which principally reflects the loss of greenfield land required to accommodate new infrastructure. **Effects of Operation** Once construction activity is complete, no ongoing impact on land use/soils is expected (initial loss of land during construction has been assessed under construction). Overall, operational effects have therefore been assessed as neutral. **Mitigation** • Appropriate construction methods should be employed to minimise the risk of contamination. **Assumptions** • It has been assumed that development sites are not contaminated. • It is expected that soils displaced during excavation associated with pipeline works would be replaced following the completion of construction activity and revegetated if appropriate. **Uncertainty** • The exact location and footprint of new infrastructure required under this option is unknown at this stage.
3. To protect and enhance the quantity and quality of surface and groundwater resources and the ecological status of water bodies	Will the option minimise the demand for water resources? Will the option protect and improve surface, groundwater, estuarine and coastal water quality? Will the option result in changes to river flows? Will the option result in changes to groundwater levels? Will the option affect the ecological status of water bodies?	**0**	**-**	**Effects of Construction** During construction, there is the potential for contaminants such as silt, concrete or fuel oil to pollute watercourses, particularly given that pipeline works would be in close proximity to/cross rivers including the Ehen and Derwent. However, it is assumed that construction activities would be undertaken in accordance with relevant best practice pollution prevention guidance and that appropriate mitigation would be implemented (such as dust suppression, soil containment and emergency response procedures). In consequence, the option has been assessed as having a neutral effect on this objective during construction. **Effects of Operation** This option would result in reduced flows in the River Irt and reduce levels in Wastwater. A minor reduction in groundwater levels (and potentially river flows) would also be

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
				expected due t o t he bor ehole a bstractions under oper ation. O verall, t he op tion has therefore been assessed as having a minor negative effect on this objective. **Mitigation** • None identified. **Assumptions** • It i s a ssumed t hat construction a ctivities w ould be under taken i n accordance w ith relevant bes t pr actice pol lution pr evention gui dance and t hat appropriate m itigation would be i mplemented (such as dust suppression, s oil c ontainment and e mergency response procedures). **Uncertainty** • None identified.
4. To reduce the risk of flooding	Will the option have the potential to cause or exacerbate flooding in the catchment area now or in the future? Will the option have the potential to help alleviate flooding in the catchment area now or in the future? Will the option be at risk of flooding now or in the future?	-	-	**Effects of Construction** The pr oposed ne w m ixing t ank at E nnerdale w ould be l ocated w ithin F lood Z one 2 (the remaining dev elopment sites ar e not w ithin F lood Z ones 2/ 3). S ections of the pr oposed pipelines w ould al so c ross F lood Z ones 2/ 3. A s a r esult, c onstruction ac tivity may b e affected by flooding (subject to timing) although the option would not be expected to cause or significantly exacerbate flooding in the area. **Effects of Operation** During oper ation, t his opt ion is n ot expected t o c ause or exacerbate flooding i n t he ar ea although the new mixing tank at Ennerdale may be at risk of flooding being located within Flood Zone 2. In consequence, the option has been assessed as having a minor negative effect on this objective. **Mitigation** • None identified. **Assumptions** • It is assumed that an appropriate Flood Risk Assessment (FRA) would be undertaken prior t o t he i mplementation o f t his opt ion w ith appr opriate mitigation measures identified to ensure that flood risk is minimised. **Uncertainty** • None identified.
