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Water Resources North Regional Plan – Strategic Environmental Assessment

Draft Environmental Report

Report for Water Resources North Regional Group

ED13785101 | Issue number 4 | 15 November 2022

Customer:

Water Resources North Regional Group

Customer reference:

Environmental Assessment of the Regional Plan

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15/11/2022

Ref: ED13785101

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Non-technical summary

Introduction

Water Resources North (WReN) is one of five regional water resources groups working under the National Framework for Water Resources (the 'National Framework'). WReN comprises the three water companies operating in the north east of England, including Yorkshire Water, Northumbrian Water and Hartlepool Water.

WReN are developing a regional water resources plan for Yorkshire and the North East of England (the 'Regional Plan') to help to facilitate sustainable growth across Yorkshire, the Humber and the North East, whilst also protecting and enhancing the region's valuable natural environment. As the region has an assumed surplus of water, WReN are working with other regional water resources groups (principally Water Resources West (WRW) and Water Resources East (WRE)) to help secure resilient water supplies for the country as a whole.

In preparing its Regional Plan, WReN has considered the environmental and social effects of each alternative option and has integrated this into the decision-making process in selecting the preferred plan and also evidencing compliance the relevant environmental legislation. Throughout the course of the development of the Regional Plan, the environmental assessments will seek to identify, describe and evaluate the likely significant effects on the environment of implementing the plan, as well as proposing measures to avoid, manage or mitigate any significant adverse effects and to enhance any beneficial effects.

These assessments consist of:

- Strategic Environmental Assessment (SEA) incorporating Invasive Non-Native Species assessment (INNS) and Biodiversity Net Gain (BNG);
- Habitats Regulation Assessment (HRA); and
- Water Framework Directive (WFD) assessment.

The Regional Plan option appraisal also integrates Natural Capital Assessment (NCA) within the WReN Options Appraisal workstream.

This Environmental Report presents the findings of the SEA of the Regional Plan. The HRA and WFD are documented separately.

Strategic environmental assessment screening

Water companies, as responsible authorities under the Environmental Assessment of Plan and Programmes Regulations 2004 (subsequently referred to as the SEA Regulations), must themselves determine if their Regional Plan falls within the scope of the SEA Regulations.

The Environment Agency's National Framework sets out the requirement for development of regional plans and sets out the actions that 'must, should and could' feature in regional plans. Amongst the requirements are that the plan must comply with SEA and HRA legislation.

The decision making process for determining WReN solutions to regional and national needs will be developed following the Environment Agency Water Resource Planning Guidelines (WRPG) and supplementary guidelines. The Supplementary Guidance "Environment and society in decision making" contains a number of requirements and recommendations for the scope of WRMP environmental assessment, in particular in relation to SEA, BNG and NCA. The Regional Plan will need to be reflected in the WRMPs and the assessments will, therefore, need to be consistent with the requirements of the WRPG.

Application of the available guidance indicated that the Regional Plan falls within the scope of the SEA Regulation, principally due to the risk that the plan may include schemes which will require environmental impact assessment, for example water pipelines, desalination plants or raising of reservoir dams.

Strategic environmental assessment and water resources management planning

In the context of regional planning for water resources, the SEA process can assist in the identification of potential environmental effects (adverse or beneficial) associated with alternative options being considered by regional groups to balance supply and demand over the 25-year planning horizon. Knowledge of these effects helped to evaluate and identify a preferred plan of schemes for balancing supply and demand over this planning horizon, in particular contributing to the option and plan appraisal processes. The preferred plan forms the basis of this Regional Plan.

The regional planning process requires a substantial element of environmental assessment and consideration. Certain environmental and social impacts are monetised and incorporated into the planning process by adding them to the capital and operating costs of schemes. SEA can add value to the appraisal process by promoting the consideration of a wider range of impacts that cannot be monetised. The SEA process also identified cumulative effects within the WReN Regional Plan and with other policies, plans, programmes and projects.

There are five key stages of the SEA process:

- Stage A: Setting the context, identifying objectives, problems and opportunities, and establishing the environmental baseline (scoping).
- Stage B: Developing and refining options and assessing effects (impact assessment).
- Stage C: Preparing the SEA Environmental Report (recording results).
- Stage D: Consulting on the draft Regional Plan and the SEA Environmental Report (seeking consensus).
- Stage E: Monitoring the significant effects of the plan or programme on the environment (verification).

In using the SEA to support decision-making, care must be taken to ensure that environmental and social impacts are not ‘double-counted’ in both the monetisation process and the SEA, as this may potentially skew the options and plan appraisal process.

The SEA provides information on the relative environmental performance of alternatives, and is intended to make the planning and decision-making process more transparent. The SEA can, therefore, be used to support the timing and implementation of regional water resource planning options.

An SEA Scoping Report was issued in April 2021 to statutory and stakeholder consultees. This included the Environment Agency, Historic England, Natural England, Energy UK, Aire Rivers Trust, Tyne Rivers Trust, National Farmers Union, Canal and Rivers Trust and the Royal Society for the Protection of Birds. Consultation bodies were invited to express their views on the proposed scope and level of detail of this SEA Environmental Report. Issues raised by consultees at the scoping stage were considered throughout the SEA process.

Assessment methodology

The assessment has been ‘objectives-led’. The SEA objectives have been derived from environmental objectives established in law, policy or other plans and programmes, and from a review of the baseline information. The SEA objectives have been categorised under the following topic areas: biodiversity flora & fauna, population & human health, material assets & resource use, water, soil geology & land use, air & climate, archaeology & cultural heritage and landscape & visual amenity. These are set out in **Table NTS 1**. The overall findings of the SEA describe the extent to which objectives for each topic are met by each of the Regional Plan options.

The outputs of the assessment are a completed, detailed appraisal framework table for each of the selected Regional Plan options, and a colour coded summary visualisation matrix (ranging from major beneficial impacts to major adverse impacts). This provides a comparative assessment of the residual environmental effects of implementing each Regional Plan option.

The appraisal tables provide an evaluation of impact scale, certainty, duration and permanence in compliance with criteria for determining the likely significance of effects specified in the SEA Regulations Part 2, Regulation 9(2a) and Schedule 1. The assessment assumes implementation of standard best practice in implementing the option, and any proposed mitigation measures incorporated into the option conceptual design and costs. This enables assessment of the significance of residual effects after mitigation, in-line with the Office of the Deputy Prime Minister (ODPM) Practical Guide and UKWIR SEA national guidance. The residual adverse and beneficial effects are identified separately to avoid mixing adverse and beneficial effects, in line with SEA best practice. This enables adverse and beneficial impacts to be independently assessed, maintaining transparency throughout the Regional Plan decision-making process.

A cumulative, or in-combination, assessment has also been undertaken which has been involved examining the potential impacts of the options included in the preferred plan in combination with each other, as well as in combination with other relevant plans and programmes.

Environmental Baseline

An essential part of the SEA process is to identify the current baseline conditions and their likely evolution in the absence of the Regional Plan. It is only with knowledge of baseline conditions that potential impacts of the Regional Plan and its schemes can be identified, monitored, and if necessary mitigated.

This Environmental Report covers a potentially long temporal period, looking as far out as 2080, presenting uncertainties in characterising the future baseline which increases with time. These will need to be updated as part of the next regional plan process leading up to the next Regional Plan submission, as well as for subsequent submissions.

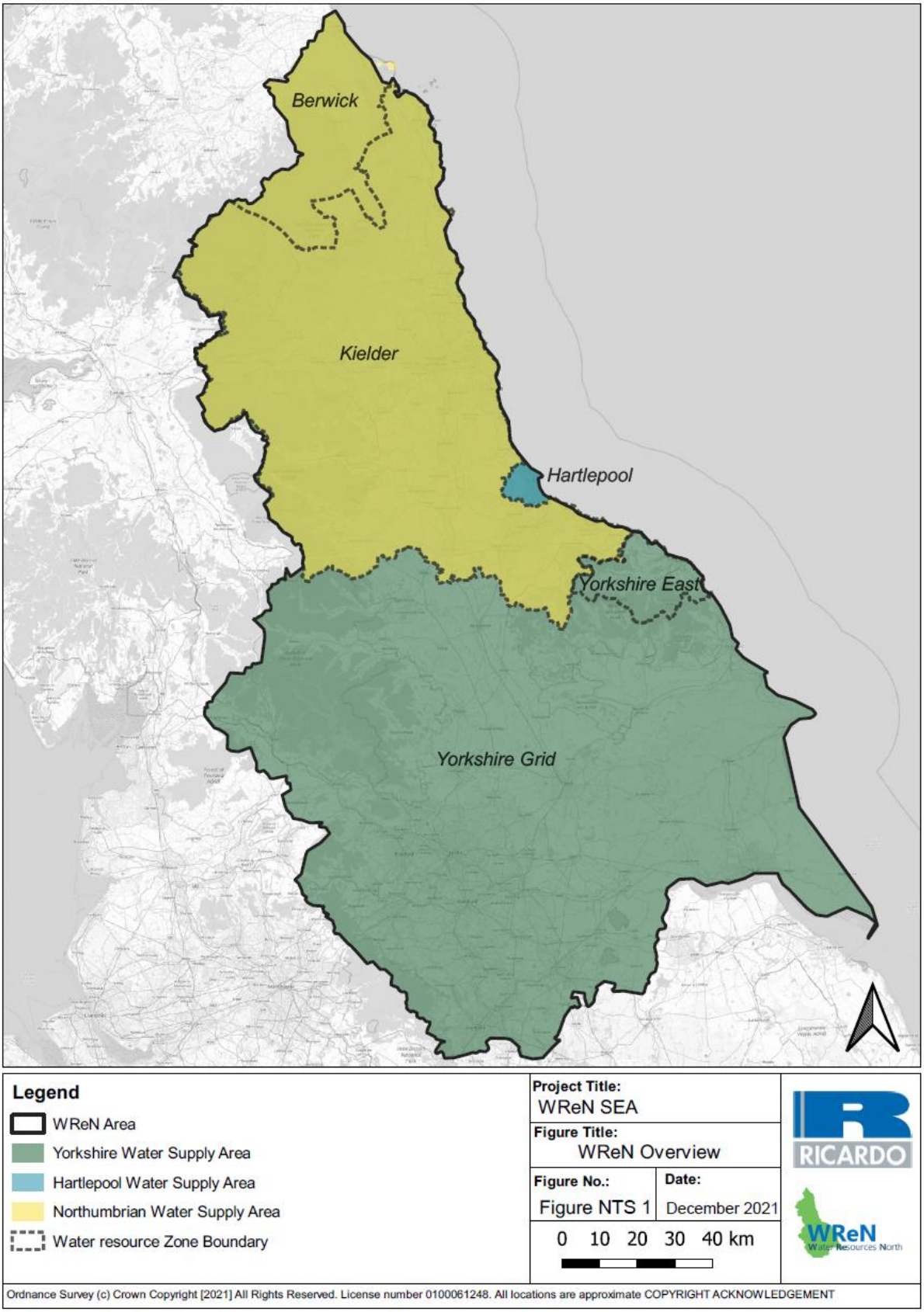
The best available projections for environmental and social characteristics have been considered and summarised, but there is significant uncertainty due to the substantial differences in the availability and temporal resolution of robust projections across the various SEA topic areas, which increases with time.

Baseline data have been drawn from a variety of sources, including the review of relevant plans, policies and programmes. The likely future trends in the environmental and social issues considered have been presented where information is available to do so. However, reliance on these data sets has in some cases meant that this information has become outdated. Whilst this is sufficient for the SEA process, local and/or site-specific data would be collected during the later EIA process where requested.

The SEA study area comprises the entirety of WReN region which itself is formed by the three water companies operating in the north east of England, including Yorkshire Water, Northumbrian Water and Hartlepool Water (**Figure NTS 1**). The WReN region encompasses a varied landscape, from the Peak District National Park in the South West, stretching to the Northumberland National Park to the south of Scotland, and the North Sea coastline along the Eastern side of the region. Annual average rainfall across the region varies; highest near the Yorkshire Dales, whilst low lying and coastal areas, such as Berwick-upon-Tweed, average less than half the volume of rainfall each year, with little seasonal variation.

The WReN Regional Plan options may have effects outside of the WReN geographical region, for example export options to neighbouring regional groups such as WRW and/or WRE. Where this is the case, the effects of the option in its entirety will be considered in the appraisal against the SEA objectives and documented in the Environmental Report. Where an option will potentially be included in the WReN Regional Plan and a neighbouring area Regional Plan the two groups will collaborate on the environmental assessment to ensure consistency in data inputs and assessment approach.

Figure NTS 1 SEA Study Area



Key issues arising from the review of baseline conditions for each of the SEA topics are summarised in **Table NTS 1**. These key issues have been used to support the development of the SEA objectives.

Table NTS 1 Summary of key sustainability issues

SEA topic	Key issues
Biodiversity, flora and fauna	• The need to protect or enhance the region's biodiversity, particularly protected sites designated for nature conservation. • The need to avoid activities likely to cause irreversible damage to natural heritage. • The need to take opportunities to improve connectivity between fragmented habitats. • The need to control the spread of Invasive Non-Native Species (INNS). • The need to engage more people in biodiversity issues so that they personally value biodiversity and know what they can do to help, including through recognising the value of the ecosystem services.
Population and human health	• The need to ensure water supplies remain affordable especially for deprived or vulnerable communities • The need to ensure continued improvements in levels of health across the region, particularly in urban areas and deprived areas. • The need to ensure water quantity and quality is maintained for other users including tourists, recreational users and other users such as farmers. • The need to ensure a balance between different aspects of the built and natural environment that will help to provide opportunities local residents and tourists, including opportunities for access to recreation resources and the natural and historic environment. • The need to accommodate an increasing population, that is geographically spread, focussed around several economic centres. • Sites of nature conservation importance, heritage assets, water resources, important landscapes and public rights of way contribute to recreation and tourism opportunities and subsequently health and well-being and the economy.
Material assets and resource use	• The need to minimise the consumption of resources, including water and energy, reducing resource demand per capita. • The need to reduce the total amount of waste produced in the region, from all sources, and to reduce the proportion of this waste sent to landfill. • Need to reduce leakage from the water supply system. • The need to encourage more efficient water use. • The need to support regional and national commitments to decarbonisation.
Water	• The need to further improve the quality of the region's river, estuarine and coastal waters taking into account WFD status targets. • The need to maintain the quantity and quality of groundwater resources taking into account WFD status targets.

SEA topic	Key issues
	• The need to improve the resilience, flexibility and sustainability of water resources in the region, particularly in light of potential climate change impacts on surface waters and groundwaters. • The need to ensure sustainable abstraction. • The need to ensure that people understand the value of water. • The need to reduce and manage flood risk.
Soil, geology and land use	• The need to protect geological features of importance and maintain and enhance soil function and health, including protecting Best and Most Versatile Agricultural land from development and pollution. • The need to manage the land more holistically at the catchment level, benefitting landowners, other stakeholders, the environment and sustainability of natural resources (including water resources). • The need to make use of previously developed land (brownfield land) and to reduce the prevalence of derelict land in the region.
Air and climate	• The need to reduce air pollutant and greenhouse emissions and limit air emissions to comply with air quality standards. • The need to mitigate against climate change through the reduction in greenhouse gas emissions to contribute to risk reduction over the long term. • The need to adapt to the impacts of climate change for example through, sustainable water resource management, specific aspects of natural ecosystems (e.g. connectivity) as well as accommodating potential opportunities of climate change. • The need to work towards achieving net zero emissions by 2030.
Archaeology and cultural heritage	• The need to conserve or enhance sites of archaeological importance and cultural heritage interest and their settings, particularly those which are sensitive to the water environment. • Ensure that any new infrastructure, provided in order to maintain or improve water resources within the District, does not impact upon the cultural heritage interest, or their settings. • The need to prevent any further assets in the Yorkshire Water Area from entering the Heritage At Risk Register.
Landscape and visual amenity	• The need to protect and improve the natural beauty of the region's AONBs and other areas of natural beauty. • It is envisaged that landscape and designated sites will be maintained and enhanced for the enjoyment of the public. • The need to preserve Green Belt and openness in the area. • The need to ensure that local character is maintained, in the face of pressures from development and climate change.

Findings of the assessments

The findings of the SEA are summarised below. **Table NTS 2** sets out the SEA topics and objectives which are identified in **Tables NTS 4** and **NTS 6**.

For each SEA objective, a residual effects assessment was determined against a significance matrix (**Table NTS 2**) which took into account the value / sensitivity of the receptor (e.g. air quality, river water quality, landscape value) and the magnitude of the assessed effect. This significance matrix comprised effects from 'major beneficial' to 'major adverse'. This colour coding was used to complete the columns for residual effects in the visual evaluation matrices summarised in **Tables NTS 4** and **NTS 6**.

Table NTS 2 SEA Topics and Objectives

Topic	Objective
Biodiversity, Flora and Fauna	1.1 To protect and enhance biodiversity, ecological functions, capacity, and habitat connectivity within the WReN region.
	1.2 To protect, conserve and enhance natural capital and the ecosystem services from natural capital that contribute to the economy.
	1.3 To avoid introducing or spreading INNS.
	1.4 To provide opportunities for habitat creation or restoration and a net benefit/gain for biodiversity
Population and Human Health	2.1 To protect and improve health and well-being and promote sustainable socio-economic development through provision of access to a resilient, high quality, sustainable and affordable supply of water over the long term
	2.2 To protect and enhance the water environment for other users, including recreation, tourism and navigation
Material assets and resource use	3.1 To reduce, and make more efficient, the domestic, industrial and commercial consumption of resources, minimise the generation of waste including leakage from the water supply system, encourage its re-use and eliminate waste sent to landfill
Water	4.1 To maintain or improve the quality of rivers, lakes, groundwater, estuarine and coastal waterbodies.
	4.2 To avoid adverse impact on surface and groundwater levels and flows, and ensure sustainable management of abstractions.
	4.3 To reduce and manage flood risk, taking climate change into account.
	4.4 To increase awareness of water sustainability and efficient use of water.
Soil, geology and land use	5.1 To protect and enhance geomorphology, and the quality and quantity of soils.
Air and climate	6.1 To maintain and improve air quality
	6.2 To minimise greenhouse gas emissions
	6.3 To adapt and improve resilience to the threats of climate change

Topic	Objective
Archaeology and cultural heritage	7.1 To conserve and enhance the historic environment, heritage assets and their settings and protect archaeologically important sites.
Landscape and visual amenity	8.1 To protect and enhance designated and undesignated landscapes, townscapes and the countryside

Table NTS 3 SEA Significance Matrix

Significance of Effect		Value/sensitivity of receptor		
		High	Medium	Low
Effect magnitude (includes scale of effect)	High	Major Beneficial / Major Adverse	Major Beneficial / **Major Adverse**	Moderate Beneficial / Moderate Adverse
	Medium	Major Beneficial / Major Adverse	Moderate Beneficial / Moderate Adverse	Minor Beneficial / Minor Adverse
	Low	Dependant on nature of impact/benefit	Minor Beneficial / Minor Adverse	Negligible

Significance levels identified in **Table NTS 3** are defined as follows.

- **Major –** Effects represent key factors in the decision-making process. They are generally associated with sites and features of international, national or regional importance. If adverse, such resources / features are generally those which cannot be replaced or relocated.
- **Moderate –** Effects are likely to be important considerations at a regional or district scale. If adverse, they are likely to be of potential concern.
- **Minor –** Effects are not likely to be decision-making issues. Nevertheless, the cumulative effect of such issues may lead to an increase in the overall effects of a particular area or on a particular resource.
- **Negligible –** Effects which are not perceptible, being within normal bounds of variation of the margin of forecasting error.

Northumbrian Water demand management options

The SEA of demand management options for the Northumbrian Water region (**Table NTS 4**) included three scenarios (high, medium, low) for demand reduction and comprised a range of activities including; leakage reduction, water efficiency programmes and smart metering with varying levels of ambition.

The demand management activities associated with each scenario are unlikely to have any major or moderate adverse effects on any of the SEA objectives. Minor adverse effects have been identified for the majority of SEA objectives. Minor adverse effects were identified for biodiversity, water, cultural heritage and landscape associated with the construction activities to resolve leakage issues, however specific locations of the scheme remain unknown. Temporary minor adverse effects on population and human health due to increased disruption were identified. All three options will have an adverse impact on air quality and greenhouse gas emissions through the increased number of vehicle journeys made to undertake the water efficiency activities (e.g. to fit water meters, take meter readings or carry out audits) and leakage works as well as increased carbon generation from the materials used to

manufacture water meters (embodied carbon) and the construction works associated with leakage reduction.

Beneficial effects have been identified for several SEA objectives, including for population and human health, water, and air quality and greenhouse gas emissions. These beneficial effects are associated with the promotion of water efficiency activities and reduced demand for water which may have beneficial effects on water quality and quantity through reducing the amount of water abstracted and improving resilience to climate change. These effects range from minor to major based on the level of ambition of each scenario. Minor beneficial effects only were identified for the BOT-DMO-Low option. However, the BOT-DMO-High option is likely to result in major beneficial effects on population and human health and water efficiency as this scenario is expected to promote water efficiency and result in reduced per capita consumption of a magnitude considered to be of a major beneficial effect.

Yorkshire Water demand management options

Customer management options

The SEA of customer management options (Table NTS 5), included Domestic customer audits and retrofit, metering domestic meter optants, metering on change of occupancy, household flow regulators and Housing Association targeted programmes.

The customer management options are unlikely to have any major or moderate adverse effects on any of the SEA objectives. Minor adverse effects have been identified in relation to the air and climate objectives regarding reduction of air pollutant and greenhouse gas emissions. Most of the options will have an impact on air emissions through the increased number of vehicle journeys made to fit water meters, take meter readings or carry out audits.

Minor beneficial effects have been identified for the majority of the customer management options, in relation to sustainable and efficient use of water resources. There are a number of options that, in isolation, will result in negligible beneficial impacts for every SEA objective. C4, and C5, are likely to result in reductions in water savings of a magnitude considered to be of a moderate beneficial effect.

Leakage options

The SEA of leakage options are outlined in **Table NTS 6**. The leakage options are unlikely to have any major or moderate adverse effects on any of the SEA objectives. Three options are anticipated to have minor adverse effects on health and wellbeing of local populations, reduction in consumption of resources, improvement in air quality. These minor adverse effects are predominantly resulting from disturbances created from the physical maintenance activities of these options, which would result in temporary increases in noise and air pollution, disturbance to communities and changes in local views and settings.

Options L4, L5 and L6 are anticipated to have major benefits on population and human health, material assets and resource use, surface and ground water flows, efficient use of water and climate resilience due to the savings created by these leakage control options.

Hartlepool Water demand management options

No demand management options were identified for the Hartlepool area as the area is considered to be in a healthy surplus and is a low level of concern.

Resource management options

A wide variety of options have been assessed, shown in **Table NTS 7**, leading to a range of environmental effects being identified. These reflect the scale of abstraction and/or the location of the option in relation to sensitive environments (aquatic and terrestrial). As may be expected, the smaller scale options generally have the lower environmental effects, but differences do occur between such options due to their environmental setting. Many of the options have no greater than minor adverse effects. However, some options may have moderate or major adverse effects for some of the SEA objectives, as discussed below:

- Three schemes are anticipated to have major adverse effects against a total of five SEA objectives: DV6(vi), DV7a(vi), DV8(iv). All the Derwent Valley (DV) resource options, with the exception of DV3 and DV8(v), are anticipated to lead to major adverse impacts on biodiversity. Major adverse impacts for these options are also anticipated in relation to material assets and resource use, protection and enhancement of geology/soil quality, and minimisation of greenhouse gas emissions. However, these options are also anticipated to be associated with major to moderate beneficial effects on population and human health and climate change resilience due to the increase in available public water supply.
- The Ouse Raw Water Transfer (R2) option is anticipated to have two moderate adverse effects on biodiversity, and archaeology and cultural heritage due to the construction of the abstraction and new pipeline. However, two major beneficial effects were identified, related to population and human health and climate change resilience due to a yield of 60Ml/d, therefore maintaining the supply-demand balance.
- The Grid network enhancement: New River Ouse WTW to York (R1c) option and associated pipelines option to North Yorkshire (R1d and R1f) have been identified as having a major adverse effect on biodiversity. The Grid network enhancement: New River Ouse WTW to North Yorkshire 3 Option (R1f) is also anticipated to result in moderate adverse effects for material assets and resource use, air and climate and archaeology and cultural heritage. R1g Grid network enhancement: New River Ouse WTW to York is not anticipated to result in any moderate or major adverse effects, but has the potential for moderate benefits to biodiversity given the opportunities for habitat enhancement and to climate reliance in relation to deployable output increases.
- All South Yorkshire Groundwater options (R6, R6b, R6c, R6d) are anticipated to result in significant adverse effects. R6 South Yorkshire Groundwater Option 1 has been identified as having a moderate adverse effect on water due to a potential impact on ground water balance and surface water flows. R6b South Yorkshire Groundwater Option 2, R6c South Yorkshire Groundwater Option 3, R6d South Yorkshire Groundwater Option 4 have potential to result in major adverse effect on biodiversity due to potential for construction phase impacts on a SSSI and other sensitive ecological receptors, as well as on archaeology and cultural heritage.
- The Sherwood Sandstone and Magnesian Limestone Boreholes Option 3 (R8c) is anticipated to lead to three moderate adverse effects; for population and human health, due to construction work being required in residential areas, and for cultural heritage, due to construction impacting upon the quality and settings of Scheduled Monuments and several Grade II Listed Buildings. R8f Sherwood Sandstone and Magnesian Limestone Boreholes Option 6 has been identified as having potential for a major adverse effect on biodiversity due to its proximity to designated sites as well as a moderate effect on archaeology and cultural heritage. Moderate benefits are however anticipated for population and human health due to the increase in supply of up to 20Ml/d. R8g Sherwood Sandstone Boreholes support to North Yorkshire is also expected to have moderate benefits for population and human health with an increased deployable output of 15Ml/d.
- The R13 East Yorkshire Groundwater Option 2 is associated with moderate adverse effects on biodiversity due to the potential for adverse temporary effects on nearby ancient woodland. Moderate adverse effects on groundwater are also associated with the option pending further investigation.
- The R29 Reservoir desilting option is assessed as having a major adverse effect on biodiversity and the quality of habitat in a number of nationally and internationally designated sites. If desilting requires extensive drawdown of the reservoirs, there will also likely be temporary moderate adverse effects on landscape and visual amenity given the setting of these reservoirs. Desilting works have the potential have a temporarily adverse effect on water quality both within the reservoir and in the downstream watercourses due to elevated turbidity in the compensation flow release water. Desilting would only occur following careful planning and further investigations, and that the list of reservoirs included in the option may decrease if unacceptable environmental impacts are identified. An increase of 11Ml/d in deployable output will likely lead to moderate beneficial effects on population and human health and adapting to climate change.

- Option R34 (Abstraction Option 1) has the potential for moderate adverse effects on population and human health, and archaeology and cultural heritage. A large proportion of the pipeline route will pass through heavily built areas, leading to temporary adverse effects from noise, dust and vibration and temporary adverse impacts on a range of recreational facilities and historical assets.
- The is also one possible moderate adverse effect for the River Aire Abstraction option 1 (R35), relating to archaeology and cultural heritage due to the proximity of the pipeline route potentially passing to a World Heritage Site (WHS). It will however provide a 10Ml/d yield on most days, contributing to moderate beneficial impacts.
- The construction phase of the R51 Supply Dales from the Tees – treated option is anticipated to result in adverse effects on material assets and resource use, and archaeology and cultural heritage given the scale and location of construction. However, given the provision of an additional 15Ml/d essential public water supplies will be maintained bringing moderate beneficial effects to population and human health, air and climate through increased resilience to climate change, and biodiversity through habitat enhancement.
- The East Yorkshire coast desalination (R61) and Tidal Abstraction Reservoir (R78) options have the potential for major adverse effects on biodiversity as it may impact on the Humber Estuary SAC/SPA/Ramsar. In addition, major adverse effects are associated with the significant amount of resource use and energy required to operate R61. However moderate benefits are anticipated for both options in relation to population and human health and climate resilience, associated with the maintenance of essential public water supply
- The Aire and Calder new WTW (R86) option may result in moderate adverse impacts on biodiversity and material assets and resource use during the construction phase, however given the increase of up to 70Ml/d benefit to public water supply, moderate benefits have been identified for population and human health and climate resilience.

Table NTS 4 Visual evaluation matrix summary for Northumbrian Water demand management options

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
BOT-DMO-High	Adverse				None													
	Beneficial				None													
BOT-DMO-Med	Adverse				None													
	Beneficial				None													
BOT-DMO-Low	Adverse				None													
	Beneficial				None													

Table NTS 5 Visual evaluation matrix summary for Yorkshire Water customer management options

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
C1a Domestic customer audits and retrofit	Adverse		None		None		None						None				None	None
	Beneficial				None		None						None				None	None
C1b Domestic customer audits and retrofit	Adverse		None		None		None						None				None	None
	Beneficial				None		None						None				None	None
C1c Domestic customer audits and retrofit	Adverse		None		None		None						None				None	None
	Beneficial				None		None						None				None	None
C1d Domestic customer audits and retrofit	Adverse		None		None		None						None				None	None
	Beneficial				None		None						None				None	None

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
C1e Domestic customer audits and retrofit	Adverse		None		None		None						None				None	None
	Beneficial				None		None						None				None	None
C2a-c Metering (domestic meter optants)	Adverse		None		None		None						None				None	None
	Beneficial				None		None						None				None	None
C4 Metering on change of occupancy	Adverse				None		None						None				None	None
	Beneficial				None		None						None				None	None
C5 Smart metering	Adverse				None		None						None				None	None
	Beneficial				None		None						None				None	None

Option	Impact	SEA Objective															
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
C6a Commercial water user audits and retrofit	Adverse				None								None				None	None
	Beneficial				None								None				None	None
C6b Commercial water user audits and retrofit	Adverse				None								None				None	None
	Beneficial				None								None				None	None
C6c Commercial water user audits and retrofit	Adverse				None								None				None	None
	Beneficial				None								None				None	None
C6d Commercial water user audits and retrofit	Adverse				None								None				None	None
	Beneficial				None								None				None	None

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
C6e Commercial water user audits and retrofit	Adverse				None								None				None	None
	Beneficial				None								None				None	None
C7a-e Commercial water user audits and retrofit - customer pays	Adverse				None								None				None	None
	Beneficial				None								None				None	None
C15a Household Flow Regulator - Internal	Adverse				None		None						None				None	None
	Beneficial				None		None						None				None	None
C15b Household Flow Regulator – Internal	Adverse				None		None						None				None	None
	Beneficial				None		None						None				None	None

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
C15c Household Flow Regulator – Internal	Adverse				None		None						None				None	None
	Beneficial				None		None						None				None	None
C15d Household Flow Regulator – Internal	Adverse				None		None						None				None	None
	Beneficial				None		None						None				None	None
C15e Household Flow Regulator - Internal	Adverse				None		None						None				None	None
	Beneficial				None		None						None				None	None
C21a Housing Associations – targeted programme	Adverse		None		None		None						None				None	None
	Beneficial				None		None						None				None	None

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
C21b Housing Associations – targeted programme	Adverse		None		None		None						None				None	None
	Beneficial				None		None						None				None	None
C21c Housing Associations – targeted programme	Adverse		None		None		None						None				None	None
	Beneficial				None		None						None				None	None
C21d Housing Associations – targeted programme	Adverse		None		None		None						None				None	None
	Beneficial				None		None						None				None	None
C21e Housing Associations – targeted programme	Adverse		None		None		None						None				None	None
	Beneficial				None		None						None				None	None

Table NTS 6 Visual evaluation matrix summary for Yorkshire Water leakage options

Option	Impact	SEA Objective 1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
L1 Active Leakage Control 14Ml/d	Adverse				None													
	Beneficial				None													
L2 Active Leakage Control 30Ml/d	Adverse				None													
	Beneficial				None													
L3 Active Leakage Control 46Ml/d	Adverse				None													
	Beneficial				None													
L4 Active Leakage Control 62Ml/d	Adverse				None													
	Beneficial				None													

Option	Impact	SEA Objective 1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
L5 Active Leakage Control 78Ml/d	Adverse				None													
	Beneficial				None													
L6 Active Leakage Control 95Ml/d	Adverse				None													
	Beneficial				None													

Table NTS 7 Visual evaluation matrix summary for resource management options

Option	Impact	SEA Objective 1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
DV3 - South Yorkshire Groundwater	Adverse				None							None						
	Beneficial											None						
DV6(iv) Import Tees to South Yorkshire Pipeline	Adverse				None							None						
	Beneficial											None						

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
DV6(v) Import Tees to South Yorkshire Pipeline	Adverse				None							None						
	Beneficial											None						
DV6(vi) Tees to South Yorkshire Pipeline	Adverse				None							None						
	Beneficial											None						
DV7a(iv) Tees to Ouse Pipeline Option 1	Adverse				None							None						
	Beneficial											None						
DV7a(v) Import Tees to Ouse Pipeline Option 2	Adverse				None							None						
	Beneficial											None						
DV7a(vi) –– Tees to York Pipeline Option 3	Adverse				None							None						

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial											None						
DV8 (iv) - York to South Yorkshire Pipeline	Adverse				None					None		None						
	Beneficial									None		None						
DV8 (v) -York WTW Capacity increase	Adverse				None							None						
	Beneficial											None						
E2 Yorkshire grid network to STW	Adverse											None						
	Beneficial											None						
R1c Grid network enhancement: New River Ouse WTW to York	Adverse				None							None						
	Beneficial											None						
R1d - Grid network enhancement: New River Ouse WTW to North Yorkshire 1	Adverse				None					None		None						

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial									None		None						
R1e - Grid network enhancement: New River Ouse WTW to North Yorkshire 2	Adverse				None					None		None						
	Beneficial									None		None						
R1f - Grid network enhancement: New River Ouse WTW to North Yorkshire 3	Adverse				None					None		None						
	Beneficial									None		None						
R1g - Grid network enhancement: New River Ouse WTW to York	Adverse				None					None		None						
	Beneficial									None		None						
R2 - Ouse Raw Water Transfer	Adverse				None							None						
	Beneficial											None						
R3 - Increased River Ouse pump storage capacity	Adverse				None							None						

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial											None						
R3a - River Ouse licence transfer	Adverse				None		None											None
	Beneficial				None		None											None
R5 - Aquifer Storage and Recovery Scheme 1	Adverse				None													
	Beneficial																	
R6 - South Yorkshire Groundwater Option 1	Adverse				None							None						
	Beneficial											None						
R6b - South Yorkshire Groundwater Option 2	Adverse				None							None						
	Beneficial	None										None						
R6c - South Yorkshire Groundwater Option 3	Adverse				None							None						

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial	None										None						
R6d - South Yorkshire Groundwater Option 4	Adverse				None							None						
	Beneficial	None										None						
R8b - Sherwood Sandstone and Magnesian Limestone Boreholes Option 2	Adverse				None							None						
	Beneficial											None						
R8c - Sherwood Sandstone and Magnesian Limestone Boreholes Option 3	Adverse				None							None						
	Beneficial											None						
R8f - Sherwood Sandstone and Magnesian Limestone Boreholes Option 6	Adverse				None							None						
	Beneficial											None						
R8g - Sherwood Sandstone Boreholes support to North Yorkshire	Adverse				None							None						

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial											None						
R12 - East Yorkshire Groundwater Option 1	Adverse				None													
	Beneficial																	
R13 - East Yorkshire Groundwater Option 2	Adverse				None							None						
	Beneficial											None						
R29 Reservoir De-silting	Adverse				None													
	Beneficial				None													
R31a - Additional bankside storage on the River Ouse	Adverse				None							None						
	Beneficial											None						
R34 - River Calder Abstraction Option 1	Adverse				None							None						

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial											None						
R35 - River Aire Abstraction Option 1	Adverse				None							None						
	Beneficial											None						
R37b(ii) - River Aire abstraction Option 4	Adverse											None						
	Beneficial											None						
R51 - Dales from the Tees - treated	Adverse				None													
	Beneficial																	
R61 - East Yorkshire coast desalination	Adverse				None							None						
	Beneficial											None						
R78 Tidal Abstraction Reservoir	Adverse				None													

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial																	
R85 - Recommission Kirklees WTW	Adverse				None						None	None	None					
	Beneficial				None						None	None	None					
R86 Aire and Calder new WTW	Adverse											None						
	Beneficial											None						
WReNE1a: Kielder to UU	Adverse				None							None						
	Beneficial											None						
WReNE1b: Kielder to UU	Adverse				None							None						
	Beneficial											None						
WReNE2a: Cow Green to UU	Adverse				None							None						

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial											None						
WReNE2b: Cow Green to UU	Adverse				None							None						
	Beneficial											None						

Key:

- Major adverse
- Moderate adverse
- Minor adverse
- Negligible adverse
- None — Not applicable
- Major beneficial
- Moderate beneficial
- Minor beneficial
- Negligible beneficial

Formulation of the preferred plan

The aim of the Regional Plan is to find the 'best value' programme of supply and/or demand options (the 'preferred plan') to restore and maintain a supply-demand balance in those WRZs for which a supply deficit has been forecast. The selection process is facilitated through programme appraisal modelling tools, which are designed to produce an optimised programme taking account of whole life cost and environmental considerations.

Water companies are required to undertake assessments at a WRMP level. Many options for consideration at the Regional Plan come from the company level WRMPs, and Regional Plans will feed into WRMPs via identification of new options to consider and by providing planning solutions with which WRMPs will need to align. Therefore, WRMP24 and WReN options are being assessed in an integrated way to ensure consistency and allow comparable assessments.

As described in the Regional Plan, WReN have completed a full options appraisal to determine the benefits and disbenefits of the feasible options to guide the decision making process for the draft plan. The WReN options appraisal workstream uses the outputs from the environmental assessment workstream to inform the environmental, societal and resilience decision-making metrics which are included in the option appraisal process, whilst ensuring that the environmental and social impacts were not 'double-counted' in both the monetisation process and the SEA, as this could potentially skew the options and programme appraisal process. Further input from the environmental assessment workstream is also considered in a qualitative review during development of planning solutions.

The preferred plan has been selected in accordance with WReN's goal to use demand management and leakage reduction measures to meet the predicted supply-demand deficit as far as possible. This is also in line with guidance from Ofwat and Defra, and preferences expressed by customers across the WReN region. Whilst the optimisation process delivers a least cost solution, this does not consider regulatory and customer preferences or any wider resilience benefits from alternative solutions. As mentioned above, the WReN Regional Plan has been developed in parallel to the WRMP24 process and the objectives of both the Regional Plan and individual companies' WRMPs are aligned.

Preferred plan

The draft Regional Plan preferred plan is set out in **Table NTS 8**. The plan includes five demand management options that will meet government aspirations with regards to achieving 50% leakage reduction and reduction PCC (per capita consumption to 110 l/p/d by 2050. Three of these demand options are to address deficits in the Northumbrian region, specifically the Kielder WRZ, and were assessed as part of the BOT-DMO-Med scenario (see Section 5.2) with the exception of a more ambitious 50% leakage reduction target to replace the 40% target originally assessed. The BOT-DMO-Med scenario is assessed as resulting in moderate beneficial effects relating to sustainable and efficient use of water resources and increased resilience to climate change effects. The SEA findings also conclude minor beneficial effects across a range of other SEA objectives. Minor adverse effects have been identified for many of the SEA objectives relating to the construction associated with leakage reduction activities.

The remaining two demand options cover the Yorkshire Water area; L6 Active leakage control 95Ml/d and C5 Smart metering and water efficiency. The demand measures within the preferred plan also include customer demand management measures to further reduce water consumption per person/per property within Yorkshire Water's supply area. The C5 Smart metering and water efficiency option is assessed as resulting in moderate beneficial effects relation to sustainable and efficient use of water resources. The SEA findings also conclude that C5 Smart metering and water efficiency will result in minor beneficial effects across a range of other SEA objectives. The L6 Active leakage control 95Ml/d option is assessed as resulting in major beneficial effects across five SEA objectives in relation to human health and wellbeing, sustainable and efficient use of water resources and climate change resilience. Minor adverse effects have been identified in relation to the air and climate SEA objectives regarding use of material resources, air pollutant and greenhouse gas emissions.

Most of the WRZs in the WReN region are in a healthy surplus, however, the Kielder WRZ and Grid SWZ are presenting deficits. Given this position, options are required to bridge the deficits in these WRZs. For Northumbrian Water, no supply options have been selected in the preferred plan, since demand management alone is sufficient to cover deficits in the Kielder zone. For Yorkshire Water, investment in both supply and demand reduction options is required, therefore the focus of the preferred plan is to address this.

Major adverse impacts for options DV7a(vi) Tees to York Pipeline Option 3 and DV8(iv) York to South Yorkshire Pipeline within the preferred plan are anticipated in relation to biodiversity, material assets and resource use, protection and enhancement of geology/soil quality, and minimisation of greenhouse gas emissions. However these options are also anticipated to be associated with major to moderate beneficial effects on population and human health and climate change resilience due to the increase in available public water supply. The construction phases of an additional four resource options within the preferred plan are anticipated to result in moderate adverse effects on biodiversity in relation to scheme construction and minor adverse effects across a number of SEA objectives including for population and human health and cultural heritage. The remaining six supply side options in the preferred plan are assessed resulting in negligible to minor adverse effects only across all SEA objectives. The majority of resource options provide opportunities to result in biodiversity enhancement (habitat creation/restoration), provide beneficial effects on population and human health and in relation to climate change resilience.

The HRA of the Regional Plan preferred plan has concluded that following inclusion of appropriate mitigation measures during the construction phase of relevant schemes that no adverse effects on the integrity of any European site are anticipated. Further details are provided within the HRA report which accompanies this Environmental Report[1].

The WFD compliance assessment has informed SEA findings against the water topic objectives, and has identified uncertain impacts associated with multiple WFD water bodies in relation to four schemes within the preferred plan: R8b Sherwood Sandstone and Magnesian Limestone Boreholes Option 2, R8g Sherwood Sandstone Boreholes support to North Yorkshire, R13 East Yorkshire Groundwater Option 2, and DV7a(vi) Tees to York Pipeline Option 3. Further investigations will need to be carried out to confirm these impacts before the schemes could be implemented. East Yorkshire Groundwater Option 2 will be within any constraints imposed following Water Industry National Environment Programme (WINEP) investigations. Further details are provided within the WFD compliance assessment report which accompanies this Environmental Report[2].

Implementation of the four options above, as well as options R37b(ii) River Aire Abstraction Option 4 and DV3 South Yorkshire Groundwater, will be dependent on meeting Environment Agency licensing requirements.

Implementation of this plan will result in no deficit in the 25-year period of the Regional Plan.

Table NTS 8 Draft Regional Plan preferred plan

Category	Option Reference	Scheme	Benefit (Ml/d) on full implementation	First Year of Benefit
NWL Demand	BOT-DMO-Med (with leakage reduction	Active Leakage Control to reduce leakage by 50% by 2050	49	2025/26
		Metering Replacement of existing meters with smart	15	2025/26

[1] Ricardo Energy & Environment (2022) Habitats Regulation Assessment of the Draft WRMP24. Report prepared for Yorkshire Water Services, September 2022.

[2] Ricardo Energy & Environment (2022) Water Framework Directive Regulations Compliance Assessment of the Draft WRMP24. Report prepared for Yorkshire Water Services, September 2022.

Category	Option Reference	Scheme	Benefit (Ml/d) on full implementation	First Year of Benefit
	increased to 50%)	meters by 2035 and Enhanced Optant Smart Metering		
		Water Efficiency Programme In home interventions and digital engagement to reduce PCC to 110l/p/d by 2050	47	2025/26
Customer management	C5	Smart metering	31	2025
Leakage	L6	Active leakage control 95 Ml/d	95	2025
Resource	DV3	South Yorkshire groundwater	5	2027
Resource	DV7a(vi)	Tees - York Pipeline Option 3	140	2049
Resource	DV8(iv)	York to South Yorkshire pipeline	N/A – 50Ml/d capacity required to transfer new source of supply to South Yorkshire	2035
Resource	DV8(v)	York WTW capacity increase	50	2029
Resource	R3a	River Ouse licence transfer	0.3 (15 maximum)	2027
Resource	R8b	Sherwood Sandstone and Magnesian Limestone Boreholes Option 2	5	2027
Resource	R8g	Sherwood Sandstone Boreholes support to North Yorkshire	15	2028
Resource	R13	East Yorkshire Groundwater Option 2	6 (8 maximum)	2025
Resource	R31a	Additional bankside storage on the River Ouse	11	2066
Resource	R37b(ii)	River Aire Abstraction Option 4	34	2025
Resource	R85	Recommission Kirklees WTW	8	2068

A visual summary of SEA findings for each of the schemes included in the preferred plan is provided in **Table NTS 9**.

Table NTS 9 Visual summary for options in the preferred plan

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
BOT-DMO-Med	Adverse				None													
	Beneficial																	
C5 Smart Metering and Water Efficiency	Adverse				None		None						None				None	None
	Beneficial				None		None						None				None	None
L6 Active Leakage Control 95Ml/d	Adverse				None													
	Beneficial				None													
DV3 - South Yorkshire Groundwater	Adverse				None							None						
	Beneficial											None						
DV7a(vi) - Tees - York Pipeline Option 1	Adverse				None							None						
	Beneficial											None						

Option	Impact	SEA Objective															
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
DV8 (iv) - York to South Yorkshire Pipeline	Adverse				None					None		None						
	Beneficial									None		None						
DV8 (v) - York WTW Capacity increase	Adverse				None							None						
	Beneficial											None						
R3a River Ouse licence transfer	Adverse				None		None											None
	Beneficial				None		None											None
R8b: Sherwood Sandstone and Magnesian Limestone Boreholes Option 2	Adverse				None							None						
	Beneficial											None						
R8g Sherwood Sandstone Boreholes support to North Yorkshire	Adverse				None							None						
	Beneficial											None						

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
R13 East Yorkshire Groundwater Option 2	Adverse				None							None						
	Beneficial											None						
R31a Additional bankside storage on the River Ouse	Adverse				None							None						
	Beneficial											None						
R37b(ii) River Aire Abstraction Option 4	Adverse											None						
	Beneficial											None						
R85 Rebuild Recommission Kirklees WTW	Adverse				None						None	None	N/A					
	Beneficial				None						None	None	None					

Key:

- Major adverse
- Moderate adverse
- Minor adverse
- Major beneficial
- Moderate beneficial
- Minor beneficial

	Negligible adverse		Negligible beneficial
None	Not applicable		

Cumulative impact assessment

A cumulative assessment of the preferred plan was undertaken to consider whether the preferred plan options, when constructed or operated together, led to additional effects on each of the SEA topics.

The first year of benefit for R31a within the preferred plan is identified as 2066 (see **Table NTS 8**) and this scheme is estimated to be associated with an approximately 4 year construction phase. Both the DV8(iv) and DV8(v) schemes are also estimated to associate with a four year construction period are identified as operational in 2035 and 2029 respectively, and therefore the construction phases will not coincide with that of R31a. The DV7a(vi) scheme is identified as operational in 2049 within the preferred plan (see **Table NTS 8**) with an approximately 15 year construction phase. Therefore no cumulative effects are anticipated.

On the basis of current information the construction phases of the DV8(v) scheme is estimated to run for four years and is not currently expected to overlap with that of the DV7a(vi) and DV8(iv) schemes and therefore no cumulative effects are anticipated.

The DV7a(vi) and DV8(iv) schemes are likely to have overlapping construction phases and there is therefore potential for cumulative impacts between two schemes related to construction impacts on biodiversity (Objective 1.1, Objective 1.3), population and human health (Objective 2.1), material assets and resource use (Objective 3.1), air quality (Objective 6.1), archaeology and cultural heritage (Objective 7.1), and landscape and visual amenity (Objective 8.1). Construction measures that need to be incorporated into the scheme design and/or planning to avoid or mitigate potential effects will be agreed during the detailed design and planning stage should these schemes be progressed. The DV7a(vi) scheme will cover a large geographical area (pipeline construction from the River Tees to Ouse) as will the DV8(iv) scheme (Ouse to South Yorkshire) and therefore until detailed construction plans are available it is not possible to identify if works in proximity to sensitive receptors will coincide. However, any such cumulative impacts would be expected to be minor, as most of these activities would be localised and small in scale, and could be effectively mitigated through careful project management and best practice construction methods

There is no potential for cumulative adverse effects during operation of the schemes included in the preferred plan as there are no water bodies that are impacted by more than one option. There would be benefits associated with implementation of each option in parallel, i.e. increasing the overall volume of water savings made or water provided for supply.

Mitigation

Consideration of mitigation measures has been an integral part of the SEA process. The assessment has assumed the implementation of standard best practice mitigation measures and identified any additional measures as shown in the option SEA matrices (see **Appendix E**). The significance of effects identified in the matrices relates to residual effects after mitigation.

Certain assumptions have been made regarding this:

- Where suitable mitigation measures are known and identified, these have been taken into account and reported, such that the resultant residual impact has been determined.
- In line with recommendations made in the UKWIR SEA Guidance, the SEA appraisals have assumed the implementation of reasonable mitigation, such as the use of best practice construction methods.

Mitigation of both construction and operation components for each option are presented in **Table NTS 7**. The detail of this mitigation needs to be considered during the planning phases of each of the individual measures if and when they are taken forward for implementation. This should then be consolidated into a Construction Environmental Management Plan (CEMP) for the scheme, noting that all works should be carried out in accordance with relevant Construction Design Management (CDM) Regulations 2015. In other cases, best practice design requires consideration of mitigation measures at an early stage along with consultation with potentially affected parties. In this way, effective mitigation plans can be developed to minimise many of the residual adverse effects currently identified in the SEA appraisals.

The CEMP should include further measures to minimise, or where possible, eliminate, adverse effects on various receptors. Mitigation measures employed to reduce the potential adverse effects on sensitive receptors are categorised under each SEA Objective. Mitigation measures are set out in detail in Section 8.3. Examples of mitigation measures are detailed below:

Biodiversity

- where supporting habitat will be directly lost as a result of open cut pipeline installation, the habitat must be reinstated, or trenchless/ directional drilling pipeline installation methods should be alternatively used

Population and human health

- plan construction traffic movements to avoid routes with sensitive receptors and avoid peak traffic hours

Soils, geology and land use

- agricultural soils will be managed, preserved, retained and reinstated in accordance with Department for Environment, Food and Rural Affairs (Defra)

The SEA process has identified potential residual impacts of the Regional Plan preferred plan after mitigation measures have been taken into consideration. **Table NTS 10** summaries the residual effects attributable to the preferred plan for the draft WReN Regional Plan.

Table NTS 10 Residual adverse impacts of options within the preferred plan for the WRMP24

Ref	Option	Construction	Operation
BOT-DMO-Med (with leakage reduction increased to 50%)	Active Leakage Control to reduce leakage by 50% by 2050	No significant effects	No significant effects
	Metering Replacement of existing meters with smart meters by 2035 and Enhanced Optant Smart Metering	No significant effects	No significant effects
	Water Efficiency Programme In home interventions and digital engagement to reduce PCC to 110l/p/d by 2050	No significant effects	No significant effects
C5	Smart Metering and Water Efficiency	No significant effects	No significant effects
L6	Active Leakage Control 95 Ml/d	No significant effects	No significant effects
DV3	South Yorkshire Groundwater	No significant effects	No significant effects
DV7a(vi)	Tees to York Pipeline Option 3	Biodiversity, flora and fauna; Population and human health; Material assets and resource use; Soil, geology and land use; Air and climate; Archaeology and cultural heritage; and, Landscape and visual amenity	No significant effects
DV8(iv)	York to South Yorkshire Pipeline	Biodiversity, flora and fauna; Population and human health; Material assets and resource use; Soil, geology and land use; Air and climate;	No significant effects

Ref	Option	Construction	Operation
		Archaeology and cultural heritage; and, Landscape and visual amenity	
DV8(v)	York WTW Capacity increase	Biodiversity, flora and fauna	No significant effects
L6	Active Leakage Control 95 Ml/d	No significant effects	No significant effects
R3a	Increased River Ouse pump storage capacity	No significant effects	No significant effects
R8b	Sherwood Sandstone and Magnesian Limestone Boreholes Option 2	No significant effects	No significant effects
R8g	Sherwood Sandstone Boreholes support to North Yorkshire	No significant effects	No significant effects
R13	East Yorkshire Groundwater Option 2	Biodiversity, flora and fauna Water quality	No significant effects
R31a	Additional bankside storage on the River Ouse	Biodiversity, flora and fauna	No significant effects
R37b(ii)	River Aire Abstraction Option 4	Biodiversity, flora and fauna	No significant effects
R85	Recommission Kirklees WTW	No significant effects	No significant effects

Potential water resource impacts that could arise due to future, as yet, unknown new abstractions from common sources would be assessed and considered by the Environment Agency as informed by detailed environmental assessment work as part of the abstraction licensing and water resources planning processes.

Liaison with local planning authorities will also be essential to assess any required mitigation measures from any identified cumulative effects on development plans and projects.

Monitoring

Monitoring will be required to track the residual environmental effects to show whether they arise as anticipated in the SEA appraisal, to help identify any adverse impacts and trigger deployment of any of the mitigation measures.

Monitoring recommendations are based on the current understanding of the scheme design. As options are brought forward for development, further monitoring requirements may be set out in planning applications, borehole drilling and pump test consents, or in voluntary best-practice monitoring plans accompanying scheme development. This will be discussed with relevant key regulatory bodies and stakeholders. In practice, close dialogue should occur between WReN, Environment Agency, Historic England, Natural England and any affected third parties to agree the appropriate scale and duration of such scheme-specific monitoring activities proportionate to the assessed environmental risks.

Table NTS 11 lists the potential impacts that may arise from implementation of the Regional Plan preferred plan and which require monitoring in accordance with the SEA Regulations.

Key monitoring parameters at the strategic Regional Plan level will be those relating to the abstraction of water and the effects that this may have on waterbodies and their functions as habitats. (see **Table NTS 8**). There are also direct potential impacts on humans, the built environment, terrestrial habitats,

the atmosphere, landscape and heritage assets, which may arise from construction activities and/or option operation (see **NTS 8**). These parameters should, therefore, be included within the monitoring programme where it is practicable to do so. Extensive primary data collection is neither feasible nor appropriate for this programme level of monitoring, and use should be made where possible of existing datasets and monitoring regimes.

Site-specific monitoring requirements for the resource options included in the preferred plan will be developed during the planning process closer to the time of implementation.

Table NTS 11 Proposed SEA monitoring parameters - strategic Regional Plan monitoring

Impacted receptor/topic	Proposed strategic indicators
Biodiversity	Condition of protected sites, biological monitoring (e.g. macroinvertebrates, macrophytes, fisheries, bird surveys), INNS presence
Water resources, water quality	River flows, river levels, lake and reservoir levels. Groundwater levels. Surface and ground water quality (including proportion of surface water and groundwater bodies at 'Good; WFD status)
Flood risk	Number of properties that experience internal flooding from public sewers.
Soils, geology and land use	Area of previously undeveloped land used during construction
Climate Factors	Net greenhouse gas emissions per million litres (Ml) of treated water (kg CO_2 equivalent emissions per Ml) for Yorkshire Water supply area Energy use used in the operation of options. Renewable energy generated or purchased by Yorkshire Water.
Transport	Transport fleet fuel consumption, emissions and business mileage, as monitored by Yorkshire Water
Nuisance/ Community/ Local Economy	Scheme level community disruption of capital works would be monitored through an Environmental Monitoring Plan if required. Number of nuisance-related complaints (e.g. noise, dust) logged with Yorkshire Water and Local Authority EHOs. Pollution and flooding incidents Responses gauged through Yorkshire Water customer satisfaction surveys. Community investment, employee volunteering and match funding by Yorkshire Water.
Waste and resource use	Leakage Water saved through demand management / water efficiency measures. Amount of recycled / re-used materials. Proportion of waste sent to landfill. Chemical usage in water treatment.

Impacted receptor/topic	Proposed strategic indicators
Air Quality	Scheme related issues of capital works would be monitored through an Environmental Monitoring plan if required. Changes in air quality are monitored by the Automatic Urban and Rural Network[3] administered by Bureau Veritas, and this data would be available if required to inform a baseline
Cultural Heritage	Loss / damage or discovery / protection of cultural, historic and industrial heritage features. Condition of buried archaeology would be monitored during construction e.g. through appropriate archaeological investigations and watching briefs as required. Consultation with relevant stakeholders to ensure impacts are minimised, e.g. to water level dependent assets. Historic England monitor parameters such as Listed Buildings and Scheduled Monuments, in order to maintain a 'Heritage at risk' register.
Landscape	Loss or damage to landscape character and features of designated sites.

The SEA Regulations states that monitoring must enable appropriate remedial action to be taken. For the monitoring programme to be effective, there must therefore be a mechanism in place to detect trends and to ensure that action is taken where trends are progressively adverse.

Assessment of monitoring and any measures taken would be included within the SEA for the subsequent draft Regional Plan development. Through the proposed monitoring and analysis of the results obtained over the intervening period, the SEA will inform and influence the development of the Regional Plan for future periods.

Consultation

The SEA Regulations require consultation at the scoping stage and on the assessments documented in the Environmental Report. Scoping with the statutory consultation bodies defined by the SEA Regulations (the Environment Agency, Natural England and Historic England) is mandatory at both stages. Consultation with the public is only mandatory at the Environmental Report stage.

The Environmental Report is now being published for consultation. It also provides a useful reference point for consultees wishing to express their views on WReN's draft Regional Plan.

On adoption of the final Regional Plan, after approval by Defra, WReN will publish an SEA Post-Adoption Statement setting out how the SEA and any views expressed by the consultation bodies or the public have influenced the final Regional Plan.

[3] Accessed at http://www.bv-aurnsiteinfo.co.uk/

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Appendices

1 Introduction

1.1 Background

Water Resources North (WReN) is one of five regional water resources groups working under the National Framework for Water Resources (the 'National Framework')[4].

WReN are developing a regional water resources plan for Yorkshire and the North East of England (the 'Regional Plan') to help to facilitate sustainable growth across Yorkshire, the Humber and the North East, whilst also protecting and enhancing the region's valuable natural environment. As the region has an assumed surplus of water, WReN are working with other regional water resources groups (principally Water Resources West and Water Resources East) to help secure resilient water supplies for the country as a whole.