5. To minimise emissions of pollutant gases and particulates and enhance air quality	Will the option adversely affect local air quality as a result of emissions of pollutant gases and particulates? Will the option exacerbate existing air quality issues (e.g. in Air Quality Management Areas)? Will the option maintain or enhance ambient air quality, keeping pollution below Local Air Quality Management thresholds?	-	0	**Effects of Construction** The option would require 5,000 HGV movements over the construction period which, together w ith em issions t o ai r from pl ant, may hav e a minor negat ive effect on local ai r quality. P ipeline w orks c ould al so r esult i n di sruption t o r oads i n t he area, i ncreasing congestion and associated emissions to air, particularly as pipelines would be routed through/adjacent to l arger s ettlements s uch a s E gremont, Workington, Whitehaven and Cockermouth. Impacts m ay be m ore s ubstantial s hould works take place during peak

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
	Will the option reduce the need to travel or encourage sustainable modes of transport?			tourist periods given existing traffic congestion issues in the area caused by the large seasonal influx of visitors. However, the development sites and pipeline routes are not within designated Air Quality Management Areas (AQMAs) and therefore the option has been assessed as having a minor negative effect on air quality. **Effects of Operation** Operational emissions to air are expected to be negligible and in this respect, the option would generate only a small number of vehicle movements per year. In consequence, the option has been assessed as having a neutral effect on air quality. **Mitigation** • HGV movements and pipeline works should, where possible, be timed so as to avoid peak traffic periods e.g. between 7am-9am and 4pm-6pm. • Measures to mitigate air quality impacts arising from construction activities should be considered within a Construction and Environmental Management Plan. These measures may include, for example, dust suppression, use of lower emissions plant, and monitoring. • Detailed air quality and transport assessments should be undertaken as part of the Environmental Impact Assessment (EIA) process. **Assumptions** • None identified. **Uncertainty** • None identified.
6. To limit the causes and potential consequences of climate change	Will the option reduce or minimise greenhouse gas emissions? Will the option have new infrastructure that is energy efficient or make use of renewable energy sources? Will the option contribute positively to adaptation to climate change? Will the option increase environmental resilience to the effects of climate change?	--	--	**Effects of Construction** During the construction phase, the use of plant on-site and transportation of materials by road would result in increased emissions of greenhouse gases whilst the materials used for construction would contain embodied carbon. This option would generate 101,428 tonnes CO_2e during construction (comprising both embodied carbon in construction materials and emissions from HGV movements) which has been assessed as having a significant negative effect on this objective. **Effects of Operation** During operation, this option would involve the treatment and pumping of water which would result in a long term increase in energy use and associated emissions (there would also be embodied carbon in chemicals used to treat water). Operational vehicle movements would also contribute to emissions, although the number of HGV movements associated with the operation of this option would be small. Operational emissions would be 5,492 tonnes CO_2e/a. The predicted effects of climate change (including drier summers) mean that this option would contribute positively to climate change adaptation by increasing water supply/storage.

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
				Overall, net operational greenhouse gas emissions are expected to be high and whilst the option may generate benefits in respect of climate change adaptation, on balance it has been assessed as having a significant negative effect on climate change. **Mitigation** • Measures to reduce greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. • Where appropriate, the design of new infrastructure should incorporate the use of energy efficient materials and building techniques and, if appropriate, renewable energy provision. **Assumptions** • None identified. **Uncertainty** • None identified.
7. To ensure the protection and enhancement of human health	Will the option ensure the continuity of a safe and secure drinking water supply? Will the option affect opportunities for recreation and physical activity? Will the option maintain surface water and bathing water quality within statutory standards? Will the option adversely affect human health by resulting in increased nuisance and disruption (e.g. as a result of increased noise levels)?	-	++	**Effects of Construction** Construction activity may have an adverse effect on health as a result of air quality/noise impacts. In particular, the site near Thursby is adjacent to the settlement boundary of Thursby with residential receptors to the east whilst several farms may be affected by development near Waverton. Works near Rottington may also affect residential receptors to the west of the proposed borehole site (although receptors are limited in number). Works at Workington and Ennerdale are not expected to have any discernible effect on health given the remoteness of these sites. The proposed pipelines would pass through/be adjacent to a number of settlements including Egremont, Cockermouth, Workington and Whitehaven and associated works/HGV movements may therefore affect receptors along this route. Notwithstanding the above, works would be temporary and associated effects are expected to be felt in the short term only (i.e. over the construction period). Further, it is likely that impacts would managed/mitigated where possible using best practice (e.g. Considerate Constructors' Scheme). No substantial effects on recreation are anticipated although it is noted that some sections of pipeline would cross a number of public footpaths whilst development near Sandwith may affect the adjacent public footpath. However, any impacts are likely to be of short duration at any one location and suitable diversions are assumed to be put in place. Overall, the option has been assessed as having a minor negative effect on health during construction. **Effects of Operation** Once operational, the option is not expected to have any adverse effects on health (e.g. as a result of noise or air quality impacts). The Workington transfer to Ennerdale may impact upon informal recreation and angling due to reduced flows in the River Irt to its confluence with the River Bleng downstream of Wastwater, although this is only expected to be noticeable at times of low flow (i.e. drought years, which occur approximately 1 in 20 years).