A fundamental part of producing the Regional Plan is integrating environmental effects into the decision-making process to select the preferred plan and also evidencing compliance with the environmental legislation. The aim of environmental assessment within the plans is to provide for a high level of protection of the environment, integrating environmental considerations into the preparation and adoption of the plan with a view to contributing to sustainable development. Throughout the course of the development of the Regional Plan, the environmental assessments will seek to identify, describe and evaluate the likely significant effects on the environment of implementing the plan, as well as proposing measures to avoid, manage or mitigate any significant adverse effects and to enhance any beneficial effects.

These assessments consist of:

- Strategic Environmental Assessment (SEA) incorporating Invasive Non-Native Species assessment (INNS) and Biodiversity Net Gain (BNG);
- Habitats Regulation Assessment (HRA); and
- Water Framework Directive (WFD) assessment.

The Regional Plan option appraisal also integrates Natural Capital Assessment (NCA) within the WReN Options Appraisal workstream.

This Environmental Report presents the findings of the SEA of the Regional Plan. The HRA and WFD are documented separately[5,6].

1.2 Description of the WReN Regional Plan

WReN is designed to oversee water resources planning for Yorkshire and the North East of England. It is formed of three water companies operating in the north east of England, including Yorkshire Water, Northumbrian Water and Hartlepool Water (part of Anglian Water), as shown in Figure 1.1. Although WReN's core members and funders are the three water companies, key regulators and stakeholders act to provide support on direction and decisions in an advisory capacity. Further information can be found on the WReN website7.

WReN is actively engaging with and involving those who have an interest in water resources in the region. This includes sectors other than public water supply who make beneficial use of the water in the environment, such as agriculture, industry and energy. The importance of water to the region's environment, ecology and biodiversity will also play a key role in shaping WReN's future plans.

WReN are working with water companies and their customers, other water dependent sectors of the economy such as the agriculture and power sectors, and environmental groups and regulators. WReN's

[4] https://www.gov.uk/government/publications/meeting-our-future-water-needs-a-national-framework-for-water-resources
[5] WReN (2022) Water Resources North Draft Regional Plan: Habitats Regulation Assessment, November 2022. Report prepared by Ricardo Energy & Environment.
[6] WReN (2022) Water Resources North Draft Regional Plan: Water Framework Directive Compliance Assessment, October 2022. Report prepared by Ricardo Energy & Environment.
[7] https://www.waterresourcesnorth.org/

aim is to develop a long-term plan for managing water resources in the region, which is being published for consultation in November 2022.

Where the Regional Plan impacts on public water supply – the drinking water that is supplied by the water companies in the WReN region – it will be reflected in the water companies' statutory draft Water Resource Management Plans (WRMPs) which have been submitted to Defra in October 2022 and will be consulted on shortly afterwards.

Where this plan affects other sectors (e.g. the agriculture and power sectors) and environmental groups, WReN are working with those sectors to understand how they can also support long term water resources resilience in the north, including looking for opportunities for collaborative solutions. WReN have established an environmental destination workstream which is taking an evidence-based approach to environmental destination, working across these key sectors and with regional and local groups, such as catchment partnerships, to identify environmental improvements that are meaningful to the WReN region and its catchments. The outcomes of this workstream are reported separately[8].

The options identification process has resulted in a list of feasible supply options to meet the needs of the region which could be used for public water supply, non-public water supply or environmental improvements. The options assessed in this report include a range of supply and demand management options.

The Water Resources West (WRW) draft Regional Plan includes consideration of the reduction or cessation of an existing Severn Trent Water import to Yorkshire Water. Severn Trent Water and Yorkshire Water are working collaboratively to develop an alternative option to raise the Derwent valley reservoirs (which would provide the transfer volume). This option has entered the RAPID gated process as a SRO and will undergo significant further work, including environmental assessment in order to determine its feasibility.

1.3 Relevant Guidance

The Environment Agency's National Framework[9] sets out the requirement for development of regional plans.

The National Framework Appendix 2 'Regional Planning' provides a framework for Regional Plans and sets out the actions that 'must, should and could' feature in regional plans. Amongst the requirements are that it:

- must include enhanced environmental improvements;
- must also comply with SEA and HRA legislation;
- should look to use the natural capital approach in their decision making where appropriate; and
- must include environmental net gain in their decision making, to achieve measurable improvements for the environment on a regional and local level.

The decision making process for determining WReN solutions to regional and national needs will be developed following the Environment Agency Water Resource Planning Guidelines (WRPG)[10] and supplementary guidelines. The Supplementary Guidance 'Environment and society in decision making'[11] and contains a number of requirements and recommendations for the scope of WRMP environmental assessment, in particular in relation to SEA, BNG and NCA. The Regional Plan will need to be reflected in the WRMPs and the assessments will therefore need to be consistent with the requirements of the WRPG.

[8] WReN (2022) Emerging Regional Plan for Informal Consultation (January 2022) – Appendix 6 Environmental Destination
[9] https://www.gov.uk/government/publications/meeting-our-future-water-needs-a-national-framework-for-water-resources
[10] Environment Agency (2022) Water resources planning guideline, July 2022. Available at Water resources planning guideline - GOV.UK (www.gov.uk)
[11] Environment Agency (2021) Water resources planning guideline supplementary guidance – Environment and society in decision-making, External guidance: 18643. November 2021.

UK Water Industry Research (UKWIR) have developed a number of methodologies which support the WRPG. This includes an updated guidance document for SEA, HRA, and new guidance for WFD assessment and NCA for strategic water resource plans and drought plans[12]. The guidance has been updated for WRMP24 and regional plans to account for recent developments in regulatory guidance, new legislation and current best practice methods.

The UK Government has also produced generic SEA guidance[13] that sets out the stages of the SEA process - the 'Practical Guide', which provides best practice guidance.

1.3.1 All Company Working Group methodologies

As part of the assessment of water companies' PR19 business plans, Ofwat introduced proposals in their December 2019 Final Determination[14] to support the delivery of Strategic Regional Water Resource Options (SROs) over the next 5 to 15 years with solutions required to be 'construction ready' for the 2025-2030 period. Ofwat set out a RAPID gateway process[15], for development of SROs for the co-ordination and development of a consistent set of SROs.

In October 2020, the group of Water Companies involved in developing SROs in the RAPID gateway process (known as the All Company Working Group - ACWG), published guidance[16] for environmental assessment methods for SROs which is aligned to the draft WRPG to increase the consistency of environmental assessment. This is supplemented with the ACWG Strategic Environmental Assessment: Core Objective Identification report (October 2020). These being the SEA objectives that the ACWG identified following a review of Water Company approaches to SEA.

The development of methodologies for the WReN environmental assessment has had regard to the ACWG guidance and the RAPID requirements as much as is practicable. This will facilitate inter-regional comparison and future assessment of any WReN options which enter the RAPID gateway process. This would include the Severn Trent Water (STW) and Yorkshire Water Derwent Valley dam raising option which has recently entered the RAPID gated process as a SRO.

Yorkshire Water and STW are developing a Strategic Resource Option (SRO) that would increase the reservoir capacity in the STW supply area with potential to meet STW's needs and allow the transfer to Yorkshire to be maintained. However, during the third round of the reconciliation process, Water Resources West's (WRW) options appraisal concluded STW would be required to both stop the transfer *and* increase its reservoir capacity to meet its own supply–demand balance deficit. This means that the most likely scenario is that the transfer will cease in 2035 and we have included this loss of resource in our baseline supply–demand balance. The transfer is currently a critical source of supply to the South Yorkshire area and our plan must include a new source of supply to this area to offset the loss of the transfer.

1.4 SEA approach

SEA is a statutory requirement under the Environmental Assessment of Plans and Programmes Regulations 2004 ('the SEA Regulations') requiring the assessment of effects of certain plans and programmes on the environment. The objective of SEA is to:

> '*provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans with a view to promoting sustainable development'.*

[12] UKWIR (2021) Environmental Assessment Guidance for Water Resources Management Plans and Drought Plans. Report Ref 21/WR/02/15.
[13] Office of the Deputy Prime Minister (2005). A Practical Guide to the Strategic Environmental Assessment Directive.
[14] Ofwat (2019) PR19 Final Determinations, Strategic regional water resource solutions appendix
[15] Regulatory Alliance for Progressing Infrastructure Development (RAPID) Gated planning process https://www.ofwat.gov.uk/regulated-companies/rapid/
[16] Mott MacDonald Limited (2020). All Companies Working Group WRMP environmental assessment guidance and applicability with SROs. Published October 2020

The SEA Regulations requires preparation of an Environmental Report in which the likely significant effects on the environment of implementing the plan or programme, and reasonable alternatives taking into account the objectives and geographical scope of the plan or programme, are identified, described and evaluated.

1.4.1 Information requirements

Schedule 2 of the SEA Regulations requires the following specific information to be included within the Environmental Report:

- An outline of the contents and main objectives of the plan or programme, and of its relationship with other relevant plans and programmes. (see Section 2).
- The relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme (see Section 3).
- The environmental characteristics of areas likely to be significantly affected (see Section 3).
- Any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Directives 79/409/EEC (the 'Birds Directive') and 92/43/EEC (the 'Habitats Directive') (see Sections 1.5 and 1.6).
- The environmental protection objectives, established at international, (European) Community or Member State level, which are relevant to the plan or programme and the way those objectives and any environmental considerations have been taken into account during its preparation" (see Section 4).

1.4.2 Purpose of the Environmental Report

SEA incorporates the following generic stages as set out in the UK Government Practical Guide[13]:

- Stage A: Setting the context, identifying objectives, problems and opportunities, and establishing the environmental baseline (scoping).
- Stage B: Developing and refining options and assessing effects (impact assessment).
- Stage C: Preparing the Environmental Report (recording results).
- Stage D: Consulting on the Draft Plan and the Environmental Report (seeking consensus).
- Stage E: Monitoring the significant effects of the plan or programme on the environment (verification).

This Environmental Report documents stages B and C of the SEA being undertaken by WReN to establish the environmental effects of the regional water resources planning for Yorkshire and the North East of England. The purpose and scope of the WReN regional plan is explained in more detail in Section 1.2.

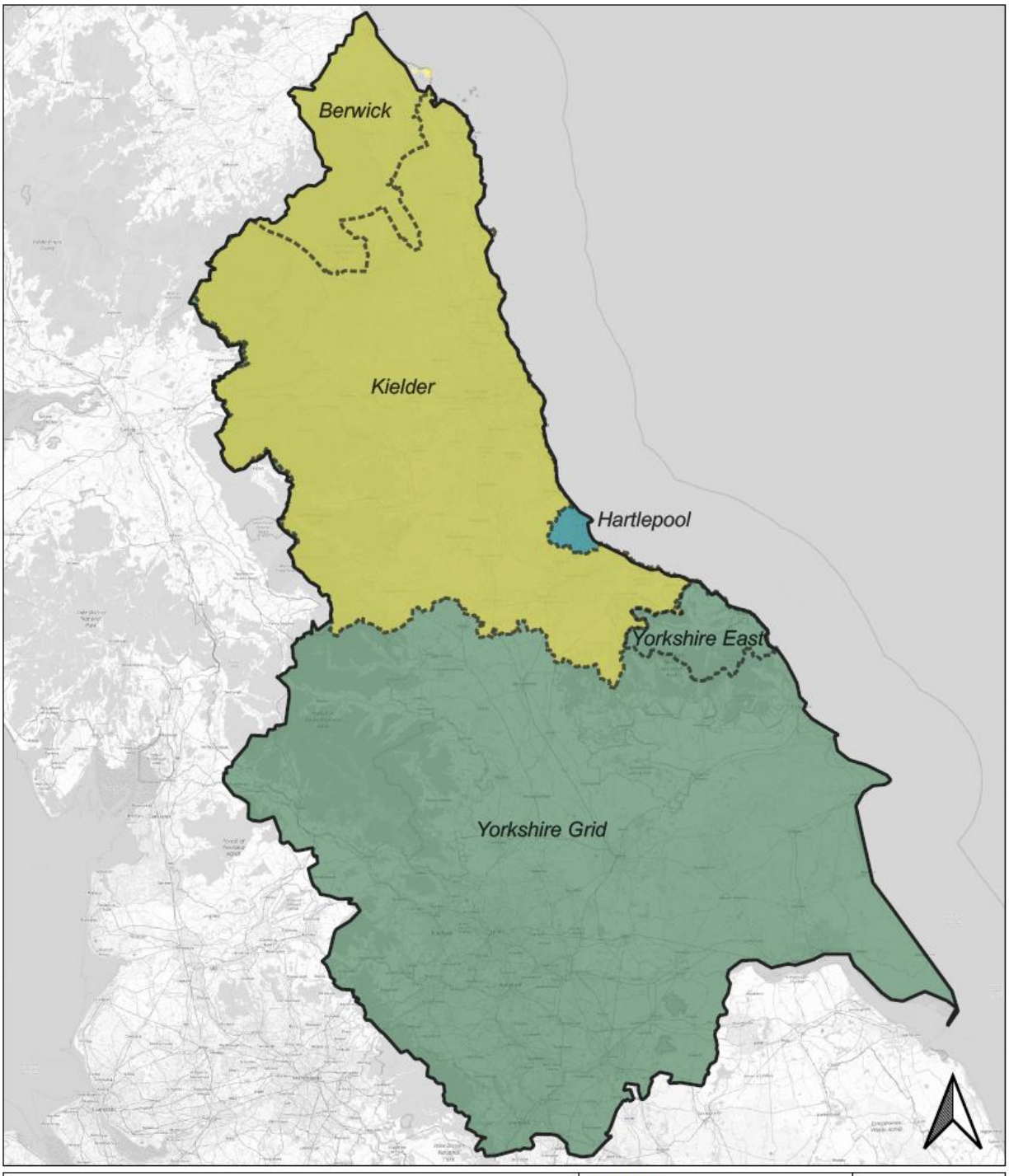
The requirements of the Environmental Report are set out in Regulation 12 of the SEA Regulations. According to Regulation 12(2) the Environmental Report shall

> *'identify, describe and evaluate the likely significant effects on the environment of-*
>
> > *a) implementing the plan or programme; and*
> >
> > *b) reasonable alternatives taking into account the objectives and the geographical scope of the plan or programme.*

Schedule 2 of the SEA Regulations lists specific items of information which should be included in the Environmental Report. The Practical Guide provides a Quality Assurance checklist to help ensure that the requirements of the SEA Directive are met throughout the entire process. Compliance against this checklist is set out in **Appendix A**.

This Environmental Report identifies the baseline information for supply options under consideration for the WReN regional plan (a 'feasible list' of options), as well as identifying their environmental effects (beneficial or adverse). It also identifies the potential mitigation and enhancement measures, and suggests monitoring that could be undertaken to track the environmental effects of the plan once implemented.

Figure 1.1: Study Area and Relevant Water Company Boundaries



1.5 Habitats Regulations Assessment

The HRA has been undertaken in accordance with available guidance[17,18,19,20,21,22,23] and is based on a precautionary approach as required under the Conservation of Habitats and Species Regulations 2017 (as amended). A HRA Test of Likely Significance has been applied as a first step during assessment of the Regional Plan option list.

The objective of a HRA is to establish whether a plan or project is likely to have a significant effect on European sites (alone or in-combination with other plans or project), adopting the precautionary principle (Stage 1 Screening), and where likely significant effects cannot be ruled out, to determine through Appropriate Assessment (Stage 2 Appropriate Assessment) whether the plan or project would adversely affect the integrity of an European site(s). Where significant adverse effects are identified at the Appropriate Assessment stage, the derogation process would apply (Stage 3 Alternative Solutions and Stage 4 Imperative Reasons of Overriding Public Interest (IROPI)).

As the Draft Regional Plan submission does not form a statutory plan or project, the principles of the HRA process have been applied to help identify *risks to feasibility* and deliverability of the option components. A Stage 1 screening will be undertaken as part of the initial screening exercise for each of the feasible options.

The HRA Stage 1 screening[5] of feasible options has been completed prior to SEA option-level assessments has informed the SEA (biodiversity topic).

Following recent case law developments including the 'People over Wind' judgement, a number of options would require Stage 2 Appropriate Assessment should the options be included in the preferred plan. The approach will be 'appropriate' to the level of detail of this strategic plan whilst demonstrating compliance. It is unlikely that schemes will be included in the Regional Plan if an Appropriate Assessment cannot conclude no effect on site integrity, therefore, it is unlikely that HRA Stages 3 or 4 will be required.

1.6 Water Framework Directive Assessment

The WFD assessment's purpose is to ensure the Regional Plan both helps to avoid the deterioration and contribute to the improvement of the status of water bodies, including rivers, lakes, groundwater and estuarine and coastal waters.

A robust, practical approach has been used to deliver a proportionate WFD compliance assessment that complies with statutory requirements and regulatory guidelines. The approach has been primarily based on that set out in the updated UKWIR Guidance[24].

A sequential 4-stage process for undertaking WFD compliance assessments will be applied through the development of the Regional Plan. The sequential four steps are as follows:

1. WFD compliance assessment screening: involves a preliminary assessment of each option and identifies whether there may be any risk of deterioration in WFD status. This is based on expert judgement. Where a risk is identified, the option is subject to the WFD compliance assessment.

2. WFD compliance assessment: This involves assessment of the likely changes to hydro-

[17] European Commission Environment DG (2001) Assessment of plans and projects significantly affecting European Sites. Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC.
[18] Department for Communities and Local Government (DCLG) (2006) Planning for the Protection of European Sites. Guidance for Regional Spatial Strategies and Local Development Documents.
[19] English Nature (1997) The Appropriate Assessment (Regulation 48) The Conservation (Natural Habitats &c) Regulations, 1994. Guidance Note HRGN1.
[20] English Nature (1997) The Determination of Likely Significant Effect under The Conservation (Natural Habitats &c.) Regulations 1994. Guidance Note HRGN3.
[21] Defra (2012) The Habitats and Wild Birds Directives in England and its seas: Core guidance for developers, regulators & land/marine managers.
[22] Tyldesley, D. & Chapman, C. (2013) The Habitats Regulations Assessment Handbook. December 2020 edition DTA Publications.
[23] Environment Agency (2020). Water resources planning guideline – draft for consultation July 2020
[24] UKWIR (2021) Environmental Assessment Guidance for Water Resources Management Plans and Drought Plans. Report Ref 21/WR/02/15.

morphology and water quality occurring as a result of the construction or operation of the option and the possible risks to WFD status. In addition, the potential effects on WFD protected areas are assessed. .

3. Option level WFD compliance assessment: This involves summarising WFD compliance assessments of each of the options on the feasible list (from Steps 1 and 2).

4. Preferred plan WFD compliance statement: This involves a statement of the compliance of the preferred plan against each of the WFD compliance objectives (set out below). This involves assessment of the set of options within the programme, both alone and in combination with other options within the programme. The assessment is also used to identify where multiple options potentially impact on the same WFD waterbody, and potentially downstream waterbodies where appropriate.

Findings from the WFD compliance assessment have been integrated into assessments of relevant SEA topics.

1.7 Consultation

The SEA Regulations require consultation at the scoping stage and on the assessments documented in the Environmental Report. Scoping with the statutory consultation bodies defined by the SEA Regulations (the Environment Agency, Natural England and Historic England) is mandatory at both stages. Consultation with the public is only mandatory at the Environmental Report stage.

1.7.1 Consultation on the Scoping Report

The WReN Environmental Assessment Scoping Report[25] was issued for consultation on 20 April 2021 to statutory and stakeholder consultees. This included the Environment Agency, Historic England, Natural England, Energy UK, Aire Rivers Trust, Tyne Rivers Trust, National Farmers Union, Canal and Rivers Trust and the Royal Society for the Protection of Birds.

Consultation bodies were invited to express their views on the WReN Environmental Assessment Scoping Report and the scope of the SEA proposed in accordance with SEA Regulation 12(5).

Scoping consultation comments received from statutory consultees with responses to those comments set out in **Appendix B**, along with the consequent actions. The assessment stage was undertaken according to the scope and approach agreed through consultation on the Scoping Report.

1.7.2 Consultation on the Environmental Report

This Environmental Report has been produced in accordance with the approach agreed by WReN and taking into consideration the responses received from consultation bodies in response to the Scoping consultation. SEA reporting provides assessments of the likely significant effects of the Regional Plan options considered by WReN. In January 2022 WReN published an 'Emerging Regional Plan for consultation' and this was accompanied by an interim SEA Environmental Report. Consultation responses received on the January submission have been taken into account in updating the Environmental Report. This information is set out in this Environmental Report, which will is being publicly consulted upon alongside the draft WReN Regional Plan in November 2022.

1.8 Structure of the Environmental Report

This Environmental Report is the output of Stages B and C of the SEA process and documents the findings throughout the SEA process as described in Section 1.1. It has been prepared to facilitate

[25] WReN (2020) Water Resources North Regional Plan Environmental Assessment Scoping Report. Report produced by Ricardo Energy & Environment. Available at https://www.waterresourcesnorth.org/globalassets/water-resources-north/water-resources-north-environmental-assessment-scoping-report.pdf

consultation on the SEA process and outcomes (Stage D). The Environmental Report is structured as follows:

- **Section 1** –describes the WReN Regional Plan and the approach to regional water resources management planning, as well as the requirement for, purpose and process of the SEA, and its context in relation to the WReN Regional Plan.
- **Section 2** – summery of policy context, key messages and environmental protection and social objectives from a review of relevant policies and plans. Further details are provided in **Appendix C**.
- **Section 3** – summary of environmental baseline review and the key environmental and social issues considered in the SEA. Identifies the current and future baseline conditions within the area of potential influence of the Regional Plan. Also included is a discussion of limitations identified in the data and the reasoning behind any assumptions made. Further details are provided in **Appendix D**.
- **Section 4** – Describes the methodological framework and processes that have been used to undertake the SEA of the individual options and assess any potential cumulative effects of options included in the WReN Regional Plan.
- **Section 5** – Assessment of individual Regional Plan options, presents the potential impacts of the various options against the SEA framework. Full details are provided in **Appendix E**.
- **Section 6** – Provides an assessment of options and cumulative effects assessment, discussing the potential in-combination impacts of individual options within the preferred plan and with other relevant programmes, plans and projects.
- **Section 7** – Outlines the assessment of the WReN regional preferred plan, alternative plans considered and associated cumulative assessments on an option and programme level, discussing the potential in-combination impacts of individual options within the preferred plan and with other relevant programmes, plans and projects.
- **Section 8** – Mitigation and enhancement, discusses measures envisaged to prevent, reduce and offset any significant adverse effects of implementing the plan.
- **Section 9** – Monitoring to track the environmental effects against the assessments, to help identify any adverse impacts and trigger deployment of any mitigation measures where necessary.

2 Policy context

2.1 Introduction

Schedule 2 of the SEA Regulations requires the following specific information to be included within the Environmental Report:

> *'An outline of the contents and main objectives of the plan or programme, and of its relationship with other relevant plans and programmes.'*
>
> *'the environmental protection objectives, established at international, Community or Member State level, which are relevant to the plan or programme and the way those objectives and any environmental considerations have been taken into account during its preparation.'*

In accordance with the Regulations, a review of relevant plans and programmes is presented in Section 2.2. A summary of their key objectives is presented in **Table 3.1**. These objectives were originally identified in the Environmental Assessment Scoping Report[25].

2.2 Review of plans, policies and programmes

A summary of key messages derived from the review is presented below in **Table 2.1**. The review identifies how the WReN Regional Plan might be influenced by other plans, policies, programmes and other objectives which the Regional Plan should consider. This information has helped to identify and inform the scope of the assessment, in particular the objectives for the SEA process.

Relevant plans, policies and programmes were identified from the wide range that has been produced at an international, national, regional and local level. The emphasis is on "relevant": plans and programmes that have no likely interaction with the Regional Plan (i.e. they are unlikely to influence the Regional Plan , or be influenced by it), have been excluded from the review.

The review and the key messages derived from it are documented in **Appendix C**. Alongside the current and future baseline information reviewed in Section 3, the key messages have been used to develop proposed objectives for the SEA (see Section 4).

Table 2.1 Key policy messages and objectives from the review of plans, policies and programmes

SEA Topic	Key Messages and Objectives
Biodiversity, flora and fauna	Conservation and enhancement of the natural environment and of biodiversity, particularly internationally and nationally designated sites and priority habitats and species (NERC Act Section 41 for England), whilst taking into account future climate change. Promote a catchment-wide approach to water use to ensure better protection of biodiversity. To achieve favourable condition for priority habitats and species in particular designated sites. Avoidance of activities likely to cause irreversible damage to natural heritage. Support well-functioning ecosystems, respect environmental limits and capacities, and maintain/enhance coherent ecological networks, including provision for fish passage and connectivity for migratory/mobile species. Strengthen the connections between people and nature and realise the value of biodiversity. Protection, conservation and enhancement of natural capital. Ecosystem services from natural capital contributes to the economy and therefore should be protected and, where possible, enhanced. Avoidance of activities likely to cause the spread of Invasive Non-Native Species (INNS) A need to protect the green infrastructure network.
Population and human health	Water resources play an important role in supporting the health and recreational needs of local communities and businesses. To ensure all communities have a clean, safe and attractive environment in which people can take pride. To ensure secure, safe, reliable, dependable, sustainable and affordable supplies of water are provided for all communities. Access to high quality open spaces and opportunities for sport and recreation can make an important contribution to the health and well-being of communities. Promotion of healthy communities and protection from risks to health and wellbeing. Promotion of a sustainable economy supported by access to essential utility and infrastructure services.
Material assets and resource use	Promote sustainable production and consumption whilst seeking to reduce the amount of waste generated by using materials, energy and water more efficiently. Consider issues of water demand, water supply and water quality in the natural environment and ensure a sustainable use of water resources. Contribute to a resource efficient, green and competitive low carbon economy. Maintain a reliable public water supply and ensure there is enough water for human uses, whilst seeking to maintain a healthy water environment.

SEA Topic	Key Messages and Objectives
	Minimise the production of waste, ensure waste management is in line with the 'waste hierarchy', and eliminate waste sent to landfill. Promote the sustainable management of natural resources.
Water	Promote sustainable water resource management, including a reduction in water consumption. Maintain and improve water quality and water resources (surface waters, groundwater and bathing water). Meet protected area targets related to water quality and flow in the Water Framework Directive. Expand the scope of water quality protection measures to all waters, surface waters and groundwater. Improve the quality of the water environment and the ecology which it supports, and continue to provide high levels of drinking water quality. Ensure appropriate management of abstractions and protect flow and level variability across the full range of regimes from low to high conditions. Prevent deterioration of water body status. Balance the abstraction of water for supply with the other functions and services the water environment performs or provides. Steer new development to areas with the lowest probability of flooding and manage any residual flood risk, taking account of the impacts of climate change. Promote measures to enable and sustain long term improvement in water efficiency. Promote a catchment based approach to the management and work with local stakeholders to deliver catchment-based solutions to water quantity and quantity. Develop a resilient and flexible water management approach to cope with changing climate, population and economic conditions. Reduce flood risk to people, residential and non-residential properties, community facilities and key transport links, as well as designated nature conservation sites and heritage assets and landscapes of value. Reduce risk of flooding by changing operation of reservoirs.
Soil, geology and land use	Protect and enhance the quality and diversity of geology (including geological SSSIs) and soils, including geomorphology and geomorphological processes which can be lost or damaged by insensitive development. Ensure that soils will be protected and managed to optimise the varied functions that soils perform for society (e.g. supporting agriculture and forestry, protecting cultural heritage, supporting biodiversity, as a platform for construction), in keeping with the principles of sustainable development.

SEA Topic	Key Messages and Objectives
	Promote catchment-wide approach to land management by relevant stakeholders, in order to benefit natural resources, reduce pollution and develop resilience to climate change. Promote mixed use developments, and encourage multiple benefits from the use of land in urban and rural areas, recognising that some open land can perform many functions. Encourage the effective use of land by reusing land that has been previously developed (brownfield land), provided that it is not of high environmental value.
Air and climate	Reduce greenhouse gas emissions. Targets include: reduce the UK's greenhouse gas emissions by at least 80% (relative to 1990 levels) by 2050. Reduce the effects of air pollution on ecosystems. Improve overall air quality. Minimise energy consumption, support the use of sustainable/renewable energy and improve resilience to climate change. Build in adaption to climate change to future planning and consider the level of urgency of associated risks of climate change impacts accordingly. Need for adaptive measures to respond to likely climate change impacts on water supply and demand. Achieve and sustain compliance with and contribute towards national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas. Minimise energy consumption, support the use of sustainable/renewable energy and improve resilience to climate change.
Archaeology and cultural heritage	Built development in the vicinity of historic buildings and Scheduled Monuments could have implications for the setting and/or built fabric and cause damage to any archaeological deposits present on the site. Ensure active management of the Region's environmental and cultural assets. Ensure effects resulting from changes to water level (surface or sub-surface) on all heritage assets are avoided. Consider effects on important wetland areas with potential for paleo-environmental deposits. Promote the conservation and enhancement of the historic environment, including the promotion of heritage and landscape as central to the culture of the region and conserve and enhance distinctive characteristics of landscape and settlements. Conserve and enhance the historic environment, heritage assets and their settings.

SEA Topic	Key Messages and Objectives
Landscape and visual amenity	Protection and enhancement of landscape (including designated landscapes, landscape character, distinctiveness and the countryside) Abstraction and low river flows could negatively affect landscape and visual amenity. Enhance the value of the countryside by protecting the natural environment for this and future generations. Improve access to valued areas of landscape character in sustainable ways to enhance its enjoyment and value by visitors and stakeholders.

3 Environmental baseline review

3.1 Introduction

Schedule 2 of the SEA Regulations requires the following specific baseline information to be included within the Environmental Report:

> *'the relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme'*
>
> *'the environmental characteristics of areas likely to be significantly affected'*
>
> *'any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Council Directive 79/409/EEC on the conservation of wild birds and the* [92/43/EEC] *Habitats Directive.'*

An essential part of the SEA process is to identify the current baseline conditions and their likely evolution in the absence of the Regional Plan. It is only with knowledge of baseline conditions that potential impacts of the Regional Plan and its schemes can be identified, monitored, and if necessary mitigated.

Baseline data have been drawn from a variety of sources, including a number of the plans, policies and programmes reviewed and summarised earlier in **Table 2.1** and **Appendix C**.

The baseline data are presented in **Appendix D**. The likely future trends in the environmental and social issues considered (where information is available to do so) are also summarised. The key issues arising from the review of baseline conditions (and of relevant plans, programmes and policies) are summarised in Section 3.5.

3.2 Spatial extent of the SEA

The WReN region encompasses a varied landscape, from the Peak District National Park in the South West, stretching to the Northumberland National Park to the south of Scotland, and the North Sea coastline along the Eastern side of the region. Annual average rainfall across the region varies; highest near the Yorkshire Dales, whilst low lying and coastal areas, such as Berwick-upon-Tweed, average less than half the volume of rainfall each year, with little seasonal variation.

The WReN Regional Plan options may have effects outside of the WReN geographical region, for example export options to neighbouring regional groups such as Water Resources West and/or Water Resources East. Where this is the case the effects of the option in its entirety will be considered in the appraisal against the SEA objectives and documented in the Environmental Report. Where an option will potentially be included in the WReN Regional Plan and a neighbouring area Regional Plan the two groups will collaborate on the environmental assessment to ensure consistency in data inputs and assessment approach.

3.3 Temporal scope of the SEA

The current environmental and social baseline for the SEA study area is described in **Appendix D**, together with the likely future changes to this baseline as currently understood. The temporal period covered by the Regional Plan is potentially of long duration as the Regional Plan looks as far out as 2080, presenting uncertainties in characterising the future baseline which increases with time. These will need to be updated as part of the next regional plan process leading up to the next Regional Plan submission, as well as for subsequent submissions.

3.4 Limitations of the data and assumptions made

The principal limitations surround the future social and environmental baseline where there are substantial differences in the availability and temporal resolution of robust projections across the various SEA topic areas: for example, whilst some water companies are planning up to 80 years ahead and

climate change estimates extend to a similar horizon, regional population and housing forecasts rarely go beyond a 40 year horizon and forecasts of how the natural environment may change are very limited.

The study area for the SEA is relatively large and covers a number of different geographical and political regions, which makes establishing a baseline at the sub-regional level challenging. There are also challenges around extrapolating information from data collated at differing spatial resolutions. Spatial data have been obtained for most of the SEA topics, and the baseline is presented graphically as mapped information where appropriate. In some instances, reporting cycles mean that available information is dated.

Data have generally been sourced from national or regional bodies where information is collected for the Yorkshire and North East region using consistent methods. This allows for a more effective comparison between the regional and national averages; however, reliance on these data sets has in some cases meant that information is a number of years old.

3.5 Key issues

The baseline was set out in the Scoping Report and has been updated based on feedback provided through consultation. The baseline is detailed further in **Appendix D**. Key issues arising from the review of baseline conditions for each of the SEA topics are summarised in **Table 3.1**. These key issues have been used to support the development of the SEA objectives in Section 4.

Table 3.1 Summary of key sustainability issues

SEA topic	Key issues
Biodiversity, flora and fauna	• The need to protect or enhance the region's biodiversity, particularly protected sites designated for nature conservation. • The need to avoid activities likely to cause irreversible damage to natural heritage. • The need to take opportunities to improve connectivity between fragmented habitats. • The need to control the spread of Invasive Non-Native Species (INNS). • The need to engage more people in biodiversity issues so that they personally value biodiversity and know what they can do to help, including through recognising the value of the ecosystem services.
Population and human health	• The need to ensure water supplies remain affordable especially for deprived or vulnerable communities • The need to ensure continued improvements in levels of health across the region, particularly in urban areas and deprived areas. • The need to ensure water quantity and quality is maintained for other users including tourists, recreational users and other users such as farmers. • The need to ensure a balance between different aspects of the built and natural environment that will help to provide opportunities local residents and tourists, including opportunities for access to recreation resources and the natural and historic environment. • The need to accommodate an increasing population, that is geographically spread, focussed around several economic centres. • Sites of nature conservation importance, heritage assets, water resources, important landscapes and public rights of way contribute to recreation and tourism opportunities and subsequently health and well-being and the economy.

SEA topic	Key issues
Material assets and resource use	• The need to minimise the consumption of resources, including water and energy, reducing resource demand per capita. • The need to reduce the total amount of waste produced in the region, from all sources, and to reduce the proportion of this waste sent to landfill. • Need to reduce leakage from the water supply system. • The need to encourage more efficient water use. • The need to support regional and national commitments to decarbonisation.
Water	• The need to further improve the quality of the regions river, estuarine and coastal waters taking into account WFD status targets. • The need to maintain the quantity and quality of groundwater resources taking into account WFD status targets. • The need to improve the resilience, flexibility and sustainability of water resources in the region, particularly in light of potential climate change impacts on surface waters and groundwaters. • The need to ensure sustainable abstraction. • The need to ensure that people understand the value of water. • The need to reduce and manage flood risk.
Soil, geology and land use	• The need to protect geological features of importance and maintain and enhance soil function and health, including protecting Best and Most Versatile Agricultural land from development and pollution. • The need to manage the land more holistically at the catchment level, benefitting landowners, other stakeholders, the environment and sustainability of natural resources (including water resources). • The need to make use of previously developed land (brownfield land) and to reduce the prevalence of derelict land in the region.
Air and climate	• The need to reduce air pollutant and greenhouse emissions and limit air emissions to comply with air quality standards. • The need to mitigate against climate change through the reduction in greenhouse gas emissions to contribute to risk reduction over the long term. • The need to adapt to the impacts of climate change for example through, sustainable water resource management, specific aspects of natural ecosystems (e.g. connectivity) as well as accommodating potential opportunities of climate change. • The need to work towards achieving net zero emissions by 2030.
Archaeology and cultural heritage	• The need to conserve or enhance sites of archaeological importance and cultural heritage interest and their settings, particularly those which are sensitive to the water environment. • Ensure that any new infrastructure, provided in order to maintain or improve water resources within the District, does not impact upon the cultural heritage interest, or their settings.

SEA topic	Key issues
	• The need to prevent any further assets in the Yorkshire Water Area from entering the Heritage At Risk Register.
Landscape and visual amenity	• The need to protect and improve the natural beauty of the region's AONBs and other areas of natural beauty. • It is envisaged that landscape and designated sites will be maintained and enhanced for the enjoyment of the public. • The need to preserve Green Belt and openness in the area. • The need to ensure that local character is maintained, in the face of pressures from development and climate change.

4 Assessment methodology

4.1 SEA objectives

An objectives-led approach has been the approach adopted for SEA of WRMPs and is also the approach recommended by the ODPM Practical Guide. This section outlines the draft SEA objectives and proposed assessment framework that will be used to identify the environmental and social effects of the options identified in the Regional Plan.

Assessment objectives have been developed based on:

- The key policy messages, social and environmental protection objectives identified in the review of policies, other plans and programmes (see Section 2). It is important that the assessment takes these objectives into account as this will help it to highlight any area where the Regional Plan may help or hinder the achievement of the objectives of other plans (e.g. at local, national and international level).
- The current state of the environment in the area under consideration for the SEA (see Section 3) and the key environmental issues identified.

The SEA objectives are set out in **Table 4.1** alongside the key messages identified from the review of policies, plans and programmes and the key issues highlighted from the review of baseline information.

As well as the overall SEA objectives, a number of key questions have been developed for each SEA topic. These key 'indicator' questions will be used as prompts in the assessments to help ensure consistent and robust assessment of these SEA topic areas. These key questions will prompt the assessment and ensure it considers all the relevant aspects.

The SEA objectives are intended to reflect changes that contribute to sustainability. By assessing each option against the objectives, it is more apparent where there might be adverse effects and where options could be developed to provide beneficial effects.

The SEA objectives and indicator questions have been developed with regard to the SRO SEA objectives set out in Table 6.1 of the ACWG Strategic Environmental Assessment: Core Objective Identification report (see Section 1.3.1).

4.1.1 Interactions between objectives

Schedule 2, paragraph 6 of the SEA Regulations requires that the inter-relationship between the issues referred to between SEA topics shall be explored. The matrix in **Table 4.2** identifies potential interactions between the proposed SEA objectives. In most cases the interactions are identified as compatible, or no interactions occur. Exceptions comprise:

- Potential incompatibility between objectives 2.1 and 4.4, as efforts to increase water efficiency could exacerbate inequalities by disproportionately impacting low income or vulnerable communities.
- Potential mixed interactions between objectives 4.2, 6.3 and 8.1, as actions to improve water resource management and climate change resilience (e.g. water management infrastructure) could be considered to enhance or detract from landscape quality.

Table 4.1 SEA objectives and indicator questions

SEA topic	Plans, policies and programmes Key Messages	Baseline Key Issues	SEA Objectives	Indicator Questions
Biodiversity, flora and fauna	• Conservation and enhancement of the natural environment and of biodiversity, particularly internationally and nationally designated sites and NERC Act priority habitats and species, whilst taking into account future climate change. • Promote a catchment-wide approach to water use to ensure better protection of biodiversity. • To achieve favourable condition for priority habitats and species in particular designated sites. • Avoidance of activities likely to cause irreversible damage to natural heritage. • Support well-functioning ecosystems, respect environmental limits and capacities, and maintain/enhance coherent ecological networks, including provision for fish passage and connectivity for migratory/mobile species. • Strengthen the connections between people and nature and realise the value of biodiversity. • Protection, conservation and enhancement of natural capital. Ecosystem services from natural	• The need to protect or enhance the region's biodiversity, particularly protected sites designated for nature conservation. • The need to avoid activities likely to cause irreversible damage to natural heritage. • The need to take opportunities to improve connectivity between fragmented habitats. • The need to control the spread of Invasive Non-Native Species (INNS). • The need to engage more people in biodiversity issues so that they personally value biodiversity and know what they can do to help, including through recognising the value of the ecosystem services.	• To protect and enhance biodiversity, ecological functions, capacity, and habitat connectivity within the WReN region. • To provide opportunities for habitat creation or restoration and a net benefit/gain for biodiversity. • To protect, conserve and enhance natural capital and the ecosystem services from natural capital that contribute to the economy. • To avoid introducing or spreading INNS.	• Will it avoid damage to aquatic, transitional and terrestrial species and habitats including fish populations (particularly migratory fish)? • Will it enhance aquatic, transitional and terrestrial species and habitats? • Will it protect the most important sites for nature conservation? • Will it affect HRA compliance? • Is the option likely to affect ancient woodland? • Will the option affect a priority habitat on the priority habitat inventory? • Are there any opportunities for habitat creation or restoration and a net benefit/gain for biodiversity? • Will the option contribute to the loss or gain in habitat connectivity? • Will it ensure the sustainable management of natural habitats, taking into account climate change adaptability? • Will it affect WFD compliance e.g. good ecological potential/status? • Does it protect, conserve and enhance biodiversity natural capital

SEA topic	Plans, policies and programmes Key Messages	Baseline Key Issues	SEA Objectives	Indicator Questions
	capital contributes to the economy and therefore should be protected and, where possible, enhanced. • Avoidance of activities likely to cause the spread of Invasive Non-Native Species (INNS) • A need to protect the green infrastructure network.			and the ecosystem services the natural capital provides? • Is there a possibility for INNS to be spread/ introduced? • Is there an opportunity to improve biodiversity value through removal of INNS?
Population and human health	• Water resources play an important role in supporting the health and recreational needs of local communities. • To ensure all communities have a clean, safe and attractive environment in which people can take pride. • To ensure secure, safe, reliable, sustainable and affordable supplies of water are provided. • Access to high quality open spaces and opportunities for sport and recreation can make an important contribution to the health and well-being of communities. • Promotion of healthy communities and protection from risks to health and wellbeing. • Promotion of a sustainable economy supported by universal access to essential utility and infrastructure services.	• The need to ensure water supplies remain affordable especially for deprived or vulnerable communities • The need to ensure continued improvements in levels of health across the region, particularly in urban areas and deprived areas. • The need to ensure public awareness of drought conditions and importance of maintaining security of supply without the need for emergency drought measures. • The need to ensure water quantity and quality is maintained for other users including tourists, recreational users and other users such as farmers. • The need to ensure a balance between different	• To protect and improve health and well-being and promote sustainable socio-economic development through provision of access to a resilient, high quality, sustainable and affordable supply of water over the long term. • To protect and enhance the water environment for other users including recreation tourism and navigation.	• Will it help to ensure access to a resilient and secure supply of drinking water? • Will it help to promote healthy communities and protect from risks to health and wellbeing? • Will it assist in provision of essential infrastructure and services to support health and well-being and a sustainable economy? • Will it avoid negative effects on human health or quality of life, e.g. through noise, air quality or transport impacts? • Will it protect or enhance opportunities for recreation, tourist activities and navigation? • Will the option affect Public Rights of Way? • Will the option have an effect on active lifestyles, such as impacts on active travel through disruption to pedestrian and cycle routes?

SEA topic	Plans, policies and programmes Key Messages	Baseline Key Issues	SEA Objectives	Indicator Questions
		aspects of the built and natural environment that will help to provide opportunities local residents and tourists, including opportunities for access to recreation resources and the natural and historic environment. • The need to accommodate an increasing population. • Sites of nature conservation importance, heritage assets, water resources, important landscapes and public rights of way contribute to recreation and tourism opportunities and subsequently health and well-being and the economy.		• Does the option improve access to the natural environment for recreation, including those living within deprived areas?
Material assets and resource use	• Promote sustainable management of natural resources, sustainable production and consumption whilst seeking to reduce the amount of waste generated by using materials, energy and water more efficiently. • Consider issues of water demand, water supply and water quality in the natural environment and ensure a sustainable use of water resources.	• The need to minimise the consumption of resources, including water and energy • The need to reduce the total amount of waste produced in the region, from all sources, and to reduce the proportion of this waste sent to landfill.	• To reduce, and make more efficient, the domestic, industrial and commercial consumption of resources, minimise the generation of waste, including leakage from the water supply system, encourage its re-use and eliminate waste sent to landfill.	• Will it minimise the use of energy and promote energy efficiency? • Will it minimise waste, and increase the proportion sent to reuse or recycling? • Will it make use of existing infrastructure? • Will it help to encourage sustainable design or use of sustainable materials (e.g. supplied from local resources)?

SEA topic	Plans, policies and programmes Key Messages	Baseline Key Issues	SEA Objectives	Indicator Questions
	• Contribute to a resource efficient, green and competitive low carbon economy. Maintain a reliable public water supply and ensure there is enough water for human uses, as well as providing an improved water environment. • Minimise the production of waste, ensure waste management is in line with the 'waste hierarchy', and eliminate waste sent to landfill. • Promote the sustainable management of natural resources.	• Need to reduce leakage from the water supply system. • Daily consumption of water resources is higher than the national average in the area and there is a need to encourage more efficient use.		• Will the option affect major built assets and infrastructure, including transport infrastructure?
Water	• Maintain and improve water quality (surface waters and groundwater). • Improve the quality of the water environment and the ecology which it supports, and continue to provide high levels of drinking water quality. • Expand the scope of water protection to all waters, surface waters and groundwater. • Ensure appropriate management of abstraction and protect flow and level variability across the full range of regimes from low to high conditions. • Develop a resilient and flexible water management approach to cope with changing climate, population and economic conditions.	• The need to further improve the quality of the region's river, estuarine and coastal waters taking into account WFD status targets. • The need to maintain the quantity and quality of groundwater resources taking into account WFD status targets. • The need to improve the resilience, flexibility and sustainability of water resources in the region, particularly in light of potential climate change impacts on surface waters and groundwaters.	• To maintain or improve the quality of rivers, lakes, groundwater, estuarine and coastal waterbodies. • To avoid adverse impact on surface and groundwater levels and flows, and ensure sustainable management of abstractions. • To reduce and manage flood risk, taking climate change into account. • To increase awareness of water sustainability and efficient use of water.	• Will it avoid contamination of groundwater? • Will it help to minimise risks associated with unsustainable abstraction of ground and surface waters? • Will it abstract from a water resource with resource availability (with reference to CAMS status and WFD considerations)? • Is the option likely to contribute to or conflict with the achievement of WFD objectives? • Will it alter the flow or level regime or residence time of surface waters or groundwaters? • Will it enable flexible control over the level of abstraction at short

SEA topic	Plans, policies and programmes Key Messages	Baseline Key Issues	SEA Objectives	Indicator Questions
	• Balance the abstraction of water for supply with the other functions and services the water environment performs or provides. • Encourage more efficient use of water and promote awareness of water sustainability. • Steer new development to areas with the lowest probability of flooding and manage any residual flood risk, taking account of the impacts of climate change. • Promote a catchment based approach to the management and work with local stakeholders to deliver catchment-based solutions to water quantity and quantity. • Develop a resilient and flexible water management approach to cope with changing climate, population and economic conditions. • Reduce flood risk to people, residential and non-residential properties, community facilities and key transport links, as well as designated nature conservation sites and heritage assets and landscapes of value. • Reduce risk of flooding from reservoirs.	• The need to ensure sustainable abstraction. • The need to ensure that people understand the value of water. • The need to reduce and manage flood risk.		notice in response to changing environmental conditions? • Will it avoid reducing flood plain storage, or provide opportunities to improve flood risk management? • Will it enable a sustainable use of water resources that balances demand for water with environmental protection? • Will it contribute towards improving the awareness of water sustainability and its true value? • Will the option protect and enhance the environmental resilience of the water environment to climate change, flood risk and drought?
Soil, geology and land use	• Protect and enhance the quality and diversity of geology (including geological SSSIs) and soils,	• The need to protect geological features of importance and maintain	• To protect and enhance geology, geomorphology, and	• Will it avoid damage to and protect geologically important sites?

SEA topic	Plans, policies and programmes Key Messages	Baseline Key Issues	SEA Objectives	Indicator Questions
	including geomorphology and geomorphological processes which can be lost or damaged by insensitive development. • Ensure that soils will be protected and managed to optimise the varied functions that soils perform for society (e.g. supporting agriculture and forestry, protecting cultural heritage, supporting biodiversity, as a platform for construction), in keeping with the principles of sustainable development. • Promote catchment-wide approach to land management by relevant stakeholders, in order to benefit natural resources, reduce pollution and develop resilience to climate change. • Promote mixed use developments, and encourage multiple benefits from the use of land in urban and rural areas, recognising that some open land can perform many functions. • Encourage the effective use of land by reusing land that has been previously developed (brownfield land), provided that it is not of high environmental value.	and enhance soil function and health. • The need to manage the land more holistically at the catchment level, benefitting landowners, other stakeholders, the environment and sustainability of natural resources (including water resources). • The need to make use of previously developed land (brownfield land) and to reduce the prevalence of derelict land in the region.	the quality and quantity of soils.	• Will it avoid damaging the quality of agricultural land? • Will it protect, maintain and enhance soil function and health? • Will it ensure efficient use of land (e.g. make use of previously developed land)? • Will it contribute towards a catchment-wide approach to land management?
Air and climate	• Reduce greenhouse gas emissions to put UK on the path to net zero emissions. Targets include: reduce the UK's greenhouse gas emissions	• The need to reduce air pollutant and greenhouse emissions and limit air	• To maintain and improve air quality. • To minimise greenhouse gas emissions.	• Will it reduce or minimise air pollutant emissions? • Will it increase emissions to air in an areas sensitive to emissions

SEA topic	Plans, policies and programmes Key Messages	Baseline Key Issues	SEA Objectives	Indicator Questions
	by at least 80% (relative to 1990 levels) by 2050. • Reduce the effects of air pollution on ecosystems. • Improve overall air quality. • Minimise energy consumption, support the use of sustainable/renewable energy and improve resilience to climate change. • Build in adaption to climate change to future planning and consider the level of urgency of associated risks of climate change impacts accordingly. • Need for adaptive measures to respond to likely climate change impacts on water supply and demand. • Sustain compliance with and contribute towards EU limit values or national objectives for pollutants, taking into account the presence of Air Quality Management Areas and the cumulative impacts on air quality from individual sites in local areas.	emissions to comply with air quality standards. • The need to mitigate against climate change through the reduction in greenhouse gas emissions in order to contribute to risk reduction over the long term. • The need to adapt to the impacts of climate change for example through, sustainable water resource management, specific aspects of natural ecosystems (e.g. connectivity) as well as accommodating potential opportunities of climate change.	• To adapt and improve resilience to the threats of climate change.	(e.g. in proximity to an AQMA or sensitive habitat)? • Will it reduce or minimise transport or energy requirements, and associated air and greenhouse gas emissions and contribute to net zero emission targets? • Is there potential for the option to incorporate climate mitigation measures to reduce its carbon footprint, such as lower embodied carbon or incorporating renewable energy? • Is the option vulnerable to climate change effects? • Will it reduce vulnerability to risks associated with climate change effects (e.g. reduce the adverse effects of droughts and floods)?
Archaeology and cultural heritage	• Built development in the vicinity of historic buildings could have implications for the setting and/or built fabric and cause damage to any archaeological deposits present on the site.	• The need to conserve or enhance sites and the settings of archaeological importance and cultural heritage interest, particularly those which are sensitive to the water environment.	• To conserve and enhance the historic environment, heritage assets and their settings, and protect archaeologically important sites.	• Will it avoid harm to and protect the historic environment, heritage assets (including unknown heritage assets) and their settings? • -Will it respect, maintain and strengthen historic local character and distinctiveness?

SEA topic	Plans, policies and programmes Key Messages	Baseline Key Issues	SEA Objectives	Indicator Questions
	• Ensure active management of the Region's environmental and cultural assets. • Ensure effects resulting from changes to water level (surface or sub-surface) on all water dependent heritage assets are avoided. Consider effects on important wetland areas with potential for paleo-environmental deposits. • Promote the conservation and enhancement of the historic environment, including the promotion of heritage and landscape as central to the culture of the region and conserve and enhance distinctive characteristics of landscape and settlements. • Conserve heritage assets in a manner appropriate to their significance, so that they can be enjoyed for their contribution to the quality of life of this and future generations.			• Will is contribute to the better management of heritage assets and tackle heritage at risk? • Will abstraction alter the hydrological setting of water-dependent assets? • Will it improve access, value, understanding or enjoyment of heritage assets and their settings and culturally/historically important assets and their settings in the region?
Landscape and visual amenity	• Protection and enhancement of landscape (including designated landscapes, landscape character, distinctiveness and the countryside). • Abstraction and low river flows could negatively affect landscape and visual amenity. • Enhance the value of the countryside by protecting the natural	• The need to protect and improve the natural beauty of the region's AONBs and other areas of natural beauty.	• To protect and enhance designated and undesignated landscape, townscape and the countryside.	• Will it avoid adverse impacts and enhance designated landscapes? • Will the option affect visual amenity? • Will it improve access to valued areas of landscape character, e.g. the countryside and open space? • Will the option create or improve green infrastructure which

SEA topic	Plans, policies and programmes Key Messages	Baseline Key Issues	SEA Objectives	Indicator Questions
	environment for this and future generations. • Improve access to valued areas of landscape character in sustainable ways to enhance its enjoyment and value by visitors and stakeholders.			contributes to access to the landscape? • Will it help to protect and improve non-designated areas of natural beauty and distinctiveness (e.g. woodlands) and avoid the loss of landscape features and local distinctiveness?

Table 4.2 SEA objective interaction matrix

		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
1.1	To protect and enhance biodiversity, ecological functions, capacity, and habitat connectivity within the WReN region.																	
1.2	To protect, conserve and enhance natural capital and the ecosystem services from natural capital that contribute to the economy.	C																
1.3	To avoid introducing or spreading INNS.	C	C															
1.4	To provide opportunities for habitat creation or restoration and a net benefit/gain for biodiversity	C	C	C														
2.1	To protect and improve health and well-being and promote sustainable socio-economic development through provision of access to a resilient, high quality, sustainable and affordable supply of water over the long term.	C	C		C													
2.2	To protect and enhance the water environment for other users, including recreation, tourism and navigation.	C	C	C	C	C												
3.1	To reduce, and make more efficient, the domestic, industrial and commercial consumption of resources, minimise the generation of waste, encourage its re-use and eliminate waste sent to landfill.		C			C	C											
4.1	To maintain or improve the quality of rivers, lakes, groundwater, estuarine and coastal waterbodies	C	C	C	C	C	C											
4.2	To avoid adverse impact on surface and groundwater levels and flows, and ensure sustainable management of abstractions.	C	C	C	C	C	C		C									
4.3	To reduce and manage flood risk, taking climate change into account.	C	C		C		C											
4.4	To increase awareness of water sustainability and efficient use of water.	C	C		C	I	C	C		C								
5.1	To protect and enhance geology, geomorphology, and the quality and quantity of soils.	C	C		C				C	C	C							
6.1	To maintain and improve air quality.	C	C		C	C	C	C		C			C					
6.2	To minimise greenhouse gas emissions.	C	C		C	C	C	C		C			C	C				
6.3	To adapt and improve resilience to the threats of climate change.	C	C		C	C	C	C	C	C	C			C	C			
7.1	To conserve and enhance the historic environment, heritage assets and their settings and protect archaeologically important sites.	C				C	C			C	C			C		C		
8.1	To protect and enhance designated and undesignated landscapes, townscapes and the countryside.	C	C		C	C	C		M	M	C		C			M	C	

C	Compatible
I	Incompatible
M	Mixed
	No direct interaction

4.2 Assessment Methodology

4.2.1 Primary assessment

An appraisal framework was used to assess each of the potential Regional Plan options against the SEA objectives. The appraisal framework has been applied to test the performance of each of the alternative measures (Regional Plan options) against the SEA objectives. This approach has enable the environmental performance of these options to be used to inform the selection of options for inclusion in the Regional Plan.

An example appraisal framework table is given in **Table 4.3**.The appraisal framework is structured as follows:

- The first and second columns set out the SEA topics and objectives.
- The scale of the effect, which might relate to either geographical scale or the size of the population affected, is identified in the third column on a scale of small, medium to large.
- The impact evaluation includes consideration of the nature of the impact, certainty of effect, duration and permanence (fourth, fifth and sixth columns of **Table 5.2**) in compliance with criteria for determining the likely significance of effects specified in the SEA Directive Article 3(5) and Annex II, and the SEA Regulations Part 2, Regulation 9(2a) and Schedule 1. With respect to duration of temporary effects, short-term impacts are defined as those that last for up to six months, medium term impacts are those that extend for six months to two years whilst longer term temporary impacts are assessed as those that extend to two to five years. A ‘significant long term’ temporary impact category is used for those temporary effects that continue beyond five years in duration.
- The seventh column identifies the magnitude of the effect on a scale of low, medium and high.
- The value/sensitivity of the receptor(s) is identified in the eighth column on a scale of low, medium and high.
- The ninth column will be populated during the assessment with a commentary and evaluation of the impact of each alternative measure on the objectives for each topic, with reference to the indicator questions set out in column three. The assessment will assume the implementation of standard best practice in implementing the measures and any defined mitigation measures (which will be set out) so that the significance of effects relates to the residual effects after mitigation in line with the ODPM Practical Guide and UKWIR SEA national guidance. The mitigation measures for any identified adverse effects will be identified within the appraisal framework.
- The residual adverse and beneficial effects (after application of best practice approaches and any appropriate mitigation measures) are identified in the tenth and eleventh columns respectively. These were identified separately so as to avoid mixing adverse and beneficial effects. The commentary in column nine, combined with the magnitude (column seven) and value/sensitivity (column eight) informs the residual adverse or beneficial effects.

Table 4.3 Example SEA appraisal matric for the biodiversity, flora and fauna topic

Topic	SEA objective	Scale of effect: geographical &/or population affected (Small/ Medium/ Large)	Certainty of effect (Low/ Medium/ High)	Duration of effect (short/ medium /long term)	Permanence of effect (permanent/ temporary)	Magnitude of effect (Low/ Medium/ High)	Value/ sensitivity of receptor (Low/ Medium/ High)	Potential residual effect on sensitive receptors (assuming good practice construction methods)	Residual Adverse Effect (likely to remain after reasonable mitigation)	Residual Beneficial Effect (likely to remain after reasonable mitigation)
Biodiversity, fauna and flora	1.1 To protect and enhance biodiversity, ecological functions, capacity, and habitat connectivity within the WReN region.									
	1.2 To provide opportunities for habitat creation or restoration and a net benefit/gain for biodiversity.									
	1.3 To protect, conserve and enhance natural capital and the ecosystem services from natural capital that contribute to the economy.									
	1.4 To avoid introducing or spreading INNS.									