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
				The option has a design capacity of 24.5 Ml/d, helping to ensure the continuity of a safe and secure drinking water supply and serving to address the deficit within the West Cumbria WRZ. On balance, the option has therefore been assessed as having a significant positive effect on health. **Mitigation** • No additional mitigation identified. **Assumptions** • It is assumed that construction would adopt practices which seek to reduce noise/air quality impacts (such as those practices outlined under the Considerate Constructors' Scheme). • It is assumed that suitable diversions would be put in place where works are likely to affect public footpaths. **Uncertainty** • None identified.
8. To maintain and enhance the economic and social well-being of the local community	Will the option ensure sufficient infrastructure is in place for predicted population increases? Will the option ensure sufficient infrastructure is in place to sustain a seasonal influx of tourists? Will the option help to meet the employment needs of local people? Will the option ensure that an affordable supply of water is maintained and vulnerable customers protected? Will the option improve access to local services and facilities (e.g. sport and recreation)? Will the option contribute to sustaining and growing the local and regional economy? Will the option avoid disruption through effects on the transport network? Will the option be resilient to future changes in resources (both financial and human)?	++/-	++	**Effects of Construction** The construction of this option would represent a large capital investment. This is likely to generate a number of employment opportunities and supply chain benefits (e.g. associated with the supply of raw materials and appointment of contractors to undertake the works). Whilst the degree to which this would benefit the local labour market and local businesses would depend to an extent on the recruitment practices of contractors appointed to undertake the works, skills within the local labour market and the procurement policies of both United Utilities and any sub-contractors, benefits are expected to be substantial. Works may affect the amenity of recreational users particularly in respect of those sites located within the Lake District National Park. However, construction activity is not expected to have a substantial adverse impact on the local tourist economy given that works would be temporary and impacts are likely to be managed/mitigated where possible using best practice (e.g. Considerate Constructors' Scheme). HGV movements and pipeline works of the proposed scale could result in disruption to roads in the area. In particular, the pipeline between Quarry Hill and Whitehaven would follow the A66, A596 and A595 as well as B and C roads for circa 40km length and associated works would be likely to cause traffic disruption and congestion along these routes. However, any effects would be temporary and felt in the short term only whilst the magnitude of effects are likely to be lessened by the adoption of mitigation measures at the project level, informed by a detailed transport assessment. Taking into account the potential for substantial economic benefits to arise during construction but the likelihood of traffic disruption, the option has been as having a mixed significant positive and minor negative effect on this objective.

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
				Effects of Operation As noted above, the Workington transfer to Ennerdale may impact upon informal recreation and angling due to reduced flows in the River Irt to its confluence with the River Bleng downstream of Wastwater, although this is only expected to be noticeable at times of low flow (i.e. drought years, which occur approximately 1 in 20 years). The option has a design capacity of 24.5 Ml/d, serving to address deficit within the West Cumbria WRZ. This may support economic and population growth in the West Cumbria area and help sustain the seasonal influx of tourists. The additional supply may also help to ensure that an affordable supply of water is maintained in the long term, serving to protect vulnerable customers. This option would not require significant levels of additional resource (financial or human) during operation and in consequence, it is likely to be resilient to any future changes in these resources. Overall, in view of the substantial capacity of this option, effects on this objective have been assessed as significant. **Mitigation** • Where possible, United Utilities and any contractors should seek to utilise local labour. • Where possible, United Utilities and any contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. **Assumptions** • None identified. **Uncertainty** • The extent to which the construction of this option would benefit the local economy/local labour market is uncertain. However, given the scale of investment, benefits are nonetheless expected to be significant. • A detailed transport assessment should be undertaken as part of the EIA process.
9. To ensure the sustainable and efficient use of water resources	Will the option lead to reduced leakage from the supply network? Will the option improve efficiency in water consumption?	**0**	**0**	**Effects of Construction and Operation** The option would not lead to a reduction in losses from the supply network. There are no measures in the option that would improve water efficiency. In consequence, the option has been assessed as having a neutral effect on this objective during both construction and operation. **Mitigation** • None identified. **Assumptions** • None identified.

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • None identified.
10. To promote the efficient use of resources	Will the option seek to minimise the demand for raw materials? Will the option reduce the total amount of waste produced and the proportion of waste sent to landfill? Will the option encourage the use of sustainable design and materials? Will the option reduce or minimise energy use?	--	--	**Effects of Construction** This option comprises several infrastructure components including new boreholes and associated facilities, mixing tank, 2 PSs together with over 100 km of new pipeline that would require a large volume of raw materials and energy to construct. Using the embodied carbon associated with the construction phase (101,428 tonnes of CO_2e) as a proxy, material use and energy requirements are considered to be substantial and the option has therefore been assessed as having a significant negative effect on this objective. This option would generate construction wastes (e.g. excavation waste and replaced infrastructure) although it is expected that a large proportion of this waste would be reused/recycled. Overall, this option has been assessed as having a significant negative effect on resource use during construction. **Effects of Operation** The operation of this option would require additional resources such as chemicals used in the treatment of raw water. The treatment and pumping of water would also result in a long term increase in energy use (operational energy usage is estimated to be approximately 3,604 KWh/Ml). The treatment of water would generate waste (e.g. sludge), although quantities are uncertain at this stage. Overall, the operation of this option has been assessed as having a significant negative effect on resource use. **Mitigation** • Opportunities to utilise reused/recycled materials during construction should be considered where appropriate. • Construction and operational wastes should be reused/recycled where possible. • Measures to reduce energy usage during construction should be considered including, for example, the use of low energy usage plant. • Where appropriate, the design of new infrastructure should incorporate the use of energy efficient materials and building techniques and, if appropriate, renewable energy provision. **Assumptions** • None identified.

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • Opportunities to reduce waste, reuse materials and use recycled materials for construction are unknown at this stage. • The exact resource requirements (e.g. volumes of specific materials) associated with the construction/operation of this option are unknown at this stage. • The volume of waste generated under operation of this option is uncertain at this stage.