The SEA appraisal framework is used to capture the assessment for each option (one table completed per option), alternative programmes and the Regional Plan as a whole.

Varying levels of uncertainty are inherent within the assessment process. The assessment has minimised uncertainty through the application of expert judgement. The level of uncertainty of the option assessment for each SEA objective has been reported in the appraisal framework. Where there is significant uncertainty which precludes an effects assessment category being assigned for a particular option and SEA objective, an "uncertain" residual effects assessment label has been applied to that specific SEA objective.

The assessment of the options and the overall Regional Plan has been carried out using the effects assessment matrix shown in **Figure 4.1**, taking account of the scale, duration and permanence of the effect. The definitions for the effect significance are explained beneath **Figure 4.1**.

The effects assessment has taken account of any proposed mitigation measures that have been incorporated into the option conceptual design and costs, i.e. it is the residual effects after the application of mitigation that will be assessed.

The resulting significance of effects have been considered in the prioritisation of options and programmes of options. Where major adverse residual effects are predicted, should the option/programme be included in the Regional Plan, measures envisaged to prevent, reduce and as fully as possible offset these effects on the environment (as a result of implementing the Regional Plan) are outlined Section 7 as appropriate. These will be in addition to any mitigation that has already been included in the conceptual design and costs of each alternative option. Mitigation may include additional provisions within the Regional Plan itself and/or measures to be applied during the Regional Plan implementation stage. It may also include proposals for changing other plans and programmes to address significant cumulative residual effects. WReN will consider how any remaining significant residual effects identified are to be monitored to identify any unforeseen adverse effects and to enable appropriate remedial action to be taken.

Figure 4.1 Significance matrix used to assess effects of each Regional Plan option on each SEA objective

Significance of Effect		Value/sensitivity of receptor		
		High	Medium	Low
Effect magnitude (includes scale of effect)	High	Major Beneficial / Major Adverse	Major Beneficial / **Major Adverse**	Moderate Beneficial / Moderate Adverse
	Medium	Major Beneficial / Major Adverse	Moderate Beneficial / Moderate Adverse	Minor Beneficial / Minor Adverse
	Low	Dependent on nature of impact/benefit	Minor Beneficial / Minor Adverse	Negligible

4.2.1.1 General Significance Definitions

Major - effects represent key factors in the decision-making process. They are generally associated with sites and features of international, national or regional importance. If adverse, such resources/features are generally those which cannot be replaced or relocated.

Moderate - effects are likely to be important considerations at a regional or district scale. If adverse, they are likely to be of potential concern.

Minor - effects are not likely to be decision-making issues. Nevertheless, the cumulative effect of such issues may lead to an increase in the overall effects on a particular area or on a particular resource.

Negligible - effects which are not perceptible, being within normal bounds of variation or the margin of forecasting error.

For the '**high' effect magnitude** (top row), a major effect significance is assigned for both high and medium value receptors to reflect the magnitude of the effect.

For the **'low' effect magnitude and 'high' value receptor** (bottom left box), the significance of effect could be minor, moderate or major dependent on the precise nature of the impact or benefit.

All options have been assessed to the same level of detail, in line with the SEA legislative requirements, national SEA guidance and the UKWIR SEA guidance. The level of detail for the environmental assessment of each option is consistent with the strategic nature of SEA. This is a high-level, strategic assessment, carried out without the detailed information which would be support an EIA. In the event that new options are introduced at a later stage (which may have less detailed information available) every endeavour will be made to ensure that the assessment is undertaken to a similar standard.

The analysis used a detailed suite of environmental and social datasets that are available at a consistent quality across the geographical footprint of all the options under consideration. The HRA[5] and WFD[6] assessments also informed the assessment at each key stage, with any adverse implications for Habitats Regulations or WFD compliance flagged during option assessments and used inform decision-making at the programme appraisal stage.

The assessment includes some quantitative analysis of environmental and social effects. The WReN decision making methodology also includes metrics which relate to environmental and social aspects. These metrics are incorporated in a multi criteria analysis (MCA) approach to producing a best value plan. Where there is a clear overlap between the decision-making metrics and the SEA objectives, the SEA outputs have provided the data for measuring the metric[26].

Each feasible option is also assessed against the natural, social, human and financial and manufactured capitals. The natural, social and human capitals overlap with the SEA objectives. The approach of combining the SEA with the capitals creates a risk that the costs and benefits could be double counted at both an option and plan level and the Supplementary Guidance 'Environment and society in decision making'[11] recognises it is not possible to avoid this completely. At the end of the option appraisal process, an assessment will be made of the environmental and social impacts of the preferred plan to identify if any double counting could be a factor.

The assessment also considers effects on sites designated at a national and local level. The assessment of effects on SSSIs took account of conservation objectives established by Natural England, and SSSI Impact Risk Zone (IRZ) datasets. Effects on other designated sites set out in the WRPG have also been assessed, comprising National Nature Reserves, Local Nature Reserves, Marine Conservation Zones, Scheduled Ancient Monuments, World Heritage Sites, National Parks and Areas of Outstanding Natural Beauty. Information on Local Wildlife Sites has been included in the assessment where data are available, however detailed assessment of impacts on Local Wildlife Sites would occur during project-level EIA preparation.

4.2.2 Secondary, cumulative and synergistic environmental effects

Schedule 2(6) of the SEA Regulations requires the assessment of "The likely significant effects on the environment, including short, medium and long-term effects, permanent and temporary effects, positive and negative effects, and secondary, cumulative and synergistic effects…." These can be defined as follows:

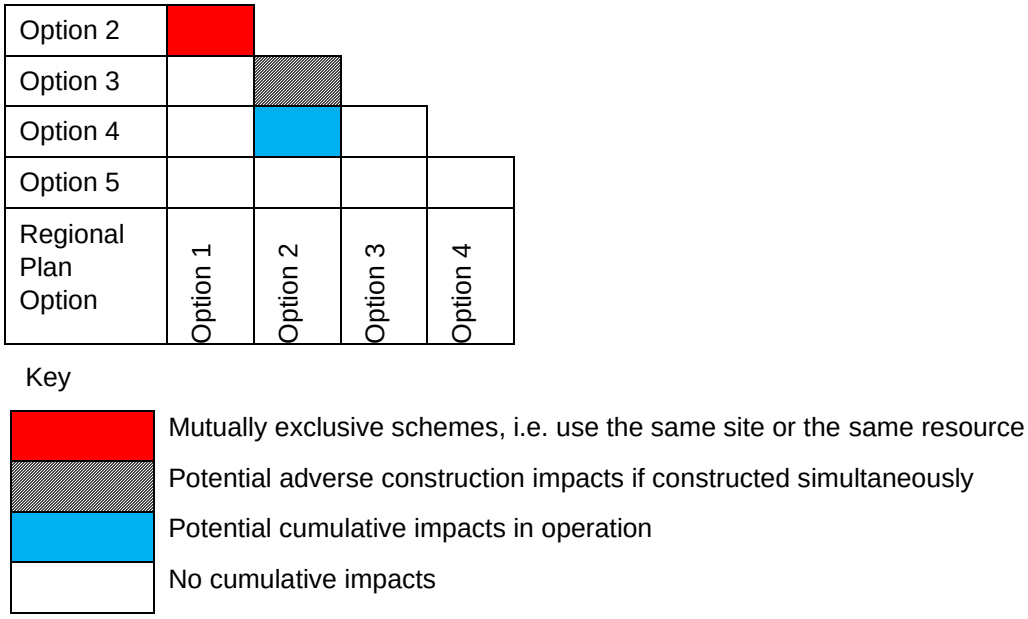
[26] WReN (2022) Emerging Regional Plan for Informal Consultation (January 2022) – Appendix 4 Objective and metric development.

- Secondary or indirect effects are effects that are not a direct result of the plan, (e.g. an abstraction that changes local groundwater levels and thus affects the ecology of a nearby wetland).
- Cumulative effects arise, for instance, where several nearby groundwater sources each have insignificant effects but together have a measurable effect on river flows; or where several individual effects of a preferred programme (e.g. traffic disruption) have a combined effect.
- Synergistic effects interact to produce a total effect greater than the sum of the individual effects. Synergistic effects often happen as habitats, resources or human communities get close to capacity. For instance, a wildlife habitat can become progressively fragmented with limited effects on a particular species until the last fragmentation makes the areas too small to support the species at all.

The term 'cumulative effects' is being adopted as the collective term to include secondary, cumulative and synergistic effects (as suggested by the Practical Guide). The SEA of the Regional Plan will include cumulative effects assessment at each of the assessment levels as described in the following sections (option-level, programme-level and overall Regional Plan). It should be noted that some options may be mutually exclusive (i.e. only one of these options can be developed) and this will also be identified in the SEA as part of the option-level assessment. For the programme level and Regional Plan level assessment, cumulative effects will include consideration of other plans, programmes and projects in the context of spatial and/or temporal proximity.

A matrix such as the example provided in **Figure 4.2** will be used to help consider interactions between options or programmes. In assessing these effects, consideration will be given to other factors which may affect the receiving environment in the short, medium and long term.

Figure 4.2 Cumulative Effects Assessment Matrix



4.2.2.1 Programme and Regional Plan level cumulative effects assessment

To meet the requirements of the SEA Regulations, consideration will be given to the cumulative effects between the preferred programmes and the Regional Plan with other relevant plans, programmes or projects. This will include consideration of effects with neighbouring Regional groups, including Water Resources East and Water Resources West Regional Plans and Drought Plans.

Cumulative effects with non-water resources related plans, programmes and projects will be considered where relevant, including existing completed projects, approved but uncompleted projects, ongoing activities, plans or projects for which an application has been made and which are under consideration by consenting authorities and plans and projects which are reasonably foreseeable (i.e. projects for which an application has not yet been submitted, but which are likely to progress before completion of

the development and for which sufficient information is available to assess the likelihood of cumulative and in-combination effects). Sources of information include the following:

- Land use and development plans to identify major development proposals (those which are likely to generate large scale construction or operational effects e.g. growth points, strategic centres;
- Transport and other infrastructure plans (e.g. flood risk management plans, energy, and other utilities).
- Local Plans

The following cumulative assessments are proposed in the SEA:

- An assessment of cumulative effects of options that could potentially be implemented at the same time. Mutually exclusive options (e.g. those that draw upon the same resource or use the same site) will also be identified.
- Assessment of cumulative effects of the WReN Regional Plan preferred programme with the other regional groups' Regional Plans and water company Drought Plans and WRMPs, and other relevant water management plans.

4.3 Limitations of the study

SEA is a high-level assessment aimed at highlighting potential environmental concerns. The environmental data used in this assessment are based on that which is readily available from existing sources. Difficulties encountered in undertaking this SEA included the requirement to rely on varying levels of detail in design specifications of schemes, many of which are at conceptual or outline design stage only. Assessment of impacts is necessarily limited when, for example, pipeline routes are at an indicative stage only.

Where particular limitations or outstanding issues are known, these are briefly described in the SEA appraisal tables for the relevant option concerned. Detailed assessments of options will be conducted at the detailed design stage (including project-level EIA) closer to the time of option implementation.

5 Assessment of options

5.1 Overview

WReN investigated an unconstrained list of potential options to balance future supply and demand. Unconstrained options include all options that could technically be used to meet the deficit. Further review of the options, including consideration of technical attributes, construction / delivery costs and resilience benefits resulted in a sub-set of options, referred to as the "feasible" list. Demand measures included in the Regional Plan would be implemented at a company level, therefore options on the 'feasible' list have been grouped as such:

- Northumbrian Water demand management options
- Yorkshire Water demand management options
    - Customer management
    - Leakage reduction
- Resource options

No feasible options were identified for Hartlepool as the area is considered to be a low level of concern.

The feasible options considered by WReN are documented in Error! Reference source not found.. For e ach option, baseline information was collated to permit SEA, WFD and HRA assessments to be completed, focussing on:

- Analysis of the environmental and hydrological issues
- Strategic assessment of the residual environmental effects after mitigation (including construction / implementation and operational effects)
- Assessment of secondary, cumulative and synergistic effects
- Identification of potential monitoring requirements.

Table 5.1 Draft Regional Plan feasible list of options

Reference	Scheme
Northumbrian Water Demand Management Options	
BOT-DMO-High	This option includes compulsory Metering by 2035 and 50% leakage reduction by 2050. It also includes a high impact water efficiency plan comprising 12 household water efficiency options within 5 categories (Water Use Audit and Inspection, Advice and Information on Leakage Detection and Fixing Techniques, Water Efficiency Enabling Activities, Promotion of Water Saving Devices, and Targeted Water Conservation Information (advice on appliance water usage).
BOT-DMO-Med	This option includes Option 2 Metering Smart by 2035 and 40% leakage reduction by 2050. It also includes a Medium impact water efficiency plan comprising 12 household water efficiency options within 5 categories (Water Use Audit and Inspection, Advice and Information on Leakage Detection and Fixing Techniques, Water Efficiency Enabling Activities, Promotion of Water Saving Devices, and Targeted Water Conservation Information (advice on appliance water usage)
BOT-DMO-Low	This option includes low metering, AMI Smart metering (3 AMP - 15 year roll-out from 2020) and 30% leakage reduction by 2050. It also includes a Low impact water efficiency plan comprising 6 household water efficiency options within 3 categories (Water Use Audit and Inspection, Advice and Information on Leakage Detection and Fixing Techniques, and Targeted Water Conservation Information (advice on appliance water usage)).

Reference	Scheme
Yorkshire Water Demand Management Options	
Customer management	
C1a - C1e	Domestic customer audits and retrofit
C2a to C2c	Metering (domestic meter optants)
C4	Metering on change of occupancy
C5	Smart metering
C6a to C6e	Commercial water user audits and retrofit
C7a - C7e	Commercial water user audits and retrofit - customer pays
C15a to C15e	Household flow regulator - internal 15,000 to 75,000 properties over 25 years
C21a to C21e	Housing Associations - targeted programme Housing
Leakage management	
L1	Active leakage control 14 Ml/d
L2	Active leakage control 30 Ml/d
L3	Active leakage control 46 Ml/d
L4	Active leakage control 63 Ml/d
L5	Active leakage control 79 Ml/d
L6	Active leakage control 95 Ml/d
Resource management	
DV3	South Yorkshire groundwater
DV6(iv)	Tees to South Yorkshire Pipeline Option 1
DV6(v)	Tees to South Yorkshire Pipeline Option 2
DV6(vi)	Tees to South Yorkshire Pipeline Option 3
DV7a(iv)	Tees to Ouse Pipeline Option 1
DV7a(v)	Tees to Ouse Pipeline Option 2
DV7a(vi)	Tees to York Pipeline Option 3
DV8(iv)	York WTW to South Yorkshire pipeline
DV8(v)	York WTW capacity increase
R1c	Grid network enhancement: New River Ouse WTW to York
R1d	Grid network enhancement: New River Ouse WTW to North Yorkshire 1
R1e	Grid network enhancement: New River Ouse WTW to North Yorkshire 2
R1f	Grid network enhancement: New River Ouse WTW to North Yorkshire 3
R1g	Grid network enhancement: New River Ouse WTW to York
R2	Ouse Raw Water Transfer
R3	Increased River Ouse pump storage capacity
R3a	River Ouse licence transfer

Reference	Scheme
R5	Aquifer Storage and Recovery Scheme 1
R6	South Yorkshire Groundwater Option 1
R6b	South Yorkshire Groundwater Option 2
R6c	South Yorkshire Groundwater Option 3
R6d	South Yorkshire Groundwater Option 4
R8b	Sherwood Sandstone and Magnesian Limestone Boreholes Option 2
R8c	Sherwood Sandstone and Magnesian Limestone Boreholes Option 3
R8f	Sherwood Sandstone and Magnesian Limestone Boreholes Option 6
R8g	Sherwood Sandstone Boreholes support to North Yorkshire
R8h	New groundwater (Sherwood Sandstone) supply to existing North Yorkshire WTW
R12	East Yorkshire Groundwater Option 1
R13	East Yorkshire Groundwater Option 2
R29	Reservoir De-silting
R31a	Additional bankside storage on the River Ouse
R34	River Calder Abstraction Option 1
R35	River Aire Abstraction Option 1
R37b(ii)	River Aire Abstraction Option 4
R49	Supply Dales from the Tees - raw Option 1
R51	Supply Dales from the Tees - treated
R61	Yorkshire coast desalination
R78	Tidal Abstraction Reservoir
R85	Recommission Kirklees WTW
R86	Aire and Calder new WTW
Export	
E2	Yorkshire grid network to Severn Trent Water
WReNE1a	Kielder to UU
WReNE1b	Kielder to UU
WReNE2a	Cow Green to UU
WReNE2b	Cow Green to UU

The assessment for each of the plan options has been undertaken in accordance with the methodology set out in Section 4. Appraisal framework tables have been completed for each individual option and are provided in **Appendix E**. A summary of the likely significant effects for each option is provided in this section and is presented as a colour-coded visual evaluation matrix.

5.2 Northumbrian Water Demand Management Options

Table 5.2 provides a summary of the SEA evaluation for each of the demand management scenarios assessed.

The demand management activities associated with each scenario are unlikely to have any major or moderate adverse effects on any of the SEA objectives. Minor adverse effects have been identified for the majority of SEA objectives. Minor adverse effects were identified for biodiversity, water, cultural heritage and landscape associated with the construction activities to resolve leakage issues, however specific locations of the scheme remain unknown. Temporary minor adverse effects on population and human health due to increased disruption were identified. All three options will have an adverse impact on air quality and greenhouse gas emissions through the increased number of vehicle journeys made to undertake the water efficiency activities (e.g. to fit water meters, take meter readings or carry out audits) and leakage works as well as increased carbon generation from the materials used to manufacture water meters (embodied carbon) and the construction works associated with leakage reduction.

Beneficial effects have been identified for several SEA objectives, including for population and human health, water, and air quality and greenhouse gas emissions. These beneficial effects are associated with the promotion of water efficiency activities and reduced demand for water which may have beneficial effects on water quality and quantity through reducing the amount of water abstracted and improving resilience to climate change. These effects range from minor to major based on the level of ambition of each scenario. Minor beneficial effects only were identified for the BOT-DMO-Low option. However, the BOT-DMO-High option is likely to result in major beneficial effects on population and human health and water efficiency as this scenario is expected to promote water efficiency and result in reduced per capita consumption of a magnitude considered to be of a major beneficial effect.

5.3 Yorkshire Water Demand Management Options

5.3.1 Customer management options

Table 5.2 provides a summary of the SEA evaluation for each customer management option in the Regional Plan. The detailed appraisal framework tables for each option are provided in **Appendix E**.

The customer management options are unlikely to have any major or moderate adverse effects on any of the SEA objectives. Minor adverse effects have been identified in relation to the air and climate objectives regarding reduction of air pollutant and greenhouse gas emissions. Most of the options will have an impact on air emissions through the increased number of vehicle journeys made to fit water meters, take meter readings or carry out audits.

Minor beneficial effects have been identified for the majority of the customer management options, in relation to sustainable and efficient use of water resources. There are a number of options that, in isolation, will result in negligible beneficial impacts for every SEA objective. C4, and C5, are likely to result in reductions in water savings of a magnitude considered to be of a moderate beneficial effect.

Table 5.2 Visual evaluation matrix summary for the NWL demand management scenarios

Option	Impact	SEA Objective																Summary Commentary
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1	
BOT-DMO-High	Adverse				Non														Three minor adverse effects have been identified on air, GHG emissions and material assets as a result of increased number of vehicle journeys made to fit smart meters at properties. Seven further minor adverse effect have been identified on material assets, landscape, biodiversity, soils, water quality, historic environment and human health as a result of construction activities.
	Beneficial				None														Two major beneficial effects have been identified for water (sustainability and efficiency) and population and human health. Six moderate beneficial effects have been identified regarding biodiversity, water (quality and quantity), landscape and climate change resilience. One minor beneficial effect has been identified with respect to GHG emissions.
BOT-DMO-Med	Adverse				Non														Three minor adverse effects have been identified on air, GHG emissions and material assets as a result of increased number of vehicle journeys made to fit smart meters at properties. Seven further minor adverse effect have been identified on material assets, landscape, biodiversity, soils, water quality, historic environment and human health as a result of construction activities.
	Beneficial				Non														Three moderate beneficial effects have been identified for water on population, climate change resilience and landscape. Six minor beneficial effects have been identified regarding biodiversity, water (quality and quantity), landscape and GHG emissions.
BOT-DMO-Low	Adverse				None														Eight minor adverse effects have been identified on population, water, air and GHG emissions as a result of increased disruption and vehicle movements from the construction activities.
	Beneficial				None														Six minor beneficial effects have been identified for water, population and human health, air and GHG emissions.

Table 5.3 Visual evaluation matrix summary for Yorkshire Water customer management options

Option	Impact	SEA Objective 1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1	Summary Commentary
C1a Domestic customer audits and retrofit	Adverse		None		None		None						None				None	None	Two minor adverse effects have been identified on air and greenhouse gas (GHG) emissions as a result of increased number of vehicle journeys made to deliver water audits and fit appropriate water efficient devices.
	Beneficial				None		None						None				None	None	The scheme would have minor beneficial effects with respect to water efficiency.
C1b Domestic customer audits and retrofit	Adverse		None		None		None						None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to deliver water audits and fit appropriate water efficient devices.
	Beneficial				None		None						None				None	None	The scheme would have minor beneficial effects with respect to water efficiency.
C1c Domestic customer audits and retrofit	Adverse		None		None		None						None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to deliver water audits and fit appropriate water efficient devices.
	Beneficial				None		None						None				None	None	The scheme would have minor beneficial effects with respect to water efficiency.
C1d Domestic customer audits and retrofit	Adverse		None		None		None						None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to deliver water audits and fit appropriate water efficient devices.
	Beneficial				None		None						None				None	None	The scheme would have minor beneficial effects with respect to water efficiency.
C1e Domestic customer audits and retrofit	Adverse		None		None		None						None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to deliver water audits and fit appropriate water efficient devices.
	Beneficial				None		None						None				None	None	The scheme would have minor beneficial effects with respect to water efficiency.
C2a-c Metering (domestic meter optants)	Adverse		None		None		None						None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to deliver water audits and fit appropriate water efficient devices.
	Beneficial				None		None						None				None	None	The scheme would have minor beneficial effects with respect to water efficiency and air and climate.
C4 Metering on change of occupancy	Adverse				None		None						None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to deliver water audits and fit appropriate water efficient devices.
	Beneficial				None		None						None				None	None	Three moderate beneficial effects have been identified for population and human health, water and air and climate. Five minor benefits are also anticipated.

Option	Impact	SEA Objective																Summary Commentary
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1	
C5 Smart metering	Adverse				None		None						None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to deliver water audits and fit appropriate water efficient devices.
	Beneficial				None		None						None				None	None	Three moderate beneficial effects have been identified for population and human health, water and air and climate. Five minor benefits are also anticipated.
C6a Commercial water user audits and retrofit	Adverse				None								None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to deliver audits and install appropriate water saving retrofit devices in individual commercial properties.
	Beneficial				None								None				None	None	The scheme would have seven minor beneficial effects with respect to biodiversity, flora and fauna, population and human health, material assets and resource use, water and air and climate.
C6b Commercial water user audits and retrofit	Adverse				None								None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to deliver audits and install appropriate water saving retrofit devices in individual commercial properties.
	Beneficial				None								None				None	None	The scheme would have seven minor beneficial effects with respect to biodiversity, flora and fauna, population and human health, material assets and resource use, water and air and climate.
C6c Commercial water user audits and retrofit	Adverse				None								None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to deliver audits and install appropriate water saving retrofit devices in individual commercial properties.
	Beneficial				None								None				None	None	The scheme would have seven minor beneficial effects with respect to biodiversity, flora and fauna, population and human health, material assets and resource use, water and air and climate.
C6d Commercial water user audits and retrofit	Adverse				None								None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to deliver audits and install appropriate water saving retrofit devices in individual commercial properties.
	Beneficial				None								None				None	None	The scheme would have seven minor beneficial effects with respect to biodiversity, flora and fauna, population and human health, material assets and resource use, water and air and climate.
C6e Commercial water user audits and retrofit	Adverse				None								None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to deliver audits and install appropriate water saving retrofit devices in individual commercial properties.
	Beneficial				None								None				None	None	The scheme would have seven minor beneficial effects with respect to biodiversity, flora and fauna, population and human health, material assets and resource use, water and air and climate.
C7a-e Commercial water user audits and retrofit - customer pays	Adverse				None								None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to deliver audits and install appropriate water saving retrofit devices in individual commercial properties.
	Beneficial				None								None				None	None	Seven minor beneficial effects have been identified for biodiversity, population and human health, material assets and resource use, water and air and climate.
C15a Household Flow	Adverse				None		None						None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to fit the devices at properties.

Option	Impact	SEA Objective																Summary Commentary
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1	
Regulator - Internal	Beneficial				None		None						None				None	None	Negligible beneficial effects have been identified with respect to population and human health, material assets and resource use, water and air and climate.
C15b Household Flow Regulator – Internal	Adverse				None		None						None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to fit the devices at properties.
	Beneficial				None		None						None				None	None	Negligible beneficial effects have been identified with respect to population and human health, material assets and resource use, water and air and climate.
C15c Household Flow Regulator – Internal	Adverse				None		None						None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to fit the devices at properties.
	Beneficial				None		None						None				None	None	Negligible beneficial effects have been identified with respect to population and human health, material assets and resource use, water and air and climate.
C15d Household Flow Regulator – Internal	Adverse				None		None						None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to fit the devices at properties.
	Beneficial				None		None						None				None	None	Negligible beneficial effects have been identified with respect to population and human health, material assets and resource use, water and air and climate.
C15e Household Flow Regulator - Internal	Adverse				None		None						None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to fit the devices at properties.
	Beneficial				None		None						None				None	None	Negligible beneficial effects have been identified with respect to population and human health, material assets and resource use, water and air and climate.
C21a Housing Associations – targeted programme	Adverse		None		None		None						None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to deliver water audits and fit appropriate water efficient devices.
	Beneficial				None		None						None				None	None	The scheme would have minor beneficial effects with respect to water efficiency.
C21b Housing Associations – targeted programme	Adverse		None		None		None						None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to deliver water audits and fit appropriate water efficient devices.
	Beneficial				None		None						None				None	None	The scheme would have minor beneficial effects with respect to water efficiency.
C21c Housing Associations – targeted programme	Adverse		None		None		None						None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to deliver water audits and fit appropriate water efficient devices.
	Beneficial				None		None						None				None	None	The scheme would have minor beneficial effects with respect to water efficiency.

Option	Impact	SEA Objective																	Summary Commentary
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1	
C21d Housing Associations – targeted programme	Adverse		None		None		None						None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to deliver water audits and fit appropriate water efficient devices.
	Beneficial				None		None						None				None	None	The scheme would have minor beneficial effects with respect to water efficiency.
C21e Housing Associations – targeted programme	Adverse		None		None		None						None				None	None	Two minor adverse effects have been identified on air and GHG emissions as a result of increased number of vehicle journeys made to deliver water audits and fit appropriate water efficient devices.
	Beneficial				None		None						None				None	None	The scheme would have minor beneficial effects with respect to water efficiency.

Note: See Section 4.1 for description of SEA objectives.

Key:

- Major adverse
- Moderate adverse
- Minor adverse
- Negligible adverse
- None — Not applicable
- Major beneficial
- Moderate beneficial
- Minor beneficial
- Negligible beneficial

5.3.2 Leakage options

Table 5.4 provides a summary of the SEA evaluation for each of the leakage management options in the Regional Plan. The detailed appraisal framework tables for each option are provided in **Appendix E**.

The leakage options are unlikely to have any major or moderate adverse effects on any of the SEA objectives. Three options are anticipated to have minor adverse effects on health and wellbeing of local populations, reduction in consumption of resources, improvement in air quality. These minor adverse effects are predominantly resulting from disturbances created from the physical maintenance activities of these options, which would result in temporary increases in noise and air pollution, disturbance to communities and changes in local views and settings.

Options L4, L5 and L6 are anticipated to have major benefits on population and human health, material assets and resource use, surface and ground water flows, efficient use of water and climate resilience due to the savings created by these leakage control options.

Table 5.4 Visual evaluation matric summary for Yorkshire Water leakage options

Option	Impact	SEA Objective 1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1	Summary Commentary
L1 Active Leakage Control 14Ml/d	Adverse				None														No adverse effects have been identified.
	Beneficial				None														Five minor beneficial effects are anticipated for population and human health, material assets and resource use, water and air and climate.
L2 Active Leakage Control 30Ml/d	Adverse				None														No adverse effects have been identified.
	Beneficial				None														Five moderate beneficial effects are anticipated for population and human health, material assets and resource use, water and air and climate.
L3 Active Leakage Control 46Ml/d	Adverse				None														No adverse effects have been identified.
	Beneficial				None														Five moderate beneficial effects are anticipated for population and human health, material assets and resource use, water and air and climate.
L4 Active Leakage Control 62Ml/d	Adverse				None														Three minor adverse effects have been identified for population and human health, material assets and resource use, air and climate.
	Beneficial				None														Due to the amount of savings created by this leakage control option (65Ml/d), five major benefits are anticipated for population and human health, material assets and resource use, water and air and climate. Two minor benefits have also been identified for biodiversity and water.
L5 Active Leakage Control 78Ml/d	Adverse				None														Three minor adverse effects have been identified for population and human health, material assets and resource use, air and climate.
	Beneficial				None														Due to the amount of savings created by this leakage control option (78Ml/d), five major benefits are anticipated for population and human health, material assets and resource use, water and air and climate. Two minor benefits have also been identified for biodiversity and water.
L6 Active Leakage Control 95Ml/d	Adverse				None														Three minor adverse effects have been identified for population and human health, material assets and resource use, air and climate.
	Beneficial				None														Due to the amount of savings created by this leakage control option (78Ml/d), five major benefits are anticipated for population and human health, material assets and resource use, water and air and climate. Two minor benefits have also been identified for biodiversity and water.

Note: See Section 4.1 for description of SEA objectives.

Key:

- Major adverse
- Moderate adverse
- Minor adverse
- Negligible adverse
- None — Not applicable
- Major beneficial
- Moderate beneficial
- Minor beneficial
- Negligible beneficial

5.4 Resource management options

Table 5.5 provides a summary of the SEA evaluation for each of the resource management options in the WReN Regional Plan. The detailed appraisal framework tables for each option are provided in **Appendix E**.

A wide variety of options have been assessed, leading to a range of environmental effects being identified. These reflect the scale of abstraction and/or the location of the option in relation to sensitive environments (aquatic and terrestrial). As may be expected, the smaller scale options generally have the lower environmental effects, but differences do occur between such options due to their environmental setting. Many of the options have no greater than minor adverse effects. However, some options may have moderate or major adverse effects for some of the SEA objectives, as discussed in the following paragraphs.

Three schemes are anticipated to have major adverse effects against a total of five SEA objectives: DV6(vi), DV7a(vi), DV8(iv). All the Derwent Valley (DV) resource options, with the exception of DV3 and DV8(v), are anticipated to lead to major adverse impacts on biodiversity. Major adverse impacts for these options are also anticipated in relation to material assets and resource use, protection and enhancement of geology/soil quality, and minimisation of greenhouse gas emissions. However, these options are also anticipated to be associated with major to moderate beneficial effects on population and human health and climate change resilience due to the increase in available public water supply.

The Ouse Raw Water Transfer (R2) option is anticipated to have two moderate adverse effects on biodiversity, and archaeology and cultural heritage due to the construction of the Ouse abstraction and new pipeline. However, two major beneficial effects were identified, related to population and human health and climate change resilience due to a yield of 60Ml/d, therefore maintaining the supply-demand balance.

The Grid network enhancement: New River Ouse WTW to York (R1c) option and associated pipelines option to North Yorkshire (R1d and R1f) have been identified as having a major adverse effect on biodiversity. The Grid network enhancement: New River Ouse WTW to North Yorkshire 3 Option (R1f) is also anticipated to result in moderate adverse effects for material assets and resource use, air and climate and archaeology and cultural heritage. Grid network enhancement: New River Ouse WTW to York is not anticipated to result in any moderate or major adverse effects, but has the potential for moderate benefits to biodiversity given the opportunities for habitat enhancement and to climate reliance in relation to deployable output increases.

All South Yorkshire Groundwater options (R6, R6b, R6c, R6d) are anticipated to result in significant adverse effects. R6 South Yorkshire Groundwater Option 1 has been identified as having a moderate adverse effect on water due to a potential impact on ground water balance and surface water flows. R6b South Yorkshire Groundwater Option 2, R6c South Yorkshire Groundwater Option 3, R6d South Yorkshire Groundwater Option 4 have potential to result in major adverse effect on biodiversity due to potential for construction phase impacts on a SSSI and other sensitive ecological receptors, as well as on archaeology and cultural heritage.

The Sherwood Sandstone and Magnesian Limestone Boreholes Option 3 (R8c) is anticipated to lead to three moderate adverse effects; for population and human health, due to construction work being required in residential areas, and for cultural heritage, due to construction impacting upon the quality and settings of Scheduled Monuments and several Grade II Listed Buildings. R8f Sherwood Sandstone and Magnesian Limestone Boreholes Option 6 has been identified as having potential for a major adverse effect on biodiversity due to its proximity to designated sites as well as a moderate effect on archaeology and cultural heritage. Moderate benefits are however anticipated for population and human health due to the increase in supply of up to 20Ml/d. R8g Sherwood Sandstone Boreholes support to North Yorkshire is also expected to have moderate benefits for population and human health with an increased deployable output of 15Ml/d.

The R13 East Yorkshire Groundwater Option 2 is associated with moderate adverse effects on biodiversity due to the potential for adverse temporary effects on nearby ancient woodland. Moderate adverse effects on groundwater are also associated with the option pending further investigation.

The reservoir desilting option (Option R29) relates to 25 separate reservoirs, some of which could lead to adverse effects on European sites depending on the method of desilting that is adopted in the detailed design stage. It is therefore currently assessed as having a major adverse effect on biodiversity. If desilting requires extensive drawdown of the reservoirs, there will also likely be temporary moderate adverse effects on landscape and visual amenity given the setting of these reservoirs, some of which are located within or in visual proximity to the Peak District and Yorkshire Dales National Parks, as well as Nidderdale AONB. Desilting works have the potential to temporarily adversely affect water quality both within the reservoir and in the downstream watercourses due to elevated turbidity in the compensation flow release water. This will be mitigated by best practice methods (e.g. settling pools and use of straw bales to filter out sediments), but some minor impacts are likely. Desilting would only occur following careful planning and further investigations, and that the list of reservoirs included in the option may decrease if unacceptable environmental impacts are identified. However, an increase of 11Ml/d in deployable output will likely lead to moderate beneficial effects on population and human health and adapting to climate change.

Option R34 (River Calder Abstraction Option 1) has the potential for moderate adverse effects on population and human health, and archaeology and cultural heritage. A large proportion of the pipeline route will pass through heavily built areas, leading to temporary adverse effects from noise, dust and vibration and temporary adverse impacts on a range of recreational facilities and historical assets.

There are also moderate adverse effects associated with the River Aire Abstraction Option 1 (R35), relating to archaeology and cultural heritage due to the pipeline route potentially passing through a World Heritage Site (WHS). It will however provide a 10Ml/d yield on most days, contributing to moderate beneficial impacts.

The construction phase of the R51 Supply Dales from the Tees - treated is anticipated to result in adverse effects on material assets and resource use, and archaeology and cultural heritage given the scale and location of construction. However, given the provision of an additional 15Ml/d essential public water supplies will be maintained bringing moderate beneficial effects to population and human health, air and climate through increased resilience to climate change, and biodiversity through habitat enhancement.

The East Yorkshire coast desalination (R61) and Tidal Abstraction Reservoir (R78) options have the potential for major adverse effects on biodiversity as it may impact on the Humber Estuary SAC/SPA/Ramsar. In addition, major adverse effects are associated with the significant amount of resource use and energy required to operate R61. However moderate benefits are anticipated for both options in relation to population and human health and climate resilience, associated with the maintenance of essential public water supply

The Aire and Calder new WTW (R86) option may result in moderate adverse impacts on biodiversity and material assets and resource use during the construction phase, however given the increase of up to 70Ml/d benefit to public water supply, moderate benefits have been identified for population and human health and climate resilience.

Table 5.5 Visual evaluation matrix summary for resource management options

Option	Impact	SEA objective																Summary Commentary
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1	
Yorkshire Water Grid Surface Water Resource Zone Options																			
R1c: Network Enhancement New River Ouse WTW to York	Adverse				None							None							Major adverse effects on biodiversity flora and fauna are identified as were two moderate adverse effects on population and human health and landscape and visual amenity. Nine minor adverse effects were identified on the INNS; recreation and tourism; material assets and resource use; water (flows and flood risk); soils and geology; air and climate; historic environment and landscape and visual amenity topics.
	Beneficial											None							The scheme would have moderate beneficial effects with regard to provision of water supplies for population and human health; resilience to the threat of climate change and biodiversity net gain.
R1d: Grid network enhancement: New River Ouse WTW to North Yorkshire 1	Adverse				None					None		None							Major adverse effects on biodiversity flora and fauna are identified as were two moderate adverse effects on material assets and resource use and climate change. Eight minor adverse effects were identified for biodiversity, flora and fauna (natural capital and INNS); population and human health; soils and geology; air quality; historic environment and landscape and visual amenity topics.
	Beneficial									None		None							The scheme would have moderate beneficial effects with regard to provision of water supplies for population and human health; resilience to the threat of climate change and biodiversity net gain.
R1e: Grid network enhancement: New River Ouse WTW to North Yorkshire 2	Adverse				None					None		None							Moderate adverse effects on biodiversity flora and fauna and climate change are identified as were nine minor adverse effects on biodiversity, flora and fauna (natural capital and INNS); population and human health; material assets and resource use; soils and geology; air quality; historic environment and landscape and visual amenity topics.
	Beneficial									None		None							The scheme would have minor beneficial effects with regard to provision of water supplies for population and human health; resilience to the threat of climate change and biodiversity net gain.
R1f: Grid network enhancement: New River Ouse WTW to North Yorkshire 3	Adverse				None					None		None							Major adverse effects on biodiversity flora and fauna are identified as were three moderate adverse effects on material assets and resource use; climate change and historic environment. Seven minor adverse effects were identified, including those relating to INNS natural capital population and human health, soils and geology, air quality and landscape and visual amenity topics.
	Beneficial									None		None							The scheme would have moderate beneficial effects with regard to biodiversity net gain and minor beneficial effects with regards to provision of water supplies for population and human health and resilience to the threat of climate change and.
R1g: Grid network enhancement: New River Ouse WTW to York	Adverse				None					None		None							Eleven minor adverse effects were identified, including those relating to biodiversity, population/human health, material assets, water, soil and land use, air and GHG emissions, archaeology and landscape amenity.
	Beneficial									None		None							The scheme would have moderate beneficial effects with regards to provision of water supplies for population and human health and resilience to the threat of climate change and minor beneficial effects for biodiversity net gain.
R2: Ouse Raw Water Transfer	Adverse				None							None							Two moderate adverse effects were identified – for biodiversity and archaeology and cultural heritage. Eight minor adverse effects were identified, including those relating to population and human health, material assets, water quality and water levels/flows, soil and land use, and air quality.

Option	Impact	SEA objective																Summary Commentary
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1	
	Beneficial											None							Two major beneficial effects were identified, related to population and human health and an increase in deployable output as a result of the scheme of 60Ml/d (maintaining the supply-demand balance), and climate change adaptation. The scheme also provides the potential for minor beneficial effects on biodiversity enhancements.
R3: Increased River Ouse pump storage capacity	Adverse				None							None							One moderate adverse effect was identified relating to archaeology and cultural heritage. Six minor adverse effects were regarding biodiversity, population and human health, material assets, water, soil and land use, and GHG emissions.
	Beneficial											None							The scheme also provides the potential for moderate beneficial effects on biodiversity enhancements. Two minor beneficial effects were identified relating to climate change adaptation and population and human health due to the increase of 10Ml/d into the regional potable water supply.
R3a: River Ouse licence transfer	Adverse				None		None											None	Minor adverse effects on biodiversity are identified in relation to uncertainty in the HRA around the impacts on the Humber estuary. A HRA Stage 2 Appropriate Assessment would be required should this scheme be selected in the preferred programme.
	Beneficial				None		None											None	Two minor beneficial effects were identified relating to climate change adaptation and population and human health, both regarding the increased output into the regional water supply.
R5 Aquifer Storage and Recovery Scheme 1	Adverse				None														Eleven minor adverse effects were identified, including those relating to biodiversity, population/human health, material assets, water, soil and land use, air and GHG emissions, archaeology and landscape amenity.
	Beneficial																		Three minor beneficial effects were identified relating to population/human health, material assets/resource and climate change resilience.
R6 South Yorkshire Groundwater Option 1	Adverse				None							None							The construction and operation of this scheme is not associated with any major European sites. However, the scheme may have one moderate adverse effect on water flows. Several minor negative effects on population and human health, resource use, water quality, soils and geology, GHG emissions, and landscape and visual amenity.
	Beneficial											None							Three minor beneficial effects were identified for population and human health (supply of a resilient water supply), climate change resilience and resource efficiency.
R6b South Yorkshire Groundwater Option 2	Adverse				None							None							Major adverse effects on biodiversity flora and fauna as well as archaeology and cultural heritage. One moderate adverse effect on biodiversity with regards to natural capital. Seven minor adverse effects were identified, including those relating to population and human health, material assets and resource use, water, soils and geology, air quality and GHG emissions and landscape and visual amenity topics.
	Beneficial	None										None							Moderate beneficial effects on human health and wellbeing associated with the provision of an additional water resource which would help to maintain essential public water supplies and therefore help maintain public health and well-being. Moderate beneficial effects on improving resilience to climate change and the potential for moderate beneficial effects on biodiversity enhancement.

Option	Impact	SEA objective																Summary Commentary
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1	
R6c South Yorkshire Groundwater Option 3	Adverse				None							None							Major adverse effects on biodiversity flora and fauna as well as archaeology and cultural heritage. One moderate adverse effect on biodiversity with regards to natural capital. Seven minor adverse effects were identified, including those relating to population and human health, material assets and resource use, water, soils and geology, air quality and GHG emissions and landscape and visual amenity topics.
	Beneficial	None										None							Potential for moderate beneficial effects on biodiversity enhancement and minor beneficial effects on human health and wellbeing associated with the provision of an additional water resource which would help to maintain essential public water supplies and therefore help maintain public health and well-being. Minor beneficial effects on improving resilience to climate change.
R6d South Yorkshire Groundwater Option 4	Adverse				None							None							Major adverse effects on biodiversity flora and fauna as well as archaeology and cultural heritage. One moderate adverse effect on biodiversity with regards to natural capital. Seven minor adverse effects were identified, including those relating to population and human health, material assets and resource use, water, soils and geology, air quality and GHG emissions and landscape and visual amenity topics.
	Beneficial	None										None							Moderate beneficial effects on human health and wellbeing associated with the provision of an additional water resource which would help to maintain essential public water supplies and therefore help maintain public health and well-being. Moderate beneficial effects on improving resilience to climate change and the potential for moderate beneficial effects on biodiversity enhancement.
R8b: Sherwood Sandstone and Magnesian Limestone Boreholes Option 2	Adverse				None							None							Eleven minor adverse effects were identified, including those relating to biodiversity, population/human health, material assets, water, soil and land use, air and GHG emissions, archaeology and landscape amenity, including minor adverse effects were determined for biodiversity as the construction works would be within proximity of one SSSI and rural populations.
	Beneficial											None							Minor beneficial effects are anticipated for population health and climate change resilience, both associated with additional water supplies being available. The scheme also provides the potential for minor beneficial effects on biodiversity die to the potential for biodiversity enhancements associated with the scheme.
R8c: Sherwood Sandstone and Magnesian Limestone Boreholes Option 3	Adverse				None							None							Three moderate adverse effects were identified – for population and human health, water quality, and archaeology and cultural heritage. Eight minor adverse effects were identified, including those relating to population and human health, material assets, water quality and water levels/flows, soil and land use, and air quality.
	Beneficial											None							Minor beneficial effects are anticipated on community wellbeing and on climate resilience due to an increased potable water supply for the region. It also provides the potential for minor beneficial effects on biodiversity enhancement.
R8f: Sherwood Sandstone and Magnesian Limestone Boreholes Option 6	Adverse				None							None							Major adverse effects on biodiversity flora and fauna are identified as was one moderate adverse effect on archaeology and cultural heritage. Nine minor adverse effects were identified, including those relating to population and human health, material assets and resource use, water, soils and geology, air quality and GHG emissions and landscape and visual amenity topics.
	Beneficial											None							The scheme would have moderate beneficial effects with regard to biodiversity net gain and minor beneficial effects with regards to provision of water supplies for population and human health and resilience to the threat of climate change.
R8g: Sherwood Sandstone Abstraction support to North Yorkshire	Adverse				None							None							Eleven minor adverse effects were identified, including those relating to biodiversity, population/human health, material assets, water, soil and land use, air and GHG emissions, archaeology and landscape amenity.
	Beneficial											None							The scheme would have moderate beneficial effects with regard to biodiversity net gain and minor beneficial effects with regards to provision of water supplies for population and human health and resilience to the threat of climate change.

Option	Impact	SEA objective																Summary Commentary
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1	
R12 East Yorkshire Groundwater Option 1	Adverse				None														Eight minor adverse impacts have been identified relating to biodiversity, population and human health, material assets, water quality and quantity, air & climate and landscape.
	Beneficial																		Two minor beneficial effects have been identified relating to population and human health, and climate change adaptation.
R13 East Yorkshire Groundwater Option 2	Adverse				None							None							Two moderate adverse effects were identified for biodiversity and water levels and flows. Six minor adverse effects were identified for population and human health, water quality, flood risk, and air and greenhouse gas emissions.
	Beneficial											None							Two minor beneficial effects were identified for population and human health, and climate change adaptation.
R29: Reservoir De-silting	Adverse				None														One major adverse effect was identified for biodiversity, and a moderate adverse effect were identified for landscape and visual amenity. Seven minor adverse effects relating to population and human health, material assets, water quality, air quality and greenhouse gas emissions, and archaeology/cultural heritage.
	Beneficial				None														Three minor beneficial effects were identified relating to population and human health (increase in deployable output/water supply) and climate change resilience, use of existing infrastructure.
R31a: Additional bankside storage on the River Ouse					None							None							One moderate adverse effect was identified for biodiversity, flora and fauna. Five minor adverse effects were identified, including those relating to population/human health, material assets, soil and land use, GHG emissions and archaeology and cultural heritage.
												None							Minor beneficial effects are anticipated on community wellbeing and on climate resilience due to an increased potable water supply for the region. It also provides the potential for minor beneficial effects on biodiversity enhancement.
R34 River Calder Abstraction option 1	Adverse				None							None							Two moderate adverse effects were identified relating to population and human health and archaeology and cultural heritage. Nine minor adverse effects were identified, including those relating to biodiversity, flora and fauna, material assets, water, air and GHG emissions and landscape and visual amenity.
	Beneficial											None							Two minor beneficial effects were identified with regards to population and human health and climate change resilience.
R35 River Aire Abstraction Option 1	Adverse				None							None							One moderate adverse effect was identified relating to archaeology and cultural heritage. Ten minor adverse effects were identified, including those relating to biodiversity, population & human health, material assets, water, soil and land use, air and GHG emissions and landscape/visual amenity.
	Beneficial											None							The scheme provides the potential for moderate beneficial effects on habitat restoration due to the requirement of compensatory habitat. Three minor beneficial effects were identified relating to population and human health, air and climate and material assets and resource use.

Option	Impact	SEA objective																Summary Commentary
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1	
R37b(ii) River Aire Abstraction Option 4	Adverse											None							One moderate adverse effect was identified relating to biodiversity, flora and fauna. Eleven minor adverse effects were identified, including those relating to biodiversity, population & human health, material assets, water, soil and land use, air and GHG emissions and landscape/visual amenity.
	Beneficial											None							Moderate beneficial effects are anticipated for population health and climate change resilience, both associated with additional water supplies being available. The scheme also provides the potential for minor beneficial effects on biodiversity die to the potential for biodiversity enhancements associated with the scheme.
R51 Supply Dales from the Tees - treated	Adverse				None														Two moderate adverse impacts are anticipated with regard to resource use and archaeology and cultural heritage due to pipeline construction. Minor adverse impacts were identified for biodiversity, population and human health, water, soils and geology, air quality and GHG emissions and landscape and visual.
	Beneficial																		Moderate beneficial effects on human health and wellbeing associated with the provision of an additional 15 Ml/d which would help to maintain essential public water supplies and therefore help maintain public health and well-being. Moderate beneficial effects on improving resilience to climate change as the scheme would negate the need for North Area Reservoir 1 water to be treated at the WTW and would provide resilience to the Dales area. The scheme also provides the potential for moderate beneficial effects on biodiversity enhancement.
R61 East Yorkshire Coast desalinisation	Adverse																		Three major adverse effects are anticipated with regards to biodiversity, flora and fauna, material assets and resource use and GHG emissions. Two moderate adverse impact on natural capital enhancement and air emissions. Minor adverse impacts were identified for biodiversity, population and human health, water, soils and geology, air quality, archaeology and cultural heritage, and landscape and visual.
	Beneficial																		Moderate beneficial effects on human health and well-being and climate change resilience associated with maintenance of essential public water supplies. A minor beneficial effect on surface and groundwater levels, as operation of the desalination plant should reduce reliance on these assets. It also provides the potential for moderate beneficial effects on habitat restoration due to the requirement of compensatory habitat.
R78 Tidal Abstraction Reservoir	Adverse				None														A major adverse effect is anticipated with regards to biodiversity, flora and fauna. Four moderate adverse effects on biodiversity (natural capital), population and human health, material assets and resource use and soils and geology. Minor adverse impacts were identified for biodiversity, tourism and recreation, water (water quality and flood risk), air quality and climate change, archaeology and cultural heritage, and landscape and visual amenity.
	Beneficial																		Moderate beneficial effects on human health and well-being and climate change resilience associated with maintenance of essential public water supplies. A minor beneficial effect on surface and groundwater levels, as operation of the desalination plant should reduce reliance on these assets. It also provides the potential for moderate beneficial effects on habitat restoration due to the requirement of compensatory habitat.
R85 Recommission Kirklees WTW	Adverse				None						None	None	None						Five minor adverse effects on population and human health; material assets and resource use; air quality and climate change and landscape and visual amenity.
	Beneficial				None						None	None	None						Two minor beneficial effects were identified with regards to population and human health and climate change resilience.
R86 Aire and Calder new WTW	Adverse											None							Moderate adverse effects are anticipated for biodiversity, flora and fauna and material assets and resource use. Minor adverse effects on biodiversity, population and human health, water, air quality and climate change, archaeology and cultural heritage and landscape and visual amenity.
	Beneficial											None							Moderate beneficial effects on human health and wellbeing associated with the provision of an additional water resource which would help to maintain essential public water supplies and therefore help maintain public health and well-being. Moderate beneficial effects on improving resilience to climate change and the potential for moderate beneficial effects on biodiversity enhancement.

Option	Impact	SEA objective																Summary Commentary
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1	
DV3 - South Yorkshire GW	Adverse				None							None							Minor negative effects are anticipated for population and human health due to construction works taking place in close proximity to residential dwellings; material assets due to materials being required for construction; air quality and greenhouse gases due to emissions arising from construction. Minor negative effects on landscape are anticipated due to construction work being required in a greenbelt.
	Beneficial											None							Minor positive effects are anticipated on community health and resilience to climate change due to an increase in potable water supply in the region. Minor beneficial effects are also anticipated on opportunities for biodiversity enhancements.
DV6 (iv) - Tees to South Yorkshire Pipeline (50 Ml/d)	Adverse				None							None							Major adverse effects associated with pipeline construction are anticipated on biodiversity, flora and fauna, resource use, soils and geology, air quality, GHG emissions and landscape and visual amenity. Seven moderate adverse effects were identified for population and human health, water, and cultural heritage.
	Beneficial											None							Moderate beneficial effects on human health and wellbeing associated with the provision of an additional supply to maintain public water supplies. Moderate beneficial effects are also anticipated for resilience to climate change.
DV6 (v) - Tees to South Yorkshire Pipeline (80 Ml/d)	Adverse				None							None							Four major adverse effects are anticipated with regard to biodiversity, flora and fauna, resource use, soils and geology, air quality, GHG emissions and landscape and visual amenity, due to pipeline construction. Seven moderate adverse effects were identified for population and human health, water, and cultural heritage.
	Beneficial											None							Major beneficial effects on human health and wellbeing associated with the provision of an additional supply to maintain public water supplies. Major beneficial effects are also anticipated for resilience to climate change. Moderate beneficial effects are also anticipated on opportunities for biodiversity enhancements
DV6 (vi) - Tees to South Yorkshire Pipeline (140 Ml/d)	Adverse				None							None							Four major adverse effects are anticipated with regard to biodiversity, flora and fauna, resource use, soils and geology, air quality, GHG emissions and landscape and visual amenity, due to pipeline construction. Six moderate adverse effects were identified for population and human health, water, and cultural heritage
	Beneficial											None							Major beneficial effects on human health and wellbeing associated with the provision of an additional supply to maintain public water supplies. Major beneficial effects are also anticipated for resilience to climate change. Moderate beneficial effects are also anticipated on opportunities for biodiversity enhancements
DV7 (iv) - Tees- York Pipeline Option 1 (50 Ml/d)	Adverse				None							None							Four major adverse effects are anticipated with regard to biodiversity, flora and fauna, resource use, soils and geology and GHG emissions, due to pipeline construction. Five moderate adverse effects were identified for population and human health, air quality, cultural heritage and landscape and visual amenity.
	Beneficial											None							Moderate beneficial effects on human health and wellbeing associated with the provision of an additional supply to maintain public water supplies. Moderate beneficial effects are also anticipated for resilience to climate change. Moderate beneficial effects are also anticipated on opportunities for biodiversity enhancements
DV7 (v) - Tees to York Pipeline Option 1 (80 Ml/d)	Adverse				None							None							Four major adverse effects are anticipated with regard to biodiversity, flora and fauna, resource use, soils and geology and GHG emissions, due to pipeline construction. Five moderate adverse effects were identified for population and human health, air quality, cultural heritage and landscape and visual amenity.
	Beneficial											None							Major beneficial effects on human health and wellbeing associated with the provision of an additional supply to maintain public water supplies. Major beneficial effects are also anticipated for resilience to climate change. Moderate beneficial effects are also anticipated on opportunities for biodiversity enhancements

Option	Impact	SEA objective																Summary Commentary
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1	
DV7 (vi) - Tees to York Pipeline Option (140 Ml/d)	Adverse				None							None							Five major adverse effects are anticipated with regard to biodiversity, flora and fauna, resource use, soils and geology and GHG emissions, due to pipeline construction. Five moderate adverse effects were identified for population and human health, air quality, cultural heritage and landscape and visual amenity.
	Beneficial											None							Major beneficial effects on human health and wellbeing associated with the provision of an additional supply to maintain public water supplies. Major beneficial effects are also anticipated for resilience to climate change. Moderate beneficial effects are also anticipated on opportunities for biodiversity enhancements
DV8 (iv) - York to South Yorkshire Pipeline	Adverse				None					None		None							Five major adverse impacts are anticipated on Biodiversity, material assets and resource, soil, geology and land-use, and air and climate due to the scheme land-take, size and construction impacts.
	Beneficial									None		None							Major beneficial effects are anticipated on opportunities for biodiversity enhancements.
DV8 (v) – York WTW capacity increase	Adverse				None							None							One moderate adverse impact is anticipated with regard to biodiversity as a result of direct effects on internationally designated sites in close proximity to the scheme. The scale of the construction scheme is likely to create minor adverse impacts through construction activity.
	Beneficial											None							Moderate beneficial effects on human health and wellbeing associated with the provision of an additional supply to maintain public water supplies. Moderate beneficial effects are also anticipated for resilience to climate change. Minor beneficial effects are also anticipated on opportunities for biodiversity enhancements
Yorkshire Water East Surface Water Resource Zone Options																			
None																			
Northumbrian Water Berwick Water Resource Zone Options																			
None																			
Northumbrian Water Kielder Water Resource Zone Options																			
None																			
Hartlepool Water Hartlepool Water Resource Zone Options																			
None																			
Transfer Options																			
E2 - YW export to Severn Trent Water	Adverse											None							Moderate negative effects are anticipated on soil and land use is anticipated, as the proposed pipeline intersects a permitted and an historic landfill site; on community health, due to construction works in a densely populated area, recreation, due to the proximity of the construction to Rother Valley Country Park, and air quality, as construction works will be required within the Sheffield Citywide AQMA. Minor negative effects are anticipated for natural capital assets, as construction may affect tranquillity, material assets, as the construction will require novel materials, flood risk, as there will be construction works required in Flood Zones 2 and 3, greenhouse gas emissions, heritage, as the construction would be within 1km of a number of heritage assets, and landscape, due to construction within areas of the South and West Yorkshire Greenbelt.
	Beneficial											None							Moderate positive effects are anticipated for community health and resilience to climate, due to an increase of 20-25Ml/d into the potable water supply for the region. Moderate beneficial effects are also anticipated on opportunities for biodiversity enhancements

Option	Impact	SEA objective																Summary Commentary
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1	
WReNE1a: Kielder to UU	Adverse				None							None							Seven major adverse effects are anticipated with regard to biodiversity, flora and fauna, resource use, soils and geology, air quality, GHG emissions, archaeology and cultural heritage and landscape and visual amenity due to pipeline construction. Three moderate adverse effects were identified for population and human health, tourism and flood risk.
	Beneficial											None							Major beneficial effects on human health and wellbeing associated with the provision of an additional 100Ml/d to UU supply area which would help to maintain essential public water supplies and therefore help maintain public health and well-being. Major beneficial effects on improving resilience to climate change as the scheme would provide resilience through allowing 100 Ml/d of supply to be used elsewhere in the UU supply area.
WReNE1b: Kielder to UU	Adverse				None							None							Seven major adverse effects are anticipated with regard to biodiversity, flora and fauna, resource use, soils and geology, air quality, GHG emissions, archaeology and cultural heritage and landscape and visual amenity due to pipeline construction. Three moderate adverse effects were identified for population and human health, tourism and flood risk.
	Beneficial											None							Major beneficial effects on human health and wellbeing associated with the provision of an additional 100Ml/d to UU supply area which would help to maintain essential public water supplies and therefore help maintain public health and well-being. Major beneficial effects on improving resilience to climate change as the scheme would provide resilience through allowing 100 Ml/d of supply to be used elsewhere in the UU supply area.
WReNE2a: Cow Green to UU	Adverse				None							None							Five major adverse effects are anticipated with regard to biodiversity, flora and fauna, resource use, air quality, GHG emissions and landscape and visual amenity, due to pipeline construction. Seven moderate adverse effects were identified for INNS, population and human health, tourism, water quality, water resources, flood risk and cultural heritage.
	Beneficial											None							Moderate positive effects are anticipated for community health and resilience to climate, due to an increase of 40Ml/d into the potable water supply for the region. Moderate beneficial effects are also anticipated on opportunities for biodiversity enhancements
WReNE2b: Cow Green to UU	Adverse				None							None							Five major adverse effects are anticipated with regard to biodiversity, flora and fauna, resource use, air quality, GHG emissions and landscape and visual amenity, due to pipeline construction. Six moderate adverse effects were identified for population and human health, tourism, water quality, water resources, flood risk and cultural heritage.
	Beneficial											None							Moderate positive effects are anticipated for community health and resilience to climate, due to an increase of 40Ml/d into the potable water supply for the region. Moderate beneficial effects are also anticipated on opportunities for biodiversity enhancements

Note: See Section 4.2 for description of SEA objectives.