11. To protect and enhance cultural and historic assets	Will the option conserve or enhance historic buildings, places, conservation areas and spaces that enhance local distinctiveness, character and the appearance of the public realm? Will the option avoid or minimise damage to archaeologically important sites? Will the option affect public access to, or enjoyment of, features of cultural heritage?	-	0	**Effects of Construction** There are no designated cultural heritage assets at, or within close proximity to, the development sites with the exception of one which is adjacent to a Grade II Listed Building, the setting of which may be affected by construction activity. Development at the borehole sites is unlikely to affect the settings of listed buildings in the settlements of Thursby and Waverton (due to distance from these assets and the presence of existing screening/physical barriers). There are a number of heritage features on the transfer pipeline routes, the settings of which may be affected by associated pipeline works. These assets include, for example, a number of listed buildings, Workington Hall Registered Park and Garden and Parton Roman Fort Scheduled Monument. As proposed, the pipeline between Thursby and Quarry Hill would cross through Old Carlisle Scheduled Monument although it is assumed that this asset would be avoided when the transfer pipeline route is scoped in more detail. There is also the potential for unknown archaeological items to be encountered during pipeline works particularly given the number of ancient monuments present in the area and the length of the pipeline route although this is currently uncertain. Overall, the option has been assessed as having a minor negative effect on this objective. **Effects of Operation** As noted above, one proposed borehole site is adjacent to a Grade II Listed Building, the setting of which may be affected by new above ground infrastructure (although any adverse effects could be mitigated by screening). It is expected that new pipeline would be buried with planting and re-seeding likely to return land to a pre-development state within a year (depending on the season in which works are undertaken) such that there would be no long term adverse effects on the settings of designated cultural heritage assets along the route. In consequence, the option has been assessed as having a neutral effect on this objective during operation. **Mitigation** • Pipelines should be routed so as to avoid direct impacts on cultural heritage assets. **Assumptions** • None identified.

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
				Uncertainty • The presence of undiscovered items of archaeological interest is currently uncertain.
12. To protect and enhance landscape character	Will the option avoid adverse effects on, and enhance where possible, protected/designated landscapes (including woodlands) such as National Parks or AONBs? Will the option protect and enhance landscape character, townscape and seascape? Will the option affect public access to existing landscape features? Will the option minimise adverse visual impacts?	-	-	**Effects of Construction** The WTW near Ennerdale would be located within the Lake District National Park and in consequence there is potential for substantial landscape impacts during construction. However, the scale of works would be small (construction of a new mixing tank) and development would be within or adjacent to an existing site. In consequence, landscape impacts are not expected to be significant. The proposed pipeline route under the Workington transfer component of this scheme coincides with the boundary of the Lake District National Park for most of its course and runs inside the National Park for its northern section to the WTW near Ennerdale. Similarly, the new West Cumbria aquifer boreholes element also requires 21km of new transfer pipeline to be laid which would cross the Lake District National Park for approximately 6km. Pipeline works between Quarry Hill and Workington would also be within/alongside the boundary of the Lake District National Park (for approximately 5km). In consequence, there is potential for substantial landscape effects associated with construction activity. However, the majority of the proposed pipeline routes would follow existing linear features (roads) and adverse effects would be over a short timescale with planting and re-seeding likely to return land to a pre-development state within a year (depending on the season in which works are undertaken). Development sites outside the Lake District National Park would be in rural settings and on greenfield land. In consequence there may be potential for adverse effects on local landscape character (although the PS at Workington and works at the existing borehole site would be within existing sites). Pipeline works outside the Lake District National Park may also affect local landscape character as well as townscapes (e.g. where routed through/adjacent to Egremont, Workington, Whitehaven and Cockermouth). Whilst development would be within the Lake District National Park, it is not expected that construction activity would affect public access to the area. Construction activity may affect the visual amenity of residential receptors in close proximity to the development sites. However, the sites are in rural and remote locations with few residential receptors likely to experience adverse effects. Notwithstanding, construction of new boreholes near Rottington may affect the visual amenity of residential receptors to the west of the site whilst works near Waverton and Thursby may affect residential receptors to the north and east respectively (although visual intrusion would only be to very few receptors). Further, the visual amenity of receptors along the route of the proposed pipeline as well as along transport corridors may be affected. No substantial effects on the visual amenity of recreational receptors are anticipated. Some sections of pipeline would cross public footpaths whilst development near Sandwith may affect the adjacent public footpath. However, any impact on recreational users of these footpaths is likely to be of short duration at any one location.

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
				Overall, this option has been assessed as having a minor negative effect on landscape during construction. **Effects of Operation** This option would result in new above ground infrastructure within the Lake District National Park and in consequence there would be potential for substantial landscape impacts. However, the new mixing tank at the WTW near Ennerdale would be small scale and within or adjacent to an existing site, benefitting from screening. New above ground infrastructure outside the Lake District National Park would be in rural settings and on greenfield land and in consequence there may be potential for adverse effects on local landscape character (although the PS at Workington and works at the existing borehole site would be within existing sites). New assets may also affect the visual amenity of residential receptors in close proximity to the development sites. However, as noted above the sites are in rural and remote locations with few residential receptors likely to experience adverse effects. Notwithstanding, new borehole infrastructure (e.g. kiosks and pumps) near Rottington, Waverton and Thursby may affect residential receptors in close proximity to these sites although the scale of new development would be small and with appropriate screening effects are unlikely to be significant. Overall, the option has been assessed as having a minor negative effect on landscape during operation. **Mitigation** • Construction activity should be screened where possible so as to avoid/minimise adverse landscape/visual impacts. • New above ground infrastructure should adopt high quality design principles (e.g. use of local materials). • Landscaping/screening measures should be utilised to minimise adverse landscape/visual amenity impacts. **Assumptions** • It is assumed that the land above the pipeline would be restored to its former quality after construction works have finished. **Uncertainty** • The exact design and scale of new infrastructure required under this option is unknown at this stage.
Summary	**Effects of Construction** This option would involve the collective implementation of individual smaller scale options (assessed during the feasible options stage) and would comprise seven new boreholes and associated facilities, mixing tank and two PSs together with over 100km of new pipeline. Reflecting the scale of this option, construction activity is expected to have a significant negative effect on climate change as a result of associated greenhouse gas emissions from HGV movements, construction plant and embodied carbon in raw materials (the option would generate 101,428 tonnes CO_2e during construction). Using the embodied carbon associated with the construction phase as a proxy, material use and energy requirements are considered to be substantial and the option has therefore been assessed as having a significant negative effect on resource use.			

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
	The construction of this option would represent a large capital investment which is likely to generate a number of employment opportunities and supply chain benefits as well as increased spend in the local economy by contractors and construction workers. However, HGV movements and pipeline works of the proposed scale may cause traffic disruption. The option has therefore been assessed as having a mixed significant positive and minor negative effect on economic and social wellbeing. The assessment has not identified any further significant negative or significant positive effects. Whilst none of the development sites are affected by nature conservation designations, pipeline works may affect several European designated sites including the River Ehen SAC and River Derwent and Bassenthwaite Lake SAC/SSSI. However, the HRA states that it is likely that effects on these sites arising from pipeline works could be managed/avoided with scheme specific mitigation (e.g. re-routing to avoid designated sites). In this respect, it is considered reasonable to assume that pipelines will be routed within or alongside existing carriageways and river crossings (or via suitable alternative routes identified in discussion with Natural England and the Environment Agency). In addition, it is likely that any potential effects can be avoided or mitigated with suitable measures. It should also be noted that further, scheme level investigations and appropriate assessment would be undertaken at the project stage. Notwithstanding, this option would result in the loss of greenfield land at several development sites and in consequence there is potential for localised loss of habitat and disturbance which has been assessed as having a minor negative effect on biodiversity. The option may also generate minor negative effects in respect of land use/soils (due to additional land take required under this option), flood risk (the proposed new mixing tank at Ennerdale and sections of the proposed pipelines would be within/cross Flood Zones 2/3) and cultural heritage (due to potential effects on the settings of listed buildings and scheduled monuments). With regard to landscape, the WTW near Ennerdale is located within the Lake District National Park and in consequence there is potential for significant landscape impacts. However, the scale of works would be small (construction of a new mixing tank) and development would be within or adjacent to an existing site. The proposed pipelines would also cross the Lake