Key:

	Major adverse		Major beneficial
	Moderate adverse		Moderate beneficial
	Minor adverse		Minor beneficial
	Negligible adverse		Negligible beneficial
None	Not applicable		

6 Assessment of the WReN Regional Preferred Plan

6.1 The preferred plan

Whilst the initial primary criterion in selecting a programme of schemes to meet the supply-demand deficit over the planning period is whole-life cost (including any monetised values for environmental and social costs), the Environment Agency's Water Resources Planning Guidelines (WRPG) and National Framework requires that other criteria should also be considered, including non-monetised environmental and social impacts, climate change and other risks and uncertainties.

The aim of the Regional Plan is to find the 'best value' programme of supply and/or demand options (the 'preferred plan') to restore and maintain a supply-demand balance in those WRZs for which a supply deficit has been forecast. The selection process is facilitated through programme appraisal modelling tools, which are designed to produce an optimised programme taking account of whole life cost and environmental considerations.

Water companies are required to undertake assessments at a WRMP level. Many options for consideration at the Regional Plan come from the company level WRMPs, and Regional Plans will feed into WRMPs via identification of new options to consider and by providing planning solutions with which WRMPs will need to align. Therefore, WRMP24 and WReN options are being assessed in an integrated way to ensure consistency and allow comparable assessments.

As described in the Regional Plan, WReN have completed a full options appraisal to determine the benefits and disbenefits of the feasible options to guide the decision making process for the draft plan. The WReN options appraisal workstream uses the outputs from the environmental assessment workstream to inform the environmental, societal and resilience decision-making metrics which are included in the option appraisal process, whilst ensuring that the environmental and social impacts were not 'double-counted' in both the monetisation process and the SEA, as this could potentially skew the options and programme appraisal process. Further input from the environmental assessment workstream is also considered in a qualitative review during development of planning solutions.

The preferred plan has been selected in accordance with WReN's goal to use demand management and leakage reduction measures to meet the predicted supply-demand deficit as far as possible. This is also in line with guidance from Ofwat and Defra, and preferences expressed by customers across the WReN region. Whilst the optimisation process delivers a least cost solution, this does not consider regulatory and customer preferences or any wider resilience benefits from alternative solutions. As mentioned above, the WReN Regional Plan has been developed in parallel to the WRMP24 process and the objectives of both the Regional Plan and individual companies' WRMPs are aligned.

Most of the WRZs in the WReN region are in a healthy surplus, however, the Kielder WRZ and Grid SWZ are presenting deficits. Given this position, options are required to bridge the deficits in these WRZs. For Northumbrian Water, no supply options have been selected in the preferred plan, since demand management alone is sufficient to cover deficits in the Kielder zone. For Yorkshire Water, investment in both supply and demand reduction options is required, therefore the focus of the preferred plan is to address this.

The draft Regional Plan preferred plan is set out in **Table 6.1**.

The plan includes five demand management options that will meet government aspirations with regards to achieving 50% leakage reduction and reduction PCC (per capita consumption to 110 l/p/d by 2050. Three of these demand options are to address deficits in the Northumbrian region, specifically the Kielder WRZ, and were assessed as part of the BOT-DMO-Med scenario (see Section 5.2) with the exception of a more ambitious 50% leakage reduction target to replace the 40% target originally assessed. The BOT-DMO-Med scenario is assessed as resulting in moderate beneficial effects relating to sustainable and efficient use of water resources and increased resilience to climate change effects. The SEA findings also conclude minor beneficial effects across a range of other SEA objectives. Minor adverse effects have been identified for many of the SEA objectives relating to the construction associated with leakage reduction activities.

The remaining two demand options cover the Yorkshire Water area; L6 Active leakage control 95Ml/d and C5 Smart metering and water efficiency. The demand measures within the preferred plan also include customer demand management measures to further reduce water consumption per person/per property within Yorkshire Water's supply area. The C5 Smart metering and water efficiency option is assessed as resulting in moderate beneficial effects relation to sustainable and efficient use of water resources. The SEA findings also conclude that C5 Smart metering and water efficiency will result in minor beneficial effects across a range of other SEA objectives. The L6 Active leakage control 95Ml/d option is assessed as resulting in major beneficial effects across five SEA objectives in relation to human health and wellbeing, sustainable and efficient use of water resources and climate change resilience. Minor adverse effects have been identified in relation to the air and climate SEA objectives regarding use of material resources, air pollutant and greenhouse gas emissions.

A total of 11 supply-side measures are included in the draft Regional Plan. Major adverse impacts for options DV7a(vi) Tees to York Pipeline Option 3 and DV8 (iv) York to South Yorkshire Pipeline within the preferred plan are anticipated in relation to biodiversity, material assets and resource use, protection and enhancement of geology/soil quality, and minimisation of greenhouse gas emissions. However these options are also anticipated to be associated with major to moderate beneficial effects on population and human health and climate change resilience due to the increase in available public water supply. The construction phases of an additional four resource options within the preferred plan are anticipated to result in moderate adverse effects on biodiversity in relation to scheme construction and minor adverse effects across a number of SEA objectives including for population and human health and cultural heritage. The remaining six supply side options in the preferred plan are assessed resulting in negligible to minor adverse effects only across all SEA objectives. The majority of resource options provide opportunities to result in biodiversity enhancement (habitat creation/restoration), provide beneficial effects on population and human health and in relation to climate change resilience.

The HRA of the Regional Plan preferred plan has concluded that following inclusion of appropriate mitigation measures during the construction phase of relevant schemes that no adverse effects on the integrity of any European site are anticipated. Further details are provided within the HRA report which accompanies this Environmental Report[27].

The WFD compliance assessment has informed SEA findings against the water topic objectives, and has identified uncertain impacts associated with multiple WFD water bodies in relation to four schemes within the preferred plan: R8b Sherwood Sandstone and Magnesian Limestone Boreholes Option 2, R8g Sherwood Sandstone Boreholes support to North Yorkshire, R13 East Yorkshire Groundwater Option 2, and DV7a(vi) Tees to York Pipeline Option 3. Further investigations will need to be carried out to confirm these impacts before the schemes could be implemented. East Yorkshire Groundwater Option 2 will be within any constraints imposed following Water Industry National Environment Programme (WINEP) investigations. Further details are provided within the WFD compliance assessment report which accompanies this Environmental Report[28].

Implementation of the four options above, as well as options R37b(ii) River Aire Abstraction Option 4 and DV3 South Yorkshire GW, will be dependent on meeting Environment Agency licensing requirements.

Implementation of this plan will result in no deficit in the 25-year period of the Regional Plan.

A visual summary of SEA findings for each of the schemes included in the preferred plan is provided in **Table 6.2**.

[27] Ricardo Energy & Environment (2022) Habitats Regulation Assessment of the Draft Regional Plan. Report prepared for Water Resources North, November 2022.

[28] Ricardo Energy & Environment (2022) Water Framework Directive Regulations Compliance Assessment of the Draft Regional Plan. Report prepared for Water Resources North, November 2022.

Table 6.1 Draft WRMP24 preferred plan

Category	Option Reference	Scheme	Benefit (Ml/d) on full implementation[29]	First Year of Benefit
NWL Demand	BOT-DMO-Med (with leakage reduction increased to 50%)	Active Leakage Control to reduce leakage by 50% by 2050	49	2025/26
		Metering Replacement of existing meters with smart meters by 2035 and Enhanced Optant Smart Metering	15	2025/26
		Water Efficiency Programme In home interventions and digital engagement to reduce PCC to 110l/p/d by 2050	47	2025/26
YW Demand	C5	Smart Metering and Water Efficiency	28	2025/26
YW Demand	L6	Active Leakage Control 95Ml/d	95	2025/26
Resource	DV3	South Yorkshire groundwater	5	2027/28
Resource	DV7a(vi)	Tees - York Pipeline Option 3	140	2049/50
Resource	DV8(iv)	York WTW to South Yorkshire pipeline	N/A – 50Ml/d capacity required to transfer new source of supply to South Yorkshire	2035/36
Resource	DV8(v)	York WTW capacity increase	50	2029/30
Resource	R3a	River Ouse licence transfer	0.3 (15 maximum)	2027/28
Resource	R8b	Sherwood Sandstone and Magnesian Limestone Boreholes Option 2	5	2027/28

[29] Figures have been rounded. Benefits of Demand Options are at 2050.

Category	Option Reference	Scheme	Benefit (Ml/d) on full implementation[29]	First Year of Benefit
Resource	R8g	Sherwood Sandstone Boreholes support to North Yorkshire	15	2028/29
Resource	R13	East Yorkshire Groundwater Option 2	6 (8 maximum)	2025/26
Resource	R31a	Additional bankside storage on the River Ouse	11	2066/67
Resource	R37b(ii)	River Aire Abstraction Option 4	34	2025/26
Resource	R85	Recommission Kirklees WTW	8	2068/69

Table 6.2 Visual evaluation matrix summary for options in the draft WRMP24 preferred plan

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
BOT-DMO-Med	Adverse				None													
	Beneficial																	
C5 Smart Metering and Water Efficiency	Adverse				None		None						None				None	None
	Beneficial				None		None						None				None	None
L6 Active Leakage Control 95Ml/d	Adverse				None													
	Beneficial				None													
DV3 - South Yorkshire Groundwater	Adverse				None							None						
	Beneficial											None						
DV7a(vi) - Tees - York Pipeline Option 1	Adverse				None							None						

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial											None						
DV8 (iv) - York to South Yorkshire Pipeline	Adverse				None					None		None						
	Beneficial									None		None						
DV8 (v) - York WTW Capacity increase	Adverse				None							None						
	Beneficial											None						
R3a River Ouse licence transfer	Adverse				None		None											None
	Beneficial				None		None											None
R8b: Sherwood Sandstone and Magnesian Limestone Boreholes Option 2	Adverse				None							None						
	Beneficial											None						
R8g Sherwood Sandstone Boreholes support to North Yorkshire	Adverse				None							None						

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial											None						
R13 East Yorkshire Groundwater Option 2	Adverse				None							None						
	Beneficial											None						
R31a Additional bankside storage on the River Ouse	Adverse				None							None						
	Beneficial											None						
R37b(ii) River Aire Abstraction Option 4	Adverse											None						
	Beneficial											None						
R85 Recommission Kirklees WTW	Adverse				None						None	None	N/A					
	Beneficial				None						None	None	None					

Note: See Section 5.2 for description of SEA objectives.

Key:

	Major adverse		Major beneficial
	Moderate adverse		Moderate beneficial
	Minor adverse		Minor beneficial
	Negligible adverse		Negligible beneficial
None	Not applicable		

6.2 Alternative plans

6.2.1 Least cost solution

WReN developed several plans (i.e. a selection of options or solutions with an implementation schedule) through the water resources management planning process. This allowed for comparison of the performance of the different 'alternative; plans against the preferred plan described in Section 6.1. One of the objectives of the Regional Plan is to be affordable and sustainable over the long-term, therefore it is important the plan considered cost. Therefore, a key step in the planning process was to utilise the Decision-Making Framework (DMF) 'optimisation model' to create a least cost solution for the Grid SWZ based on cost (financial capital) alone. For the Kielder WRZ, the least cost solution performs the same as the preferred plan, as the same demand management options are included in both.

Further details on the alternative 'candidate' solutions considered as part of the planning process are available in the Draft Regional Plan. This report focuses on the comparison between preferred plan and the least cost solution.

A visual summary of SEA findings for each of the schemes included in the least cost solution is provided in **Table 6.3**.

There are some major and moderate adverse impacts as well as several minor adverse impacts associated with the resource schemes. DV7a (vi) York Pipeline Option 1 and DV8 (iv) York to South Yorkshire Pipeline options have major adverse impacts across a number of SEA objectives, including biodiversity, and in addition both R8f Sherwood Sandstone and Magnesian Limestone Boreholes Option 6 and R29 Reservoir De-silting have major adverse impacts in relation to the biodiversity SEA objective. The WFD compliance assessment has identified uncertain impacts associated with multiple WFD water bodies in relation to four schemes within the least cost solution plan.

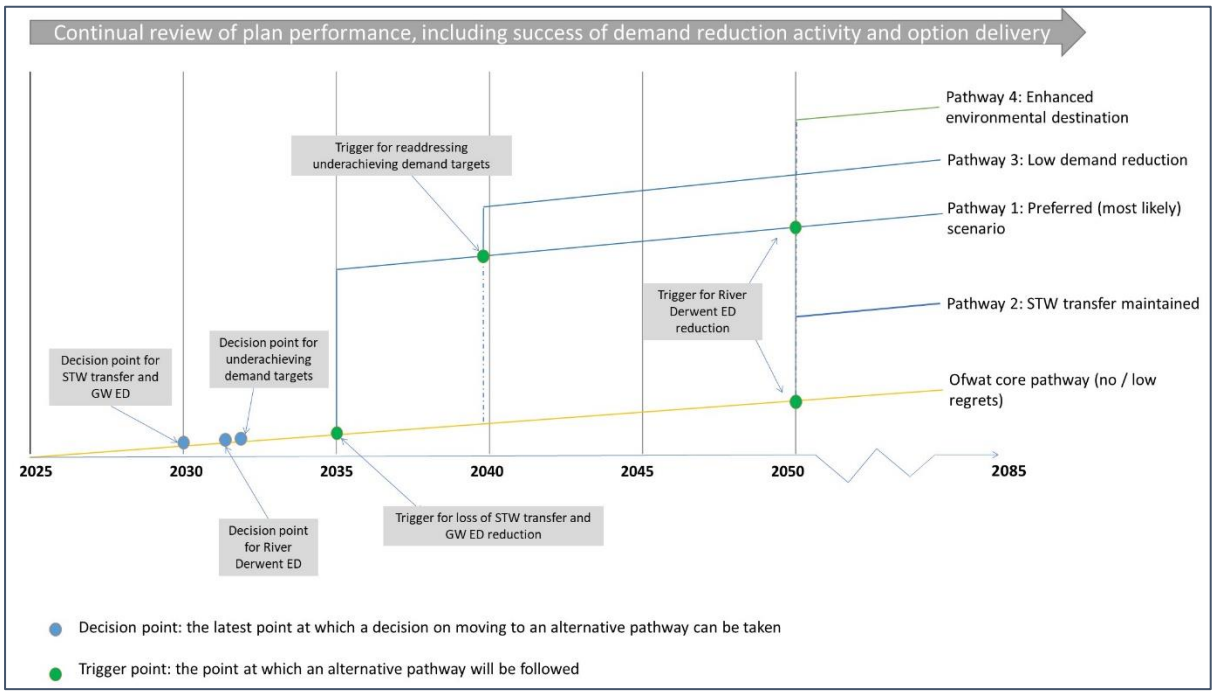
6.2.2 Adaptive pathways

The development of the Regional Plan utilises the most up to date information available to WReN, although the plan is still based on estimates and incorporates known risks to provide an appropriate level of flexibility. The final step in formulating the preferred plan is to create an adaptive plan that enables it to be flexible to the uncertainties and divert to an alternative future if required. Adaptive planning is a framework that is used to manage risk and uncertainty in the preferred plan.

For the Kielder zone, the sensitivity testing has shown that under all scenarios, a supply surplus is maintained across the planning period. Consequently, the preferred plan does not need to be an adaptive plan. For Grid zone, no additional options are required beyond those included in their preferred plan. However, there are several risks that can be linked to key dates that trigger an alternative pathway. These include the loss of the existing Severn Trent Water import and licence reductions to meet environmental destination objectives. To ensure WReN are prepared for diverting to an alternative plan the draft Regional Plan therefore includes decision points in advance of the pathway diverging**. Figure 6.1** (taken from the draft Regional Plan) visualises these decision points.

A total of five pathways have been considered in the draft Regional Plan, including the pathway of the Preferred plan. An overview of the how these pathways compare to the preferred plan and a summary of the SEA findings are provided below. Further details on the adaptive pathways are available in the draft Regional Plan.

Figure 6.1 Preferred plan adaptive pathways for tackling the Grid SWZ deficit within the WReN region



6.2.2.1 Pathway 2: Severn Trent Water (STW) transfer is maintained

Pathway 2 assumes the STW transfer could be maintained in the future. Under this pathway, there are two options included in the preferred plan that would no longer be needed. The decision would be made in 2030 and the pathway triggered in 2035.

A visual summary of SEA findings for each of the schemes included in the enhanced environmental destination pathway is provided in **Table 6.4.**

A number of resource options with significant environmental effects would not be required within this alternative future scenario, including the R31a Additional bankside storage on the River Ouse and DV8(iv) York WTW to South Yorkshire Pipeline options which are associated with major adverse impacts for options. Options with moderate adverse effects during the construction phase remain in Pathway 2 as do several with uncertainty within the WFD compliance assessment.

6.2.2.2 Pathway 3: Low demand reduction

Pathway 3 assumes the combined benefits of leakage reduction and PCC reduction will be half that assumed in the preferred plan for the Grid SWZ.

The options included in Pathway 3 are the same as the preferred plan therefore a separate visual summary has not been provided (see **Table 6.2**), however, the pathway would bring forward the implementation of option DV7a(vi) York Pipeline Option 1 and leave the Grid SWZ vulnerable in the longer term. A decision point in 2032 and a trigger in 2038 for this pathway have been included. However, the uncertainty cannot be defined to a single year, and progress with be monitored so the preferred plan can be reviewed and altered as necessary.

6.2.2.3 Pathway 4: Enhanced environmental destination

This pathway represents the enhanced environmental destination and the risk of additional deficit if the outcome of the River Derwent investigations is more severe than assumed in the preferred plan. Under this scenario, additional investment would be required in the 2060s to create an additional option to meet this deficit. The trigger for the pathway is 2049 and the decision point is in 2032 and the time between allows for the complexities of this pathway to be resolved. This pathway follows the preferred plan with the addition of a new abstraction from the Humber Estuary Tidal Abstraction Reservoir (option R78) from 2068 to address a supply deficit should licence reductions be required.

A visual summary of SEA findings for each of the schemes included in the enhanced environmental destination pathway is provided in Error! Reference source not found..

The R61 East Yorkshire coast desalination option represents an alternative abstraction from the Humber Estuary. Significant further investigation is required in relation to both these schemes. The HRA has identified likely significant effects at Stage 1 screening and a Stage 2 appropriate assessment of both schemes will need to be undertaken when further scheme details are available as these options are developed.

6.2.2.4 Ofwat Core pathway

The Ofwat Core pathway represents the minimum interventions required to ensure the future risks are mitigated and WReN are resilient to future drought events.

It assumes all options planned for AMP8 (2025-2030) and AMP9 (2030-2035) will be implemented. However, as in Pathway 2, there is potential that the Severn Trent Water transfer could continue if their plan diverts to a different pathway. There is also a possible outcome from the River Derwent environmental destination investigations that the licence is not reduced. This alternative outcome would negate the need for three options included in the preferred pathway.

A visual summary of SEA findings for each of the schemes included in the Ofwat Core pathway is provided in Error! Reference source not found..

A number of resource options with significant environmental effects would not be required within this alternative future scenario, including the R31a Additional bankside storage on the River Ouse, DV7a(vi) York Pipeline Option 1 and DV8(iv) York WTW to South Yorkshire Pipeline options which are associated with major adverse impacts for options. Options with moderate adverse effects during the construction phase remain in the Ofwat Core pathway as do several with uncertainty within the WFD compliance assessment.

Table 6.3 Visual evaluation matrix summary for options in the Least cost solution

Option	Impact	SEA Objective															
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
C15a Household Flow Regulators	Adverse				None		None						None				None	None
	Beneficial				None		None						None				None	None
L6 Active Leakage Control 95Ml/d	Adverse				None													
	Beneficial				None													
DV3 - South Yorkshire Groundwater	Adverse				None							None						
	Beneficial											None						
DV7a(vi) - Tees to York Pipeline Option 1	Adverse				None							None						
	Beneficial											None						
DV8 (iv) - Tees -York to South Yorkshire Pipeline	Adverse				None					None		None						

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial									None		None						
DV8 (v) - York WTW capacity increase	Adverse				None							None						
	Beneficial											None						
R5 Aquifer Storage and Recovery Scheme 1	Adverse				None													
	Beneficial																	
R8b: Magnesian limestone new supply to Marton-cum-Grafton SRE	Adverse				None							None						
	Beneficial											None						
R8c: Sherwood Sandstone new supply to Piper Hill SRE (Thirsk)	Adverse				None							None						
	Beneficial											None						
R8f Sherwood Sandstone and Magnesian Limestone Boreholes Option 6	Adverse				None							None						

Option	Impact	SEA Objective															
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial											None						
R8g Sherwood Sandstone Boreholes support to North Yorkshire	Adverse				None							None						
	Beneficial											None						
R13 East Yorkshire Groundwater Option 2	Adverse				None							None						
	Beneficial											None						
R29 Reservoir De-silting	Adverse				None													
	Beneficial				None													
R31a Additional bankside storage on the River Ouse	Adverse				None							None						
	Beneficial											None						
R51 Supply Dales from the Tees - treated	Adverse				None													

Option	Impact	SEA Objective															
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial																	
R86 Aire and Calder new WTW	Adverse											None						
	Beneficial											None						

Table 6.4 Visual evaluation matrix summary for options in Pathway 2: STW transfer maintained

Option	Impact	SEA Objective															
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
C5 Smart Metering and Water Efficiency	Adverse				None		None						None				None	None
	Beneficial				None		None						None				None	None
L6 Active Leakage Control 95Ml/d	Adverse				None													
	Beneficial				None													
DV3 - South Yorkshire Groundwater	Adverse				None							None						
	Beneficial											None						
DV7a(vi) - Tees - York Pipeline Option 1	Adverse				None							None						
	Beneficial											None						
DV8 (v) - York WTW Capacity increase	Adverse				None							None						

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial											None						
R3a River Ouse licence transfer	Adverse				None		None											None
	Beneficial				None		None											None
R8b: Sherwood Sandstone and Magnesian Limestone Boreholes Option 2	Adverse				None							None						
	Beneficial											None						
R8g Sherwood Sandstone Boreholes support to North Yorkshire	Adverse				None							None						
	Beneficial											None						
R13 East Yorkshire Groundwater Option 2	Adverse				None							None						
	Beneficial											None						
R37b(ii) River Aire Abstraction Option 4	Adverse											None						

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial											None						
R85 Recommission Kirklees WTW	Adverse				None						None	None	N/A					
	Beneficial				None						None	None	None					

Table 6.5 Visual evaluation matrix summary for options in Pathway 3: Enhanced environmental destination

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
C5 Smart Metering and Water Efficiency	Adverse				None		None						None				None	None
	Beneficial				None		None						None				None	None
L6 Active Leakage Control 95Ml/d	Adverse				None													
	Beneficial				None													
DV3 - South Yorkshire Groundwater	Adverse				None							None						
	Beneficial											None						
DV7a(vi) - Tees to York Pipeline Option 1	Adverse				None							None						
	Beneficial											None						
DV8 (iv) - York to South Yorkshire Pipeline	Adverse				None					None		None						

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial									None		None						
DV8 (v) - York WTW Capacity increase	Adverse				None							None						
	Beneficial											None						
R3a River Ouse licence transfer	Adverse				None		None											None
	Beneficial				None		None											None
R8b: Sherwood Sandstone and Magnesian Limestone Boreholes Option 2	Adverse				None							None						
	Beneficial											None						
R8g Sherwood Sandstone Boreholes support to North Yorkshire	Adverse				None							None						
	Beneficial											None						
R13 East Yorkshire Groundwater Option 2	Adverse				None							None						

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial											None						
R31a Additional bankside storage on the River Ouse	Adverse				None							None						
	Beneficial											None						
R37b(ii) River Aire Abstraction Option 4	Adverse											None						
	Beneficial											None						
R78 Tidal Abstraction Reservoir	Adverse				None													
	Beneficial																	
R85 Recommission Kirklees WTW	Adverse				None						None	None	N/A					
	Beneficial				None						None	None	None					

Table 6.6 Visual evaluation matrix summary for options in the Ofwat Core Programme

Option	Impact	SEA Objective															
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
C5 Smart Metering and Water Efficiency	Adverse				None		None						None				None	None
	Beneficial				None		None						None				None	None
L6 Active Leakage Control 95Ml/d	Adverse				None													
	Beneficial				None													
DV3 - South Yorkshire Groundwater	Adverse				None							None						
	Beneficial											None						
DV8 (v) - York WTW Capacity increase	Adverse				None							None						
	Beneficial											None						
R3a River Ouse licence transfer	Adverse				None		None											None

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial				None		None											None
R8b: Sherwood Sandstone and Magnesian Limestone Boreholes Option 2	Adverse				None							None						
	Beneficial											None						
R8g Sherwood Sandstone Boreholes support to North Yorkshire	Adverse				None							None						
	Beneficial											None						
R13 East Yorkshire Groundwater Option 2	Adverse				None							None						
	Beneficial											None						
R37b(ii) River Aire Abstraction Option 4	Adverse											None						
	Beneficial											None						
R85 Recommission Kirklees WTW	Adverse				None						None	None	N/A					

Option	Impact	SEA Objective																
		1.1	1.2	1.3	1.4	2.1	2.2	3.1	4.1	4.2	4.3	4.4	5.1	6.1	6.2	6.3	7.1	8.1
	Beneficial				None						None	None	None					

6.3 Option-level cumulative assessment

A cumulative assessment of the preferred plan was undertaken to consider whether the preferred plan options, when constructed or operated together, led to additional effects on each of the SEA topics. The cumulative assessment presented in this section has been carried out in line with the methodology described in Section 5 based upon the preferred plan of options discussed and presented in Section 8.1 and presented in **Table 6.1**.

Table 6.7 provides a summary of the outcomes of the cumulative assessment for the preferred plan. There are potential cumulative impacts between the following options which would require construction in the vicinity of Elvington WTW York WTW should these schemes have overlapping construction phases:

The first year of benefit for R31a within the preferred plan is identified as 2066 (see **Table 6.1**) and this scheme is estimated to be associated with an approximately 4 year construction phase. Both the DV8(iv) and DV8(v) schemes are also estimated to associate with a four year construction period are identified as operational in 2035 and 2029 respectively, and therefore the construction phases will not coincide with that of R31a. The DV7a(vi) scheme is identified as operational in 2049 within the preferred plan (see **Table 6.1**) with an approximately 15 year construction phase. Therefore no cumulative effects are anticipated.

On the basis of current information the construction phases of the DV8(v) scheme is estimated to run for four years and is not currently expected to overlap with that of the DV7a(vi) and DV8(iv) schemes and therefore no cumulative effects are anticipated.

The DV7a(vi) and DV8(iv) schemes are likely to have overlapping construction phases and there is therefore potential for cumulative impacts between two schemes related to construction impacts on biodiversity (Objective 1.1, Objective 1.3), population and human health (Objective 2.1), material assets and resource use (Objective 3.1), air quality (Objective 6.1), archaeology and cultural heritage (Objective 7.1), and landscape and visual amenity (Objective 8.1). Construction measures that need to be incorporated into the scheme design and/or planning to avoid or mitigate potential effects will be agreed during the detailed design and planning stage should these schemes be progressed. The DV7a(vi) scheme will cover a large geographical area (pipeline construction from the River Tees to Ouse) as will the DV8(iv) scheme (Ouse to South Yorkshire) and therefore until detailed construction plans are available it is not possible to identify if works in proximity to sensitive receptors will coincide. However, any such cumulative impacts would be expected to be minor, as most of these activities would be localised and small in scale, and could be effectively mitigated through careful project management and best practice construction methods

There is no potential for cumulative adverse effects during operation of the schemes included in the preferred plan as there are no water bodies that are impacted by more than one option. There would be benefits associated with implementation of each option in parallel, i.e. increasing the overall volume of water savings made or water provided for supply.