District National Park although routes would generally follow existing linear features (roads) and adverse effects would be over a short timescale with planting and re-seeding likely to return land to a pre-development state within a year (depending on the season in which works are undertaken). In consequence, effects on this objective have been assessed as minor. Emissions to air from HGV movements and construction plant may also have a minor negative effect on air quality and, together with noise/vibration, human health. Neutral effects have been identified in respect of two objectives during construction relating to water quality/resources (Objectives 3 and 9). **Effects of Operation** Similar to the construction phase, this option is likely to have significant negative effects on climate change and resource use SEA objectives. This principally reflects the additional energy requirements (and related greenhouse gas emissions) associated with the treatment and pumping of water. The option has a design capacity of 24.5 Ml/d, serving to address deficit within the West Cumbria WRZ. This has been assessed as having a significant positive effect on health (in helping to ensure the continuity of a safe and secure drinking water supply) and economic and social wellbeing (given the potential for additional supply to support economic/population growth). No further significant negative or significant positive effects have been identified. The operation of this option is expected to have minor negative effects on water quantity (Objective 3), due to a minor reduction in river flows and groundwater levels, and flood risk (Objective 4), due to the location of the mixing tank at Ennerdale within Flood Zone 2. There may also be minor negative effects on landscape which principally reflects the potential for adverse landscape/visual impacts associated with new above ground infrastructure. Neutral effects have been identified in respect of the following objectives: soils/land use (Objective 2); water resources (Objective 9); air quality (Objective 5); and cultural heritage (Objective 11). Effects on biodiversity have been assessed as uncertain at this stage. Whilst the majority of the scheme components are unlikely to have any significant adverse effects on European designated sites, the findings of the HRA in respect of the operation of the new West Cumbria aquifer boreholes, Wastwater transfer indicate that effects on several European designated sites are uncertain. Further, new borehole abstractions near Waverton and Thursby have the potential to impact on the nearby River Waverly and River Wampool and may affect water dependent SSSIs downstream of the borehole sites although no readily available flow data could be found for the River Waverley or Wampool to contextualise the abstraction volumes and current flow. **Mitigation** Adverse environmental effects associated with the construction/operation of this option could be reduced, and positive effects enhanced, through the adoption of the following mitigation measures: • Scheme specific mitigation plans will be required to ensure that any construction related adverse effects on designated sites are avoided and localised effects on biodiversity minimised.			

Objective	Guide Questions	Relationship		Commentary
		Construction	Operation	
	• The works programme and requirements should be determined at the earliest opportunity to allow investigation schemes, protected species surveys and mitigation to be appropriately scheduled and to provide sufficient time for consultations with Natural England. • Bio-security measures should be implemented during construction and operational phases. • Potential operational effects associated with the operation of the new West Cumbria aquifer boreholes should be investigated further if this option is taken forward. • Appropriate construction methods should be employed to minimise the risk of contamination. • HGV movements and pipeline works should, where possible, be timed so as to avoid peak traffic periods e.g. between 7am-9am and 4pm-6pm. • Measures to mitigate air quality impacts arising from construction activities should be considered within a Construction and Environmental Management Plan. These measures may include, for example, dust suppression, use of lower emissions plant, and monitoring. • Detailed air quality and transport assessments should be undertaken as part of the Environmental Impact Assessment (EIA) process. • Measures to reduce energy demand/greenhouse gas emissions during construction should be considered including, for example, the use of low emission plant. • Where appropriate, the design of new infrastructure should incorporate the use of energy efficient materials and building techniques and, if appropriate, renewable energy provision. • Where possible, United Utilities and any contractors should seek to utilise local labour. • Where possible, United Utilities and any contractors should seek to appoint local contractors/sub-contractors and utilise locally sourced materials. • Opportunities to utilise reused/recycled materials during construction should be considered where appropriate. • Construction and operational wastes should be reused/recycled where possible. • Pipelines should be routed so as to avoid direct impacts on cultural heritage assets. • New above ground infrastructure should adopt high quality design principles (e.g. use of local materials). • Landscaping/screening measures should be utilised to minimise adverse landscape/visual amenity impacts.			