Table 6.7 Cumulative impacts matrix for the draft WReN Regional Plan preferred plan

C5	Smart Metering and Water Efficiency														
L6	Active Leakage Control 95 Ml/d	None													
BOT-DMO-Med	50% leakage reductiob, Enhanced metering and medium water efficiency activity	None	None												
DV3	South Yorkshire Groundwater	None	None	None											
DV7avi)	Tees to York Pipeline Option 1	None	None	None											
DV8(iv)	York to South Yorkshire Pipeline	None	None	None											
DV8(v)	York WTW Capacity increase	None	None	None											
R3a	River Ouse licence transfer	None	None	None											
R8b	Sherwood Sandstone and Magnesian Limestone Boreholes option 2	None	None	None											
R8g	Sherwood Sandstone Boreholes support to North Yorkshire	None	None	None											
R13	East Yorkshire Groundwater Option 2	None	None	None											
R31a	Additional bankside storage on the River Ouse	None	None	None											
R37b(ii)	River Aire Abstraction Option 4	None	None	None											
R85	Recommission Kirklees WTW	None	None	None											
		C5	L6	BOT-DMO-Med	DV3	DV7a(vi)	DV8(iv)	DV8(v)	R3a	R8b	R8g	R13	R31a	R37b(ii)	R85

Key

- Mutually exclusive schemes, i.e. use the same site or the same resource
- Potential adverse construction impacts if constructed simultaneously
- Potential cumulative impacts in operation
- None — No cumulative impacts

6.4 Programme-level cumulative assessment

Cumulative effects of the Regional Plan with other relevant plans, programmes and projects have been considered. These include the following:

- WReN water company Drought Plans
- Neighbouring Regional Plans (to be assessed when published)
- Neighbouring water companies' drought plans
- Neighbouring water companies' WRMPs (these are to be assessed when published
- Environment Agency Drought Plans
- Canal and River Trust Management Plans
- Local Development Frameworks
- National Policy Statements and National/Regional Infrastructure Plans
- Major Projects

6.4.1 WReN company level Drought Plans

As all supply-side options included in the preferred plan are to meet the deficit in Yorkshire Water's Grid WRZ, cumulative effects are only possible in conjunction with Yorkshire Water's Drought Plan. Yorkshire Water published its Final Drought Plan in 2022. The Drought Plan provides a comprehensive statement of the actions that Yorkshire Water will consider implementing during drought conditions in order to protect essential water supplies for customers and to minimise environmental impact. Yorkshire Water's Drought Plan 2022 comprises a total of 63 drought options (58 supply side options (including 49 supply side standard options and 9 long term supply side options) and 5 demand options). The Plan includes a range of drought management actions (linked to drought triggers), that can be broadly categorised as:

- Demand Side Options (including: publicity campaigns; emergency drought orders; leakage detection; temporary-use bans.
- Supply Side Options (including: abstraction increases; reduced regulated flows; water transfers
- Drought Permits and orders

There are options in the Regional Plan preferred plan that also appear in the Yorkshire Water Drought Plan 2022 i.e. East Yorkshire Groundwater Option 2 (R13) and R37b(ii) River Aire Abstraction Option 4, or are similar schemes which would utilise the same proposed source i.e. R3a River Ouse licence transfer, DV8(v) York WTW Capacity increase and DV7a(vi) Tees - York Pipeline Option 1. No cumulative impacts will arise as they will be mutually exclusive - either the scheme will be developed as a permanent scheme under the WRMP/Regional Plan process and therefore no longer a Drought Plan option; or it will be a temporary scheme available, if required, in a drought prior to it becoming a permanent scheme in later years under the WRMP/Regional Plan.

The Yorkshire Water Drought Plan 2022 and Northumbrian Water Drought Plan 2022 both include demand side management options for increased leakage detection and repair activity. Simultaneous implementation of the Regional Plan leakage management schemes could lead to cumulative adverse impacts with leak detection and repair activity associated with the Drought Plan, however, any such impacts are likely to be no more than minor.

6.4.2 Neighbouring Regional Plans, WRMPs and Drought Plans

The draft Regional Plans, WRMPs and drought plans from the following water companies have been considered for potential cumulative effects with the draft WRMP24 preferred plan and alternative pathways.

- Water Resources West (including company level plans from Severn Trent Water and United Utilities Water)
- Water Resources East (including company level plans from Anglian Water Services)

This section is contingent on access to the other draft Regional Plans (including company level WRMPs) and their assessments which are all running concurrently to WReN. Currently, without sight of the draft

plans for other regions, it is not possible to make a definitive cumulative assessment against other regional group's draft plans and this assessment will require updating when all plans are available.

On the basis of information currently available the following potential cumulative effects are identified as requiring further consideration:

- An additional flow reduction in the River Ouse associated with Option R3a River Ouse licence transfer, included in the draft WRMP24 preferred plan, would lead to a 4% reduction in flows at the lowest hands off flow (HoF) value (400Ml/d) and a 1% reduction in flows the second lowest HoF (650Ml/d) compared to baseline conditions. This flow reduction is considered negligible[28]. However there remains potential for cumulative effects on the downstream Humber Estuary in combination with schemes in the WRW and WRE which may affect flow in the River Derwent and River Trent. Any reduction in freshwater flows could potentially affect qualifying interests for which the Humber Estuary is designated. While no cumulative effects are anticipated, on the basis of impacts associated with individual schemes, an assessment of the impact on pass forward flow to the estuary will be required when confirmation of proposed schemes in the draft plans are available.
- The Humber Estuary Tidal Abstraction Reservoir (option R78) is included in the enhanced environmental destination pathway and is identified as being required in 2068. Further investigation are required on this scheme and on an alternative scheme on the Humber Estuary, the R61 East Yorkshire coast desalination option. There is potential for cumulative effects with the Anglian Water WRMP24 should that plan contain options impacting the Humber estuary (e.g. potential de-salination schemes), and any future investigations would need to consider these potential effects.

It is not anticipated that the United Utilities' draft WRMP24 preferred plan will include any options which are in close geographical proximity or hydrological connectivity with the supply-side options in Yorkshire Water's preferred plan. This will need to be reviewed when all draft plans are available.

6.4.3 National/Regional Infrastructure Plans

6.4.3.1 National Policy Statements (NPSs)

The Planning Act 2008 introduced a procedure to streamline the decision-making process for NSIPs. Under the Act, a developer wishing to construct a Nationally Significant Infrastructure Projects (NSIP) must first apply to the Secretary of State for development consent.

The National Policy Statements comprise the government's objectives for the development of nationally significant infrastructure in a particular sector and state, including[30]:

- How this will contribute to sustainable development.
- How these objectives have been integrated with other government policies.
- How actual and projected capacity and demand have been taken into account.
- Consideration of relevant issues in relation to safety or technology.
- Circumstances where it would be particularly important to address the adverse impacts of development.
- Specific locations, where appropriate, in order to provide a clear framework for investment and planning decisions.

National Policy Statements (NPSs) establish the need for specific types of infrastructure and provide planning guidance for promoters of NSIPs, and the basis for the examination by the Examining Authority and decisions by the Secretary of State on development consent order applications. A number of NPSs have been published which set out the definition, and in some cases the location, of NSIPs.

[30] Planning Inspectorate (2022) National Infrastructure Planning. Available at: https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/national-policy-statements/

It is not expected that the draft Regional Plan will have any cumulative effects with any NPSs due to the non-site specific nature of NPSs. One NPS, Nuclear Power NPS (EN-6) does outline potential suitable sites for new nuclear power station development, one of these sites (Hartlepool) is located within the WReN area, however, there are no supply options in proximity therefore no significant cumulative effects are anticipated.

Two NSIPs are set out in the Waste Water Treatment NPS; however, both of these are located in London and are not expected to have any effect on water resource management within the YW draft WRMP24 area. Similarly, the Airports NPS concerns runway capacity in the South East of England only.

The government consulted on an NPS for water resources between 2018 and 2019. This NPS sets out the need and government's policies for the development of nationally significant infrastructure projects relevant to water resources in England. Implementation of the draft WRMP24 is likely to be compatible with those objectives of the NPS for improving water supply resilience.

6.4.3.2 Nationally Significant Infrastructure Projects (NSIPs)

All NSIPs are listed on the Planning Inspectorate website[31]. At the time of writing, 47 projects located within the WReN region were at various stages. These are detailed in **Table 6.8**.

Table 6.8 NSIPs in the WReN Region

Project	Developer	Stage
A1 Birtley to Coal House Improvement Scheme	Highways England	Decided
A19/A1058 Coast Road Junction Improvement	Highways Agency	Decided
A19 / A184 Testos Junction Improvement	Highways England	Decided
A19 Downhill Lane Junction Improvement	Highways England	Decided
Little Crow Solar Park	INRG SOLAR (Little Crow) Ltd	Decided
Able Marine Energy Park Material Change 2	Able Humber Ports Ltd	Decided
South Humber Bank Energy Centre	EP Waste Management Limited	Decided
Thorpe Marsh Gas Pipeline	Thorpe Marsh Power Limited	Decided
A63 Castle Street Improvement-Hull	Highways England	Decided
Hornsea Offshore Wind Farm (Zone 4) - Project One	SMart Wind Ltd	Decided
Ferrybridge Multifuel 2 (FM2) Power Station	Multifuel Energy Ltd	Decided
Drax Re-power	Drax Power Limited	Decided
Dogger Bank Creyke Beck	Forewind	Decided
Dogger Bank Teesside A / Sofia Offshore Wind Farm (formerly Dogger Bank Teesside B) - Project previously known as Dogger Bank Teesside A&B	Forewind Ltd	Decided
North Killingholme Power Project	C.GEN Killingholme Ltd	Decided
Knottingley Power Project	Knottingley Power Limited	Decided
A160 - A180 Port of Immingham Improvement	Highways Agency	Decided
Hornsea Offshore Wind Farm (Zone 4) - Project Two	SMart Wind Limited	Decided
Yorkshire and Humber CCS Cross Country Pipeline	National Grid Carbon Limited	Decided
River Humber Gas Pipeline Replacement Project	National Grid	Decided
Able Marine Energy Park	Able Humber Ports Ltd	Decided
North Doncaster Rail Chord (near Shaftholme)	Network Rail	Decided

[31] https://infrastructure.planninginspectorate.gov.uk/projects/

Project	Developer	Stage
White Rose Carbon Capture and Storage Project	Capture Power Limited	Decided
Eggborough CCGT	Eggborough Power Limited	Decided
Morpeth Northern Bypass	Northumberland County Council	Decided
Port Blyth New Biomass Plant	North Blyth Energy Ltd	Decided
Tees CCPP	Sembcorp Utilities (UK) Limited	Decided
York Potash Harbour Facilities Order	York Potash Ltd	Decided
A1 in Northumberland - Morpeth to Ellingham	Highways Agency	Decision
Keadby 3 Carbon Capture Power Station	Keadby Generation Limited	Decision
The Net Zero Teesside Project	Net Zero Teesside Power Limited "NZT Power" and Net Zero North Sea Storage Limited "NZNS Storage"	Examination
Byers Gill Solar	JBM Solar	Pre Application
East Yorkshire Solar Farm	East Yorkshire Solar Farm Limited	Pre Application
Immingham Green Energy Terminal	Associated British Ports	Pre Application
Humber Low Carbon Pipelines	National Grid Carbon (NGC)	Pre Application
Dogger Bank South Offshore Wind Farms	RWE Renewables UK Dogger Bank South (West) Ltd and RWE Renewables UK Dogger Bank South (East) Ltd	Pre Application
Helios Renewable Energy Project	Enso Green Holdings D Limited	Pre Application
V Net Zero Pipeline	Chrysaor Production (UK) Limited	Pre Application
Immingham Eastern Ro-Ro Terminal	Associated British Ports	Pre Application
Continental Link Multi-Purpose Interconnector	National Grid Ventures	Pre Application
Able Marine Energy Park Material Change 1	Able Humber Ports Ltd	Pre Application
Yorkshire GREEN	National Grid Electricity Transmission (NGET)	Pre Application
Ferrybridge D Combined Cycle Gas Turbine (CCGT) Power Station Project	SSE Generation Limited	Pre Application
A66 Northern Trans-Pennine Project	National Highways	Pre-Examination
Drax Bioenergy with Carbon Capture and Storage Project	Drax Power Limited	Pre Examination
North Lincolnshire Green Energy Park	North Lincolnshire Green Energy Park Limited	Pre Examination
Hornsea Project Four Offshore Wind Farm	Orsted Hornsea Project Four Limited	Recommendation

Four NSIPs have been identified as having potential for cumulative effects with one option as part of the preferred plan. Option R13 (East Yorkshire Groundwater Option 2) is situated within a zone of influence with the four NSIP which are:

- Helios Renewable Energy Project (Pre-Application)
- Drax Bioenergy with Carbon Capture and Storage Project (Pre-Examination)
- Drax Re-Power (Decided)
- White Rose Carbon Capture and Storage Project (Decided)

The Helios Renewable Energy Project is approximately 6km from the proposed R13 East Yorkshire Groundwater Option 2 construction location. This NSIP is currently in the Pre-Application stage with expected submission in 2023. There is potential for cumulative effects during construction due to construction traffic, however this is considered uncertain given insufficient planning details for this project.

The remaining three NSIPs within the zone of influence of R13 East Yorkshire Groundwater Option 2, are set to be constructed within the Drax Power Station Site. Although there may be some overlap in construction timeline, given the location, cumulative effects have been identified as small scale.

No other NSIPs have been identified to be within the zone of influence of any other options within the WReN preferred plan.

The water demands of all of these NSIPs should be considered in their applications for development consent and if significant demand is forecast, this should be considered by WReN during monitoring of the Regional Plan and in subsequent iterations.

No cumulative operational effects have been identified at this stage.

6.4.4 Local Plans

Potential cumulative effects with Local Plans have been assessed based on plans available in September 2022. Local Plans are relatively high-level policy documents and, whilst they identify potential areas for future development and zones for particular activities, the certainty of developments, the precise spatial location and their timing make it difficult to identify any specific potential cumulative effects; as they would only arise if the timing of the infrastructure required by the WRMP scheme was to coincide.

The WReN preferred plan supply options are all located within the Yorkshire Water area, thus falling within a large number of Local Authority areas. Uncertainties still remain for a number of the preferred plan options with their exact location and construction start date remaining unconfirmed. At the time of writing, it is not possible to identify all possible potential cumulative effects associated with local plans.

It is anticipated that any negative impacts could be effectively mitigated through appropriate scheduling of all the construction required so as to avoid any concurrent works.

7 Mitigation and enhancement

7.1 Overview

Key stages of the SEA process comprise Task B5: Mitigating adverse effects and Task B6: Proposing measures to monitor the environmental effects of plan or programme implementation. The sections below describe how these tasks have been addressed and how WReN intends to ensure that mitigation measures are implemented for any adverse effects that are identified and the means by which the environmental performance of the Regional Plan can be assessed.

7.2 Mitigation measures

Consideration of mitigation measures has been an integral part of the SEA process. The assessment has assumed the implementation of standard best practice mitigation measures and identified any additional measures as shown in the option SEA matrices (see **Appendix E**). The significance of effects identified in the matrices relates to residual effects after mitigation.

Certain assumptions have been made regarding this:

- Where suitable mitigation measures are known and identified, these have been taken into account and reported, such that the resultant residual impact has been determined.
- In line with recommendations made in the UKWIR Guidance[12], the SEA appraisals have assumed the implementation of reasonable mitigation, such as the use of best practice construction methods.

7.3 Residual effects

The potential effects of the draft Regional Plan are described in the sections above. The SEA process has identified potential residual impacts of the Regional Plan preferred plan after mitigation measures have been taken into consideration. Proposals to attenuate the residual negative impacts of the preferred plan are set out below.

Table 7.1 summarises the residual effects attributable to the preferred plan for the preferred plan. Mitigation of both construction and operation components for each option are presented.

The detail of this mitigation needs to be considered during the planning phases of each of the individual measures if and when they are taken forward for implementation. This should then be consolidated into a Construction Environmental Management Plan (CEMP) for the scheme, noting that all works should be carried out in accordance with relevant Construction Design Management (CDM) Regulations 2015. In other cases, best practice design requires consideration of mitigation measures at an early stage along with consultation with potentially affected parties. In this way, effective mitigation plans can be developed to minimise many of the residual adverse effects currently identified in the SEA appraisals.

Table 7.1 Residual adverse impacts of options within the preferred plan for the draft Regional Plan

Reference	Option	Construction	Operation
BOT-DMO-Med (with leakage reduction increased to 50%)	Active Leakage Control to reduce leakage by 50% by 2050	No significant effects	No significant effects
	Metering Replacement of existing meters with smart meters by 2035 and Enhanced Optant Smart Metering	No significant effects	No significant effects
	Water Efficiency Programme In home interventions and digital engagement to reduce PCC to 110l/p/d by 2050	No significant effects	No significant effects

Reference	Option	Construction	Operation
C5	Smart Metering and Water Efficiency	No significant effects	No significant effects
L6	Active Leakage Control 95 Ml/d	No significant effects	No significant effects
DV3	South Yorkshire Groundwater	No significant effects	No significant effects
DV7a(vi)	Tees to York Pipeline Option 3	Biodiversity, flora and fauna; Population and human health; Material assets and resource use; Soil, geology and land use; Air and climate; Archaeology and cultural heritage; and, Landscape and visual amenity	No significant effects
DV8(iv)	York to South Yorkshire Pipeline	Biodiversity, flora and fauna; Population and human health; Material assets and resource use; Soil, geology and land use; Air and climate; Archaeology and cultural heritage; and, Landscape and visual amenity	No significant effects
DV8(v)	York WTW Capacity increase	Biodiversity, flora and fauna	No significant effects
R3a	Increased River Ouse pump storage capacity	No significant effects	No significant effects
R8b	Sherwood Sandstone and Magnesian Limestone Boreholes Option 2	No significant effects	No significant effects
R8g	Sherwood Sandstone Boreholes support to North Yorkshire	No significant effects	No significant effects
R13	East Yorkshire Groundwater Option 2	Biodiversity, flora and fauna Water quality	No significant effects
R31a	Additional bankside storage on the River Ouse	Biodiversity, flora and fauna	No significant effects
R37b(ii)	River Aire Abstraction Option 4	Biodiversity, flora and fauna	No significant effects
R85	Recommission Kirklees WTW	No significant effects	No significant effects

There are general best-practice procedures and measures which can be applied to all options proposed in the WReN Regional Plan. The following guidance outlines the current industry best-practices in dealing with potential construction-related impacts, specifically site-derived pollutants (e.g. fuel, concrete and silt), and should be implemented as minimum standard in addition to any scheme-specific measures which have been identified through option level investigations:

- DEFRA's Pollution prevention for businesses (https://www.gov.uk/guidance/pollution-prevention-for-businesses);
- Venables R. et al. (2000) Environmental Handbook for Building and Civil Engineering Projects. 2nd Edition. Construction Industry Research and Information Association (CIRIA), London.

The documents above highlight procedures and measures designed to prevent adverse effects on a range of receptors (e.g. European sites) occurring as a result of construction activities. There is also the possibility for the pollution of water courses via surface run off and additional attention should be made when dealing with such contaminants. In these instances, works should be conducted in adherence to the guidance outlined above. For example, all vehicles and any chemical/ oil storage will be fully bunded to prevent any accidental pollution of groundwater or watercourses. Pollution Incident Control Management Plans may also be developed to limit adverse effects arising from pollution events.

In addition to the above, the CEMP should include further measures to minimise, or where possible, eliminate, adverse effects on various receptors. These are outlined below for each SEA topic.

Adverse effects on biodiversity are largely as a result of potential effects on specific species. Most mitigation measures specific to a particular species may only be determined at the option level following appropriate monitoring. Mitigation measures designed to minimise adverse effects on biodiversity receptors during the construction phase should be outlined in the CEMP. Examples of these measures are detailed below, for example:

- where supporting habitat will be directly lost as a result of open cut pipeline installation, the habitat must be reinstated, or trenchless/ directional drilling pipeline installation methods should be alternatively used;
- a programme of works should be established as early as possible to enable any investigations, surveys and mitigation to be established and give sufficient time for consultation with relevant bodies. The programme should take into account any seasonal constraints to avoid adverse effects on sensitive receptors (e.g. breeding birds);
- the site layout must be planned so that machinery and dust causing activities are located away from receptors, as far as is possible;
- consideration of the timing of construction e.g. night-time working to avoid effects on nocturnal species
- the use of lighting will ensure that potential 'displacement' effects on nocturnal animals, particularly designated bat species, are avoided;
- Construction Environmental Management Plan will be implemented with risk assessment for pollution incidents and introduction/ spread of INNS and a response plan if either occurred.
- measures to reduce noise impacts on species (e.g. birds) and residential receptors including; acoustic housing of generators, acoustic cladding surrounding construction site, appropriate siting of plant machinery and silencers or mufflers fitted to machinery where possible.
- measures to reduce adverse effects as a result of dust and air emissions including ensuring vehicles switched off when stationary, ensuring an adequate water supply for appropriate mitigation and covering vehicles entering and leaving sites to prevent escape of materials during transport.
- installation of pipe-caps to prevent species entering and becoming trapped in any laid pipe-work outside of working hours.
- utilise an Ecological Clerk of Works where required
- scheme design should aim to minimise the environmental effects by 'designing to avoid' potential habitat features that may be important e.g. those 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;

Additional mitigation measures employed to reduce the potential adverse effects on sensitive receptors can be categorised under the following:

- Population and human health

    - avoid works near to the most sensitive health receptors, where possible;
    - plan construction traffic movements to avoid routes with sensitive receptors and avoid peak traffic hours;
- Material assets and resource use
    - Production of a waste management plan which details what waste will be generated by the scheme as well as highlight opportunities for reuse or recycling of materials.
    - Minimise waste generation and adopt the waste hierarchy process
- Water
    - Compliance with Pollution Prevention Guidelines, as detailed above
    - Installation of temporary drainage measures (e.g. swales and silt fences) to reduce sediment loads
    -
- Soils, geology and land-use
    - Agricultural soils will be managed, preserved, retained and reinstated in accordance with Department for Environment, Food and Rural Affairs (Defra)
- Air quality
    - Ensure vehicles entering and leaving sites are securely covered to prevent escape of materials during transport
    - Planning site layout so that machinery and dust causing activities are located away from receptors, as far as is possible;
    - Ensure all vehicles switch off engines when stationary - no idling vehicles;
    - Ensuring an adequate water supply for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate;
    - Reuse and recycle waste to reduce dust from waste materials;
    - Ensure water suppression is used during demolition, excavation and other earth-moving operations;
    - Any demolition or concrete breakout to be undertaken in suitable weather conditions i.e. avoiding windy conditions.
- Climate change
    - utilise on-site renewable energy where possible
    - sustainable design of any new infrastructure to maximise energy efficiency
    - company fleets to utilise low emission or electric vehicles
    - use of low emission plant machinery
    - offsetting residual carbon emissions
- Archaeology and cultural heritage
    - careful consideration being given to the presence of heritage assets when finalising proposals for pipeline routing;
    - new above-ground infrastructure should be screened, where possible and informed by informed by a heritage appraisal/assessment, to minimise effects on the settings of heritage assets;
    - where required, archaeological investigations should be carried out prior to commencing construction and the findings will inform detailed mitigation, which will be agreed with the relevant authorities.
- Landscape and visual amenity
    - Landscape and visual assessments to inform landscape mitigation plans
    - Avoid unnecessary tree and vegetation removal
    - High quality design and considerate positioning of new infrastructure
    - Where lighting is required, this should be low level and directed away from sensitive receptors/areas

7.4 Mitigation of cumulative impacts with other plans and programmes

Section 7 explains the potential cumulative impacts with other plans. Potential water resource impacts that could arise due to future, as yet, unknown new abstractions from common sources would be assessed and considered by the Environment Agency as informed by detailed environmental assessment work as part of the abstraction licensing and water resources planning processes.

Liaison with local planning authorities will also be essential to assess any required mitigation measures from any identified cumulative effects on development plans and projects as discussed in Section 7.

8 Monitoring proposals

8.1 Overview

A key stage of the SEA process with regard to monitoring is Stage E: Monitoring the significant effects of the plan or programme on the environment. The sections below describe how these tasks have been addressed and how WReN proposes to monitor the effects of implementation of the Regional Plan.

8.2 Monitoring requirements

Monitoring will be required to track the residual environmental effects to show whether they arise as anticipated in the SEA appraisal, to help identify any adverse impacts and trigger deployment of any of the mitigation measures.

Monitoring for options identified in the preferred plan is set out in Section 8.3. These monitoring recommendations are based on the current understanding of the scheme design. As options are brought forward for development, further monitoring requirements may be set out in planning applications, borehole drilling and pump test consents, or in voluntary best-practice monitoring plans accompanying scheme development. This will be discussed with relevant key regulatory bodies and stakeholders. In practice, close dialogue should occur between WReN, Environment Agency, Historic England, Natural England and any affected third parties to agree the appropriate scale and duration of such scheme-specific monitoring activities proportionate to the assessed environmental risks.

8.3 Proposed monitoring

Table 8.1 lists the potential impacts that may arise from implementation of the Regional Plan and which require monitoring in accordance with the SEA Regulations.

Key monitoring parameters at the strategic Regional Plan level will be those relating to the abstraction of water and the effects that this may have on waterbodies and their functions as habitats (see **Table 8.1**). There are also direct potential impacts on humans, the built environment, terrestrial habitats, the atmosphere, landscape and heritage assets, which may arise from construction activities and/or option operation (see **Table 8.1**). These parameters should, therefore, be included within the monitoring programme where it is practicable to do so. Extensive primary data collection is neither feasible nor appropriate for this programme level of monitoring, and use should be made where possible of existing datasets and monitoring regimes.

Site-specific monitoring requirements for the resource options included in the preferred plan will be developed during the planning process closer to the time of implementation.

Table 8.1 Proposed SEA monitoring parameters – strategic WRMP monitoring

Impacted receptor/topic	Proposed strategic indicators
Biodiversity	Condition of protected sites, biological monitoring (e.g. macroinvertebrates, macrophytes, fisheries, bird surveys), INNS presence
Water resources, water quality	River flows, river levels, lake and reservoir levels. Groundwater levels. Surface and ground water quality (including proportion of surface water and groundwater bodies at 'Good; WFD status)
Flood risk	Number of properties that experience internal flooding from public sewers.
Soils, geology and land use	Area of previously undeveloped land used during construction

Impacted receptor/topic	Proposed strategic indicators
Climate Factors	Net greenhouse gas emissions per million litres (Ml) of treated water (kg CO_2 equivalent emissions per Ml) for Yorkshire Water supply area Energy use used in the operation of options. Renewable energy generated or purchased by Yorkshire Water.
Transport	Transport fleet fuel consumption, emissions and business mileage, as monitored by Yorkshire Water
Nuisance/ Community/ Local Economy	Scheme level community disruption of capital works would be monitored through an Environmental Monitoring Plan if required. Number of nuisance-related complaints (e.g. noise, dust) logged with Yorkshire Water and Local Authority EHOs. Pollution and flooding incidents Responses gauged through Yorkshire Water customer satisfaction surveys. Community investment, employee volunteering and match funding by Yorkshire Water.
Waste and resource use	Leakage Water saved through demand management / water efficiency measures. Amount of recycled / re-used materials. Proportion of waste sent to landfill. Chemical usage in water treatment.
Air Quality	Scheme related issues of capital works would be monitored through an Environmental Monitoring plan if required. Changes in air quality are monitored by the Automatic Urban and Rural Network[32] administered by Bureau Veritas, and this data would be available if required to inform a baseline
Cultural Heritage	Loss / damage or discovery / protection of cultural, historic and industrial heritage features. Condition of buried archaeology would be monitored during construction e.g. through appropriate archaeological investigations and watching briefs as required. Consultation with relevant stakeholders to ensure impacts are minimised, e.g. to water level dependent assets. Historic England monitor parameters such as Listed Buildings and Scheduled Monuments, in order to maintain a 'Heritage at risk' register.
Landscape	Loss or damage to landscape character and features of designated sites.

[32] Accessed at http://www.bv-aurnsiteinfo.co.uk/

The SEA Directive states that monitoring must enable appropriate remedial action to be taken. For the monitoring programme to be effective, there must therefore be a mechanism in place to detect trends and to ensure that action is taken where trends are progressively adverse.

Assessment of monitoring and any measures taken would be included within the SEA for the subsequent draft Regional Plan development. Through the proposed monitoring and analysis of the results obtained over the intervening period, the SEA will inform and influence the development of the Regional Plan for future periods.

Appendices

Appendix A Statutory consultee responses to the SEA Scoping Report
Appendix B Quality assurance checklist
Appendix C Review of policies, plans and programmes
Appendix D Environmental baseline review
Appendix E Option assessment matrices

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